U.S. Army Corps of Engineers, Alaska District
In-Situ Chemical Oxidation (Phase I) and Intrusive
Drum Removal/Landfill Cap
Northeast Cape, St. Lawrence Island, Alaska
Contract No. W911KB-09-C-0013
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MAIN OPERATION COMPLEX AREA
Phase I In-Situ Chemical Oxidation
SUMMARY REPORT

FINAL

AUGUST 2010

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Draft
SUMMARY REPORT

MAIN OPERATIONS COMPLEX AREA
PHASE I IN-SITU CHEMICAL OXIDATION

NORTHEAST CAPE

St. Lawrence Island, Alaska

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ACRONYMS AND ABBREVIATIONS

'	minutes
%	percent
°	degrees
°C	degrees Celsius
ACWS	Aircraft Control and Warning Station
ANCSA	Alaska Native Claims Settlement Act
AOI	Area of Interest
ATS	AECOM Technical Services, Inc.
bgs	below ground surface
bls	below land surface
Bristol	Bristol Environmental Remediation Services, LLC
COCs	contaminant of concerns
CSM	conceptual site model
DO	dissolved oxygen
DRO	diesel range organics
EC	electrical conductivity
Fe	iron
FeEDTA	iron ethylenediaminetetraacetic acid
FMC	FMC Environmental Solutions
ft	feet or foot
gpm	gallon per minute
GRO	gasoline range organics
H_2O_2	hydrogen peroxide
ISCO	in-situ chemical oxidation
mg/kg	milligrams per kilogram
mg/L	milligram per liter
mL	milliliter
MOC	Main Operations Complex
mV	millivolt
$Na_2S_2O_3$	sodium thiosulfate
$Na_2S_2O_8$	sodium persuflate

ACRONYMS AND ABBREVIATIONS (continued)

NE Cape	Northeast Cape
no.	number
OH	hydroxyl radical
OL/ML	organic clayey silt
ORP	oxidation reduction potential
OVA	organic vapor analyzer
pH	hydrogen ion concentration
PLO	Public Land Order
ppm	parts per million
PT	peat
PVC	polyvinyl chloride
QC	quality control
ROI	radius of influence
RRO	residual range organics
S_20_8	persulfate
SOW	Scope of Work
TestAmerica	TestAmerica Laboratories, Inc.
TOC	total organic carbon
TOD	total oxidant demand
TPH	total petroleum hydrocarbons
TSL	Treatability Study Laboratory
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
WP	work plan

1.0 INTRODUCTION

This Summary Report presents results of the Phase I in-situ chemical oxidation (ISCO) testing conducted at Northeast Cape (NE Cape), St. Lawrence Island, Alaska (Figure 1). NE Cape was the site of former military surveillance and communications stations that operated from about 1954 until 1972. The Phase I ISCO testing was performed to collect data about the implementability and effectiveness of ISCO to treat groundwater and soil media in the Main Operations Complex (MOC) area of the site.

This work was performed for the U.S. Army Corps of Engineers (USACE), Alaska District, under Bristol Environmental Remediation Services, LLC's (Bristol's) contract number (no.) W911KB-09-C-0013. Phase I ISCO activities were largely performed by AECOM Technical Services, Inc. (ATS), a Bristol subcontractor. The scope of services for this project is based on the Final Scope of Work (SOW) provided by the Alaska District of the USACE, dated 11 March 2009. Phase I ISCO testing was performed in accordance with the *Final Work Plan In-Situ Chemical Oxidation (Phase I) and Intrusive Drum Removal/Landfill Cap* (Bristol, 2009).

The SOW for the MOC Area Phase I ISCO Treatment included the following:

- Performing bench scale study to assess site-specific parameters affecting treatability
- Designing and performing a feasible Phase I ISCO technology in an isolated MOC location
- Evaluating the ability of ISCO to achieve remediation goals for chemicals of concern (COCs)
- Post-treatment monitoring (at least one round) preparation of a draft and final technical memorandum to summarize results
- Preparing a draft and final report detailing results of the Phase I treatment and feasibility of the technology for Phase II implementation

1.1 PROJECT PURPOSE AND OBJECTIVES

The purpose of this project was to evaluate the use of ISCO as a remediation technology for soil and groundwater contamination previously identified in the MOC area of the site. The primary objectives of the Phase I ISCO effort was to evaluate the feasibility of ISCO technology for application in an isolated location, and to evaluate the ability of ISCO to achieve remediation goals for the COCs and corresponding media of concern. Table 1 summarizes the remediation goals for the COCs and corresponding media of concern. Tables 1 through 15 are located in the Tables Section at the end of this document.

Secondary objectives of the pilot study were to:

- Determine the field soil oxidant demand
- Collect site-specific data to establish a rate of injection for the oxidant solutions
- Assess lateral and vertical distribution of oxidant
- Use distribution data to evaluate the appropriate lateral and vertical spacing for injection points during full-scale ISCO remediation
- Determine the volume and concentration of oxidant to be injected during full-scale ISCO remediation
- Collect time-series data post-injection to evaluate COC transport and propagation of an oxidant front, useful for full-scale remediation and monitoring design
- Evaluate rebound of chemical concentrations following one round of oxidant injections

2.0 SITE DESCRIPTION

2.1 LOCATION

The NE Cape site is located on St. Lawrence Island, in the Bering Sea, near the territorial waters of Russia, approximately 135 air miles southwest of Nome. The Village of Savoonga is the closest community, located 60 miles northwest of the site. The NE Cape site, at 63 degrees (°) 19 minutes (') north, 168º58' west, is 9 miles west of the northeastern cape of St. Lawrence Island. The NE Cape site originally encompassed 4,800 acres (7.5 square miles). The site is bounded by Kitnagak Bay to the northeast, Kangighsak Point to the northwest, and the Kinipaghulghat Mountains to the south. Figure 2 provides an overview of the site location on St. Lawrence Island.

2.2 SITE HISTORY

St. Lawrence Island was established as a reindeer reservation by Executive Order on 7 January 1903. The present project site was acquired by the U.S. Air Force (USAF) on 16 January 1952, under Public Land Order (PLO) 970, which removed 21,013 acres from the reserve. In 1952, the USAF Aircraft Control and Warning Station (ACWS) was formally activated by the assignment of the 712th ACWS Squadron and the 689th Security Squadron. The original site was designed to support 212 men. Throughout its existence, the NE Cape facility has been a surveillance station, providing radar coverage for the Alaskan Air Command, and later, for the North American Air Defense Command, as part of an Alaska-wide system constructed to reduce potential vulnerability to bomber attacks across the polar regions. The White Alice Station area remained in operation with minimal military staff until 1972. All lands were then withdrawn from the military under PLO 5178 for classification under Section 17(d)(1) of the Alaska Native Claims Settlement Act (ANCSA) of 1971, which entitled local community village corporations to select and receive specific tracts of federal land. Interim Conveyance No. 203 (June 1979) conveyed unsurveyed lands of St. Lawrence Island to Sivuqaq, Inc., and Savoonga Native Corporation, later renamed Kukulget, Inc. Excluded from transfer were surveyed lands, easements, and land-use permits effective before conveyance.

In 1982, transfer of the White Alice Station area, south of the MOC, to the U.S. Department of the Navy was initiated. However, this transaction was not formally completed as it was superseded by ANSCA. The Navy conducted a removal action under its Comprehensive Long-Term Environmental Action Navy program. The action included removal of specified hazardous items and containerized hazardous and toxic wastes. In 2000, the White Alice Station was reclassified as a Formerly-Used-Defense-Sites-eligible property and, in response, the USACE included the area in the ongoing cleanup program for NE Cape (USACE, 2002).

The former military installation operated from about 1954 until 1972 as a surveillance station and a White Alice Communications station. In 1982, the Navy obtained the former White Alice Property (26 acres), but did not utilize the site as a communications site. The land transfer was later deemed invalid, and property ownership reverted to Sivuqaq, Inc., and Savoonga Native Corporation. Demolition of buildings and structures has been completed under multiple USACE contracts. The runway, improved gravel roads, and concrete slabs of some of the former structures remain intact.

The MOC at the NE Cape installation encompassed the majority of the site infrastructure including buildings, heat and power supply, fuel storage tanks, maintenance, and housing quarters. Individual sites were grouped together to evaluate an overall response action for the known contamination. These sites are located on the northeast portion of the main complex gravel pad and include Sites 10, 11, 13, 15, 19, and 27. The locations of Sites 11, 13, 15, 19, 27, and adjacent sites, are illustrated on Figure 3.

2.3 PREVIOUS STUDIES AND ACTIONS

Remedial investigations were conducted in 1994, 1996, 1998, 2001, 2002, and 2004. The sampling results demonstrate that soils and groundwater contain petroleum compounds at elevated levels. No measurable free product was observed in the monitoring wells during the various phases of remedial investigation. A summary of groundwater and soil contaminant concentrations and field parameters is provided in Table 2 and Table 3, respectively.

All of the MOC structures have been demolished. Tanks and piping were reportedly removed. Contaminated concrete, polychlorinated-biphenyl-contaminated soils, and fuel-stained soils were also excavated and transported off site during removal actions from 2000 to 2005.

The USACE issued the *Draft Decision Document for NE Cape, Formerly Used Defense Site (FUDS)* in January 2009. The selected remedy for soil and groundwater at the MOC was chemical oxidation.

2.4 CONTAMINANTS OF CONCERN AND ASSOCIATED REMEDIATION GOALS

2.4.1 Soils

The primary COCs in the soil at the MOC are total petroleum hydrocarbons (TPH) as diesel range organics (DRO). Surface and subsurface soils are also contaminated with petroleum fuels as gasoline range organics (GRO), naphthalene, and benzene at depths up to 16 feet (ft) below ground surface (bgs). The fuel contamination is assumed to have created a smear zone along the shallow groundwater interface.

2.4.2 Groundwater

Shallow groundwater at the site is contaminated throughout the northern portion of the site. The primary COCs in groundwater are DRO, GRO, residual range organics (RRO), and benzene. Lead is also elevated at various locations, but was not identified as a remediation objective of the project.

2.4.3 Phase I ISCO Remediation Goals

The COCs and their target cleanup levels are summarized in Table 1.

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3.0 FIELD METHODS

In general, field work performed as a part of the Phase I ISCO evaluation was conducted as described in the *Final Work Plan In-Situ Chemical Oxidation (Phase I) and Intrusive Drum Removal/Landfill Cap* (Bristol, 2009). Phase I ISCO activities included the following work components:

- Hydrogeological evaluation
- Test-pit based site characterization
- Bench scale soil oxidant demand testing
- Bench scale treatability testing
- Pilot study design and construction
- Chemical oxidant injection
- ISCO performance monitoring

The field methods used to perform these tasks are discussed in greater detail in the sections that follow. Field notes recorded by on-site personnel during the execution of these efforts are provided in Appendix A.

Appendices A through M are located in the Appendices Section at the end of this document.

3.1 HYDROGEOLOGICAL EVALUATION

To evaluate hydrogeological conditions at the site, existing monitoring wells at the MOC were opened and groundwater allowed to equilibrate prior to gauging depth to water in each monitoring well. Groundwater levels were measured using an electronic water level indicator and measured to the nearest 1/100th of a foot. In addition to water level gauging, slug tests were also conducted in a subset of the existing monitoring wells to evaluate conductivity and permeability.

3.2 TEST PIT SITE CHARACTERIZATION

To rapidly evaluate the lithology and characterize soil conditions, test pit excavations were conducted at the site. Test pitting was selected based on the ability to collect detailed site lithologic data during excavation and the impracticality of using another rapid assessment method, such as direct-push soil sampling, in the soils at this site. Descriptive soil characteristic information provided valuable data regarding small- and large-scale variations of lithology at the site. In addition, direct observations were made about the contaminant distribution (i.e., stained soils).

To confirm the presence of contamination in the potential study area, an assessment grid was established in the field, and 12 test pits were installed to evaluate lithologic and pre-ISCO soil contaminant conditions. A CAT 322B excavator was used to dig each test pit to an approximate depth of 10 ft below land surface (bls) or to the water table, which ever was encountered first. Soil excavated from the test pits was visually evaluated, photographed, logged, and screened with an organic vapor analyzer (OVA).

Soil samples were collected to characterize soil contamination at locations where OVA readings suggested the presence of petroleum impacts. Selected soil samples underwent field screening analysis for TPH-DRO and -GRO using a siteLAB® field test kit. During the test pitting effort, samples were collected from the excavator bucket based on visual observations and OVA screening results.

The dimensions of each test pit were determined in the field based on visual observations and field screening. Each test pit was logged on a separate form as it was excavated, including types and relative percentages of materials encountered and depth to the water table (if encountered). Each pit was uniquely numbered on a base map. The sidewalls of each test pit were photographed.

The test pits were backfilled with excavated material in reverse order of excavation following completion of the test pitting activities.

3.2.1 TVA-1000B OVA Photoionization Detector/Flame Ionization Detector

A Thermo Electron Corporation TVA-1000B OVA equipped with a combination photoionization detector and flame-ionization detector was used to screen soils recovered during test pitting and soil boring activities. Soil samples were collected into 1-gallon zip-to-lock style plastic bags and sealed. The headspace was allowed to equilibrate for approximately 30 minutes, and the instrument sampling nozzle was introduced to the headspace via a slight opening in the zip seal. The instrument was calibrated at the beginning of the day of use, and calibration was confirmed at the end of the same day of use.

3.2.2 siteLAB UVF-3100 Analyzer

Field screening of test pit soils was performed using a siteLAB UVF 3100 Analyzer (siteLAB), supplied by Sitelab Corporation. The instrument was shipped calibrated to run a TPH-DRO method. For field screening of soils for DRO using the siteLAB kit, soil samples were collected in 1-gallon zip-to-lock style plastic bags, double bagged, and transported to the on-site field laboratory for screening analysis. Soil subsamples were weighed on a digital scale and extracted with methanol solvent. The liquid extract filtered through a syringe-mounted filter, and the resulting sample was diluted to read within the range of the instruments detector. The instrument was calibrated before each use; initial control standards, periodic standards, and final standards, were run during sample analysis.

3.3 BENCH SCALE TOTAL OXIDANT DEMAND TESTING

Prior to performing oxidant injections at the site, bench scale testing to evaluate the natural oxidant demand of site soils was conducted. This testing was conducted on site using site soil and groundwater media obtained during the test pit characterization efforts described above.

3.4 BENCH SCALE TREATABILITY TESTING

In addition to the total oxidant demand (TOD) testing discussed above, a bench scale treatability test was also conducted. A treatability study would normally have been conducted prior to the formulation of a field study work plan (WP); however, project schedules and limitations (frozen ground versus manual sampling versus cost) on the ability to collect representative samples prior to the summer field season caused this phase to be performed while ISCO-related site characterization and baseline sampling was underway. The objective of the bench scale treatability study was to supplement the in-situ approach by varying oxidant dosages and examining catalyzed hydrogen peroxide (H_2O_2), iron-activated persulfate, and hydrogen-peroxide-activated sodium persulfate as independent treatability scenarios. Evaluation of oxidant effectiveness and oxidant efficiencies in the bench typically help refine the design of the pilot study WP. In this situation, the results became available to help explain observations of ISCO pilot study behavior, and refine the development of the next phase of ISCO work.

The bench scale treatability test was conducted at an off-site laboratory. Testing was conducted using site soil and groundwater media obtained during the test pit characterization efforts described above. Bulk samples of soil were collected in 5-gallon pails lined with plastic bags, and bulk groundwater samples were collected in collapsible bulk containers. Groundwater samples were packed in coolers with ice packs and shipped to ATS' treatability lab facility in Orlando, Florida. Details regarding laboratory treatability testing procedures are also provided in Section 6.3.

3.5 PILOT STUDY INJECTION AND MONITORING WELL CONSTRUCTION

The pilot study was implemented at a single location where elevated concentrations of COCs were detected during previous investigation activities. The well layout for the pilot study included a single injection well and eight monitoring wells. The monitoring well locations were distributed throughout the expected area of influence and the anticipated flow path of the injected reagent. The field pilot study was designed to evaluate system performance, critical design, and operational parameters, including achievable radius of influence, oxidant consumption, and contaminant removal. These parameters were evaluated using monitoring wells strategically placed at varying radial distances from the point of injection to facilitate a better understanding of the effects of oxidant injection on the subsurface contamination.

3.5.1 Injection Well

The injection well was installed using standard hollow-stem auger drilling techniques. The injection well was installed and screened from approximately 1 ft above the groundwater table to 4 ft below the groundwater table. The injection well was completed with 5 ft of 2-inch-diameter stainless steel, wire-wrapped 0.010-inch screen and 2-inch-diameter stainless steel well casing. The well filter pack material was 10/20 silica sand placed from bottom of screen to 0.5 ft above the well screen. A 1-ft-thick finer-grained 30/70 silica sand seal pack was placed over the well filter pack to mitigate the penetration of cement into the well filter pack. Portland Type II cement was poured into place above the fine sand seal to ground surface for wellhead completion. The injection well was completed as a flush-mount well. The identity of the well was permanently marked on the well cap.

3.5.2 Monitoring Wells

A total of nine monitoring wells were installed as a part of the Phase I ISCO activities. Monitoring wells were installed using standard hollow-stem auger drilling techniques. Monitoring wells for the pilot study were screened from approximately one foot above to 4 feet below the groundwater surface interface. All monitoring wells were completed with 5 ft of 2-inch-diameter polyvinyl chloride (PVC) vee-wire 0.006-inch screens and 2-inch-diameter PVC well casings. The well filter pack material was 10/20 silica sand placed from bottom of screen to 0.5 ft above the well screen. One foot of finer-grained 30/70 silica sand was placed over the well filter pack to mitigate the penetration of fines from the neat cement into the well filter pack. Neat cement was poured into place above the sand-sealed pack to ground surface for wellhead completion. Monitoring wells were completed as flush mounts. The identity of the wells was permanently marked on the well caps.

3.5.3 Well Development

Well development was conducted no sooner than 24 hours after completion of the monitoring and injection wells. Monitoring wells and the injections wells were developed by a combination of surging, bailing, and over pumping or sustained pumping. During this process, groundwater quality parameters were recorded. All investigation-derived wastes, including soil cuttings and development fluids, were containerized or treated on site at the Hazardous Waste Accumulation Point in accordance with the Waste Management Plan.

3.6 OXIDANT INJECTIONS

3.6.1 Injectate Solution Composition

For the ISCO pilot study, H_2O_2, sodium persulfate, and iron activation (FeEDTA [ferric ethylenediaminetetraacetic acid]) chemical solutions were prepared by mixing the individual oxidants and activator with water obtained from natural springs or flowing streams located in the region of the site. Individual solutions of H_2O_2, sodium persulfate, and iron activator were prepared for injection in a sequential pulse fashion, where a small batch pulse of H_2O_2

solution was injected followed by a similar pulse of sodium persulfate and iron activator solution.

3.6.2 Injection Equipment and Process

The pilot study employed a temporary injection set-up. Injectate solution mixing and injection was accomplished using a network of transfer piping/hoses in line with centrifugal-style injection pumps, flow meters, flow totalizers, flow-control valves and pressure-relief circuits. A portable diesel-powered generator was used to supply power to the injection equipment. In general, the injection process for the pilot study involved mixing reagents with water obtained from site surface water bodies in small batches. Injections were performed by pumping the injectate solution into the injection well where it was forced through the well screen and into the target saturated zone. Oxidant injections were conducted using an alternating pulse sequence approach where small batches (<100 gallons) of the individual oxidants were injected in an alternating fashion.

3.7 PERFORMANCE MONITORING

The monitoring plan established for the pilot study consisted of three discrete sampling periods:

- Baseline monitoring
- Injection performance monitoring
- Post-injection performance monitoring

Each component of the monitoring plan is described further below:

3.7.1 Baseline Monitoring

Baseline sampling of soil and groundwater media was conducted prior to the initiation of ISCO injection activities. Results obtained during this sampling served as the basis for evaluating the overall efficacy of the treatment process.

Following well installation and development activities, but before injection activities, baseline samples were collected from all monitoring wells. The proposed monitoring plan was specific to the objectives of the study and generally included the following parameters:

- Static water level elevations
- Field parameters including temperature, hydrogen ion concentration (pH) specific conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO)
- Field analysis of residual (i.e., unreacted) persulfate, H_2O_2, and activator
- Target COCs

Baseline soil samples were collected from the smear zone soils during monitoring well installation. Samples were collected and analyzed in accordance with the Sampling and Analysis Plan.

3.7.2 Injection Monitoring

Groundwater data from the monitoring wells within the target injection region of influence, and immediately downgradient, were collected while solution was being injected. Water levels were measured periodically during the injection process at monitoring wells surrounding the injection well using an electronic water level indicator.

Vertically-discrete downhole water quality field parameters were monitored during the injection event in all pilot study monitoring wells. Field parameters, specifically, conductivity, ORP, DO, and temperature, were used as a qualitative means to evaluate injection radius of influence during injection activities. Periodically (a minimum of four times daily) throughout the course of the injection monitoring, a downhole water quality meter was slowly lowered through the screened interval and data corresponding to a discrete depth recorded to determine if injection solution initially arrived in a stratified manner. Periodic field monitoring of groundwater for injected reagents (using field-screening kits) was also conducted to gauge reagent distribution. These techniques are discussed in the following subsections.

3.7.2.1 CHEMets® Sodium Persulfate Test Kit

Field screening of groundwater samples for the presence of sodium persulfate was performed using CHEMets sodium persulfate test kits provided by CHEMetrics, Inc. This kit is an ampule reagent test kit. An aliquot of groundwater was placed into a volumetric sample cup and a factory-prepared chemical reagent ampule was opened within the sample and mixed. A colorimetric change was compared to factory provided standards, and a concentration estimate was made. Where necessary, groundwater samples were diluted with deionized water to bring the colorimetric range within the detection limit of the test kit.

3.7.2.2 Total and Ferrous Iron Test Kits

Hach Method 8146 for ferrous iron and Hach Method 8008 for total iron were performed using Hach-provided reagent packets and a DR890 portable colorimeter. Reagent packets were added to an aliquot of groundwater sample in a sample cuvette, and the concentration of iron was measured directly using the DR890, according to the method instructions.

3.7.2.3 Hydrogen Peroxide Test Kit

A drop test kit, Hach hydrogen peroxide test kit Model HYP-1, was used to test groundwater for the presence of un-reacted H_2O_2. This test kit provided a high- and low-range test method. Testing follows a titration method using ammonium molybdate, a sulfite reagent, and sodium thiosulfate to achieve a colorimetric determination of H_2O_2 concentrations.

3.7.3 Post-Injection Monitoring

After completing the injection event, monitoring wells within the pilot study area were tested periodically over the one-month study duration. Post-injection performance monitoring sampling of groundwater were conducted on a schedule corresponding to 3, 7, 14, and 28 days following the completion of oxidant injections. Data collected during this phase of monitoring was utilized to track changes in contaminant concentrations in response to the applied ISCO treatment. In addition to groundwater samples, soil samples were collected at day 7 and day 28 to evaluate the gross efficacy of the applied ISCO process on soils located within the pilot study area. Post-injection soil borings were installed within 3 to 5 feet of the installed monitoring wells to avoid damaging the constructed monitoring well while collecting samples from adjacent soils. Applicable soil and groundwater sample collection procedures are discussed below.

3.7.4 Analytical Sample Collection

The following sections detail analytical sample collection methods used in the Phase I ISCO efforts.

3.7.4.1 Soil Sample Collection

Soils collected for submittal to an off-site analytical laboratory (i.e., the sample for GRO and benzene) was collected first by placing approximately 25 grams dry-weight soil into the 4-ounce sample container. Immediately after loosely filling the container with soil, the methanol preservative was poured into the container over the soil. Enough methanol was added to cover the soil, the lid was closed tightly, and the jar swirled gently to make sure the soil was saturated with the methanol. If the soil absorbed the methanol, additional methanol was added until a thin layer of methanol persisted on the soil surface, before placing it into the sample cooler. The volume of methanol added to the sample jar was recorded on the sample jar label.

The sample for DRO, RRO, and naphthalene was filled next. The 8-ounce jar for these analyses was filled with soil, removing large gravel and rocks, and not packed. The sample for total organic carbon (TOC) was collected last by filling the 4-ounce container.

3.7.4.2 Groundwater Sample Collection

Groundwater samples were collected from the installed monitoring wells using these procedures:

- Before purging and sampling, the depth to groundwater was established by manual means with a water level sounder to an accuracy of 0.01 foot.
- The Mini-Typhoon brand centrifugal pump was used during the purging procedure.
- During purging, groundwater passed through a flow-through cell while parameters were analyzed using a YSI water quality meter. Parameters measured and recorded include pH, DO, conductivity, temperature, turbidity, and ORP.
- The mini-Typhoon brand centrifugal pump was used to collect the groundwater sample. When collecting volatile organic compounds, the flow rate of the pump was lowered as close to 100 milliliters (mL) per minute as practicable.
- Disposable polyethylene tubing was used with the pump. The pump was decontaminated between each well with an Alconox® and water solution.
- An aliquot from each reaction vessel was collected and the residual oxidant measured using H_2O_2 and sodium-persulfate-specific field test kits.
- Groundwater purging and sampling proceeded from the least contaminated to most contaminated well to minimize potential cross-contamination.

- In the case of a very-low-yield well where the well is purged "dry," the well was allowed to recover, and then water samples collected.
- Each well was purged until the measured turbidity was below 5 nephelometric turbidity units on two consecutive measurements, and the indicated parameters stabilized.
- All purged water was collected and containerized in 55-gallon drums.
- Water samples were collected using pre-cleaned containers provided by the laboratory.
- Sample vessels were chemically quenched to inhibit continuing oxidation, which would otherwise result in continual oxidation of organic compounds as the samples are transferred to the analytical laboratory. Sample containers were dosed with enough mass of solid sodium thiosulfate pentahydrate to quench the maximum concentration of persulfate in groundwater observed from residual persulfate field test kit results. This reaction is not vigorous because of the diluted concentrations of sodium persulfate expected in groundwater.

3.8 SAMPLING EQUIPMENT DECONTAMINATION

Disposable sampling equipment was used when possible. Pre-cleaned sample containers were provided by the analytical laboratory. Nondisposable field-sampling equipment was decontaminated as follows:

- Trowels or spoons used for soil sampling were scraped clean of gross contamination and washed in an Alconox solution, followed by potable and deionized water rinses.
- Sampling equipment was allowed to air dry before reuse.
- Fluids generated during sampling equipment decontamination activities were added to contaminated soil for disposal.
- Water sampling equipment was disposable (e.g., tubing for peristaltic pump).

3.9 DRILLING EQUIPMENT DECONTAMINATION

Drilling equipment (hollow-stem auger rig) used to collect samples from boreholes was decontaminated using the following procedures before moving to a new excavation or site:

1. Gross contamination was removed from sample spoons and auger with a broom or scrub brush.
2. Sampling equipment was placed into bucket containing Alconox solution and water.
3. Sample equipment in the bucket was scrubbed using a brush.
4. The sample spoon was double rinsed in potable water, followed by a deionized water final rinse.

5. Used wash water was disposed of at the water treatment impoundment.
6. Decontamination activities were documented in the field logbook.

3.10 SURVEYING

The location of test pits, soil borings, and monitoring wells and injection wells, were staked and flagged for identification. A professional land surveyor registered in the State of Alaska surveyed the locations in feet, as referenced to the North American Datum of 1983, State Plane, Zone 9. Surveying activities were performed by ECO-LAND, LLC using RTK/GPS Surveying Techniques.

3.11 WP VARIANCES

The following sections summarize deviations and additions to the WP. Where appropriate, the original WP detail is provided first in italics and is followed by an explanation of the deviation.

3.11.1 Deviations from the WP (Field)

Section 3.5: *The detailed well layout for the pilot study will include an adjacent pair of injection wells and up to seven monitoring wells.*

- A total of nine monitoring wells were installed. Two of these monitoring wells were installed as a part of site characterization efforts in order to better discern the vertical distribution of contaminants at the site. A total of one injection wells and seven monitoring wells were installed for the purpose of ISCO testing. Monitoring well ICOMW09 was subsequently used as an injection well after short-circuiting occurred during injection at ICOIW01.
- Following a teleconference between ATS, Bristol, and USACE, a single injection well was installed in the upper aquifer system identified during test-pit and soil-boring activities. Please see Section 3.4 of the Technical Memorandum (Appendix K) for further discussion of injection well installation activities.
- During the injection event, the short circuiting of oxidants solutions into the adjacent wetland area via a sidewall seep mandated a cessation of injection at the established injection well ICOIW01. Another attempt at injection was made via the conversion of monitoring well ICOMW09 to an injection location.

Section 3.5.1: *Injection wells will be installed as a vertical pair with the shallow well screened from approximately 1 ft above the groundwater table to 4 ft below the groundwater table and the deeper well screened from approximately 4 to 9 ft below the groundwater table. Injection wells will be completed with 5 ft of 2-inch diameter stainless steel wire wrapped* *screen, 2-inch diameter stainless steel well casing, and will be grouted in place with neat cement.*

- Based on observations of contaminant distribution, a shallow injection well screened from 5 ft to 10 ft bgs was installed. Based on the observations of the multiple aquifer system, the apparent distribution of contaminants as understood following evaluation of the analysis of screening soil and groundwater samples, and verbal approval to modify the approach from the USACE, a single injection well was installed rather than multiple injection wells focusing on multiple vertical intervals. The installed injection well focused injection in the vertical horizon showing the greatest levels of contamination.

Section 3.5.2: *Monitoring wells for the pilot study will be screened from approximately 1 ft above to 9 ft below the groundwater surface interface.*

- Monitoring wells for the pilot study were screened from approximately 5 ft to 10 ft bgs. This interval intersected the expected vertical interval of oxidant delivery and treatment.

3.11.2 Deviations from the WP (Treatability Study)

Section 2.0, Page A2: *Sampling points for sodium persulfate reaction vessels are set at 1, 2, 3, and 4 weeks to monitor the reaction of the oxidants with the COCs at both 2X and 5X concentrations.*

- Sampling points for sodium persulfate reaction vessels were at 1, 3, 5, and 7 weeks to monitor the reaction of the oxidants with the COCs at both 2X and 5X concentrations. Within the WP text, the submitted *Attachment 1, Analytical Matrix* indicated a 1, 3, 5, and 7-week sampling interval while the text within the body of the document had not been updated to indicate the proposed interval.

3.11.3 Additions to the WP

Based on observations of soil and groundwater during the test pit excavation activities, ATS installed four soil borings (ICOSB01 through ICOSB04) and two monitoring wells (ICOMW01 and ICOMW02) in the ISCO study area that were not proposed as part of the WP, but were necessary to confirm field conditions. The four soil-screening samples split with the off-site laboratory to confirm the siteLab soil-screening results were an addition to the WP. Groundwater samples collected from the two newly installed monitoring wells and from existing monitoring well MW88-5, and submitted for off-site laboratory analysis, were also an addition to the WP.

4.0 ANALYTICAL DATA

4.1 IN-SITU CHEMICAL OXIDATION (PHASE I) SAMPLES

Table 4 summarizes the area of concern and target parameters. Table 5 presents a summary of soil samples collected during the Phase I ISCO study. Table 6 presents a summary of groundwater samples collected during the Phase I ISCO study.

Baseline soil samples were collected during the installation of each of the proposed ISCO pilot study monitoring wells. Soil samples were selected for analysis based on screening with an OVA. Soil samples displaying the highest OVA results within depths, corresponding to the proposed screened intervals of the monitoring wells, were collected for laboratory analysis. Subsequent performance monitoring samples were collected from adjacent borings at similar depths to baseline soil samples. Soil samples were analyzed for GRO, DRO, RRO, benzene, naphthalene, and TOC in accordance with Table 7.

Baseline groundwater samples were collected from the seven proposed ISCO pilot study monitoring wells. Groundwater samples were analyzed for GRO, DRO/RRO, benzene, naphthalene, sulfate, arsenic, chromium, and lead. Subsequent performance monitoring samples were collected from these monitoring wells in accordance with Table 8.

4.2 SAMPLE IDENTIFICATION

The samples were numbered as directed by the Sample Analysis Plan. Sample numbering was as follows: ##NCXXXMMZZ, where ## is the year, NC indicates NE Cape, XXX is the site identifier, MM is the sample type, and ZZ is the sample number. Field quality control (QC) samples were labeled and numbered in the same manner to prevent the laboratory from distinguishing them from other site samples. The site identifier (XXX in the sample number) used was ITA. The sample types (YY in the sample number) were designated as GW for groundwater and SB for soil.

Labels were required for analytical samples. Site- and time-dependent information was added to the labels using indelible ink. The labels were protected from water and solvents with clear label protection tape and contained the following information:

- Project name
- Date and time of collection
- Sample number
- Analysis to be performed
- Preservative (if applicable)
- Sampler's name

4.3 Sample Packaging and Transport

All analytical samples were shipped in accordance with International Air Transport Association 2.7, Dangerous Goods in Excepted Quantities, by charter aircraft from NE Cape to Nome, Alaska, and then transported via express delivery service for overnight delivery, when possible, to the contracted laboratory.

4.3.1 Sample Preservation

The sample collection containers, preservatives, and holding times for soil samples from the Phase I ISCO are shown on Table 7. Table 8 shows the sample containers, preservatives, and holding times for groundwater samples collected during the Phase I ISCO.

4.3.2 Sample Packaging

Analytical samples were packaged in the following manner:

- Each sample was placed in a plastic Ziploc® bag and sealed.
- Frozen ice packs were placed on the bottom of an analytical laboratory-supplied cooler.
- Each individual sample enclosed by a Ziploc bag was then surrounded in bubble wrap and placed in the cooler.
- The headspace of the cooler was filled with frozen ice packs.
- The chain-of-custody form was reviewed by Bristol's Contractor Quality Control System Manager and placed inside a sealed Ziploc bag, which was then taped to the inside surface of the cooler's lid.
- A custody seal was taped across the seam where the cooler lid and body meets, signed, and dated.
- The analytical laboratory was notified of approximately when and how many samples were to arrive.

4.3.3 Sample Shipment and Contacts

Samples were staged for pickup during periodic re-supply flights from Nome. Samples were shipped via Bering Air cargo plane to Nome, transferred to Alaska Airlines' air freight service using their Goldstreak next-available flight service, and flown to the TestAmerica Laboratories, Inc.'s (TestAmerica's) analytical laboratory located in Tacoma, Washington.

4.4 LABORATORY DATA VERIFICATION

Data verification was performed on the data collected as part of the NE Cape ISCO Study field effort. Data verification was performed to evaluate the completeness, correctness, consistency, compliance with method procedures and QC requirements, and identification of anomalous data. The reported project sample values, as well as any method laboratory control samples extracted or prepared with the project samples, were reviewed. Appendix B contains the laboratory data verification report generated based on the review of laboratory analytical data associated with the field portion of the Phase I ISCO activities. ADEC Checklists are found in Appendix L.

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5.0 PHASE I ISCO AREA OF INTEREST EVALUATION AND STUDY SITE SELECTION

As a prerequisite to ISCO testing, development of a robust conceptual site model (CSM) is necessary to fully understand the distribution of contamination with respect to both lateral and vertical extents, as well as provide insight into site geology and hydrogeology. A review of historical site data indicated that within the MOC area, several areas of the site have historically displayed both soil and groundwater concentrations in excess of the target cleanup levels. Table 2 and Table 3 summarize historical groundwater and soils results respectively for select sample locations with the MOC area.

Given this information the area displaying the broadest contiguous distribution of soils exceeding target cleanup levels is the area between SB88-16 and SB88-11. In addition to soil concentrations exceeding target cleanup levels, groundwater contaminant concentrations in this area (as indicated by samples collected from MW88-5) have also been shown to exceed target cleanup levels and appear to remain stable over time. While groundwater concentrations at MW88-5 are not the highest observed within the MOC area, they also have not shown broad swings in observed contaminant concentrations, like other monitoring wells within the MOC area, and groundwater has historically been encountered at relatively shallow depths within this portion of the site. Given the available data density and presence of relatively shallow groundwater observed within this area, it was selected as the Phase I ISCO Area of Interest (AOI). Figure 4 shows the approximate bounds of the selected Phase I ISCO AOI. Prior to initiating ISCO testing within this area, additional site evaluation was performed. This Phase I ISCO AOI evaluation included the following work components:

- Site hydrogeologic conditions
- Test-pit based site characterization

Observations made during, and results obtained from, the Phase I ISCO AOI evaluation efforts are discussed in the following sections.

5.1 HYDROGEOLOGIC EVALUATION

5.1.1 Groundwater Level Gauging

To evaluate hydrogeologic conditions at the site, existing monitoring wells at the MOC were gauged for depth to water. Wells included in the gauging effort were MW88-1, MW88-3, MW88-4, MW88-5, MW88-10, MW16-1, MW16-2, MW16-3, 18MW1, 17MW1, 22MW2, 22MW3, 20MW1, and 26MW1. Monitoring wells MW16-1, MW16-2, and MW16-3 were observed to be dry during groundwater-level gauging events. Additionally, monitoring well 18MW1 was observed to be obstructed at an approximate depth of 7.82 ft bgs. As such, groundwater levels at these locations could not be measured and were not included in groundwater surface mapping. Based on the data collected, a groundwater elevation contour map was generated in the field to evaluate regional groundwater flow direction and gradient. Figure 5 displays the groundwater elevation contour map generated from water level data collected on 23 July 2009. Based on the groundwater contours, the groundwater flow direction is approximately northwest across the MOC area. The groundwater flow direction observed in the MOC area is consistent with previous observations and suggests that the groundwater trends with the surface topography of the site. A calculated horizontal gradient of 0.0313 ft/foot, as measured as the head differential between monitoring wells MW88-10 and MW88-5. Groundwater elevations for gauged monitor wells are summarized in Table 9.

5.1.2 Hydraulic Testing

In addition to water-level gauging, slug tests were conducted at a subset of the existing monitoring wells to evaluate conductivity and permeability. Wells where slug testing was performed include 20MW1, MW88-5, ICOMW01, and ICOMW02. Table 10 summarizes the conductivity values obtained from slug-testing activities at the site. Calculated conductivity values ranged from a low of 0.57 ft/day at MW88-5 to a high of 8.39 ft/day at 20MW1. Based on this data, hydraulic conductivities appear to decrease, moving northward towards the drainage basin at the site.

5.2 TEST PIT SITE CHARACTERIZATION

To rapidly evaluate the lithology and characterize soil conditions within the Phase I ISCO AOI, test pit excavations were conducted within a localized area of the MOC. Testing pitting was selected based on the ability to rapidly collect detailed site lithologic data during excavation using equipment available at the site. This area was selected based on historical data density, historical indication of contaminant concentrations exceeding cleanup criteria for both soil and groundwater media, and the likelihood of encountering groundwater at a relatively shallow depth. The locations of the test pits installed during the characterization effort are illustrated on Figure 6. Test pits were excavated using a CAT 322B excavator equipped with a 4.5-foot-wide, 2 cubic yard bucket. Test pits were excavated to a depth of 10 feet bgs or the water table, whichever was encountered first. Soil excavated from the test pits was visually evaluated, photographed, logged, and screened with an OVA. Test pitting was conducted under the supervision of a geologist that was responsible for soil characterization and soil screening.

During test pit sidewall exposure, a shallow perched water-bearing zone was observed approximately 4 to 4.5 feet bgs at Test Pits TP-2, TP-7, TP-8, TP-12, and TP-13. These test pits fall generally within the drainage basin of the MOC area, as indicated by the surface contours. The perched water zone observations are noted on Figure 7. Logs generated during the test pitting efforts are provided in Appendix C. Photographs illustrating test pitting activities being conducted at the Phase I ISCO AOI are provided in Appendix J. After test pit characterization activities were completed, the test pits were backfilled with excavated material in reverse order of excavation following completion of the test pitting activities.

5.2.1 Test Pit Soil Screening

During the test pitting efforts, soil samples were routinely screened using an OVA. Table 11 summarizes the OVA readings collected during the test pitting effort. Soil samples were collected to characterize soil contamination at locations where OVA readings or visual inspection suggested the presence of petroleum impacts. Selected soil samples underwent field-screening analysis for DRO using a siteLAB field test kit. Results of the DRO field analyses are provided in Table 12. Photographs of example extractions in sample vials are provided in Appendix J. During field screening, it was determined that screening kit results were biased significantly low. The determination that site screening kits were biased low was based on a combination of control-spiking experiments run in the field where high organic content and clean beach sand samples were spiked with known concentrations of neat diesel and analyzed using the test kits. These spike test results indicated a significant low bias in samples with high organic content. Further confirmation of the potential for low bias was obtained by direct comparison of field-screening data to off-site laboratory data for a series of split samples. It is hypothesized that naturally occurring humic and fulvic acids associated with the high organic content of the soil sample matrix may have resulted in the quenching of the flouresence used to measure DRO concentrations using the siteLAB testing kits. Based on the significant potential for low bias, data obtained using the siteLAB test kits should be considered highly qualitative at best.

5.3 PRE-ISCO SOIL BORING AND MONITORING WELL INSTALLATION

Upon completion of the test pitting efforts, four soil borings and two temporary monitoring wells were installed in the vicinity of the proposed Phase I ISCO demonstration site. Figure 6 shows the location of the four soil borings and two monitoring wells installed as a part of the characterization effort. The soil borings were designated as ICOSB01, ICOSB02, ICOSB03, and ICOSB04, and the monitoring wells were designated as ICOMW01 and ICOMW02. Screening samples for soil were collected from ICOSB01, ICOSB02, ICOSB03, and ICOSB04. Screening samples from these locations were submitted for off-site analysis to confirm the appropriateness of the proposed Phase I ISCO site. Screening results for DRO in soils measured 98 milligrams per kilograms (mg/kg) 130 mg/kg, 13 mg/kg, and 260 mg/kg in samples collected from ICOSB01, 02, 03, and 04, respectively. Data obtained from these screening samples are summarized in Table 13. Photographs of soil boring-installation-related activities are included in Appendix J.

During the installation of ICOSB01, saturated soils were initially encountered at a depth of approximately 13.5 ft bgs; however, groundwater levels were observed to rise to a depth of approximately 7 ft bgs within the augers. A similar observation was also noted during the installation of ICOSB04, providing an indication of confined aquifer conditions. The indication of a deeper (approximately 13 to 14 ft bgs) confined aquifer coupled with the observation of a previously unreported thin, shallow/perched water-bearing zone, prompted a closer look at the potential for multiple aquifers within the Phase I ISCO study area. To evaluate the potential for multiple water-bearing zones, and further evaluate contaminant distribution between these two zones, two temporary monitoring wells were installed. The first of the wells, ICOMW01, was constructed as a deeper monitoring well with a screened interval corresponding to approximately 12 to 17 ft bgs. This well was intended to isolate the confined aquifer observed during the installation of ICOSB01 and ICOSB04. A second temporary monitoring well, ICOMW02, was constructed as a shallow monitoring well with a screened interval corresponding to approximately 3.5 to 8.5 ft bgs. This monitoring well was intended to isolate the shallow/perched water-bearing zone noted in the area during test pitting activities. Also, monitoring well construction logs for the existing and adjacent monitoring well MW88-5 were reviewed. It was determined that monitoring well MW88-5 was screened from 6.5 to 16.5 ft bgs, with a sand pack from 4.5 to 16.5 ft bgs. Based on this information, it is likely that this monitoring well was screened across multiple water bearing zones.

To quickly evaluate the vertical contaminant distribution between the observed water-bearing zones, screening samples of groundwater were collected from ICOMW01, ICOMW02, and MW88-5. Results from the screening samples indicated that the shallow water-bearing zone was significantly more impacted than the lower, confined water-bearing zone. The DRO levels in the shallow zone (ICOMW02) measured 32.8 milligrams per Liter (mg/L) while DRO concentrations in the lower zone (ICOMW01) were measured at 1.18 mg/L (less than groundwater cleanup goals). The DRO concentrations in groundwater at MW88-5 measured 7.53 mg/L falling between the values observed in the shallow and deep zone, respectively. Data obtained from these screening samples are summarized in Table 13. Soil boring and well completion logs are attached in Appendix D and Appendix E, respectively.

5.4 ISCO DEMONSTRATION AREA SELECTION

Based on information gathered during test pitting and the pre-ISCO soil boring and monitoring well installation observations presented above, the shallow vertical horizon extending from approximately 5 to 10 ft bgs in the area between ICOSB04 and ICOSB02 was selected for the Phase I ISCO demonstration. This area was selected based on observations including the presence of significantly elevated soil and groundwater concentrations consistent with a continuing source of contamination and the general lack of contaminant concentrations exceeding target cleanup levels observed within the lower confined aquifer zone. Despite the area’s high organic soil content, it was determined that the geologic and hydrogeologic conditions were likely representative of conditions across the broader area. It was further determined that in order for ISCO to be an effective remedy, it would have to be capable of treating similar geologic and hydrogeologic conditions across the MOC area. The nature of historical contaminant releases, either to the ground surface or to shallow subsurface soils, and the observed prevalence of high organic content soils at the site dictate that an effective remedy be selected capable of remediation under these conditions.

5.5 PHASE I ISCO SOIL BORING, INJECTION, AND MONITORING WELL INSTALLATION

Based on the characterization information obtained during the test pitting and pre-ISCO soil and groundwater screening efforts noted above, the Phase I ISCO study was constructed to target the shallow soil and groundwater impacts identified. Figure 8 shows the installed configuration of the Phase I ISCO study monitor and injection wells. The primary injection well was identified as ICOIW01. The Phase I ISCO study monitoring wells were sequentially identified as ICOMW02 through ICOMW09. During well installation, soil borings were continuously screened using an OVA, and samples from the interval displaying the highest OVA readings were submitted for off-site laboratory analysis. Table 14 summarizes the OVA readings from the borings associated with the Phase I ISCO monitoring wells. Off-site analytical data associated with soil samples submitted to the off-site laboratory are presented in Table 15, along with historical data associated with soil borings adjacent to the selected Phase I ISCO demonstration area. Concentrations of DRO measured as a part of this effort were significantly elevated as compared to historical data (Table 15) from points in the adjacent areas, and represent the highest levels observed at the site to date.

5.6 PHASE I ISCO AOI EVALUATION SUMMARY AND REVISED SITE CONCEPTUAL MODEL

Based on information collected during test pitting, soil boring, and monitoring well installations, a series of geologic cross sections were generated. Figure 9 shows the location of two transects: one trending roughly east to west or approximately perpendicular to groundwater flow at the site, and the other trending approximately southeast to northwest or parallel to groundwater flow at the site. Figure 10 provides a visualization of the southeast to northwest, while Figure 11 provides a visualization of the east-west cross section. From these cross sections and their supporting raw data, several key observations can be made. Observations include the following:

- Fill material was consistently observed during test pitting and soil boring activities within the Phase I ISCO AOI. The fill material observed during test pitting typically ranged from 2 to 5 feet in thickness. In general, increasing fill material thickness was observed at locations closest to the drainage basin, as might be expected assuming that fill material was intended to develop a level area along the natural slope of the native topography for site construction.
- Peat and/or organic silt layers were commonly observed within the Phase I ISCO AOI. These peat and/or organic silt layers were observed at 10 of the 12 test pits excavated. The observed thickness of these layers was variable ranging from a few inches to several feet in thickness. The thickness of the peat and/or organic silt layers was generally observed to increase in locations closest to the drainage basin. The observed peat and organic silt lithologies were typically located a short vertical distance from the bottom of the fill material and were typically underlain by tighter silty lithologies.
- Frozen soil layers were intermittently encountered during test pitting. Observations of frozen or partially frozen soils were typically associated with finer-grained soils.
- A shallow water-bearing zone was observed through the central portion of the area evaluated by test pitting. This shallow water-bearing zone was observed at TP2, TP7, TP8, and TP12, at an approximate depth of 4 to 5 ft bgs.

With respect to the CSM, each of these observations are of particular interest and are likely to some extent govern the observed distribution of contamination at the site. Fill material observed at the site likely acts as a solar conductor, allowing for the seasonal development of shallow groundwater flow zones. The frequent observation of peat and organics silts, especially at shallow vertical intervals, suggests that these materials have a high potential to serve as an ongoing reservoir for contamination at the site. This potential stems from the nature of releases at the site (surface spills from leaking tanks and overfill events, and leaks from broken and separated joints of shallow underground piping), their high organic content and shallow depth of the deposition of these materials. The high fraction of organic carbon and porosity of these materials gives them increased sorptive capacity for contaminants. Additionally, their relatively shallow depth places them in direct contact with subsurface fuel transfer infrastructure, such as pipes and utilidors, as observed at Test Pit 12/13, and also leaves them ideally suited to capture vertical migration of contamination associated with surface spills. The potential for these soils to serve as an ongoing source to groundwater contamination is further exacerbated by the presence of shallow groundwater flow zones observed at the site that put groundwater in direct contact with soils having a high contaminant holding potential. Furthermore, the observed peat/organic silt soils were typically underlain by finer-grained and potentially frozen silts layers. These layers have the potential to serve as a barrier preventing excessive migration of contamination from the shallow water-bearing zone to the deeper confined aquifer and likely contribute to the reason confined conditions are observed within the deeper water-bearing zone. Frozen zones also have the potential to dramatically impact the vertical and horizontal distribution and transport of groundwater across the area.

6.0 PILOT STUDY ACTIVITIES AND OBSERVATIONS

Phase I ISCO pilot study activities included the following work components:

- Bench scale soil oxidant demand testing
- Bench scale treatability testing
- Pilot study design and construction
- Chemical oxidant injection
- Performance monitoring

The Phase I ISCO test results are discussed in the following sections.

6.1 FIELD LABORATORY SETUP

ATS utilized an on-site construction trailer to construct a temporary on-site field laboratory facility. A bench-top ventilation hood was installed, and a shower and eyewash station and tables were set up to provide work stations for an equipment calibration station, analytical equipment, and the TOC study.

6.2 OXIDANT DEMAND TESTING

Prior to performing oxidant injections at the site, bench scale testing was done to evaluate the natural oxidant demand of soil and groundwater from the MOC area. Iron- and hydrogen-peroxide-catalyzed sodium persulfate ($Na_2S_2O_8$), and FMC Environmental Solutions' (FMC's) commercially available Klozur® sodium persulfate, were used for the bench-scale TOD study.

6.2.1 Sample Collection and Preparation

Soil samples were collected at various times during July 2009 site soil and groundwater investigation activities for characterization and reaction behavior evaluation. Soil samples for TOD testing were collected on 19 and 20 July 2009 during installation of temporary soil borings. Soil samples collected at soil boring ICOSB03 were organic clayey silts (OL/ML) collected at 5 to 7 ft bls. Soil samples collected at soil boring ICOSB02 (6 to 7 ft bls) and ICOSB01 (5 to 6 ft bls) were primarily peat (PT), while those from ICOSB03 (9-11) were gray silt (ML). Groundwater samples were collected on 18 July 2009, from monitoring wells 88MW-4 and 88MW-5. Groundwater samples were composited.

The determination was made in the field lab to examine the TOD exerted by each of the three predominant soil types encountered in the MOC area: PT, OL/ML ML. To prepare for the treatability study, soil samples from the three soil types were composited by type. Soil/groundwater slurry vessels were then prepared to perform TOD tests. The slurries were prepared by placing 100 grams of site soil in 0.5-liter bottles. For each soil type, composite groundwater was added to the soil to create a liquid slurry. Photographs of the field laboratory bench set-ups are provided in Appendix J.

6.2.2 TOD Testing Activities

Duplicate vessel soil and groundwater slurry tests from each soil sampling interval were prepared for TOD study at room temperature, and single-vessel slurry tests were prepared for 4 degrees Celsius (4 °C) tests. In total, nine test vessels per location were used for the TOD study: three $Na_2S_2O_8$ only, three iron-catalyzed $Na_2S_2O_8$, and three H_2O_2-catalyzed $Na_2S_2O_8$ test vessels. Each vessel was composed of soil and groundwater slurry amended with 20 grams per kilogram of FMC Klozur sodium persulfate. The H_2O_2-catalyzed TOD tests were prepared and also dosed with an appropriate volume of 8 percent (%) by weight hydrogen peroxide solution. For the iron-catalyzed TOD tests, each slurry vessel was additionally dosed with an appropriate mass of FeEDTA to generate a 300 parts per million (ppm) concentration of iron in solution.

Each vessel was then mixed briefly by hand swirling, and allowed to sit undisturbed for five days. The ORP and pH were measured and recorded at 24-hour intervals to monitor oxidant consumption. At the end of treatment, all vessels were iodometrically titrated to an endpoint, or monitored for an ORP inflection point, and the TOD was calculated.

Periodic laboratory parameter checks from set-up through day five indicated an immediate drop in pH from 5 to 6 downward to approximately 2 to 2.5 for the monitored period. Baseline ORP values ranged from approximately 80 millivolts (mV) to 125 mV for the various soil types. Following addition of reagents, ORP increased to values greater than 400 mV in nearly all reactions. The ORP remained elevated for the duration of the TOD study. The TOD results for the soil-groundwater slurries are reported in Table G-1 (Appendix G).

6.3 TREATABILITY TESTING

In addition to the field demonstration effort, a bench scale treatability study was also conducted. A treatability study would normally be conducted prior to formulating a field study WP; however, project schedule and limitations (frozen ground versus manual sampling versus cost) on the ability to collect representative samples prior to the summer field season committed this phase to be performed following ISCO-related site characterization.

The objective of the bench scale treatability study was to supplement the *in-situ* approach by varying oxidant dosages and examining catalyzed H_2O_2, iron-activated persulfate, and hydrogen-peroxide-activated sodium persulfate, as independent treatability scenarios. Evaluation of oxidant effectiveness and oxidant efficiencies in the bench typically help refine the design of the pilot study WP.

ATS's Treatability Study Laboratory (TSL) in Orlando, Florida, conducted a bench-scale treatability study from August to December 2009, using site soils and groundwater from the NE Cape USACE site. Soil and groundwater samples were collected on 8 August 2009, from one monitoring well on site, ICOMW07. Soil samples were collected from hollow-stem auger flights, and immediately transferred to a 5-gallon bucket lined with a thick polyethylene bag, to assist with moisture retention as well as to minimize volatilization of contaminants. Groundwater samples were collected using a mini Typhoon centrifugal pump, as described previously. Groundwater samples were collected in 5-liter collapsible polyethylene bottles and immediately packed with reusable ice packs prior to transportation. A total of four 5-liter bottles of site groundwater and one 5-gallon Nalgene® polypropylene bucket of site soils were collected for the bench scale treatability study. Groundwater and soil samples were shipped from the site on ice, under chain of custody, via FedEx to ATS's TSL in Orlando, Florida, as follows:

> Groundwater samples from the site were received at the TSL on 21 August 2009, via FedEx courier. Soil samples were delayed in transit, and were received in good condition at the TSL on 26 August 2009. Once received, samples were checked for condition of container, appearance, temperature, and pH. The TSL logged in approximately 20 kilograms of soil. Samples were moist, brown in color, with a strong petroleum odor noted. Groundwater samples were checked and three of the four 5-liter bottles of groundwater were observed to be intact. One sample bottle was

noted to have a cracked cap, which may have resulted in sample volume loss during transportation. The 5-liter groundwater sample bottle was received with approximately 4.5 liters of sample. Samples appeared cloudy and had an orange-brown color, with a slight petroleum odor. A login temperature of 4 °C and a pH range of 5 to 6.5 were recorded for groundwater samples. Soil pH was not measured. A sample aliquot of both the groundwater and soil was collected following sample login and submitted to TestAmerica, an Alaska-certified laboratory, in Tacoma, Washington, for baseline analyses of parameters listed in Table G-2 (Appendix G). The remaining samples were transferred to a 4 °C in-house refrigerator for storage until use in the bench-scale treatability study.

Baseline sampling of site groundwater and soil samples from the NE Cape site was conducted on 21 August 2009 and 26 August 2009, respectively. Two different remedial approaches were studied in the bench scale treatability study: activated $Na_2S_2O_8$ and catalyzed H_2O_2. Detectable levels of the key COCs (DRO, GRO, and RRO) were observed in both matrices.

On 15 September 2009, a treatability study was set up following completion of the TOD study in Alaska. Based on results obtained from the TOD study, two $Na_2S_2O_8$ concentrations were selected for the bench-scale treatability study, a 2% (low) and a 10% (high) concentration. Hydrogen peroxide and FeEDTA were used as activators in the $Na_2S_2O_8$ treatment set-ups. The study was set to run for seven weeks,with five sampling events scheduled at set-up and at weeks 1, 3, 5, and 7. Additionally, a cumulative 7-hour catalyzed H_2O_2 study was planned with five sampling events scheduled at set-up and hours 1, 3, 5, and 7.

6.3.1 Setup and Sampling

6.3.1.1 Activated Sodium Persulfate

Reaction vessels were set up on 15 September 2009, using approximately 500 grams of site soil and 1,000 mL of site groundwater. An untreated control of site soil and site groundwater only was sampled and submitted to TestAmerica for analysis on 15 September 2009. A list of analyses is presented in Table G-2 (Appendix G). Vessels for the four remaining study periods, weeks 1, 3, 5 and 7 were set up as illustrated in Table G-3 (Appendix G).

Each vessel was dosed with a 2% or 10% FMC Klozur $Na_2S_2O_8$ solution, except for the soil and groundwater only control. The low and high persulfate (S_2O_8) treatment reactions were then activated by adding the target volume of 8% H_2O_2 solution or mass of FeEDTA to obtain an iron (Fe) concentration of 300 ppm. Five vessels were set up for each of the four sampling events for a total of 20 study vessels. To avoid loss of contaminant during testing, corresponding reaction vessels were set up for pH and ORP monitoring. All reaction vessels were hand swirled and allowed to sit undisturbed for the duration of the respective study periods. Fermentation corks were attached to each vessel to aid with release of pressure buildup during the oxidation reaction. The pH and ORP measurements were taken following set-up and at each sampling event.

Sacrificial samples were collected on 23 September, 8 October, 22 October, and 10 November 2009, corresponding to the four sampling events at weeks 1, 3, 5, and 7, respectively. At the end of each study period, reaction vessels were quenched with a 0.5 molar sodium thiosulfate solution ($Na_2S_2O_3$) to quench sodium persulfate prior to sampling. Samples were collected in the appropriate sample containers and immediately placed on ice. They were shipped under chain of custody to TestAmerica via FedEx overnight courier for laboratory analysis. The pH, ORP, and residual oxidant measurements were obtained from the duplicate vessels at the time of sampling.

6.3.1.2 Catalyzed Hydrogen Peroxide

On 18 November 2009, a modified catalyzed H_2O_2 study was set up. Catalyzed H_2O_2 is an advanced oxidation process by which H_2O_2 reactions produce highly reactive radical species. These radicals subsequently serve as the active oxidants. Hydrogen peroxide is typically catalyzed by exposure to a divalent metal, e.g., ferrous iron (Fe+2). The reaction of Fe+2 with H_2O_2 produces a highly reactive hydroxyl radical (OH), which is the strongest oxidant used for ISCO. Only fluorine, which is not used because of its hazardous properties, is a stronger chemical oxidant. The driving force as an oxidant is illustrated by the thermodynamic standard electrode potential for the hydroxide as shown in the half-reaction below.

$$\mathbf{2\ \cdot OH + 2H^+ + 2\mathit{e}^- \rightarrow 2H_2O \quad E^\circ{=}{+}2.8V}$$

In addition to OH production, H_2O_2 and catalyzed H_2O_2 can also result in the formation of a number of other reactive species capable of degrading common organic contaminant species. Half reactions for some of these additional reactive species are shown below.

$$\mathbf{H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O \quad E° = +1.8V}$$

$$\mathbf{HO_2 + 2H^+ + 2e^- \rightarrow 2H_2O \quad E° = +1.7V}$$

$$\mathbf{O_2^- + 4H^+ + 3e^- \rightarrow 2H_2O \quad E° = -2.4V}$$

$$\mathbf{HO_2^- + H_2O + 2e^- \rightarrow 3OH^- \quad E° = -0.88V}$$

Advantages offered by application of catalyzed H_2O_2 include the very rapid generation of highly reactive, non-specific hydroxyl radicals and intermediate reactive species as described above.

Reaction vessels were made up of approximately 500 grams of site soil and 1,000 mL of site groundwater. A low (5%) and a high (10%) hydrogen peroxide-dosed treatment vessel were set up to estimate the efficacy of the tested oxidants to mineralize the targeted contaminants. An untreated vessel containing site soil and groundwater only was also set up to serve as a control. The catalyzed H_2O_2 experimental set-up is illustrated in Table G-4 (Appendix G).

FeEDTA (as indicated in Table G-3, Appendix G) was added to the low and the high reaction vessels to obtain a target iron concentration of 30 ppm and 60 ppm, respectively. The reaction was conducted in an ice bath to control the temperature rise caused by the addition of H_2O_2 to FeEDTA, generally an exothermic reaction. A 5% and 10% H_2O_2 solution was slowly added to the 30 ppm and 60 ppm FeEDTA-dosed reaction vessels, respectively. A bubbling effect as well as generation of fumes was observed in the containers. A slow addition of H_2O_2 with continuous adjustment to the pH, as needed, controlled changes in the pH and temperature during the reaction. A temperature range of 20°C – 30°C was noted. The reaction pH was observed to be stable within the range of pH 3 to pH 5. Fermentation corks were attached to each vessel to aid with release of pressure buildup during the oxidation reaction. Nine reaction vessels consisting of 1 control, 4 low-level treatments, and 4 high-level treatments were assembled. Reaction vessel setup began with the 7-hour reaction vessels and ended with the 1-hour reaction vessels. Reactions started immediately following setup. Reaction start and stop times were logged for each of the study periods.

At the end of each study period the reactions were quenched with Sigma-Aldrich® brand C3155, bovine catalase, which has approximately 35,000 units of enzyme per milligram of protein. Determination of residual H_2O_2 concentrations was done via spectrophotometric analysis by using the HACH test kit Model HYP-1. The specific model measured H_2O_2 concentrations in the range of 0.2 mg/L – 10 mg/L.

Gas bubble generation within sample containers suggested occasional incomplete quenching of H_2O_2. All samples were collected and stored in a 4 °C refrigerator overnight for observation to determine if sample containers would crack from pressure buildup. All sample bottles were observed to be in good condition on 20 November 2009. Samples were packaged and shipped under chain of custody via FedEx overnight courier to TestAmerica for analysis of parameters listed in Table G-2 (Appendix G).

6.3.2 Results

An overview of key findings for the soil and water matrices is presented in the following sections. Generally, the presence of organics in the treatability study samples appeared to competitively inhibit the oxidation of the target contaminants. Persulfate was persistent through the study period, suggesting that quantity of oxidant utilized for testing was adequate, but that oxidation of the organic matter would continue for an extended period of time. Additional oxidant would likely consume a greater relative proportion of the organic matter present, and would likely do so preferentially to the contaminants of concern.

6.3.2.1 Activated Sodium Persulfate – Groundwater

Four sampling events were completed for each treatment condition. Analytical results for the groundwater samples are presented in Table G-5 (Appendix G). In general, an increase in contaminant concentrations following treatment was universal for all reaction conditions. The 10% S_2O_8 reaction vessels exhibited greater initial increases in apparent contaminant concentrations than their 2% S_2O_8 counterpart.

The pH, ORP, Fe, and residual oxidant measurements were obtained from the duplicate reaction vessels. Ferrous iron was measured in-house at weeks 5 and 7 using the HACH model IR-18C kit. Results are presented in Appendix G, Figures G-1 and G-2 for pH and ORP, respectively.

The pH in the untreated samples was in the pH 5 to 6 range. The pH in the treated samples ranged from pH 1 to 3. The 10% S_2O_8 were observed to have the lowest pH. The ORP ranged between 100 mV and 300 mV for the untreated sample during the course of the treatability study. A 300 mV to 650 mV ORP range was observed in the treated samples. The 10% S_2O_8 treatments were observed to have the highest ORP. Exaggerated ORP values may be a result of the inverse relationship between depressed pH and high ORP, which is a function of sensing electrode design.

6.3.2.2 Activated Sodium Persulfate – Soil

Frequently, soil samples were more slurry-like in composition, as organic matter had structurally collapsed following oxidation. Laboratory results are presented in Table G-6 (Appendix G). The DRO concentrations in soil for all set-ups is relatively unaffected by oxidation treatment with persulfate, as compared to baseline concentrations. There are fluctuations in concentrations over multiple sampling events, notably a downward inflection at the week 5 sampling event. However, no trend in soil contaminant response is evident over the study duration. A decrease in naphthalene was observed in the 10% treatments.

6.3.2.3 Catalyzed Hydrogen Peroxide – Groundwater

Soil and groundwater samples were submitted to TestAmerica for laboratory analysis. Groundwater results are presented in Table G-5 (Appendix G). Rapid increases in groundwater concentrations of DRO and RRO are observed immediately, as compared to baseline. This suggests desorption of DRO/RRO compounds during oxidation of natural organic matter. A decrease in DRO in the 5% H_2O_2 set-up by day 3 may be due to aqueous phase oxidation. Significant increases in contaminant concentrations in 10% H_2O_2 reaction vessels may be a product of proportionately greater oxidation of natural organic matter. Aqueous-phase destruction may have started to overcome desorption effects by the 7-hour sampling event, as indicated by declining contaminant concentrations

6.3.2.4 Catalyzed Hydrogen Peroxide – Soil

Soil DRO concentrations decrease from baseline; however, this may be due more to desorption into the aqueous phase, and less to do with direct oxidation. Soil GRO concentrations increased significantly for the 10% H_2O_2, while remaining less affected for the 5% H_2O_2 reaction vessels. Results for soil sample analysis are presented in Table G-6 (Appendix G).

Visual observations of the soil matrix in the reaction vessels with significant peat soil indicated that over time, bulk organic matter was reduced in volume and fiber size appeared to decrease. The TOC analytical results for groundwater were significantly greater compared to baseline, supporting the concept of oxidation of the soil matrix and its conversion to soluble organic carbon compounds. Desorption of COCs is likely continuous as the soil organic matter degrades and releases sorbed petroleum hydrocarbon. Increasing contaminant concentrations in groundwater for multiple COCs is similar in response to the post-ISCO monitoring results from the field effort. Higher concentrations of oxidants appear to result in greater concentrations of COCs for both activated persulfate and catalyzed H_2O_2 systems. This result may be due to either desorption of contaminants from organic matter as it is degraded, or creation of matrix interference due to the reaction between higher oxidant concentrations and the soil organic matter.

6.3.3 Data Quality Assurance/Quality Control Review

ATS performed independent QC checks of laboratory procedures that were used in collecting and analyzing the data. This review addressed holding times, blanks, laboratory control samples, surrogate recoveries, and matrix spike/matrix duplicates to verify that the data collected adhered to method, standard, or laboratory-specific QC requirements.

A review of laboratory data collected in the current reporting period identified these QC notations:

- Hexavalent chromium analysis was completed out of hold for each event due to time taken to get samples to the laboratory. The analysis has a 24-hour hold time for both soil and groundwater samples. Samples were shipped from the TSL overnight via FedEx courier to TestAmerica in Tacoma, Washington, but were unable to be logged in to complete analysis within specified hold times.
- pH was in the 1 to 3 range in a number of the treated samples. This was below the pH required to analyze for alkalinity by U.S. Environmental Protection Agency Method 310.1. Therefore, alkalinity results were not reported for a number of samples.
- Sample volume was lost. A few samples were lost in the catalyzed H_2O_2 reaction study when expulsion of sample from the container occurred due to sample vessel pressurization during transport. Due to limited sample availability, a number of the metals analyses could not be completed.

- Sample preservation methods were modified. When gas bubbles accumulated and generated headspace in volatile samples submitted to the laboratory for analysis in the early stages of the study, subsequent samples were collected in unpreserved 40 mL volatile organic analysis vials and were preserved by the laboratory prior to analysis.

The notations listed above should be considered when reviewing the applicable analytical data. No additional QC issues were encountered requiring qualification of the data.

6.4 PILOT STUDY DESIGN AND CONSTRUCTION

Details regarding the design and construction of the pilot study injection and monitoring well network are provided in Section 3.5. Prior to accepting use of surface water for makeup water in the chemical mixing process, measurements of pH, ORP, temperature, and ferrous iron were made. No iron was detected, ORP was 73 mV, pH was 6.44, and the temperature was 16.2 °C. No parameter was such that it would disqualify use of the surface water body as a water source.

6.5 OXIDANT INJECTIONS

Oxidant injections started on the morning of 9 August 2009, at ICOIW01. Injection system pressure, flow rates, total volume delivered, and temperature of injection solution were recorded during injection. Throughout the injection program, injection pressures at the system and the injection head were maintained below 15 pounds per square inch. Flow rates averaged 4 gallons per minute (gpm), with maximum flow rates less than 7 gpm. Injections continued at ICOIW01 through the afternoon of 10 August 2009. Mechanical problems with injection pumps forced a shutdown on the late afternoon of 10 August 2009. Following repairs on the morning on 11 August 2009, injections were restarted and continued until site reconnaissance noted release from a seep and the related collection of oxidant solution in a depression/pond 40 feet northeast of the injection well ICOIW01 in the late afternoon. Based on observations of color and depth of collected liquid in the depression/pond, it is estimated that the release to surface was less than 15 gallons.

Following this observation, injection activities were transitioned to ICOMW09 in an effort to achieve the target volumes and mass of oxidants estimated for the Phase I ISCO study area. Unfortunately, short circuiting of injected fluids was once again observed through the side wall in the same low-lying area immediately adjacent to the Phase I ISCO study area. As a result, no further injection activities were attempted. Target injection volumes and oxidant masses were not achieved because of the occurrence of the short circuit and resulting surface release.

6.5.1 Injectate Solution Composition and Volume

Individual solutions of H_2O_2, sodium persulfate, and iron activator (as FeEDTA) were prepared for injection in a sequential pulse fashion. Photographs of chemical mixing stations are provided in Appendix J.

Stabilized H_2O_2 concentrations ranging from 8% to 12% were prepared from 35% H_2O_2. The 35% H_2O_2 was delivered in U.S. Department of Transportation-approved 55-gallon drums and stored in the chemical container until needed. A pallet holding four drums of H_2O_2 was transferred from the chemical container to a pallet containment staging area adjacent to the injection system container, and diluted in an 80-gallon over-pack drum with on-site water. On-site water, collected from an upgradient contaminant-free stream, was delivered to the injection system container by Bristol on an as-needed basis.

A 26% to 36% solution of sodium persulfate was prepared, as needed, with on-site water and dry sodium persulfate. Dilution of the higher concentration persulfate solutions to delivered concentrations was accomplished by combining liquid volumes of iron solution via an in-line mixer, thus achieving the delivery concentration of both reagents via dilution with the other. The sodium persulfate was shipped to the site in 55-pound plastic bags stacked on pallets. Pallets of sodium persulfate were stored adjacent to the chemical container and covered with plastic sheeting to protect from rain, and bags were transferred by hand to the injection system and mixed with on-site water in an 80-gallon over-pack drum using an electric mixing motor with attached mixing blade.

A maximum concentration of 3,280 ppm iron as FeEDTA catalyst was mixed in an 80-gallon over-pack drum using on-site water, using an electric mixing motor with attached mixing blade. The catalyst consisted of a chelated iron complex and was staged separately from the two oxidants.

Because personal protective equipment and spill prevention measures were utilized in the field and chemicals were staged and mixed on-site (in lieu of shipping prepared solutions), a safe staging area was maintained to ensure very limited risk to field workers and site personnel.

Oxidant injections were conducted as an alternating pulse sequence where small batches of H_2O_2 solution were staggered between small batches of a combined sodium persulfate and FeEDTA activator solution. Injection volumes totaled approximately 1,090 gallons of oxidant/activator solution at ICOIW01 and 646 gallons of oxidant/activator solution at ICOMW09. The concentration of H_2O_2 in the injectate solution ranged between approximately 8% and 12%. The total mass of H_2O_2 injected at ICOIW01 was approximately 1,320 pounds and the approximate total mass of H_2O_2 injected at ICOMW09 was 944 pounds. The concentration of sodium persulfate in the injectate ranged between 13% and 18%, and the total mass of sodium persulfate injected was approximately 660 pounds at ICOIW01 and 932 pounds at ICOMW09. The maximum concentration of iron delivered via injection was 1,640 ppm. Approximately 51 pounds of FeEDTA was injected in ICOIW01, and approximately 43 pounds of FeEDTA was delivered to ICOMW09. Injection rates and quantities are presented in Table H-1 (Appendix H). A visual overview of the injection system set-up is presented in Appendix J.

Based on the 1,090-gallon volume of injectate applied to the subsurface at ICOIW01 across a 5-foot screen interval, the theoretical radius of influence (ROI) of the injection was expected to range between 4.8 and 9.6 feet based on a total porosity of 40%, and a mobile porosity in the range of one-half to one-eighth of the total porosity. Similarly, based on the 646-gallon volume of injectate applied to the subsurface at ICOMW09, the theoretical ROI was calculated to be between 3.7 and 7.4 feet.

6.6 PERFORMANCE MONITORING

The monitoring plan for the pilot study consisted of three discrete sampling periods:

- Baseline monitoring
- Injection performance monitoring
- Post-Injection performance monitoring

Each component of the monitoring plan is described further in the following sections:

6.6.1 Baseline Monitoring

Baseline sampling of soil and groundwater media was conducted prior to the initiation of ISCO injection activities. Baseline soil samples were collected from the smear zone soils during monitoring well installation. Following well installation and development activities, and prior to injection activities, baseline groundwater samples were collected from all monitoring wells. Results obtained during baseline monitoring are presented in conjunction with post injection monitoring results below.

6.6.2 Injection Performance Monitoring

Groundwater data from the monitoring wells within the target injection ROI and immediately downgradient, were collected while oxidant/activator solution was being injected. Field parameters, including electrical conductivity (EC), ORP, DO, pH, and temperature were used as a qualitative means to evaluate injection ROI during injection activities. Table H-2 in Appendix H contains the vertically discrete downhole water quality field parameters collected during the injection event. Based on the field-parameter data collected during the injection event, the injected oxidant combination was evident at monitoring wells ICOMW03, ICOMW05, and ICOMW06. The EC data at these locations displayed a greater than tenfold increase, and ORP levels at these locations were observed to exceed 400 mV during the injection process. These locations also displayed the greatest concentrations of total iron, ferrous iron, sodium persulfate, and H_2O_2, based on field test kit results for these parameters. Further discussion of temperature and conductivity stratification is provided in the following sections. Figures, which illustrate the stratification characteristics for these two parameters at multiple monitoring locations, are provided in Appendix H. Examples of performance monitoring activities are illustrated in Appendix J.

A coarse layer of, broadly, silty gravel is present, which lays atop the peat layer of significant thickness in the treatment area. Beneath the peat is a dense, not infrequently frozen, silt layer, acting as a confining unit. The perched aquifer normally sits atop the silts, and flows at the base of the peat. When injections started, the injected solution mounded within the peat and into the gravels, where present. This layer was a preferential flow path and horizontal conduit, thus allowing warm oxidant solution to move rapidly into and across the upper zone of the shallow aquifer, appearing at ICOMW03, ICOMW05, and ICOMW06.

6.6.2.1 Temperature Stratification

The progression of in-situ performance indicators spatially and over time at the site suggest preferential flow paths are driven by inhibited groundwater flows due to intermittently occurring permafrost within peat and dense silts and the presence of dense silt lenses underlaying shallow non-frozen peat and gravel layers. The observed spatial and temporal distributions of performance indicators provides additional lines of supporting evidence for site features observed grossly in the cross sectional observations of test pit sidewalls and discreet profiles from soil borings and well installations.

On the first day of the injection-monitoring period, the appearance of temperature increases from baseline were observed at monitoring well ICOMW05. Within hours of initiating injections at injection well ICOIW01, temperatures increased in the upper few feet of the water column. Immediately evident is that temperature was highly stratified with depth, ranging from highs of 30 °C in the upper few feet of the water table, to less than 6 °C at the bottom of the shallow aquifer, at the same monitoring time point.

Examining the pattern of temperature rise over time reveals that the temperature in the upper few feet of the shallow aquifer can increase from baseline rapidly, while temperature in the bottom of the shallow aquifer, while capable of increasing, is quenched rapidly when the influence of oxidant injection is removed. Note the approximate temperature progression in ICOMW05 illustrated on the vertical profile figures (Appendix H): 4, 7.5, 8 (increasing on August 9); 24.5 (on August 10); and rapidly returning back to 5 °C (on August 12 and 13). However, the upper layer of the shallow aquifer maintains elevated temperatures (20 °C to 30 °C) once achieved. An explanation for this observation lies in the presence of a permafrost silt lens at deeper intervals previously observed at test pits and in soil boring samples, which rapidly quenches the temperature increase made possible by introducing the oxidant cocktail. This same response pattern of temperature stratification is evident at monitoring wells ICOMW03 and ICOMW06, which are monitoring wells that were most directly impacted by the chemical injections.

Examination of temperature stratification in ICOMW07, ICOMW02, and ICOMW04, reveals overall temperatures across the monitored vertical interval never exceeded 7 °C. There are indications that the upper interval reached 7 °C at ICOMW02 during active injection. However, lower interval temperatures remained less than 2 °C for all three locations throughout the active injection period.

Temperatures at ICOMW02, ICOMW04, and ICOMW07, exhibited further increases by 2 to 4 degrees within a few days post-injection and remained a few degrees higher than measured during active injection at all three locations through the last sampling event 28 days post injection. This suggests that the groundwater that was treated by oxidation addition was eventually migrating into these wells.

Oxidant temperature effects did not appear at ICOMW02 during injection because preferential flow paths were established towards the seep at the sidewall of the pond, and release to the surface occurred there, prior to injection solution propagation much further than ICOMW06. Had the short circuit not occurred, projected additional oxidant volume would have covered the approximate 10-foot interval from ICOMW06 to ICOMW02. Further, the shift to ICOMW09 for injection added an additional 10 feet to the distance from the injection point, reducing the likelihood that influence would be observed at ICOMW02.

Oxidant temperature effects did not appear at ICOMW07 because of permafrost. At this location, ice crystals and frozen peat was observed from approximately 4 feet to a depth of 7.5 feet. The surficial gravel/fill layer here is notably thinner than at the other boring locations, allowing a thicker permafrost lens to form at shallow depths. The preferential flow path is through the peat layer, and flow towards this location was inhibited by the permafrost. Flow that does occur at this well is in the lower 2 feet of the well screen, as suggested by the wet-to-saturated condition at 8.5 to 9 feet.

6.6.2.2 Electrical Conductivity Stratification

The order of appearance of EC changes at the performance monitoring wells follows the pattern for temperature effects. Interestingly, the graphical representation of EC for the wells exhibiting influence suggest EC is slow to change in the shallow vertical interval, while the middle and bottom vertical intervals are increasing rapidly. This is in fact an artifact of the height of the water column within the monitoring well in relation to top of screen height. For ICOMW03, ICOMW05, and ICOMW06, the water column was above the well screen throughout the monitoring events.

The EC values at the middle and bottom monitoring points (within the well screen) are exhibiting the expected increasing response resulting from the presence of sodium persulfate. The vertical distribution of EC across the screen interval is usually slightly higher at the middle interval, than at the bottom interval, which is similar to the apparent behavior suggested by temperature distribution data.

Neither groundwater nor oxidant appeared at ICOMW08 because of the presence of permafrost, and dense, low-moisture content silt-inhibiting flow to 3.5 feet of the 5-foot well screen. An apparent perched water table at 5.5 feet, which was present at the time of installation, was approximately 6 inches thick. The formation at this location was poorly transmissive. Oxidant solution flow trended away from this location towards preferential flow paths.

6.6.2.3 Oxidation-Reduction Potential

The ORP values in the 400 mV plus range at monitoring wells ICOMW03, ICOMW05, and ICOMW06 are typical for the oxidants applied. The ORP at ICOMW07 increased from slightly positive (10 – 15 mV) to over 200 mV from 12 August to 13 August 2009. However, post-injection performance monitoring ORP values at ICOMW07 were consistently negative from the 3-day post injection sampling event through the rebound sampling event, suggesting direct oxidation influence at the well, if any, was short-lived.

6.6.2.4 Hydrogen Peroxide Monitoring

Hydrogen peroxide injection concentrations ranged from approximately 8% to 12%. Measured H_2O_2 concentrations at ICOMW05, located 5 feet away, were no greater than 15 mg/L. This concentration and the greatest sitewide H_2O_2 concentration of 33 mg/L at ICOMW06, were both measured on the final day of injections during a 12% H_2O_2 injection event. These results suggest that peroxide is nearly entirely consumed within 5 to 10 feet of the injection point, the distance variance is likely a function of travel along preferential flow paths.

6.6.2.5 Sodium Persulfate Monitoring

Injection concentration of $Na_2S_2O_8$ was approximately 13% to 18%. Field-kit-measured concentrations of $Na_2S_2O_8$ were 1400 to 3000 mg/L in oxidant-influenced monitoring wells. Previous experience injecting $Na_2S_2O_8$ into low organic content soils at other sites has indicated that a 20% persulfate solution can frequently be measured at a 2% concentration within 10 feet of the injection well, once detected at the monitoring point, and is usually assignable to fractional pore volume dilution effects. The residual $Na_2S_2O_8$ at this study area is 1% to 1.5% of this typical pore volume dilution percentage.

6.6.2.6 Iron Monitoring

Generally, the iron activator is present at the oxidant-affected monitoring wells at the same time as the oxidants. At these wells, ferrous iron concentrations are a fraction of the apparent total iron concentration, suggesting consumption of iron by the H_2O_2. Total and ferrous iron concentrations in monitoring wells that did not exhibit influence by oxidant were also close in value, indicating most of the iron was in ferrous form. Field-kit evaluation of total and ferrous iron concentrations at monitoring wells ICOMW03, ICOMW05, and ICOMW06 required substantial dilution, and the reported values are of questionable use as direct measures of iron concentration.

6.6.2.7 Radius of Influence

Based on the distance of the monitoring wells from the injection location at ICOIW01, and the evidence for distribution of oxidant to the wells ICOMW03, ICOMW05, and ICOMW06, it is suggested that the ROI achieved by the injection was approximately 5 feet, which agrees well with the calculated theoretical ROI derived from the injected volumes. However, the influence was not radially symmetrical due to the presence of intermittent permafrost and variations in silt and peat thicknesses across the study area. Additionally, the oxidants appear to be nearly expended at this distance.

6.6.3 Post-Injection Performance Monitoring

Post injection performance monitoring of groundwater was conducted on a schedule corresponding to 3, 7, 14, and 28 days following the completion of oxidant injections. In addition to groundwater samples, soil samples were also collected in conjunction with the day 7 and day 28 post injection sampling event, to evaluate the gross efficacy of the applied ISCO process on soils located within the pilot study area. Baseline soils were collected at depths ranging from 5.5 to 7.5 feet below surface, and subsequent samples were collected from the same depth interval for each sampling event. Table 16 contains the groundwater baseline and performance monitoring data, and Table 17 contains the soil baseline and performance monitoring data. Performance monitoring soil sample locations are shown on Figure 12. Low-flow groundwater sampling forms are attached as Appendix F. Photographs of soil sample access casings and example day 28 soil samples are provided in Appendix J.

Groundwater analytical results at day 3 indicated an immediate significant increase in concentrations of DRO, GRO, RRO, and benzene for most sampling locations. This response may be due to desorption of fuels from the highly organic soils. However, it was noted that concentrations of the groundwater COCs were decreasing by day 7, potentially due to aqueous-phase oxidation of desorbed COCs. By day 28, concentrations were at or slightly below baseline levels, and the oxidants were mostly consumed. This response is attributed to a continual shift of petroleum hydrocarbons from the highly organic soil matrix into the aqueous phase, with the concomitant oxidation of a portion of this petroleum hydrocarbon mass in the presence of the injected oxidants. The significant source mass sorbed to the highly organic soils may have led to an apparent equilibrium between aqueous-phase oxidation and desorption from the soil matrix, and thus the static groundwater concentrations. Additionally, the aquifer system was under dosed with oxidants, given the apparent preferential path and release to the surface described in previous sections, thus reducing the system's capacity for aqueous-phase oxidative treatment. Cleanup target goals were met by day 28 for GRO at ICOMW08. Cleanup target goals for groundwater were not met at the locations sampled for the remaining COCs.

Some treatment of groundwater, as indicated by decreasing GRO concentrations towards the end of the post-injection monitoring period, occurs at wells outside the ROI of the injection wells. This is most likely a function of treated groundwater flow and contaminant transport from the upgradient zone surrounding ICOMW09. Ultimately, the post-injection groundwater dataset is constrained by the limitations of a 28-day monitoring period.

Analytical results for soil suggest a significant decreasing trend for benzene and naphthalene from baseline to day 7, which may be a function of aggressive initial oxidation effects. However, benzene results are variable through day 28, and DRO and naphthalene apparently increased through day 28. These results may be attributed to variation in the soil types over short lateral distances (e.g., horizontal horizon). These variations are problematic because pre-injection baseline soil samples may have had lower starting concentrations than the soils sampled post ISCO. Thus, the same relative reduction would not seem to be as effective in the soils with higher starting concentrations. Target cleanup goals were met by day 28 for DRO at ICOMW07 and ICOMW04; however, these results may be attributable to soil sample heterogeneity. Cleanup target goals for soil were not met at the locations sampled for the remaining COCs.

6.6.3.1 Post-Injection Sodium Persulfate Monitoring

The persulfate concentrations measured by field kit during the post-injection monitoring period illustrate the dichotomy of contact between ICOMW03, ICOMW5, and ICOMW06, and little to no contact at ICOMW02, ICOMW04, ICOMW07, and ICOMW08. However, it also illustrates the effect of injection at ICOMW09, post-injection. Persulfate concentrations increase at both MW07 and MW08 from 1 day post injection through 7 days post injection. The appearance of persulfate at MW04 at 7 days post injection, and the upward trend in concentration through the final post-injection sampling event at wells which did not exhibit influence during injections at ICOIW01, suggest that the injected solution at MW09 has migrated downgradient through the study area.

6.6.3.2 Contaminant Mass Reduction

Baseline DRO mass in soil is estimated to have been approximately 21,000 pounds for the AOI [ISCO Study area]. A calculation of contaminant mass reduction in soil for the site is not achievable based on the results, which exhibit higher DRO and RRO soil concentrations at most locations for the final sampling event (Appendix I). This is likely a result of the confounding effects of soil sample location selection on the ability to attain comparative samples, as was discussed previously.

7.0 CONCLUSIONS

Characterization efforts associated with the Phase I ISCO AOI unveiled a number of key items related to the MOC area's CSM. These items included observing locally extensive peat and organic silt layers within the shallow site lithology, shallow perched water-bearing zone, locally confined aquifer conditions at greater depths, and at least locally, higher than expected DRO concentrations in shallow subsurface soils. The greatest concentrations of DRO observed in the Phase I ISCO area of the site appear to correspond well with the occurrence of high organic content soils layers and the shallow perched water aquifer identified in the area of study, which happen to further correspond and locally intersect with the historical underground storage tank excavation areas associated with Sites 13 and 27.

The primary objectives of the Phase I ISCO effort were to evaluate the feasibility of ISCO technology for application in an isolated location, and to evaluate the ability of ISCO to achieve remediation goals for the COCs and corresponding media of concern. Based on field observations and monitoring data collected during Phase I ISCO, it appears that it will be difficult to reach target cleanup levels for the COCs and corresponding media of concern at the site. These difficulties stem primarily from the prevalence of shallow peat and organic silt lithologies. These layers have been demonstrated to retain high concentrations of contamination (especially DRO), and the natural organics that comprise these materials exhibit significant oxidant demand resulting in excessive competition for the oxidants applied, ultimately limiting the treatment effectiveness. Based on the results obtained during the Phase I ISCO testing, it does not appear that ISCO is well suited to achieve remediation goals for the COCs and corresponding media of concern in areas where peat or organic silts predominates the lithology. However, ISCO may be a viable and applicable technology at other areas of the site where peat and organic silts do not predominate the lithology.

Secondary objectives of the Phase I ISCO testing centered on the implementability of ISCO technology. The application of ISCO at this isolated location proved to be challenging due to a number of unforeseen conditions encountered in the field. Some of the conditions include the presence of high organic soils (peats and organic silts), the presence of permafrost and/or semi-permafrost zones, and the observation of preferential flow zones. Despite these challenges, the overall process was demonstrated to be manageable and implementable.

In addition to the field testing, bench scale treatability was also conducted using contaminated site media to evaluate additional oxidant and activator combinations not tested in the field. The results of the laboratory treatability studies did not suggest that the additional tested oxidant and activator combinations were more effective than the approach selected for the field application. Results of the laboratory treatability study closely mimicked those observed during the field pilot testing and confirm that ISCO is not likely to achieve target treatment levels for site COCs and the corresponding media of concern under high organic conditions.

Comments on the draft ISCO Summary Report are provided in Appendix M.

8.0 RECOMMENDATIONS

The shallow high organic content soils observed across much of the Phase I ISCO AOI have demonstrated the ability to serve as a significant contaminant reservoir with a limited potential for treatment via ISCO. The sorptive capacity of these soils combined with the high organic content, results in a poor match for ISCO as a primary treatment technology. The relative shallow deposition of these highly impacted soils make them an excellent candidate for excavation and ex-situ treatment through off-site disposal, or on-site treatment technologies such as thermal treatment or aggressive landfarming techniques. Prior to, or in conjunction with, evaluation of alternative remedial strategies for the shallow high organic content soils, it is strongly suggested that additional site characterization be performed to better define the horizontal and vertical extents of contamination at the site, and, where possible, tie the distribution of contaminants observed at the site to specific geologic and hydrogeologic units. One potential mechanism for accomplishing this would be through the application direct-sensing technologies such as Laser-Induce Fluorescence/UltraViolet Optical Screening Tool and conductivity logging to develop a three-dimensional model of contaminant deposition and site lithology. As a part of these additional characterization efforts, performing a geophysical survey is also recommended to aid in identifying subsurface features, such as the fuel line observed during test pitting efforts, which have the potential to serve as continuing sources of contamination.

If, following further site characterization, it is determined that other areas of the site display significant soils and groundwater concentrations of site COCs associated with lithologies that are not dominated by high organic soils, Phase II ISCO testing could be recommended. Potential areas that could meet these conditions include the southern and/or eastern portions of the MOC area, for example, around SB13B1 and upgradient near MW88-10. However, insufficient information currently exists regarding the lateral, vertical, and lithologic association of contaminants in these area to warrant Phase II ISCO testing at this time.

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9.0 REFERENCES

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TABLES

Table 1 - Phase I ISCO Remediation Goals

Contaminant of Concern	Soil Cleanup Level (mg/kg)	Groundwater Cleanup Level (mg/L)
Diesel Range Organics (DRO)	9,200	1.5
Gasoline Range Organics (GRO)	N/A	1.3
Residual Range Organics (RRO)	N/A	1.1
Naphthalene	120	N/A
Benzene	2	0.005

Notes: N/A – not applicable
ISCO = in-situ chemical oxidation
mg/L = milligrams per liter

Table 2 - Summary Historical Groundwater Analytical Results

Well ID	DRO (mg/l)		GRO (mg/L)		RRO (mg/L)		Benzene (µg/L)		Lead (µg/L)	
	2002	2004	2002	2004	2002	2004	2002	2004	2002	2004
MW88-1	1.2	[0.345]B	0.024 VJ	0.0141J	0.43	0.168J	0.58	[0.4]	-	[1.00]B
MW88-2	0.71	0.421B	ND (0.05)	0.0492J	1.3	[0.543]B	0.92	0.26J	-	54.6
MW88-3	34	0.768B	0.42	0.104	0.22	[0.549]B	0.57	[0.4]	-	[1.00]B
MW88-4	72	3.89	1.2	1.25	1.9	1.46B	30	33.7	-	5.02
MW88-5	9.8	11.3	1.3	1.5J	2.3	2.28B	19	29.7	-	12
MW88-6	69	4.56J	1.1	1.02	2.1	0.651B	0.74	1.18	-	8.87
MW88-7	6.1 VLB	-	1.5	-	0.32	-	14	-	-	-
MW88-8	20	3.37	0.52	0.415	0.18 VJ	0.816B	0.12 VJ	[0.4]	-	4.07B
MW88-10	55	1.38	0.12	.0357J	1.3	[0.549]B	2.7	[0.4]	-	37.6
17MW1	-	[0.337]B	-	[0.090]	-	[0.562]B	-	[0.4]	-	7.08
18MW1	-	[0.341]B	-	0.0191J	-	[0.568]B	-	[0.4]	-	1.21B
20MW1	-	[0.333]B	-	0.0194J	-	[0.556]B	-	[0.4]	-	51.7

Notes:

Source: Phase IV RI, Shannon & Wilson, June 2005 and Phase III RI, MWH, 2003, Figure 2-6.

Well MW88-4 associated with primary, duplicate and triplicate. Highest value included.

[#} B = Result qualified as non detected due to method, trip or equipment blank detection

ND = Not detected above reporting limit

VJ = estimated value

VLB = Result negatively biased

Table 3 - Summary Historical Soil Analytical Results

Sample Location	Sample Depth (ft bgs)	DRO (mg/kg)	GRO (mg/kg)	RRO (mg/kg)	Benzene (mg/kg)	Naphthalene (mg/kg)	Chromium (mg/kg)
MW 88-1	15.5-17.5	5,000	19	39 VJ	ND(0.012)	0.0022 VJ	6.5
MW 88-1	17.5-20	1,400	4.9	16 VJ	ND(0.011)	0.00038 VJ	4.38
MW 88-2	8-10	ND (12)	ND (3)	6 VJ	ND(0.014)	.0001 VJ	16.1
MW 88-2	10-12	ND (11)	ND (3.6)	7.1 VJ	ND (0.015)	.00056 VJ	8
MW 88-3	4-6	7.6 VJ	ND (6)	120 VJ	ND(0.023)	.00081 VJ	22.3
MW 88-3	16-18	3,700	51	24 VJ	ND(0.021)	1.5	13.1
MW 88-4	9-11	12,000	44	3,700	0.047	5.9 VHB	17.3
MW 88-4	11-13	2,600	54 VHB	16 VJ	ND(0.018)	2.3	3.73
MW 88-5	1-3	380	ND(2.8)	3,400	ND(0.012)	0.0041 VJ	42.3
MW 88-5	11-13	21	ND (4)	25 VJ	ND (0.014)	.0037 VJ	4.5
MW 88-6	7-9	3,100	130 VHB	23 VJ	ND(0.012)	4.1	12.8
MW 88-6	11-13	1,200	83 VHB	30 VJ	ND(0.012)	1.1	8.3
MW 88-7	7-9	12,000	140 VHB	55 VJ	ND(0.012)	7.9	17
MW 88-7	11-13	9,200	130 VHB	54 VJ	ND(0.011)	8.4	11.6
MW 88-8	10-12	5,200	68 VHB	11 VJ	ND(0.018)	3.3	9.63
MW 88-8	14-16	2,300	73 VHB	7.4 VJ	ND(0.018)	2.3	8.34
MW 88-10	22-24	1,400	31	ND (110)	ND(0.015)	0.48	10
MW 88-10	24-26	750	19	ND (110)	ND(0.015)	0.11	4.8
SB 88-11	3-5	13,000	70	5,100	0.12	12	16.5
SB 88-11	7-9	51,000	99	6,000	0.19	81	23.7
SB 88-12	4-6	190	ND (5.2)	1,500	ND (0.022)	0.0045 VJ	12.4
SB 88-12	10-12	20	ND (3.8)	33 VJ	ND (0.017)	0.0011 VJ	9.52
SB 88-13	6-8	430	11 VJ	4,600	0.37	0.042	16.5
SB 88-13	14-16	77	ND (6.1)	420	ND (0.022)	0.0018 VJ	14.3
SB 88-14	2-4	47,000	220 VHB	3,000	0.019	79	22.7
SB 88-14	12-14	210	62	900	0.24	0.041	22.8
SB 88-15	10-12	33	ND (4.9)	150	ND (0.018)	0.018	23
SB 88-15	12-14	79	ND (4.4)	590	ND (0.021)	0.0047 VJ	23.4
SB 88-16	6-8	16,000	110 VHB	33 VJ	ND(0.015)	28	15.6
SB 88-16	10-12	4,200	60 VHB	12 VJ	ND(0.017)	0.9 VLB	6.7
SB 88-17	8-10	4,700	130 VHB	450	ND(0.013)	12	18.2
SB 88-17	12-14	4,300	140 VHB	110 VJ	ND(0.012)	3.6	8.31
SB 88-18	8-10	7,300	100 VHB	24 VJ	0.018 VHB	10	14
SB 88-18	10-12	4,000 VJ	170 VHB	226	0.062 VJ	6.9 VJ	16.7 VJ

Notes:
Source: Phase III RI, MWH, 2003, Figure 2-6 (NOTE SAMPLES COLLECTED IN 2002)
[#} B = Result qualified as non detected due to method, trip or equipment blank detection
DRO = diesel range organics
ft = feet
GRO = gasoline range organics
mg/kg = milligrams per kilogram
ND = Not detected above reporting limit
RRO = residual range organics
VHB = Result is an estimate with high bias
VJ = estimated value
VLB = Result negatively biased

Table 4 - Phase I ISCO Sampling Areas

Site Description	Area	Depth (bgs)	Target Parameters
Phase I ISCO Pilot Study Area	25 x 25 feet	~5 to ~20 feet	GRO, DRO/RRO, Benzene, Naphthalene, TOC, arsenic, lead, chromium, and sulfate

Notes:

1) Actual injection well screen depths to be determined in the field.

bgs = below ground surface
DRO = diesel-range organics
GRO = gasoline-range organics
ISCO = in-situ chemical oxidation
RRO = residual-range organics
TOC = total organic carbon

Table 5 - Sample Quantities for ISCO Soil Samples

	Parameter	Preparation/Analytical Method	Analytical Samples	QC	MS/MSD
Pilot Study Characterization					
Soil	GRO/Benzene and Napthalene	AK 101/ EPA 5035A/8260B	7	1	1
Soil	DRO/RRO	AK 102/103	7	1	1
Soil	TOC	EPA 9060	7	1	1
Performance Monitoring (2 events)					
Soil	GRO/Benzene and Napthalene	AK 101/ EPA 5035A/8260B	14	2	1
Soil	DRO/RRO	AK 102/103	14	2	1
Soil	TOC	EPA 9060	7	1	1

Notes:

Clear glass may be substituted for amber if samples are protected from exposure to light; this exception does not apply to metals.

AK = Alaska Method
DRO = disel-range organics
EPA = U.S. Environmental Protection Agency
GRO = gasoline-range organics
ISCO = in-situ chemical oxidation

MS = matrix spike
MSD = matrix spike duplicate
QC = quality control
RRO = residual range organics
TOC = total organic carbon

Table 6 - Sample Quantities for ISCO Water Samples

	Parameter	Preparation/Analytical Method	Analytical Samples	QC	MS/MSD
Pilot Study Characterization					
Groundwater	GRO/ Benzene	AK 101/ EPA 5030B/8260B	7	1	1
Groundwater	DRO/RRO	AK 102/103	7	1	1
Groundwater	Napthalene	EPA 3510C/8270C SIM	7	1	1
Groundwater	Sulfate	EPA 300	7	1	1
Groundwater	Metals (As, Cr, Pb)	EPA 3005A/6020	7	1	1
Performance Monitoring (4 events)					
Groundwater	GRO/ Benzene	AK 101/ EPA 5030B/8260B	28	3	2
Groundwater	DRO/RRO	AK 102/103	28	3	2
Groundwater	Napthalene	EPA 3510C/8270C SIM	28	3	2
Groundwater	Sulfate	EPA 300	7	1	1
Groundwater	Metals (As, Cr, Pb)	EPA 3005A/6020	7	1	1

Notes:

Clear glass may be substituted for amber if samples are protected from exposure to light; this exception does not apply to metals.

AK =	Alaska Method	ISCO	in-situ chemical oxidation
As =	arsenic	MS/MSD	matrix spike/matrix spike duplicate
Cr =	chromium	Pb	lead
DRO =	diesel-range organics	QC	quality control
EPA =	U.S. Environmental Protection Agency	RRO	residual-range organics
GRO =	gasoline range organics	SIM	selective ion monitoring

Table 7 - Sample Collection, Preservatives, and Holding Times for ISCO Soil Samples

	Parameter	Preparation/ Analytical Method	Container Description (Minimum)[1]	Preservation/Holding Time
Soil	GRO/Benzene	AK 101/ EPA 5035A/8260B	4-oz wide-mouth, amber glass jar with Teflon®-lined silicon rubber septum seal	Methanol preservative, Cool 4° ± 2°C / 14 days to analysis
Soil	DRO/RRO and Napthalene	AK 102/103 and EPA 3550B/8270C SIM	8-oz wide-mouth, clear glass jar, TLC	Unpreserved, Cool 4° ± 2°C / 7 days to extraction/ 40 days to analysis
Soil	TOC	EPA 9060	4-oz wide-mouth, clear glass jar, TLC	Unpreserved, Cool 4° ± 2°C / 28 days to analysis

Notes:

[1]Clear glass may be substituted for amber if samples are protected from exposure to light; this exception does not apply to metals.

± = plus or minus
°C = degrees Celsius
AK = Alaska Method
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
GRO = gasoline-range organics
ISCO = in-situ chemical oxidation
oz = ounce
RRO = residual-range organics
SIM = selective ion monitoring
TLC = Teflon-lined screw cap
TOC = total organic carbon

Table 8 - Sample Collection, Preservatives, and Holding Times for ISCO Groundwater Samples

	Parameter	Preparation/ Analytical Method	Container Description (Minimum)[1]	Preservation/Holding Time
Groundwater	GRO/Benzene	AK 101/ EPA 5030B/8260B	6, 40-ml VOA vials	HCl, Cool 4° ± 2°C / 14 days to analysis
Groundwater	DRO/RRO	AK 102/103	1-Liter amber glass	HCl, Cool 4° ± 2°C / 14 days/ 14 days to extraction/ 40 days to analysis
Groundwater	Napthalene	EPA 3510C/8270C SIM	1-Liter amber glass	Unpreserved, Cool 4° ± 2°C / 7 days to extraction/ 40 days to analysis
Groundwater	Sulfate	EPA 300	Plastic, 250 ml	Unpreserved, Cool 4° ± 2°C / 28 days to analysis
Groundwater	Metals (As, Pb, Cr)	EPA 3005A/6020	Plastic, 250 ml	Nitric Acid, Cool 4° ± 2°C / 6 months to extraction and analysis

Notes:

[1]Clear glass may be substituted for amber if samples are protected from exposure to light; this exception does not apply to metals.

± = plus or minus
°C = degrees Celsius
AK = Alaska Method
As = arsenic
Cr = chromium
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
GRO = gasoline-range organics
HCl = hydrochloric acid
ISCO = in-situ chemical oxidation
ml = milliliter
oz = ounce
Pb = lead
RRO = residual-range organics
SIM = selective ion monitoring
VOA = volatile organic analysis

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
ISCO AOI				
ICOiW01	23-Jul-09	69.54	NG	--
	05-Aug-09		5.02	64.52
	06-Aug-09		5.06	64.48
	8-Aug-09, 09:00 hrs		NG	--
	8-Aug-09, 18:25 hrs		7.40	62.14
	9-Aug-09, 07:05 hrs		8.11	61.43
	9-Aug-09, 12:05 hrs		NG	--
	10-Aug-09		NG	--
	11-Aug-09		NG	--
	12-Aug-09		3.64	65.90
	13-Aug-09		NG	--
	15-Aug-09		4.27	65.27
	16-Aug-09		4.82	64.72
ICOMW01	23-Jul-09	70.66	9.35	61.31
	05-Aug-09		NG	--
	06-Aug-09		NG	--
	8-Aug-09, 09:00 hrs		9.48	61.18
	8-Aug-09, 18:25 hrs		9.46	61.20
	9-Aug-09, 07:05 hrs		9.48	61.18
	9-Aug-09, 12:05 hrs		9.46	61.20
	9-Aug-09, 13:13 hrs		9.48	61.18
	10-Aug-09, 10:00 hrs		9.45	61.21
	11-Aug-09		9.52	61.14
	12-Aug-09		9.52	61.14
	13-Aug-09		9.46	61.20
	15-Aug-09		9.35	61.31
	16-Aug-09		4.67	65.99
ICOMW02	23-Jul-09	67.27	5.38	61.89
	05-Aug-09		4.53	62.74
	06-Aug-09		4.59	62.68
	8-Aug-09, 09:00 hrs		4.70	62.57
	8-Aug-09, 18:25 hrs		4.70	62.57
	9-Aug-09, 07:05 hrs		4.70	62.57
	9-Aug-09, 12:00 hrs		4.66	62.61
	9-Aug-09, 13:13 hrs		4.75	62.52
	9-Aug-09, 16:00 hrs		4.71	62.56
	9-Aug-09, 18:35 hrs		4.72	62.55
	10-Aug-09, 10:00 hrs		4.63	62.64
	10-Aug-09, 13:49 hrs		4.61	62.66
	10-Aug-09, 16:32 hrs		4.64	62.63
	11-Aug-09, 13:00 hrs		4.69	62.58
	11-Aug-09, 15:58 hrs		4.71	62.56
	12-Aug-09, 08:30 hrs		4.69	62.58
	12-Aug-09, 11:35 hrs		3.95	63.32
	12-Aug-09, 15:30 hrs		4.48	62.79
	13-Aug-09		4.70	62.57
	15-Aug-09		4.77	62.50
	19-Aug-09		4.88	62.39
	25-Aug-09		5.61	61.66
	11-Sep-09		7.49	59.78

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
ICOMW03	04-Aug-09	69.31	3.08	66.23
	05-Aug-09		3.07	66.24
	06-Aug-09		3.15	66.16
	8-Aug-09, 09:00 hrs		3.34	65.97
	8-Aug-09, 18:25 hrs		3.24	66.07
	9-Aug-09, 07:05 hrs		3.35	65.96
	9-Aug-09, 12:00 hrs		3.17	66.14
	9-Aug-09, 12:33 hrs		3.34	65.97
	9-Aug-09, 17:19 hrs		3.22	66.09
	10-Aug-09, 10:00 hrs		3.48	65.83
	10-Aug-09, 13:12 hrs		3.15	66.16
	10-Aug-09, 16:00 hrs		3.25	66.06
	11-Aug-09, 13:00 hrs		3.58	65.73
	12-Aug-09, 08:30 hrs		3.11	66.20
	12-Aug-09, 11:40 hrs		2.74	66.57
	12-Aug-09, 15:25 hrs		2.80	66.51
	13-Aug-09		2.85	66.46
	15-Aug-09		3.48	65.83
	19-Aug-09		4.81	64.50
	25-Aug-09		4.58	64.73
	11-Sep-09		4.38	64.93
ICOMW04	23-Jul-09	69.31	NG	--
	05-Aug-09		7.33	61.98
	06-Aug-09		7.52	61.79
	8-Aug-09, 09:00 hrs		7.55	61.76
	8-Aug-09, 18:25 hrs		6.05	63.26
	9-Aug-09, 07:05 hrs		6.58	62.73
	9-Aug-09, 12:00 hrs		6.46	62.85
	9-Aug-09, 12:19 hrs		6.51	62.80
	9-Aug-09, 15:28 hrs		6.40	62.91
	9-Aug-09, 18:00 hrs		6.42	62.89
	10-Aug-09, 10:00 hrs		6.47	62.84
	10-Aug-09, 13:18 hrs		6.50	62.81
	11-Aug-09, 13:00 hrs		6.49	62.82
	11-Aug-09, 16:11 hrs		6.49	62.82
	11-Aug-09, 16:17 hrs		6.35	62.96
	12-Aug-09, 08:30 hrs		6.27	63.04
	12-Aug-09, 09:32 hrs		6.27	63.04
	12-Aug-09, 11:47 hrs		6.15	63.16
	12-Aug-09, 15:20 hrs		6.53	62.78
	13-Aug-09		7.30	62.01
	15-Aug-09		6.98	62.33
	18-Aug-09		btp	--
	25-Aug-09		8.11	61.20
	11-Sep-09		7.67	61.64

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
ICOMW05	04-Aug-09	69.35	3.08	66.27
	05-Aug-09		2.95	66.40
	06-Aug-09		3.10	66.25
	8-Aug-09, 09:00 hrs		3.48	65.87
	8-Aug-09, 18:25 hrs		3.47	65.88
	9-Aug-09, 07:05 hrs		4.39	64.96
	9-Aug-09, 12:00 hrs		4.16	65.19
	9-Aug-09, 12:41 hrs		3.48	65.87
	9-Aug-09, 15:16 hrs		4.16	65.19
	10-Aug-09, 10:00 hrs		4.05	65.30
	11-Aug-09, 13:00 hrs		3.91	65.44
	11-Aug-09, 16:30 hrs		3.44	65.91
	12-Aug-09, 08:30 hrs		3.65	65.70
	12-Aug-09, 09:39 hrs		3.70	65.65
	12-Aug-09, 11:53 hrs		2.95	66.40
	12-Aug-09, 14:40 hrs		2.70	66.65
	13-Aug-09		3.65	65.70
	15-Aug-09		3.84	65.51
	19-Aug-09		5.68	63.67
	25-Aug-09		btp	--
	11-Sep-09		5.40	63.95
ICOMW06	05-Aug-09	68.49	4.03	64.46
	06-Aug-09		3.92	64.57
	8-Aug-09, 09:00 hrs		3.80	64.69
	8-Aug-09, 18:25 hrs		3.71	64.78
	9-Aug-09, 07:05 hrs		3.84	64.65
	9-Aug-09, 12:00 hrs		3.82	64.67
	9-Aug-09, 13:06 hrs		3.84	64.65
	9-Aug-09, 15:50 hrs		3.85	64.64
	9-Aug-09, 18:09 hrs		3.72	64.77
	10-Aug-09, 10:00 hrs		3.62	64.87
	10-Aug-09, 13:30 hrs		3.68	64.81
	11-Aug-09, 13:00 hrs		3.93	64.56
	11-Aug-09, 15:50 hrs		4.10	64.39
	12-Aug-09, 08:30 hrs		3.97	64.52
	12-Aug-09, 11:25 hrs		3.95	64.54
	12-Aug-09, 14:45 hrs		3.70	64.79
	13-Aug-09		4.11	64.38
	15-Aug-09		4.29	64.20
	19-Aug-09		btp	--
	25-Aug-09		5.59	62.90
	11-Sep-09		5.30	63.19

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
ICOMW07	05-Aug-09	68.03	5.68	62.35
	06-Aug-09		5.72	62.31
	8-Aug-09, 09:00 hrs		5.74	62.29
	8-Aug-09, 18:25 hrs		5.68	62.35
	9-Aug-09, 07:05 hrs		5.70	62.33
	9-Aug-09, 12:00 hrs		5.67	62.36
	9-Aug-09, 12:58 hrs		5.70	62.33
	9-Aug-09, 16:09 hrs		5.72	62.31
	9-Aug-09, 18:25 hrs		5.68	62.35
	10-Aug-09, 10:00 hrs		5.66	62.37
	10-Aug-09, 13:37 hrs		5.69	62.34
	10-Aug-09, 16:32 hrs		5.65	62.38
	11-Aug-09, 13:00 hrs		5.72	62.31
	11-Aug-09, 17:00 hrs		5.69	62.34
	12-Aug-09, 08:30 hrs		5.71	62.32
	12-Aug-09, 10:20 hrs		5.65	62.38
	12-Aug-09, 12:13 hrs		5.36	62.67
	12-Aug-09, 14:50 hrs		5.50	62.53
	13-Aug-09		5.69	62.34
	19-Aug-09		5.77	62.26
	25-Aug-09		5.66	62.37
	11-Sep-09		5.51	62.52
ICOMW08	05-Aug-09	69.41	8.16	61.25
	06-Aug-09		7.52	61.89
	8-Aug-09, 09:00 hrs		7.55	61.86
	8-Aug-09, 18:25 hrs		7.34	62.07
	9-Aug-09, 07:05 hrs		7.19	62.22
	9-Aug-09, 12:00 hrs		7.13	62.28
	9-Aug-09, 13:54 hrs		7.19	62.22
	9-Aug-09, 16:25 hrs		7.22	62.19
	9-Aug-09, 18:45 hrs		7.16	62.25
	10-Aug-09, 10:00 hrs		6.89	62.52
	10-Aug-09, 13:26 hrs		7.05	62.36
	11-Aug-09, 13:00 hrs		6.84	62.57
	11-Aug-09, 17:35 hrs		6.92	62.49
	11-Aug-09, 20:15 hrs		6.89	62.52
	12-Aug-09, 08:30 hrs		7.43	61.98
	12-Aug-09, 10:10 hrs		btp	--
	12-Aug-09, 12:02 hrs		8.25	61.16
	12-Aug-09, 15:05 hrs		7.81	61.60
	13-Aug-09		6.96	62.45
	15-Aug-09		6.65	62.76
	19-Aug-09		btp	--
	25-Aug-09		btp	--
	11-Sep-09		btp	--

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
ICOMW09	05-Aug-09	69.87	7.86	62.01
	06-Aug-09		7.58	62.29
	8-Aug-09, 09:00 hrs		7.36	62.51
	8-Aug-09, 18:25 hrs		7.40	62.47
	9-Aug-09. 07:05 hrs		7.68	62.19
	9-Aug-09. 12:00 hrs		7.70	62.17
	9-Aug-09. 13:30 hrs		7.68	62.19
	10-Aug-09, 10:00 hrs		6.89	62.98
	11-Aug-09, 13:00 hrs		7.28	62.59
	12-Aug-09, 08:30 hrs		8.18	61.69
	15-Aug-09		7.97	61.90
MOC AREA WELLS				
MW88-1	11-Jul-09	84.49	14.45	70.04
	23-Jul-09		14.63	69.86
	01-Aug-09		15.26	69.23
MW88-3	11-Jul-09	79.99	10.12	69.87
	23-Jul-09		10.24	69.75
	01-Aug-09		10.74	69.25
MW88-4	11-Jul-09	70.64	7.38	63.26
	23-Jul-09		9.02	61.62
	01-Aug-09		9.69	60.95
MW88-5	11-Jul-09	70.35	8.91	61.44
	23-Jul-09		9.11	61.24
	01-Aug-09		NG	--
	08-Aug-09 09:00 hrs		9.22	61.13
	08-Aug-09 18:25 hrs		9.21	61.14
	9-Aug-09, 07:05 hrs		9.24	61.11
	10-Aug-09, 10:00 hrs		9.22	61.13
	11-Aug-09, 13:00 hrs		9.27	61.08
	12-Aug-09, 08:30 hrs		9.27	61.08
	13-Aug-09		9.21	61.14
	15-Aug-09		9.09	61.26

Table 9 - Summary of Groundwater Elevations

Well ID	Date	Top of Casing NAD83	Depth to Groundwater	Groundwater Elevation*
MW88-10	11-Jul-09 23-Jul-09 01-Aug-09	89.03	18.32 18.57 19.02	70.71 70.46 70.01
17MW1	11-Jul-09 23-Jul-09 01-Aug-09	74.11	9.81 10.43 10.85	64.30 63.68 63.26
18MW1		85.78		85.78
20MW1	11-Jul-09 23-Jul-09 01-Aug-09	91.71	19.93 20.26 21.06	71.78 71.45 70.65
22MW2	11-Jul-09 23-Jul-09 01-Aug-09	96.38	24.33 25.43 26.46	72.05 70.95 69.92
22MW3	11-Jul-09 23-Jul-09 01-Aug-09	101.97		101.97 101.97 101.97
26MW1	11-Jul-09 23-Jul-09 01-Aug-09		32.21 32.35 33.50	-- -- --

Notes:
The specific gravity (SP) used for the free product is 0.81 (Diesel). The SP for Diesel is used in elevation correction calculations when free product is present in the monitoring well. (TOC - [FP Thickness * 0.81) + DTW])
All elevation and measurements are in feet.
Elevations are in U.S. Feet, based on the NAD 1983.

-- = no data
AOI = area of interest
btp =
ISCO = in-situ chemical oxidation

MOC = Main Operations Complex
NAD = Normal American Datum
NG = not gauged

Table 10 - MOC Area Slug Testing Results

Well	Test #	K (ft/day)
20MW1	1	8.96
	2	8.96
	3	7.24
	Average	**8.39**
MW 88-5	1	0.556
	2	0.611
	3	0.561
	4	0.51
	5	0.51
	6	0.533
	Average	**0.547**
MW 88-3	Unable to create enough drawdown for test	
MW 88-10	Unable to create enough drawdown for test	
ICOMW01	1	1.368
	2	1.625
	3	1.872
	Average	**1.62**
ICOMW02	1	1.45
	2	1.76
	3	1.77
	4	3.64
	5	1.66
	6	1.87
	Average	**2.03**

Notes:
ft/day = feet per day
MOC = Main Operations Complex

Table 11 - Test Pit Soil Headspace Screening Readings

Test Pit Location	Depth (ft bgs)	FID Reading (ppm)	PID Reading (ppm)
TP1	3.0-4.0	52.1	18.5
	4.0-5.0	556	144
	5.0-6.0	902	200
TP2	3.5-4.0	740	160
	6.0-6.5	1,040	420
	7.0-7.5	720	140
	9.5-10.0	580	204
TP3	2.0-2.5	bkg	bkg
	4.0-4.5	42	48
	6.0-6.5	3.2	4
	7.5-8.0	41.5	16.8
	8.5-9.0	51	4.8
	10.5-11.0	37.5	2.9
TP4	2.0-2.5	1.2	2.3
	5.0-5.5	138	17
	7.0-7.5	1,280	205
TP5	2.0-2.5	40	bkg
	3.5-4.0	30	bkg
	6.5-7.0	60	3.2
	9.0-9.5	30	bkg
TP6	3.5-4.0	10	3
	6.5-7.0	30	15
TP7	3.5-4.0	11	1.4
	7.5-8.0	327	70
TP8	3.5-4.0	1,925	380
	7.5-8.0	1,750	350
	9.5-10	40	4
TP9	5.5-6.0	3.2	2.1
	8.0-8.5	17.6	69
	9.5-10	305	94
TP10	4.0-4.5	19	34
	6.5-7.0	742	151
	9.5-10	305	192
TP11	3.5-4.0	78	3.2
	7.0-7.5	720	3.5
	9.5-10	1,300	2.5
TP12/13	2.0-2.5	bkg	bkg
	3.5-4.0	1058	201
	4.5-5.0	555	125
	6.5-7.0	1,635	238

Notes:
bkg = reading was less than or equal to background
FID = flame-ionization detector
ft bgs = feet below ground surface
PID = photoionization detector
ppm = parts per million

Table 12 - siteLAB DRO Screening Results

Test Pits			Soil Borings	
Sample Location (depth)	**Reading (ppm)**		**Sample Location (depth)**	**Reading (ppm)**
TP-1 (3-4)	1736.5		TP-12 (2-2.5)	108.3
TP-1 (4.5-5)	2074.5		TP-12 (3.5-4)	605
TP-1 (5-6)	1695		TP-13 (4.5-5)	3604
TP-2 (3.5-4)	3509		TP-13 (6.5-7) (dup)	5142 (5186)
TP-2 (6-6.5)	2801		SB01 (5-6)	8722
TP-2 (7-7.5)	2021		SB01 (6-7)	3490
TP-2 (9.5-10)	367.8		SB01 (7-8)	4032
TP-3 (2-2.5)	110.3		SB01 (9-10)	8.536
TP-3 (4-4.5)	20.7		SB01 (10-11)	96.3
TP-3 (7.5-8)	12.7		SB01 (11-12)	25.7
TP-3 (10.5-11)	108		SB01 (12-13)	28
TP-4 (2-2.5) (dup)	4.4 (7.628)		SB01 (13-14)	14.8
TP-4 (2-2.5)	7.628		SB02 (4-5)	2578
TP-4 (5-5.5)	29.2		SB02 (5-6)	4065
TP-4 (7-7.5)	1276		SB02 (6-7)	856
TP-5 (2-2.5)	4.7		SB02 (9-10)	2517
TP-5 (3.5-4)	1.3		SB03 (5-7)	2963
TP-5 (6.5-7)	6.1		SB03 (7-9)	326
TP-5 (9-9.5)	0.97		SB03 (9-11)	10.934
TP-6 (3.5-4)	168.5		SB04 (5-6)	1122
TP-6 (6.5-7)	18.7		SB04 (6-7)	412
TP-7 (3.5-4)	27.7		SB04 (10-12)	1125
TP-7 (7.5-8)	2798		SB04 (12.5-14.5)	19.092
TP-8 (3.5-4) (dup)	4267 (4382)		MW01 (4-5)	2330
TP-8 (7.5-8)	5466		MW01 (6-7)	3772
TP-8 (9.5-10)	85.4		MW01 (7-8)	3766
TP-9 (6-6.5)	69		MW01 (8-9)	8638
TP-9 (8-8.5)	50.8		MW01 (9-10)	21.8
TP-9 (9.5-10) (dup)	347.3 (316.3)		MW01 (12-13)	375
TP-10 (4-4.5) (dup)	3.206 (2.91)		MW01 (14-16)	42.1
TP-10 (6.5-7) (dup)	304.9 (290.4)		MW01 (5-6)	3852
TP-10 (9.5-10) (dup)	1377.5 (1420)			
TP-11 (3.5-4) (dup)	48.5 (44.4)			
TP-11 (7-7.5) (dup)	14.8 (14.2)			
TP-11 (9.5-10) (dup)	19.8 (22.7)			

Notes:

Sample depth interval in feet below ground surface

DRO = diesel-range organics

dup = duplicate sample

ppm = parts per million

Table 13 - Screening Sample Analytical Data

Sample Location	Depth Interval (ft bgs)	DRO (mg/kg)
ICOSB01	5-6	98 B
ICOSB02	5-6	130,000 B, X
ICOSB03	9-11	13,000 B
ICOSB04	5-6	260,000 B,X
Sample Location	**Screen Interval (ft bgs)**	**DRO (mg/L)**
ICOMW01	12-17	1.18
ICOMW02	3.5-8.5	32.8
MW88-5	6.5-16.5	7.53

Notes:

B - Compound was found in blank and sample.

X - Surrogate not quantitated due to high dilution

DRO = diesel range organics

ft bgs = feet below ground surface

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

Table 14 - Soil Boring Headspace Screening Readings

Location	Depth (ft bgs)	FID Reading (ppm)	PID Reading (ppm)
ICOSB01	4.0-5.0	6,200	58
	5.0-6.0	5,400	48
	6.0-7.0	7,500	42
	7.0-8.0	650	29
	8.0-9.0	4,230	41
	9.0-10.0	750	37
	10.0-11.0	4,260	58
	11.0-12.0	25	2.5
	12.0-13.0	3,700	24
	13.0-14.0	5,600	21
ICOSB02	4.0-5.0	2,600	22
	5.0-6.0	24,000	140
	6.0-7.0	4,750	46
	9.0-10	3,800	29
ICOSB03	5.0-7.0	1,305	258
	7.0-9.0	530	130
	9.0-11.0	375	150
ICOSB04	4.0-5.0	1,050	240
	5.0-6.0	530	200
	6.0-7.0	2,150	850
	10.0-12.0	810	370
	12.5-14.5	610	150
ICOMW01	4.0-5.0	350	95
	5.0-6.0	630	150
	6.0-7.0	320	81
	7.0-8.0	620	168
	8.0-9.0	850	130
	9.0-10.0	200	37
	10.0-12.0	480	68
	12.0-13.0	200	40
	14.0-16.0	420	90
ICOMW02	See ICOSB02		
ICOMW03	4.5-5.0	490	93
	5-6.5	2,010	3.7
	6.5-7.0	309	35
	7.0-8.5	318	32
	8.5-9.5	740	100
	9.5-10	40	5
ICOMW04	6-7.5	250	1500
	7.5-9.0	950	165
	9-9.5	140	24
ICOMW05	5.0-6.0	590	240
	6.5-8.0	820	140
	8-8.5	68	10
ICOMW06	4.0-5.0	145	42
	5.0-6.0	630	124
	6.0-7.0	116	35
ICOMW07	5.5-6.5	650	50
	6.5-7.5	1,150	229
	7.5-8.5	240	114
ICOMW08	4.5-5.5	1,050	190
	5.5-6.5	89	17
	7.5-9.5	48	10
ICOMW09	5-5-6.5	1,300	180
	6.5-8.0	450	60
	9.0-10.0	82	12

Notes:

FID = flame-ionization detector
ft bgs = feet below ground surface

PID = photoionization detector
ppm = parts per million

Table 15 - Summary Comparison of Soil Sample Results

		Depth (ft)	Year	Benzene (mg/kg)	Naphthalene (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	RRO (mg/kg)	TOC (mg/kg)
Soil Cleanup Level (mg/kg)				*2*	*120*	*NA*	*9,200*	*NA*	*NA*
AECOM	**ICOMW02**	5 - 6					**140,000**		
(pre-ISCO)		6 - 7	2009	NS	NS	NS	**13,000**	NS	NS
		9 - 11					100		
	ICOMW03	5 - 6.5	2009	1 QL	120 QL	1000 B	**170,000**	7,200	213000 Q
	ICOMW04	6 - 7.5	2009	0.93 QL	81 QL	470 B, QL	**17000 QH**	4400 QH	185000 Q
	ICOMW05	5 - 6	2009	1 QL	93 QL	680 B	**130000 X**	7700 X	199000 Q
	ICOMW06	5 - 6	2009	0.58 QH	240 QH	2100 QH, B	**110000 X**	8400 X	215000 Q
	ICOMW07	6.5 - 7.5	2009	0.27	25	480 B	**13000 QH**	2800 X	190000 Q
	ICOMW08	4.5 - 5.5	2009	**3.6 QH**	300 QH	4400 QH	**240000 X**	5300 X	453000 Q
	ICOMW09	5.5 - 6.5	2009	**4.3 QH, M**	270 QH	1600 QH, B	6,500	5300 X	261000 Q
S&W	**19B1**	5	2004	NS	NS	1	4.68	23.8	NS
		12	2004	NS	NS	91.6	3,590	489	NS
		18	2004	NS	NS	4.9	3,080	109	2,490
MWH	**SB 88-11**	4	2002	**0.12**	12	70	**13,000**	5,100	NS
		8	2002	**0.19**	81	99	**51,000**	6,000	NS
	SB 88-14	3	2002	**0.019**	79	220	**47,000**	3,000	NS
		13	2002	**0.024**	0.041	62	210	900	NS
	MW 88-5	2	2002	**<0.012**	0.0041	<2.8	380	3,400	NS

Notes:

Bold results exceed soil cleanup target levels

DRO = diesel range organics

ft = feet

GRO = gasoline range organics

mg/kg = milligrams per kilogram

MWH = Montgomery Watson Harza (Phase III RI, MWH, 2003, Figure 2-6 [Note: Samples collected in 2002]

NS = not sampled

RRO = residual range organics

S&W = Shannon & Wilson (Phase IV RI, S&W, 2005, Table 5-9b [Note: Samples collected in 2004]

TOC = total organic carbon

X-Surrogate not reported due to sample dilution in the presence of high target analytes
B-Contamination was reported in the method blank below the reporting limit
QH-Sample result may be biased high based on high surrogate recoveries
QL-Sample result may be biased low due to low surrogate recoveries.
M-A matrix effect was present
Q -Quality control failure

Table 16 - Phase I ISCO Study Groundwater Results

Well ID	Sampling Event	Benzene (µg/L)	Naphthalene (µg/L)	GRO (mg/L)	DRO (mg/L)	RRO (mg/L)	As (mg/L)	Cr (mg/L)	Pb (mg/L)	SO_4 (mg/L)
Groundwater cleanup levels		*5*	*NA*	*1.3*	*1.5*	*1.1*	*NA*	*NA*	*NA*	*NA*
ICOMW03	Baseline	0.74 J	29	0.37	**21**	**1.7**	0.0016 J	0.0056 B	0.0020 J	34 H,I
	Day 3	1.3	49	**14**	**2.7** L	**1.6** L	*NA*	*NA*	*NA*	*NA*
	Day 7	3 J,X	50 X	0.70	**24** D	**2.7** D	*NA*	*NA*	*NA*	*NA*
	Day 14	2.4	87	0.81	**18** X	**1.5** X	*NA*	*NA*	*NA*	*NA*
	Day 28	2.5	110	0.8	**14**	**1.2**	0.0046 B	0.023	0.042	1000 J
ICOMW04	Baseline	**63**	74	0.92	**11**	**2**	0.0041	0.0045 B	0.001 J	16
	Day 3	**86**	34	**21**	**20** L	0.76 L	*NA*	*NA*	*NA*	*NA*
	Day 7	**56** X	7.4 X	0.54	**7.9** D	**1.2** D	*NA*	*NA*	*NA*	*NA*
	Day 14	**53**	4.6	0.54	**5.7** X	**1.7** X	*NA*	*NA*	*NA*	*NA*
	Day 28	**70**	7	0.66	**9.5**	**1.7**	0.007 B	0.008	0.0058	130
ICOMW05	Baseline	1.1	31	0.29	**13**	**1.9**	0.0012 J	0.0091 B	0.0024	40 H
	Day 3	4.6	81	**23**	**22** L	**1.8** L	*NA*	*NA*	*NA*	*NA*
	Day 7	**6.1** J	83 H	0.93	**18** D	**2.4** D	*NA*	*NA*	*NA*	*NA*
	Day 14	**11**	100	0.85	**9.9** X	**1.5** X	*NA*	*NA*	*NA*	*NA*
	Day 28	**34**	68	1.1	**14**	**2.1**	0.023 B	0.092	0.094	1900
ICOMW06	Baseline	4.9	100	0.97	**19**	**2.3**	0.0034	0.0039 B	0.0013 J	29
	Day 3	1.7	57	**11**	**18** L,X,D	**2.4** L,X,D	*NA*	*NA*	*NA*	*NA*
	Day 7	1.7 J	58 H,X	0.62	**19** D	**2.8** D	*NA*	*NA*	*NA*	*NA*
	Day 14	1.7	56	0.56	**17** X	**2.3** X	*NA*	*NA*	*NA*	*NA*
	Day 28	2.1	51	0.37	**18**	**2.2**	0.066 B	0.041	0.044	2300
ICOMW07	Baseline	**45**	4	**1.4**	**8.5**	**1.2**	0.0038	0.0093 B	0.0006 J	13
	Day 3	**34**	4.6	**32**	**12** L,X,D	**2.0** L,X,D	*NA*	*NA*	*NA*	*NA*
	Day 7	**36**	6.7 J,H	**1.8**	**10** D	**1.4** D	*NA*	*NA*	*NA*	*NA*
	Day 14	**40**	4.9	**1.4**	**9.1** X	**1.4** X	*NA*	*NA*	*NA*	*NA*
	Day 28	**32**	3.7	**1.5**	**11**	**1.2**	0.0036 B	0.0057	0.00028 J	4800
ICOMW08	Baseline	**69**	120	**39**	**11** L	**1.3** L,I,X	*NA*	*NA*	*NA*	*NA*
	Day 3	**70**	88	**29**	**13** L	1.0 L	*NA*	*NA*	*NA*	*NA*
	Day 7	**76**	90	**1.5**	**10** D	**2.0** D	*NA*	*NA*	*NA*	*NA*
	Day 14	**43**	ND (1.0)	0.63	**8.6** X	**1.6** X	*NA*	*NA*	*NA*	*NA*
	Day 28	**32**	16	0.91	**9.5**	**1.4**	0.0048 B	0.0061	0.0043	24
ICOMW02	Baseline	**72**	380	**2.6**	**24** X	**2.3** L,X	0.0052	0.016 B	0.013	25
	Day 3	**86**	300	**54**	**21** L	**1.3** L	*NA*	*NA*	*NA*	*NA*
	Day 7	**46** X	340 H,X	**2.8** X	**18** D,X	**1.6** D,X	*NA*	*NA*	*NA*	*NA*
	Day 14	**71**	290 H	**2.8**	**28** X	**1.8** X	*NA*	*NA*	*NA*	*NA*
	Day 28	**97**	260	**3.1**	**110**	**4.5**	0.0038 B	0.011	0.0025	3700
ICOMW09	Baseline	**57**	33	0.88	**5.7** X	0.78 L,X	0.0030	0.0064 B	0.0027	10

Notes:

B-Compound was found in the blank and sample.

D-Samples were diluted due to presence of target analytes. The dilution made quantitition of surrogate recoveries impractical.

H-Sample analyzed past recommended 14 day holding time.

I-Indicates the presence of an interference; recovery is not calculated.

J-Result is an estimate. The reported concentration is between the method MDL and PQL.

L-Result is an estimate due to the LCS/LCSD exceeding the method RPD limit.

X-Surrogate recovery outside of acceptance limits due to target analyte interference.

As = arsenic
Cr = chromium

NA = not analyzed
ND (value) = Analyte not detected above (reporting limit)

Table 17 - Phase I ISCO Study Soil Results

Well ID	Sampling Event	Benzene (µg/kg)	Naphthalene (mg/kg)	DRO (mg/kg)	RRO (mg/kg)	GRO (mg/kg)	TOC (mg/kg)
Soil Cleanup Criteria		*2,000*	*NA*	*9,200*	*NA*	*NA*	*NA*
ICOMW03	Baseline	1,000	120	**170,000**	7,200	1000 B,X	213,000 Q
	Day 7	520 H	610 H,X	**330,000** D	13,000 D	9000 X	400,000 H
	Day 28	230	310	**360,000** X	16,000 X	3100 X	410,000
ICOMW04	Baseline	930	81	**17,000**	4,400	470 B	185,000 Q
	Day 7	95 H	15 H	4,600	5,400	170	200,000 H
	Day 28	240	9	6,400	2,500	98 X	180,000
ICOMW05	Baseline	1,000	93	**130,000**	7,700	680 B	199,000 Q
	Day 7	240 H	600 H,X	**250,000** D	17,000 D	7,500 X	290,000 H
	Day 28	260	440	**390,000** X	24,000 X	3,800 X	260,000
ICOMW06	Baseline	580	240	**110,000**	8,400	2,100 B	215,000 Q
	Day 7	1,000 H	64	**77,000**	6,800	490 X	150,000 H
	Day 28	1,400	270	**170,000** X	7,600	1900 X	200,000
ICOMW07	Baseline	270	25	**13,000**	2,800	480 B	190,000 Q
	Day 7	ND (69) H	ND (0.17) H	540	6,300	6.7 J	240,000 H
	Day 28	ND (110)	ND (0.26)	370	3,000	12 J	150,000
ICOMW08	Baseline	**3,600**	300	**240,000**	5,300	4,400 B	453,000 Q
	Day 7	490 H	190 H,X	**77,000** D	7,600 D	1,000 X	150,000 H
	Day 28	**3,700**	460	**360,000** X	20,000 X	3,200 X	250,000
ICOMW09	Baseline	**4,300**	270	6,500	5,300	1,900 B	261,000 Q
	Day 7	220 H	65 H,X	**44,000** D	11,000 D	270 X	260,000 H
	Day 28	**2,000**	280	**150,000** X	8,100 J,X,Q	2,000 X	200,000
ICOMW02	Baseline	*NA*	*NA*	**13,000**	*NA*	*NA*	*NA*
	Day 7	280 H,X	3,100 H,X	2,700	11,000	73	300,000 H
	Day 28	750	760	**17,000**	3,000	26 X	320,000

Notes:

B-Compound was found in blank and sample.

D-Samples were diluted due to presence of target analytes. The dilution made quantitition of surrogate recoveries impractical

H-Sample analyzed past recommended 14-day holding time.

J-Result is an estimate. The reported concentration is between the method MDL and PQL.

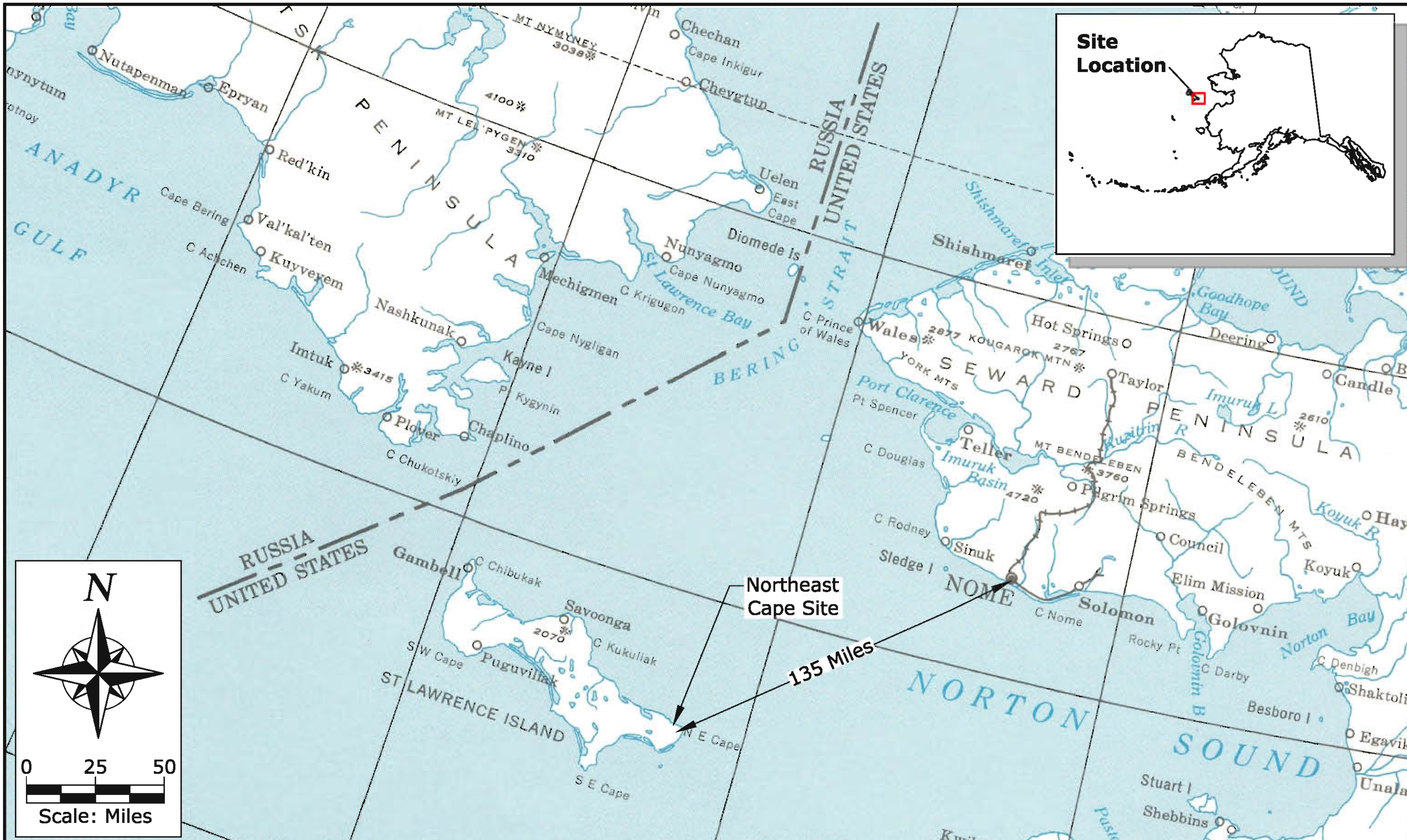
Q-Reporting limit elevated due to sample dilution.

X-Surrogate recovery outside of acceptance limits due to target analyte interference.

µg/kg = micrograms per kilogram
DRO = diesel range organics
GRO = gasoline range organics
mg/kg = milligrams per kilogram

NA = not analyzed
ND (value) = Analyte not detected above (reporting limit)
RRO = residual range organics
TOC = total organic carbon

FIGURES



MARCH 9, 2010
FIGURE 1 - VICINITY MAP.DWG

IMAGE SOURCE: USGS NATIONAL ATLAS SHEET NUMBER 42-43

VICINITY MAP PROVIDED BY BRISTOL ENVIRONMENTAL REMEDIATION SERVICES LLC. - 49028_FIG1_SAP_APR09.DWG, DATED 4-16-2009.

AECOM

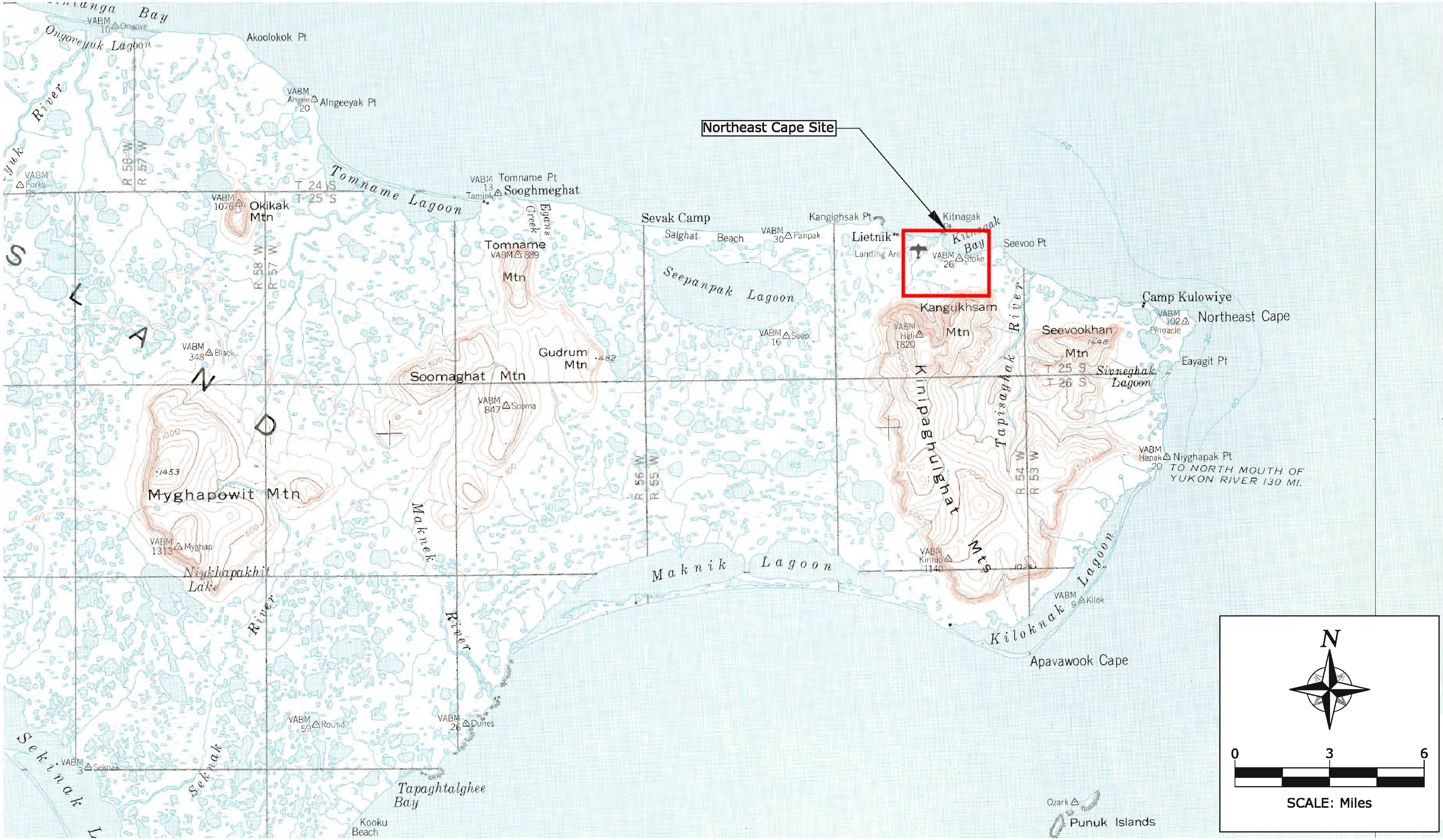
FIGURE 1

VICINITY MAP

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

112321



VICINITY MAP PROVIDED BY BRISTOL ENVIRONMENTAL REMEDIATION SERVICES LLC. - 49028_FIG2_SAP_APR09.DWG, DATED 4-16-2009.

AECOM

FIGURE 2

LOCATION MAP

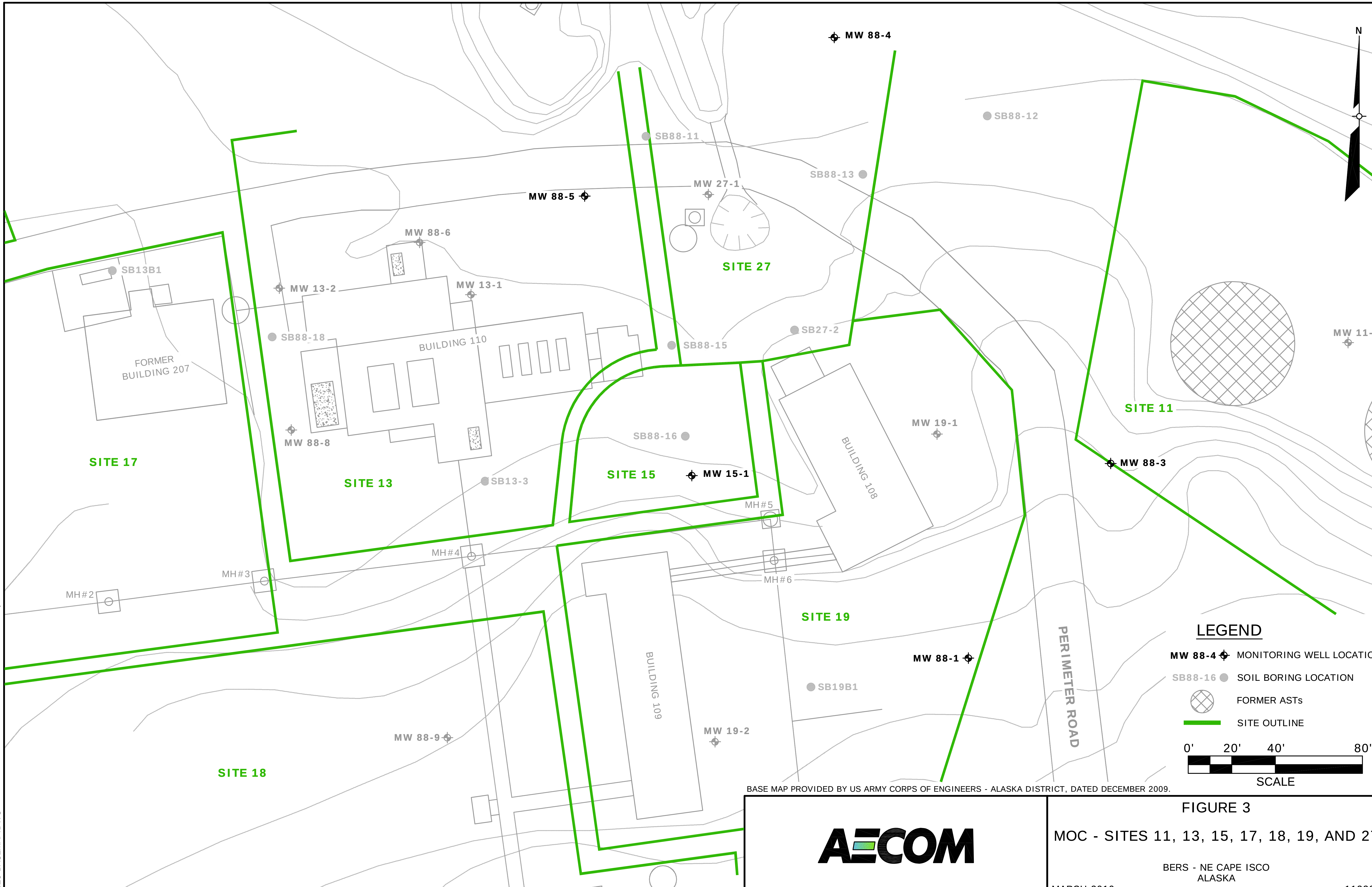
BERS - NE CAPE ISCO
ALASKA

MARCH 2010

112321

MARCH 9, 2010

FIGURE 2 - LOCATION MAP.DWG



BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 3

MOC - SITES 11, 13, 15, 17, 18, 19, AND 27

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

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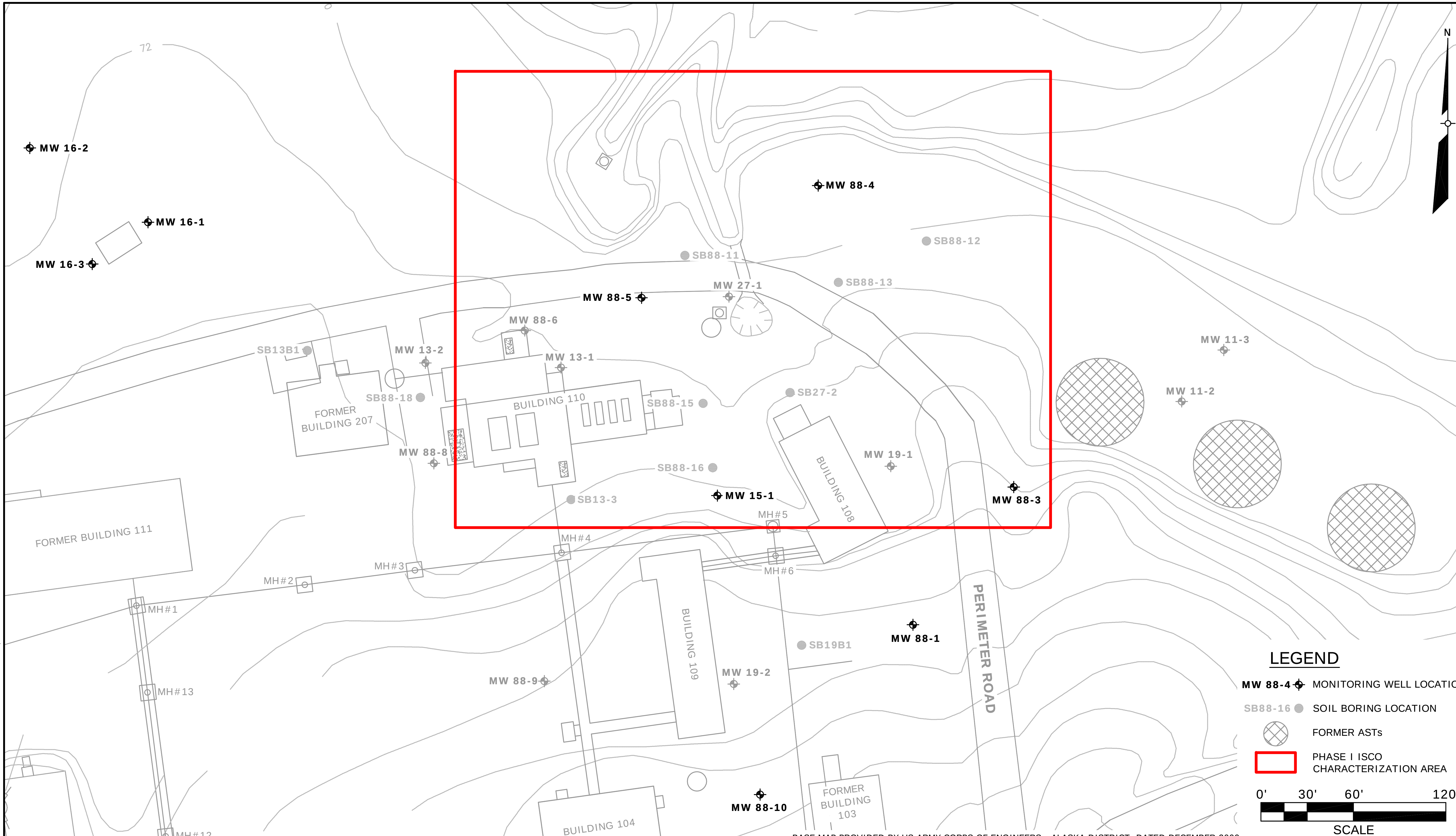
MARCH 5, 2010

NEC BASEMAP.DWG



BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

MARCH 5, 2010

NEC BASEMAP.DWG

AECOM

FIGURE 4

PHASE I ISCO AREA

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

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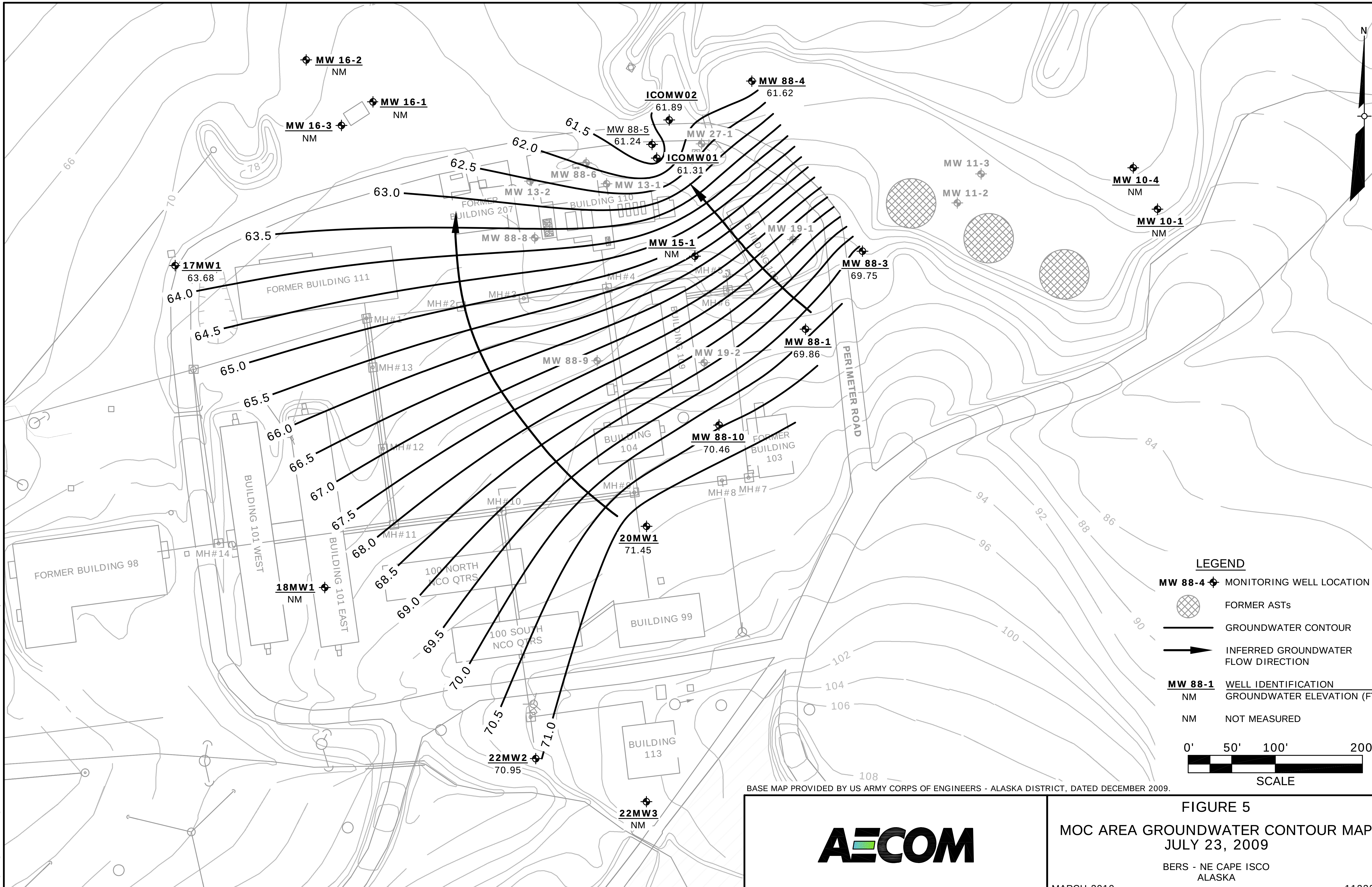

FIGURE 5

MOC AREA GROUNDWATER CONTOUR MAP
JULY 23, 2009

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

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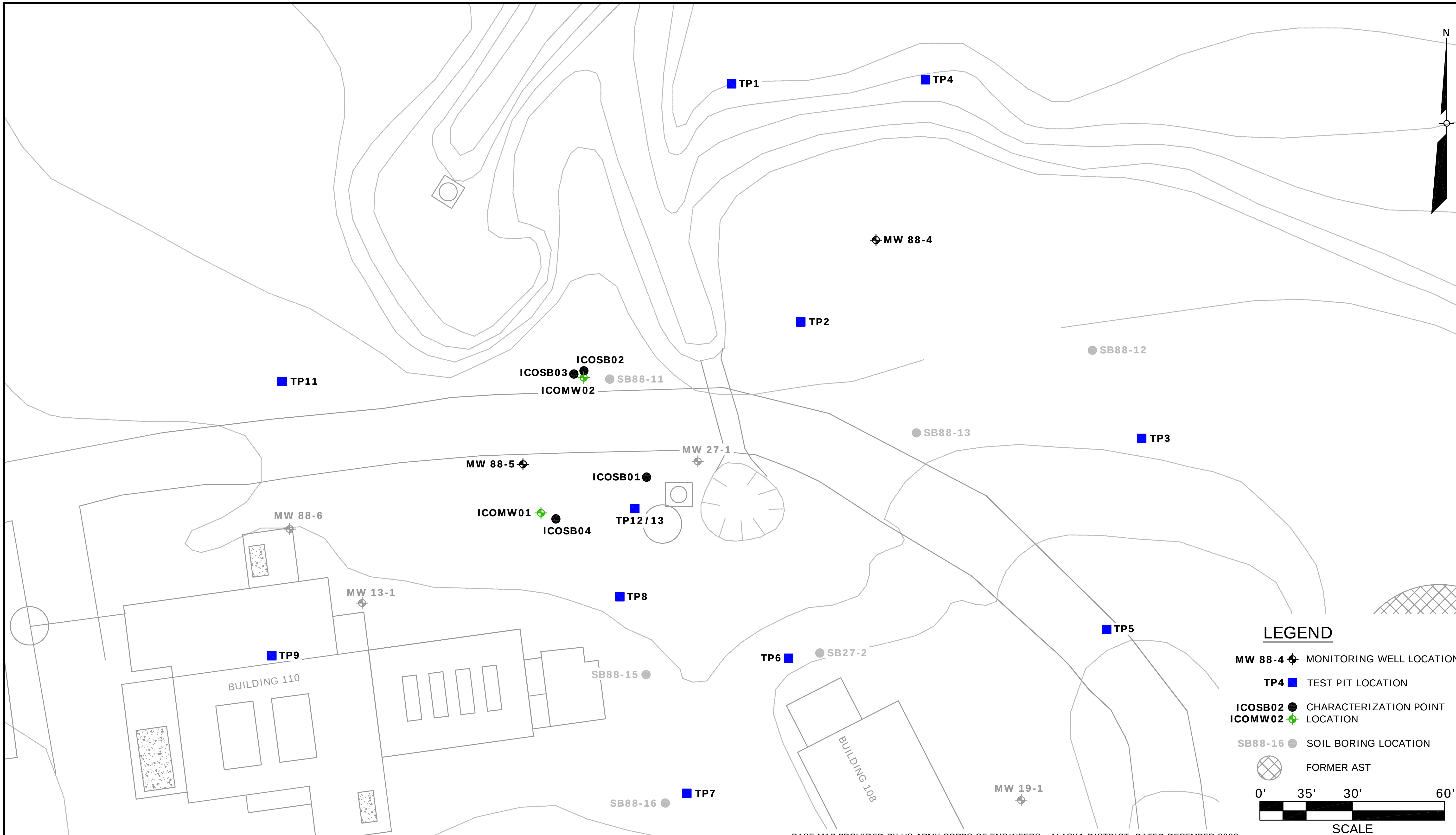

BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 6

PHASE I ISCO
CHARACTERIZATION LOCATIONS

BERS - NE CAPE ISCO
ALASKA

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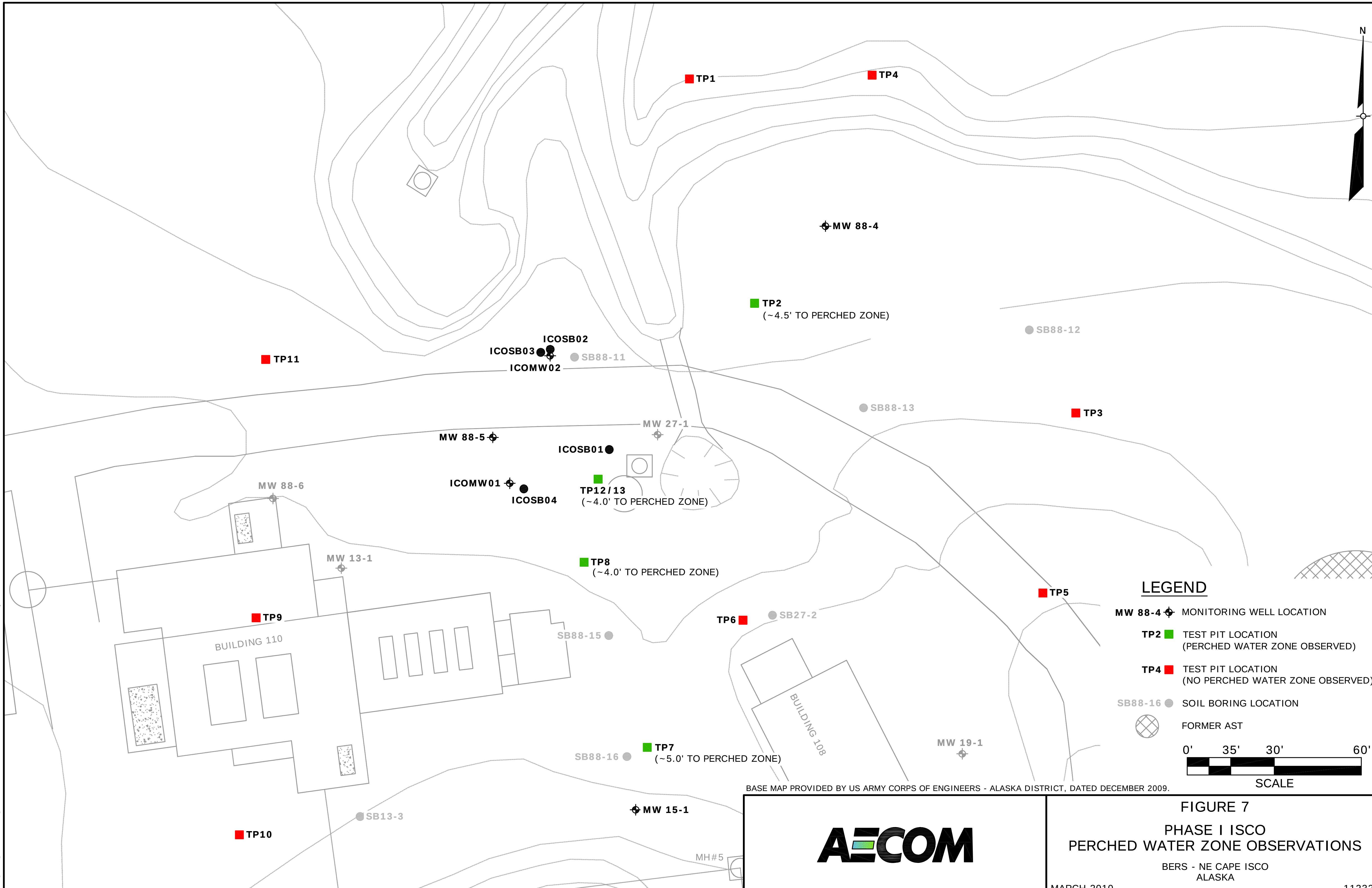
NEC BASEMAP.DWG



AECOM

FIGURE 7

PHASE I ISCO
PERCHED WATER ZONE OBSERVATIONS

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

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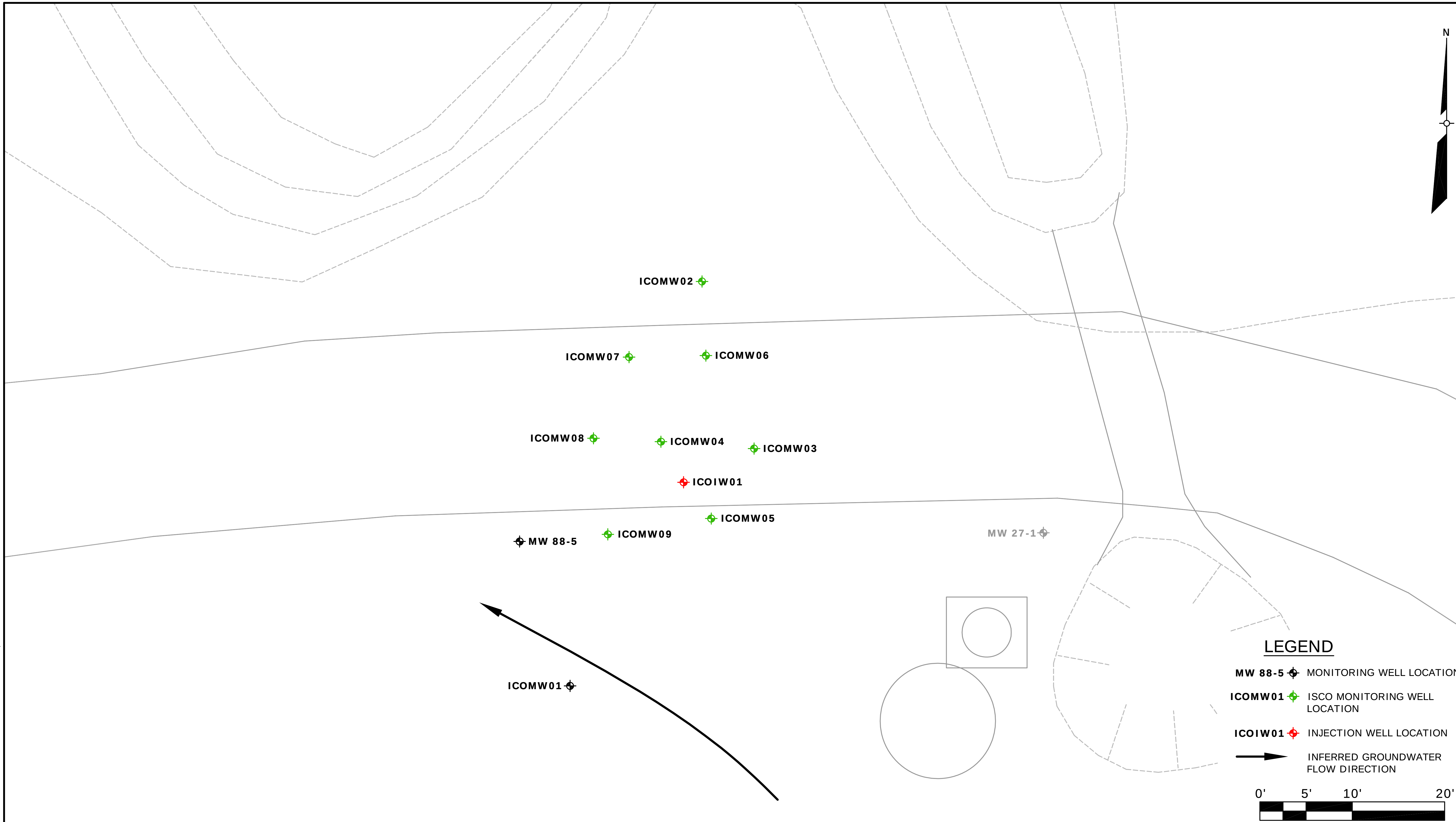
MARCH 5, 2010

NEC BASEMAP.DWG



BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 8

PHASE I ISCO STUDY
MONITORING AND INJECTION WELLS

BERS - NE CAPE ISCO
ALASKA

JUNE 2010

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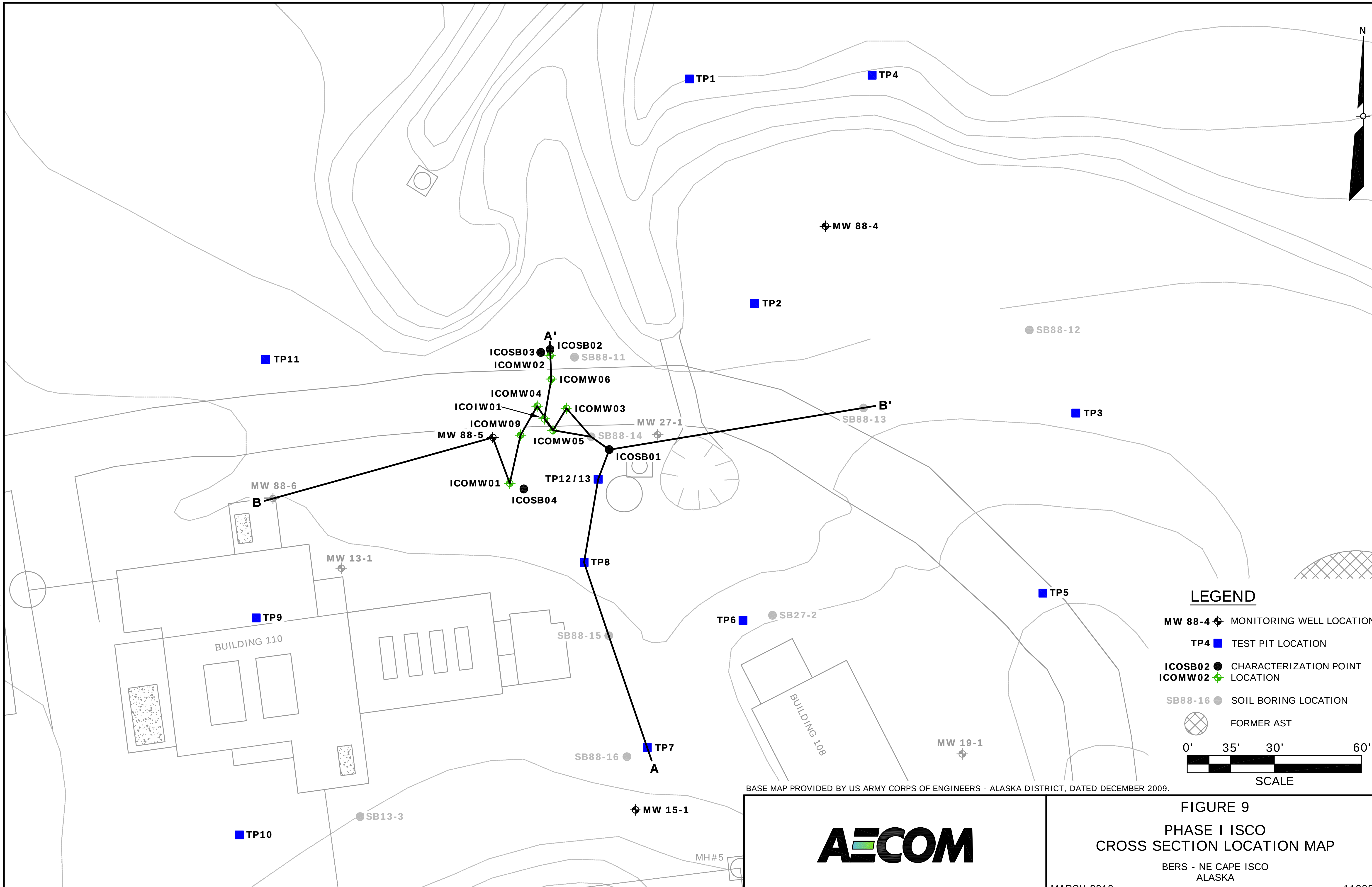
JUNE 11, 2010

NEC BASEMAP.DWG



BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 9

PHASE I ISCO
CROSS SECTION LOCATION MAP

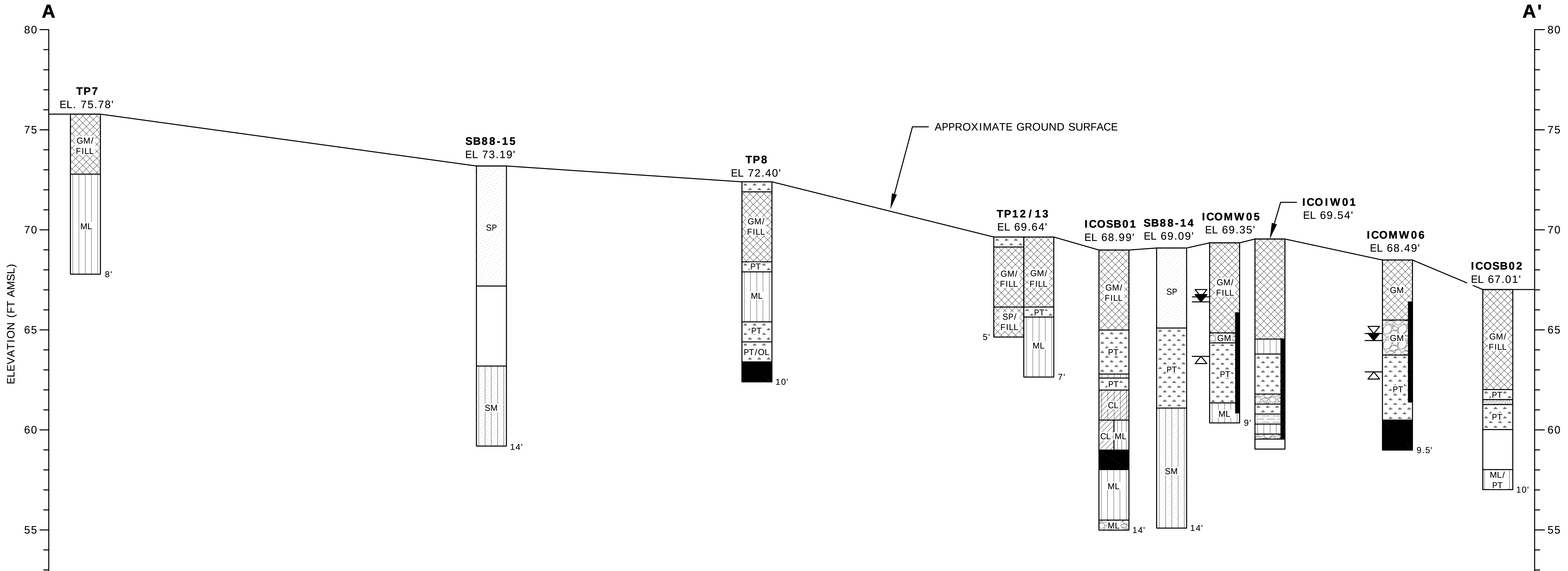
BERS - NE CAPE ISCO
ALASKA

MARCH 2010

112321

MARCH 5, 2010

NEC BASEMAP.DWG



LEGEND

GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
SP	POORLY GRADED SANDS, GRAVELLY SANDS
SM	SILTY SANDS, SAND-SILT MIXTURES
ML	INORGANIC SILTS AND FINE SANDS
CL	INORGANIC CLAYS, GRAVELLY/SANDY/SILTY CLAYS
OL	ORGANIC SILTS
PT	PEAT
TP	TEST PIT
SB	SOIL BORING
	FROZEN
	HIGHEST GROUNDWATER ELEVATION
	LOWEST GROUNDWATER ELEVATION
	BASELINE ISCO GROUNDWATER ELEVATION (08/05/2009)
	SCREENED INTERVAL

NOTE:

1. MONITORING LOCATION WIDTH EXAGGERATED FOR ILLUSTRATIVE PURPOSES.
2. INFORMATION FOR SB88-15 AND SB88-14 BASED ON 2002 PHASE III REMEDIAL INVESTIGATION LOGS PROVIDED BY MWH.
3. ELEVATIONS ASSOCIATED WITH PHASE III REMEDIAL INVESTIGATION BORINGS WERE ADJUSTED UPWARD BY ~2 FT BASED ON OBSERVED DISCREPANCIES BETWEEN CURRENT AND HISTORICAL SURVEY DATUM.
4. SOIL BORING ANALYTICAL DATA ARE SUMMARIZED IN TABLE 3 (HISTORICAL DATA), TABLE 13 (ICOSB DATA) AND TABLE 17 (ICOMW DATA).

HORIZ. 0' 5' 10' 20'
VERT. 0' 5' 10'
SCALE

AECOM

FIGURE 10

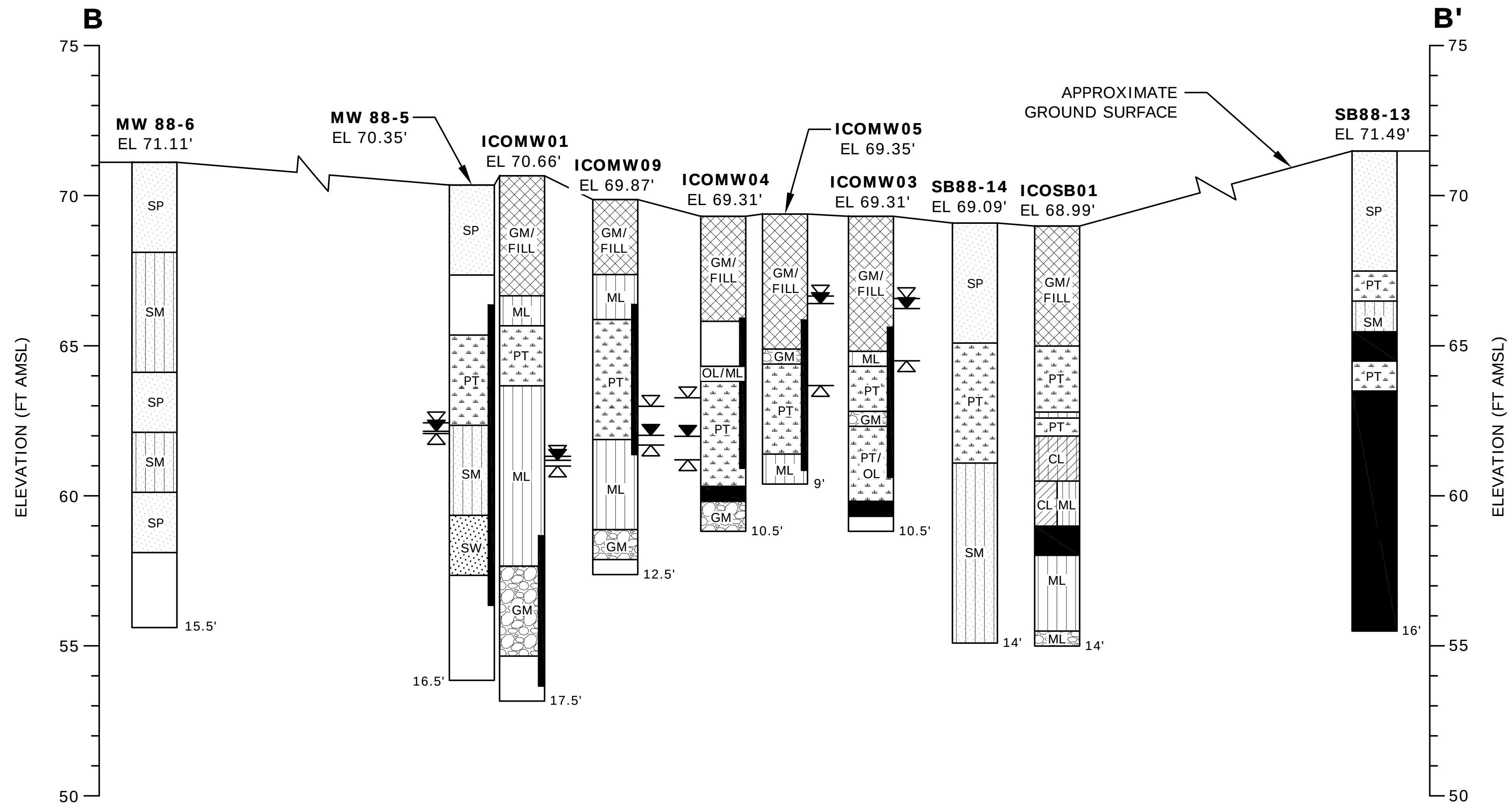
PHASE I ISCO
CROSS SECTION A - A'

BERS - NE CAPE ISCO
ALASKA

JUNE 2010 112321

JUNE 18, 2010

NEC BASEMAP.DWG



LEGEND

GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
SW	WELL GRADED SANDS, GRAVELLY SANDS
SP	POORLY GRADED SANDS, GRAVELLY SANDS
SM	SILTY SANDS, SAND-SILT MIXTURES
ML	INORGANIC SILTS AND FINE SANDS
CL	INORGANIC CLAYS, GRAVELLY/SANDY/SILTY CLAYS
OL	ORGANIC SILTS
PT	PEAT
TP	TEST PIT
SB	SOIL BORING
	FROZEN
	HIGHEST GROUNDWATER ELEVATION
	LOWEST GROUNDWATER ELEVATION
	BASELINE ISCO GROUNDWATER ELEVATION (08/05/2009)
	SCREENED INTERVAL

NOTE:

1. MONITORING LOCATION WIDTH EXAGGERATED FOR ILLUSTRATIVE PURPOSES.
2. INFORMATION FOR MW 88-6, MW 88-5, SB88-13 AND SB88-14 BASED ON 2002 PHASE III REMEDIAL INVESTIGATION LOGS PROVIDED BY MWH.
3. ELEVATIONS ASSOCIATED WITH PHASE III REMEDIAL INVESTIGATION BORINGS WERE ADJUSTED UPWARD BY ~2 FT BASED ON OBSERVED DISCREPANCIES BETWEEN CURRENT AND HISTORICAL SURVEY DATUM.
4. SOIL BORING ANALYTICAL DATA ARE SUMMARIZED IN TABLE 3 (HISTORICAL DATA), TABLE 13 (ISCOSB DATA) AND TABLE 17 (ICOMW DATA).

HORIZ. 0' 5' 10' 20'
VERT. 0' 5' 10'
SCALE

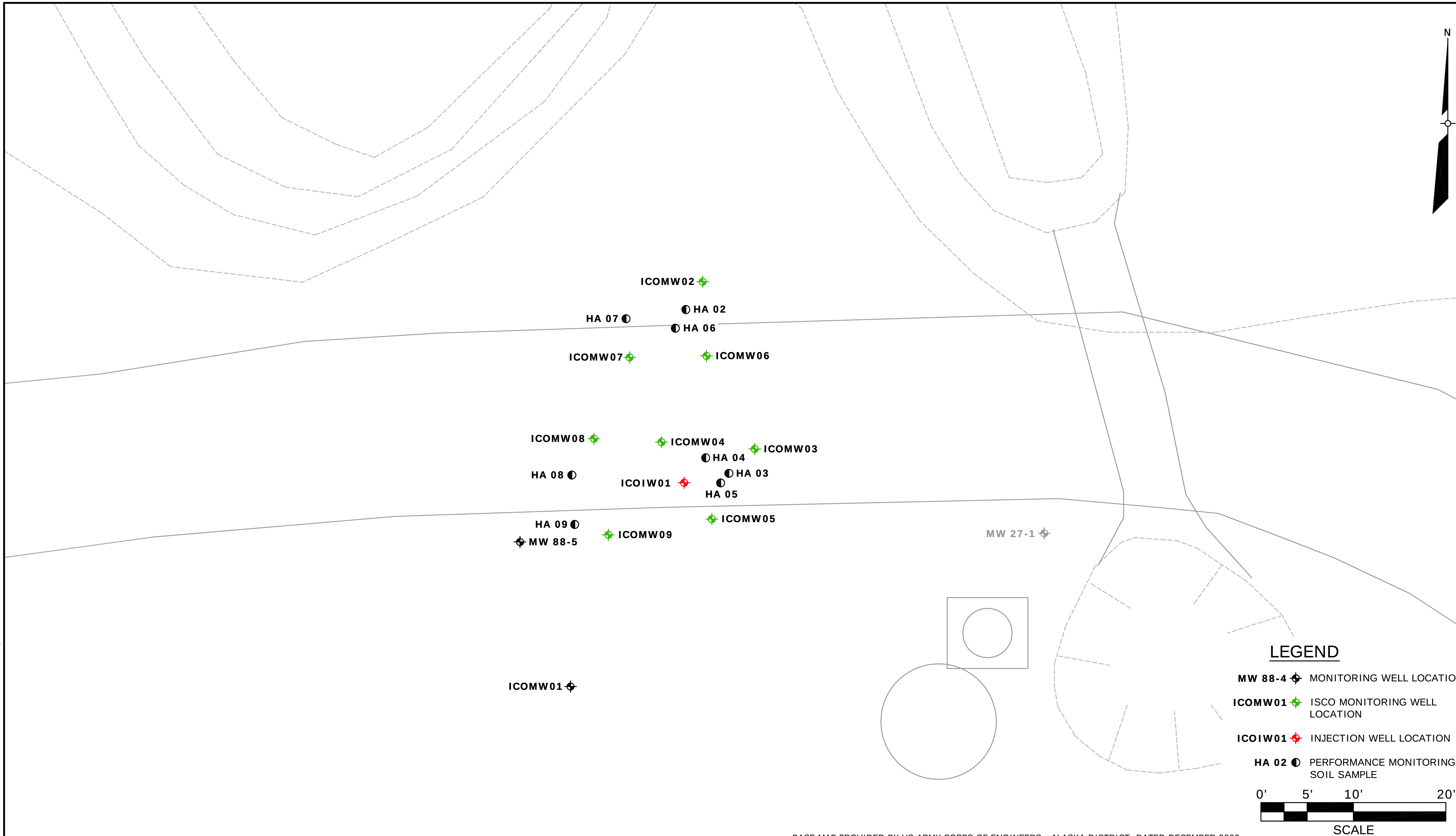
AECOM

FIGURE 11
PHASE I ISCO
CROSS SECTION B - B'

BERS - NE CAPE ISCO
ALASKA

JUNE 2010
112321

JUNE 18, 2010
NEC BASEMAP.DWG



BASE MAP PROVIDED BY US ARMY CORPS OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 12

PHASE I ISCO STUDY
SOIL MONITORING LOCATIONS

BERS - NE CAPE ISCO
ALASKA

MARCH 2010

112321

MARCH 5, 2010

NEC BASEMAP.DWG

APPENDIX A

Field Notes

13-July-2009

TP-1 (3-4) High Organic Load

100g soil
~50 mL DI H_2O added to create slurry
Temp 63.9 °F
ORP ~~94~~ 136 (w/ DI H_2O)
pH 5.48

Add 5 mL 17.5% wt H_2O_2
pH 5.27
T 64.3
ORP 363

Add 5 mL 17.5% wt H_2O_2
pH 5.20
T 64.5
ORP 370

Add 5 g Fe EDTA
pH 5.02
T 64.7
ORP 412

T 68.1 T 74.8

Stabilize
98°F / 3.98 pH

Add 5 mL 17.5% H_2O_2
110°F
pH 3.5
Prior to $Na_2S_2O_8$ T 107.5 ↓ falls
ORP 293 mV ↓

Add 3.8 g $Na_2S_2O_8$
475 ORP
99.9 °F

542 ORP
97.5 °F
2.38 pH

13-July-2009

TP-4 (2-2.5) clayey silts w/ some roots/organics

Init Conditions

100 g soil
50 ml H_2O

T 64.6 °F
pH 5.61
ORP 215

Add 10 mL H_2O_2
ORP 400 mV max
pH 5.37
T 64.1 °F

pH 5.42, 64.5 °F, 356 mV — Add 5 g FeEDTA

+ 30 sec	+ 60 sec	+ 2:00 min	+ 3:00 min
64.8 °F	66.2	74.5	88.5
401 mV	418 mV	443	~~97~~ 461
4.46 pH	4.34 pH	3.95 pH	3.88 pH

+ 5 min	+ 7 min	+ 10 min
107.5 °F	105.6	101 °F
468 mV	444 mV	353 mV
~~4~~ 3.92 pH	3.93	3.93

+ 12:37 min add 5 mL H_2O_2
455 ~~mV~~ mV
116 °F
4.02 pH

+ 17:36 min Add 3.8 $Na_2S_2O_8$
452 ~~mV~~ mV
107.7 °F
3.79 pH

+ 20:48 min	+ 28.26 min
470 mV	506 mV
100.6 °F	95.7 °F
3.61 pH	3.06 pH

+ 23:25	+ 32:00
476 mV	518 mV
98.4 °F	94.4 °F
3.45 pH	2.87

VWR Sulfuric Acid 1 N (Dilute to .5N)
buffer capacity ↳ample $39.41 ↳ buy 1L @ $33.85

Add w/ buret to slurry in small volumes to graph pH change

7/18/09

0930 Setup for TOD

Peat
SILT
SAND

Qualitative Estimate / Mass / Volume peat to sample jar

Weigh 50.2g Peat into tared weigh boat.
Carefully transfer to 500 mL amber glass jar with teflon lined cap.

— Observe - 50g peat, uncompressed, fills jar to 3/4 pt.
Add 100 mL H_2O DI to peat & shake vigorously for 1 minute
Significant peat remains unhydrated & floating.
Add 50 mL H_2O DI to peat slurry.
Shake for 1 minute
Tap jar to vibrate sidewall clinging material down into slurry.

— Weigh 100 g ORG/SILT INTO 250mL clear glass jar
Add 50 mL H_2O DI - SHAKE 30 SECONDS
slurry very thin. Could get better slurry w/ 25mL H_2O

— Weigh 100g SILT ONLY INTO 250 mL clear glass jar
Add 25 mL H_2O DI - SILT PARTIALLY SATURATED, WITH dry clumps
Add 25 mL H_2O DI - SILTS SATURATED & SUSPEND.
SHAKE 30 SECONDS

7/18/09 Select setup matrix

	SILTS	SILTS/ORGANICS	ORGANICS/PEAT	
$Na_2S_2O_8$	✓ x3	✓ x3	– x3	9
$Na_2S_2O_8$ + FeEDTA	✓ x3	✓ x3	– x3	9
$Na_2S_2O_8$ + H_2O_2 (8%)	✓ x3	✓ x3	– x3	9

~~Or~~ WORK PLAN SCOPE ONLY PROPOSED A SINGLE SOIL CONDITION.
will setup triplicates of each condition & obtain an average value.

Dissolve Fe EDTA activator calculation
FeEDTA is 13.26% iron

$\frac{300 \text{ mg/L Fe}}{0.1326} = 2262.443 \text{ mg/L FeEDTA}$

$= 2.262 \text{ g/L FeEDTA}$ ← PREP STOCK

$= 0.0023 \text{ g/mL}$ (don't have resolution on scale)

Will need to pre-prep chemical dose solution for each slurry.

For silts / silty organics look like 50 mL H_2O / 100 g soil is adequate.

18 vessels to prep @ this ratio × 50 mL = 900 mL
FeEDTA prep = 50 mL × ~~9~~6 = 300 mL
$Na_2S_2O_8$ of = 50 mL × ~~9~~6 = 300 mL

For Peat
FeEDTA = 150 mL × 3 = 450 mL
$Na_2S_2O_8$ only = 150 mL × 3 = 450 mL

2.262 g/L × 5 CONC. = 11.31 g/L STOCK FeEDTA
or 5.66 g/500 mL

For e.g. 100 mL @ 300 ppm Fe → add 20 mL 5x stock + 80 mL H_2O

$\frac{20}{80} = \frac{5}{50}$

2000 80
× 1.25

1 M sodium Thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$)

Sodium Thiosulfate Pentahydrate — water x 5

MW = 248.19
− 90.08
158.11

$$\frac{1\ M\ Na_2S_2O_3 \,\Big|\, 158.11\ g\ \cancel{\text{mol}} \,\Big|\, \text{mol}}{\Big|\ \text{mol}\ \Big|\ L} = 158.11\ g/L$$

$$158.11 \left| \frac{248.19}{158.11} \right| = 248.19\ g/L\ Na_2S_2O_3 \times 5H_2O$$

$= 12.82\ g/100\ mL$

Prepare 1 M $Na_2S_2O_3 \cdot 5H_2O$ in 100 mL volumetric flask.
shake by rapid inversi

Use 35% wt H_2O_2 to prepare 17.5% wt H_2O_2
Wash + tare bottle, glass, 250 mL.
Add 100 g E H_2O
Add 100 g 35% H_2O_2

As needed, prepare 8% H_2O_2 w/ 17.5% wt H_2O_2
Wash 250 mL glass bottle + tare
Add 100 g H_2O
Add 100 g 17.5% wt H_2O_2

1330
ORP/Temp/pH check of groundwater grab sample collected 7/1/09 with bailer from BBMW-4 = 6.00 pH
ORP = 105
Temp = 67.6F

ORP/Temp pH check of gw grab sample collect 7/1/09 w/ bailer from BB MW-5 = 5.58 pH
ORP 110
Temp 68.0

18-July-2009

2100/TP-1 (3-4) pH 2.85 351 62.5°F
2105/TP-4 (2-5) pH 2.50 351 62.4°F

2040 ~~2140~~	Check pH	PRE-CAL	Post Cal
	10.06	10.33	9.98
	4.00	4.19	4.01
	7.01	7.37	7.00

19-July-2009

From UVF ~~data~~ analysis conducted by Mark on 18-July-2009:

- SAMPLE NOMENCLATURE

#NCXXXMMZZ

= year
NC = NORTHEAST CAPE
XXX = ITA (ISCO TREATMENT AREA
MM = SAMPLE TYPE
SB = SOIL
GW = groundwater
WA = water
ZZ = sample number

~~20~~ 19-JULY-2009

TOD soils RECEIVED @ 1345 HRS

ICO SB 03 (9-11 ft bgs) Gravelly SILT - SATURATED
ICO SB 03 (5-7 ft bgs) from cuttings ORGANIC CLAYEY SILT
ICO SB 03 (7-9 ft bgs) FROZEN WHEN COLLECTED BROWN SILT
THAWS - SATURATED

PROPOSE USING 5-7 sample as ORGANIC SILT study setup (DJP 7/21/09)
Notes: strong petroleum odor
i saturation complete

ORGANIC (DJP 7/21/09)

SILT $Na_2S_2O_8$ dose only

1) ~~10~~ 100.3 g soil
2) 100.0 g soil
3) ~~100 g soil~~ 100.2 g soil

ORGANIC
SILT $Na_2S_2O_8$ + FeEDTA (@ 300 ppm Fe)

1) 100.3 g soil
2) 100.1 g soil
3 100.0 g soil

100

ORGANIC
SILT $Na_2S_2O_8$ + 8% Wt H_2O_2

1) 100.3 g soil
2) ~~100.0 g soil~~ 100.2 g soil
3) 100.0 g soil

50 mL Dose of composited site water (50/50 composite of GW from added to each triplicate, except 88 MW4 and 88 MW5, collected 7/11/09)
30 mL added to Silt + Persulfate + 8% H_2O

Allow to equilibrate, and expect to add thermal TOD study soil on 20-July-2009!

20-July-2009

Prepare ICO SB03 Extract for DRO Field Screen

5-7'	5g soil + 10mL MeOH	2x
7-9'	5g soil + 10mL MeOH	2x
9-11'	5g soil + 10mL MeOH	2x

ICO SB04 Extract for DRO Field Screen

4-5'	5g soil + 10mL MeOH	2x
5-6'	5g soil + 20mL MeOH	4x
6-7'	5g soil + 10mL MeOH	2x
10-12'	5g soil + 10mL MeOH	2x
12.5-13.5	5g soil + 10mL MeOH	2x

Collect the supernatant aliquots into 10mL syringe & filter via a syringe filter (? µm) into ~~vial~~ sample vials.

Hold for further analysis or dilution/analysis

Shift focus to collection of fixed lab soil confirmation samples.

Soils samples proposed:

✓ ICO SB01 (5-6) – peat, high SiteLAB ~~DRO~~ DRO value.

ICO SB04 (6-7) – or, other silt only (gray mottled) layer

✓ ICO SB03 (9-11) – A clean sample?, ~~probably~~.
or not – SB-2 9-10 was

X ICO SB 01 (9-10) – silt / no ~~DRO~~ appreciable DRO via SiteLAB

10

20 - JULY - 2009

SAMPLE ID		LOCATION ID / AECOM ID		DEPTH (ft)	Bot. HG LOT#
1445 09NCMOC SB01	(SILT)	MOC-01	ICO SB03	9-11	042540IT
1500 09NC MOC SB02	(PEAT)	MOC-01	ICO SB01	5-6	"
1510 09NC MOC SB03	(PEAT)	MOC-01	ICO SB02	6-7	"
1520 09NC MOC SB04		MOC-01	ICO SB04	5-6	"

21-July-2009

Check pH, ORP, Temp of SILTS, ORGANIC SILTS ICO SB03 (5-7)

		pH	ORP	Temp (°F)
1430 $Na_2S_2O_8$ only	1	5.72 pH	52 mV	66.5
	2	5.75 pH	57 mV	66.9
	3	5.66	61 mV	~~64.0~~ 66.4
FeEDTA	1	5.75 pH	46 mV	65.7
	2	5.72	49	66.9
	3	5.72	54	66.0
H_2O_2	1	5.61	50	66.7
	2	5.64	53	67.9
	3	5.61	58	67.2

NOTE: FLIGHT AVAILABLE TO COLLECT SOIL SAMPLES 09NCMOC SB01 — SB04 AND DELIVER TO TESTAMERICA IN TACOMA, WA.

PEAT SOIL SETUP

PEAT $Na_2S_2O_8$ dose only

1 100.2 g soil + 100 mL composite ~~Bgmmw4~~ + 80 mw-5 water
2 100.1 g soil + 100 mL composite H_2O
3 100.7 g soil + 100 mL composite H_2O

PEAT 300 mg/L FeEDTA + $Na_2S_2O_8$

1 100.4 g + 100 mL composite H_2O
2 100.4 g + 100 mL composite H_2O
3 100.0 g + 100 mL composite H_2O

PEAT 8% H_2O_2 + $Na_2S_2O_8$

1 100.3 g + 80 ~~100~~ mL composite H_2O
2 100.0 g + 80 ~~100~~ mL composite H_2O
3 100.3 g + 80 ~~100~~ mL composite H_2O

21-July-2009

SILT SOIL PREP / NO ORG

SILT $Na_2S_2O_8$ dose only

1) ~~100.0g~~ 100.1g + 50 mL COMPOSITE 88MW-4 + 88MW-5 H_2O
2) 100.1g + 50mL COMPOSITE H_2O
3) 100.0g + 50mL COMPOSITE H_2O

SILT FeEDTA + $Na_2S_2O_8$

1) 100.0g + 50 mL Composite H_2O
2) 100.1g + 50 mL COMPOSITE H_2O
3) 100.2g + 50 mL Composite H_2O

SILT ~~8%~~ 8% H_2O + $Na_2S_2O_8$

1) 100.0 + ~~50~~ 30 mL COMPOSITE H_2O
2) 100.3 + ~~50~~ 30 mL COMPOSITE H_2O
3) 100.2 + ~~50~~ 30 mL COMPOSITE H_2O

PEAT BASELINE pH, ORP, Temp.

PEAT $Na_2S_2O_8$ dose only

~~1~~	pH	ORP (mV)	Temp (°C)
~~2~~ 1)	5.08	120	16.5
~~3~~ 2)	5.13	118	16.6
3)	5.12	122	16.7

PEAT FeEDTA + $Na_2S_2O_8$

1)	5.18	119	16.5
2)	5.10	127	16.5
3)	5.11	127	16.6

PEAT 8% H_2O_2 + $Na_2S_2O_8$

1)	5.15	124	~~124~~ 16.3
2)	5.13	125	16.3
3)	5.17	127	16.3

~~BRUSH SHIPS COOLER WITH FOUR SOIL SAMPLES OUT FOR ANALYSIS~~
~~09NE MOCSBGL~~

21-July-2009

SILT soils BASELINE CHECK

SILT ~~pH~~ $Na_2S_2O_8$ dose only

1)	5.87 pH	84 mV	15.7°C
2)	5.88 pH	104 mV	16.0°C
3)	5.98 pH	72 mV	16.2°C

SILT FeEDTA + $Na_2S_2O_8$

1)	5.84 pH	90 mV	16.1°C
2)	5.97 pH	78 mV	16.3°C
3)	5.99 pH	74 mV	16.0°C

SILT 8% H_2O_2 + $Na_2S_2O_8$

1)	~~5.82~~	~~115 mV~~	~~16.1°C~~	5.95 pH	84 mV	15.8°C
2)	~~5.97~~	~~78 mV~~	~~16.3°C~~	5.88 pH	105 mV	15.7°C
3)	5.77 pH	74 mV	15.6°C			

22-JULY-2009

Add sodium persulfate to each soil jar. Pour 20g/kg.

$$\frac{20g}{1000g} = \frac{2g \text{ persulfate}}{100g \text{ soil}}$$

$$\frac{2g\ S_2O_8}{} \left| \frac{238\ g/mol\ Na_2S_2O_8}{192.1\ g/mol\ S_2O_8} \right. = 2.4779\ g\ Na_2S_2O_8 / 100g \text{ soil}$$

Utilize 2.5g $Na_2S_2O_8$ as Klozur Sodium Persulfate from FMC, stock reagent from purchased bulk 55 lb bags.

~~Add 50 mL H_2O all reaction vessels org~~

1130 Add FeEDTA to SILT, ORGANIC SILT, PEAT TRIPLICATES LABELED FeEDTA STIR BY TILTING WRIST ACTION

Add 35% H_2O_2 to SILT + ORGANIC SILTS TRIPLICATES, as calculated below.

x mL · 35% = 50mL · 8%

$.35x = 4$

$x = 11.4$ mL

Use 11mL of 35% H_2O_2, plus 4 mL composite sitewater to complete reaction vessel setup

22-July-2009

Observe silts only reaction is uneventful in persulfate only, persulfate + FeEDTA; however, persulfate + 8% H_2O_2 reaction vessels produce slight off gass + ~~fine~~ bubbles @ surface of silt/water interface. No temperature increase observed in first minute of reaction.

Temperature in silt only persulfate + H_2O_2 rises to max 25°C. Gas evolution in form of tiny bubbles evident + silt layer "fluffing" observed.

~~Add 10 mL 35% H_2O_2 + 4 mL composite site water to →~~

Silt organic reaction vessels begin to ~~generate~~ evolve a large qty. of gas, and soil lift + foam.

Temperature monitoring indicates increase over time

11:40 ICOSB03 (5-7) Temps, approximate
~~Ave~~

11:41	30°C
11:43	35°C
11:45	41°C
11:50	65°C

All 3 triplicates push soil material out and over rim of reaction vessel; result: loss of soil, and need to reconstruct soil reaction vessels.

Add 35% to Peat reaction vessel, 1 and 2

x mL $H_2O_2 \cdot 35\% = 100\,mL \cdot 8\%$

$.35x = 8$

$x = 22.85$ mL

Add the volume in 10 mL dose + 3 mL dose + stir with spatula to reduce soil lift by releasing trapped air. Total liquid volume is actually 103 mL in these I ~~duplicates~~ duplicates reaction vets.

Temperature climbs to 65°C in reaction vessels. However, larger 500 mL rxn vessel prevents overflow of ~~ma~~ ingredients.

No soil mass lost.

~~Cut~~ Construct a new ~~silt~~ organic silt Hydrogen Peroxide / sodium persulfate

Cont'd pg. 14.

REACTION VESSEL TRIPLICATE

1336 WEIGH 100 grams SOIL [ICO SB 03 (5-7)]. ADD 2.5 grams SODIUM PERSULFATE SOLID TO SOIL MASS. UTILIZE STOCK 8% hydrogen peroxide PREPARED ON 18-JULY-2009 AND ADD 50 mL TO SOIL / PERSULFATE

1345 MIX BY RAPID INVERSION CYCLING. REMOVE CAP TO RELEASE PRESSURE FROM GAS EVOLUTION.
PLACE REACTION VESSEL 1 IN REFRIGERATOR TO RUN COLD TEMP RXN.

~~1358~~ OBSERVE REACTION. ONLY SLIGHT APPARENT EVOLUTION OF GASSES.

~~1357~~ 1417 SUDDEN INCREASE IN VOLUME OF SOIL MASS, TEMPERATURE RISE.
MAX TEMPERATURE QUICKLY REACHES OF 50°C; HOWEVER

~~1427~~ 1421 ADDITIONAL 50 mL of GROUNDWATER ADDED TO COOL REACTION. TEMPERATURE DROPS TO 25°C AND OFF GASSING DECREASES, ALLOWING LEVEL OF SOIL "FLUFF" TO FALL BACK DOWN 500 mL vessel walls. OVER NEXT 15 MINUTES

~~1445~~ 1436 CONTINUE TO MONITOR TEMPERATURE

~~1420~~ 1441 PREPARE PEAT / HYDROGEN PEROXIDE / SODIUM PERSULFATE REACTION VESSEL 3 WITH A MODIFICATION TO PEROXIDE ADDITION.

POUR OFF + FILTER 20 mL of ~~SA~~ WATER SUPERNATANT FROM VESSEL 3. ADD 20 mL of 8% HYDROGEN PEROXIDE TO ATTAIN 100 mL FINAL REACTION VESSEL LIQUID VOLUME.
THUS, DILUTING THE PEROXIDE 1:4.

14 ~~40~~ 50 TEMPERATURE RISE IS ONLY TO 25°C

~~1450~~ 1500 CONTINUE TO MONITOR TEMPERATURES IN ALL REACTION VESSELS AND ~~OFF GAS~~ GAS EVOLUTION, IF NEEDED

1530 TEMPERATURE IN ALL REACTION VESSELS HAS REACHED STABLE TEMPERATURE OF 20°C; HOWEVER, SILT REACTION VESSELS STILL EVOLVING GAS.

1550 LEAVE ALL REACTION VESSELS ~~UN~~ LOOSELY CAPPED. HYDROGEN PEROXIDE DOSED REACTION VESSELS ARE PLACED IN LARGE CAPACITY WEIGH BOAT TO CAPTURE OVERFLOW, AS NEEDED. ANY RXN VESSELS THAT LOSE MASS DUE TO OVER-PRESSURIZATION WILL BE RE-DONE.

22 - JULY - 2009

1600 PROCEED TO CHECK pH of groundwater COLLECTED FROM NEWLY INSTALLED MONITOR WELL IN ~~DEEP~~ LOWER (OR INTERMEDIATE, POSSIBLY) AQUIFER TO CHECK AGAINST AN APPARENT ~~DISC~~ RESULT FROM THE FIELD.
pH check @ 5.89.

~~Bettuck~~

1[illegible]20 HOST VALARIE WITH ~~EOR~~ ACOE. DISCUSS TEO EXPERIMENT PURPOSE, DESIGN, OBSERVATION, RELATION TO FIELD STUDY. DISCUSS CHEMISTRY OF ~~ISCO~~ IN SITU CHEMICAL OXIDATION; ADVANTAGES OF USING ~~THE~~ TWO OXIDANTS IN COMBINATION WITH THE FERRATE.

23-July-2009

Collect surface water sample from ______________ (same location as the spot where Bristol is collecting water to supply ISCO mix system.

Calibration of pH meter HANNA 991003

STD	READ INITIAL	CALIB FINAL
7.01	7.00	7.00
4.00	3.86	4.01
10.00	9.93	9.98

Monitor pH + conductivity of surface water sample

Temp	16.2°C
pH	6.44
ORP	73 mV

Fe^{2+} 8 mg/L by HACH Fe^{2+} Kit IR-18C

PEAT ~~Sam~~

PEAT Rxn Vessel — S_2O_8 only

1)	3.13 pH	484 mV	0.3°C
2)	2.76 pH	529 mV ORP	18.1°C
3)	2.70 pH	558 mV ORP	18.0°C

FeEDTA + S_2O_8

1)	3.27	484 mV orp	1.8°C
2)	2.52 pH	559 mV ORP	18.1°C
3)	2.54 pH	544 mV orp	18.0°C

H_2O_2 + S_2O_8

1)	2.38	522 mV	0.4°C
2)	2.20 pH	221 mV	18.0°C
3)	2.27	~~48~~ 503 mV	18.4°C

ORG SILT - S_2O_8

1)	2.39 pH	487 mV	1.1°C
2)	2.24 pH	518 mV	18.8°C
3)	2.21 pH	480 mV	18.6°C

ORG SILT FeEDTA + $Na_2S_2O_8$

1)	2.40 pH	495 mV ORP	0.8°C
2)	2.39 pH	~~257~~ 393 mV ORP	18.6°C
3)	2.43 pH	399 mV ORP	18.4°C

~~PEAT~~ ORG SILT + H_2O_2 + $Na_2S_2O_8$

1)	2.04	256 mV	1.1°C
2)	2.00 pH	282 mV ORP	18.7°C
3)	1.96 pH	301 mV	18.6°C

SILT $Na_2S_2O_8$ only

1)	2.38 pH	585 mV	2.4°C
2)	2.28 pH	640 mV	18.8°C
3)	2.23 pH	642 mV	18.8°C

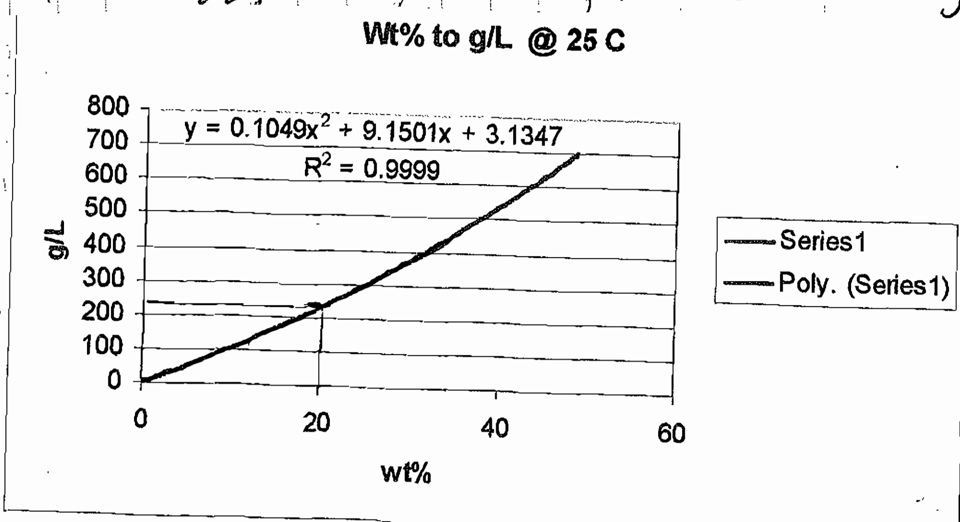
SILT FeEDTA + $Na_2S_2O_8$

1)	1.95	551 mV	2.1°C
2)	1.93 pH	482 mV	18.8°C
3)	1.84 pH	462 mV	18.7°C

SILT H_2O_2 + $Na_2S_2O_8$

1)	1.82 pH	584 mV	1.2°C
2)	2.00 pH	480 mV	18.7°C
3)	1.71 pH	481 mV	18.8°C

20% wt/wt% $Na_2S_2O_8$ solution, from density vs wt% curve = 228.1 g Klozur Persulfate / L soln.



24-July-2007

Surface water collected from local stream as water supply expected for use in batch chemical mixing. Measured for pH, ORP, Temp., Fe

pH 6.41
ORP 89 mV
Temp ~~13°C~~ 15°C
Fe^{2+} Ø mg/L by HACH, Ferrous Iron Test Kit IR-18C
Total Fe 0.17 mg/L by HACH, FerroVer Method
Calibration check on pH meter Hanna 991003

STD	Read Initial	CAL
7.01	7.03	None Required
4.00	4.02	↓
10.00	9.98	

PEAT

S_2O_8 Only

		pH	ORP (mV)	Temp (°C)
Cold	1)	2.97	504	0.7
	2)	2.58	551	16.5°C
	3)	2.41	570	16.6°C

S_2O_8 + FeEDTA

Cold	1)	3.13	503	10.4	(Allow to thaw to measure)
	2)	2.27	547	16.6°C	
	3)	2.21	587	16.6°C	

S_2O_8 + H_2O_2

Cold	1)	2.25	441	0.8°C
	2)	2.27	211	16.7
	3)	2.26	424	16.8

Organic silts - S_2O_8 only

		pH	ORP (mV)	Temp (°C)
Cold	1)	2.39	541	1.5
	2)	2.38	441	16.6
	3)	2.40	413	16.9

S_2O_8 + FeEDTA

Cold	1)	2.37	455	7.5
	2)	2.54	369	17.0
	3)	2.58	370	16.7

~~24-J~~

24 - JULY - 2009

ORG. SILTS $S_2O_8 + H_2O_2$

COLD	1)	1.96	284	9.5°C	THAW
	2)	2.12	283 mV	17.9°C ~~19.~~	
	3)	2.07	281	17.0°C	

SILTS $Na_2S_2O_8$ only

		pH	ORP (mV)	Temp (°C)	
COLD	1)	2.52	589	7.9°C	THAW
	2)	2.27	635	16.8	
	3)	2.27	638	16.6	

S_2O_8 + FeEDTA

COLD	1)	1.94	~~275~~ 484 mV	9.41	THAW
	2)	2.25	416 mV	16.6	
	3)	2.13	433 mV	16.5	

$S_2O_8 + H_2O_2$

COLD	1)	1.95	448 616	11.2	THAW – GAS BUBBLES ACCUMULATE
	2)	2.22	~~268~~	16.5	+ SLIGHT FOAM FORMS
	3)	2.12	426	16.4	

25-JULY-2009

MONITORING OF TOD REACTION VESSELS

PEAT

		pH	ORP (mV)	Temp (°C)
		$Na_2S_2O_8$ only		
cold	1)	2.98	503	0.5 °C
	2)	2.54	553	17.1 °C
	3)	2.42	569	17.0 °C
		$Na_2S_2O_8$ + FeEDTA		
cold	1)	3.21	478	9.2 °C
	2)	2.30	537	17.1 °C
	3)	2.32	541	17.2
		$Na_2S_2O_8$ + H_2O_2		
cold	1)	2.20	513	0.6
	2)	2.21	585	17.3
	3)	2.25	576	17.4

ORGANIC SILTS

		pH	ORP (mV)	Temp (°C)
		$Na_2S_2O_8$ only		
cold	1)	2.32	449	~~17.3~~ 0.9
	2)	2.36	445	17.2
	3)	2.34	447	17.2
		$Na_2S_2O_8$ + FeEDTA		
cold	1)	2.39	442	0.9
	2)	2.53	368	17.3
	3)	2.54	369	17.2
		$Na_2S_2O_8$ + H_2O_2		
cold	1)	1.94	286	0.7
	2)	2.11	284	17.2
	3)	2.06	283	17.0

SILTS

		pH	ORP (mV)	Temp (°C)
		$Na_2S_2O_8$ only		
cold	1)	2.47	~~45~~ 653	0.7
	2)	2.27	633	17.2
	3)	2.27	635	17.1
		$Na_2S_2O_8$ + FeEDTA		
cold	1)	1.92	485	0.6
	2)	2.25	426	17.4
	3)	2.12	435	17.1

		pH	ORP (mV)	Temp (°C)
		$Na_2S_2O_8$ + H_2O_2		
cold	1)	1.94	620	0.6
	2)	2.20	450	17.3
	3)	2.12	432	17.2

26-July-2009

CALIBRATION CHECK pH meter

STD	READ INIT	CAL
7.00	7.00	None
4.00	3.88	↓
10.06	9.97	

PEAT

$Na_2S_2O_8$ only

		pH	ORP (mV)	Temp (°C)
cold	1)	~~2.79~~ 2.80	~~382~~ 523	4.1
	2)	2.79	382	17.6
	3)	2.42	511	18.2

$Na_2S_2O_8$ + FeEDTA

cold	1)	2.89	490	4.1
	2)	2.21	547	17.9
	3)	2.18	554	18.0

$Na_2S_2O_8 + H_2O_2$

cold	1)	2.31	374	2.7
	2)	2.25	205	17.7
	3)	2.43	360	18.1

ORGANIC SILTS $Na_2S_2O_8$ only

		pH	ORP (mV)	Temp (°C)
cold	1)	2.23	~~2~~512	4.2
	2)	2.31	403	17.8
	3)	2.41	389	17.8

$Na_2S_2O_8$ + FeEDTA

cold	1)	~~2~~ 2.43	428	4.3
	2)	2.54	358	17.6
	3)	2.57	358	17.7

$Na_2S_2O_8 + H_2O_2$

cold	1)	~~1.91~~ 2.09	~~565~~ 290	~~5.3~~ 1.8°C
	2)	2.18	270	17.5
	3)	2.06	275	17.5

SILTS $Na_2S_2O_8$

		pH	ORP (mV)	Temp (°C)
Cold	1)	2.33	577	0.9
	2)	2.24	621	17.2
	3)	2.29	611	17.3

$Na_2S_2O_8$ + Fe EDTA

Cold	1)	2.10	480	6.3
	2)	2.30	401	16.9
	3)	2.37	385	17.2

$Na_2S_2O_8$ + H_2O_2

Cold	1)	2.08	608	7.1
	2)	2.17	~~270~~ 437	16.9
	3)	2.12	425	17.1

Post Read cal check

std	Read.
7.00	7.05
4.00	4.04
10.06	9.90

STD	READ	CAL
7.01	7.01	LOW RANGE TARGET MET
4.00	4.02	
10.06	9.98	

REAT

$Na_2S_2O_8$ Only

	pH	ORP (mV)	Temp (°C)
1)	2.71	535	12.6 °C
2)	2.82	378	18.6
3)	2.39	260	19.7

$Na_2S_2O_8$ + FeEDTA

	~~pH~~		
1)	2.80	531	10.4
2)	2.33	454	~~18.4~~ 19.1
3)	2.27	458	19.4

Surface H_2O
~~GW~~ Only + $Na_2S_2O_8$ + FeEDTA
pH 2.01
ORP 598 mV

$Na_2S_2O_8$ + H_2O_2 (8%)

1)	2.30	298	~~10.0~~ 10.0
2)	2.29	269	~~18.7~~ 18.7
3)	2.48	344	19.5

ORGANIC SILTS

$Na_2S_2O_8$ Only

1)	2.21	497	13.0
2)	2.40	~~255~~ 369	19.5
3)	2.47	378	19.6

$Na_2S_2O_8$ + ~~Fe~~ FeEDTA

1)	2.41	415	12.9
2)	2.58	345	18.8
3)	2.62	350	19.2

$Na_2S_2O_8$ + H_2O_2 (8%)

1)	2.00	304	12.2
2)	2.14	273	18.2
3)	2.13	260	18.8

SILTS

$Na_2S_2O_8$ Only

	pH	ORP (mV)	Temp (°C)
1)	2.38	598	13.4
	~~2.28~~	~~621~~	~~19.0~~
2)	2.28	621	19.0
3)	2.25	626	18.2

$Na_2S_2O_8$ + FeEDTA

1)	1.91	521	14.1 °C
2)	2.30	408	18.2
3)	2.29	396	18.3

$Na_2S_2O_8$ + H_2O_2 (8%)

1)	2.05	499	16.0
2)	2.25	430	17.9
3)	2.27	401	18.2

END pH

4.00	4.08
7.01	7.08

8/6/09

~~Total~~ Iron Screening — BASELINE

22:10 09NC MOC MW07 — ZERO ON SAMPLE 0.00 mg/L
READ REACTED SAMPLE >3.30 mg/L
10 mL SAMPLE OF FIELD SAMPLE

1 mL SAMPLE OF FIELD SAMPLE
9 mL of DI WATER
3.26 mg/L = 32.6 TOTAL IRON

1 mL SAMPLE OF FIELD SAMPLE
9 mL DI WATER
~~0.77 mg/L = 7.7 mg/L Ferrous Iron~~ Re-dilute as new sample
1.93 mg/L = 19.3 Ferrous Iron

09NC MOC MW02 — ZERO ON 10x 0.00 mg/L
Dilute 10x
TOTAL IRON 0.89 mg/L x 10 = 8.9 mg/L

Dilute 10x
Ferrous Iron 0.45 mg/L x 10 = 4.5 mg/L

09 NC MOC06 — ZERO ON SAMPLE 10x Dilution 0.00 mg/L
DILUTE 10x
TOTAL IRON 0.95 mg/L x 10 = 9.5 mg/L

Dilute 10x
Ferrous Iron 0.00 mg/L x 10 = 0.0 mg/L

At 1x
Ferrous Iron 0.00 mg/L

7/11/09.

0630 H&S meeting

0745. Prepratory Phase meeting for Test Pit digging.

ToDo 1) Expose drums on north sides of site? Slight raking to expose whether they are of concern.

* Make copy of trench pit log for Russell

\- No entrance in pit if over 4' deep.

0900 Mobilize to site and go to most southerly pit location and dig trench to 6.5' Contamination (diesel) found at 3' to bottom of hole. Take samples below and run head space (ppm) Dup's taken for onsite lab

TP1	-3-4'	FID = 52.1 ppm	PID = 18.5 ppm
	4-5	FID = 556	PID = 144
	5-6	FID = 902	PID = 200

1030 Mob to location TP2 take samples below for headspace. See log for details of lithology -

TP2	Depth	FID ppm	PID ppm	
	3.5-4	740	160	> Dups taken for onsite lab also
	6-6.5	1040	420	
	7-7.5	720	140	
	9.5-10	580	204	

1120. Mob to location TP3, appears during trenching that there are several zones of clayey silt, lt gy that are catching cont, several peat layers headspace sample taken as well as dups for onsite lab analysis for DRO/RRO

TP3	Depth	FID ppm	PID ppm
	2-2.5	bkg	bkg
	4-4.5	420	48
	6-6.5	320	4.0
	7.5-8	41.5	16.8
	8.5-9	51.0	4.8
	10.5-11	37.5	2.9

1600 Mob to TP4 take samples for headspace and dups for DRO/RRO at onsite lab.

TP4.	Depth	FIDppm	PIDppm
	2-2.5'	7.2	2.3
	5-5.5'	138	17
	7-7.5'	1280	205

7-7.5 @ capfringe.

1700 Return to office,
Unpack gear and post cal instrument.
- Finish up logs
- Organize shop.

1900 EOD.

7/11/09

7/12/09.
0630 - H&S meeting @ mess hall.
- Open trenches at MOC
- Watch for trucks.
- Hazardous materials in trash.
- Tripping hazards in camp area from previous camps

0700 - Prepare to go out to continue test pits

0900 Dig test pit # TP5 to about 10', occ peat found @ 3.5' BgL appears to be contaminated throughout. water at ~10' bgs.

0930 Dig Test pit TP6 - peat @ 7' is about 1/2' thick, appears very slightly contaminated

1015. Dig Test Pit TP7, encounter Seep zone @ ~5', in sl silty gravel.

1100 To test pit TP8, seep @ 4' TD @ 10' - ground water not encountered

1200 - Return for lunch.

1300. Review data, work on headspace sample from TP and record on logs.

1700 - Go out to site and GPS locations of completed test pits.

1900 Finish bookwork and prepare for test pits tomorrow AM.

2000 EOD.

RJH SL

7/13/09

0630 H&S meeting w/ all hands.

0700 Calibrate FID/PID for use in field for continued Test putting.

0900 On site @ location for TP10.

Upper fill to 4', abundant gravels throughout, TD @ 10', no sign of water in pit after digging!

0930 To location of Test Pit TP11
Some peat @ 3.5' below fill and another layer of peat @ 6-7' - abundant contamination and diesel odor throughout entire trench/pit.

1000 Return to office so I can run PID/FID instrument on soil samples collected from Test pits TP10 & TP11

1200 Lunch
1230 - Analyze data

~1700 - Put togeather spreadsheet to put with DEQ field screening results that Scott & Mark are generating.

1900 EOD

[signature]

7/14/09.

0630 H&S meeting.

0800 Work on map of MOC, have Russell from PERS use GIS to produce map.

0930 Go to MOC and GPS in road and remaining monitoring wells of concern.

1000 Work on setting up the InSitu transducer and logging package in anticipation of doing slug test. Will try to get Aqtesolv from home.

1330 Continue getting equipment ready for slug tests

1700 Go to MW83-3 to do slug tests.

WL 10.14

TD 19.45

Set transducer @ 18.14 = 8' H_2O

Run 3 Rising & 3 Falling head tests

- Need Tape measure
- Stop for slug

1900 Return to office unload equipment work on download of computer

2000 EOD

[signature]

7/15/09

0630 H&S meeting all hands

0700 Call Bill to arrange AQTESOLV software to site

0900 TO site setup on 88MW-1 for slug tests

WL 14.53 TOC

TD 24.05 TD

24.05 22.00

Set Transducer @ 22.0'

14.53

WATER TEMP 6.23

7.47

Initial DTW 7.066 OFF 0.4

BTM OF SLUG WHICH IS 1 1/4 x 5' @ 20'

WELLS FOR SURE TO DO 88-5 88.10

Complete 3 rising & falling tests

initial observations very fast recovery.

1001 Back to camp for tape measure

.083
.166

1030 On Loc 88MW-5

WL 9.03 14.80

TD 14.8 9.03

Set transducer @ 5.77 H_2O

14.5'

14.8
9.0
5.8

Transducer Reads 5.52' H_2O

14.5
9.03
5.47

Set slug btm @ 13.75'

88MW-5-2

Log for 88MW5-2R & 88MW5-2F labeled backwards

Transducer moved during insertion of slug on 88MW-5-3F - Reset immediately after insertion

Transducer read 5.565 after reset & well recovered volume of slug

$\pi r^2 h$ $\quad$ 1.25 = r .5625^2 = .3164 = 59 in^2

= 3.14 x .3164 x 60 = 59 in^2

1300 Well MW8810

WL 18.43 $\quad$ 1843 + 6.1 = 2453 $\quad$ 25.30 − 18.43 = 6.87

TD 25.30

Set Transducer @ 24.5'

Btm of Slug @ 23.5

3 good falling & rising head tests

1445. TO 20MW1

WL 20.04

TD 28.85.

SET TRANSDUCER @ 28.0

Set. BTM OF SLUG BLOCK @ 26.0

3 good falling & rising head tests

1615. TO ~~[illegible]~~ 17MW1 ~~OBSTRUCTION~~

WL 10.15

TD. 16.8

Set transducer @ 16'

BTM OF SLUG @ ~~15.0~~ 14.5

~~do~~ 3 rising & falling head tests

Seem problematic, well problems?

1.45 x 10^{-6} ft/sec

000000 1.45 x 10^{-6} $\frac{ft}{sec}$ x 60 = ft/min x 60 = ft/hr x 24.

x 60 =

v = Ki $\quad$ = .39

88-5 = K = 1.21 f $\quad$ 88-5 $\quad$ K = 14.567 ft/day = .39'/day

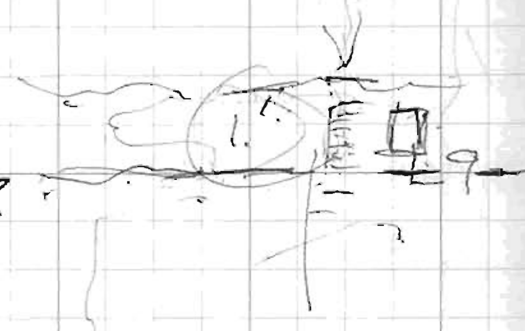
K $\quad$ 8.74 − $\quad$ K 8.74 ft/day = .235

gradient .27

7/16/09

- Sample continuous from below fill to WT.
- Eric Sample bottles.
- 1-5 gallon bucket of hot soil for Scott.

GRO, RRO, VOC 8260B,



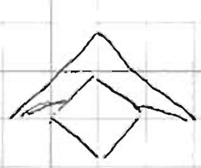
- Decon Area.
- Soil Drums for cuttings?
- WATER - GAC?
- SAMPLE ID SCHEME. -

- GLOVES
- TERRA CORES
- GRO BTLS
- 25 ml MeOH
- FID / PID
- COOLER
- ICE
- BAGGIES
- LOGGING FORMS
- SAMPLE LOGS
- BUCKETS
- ALCONOX.
- DW IN TOTE

4°

LOC ID

MWH Phase III Summary Report • 2-4-01 2-4-03
4-6-02 4-6-04
ONLY ON COC



Sample #
~~09NCEMOC~~
HOLE 1 09NCMOCSB01 -
HOLE 2 09NCMOCSB02 -

MEETING W/ Drillers etc.

Sample ID

Need VOA's

Field Dup - 09NCMOCSB03
New # Samp loc. ID.
Matrix Spike ← 09NCMOCSB03 MS/MSD

— Samples
GRO / BTEX - 25 ml and MeOH,

NPDL # 09-034 — IN COMMENT SECTION OF Sample #s
[MOC-01~~m~~ - dups samenumber
MS/MSD - GRO - 1 bottles
DRO/RRO - MS

naphlene/GRO/BTEX in 4 oz

DRO/RRO - 4 oz

~~8~~1

7/17/09 Raining
0630 H&S meeting -
0800 - Take drill crew to beach to P/U drill rig, come back to office to prepare for drilling effort, gather equipment and supplies

1200 break for lunch.

1300 - Meet with Bristol people and USCE about drilling effort, meet w/ Eric to get Sampling scheme.

MOC1 - location ID 1st Boring
MOC2 - 2nd well etc
DATE yr, NE cape, loc, Soil
09NC MOC SB01
Sample #1

FIELD dup same number as loc ID. Same time.
MS/MSD
~~orig~~ orig sample 09NCMOCSB01
field dup. 09NCMOCSB01
MS/MSD 09NCMOCSB01 MS/MSD

1515 Run Aqtesolv on slug tests
MW88-3-1R = 9.751 E-5 ft/sec = 8.42 ft/day
gradient .027 × .027 = .227 ft/day = velocity

88-10-1R = 1.449 E-4 ft/sec = 12.51 ft/day
× gradient .027 = .338 ft/day
88-10-2R = 1.916×10^{-4} ft/sec = 16.54 ft/day
× gradient .027 = .446 ft/day
88-10-3R = 1.637×10^{-4} ft/sec = 14.14 ft/day
× .027 = velocity = .382 ft/day

20MW1-1R K = ~~0.0~~ 1.856 x 10^{-4} ft/sec = 16.03 ft/day
x .027 = .439 ft/day y° 43.71

20MW1-2R K = 1.087 x 10^{-4} ft/sec = 9.391 ft/day
x .027 = (.253 ft/day velocity)

20MW1-3R K = 8.43 x 10^{-5} = 7.28 ft/day
x .027 = .196 ft/day velocity.

Finish slug tests data reduction for day

- Talk about area for pilot study

1700 Lay out pilot area holes in
field based on gw flow

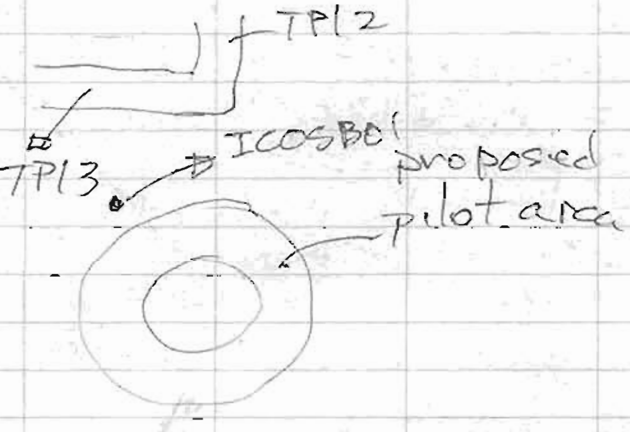
1900 EOD

[signature] 7/18/09

7/18/09 ~45° misty - rainy

0630 H&S meeting all hands in Camp

0700 Talk to drill crew, will do boring between TP13 and target area as below.



0900 Set transducer program to every 12 hrs in 8EMW-5 WL 9.04' @ 0900

Set up on ICOSB01 -

Log in Book because of rainy conditions

0 - Surface disturbed soil w/ gravel & cobbles v tight dense gravels & cobble w/ silt & sand matrix (FILL), auger to 5'

Run 2½" x 18' spoon @ 5'

1030 Blow cnts 2,3,2 5-6.5'

PID .25ppm fid 2250 - Bkd - 15 FID PID - 0

@ 5' silty peat, fines sft, dk yel brn, becoming lt gy @ ~~6~~ 6½

- follow w/ 18" ss @ 6.5 push to get to depth w/ drive head

bcnts 6.5-8' 3,3,4' pid - 20 Fid = 6.5q

peat to 7.0, sharp contact w/ yel brn - dk brn clay w/ lt ... silty to 7.5 back to peat

Smr

auger to 8' for next spoon.
8-9.5 blow counts - 2,5,5 BZ - Bkgd.
@ 8.5 lt gy silty clay pid 140 Fid 1250
sl - mod plastic, mod sft, uniform, occ sdy
9.5-11 bc 3,4,5 pid 2.5 - fid bkg.
to. 10' silty sandy clay a/a becoming
pred clayey silt @ 10' - uniform, sl - mod
plastic mod sft, tight, sl moist., partially frozen @ 10'
1200 Break for lunch.

1245 back on location

1250 Auger to 11' to take next splitspoon.
11-12.5 ss 3,6,5 pid Bkg FID Bgd
11 - 12.5 ~ partially frozen clayey
silt, sndy IP m-dkgy, occ scat org
throughout, no odor, occ yel brn -
red brn ox zones, mod plastic, mod sft,
sl moist to occ partially frozen, doesn't appear sat.
Auger to 12.5'
Breathing zone while augering to 12.5'
Bkg.
12.5 - 14 Blow cnts, drill
6,4,9
Appears slightly harder @ 13.5
gravel @ 13.5 silty gravel - gravelly silt.
- measure WL in hole = 7.5' BGL
no water in hole until we hit H_2O.
Backfill w Cetco medium
chips to 1' of surface w/ 6 bags.

1400 - drillers to decon. use brush to
knock of excess, scrub w/ Alconox wash,
rinse w/ ~~de~~ potable & then DI

1530 Spud ICOSB02
Auger to ~~4~~' to sample - fill appears to
end @ 4' per driller
wet cuttings @ 4' - seep?

PID FID

drive spoon - 4-5.5 Blow cnts 1,1,2 22, 500

4-5. Silty gravel, md-dk brn, w/org and peat throughout

@ 5.0 peat, dk brn silty, IP, sft, some diesel smell, occ sand.

Bkg for PID because of downwind of TP13, TP12, TP8 FID - 117 ppm. PID - 2.58

~~Auger to~~ follow up w/ sp 5.5-7' -

BC 1, 1, 5, 5 PID 50 - FID 120 ppm.

~~5-6.5~~ 5.5-7.0

7.0 - 8.5 → No recovery

~~6.5 - 8.0.~~ Bit fell through peat or sft material to 9'

SP - 9-10.5.

LOST 7-9'

- Driller will hang center bit to catch up to 10.5'. Sample 9-10

Take sample @ 9-10'. pid 22 Fid 750

Hole appears to be connected all the way down (H_2O).

- Don't want to drag contamination downward so TD hole @ 10.0'

TD hole @ 10.0

1200 - Drillers to decon area to decon augers and spoons.

1900 EAT Dinner

1930 Work on headspace readings on samples taken from SB01 & SB02

2200 EOD

[signature]

7/19/09

0630 H&S Meeting - Cloudy ~ 70% humidity ~50°
0700 Meet w/ Scott & Mark about punch list for the day.

0930 Onsite for SB03 - ICOSB03 adjacent to SB02 to get saturated peat for TOD study

Auger to 7' for spoon sample, lithology 3' to east of IS SB02 which had a perched zone @ 4°. This boring does not appear to be as saturated as the previous boring (SB02).
- Boring has flowing silt which came in
- btm of auger 1³ into sampler, pull and clean sampler, only ~~shoe~~ shoe had clay silt in it w/odor

1120. TD ICOSB03 @ 11° - lithology difference from ICOSB02 appears considerably different than last. Not as much saturated peat and mostly peat has becoming organic silt (OL).
- Hole is frozen - partially frozen @ 7'
- driller reports relatively stiffer zones which could be ~~long~~ icy zones.

- Take photo of rig
- TAke photo of backfilling ICOSB03 with chips
-

~1150. Go to conex to get bentonite chips, we have plenty to finish all the borings we have planned.
* - Boring location for downgradient of site doesn't look good because of uneven ground, maybe put the soil boring just south of 88MW-5.
Augers after removal ~~are~~ have stained (diesel and silty soil)

1200 Break for lunch.

1300 Meet at site - mobilize to location for ICOSB04, which is on east side of proposed pilot study area.

Auger to 4' to begin sampling

Sample 4-6
6-8 - lost 7-8
8-10 no recovery

Water @ ~ 12 where it is moist, saturated @ 13' - collect samples in baggies for TOD study

* Water in boring comes up to ~9.25' when drilling is completed, appears as in SB- ICOSB01 that there is a head differential between the lower aquifer and seep zones above.

*
1700 Finish boring, Drillers decon, backfill w/ bentonite chips @ site using brushes to knock of excess soil, to drum, wash w/ Alconox and water rinse with water from water source (Creek) that was brought via water truck to site in Cubie - Return to office.

1900 return to lab, run headspace on FID/PID.

2000 Continue input of log data, download photos.

2100 EOD - drillers on standby for tomorrow
[signature]

7/20/09
0630 H&S meeting - all hands
0700 Waiting on Corps to decide what they want to do about putting in a lower completion to look at the lower confined aquifer @ ~12'-13'. Work on slug test evaluation and begin putting togeater spread sheet depicting lithologies and seep correlation using test pit and soil boring data.

1500 Get the OK to put in a temporary lower completion in. After discussions with Mark & Scott decide to put lower well completion in between 88MW-5 and ICOSB04.
Auger to 5' to get through fill
run split spoon sampler in 2' intervals from 4-16'
- appears moist @ ~about 12.4
cap fringe 12.4 - 13.2
- Top on Saturation @ 13.2

Set .006 slot screen 5' long -
Sump. 17.5-17.0
Screen Int 17.0 - 12.0
- 10/20 Sand. 17.5 - 10.0 - 3 bags
= 3/8" bentonite chips. 10.0 - 4.0 - 4 bags.
= H_2O after drilling at ~9.5
- ~~Driller dec~~ Drillers will leave augers on decon pad for night, no Surface completion as this will be a temorary well for now.

2200 - Return to office -

2300 - EOD

[signature]

Rite in the Rain
ALL-WEATHER WRITING PAPER

7/21/09
0630 H&S Meeting all hands
0700 Let drill crew know we are putting
them on standby, going home, as we
are not going to be doing anymore
drilling right now. - They will decon & rig down
0730 Calibrate YSI for well development.
0830 Go to site to begin well development.
WL = ICOSB05. Temp well @ 0845
prior to development, pull cap and under
pressure - let equilibrate
WL @ 13.8 BGL - Begin development on
Well name change to ICOMW01,
When installed ~~sand~~ and silt surged
into augers up to 14' so the well
is pretty dirty. Surge and pump
with BK pump system. Continue pumping
and surging.

1000 Continue development on the well
1030 Get ok to install upper completion to
look at seep zone will install near SB03 &
SB02
1100 Well beginning to clear up.
1110 Drillers auger to 9' to set well in
upper seep zone. - No samples
1200. ICOMW02 - Set 2", 006 prepack -
sump. 9' - 8'
10/20 Silica Sand 9' - 3' - 5 bags -
soaking and disappearing into sloppy peat
3/8" bentonite chips: 1' - 3'
No surface completion as might be temporary
well.
Develope w/ BK pump makes very
little water

7/21/09 Cont.

1750. Prepare to sample ICOMW01 for DRO/~~RRO~~

09NCMCCGW01 - ICOMW01

Sample for DRO/~~ERO~~ @ 1800 hrs.

1 - 1 lt Amber glass pres w/ HCL

WL 9.49 using mini typoon pump <100 ml/min flow

- Take 1 lt btl for Scott.

1900 - Finish sampling, return to office and take care of samples,

2000 Work on recording data on X4 @ Atie.

2100. EOD

[signature]

7/22/09

0630 meet for H&S meeting

07Ø0 Prepare to go out to sample 88MW-5 and temp well ICOMW02.

Call inst ~~at~~ (YSI),

0800 Sample 88MW5 - FOR DRO/RRO, quick turnaround

1100 Sample ICOMW02 FOR DRO/RRO/quick turnaround.

1200 Lunch

1300 Level Survey of existing wells.

STA.	T	M	B	$\bar{E}$LEV	ELEV
INST	8.85	8.03	7.21	75.32	67.29
88 TOC 4	7.89	7.36	6.82		67.96
TOC ICOMW1	7.80	7.29	6.79		68.03
885 TOC	8.15	7.60	7.04		67.72
TOC ICOMW2	10.57	10.05	9.52		65.27
Pipe	2.88	2.15	1.11		73.17
INST HT	9.60	8.80	7.99	81.97	
ROCK	7.71	6.75	5.79		75.22
INST HT	2.87	2.26	1.66		71.52
STAND PIPE	7.49	6.31	5.14		71.17
INST HT	3.09	2.27	1.45	73.44	
BM	7.40	6.10	4.80		67.27
			Closed		

STA	T	M	B	$\bar{E}$L	ELEV
INST BM	11.69	10.93	10.17	78.22	67.29
TOC 88MW5	1.25	.98	.71		77.24
INST HT	12.17	11.17	10.18	88.41	
88MW-1	7.08	6.55	6.11		81.66
88MW-10	[illegible]	[illegible]	6.83		86.24
INST HT	9.07	5.62	8.18	94.86	
20MW1	6.32	5.99	5.66		88.87
Inst HT	6.69	5.52	4.37	94.39	
22MW2		.80			93.59
Inst	12.32	11.46	10.62	94.39	~~Plugged~~
STA	8.81	8.37	7.92	101.96	
TOC 22MW3	3.05	2.77	2.53		99.19
INST HT	12.04	11.28	10.51	190.47	
26MW1	4.28	3.24	2.2		107.23

1500 Return to office, download equipment do paperwork

1900 - Dinner

1930 Return and work on X-Secs for Corps

2030 END

[signature]

7/25/09

1500. Set up for slug test on ICOMW02
Put 4 transducers in ICOMW01 WL 9.45 TD 18.6 -12
88MW-5 9.20 14.80 -12
ICOMW I 5.42 9.80 -9.6

9.38

7/26/09

0630 HES meeting

0700 - Discuss plan for injection or infiltration gallery with Mark & Scott, look @ K values, Target perch zone @ top of peat.

0900 Go to 88MW05 and do six drawdown recovery tests.

Initial WL 9.20
TD 14.52

Use Mini Typhoon water pump to evacuate well, let recover - Run six tests

1400 Run Aqtesolv software to figure K values using 90% recovery method

Initial WL 9.2, 90% = 10.12

D1 - K = .6111 ft/day
D2 = .555 ft/day
D3 .561
D4 .562
D5 .509
D6 .534

1600 Unload truck prepare spreadsheet with K values.

1800 Download data and finish K values for site

1900 EOD

[signature]

7/22/09.

0630 H&S Meeting all hands.

0700, Talk about what sample intervals are to be taken during well installation and sent out to labs for analysis.

0800 - Go to drum storage to get drums for cuttings for well installation.

- Well Installation. Lower well for injection will be set ~6" into frozen silt @ 10.09', other adjacent well will be set ~ 1' high (9') for secondary injection if deemed necessary.

7/28/09
0630 - H&S meeting all hands
0700 - H&S meeting - AECOM, AGC AND Denali Drilg.
0730 Mob to site set up on 1st MW in grid ICOMW03

0800 Drill and sample for GRO Screen
take samples for GRO @ 5-6⁵, 6⁵-7⁵
7⁰-8⁵ - 8⁵-9⁵ and 9⁵/10⁰

~~1200 Break for~~
Set well @ 10⁵
Sump 10⁵-10⁰
Screen 10⁰-5⁰ .006 prepack w/10/20 Sand
10/20 Sand to 4⁵ 3bags, pour sand as we go out of hole w/augers
30/70 Silica Sand to 3⁵
Neat Cement to 0.5

1400 Move to ICOMW04
WL in ICOMW03 - ~7⁶ Bgl   7.41

Samples taken @ ICOMW04
6'-7.5 @ 1445
7.5-9⁰ @ 1500
9⁰-9⁵ @ 1515
} GRO 25g soil w/ 25 ml methanol in 4 oz teflon septa jar.
* Set well at 10⁰'

1600 WL - ICOMW03 6⁸ Bgl

59.82 + 1.13 = 60.95
6.45 - 5.52 = 1.13
6.45 - 5.38 = 1.07
59.82 + 1.07 = 60.89
61.03 + 1.07 = 62.10

61.03 MW03 WL elev
59.82 WL MW02 elev 1.00

1730 Shoot TOC
MW02 6.45
MW03 5.52 - 5.76 - 5.17
MW04 5.38

5.45 5.45
6.45 - 5.52 = .93
5.17
7.00

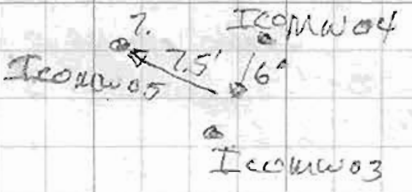
6.45 - 5.45 = 1.00
6.45 - 5.38 = 1.07

7/29/09

	ELEV		
TOC MW02	5902 -	5.48	= 53.54
TOC MW03	~~6103~~ 60.95 -	~~7.~~ 4.64 -	
TOC MW04	60.89 -	WL 7.41	- 53.48

tine between 3 & 4. 7.5' South - -

1030. Start ICOMW5 Raining all logging & sampling done in truck - will transfer boring log to AECOM form later



Auger through fill

1040 Rig down - shifting problems - needed transmission fluid

1050 Back to drilling

0 - 4.5 Fill gravel, 1/2" - 2" w/ occ larger to 4"
4.5 - 6.5 - split spoon Blow cnts 2222

4.5 - 5.0 gravel & silt mg cut - 73 - 250
gy - Fill? peat 195 - 750
5 - 6.5 peat m brn -
dk brn, strong odor, stiff
moist, fine peat w/ silt
6.5 - 8.5 Blowcounts 2, 3, 3, 4
6.5 - 9.0 peat a/a - silty IP moist, mod dense - rather sharp contact
8.0 - 8.5 - silt, clayey IP m gy dry - sl moist - fid pid qint because of moisture
auger to 9.0 for ~~sample~~ well install
1800 Return to office. - eat.
1830 Work on logs and label samples after screening

2200 EOD [signature]

7/30/09 Windy raining, miserable weather
0630 H&S Meeting.

MW3 3.52 9.51 TD   MW4 - 7.41
MW5 WL ~~5.17~~ 4.99   MW2 - 5.38

0830 Mob to MW6   During augering wet @ 3.0
4-6 2212   in Fill Sat @ 4.0
to 4.8 Silty gravel - saturated
4.8 peat m-dk brn, v silty med damp
sft, uniform, v strong odor
6-8 2334, peat as above 6-7 Sat
from up hole 7-8 moist silty peat
@ 8-9.5 drill spoon 225 Blow counts
@ 8.5 clayey silt m-dk gy, ang
contact w/ peat (see photo)
partially frozen, TD @ 9.5
Sump 9.5 - 9.0   Set btm of well @ 9.5
Screen 9.0 - ~~4~~.0
1020 3.5 - 3 1/2 bags
3/20 - to 2.5   RIH w/ button bit to knock out
plug → neat cement 1#94 bag/6 gallons - to 0.5
MW3 66.20 - 3.52 = 62.68   66.20 - -
MW5 - 66.20 4.99 = 61.21
MW4 - 66.34 - 7.41 = 58.93
MW2 - ~~58~~ ~~69.77~~ 65.27 - 5.38 59.87

1400 Use BK pump to begin development of ICOMW04. Pump 2 gallons to make well pumped dry.
1430. Pour 2 gallons clean H_2O used for decomming into well and surge.
1445. Pump well dry - abundant silt in water, diesel odor.

1515 - Spud MW7
Fill 2.5.0   2.5 - 4.5 splitspoon Blowcnts 2546
2.5 - 2.7 Fill silty gravel
2.7 - 3.8 m clayey silt, cold, tight, grading to @
3.8 - peat md brn, coarse to fine, silty, occ pebbles,
mod pet odor., ice crystals visible

4^5-6^5 Blow cuts 6557
Blow cuts display frozen peat, pet odor,
silty I.P., occ sand & pebbles, occ
vfine grained peat, intbd peats and silts
silts 5^5-6^5
6^5-8^5 2,3,4
recovered only 1^0
frozen to 7^5 @ 7^5 v coarse peat
mod soft - sl pet odor.
8^5-10^0 sp @ 8^5 Sloppy peat wet and
then m-dk gy silt, w/occ gravel to 1½
water in augers to 6' after drilling hole.
Btm of sump @ 18^0 .
Sump 10^5-10^0
Screen 10^0-5^0
10/20 Sand 10^5 4^5 3 Bags.
Stop for night will set rest of well
tomorrow AM
1800 Return to office

Prep Samples for Analysis.
09NCMOCSB08 @ 1000 - GRO - 4oz w/septa & Benzene
ICOMW06 5'-6' Peat DRO/RRO/Nap - 1-8oz clear
TOC - 1-4oz clear jar

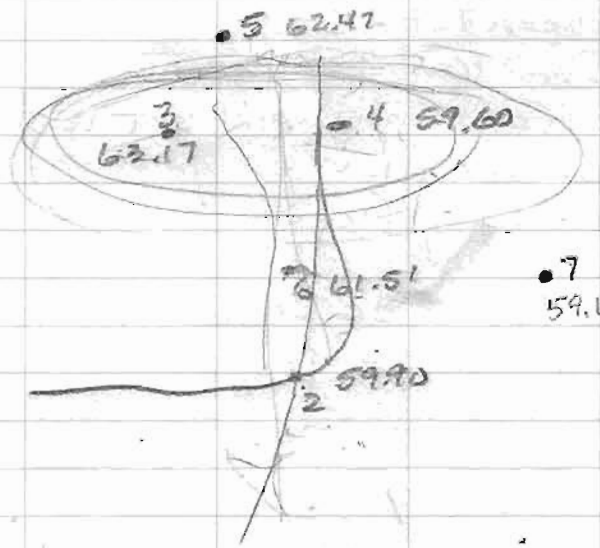
09NCMOCSB09 @ 1615
ICOMW07 6^5-7^5 GRO-AK101 4oz w/septa
Benzene.
DRO/RRO
Nap. - 1 8oz Clear jar
TOC - 1 4oz clear jar

7/31/09
0630 - H&S Meeting
0700 - Prepare for field work.
Run 30/70 Sand in ICOMW07 to 2' BGL, Grout to 0'
w/ Neat Cement 8 gallons H_2O w/ 1 94# bag of
portland cement.

WORK ON WL Problems below

WL 3.13 - MW3 63.17	3.73 - MW5 -62.47	61.51 MW2 - 5.37 -59.90	
WL 6.74 - MW4 59.60	3.91 - MW6	65.42	

$$\begin{array}{r} 66.20 \\ 3.13 \\ \hline 63.17 \end{array} \quad \begin{array}{r} 66.34 \\ 6.74 \\ \hline 59.60 \end{array} \quad \begin{array}{r} 66.20 \\ 3.73 \\ \hline 62.47 \end{array} \quad \begin{array}{r} 65.42 \\ -\ 3.91 \\ \hline 61.51 \end{array} \quad \begin{array}{r} 65.27 \\ 5.37 \\ \hline 59.90 \end{array}$$



5.68 WL MW07 - Shoot elev grd 66.41 TOC 64.82
WL ELEV 59.14

1000 - Drillers working on surface completions
do surface completions on ICOMW07, ICOMW06,
ICOMW03, ICOMW05. - Lance developing MW03
and MW04.

1200 Lunch

1235. P/U drums for soil cuttings

1330 - begin auger ICOMW08
Auger to 3⁵ through fill to sample to 3⁷ (Fill
- 3⁷ - 4⁵ m-dk gy silt.
4⁵ - 6⁰ Peat, v coarse w/ ~~plant~~ stems throughout.
6⁰ - 8⁵ Peat/OL org silt, moist @ 6⁰
8⁵ - 9⁵ ML - m-dk gy silt.

Take headspace samples @ 4⁵-5⁵, 5⁵-6⁵
7⁵-9⁵

Finish drilling, TD @ 9⁵

1500 Set well -
Sump 10⁰ - 9⁵
9⁵ - 4⁵ Screen .006 prepack (2" sch 40 .006 Screen inside 3" sch 40 .006 screen w/ 10/20 Silica Sand prepack.
10/20 Silica Sand - 10⁵ - 4⁰ - 3 sacks
30/70 Silica Sand - 4⁰ - 3⁰ - 1 sack
neat cement 1 94# sack of portland w/ 6 gals H_2O

1600 Finish well; set surface casing & cement.

1720 Leave site for office

1740 Run headspace samples on ICOMW08 Samples.

Depth	FID (ppm)	PID (ppm)
4⁵ 5⁵	1050	190 -
5⁵-6⁵	89	17
7⁵-9⁵	48	10

~~Send~~ Prepare sample to ship to lab.
09NCMOCSB10 @ 1620 5⁵ - 6⁵
ICOMW08 - FOR DRO/RRO naph - 8 oz jar
Benzene meth GRO - 4 oz jar w/ Septa 25 ml
TOC - 4 oz jar clear

8/1/09

0630 - H&S meeting all hands

0700

WL TOC	LOC	WL TOC	LOC
6.99	MW88-4	33.50	26MW1
10.74	MW88-3	30.45	22MW3
15.26	MW88-1	26.46	22MW2
19.20	MW88-10	10.85	17MW1
21.06	20MW-01		

0800

WL MW4 7.76 MW7 5.72 MW6 - 3.91 MW3 - 3.03
MW8 - DRY MW2 - 5.40

4.35 ~~2.85~~ 3
~~3.8~~
3.15 3.15
~~1.20~~

0930 Begin drilling ICOMW09

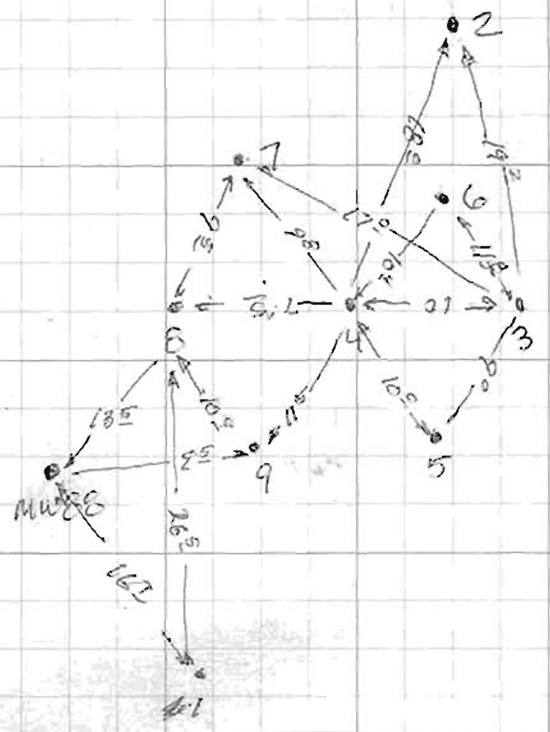
Drill and sample to 12'
Dry to 11' then gravel which appears to be confining as in 88MW-5 - Hold off on completeing well until Mark and I can talk about what we want to do with well. Take FD and MS MSD @ 5.5-6.5

1200 Lunch.

1230 Put drillers on standby until a desition can be made on what we want to do.

Mark and I go over what is happening with gw. Do we have two systems interacting? Upper and lower confined

1600 Go get drillers have them auger to 12½ and set well.
12.5 - 12.0 Sump.
12.0 - 7.0 2" PVC Screen with 3" outer screen with #50 Sand inside (prepack)
10/20 Sand (3 bags) 12.0 - 6.5
30/20 Sand ½ bag 6.5 - 5.5



Sketch of Well Network

1800 Drillers will finish well (Grout) tomorrow.
BACK to office
Drill crew decon augers & downhole equipment
1900. Do headspace values from ICOMW09.

Depth	FID	PID
5.5 - 6.5	1300	180
6.5 - 8.0	450	60
9.0 - 10.5	82	12

Pack samples for Analysis.

PACK 09NCMOCSB11 for DRO/RRO NAD, Benzene GRO, TOC, 1 4oz w/septa MeOH pres, 1-8oz, 1 4oz clear

8/2/09

0630 H&S meeting all hands.

0700 Mobilize to site.

Drillers grout ICOMW09 to 0.5 of surface, complete surface and set Christ, Box.

1000. Begin auger ICOIW01 -

Auger to 5.0 through fill.

splitspoon sample 5.0-7.0, 7.0-9.0 & 9.0-10.5 encounter grav gravel @ 7.7

appears lithology of hole is similar to ICOMW03 & ICOMW05, ICOMW05 does not have intermediate gravel zone..

1030 Do some slug testing on ICOMW05.

1200 - Reach TD on ICOIW01 @ 10.5

1300 Begin setting well, through auger w/ .006 Wire wond screen, 10.5-10.0, ~~10/20~~ Sump., 10.0-5.0 screened. 10/20 Silica sand 10.5

1400 Go through logs of mw for headspace readings for input in spread sheet.

WELL	~~PID~~ DEPTH	PID	FID
ICOMW03	4.5-5.0	93	490
	5.0-6.5	307	2010
	6.5-7.5	35	307
	7.0-8.5	32	318
	8.5-9.5	100	440
ICOMW05	No Readings on log	- Flameout, & moisture	
ICOMW04	6-7.5	250	1500
	7.5-~~9~~.0	165	950
	9.0-9.5	24	~~1-2~~ 140
ICOMW08	4.5-5.5	190	1050
	5.5-6.5	17	89
	7.5-9.5	10	48
ICOMW06	4-5	42	145
	5-6	124	630
	6-7	35	116
ICOMW07	5.5-6.5	50	650
	6.5-7.5	229	1150
	7.5-8.5	114	220

1530 WL 7.08 in ICOIW01
Drillers setting surface casing in ICOIW01
& ICOMW02.

New casing top TOC for ICOMW02 - 64.23
For ICOIW01 - TOC - 6658
ICOIW01 - GRD 66.76

Survey of Wells with elev.

~~MW08~~

LOCATION	ELEV TOC	ELEV GRD
88MW-05	67.72	
ICOMW01 ~~TOC~~	6803	67.61
ICOSB04		67.52
TP8		68.86
TP12		67.84
ICOSB01		66.73
ICOMW03	66.20	66.52
ICOMW05	66.20	66.67
ICOMW02	64.23	64.55
ICOMW04	66.34	66.64
ICOSB02		64.56
ICOSB03		64.52
ICOMW07	64.82	65.41
ICOMW08	66.30	66.57
ICOMW06	65.42	65.59
ICOIW01	66.58	66.76
ICOMW09	66.45	67.00

1725 WL ICOMW09 - 9.28 BGL TD 12.1

Headspace Samples

ICOIW01	FID	PID	DEPTH
-	1450	280	5.0 - 7.0
	140	28	7.0 - 9.0

8/3/09.
0630 H&S Meeting all hands
0700 Work on getting all samples ready to ship.

0930 Work on updating spread sheets for TVA data & for elevations of Borings and monitoring wells.

1200 lunch

1300 Back @ ISCO Site
Conduct drawdown tests on ICOMW05 and ICOMW07

1700 complete drawdown test

1800 - To office

1900 Clean up equipment postcal TVA after taking headspace readings.

8/4/09
0630 - H&S Meeting all hands
0800 Prepare equipment for field, download photos.

1045. Set up on MW07 to take another drawdown test.

WL - ~~5.75~~ 5.70

ICOMW09 appears to have a schedule 80 screen as the BK will not fit down to bottom of well with swab, the screen also is packed with #50 sand.

Run test ICOMW07 Test84 - did not have pump in btm of hole.

Recovery very Fast.

Run new test ICOMW07 Test 284

— 1200 Lunch.
1350. Start Purging ICOMW05 To
WATER SAMPLE @ 1545 09NCMOCGW03-4 RMS 8/4/09
6 - 40ml vials w/ HCL for GRO AK101, Benz Naph.
2 - 1 lt Amber w/ HCL FOR DRO/RRO AK102 / AK103
1 - 250ml poly - sulfates
1 - 250ml poly w/ HNO3 for metals

1600 Start purging ICOMW0~~4~~5 for Sampling — RMS 8/4/09
Sample # 09NCMOCGW~~04~~05 RMS/8/4/09

C 1730 TAKE identical sample sweet a/a.

1800. Back to OFFICE

1900 PACK and label samples for Shipment.

8/5/09
0630 H&S Meeting all hands
0700 Prepare equipment for days water sampling and Development
0800 - Download camera w/ photos, download gps data from site taken yesterday
0900 - To site, gather bottles for water sample from ICOMW07
WL in swamp well 2.45 TOC
Purge well, see Water sample data Records.
1130 Sample ICOMW07
Sample # 09NCMOCGW06
& MS/MSD - 09NCMOCGW06 MS/MSD.
each sample containers
6- 40ml vial HCL pres. for GRO AK101, Benz, Naph
2- 1 lt Amber HCL pres for AK102/AK103 DRO/RRO
1- 250 ml poly - Sulfates
1- 250 ml poly HNO3 pres for Metals.
1200 Lunch
1230. PACK and prepare above sample when shipment goes out.
1400 At site to sample ICOMW04 & ICOMW06.
1500 Sample ICOMW04 w/ peristaltic (geo-pump, because of recovery issues.
- Sample # 09NCMOCGW07
1- 250ml poly for Sulfates
1- 250ml poly pres w/ HNO3 for metals
2- 1 lt Amber pres w/ HCL for DRO/RRO AK102/AK103
6- 40ml vials pres w/ HCL for GRO, AK101, Benzene Naphtalene

1600 Begin sampling ICOMW06, it was purged dry @ 1030 AM. Sampled using geopump (peristaltic) Sample # 09NCMOCGW08
1- 250ml poly for Sulfates
1- 250ml poly pres. w/ HNO3 for Metals
2- 1 lt Amber pres w/ HCL for DRO/RRO AK102/AK103.
6- 40 ml vials w/ HCL for GRO AK101, Benzene, Napthalene.

8/6/09
0630 H&S Meeting - Security evaluation.

0800 GET PACKED to leave, clean up office area -

Meeting - pre-injection w/ Bristol & USACE.
- H&S of Chemicals usage.

Rite in the Rain

NE Cape - AECOM / Bristol

9/10/09 -

0800 - Leave Palmer to Anchorage to fly to Nome.

1200 Meet Aaron from AECOM, Eric & Russell from Bristol.

1300 Contact person in Nome who has equipment left behind on last trip for use in field effort this round. Inventory and then go to Bering Air to check on equipment there.

Get everything ready for tomorrow
1600 EOD

9/11/09 - Go to Bering Air @ 0800 fly to NE Cape, get there about 0900 - transport supplies and equipment to site. - Aaron and I purge wells for water samples - Eric soil sampling

9/11/09. Cont.
NE CAPE.

~~ICOMW04~~ ICOMW04
1020 WL : 7.65 9.70 TD
1100 Purge. 09NCMOGW44 MOC19
initial - Sheen on WATER

Temp	Cond	DO mg	pH	ORP	Turb	Time	Tu
5.22	.517	1.05	4.96	47.2	8.45	1105	
	Well	Dry				1110	
5.69	.584	2.97	5.32	40.2	7.84	1120	purge total 2 gal
5.51	.610	1.19	5.56	33.1	6.64	1130	
5.39	.597	0.79	5.65	34.8	6.25	1140	

Sample @ 1140 purge total of 2 gallons.
TOOK VOCs @ ~40 ml/min, had to wait for recharge, lower pump to btm of well -
Sample Sulfate & metals @ 1200
Begin DRO/RRO @ 1210 - no water, let recharge and come back

2.05
2.49
10.45
8200
.9045

9/11/09 Cont

1220- TD MW03 — FCOMW03

WL 4.38 9.50

Temp	Cond	DO mg/L	pH	ORP	Turb	Time
7.76	1.661	3.47	3.75	278.3	6.75	1230 Initial
7.94	1.668	0.94	3.82	283.5	6.09	1240 WL 4.8
7.93	1.771	0.87	3.81	284.4	4.05	1245 WL 4.9
8.68	1.787	0.47	3.81	287.9	2.99	1250

1230 purge @ ~ 100 ml/min, water appears clear, sl tannic, no odor., sl foam on water. surface when going in bucket.

Sample @ 1255

2- 1L Amber DRO/RRO HCl pres
6 - VOC 40 ml w septa w/ HCL
1 - 250 ml poly
1 - 250 ml poly w HNO3
1 - 500 ml poly

5.12
.49
46.08
20480
25088

9/11/09 Cont.

1335 - 5.35 WL MW05 8.45 TD

— ICOMW05

Temp	Cond	DO mg/L	pH	ORP	Turb	Time
7.66	2.274	3.88	3.45	322.2	17.6	Initial 1345
8.27	2.261	2.69	3.46	324.6	16.4	1350
7.95	1.825	2.81	3.56	313.5	16.1	1355
7.70	1.768	2.89	3.58	306.5	16.1	1400
7.59	1.792	2.87	3.58	301.5	16.0	1405

color tannic, some diesel odor.
purge @ ~ 100 ml/min
Sample @ 1405
Well dry ~~resa~~ recharge
Sample for DRO/RRO &
field parameters @ 1515 ±
unable to get all sample
volume, pump up into tubing,
pull pump and drain water
into bottles. for remaining samples.

3.70
.49
1.75

9/11/09 Cont.

Aaron's taking remaining well water samples as most are low recharge.

1600 Help Eric pull soil samples and prep and pack them

1700 - Pack up equipment and transport back to airstrip, run purge water through GAC, load plane and head back to Nome.

~1800 - Arrive Nome, unload, will come back tomorrow and sort equipment, take samples that will be sent to lab as well as volume brought back for field analysis to Hotel.

1900 EOD.

9/12/09.

0800 - Meet with Aaron, Eric and Russell in old bar of Hotel and set up so Aaron can do field parameters of water that we brought back from the cape. Eric and I work on packing samples to be sent to laboratory for analysis.

1200 Finish packing samples and Aaron is finished and has all his sample excess ready to ship to lab.

1600 Go to Bering air and sort out equipment that needs to go to Anchorage and shipped to Scott in FL

7/30 THUR Arrive on SITE @ 1630 site tour with Mark, Dinner review paperwork and geology to date 0800-AM to 1200 PM Arrive Nome AP @ ~~0900~~ 1100 WAITING GAME untill 1530.
Fly to site with crew / concrete + medic Kevin

7/31 FRI DAY 01 WELL DEVELOPEMENT ISCOMW03 + ISCOMW05 - MW04
AM WQ CAL, NTU, POST CAL

8/1 SAT Continue WELL DEVELOPEMENT @
AM/PM CALIBRATION continued WELL DEVELOPEMENT.
Brown (Peat) (Gray SILT).
WORK THROUGH INJECTION WELL LOCATION WITH MARK POST
Dinner interbedded Peat + SILT, confined Aquifer is ~~tough~~ tuff. Re Layout and survey MW, SELECT Injection well location.
continued developement @ ISCOMW04 + ISCOMW05
WELLS req. significant surb/BK swab/ ballasting or bouncing bailer/BK out tube, pumping + recharge.

8/2 Sun 0630 am meeting back For Dinner 1800 - 1900 paperwork
CALLED THE GIRLS

Developement @ ISCOMW04 AM
ISCOMW06, 07, ISCOMW08 has H_2O @ AM check.
This well was dry at the previous 8/1/AM check.
1300 + 1400 check hanging out *
LAST WELL ~~ISCOM~~ ISCOIW01 installed @ +/- 1500 * 48 hour waiting period.

Sprayer broke, fried the low flow controller.

Wrap-up @ 1700-1800 Valery ~~stopp~~ stops by twice.

Done with Drillers put up rig. / Very Nice day.

— POST CALIBRATION

WELLS + Volume Removed By Date

	FSCOMW01	MW02	MW03	MW04	MW05	MW06	MW07
7/31							
8/1							
8/2							
8/3							
8/4							

	MW08	MW09	FSCOTW01

8/2 WELLS Ready to sample FSCOMW03, MW05.

8/05/2009 0905 8/05/2009 1245

02	~~4.53~~	
03	Done 3.07	
04	7.33	7.70
05	Done 2.95	
06	4.03	5.25
07	5.68	
08	8.16	
09	7.86	
IW01	5.02	7.80

MW06 8/04/09 PM LFP = 5gal 1300-1900

Time	Vol	ORP	DTW	PH	Cond	Turd/DO	Temp
0915	Initial	119	4.03	5.92	0.169	12.50/22.1	5.26
0945	1.5g	172	6.80	5.86	0.167	21.01/8.62	5.28
1005	2.0g	176	8.30	6.00	0.170	38.1/9.79	4.53
1025	2.5	147.8	8.45	6.15	0.178	53.4/9.60	5.24
1030			8.80	Dry			
1400-1500	1.0	~~87.4~~ 148.1 LCP	8.85	5.94	0.179	13.1/9.65	5.21

MW04 8/04/09 PM LFP = 3 gal 1300-1900

0920	Intial	168	7.33	5.84	0.236	7.99/9.98	4.11
0948	1.0 gal	189	9.00	5.71	0.218	13.68/12.28	3.64
1000	1.5	189.8	~~9.50~~ Dry 9.52	5.73	.210	13.70/13.01	4.13
		HALT	LOW FLOW	Purge	Dry = Recovery		
1400-1500	1.0	187.4	8.45	5.79	0.179	12.10/9.65	4.14

IW01
0920 SWAB 15 min Large bail Removed 5.0 gal
0955 Recovery set pump
1000 pumped off 1 gallon ~~it is~~ Dark gray.
1000-1200 pumped off 3 gallons w recovery of +/- 40 min DK gray
1200-1245 Lunch & Recovery
1245 Continued recovery @ 04 & 04, surge + bail @ IW01, 09 surge
1300-1600 surge bail and pumped removed 10 gallons @ IW09
MW09 surged + bailed 1 gal per hour 1400 to 1700 total = 3 gallons

1600-1800
1800-1830 Dinner
1830-1930 Post CAL ACK, Paperwork.

8.06.09

0630 CALIBRATION misc prep
0800 ISCO Prepping meeting
0900 GATHER up supplies Project planning
need additional GW Sample each Location for Base line
onsite Kits Bailer.
1000 clean trailer + Truck
1015 Arrive on sites

WATER LEVELS

Loc	DTW	TD
MW02	4.59	
03	3.15	
04	7.57	
05	3.10	
06	3.92'	
07	5.72	
08	7.52'	
09	7.58'	
IW1	5.06'	

MW09
PP
1045 start purge
use LF to hit NTU's
Dry
1325 10.05
sample 1325 to 1328
1 pump Low flow 0.75 L
~~1500~~ - 1400 to 1830
~~1810~~ bail for ORO
GRO / metals, etc.
dry again @ 1800,
1815, 1830-1845, Break 4 Dinner
dry @ 1945.

MW08
PP
1100 start purge
USE LF to hit NTU's
Dry
1322 8.85

LF = Low Flow
1400 talked w/MH
this wells recharge
hasn't improved
MW02 will be
used as a replacement
for baseline + flow on
events.

IW01
1080 start purge LF Typhoon

Dry pumped 4.0 gal.
1300 - 1800 pumped dry
4 times total removed
5 gallons.
1800 dry
1975 7.75 2.69' Recovery
2000 pumped dry 3.0 gallon
total removed 8/6/2009
12 gallons
no swabing

8/6/2009
GW Sampling overview baseline sampling @ MW09 will be completed 8/7/2009 early a.m. 2-250 mL plastic metals + TOC will be collected, + VOC's 6-40 mL VOAS.
MW09 was low flow purged dry +/- 4-6 times during GW Quality parameters, and flow up sample collect.

MW02 replaced proposed UP Locations MW08
MW02 was developed prior to my arrival for early site characterization + location selection
LF purge failed to meet NTU's, pumped dry @ Low Flow proceeded with sample collection. Samples were still ~~tu~~ Turbid
Collected 8oz + All MW02-09 For Fe field kit.
1800-1845 Dinner
1845-1950 site overview with Molly + Terry (USACE)
Client + Client/Client.
Collect 2 addition Vol @ GRO/DRO 1845-1950

8/7/2009
Complete samples @ ICOMW02 - 2 of 250 mL Polys + 6 VOA's GRO/VOCs/AK101 0830
0900-1400 misc download Winsitu etc
1400-1800 WATER LEVELS + TROLL Deployment see back of Book for H_2O Levels + misc Infor
1800 Fuse problems, Pre injection testing delayed
1800-1900 DINNER
1900- SAMPLE prep for Lab submission
Fixed sprayer, Water level indicator.
POST CALIBRATION

8/08/2009

0630 - 0700 Am meeting
0700-0800 pack 3 coolers For lab possible
plane to ANCHORAGE Today,
0800 Gear up LOAD supplies mob to well field
water levels + Troll down Load, check data
stream, restart test.

LOC ~~DTW~~ DTW 0840-0918* ① H_2O events 1, 2, 3 ② ③ 4

MW02	~~4.70~~ 9.48	
MW02	4.70	
MW03	3.34	+/-Δ 3.34 2.85 0.5"
MW04	7.55	+/-Δ 0.48"
MW05	3.48	
MW06	3.80	
MW07	5.74	
MW08	7.55	
MW09	7.36	+/-Δ 0.20
MW 88-5	9.22	

Treatability sample well Pretest 8/8/09 1: pm START 8

MW09 LDTW 7.46 Temp 1.56 Pressure STOPPED 1134 MT
#142308 troll #

MW05 LDTW ~~3.18~~ 3.48 Temp 3.18 Pressure STOPPED 1239 MT
STOPPED 1236
#14336 Troll #

MW03 LDTW 3.34 Temp 3.033 pressure 2.647930 STOPPED 1006 MT
108595 * start 2 pm MT

Note download time 1800 to 1300 = 17 HRS = 22 minutes.

Done

~~Sheet~~ 2nd Losse sheets for additional 2nd Rd Readings

	TEMP (°C) ~~PH~~	EC (mS/cm) ~~TEMP~~	DO (mg/L) ~~cond~~	pH ~~ORP~~	ORP (mV) ~~DO~~	DEPTH INTERVAL	
~~MW02~~							
MW-06 T	5.74	89	~~7.~~ 8.78	6.32	218.2	DTW 3.85 TOP ~~3.8~~ 4.7	
1550 M	3.55	127	2.00	7.14	218.5	MIDDLE 6.7	
B	2.39	120	0.90	7.48	217.4	BOTTOM 8.2	
~~X~~	15.					DTW 4.71	
MW-02 T	5.50	112	3.01	6.62	239	(5.0)'	
1600 M	3.19	132	~~3.19~~ 1.00	7.32	202	6.5	
B	1.53	131	0.78	7.51	201	8.1	
MW07 T	0.182	2.0	4.87	5.40	151	6.0	DTW
1609 M	0.93	184	1.08	7.05	77	7.9	5.72
B	0.62	185	1.20 ~~1.40~~	7.14	106	9.9	
MW08							DTW 7.22
T	6.51	163	1.86	5.99	192	7.45	TD 9.35
1625 B	0.53	158	2.20	6.03	193	8.85	

Data entry 8/11/09 0745 ZMP

Round #3 readings begin ~~1645~~ 1700 1715

Loc/Time	Temp	EC	~~mS/cm~~ DO	PH	ORP (mV)	DTW	DT Readings
MW03							
T	6.97	133	1.12	6.69	243.1	3.22'	4.75
1719 M	4.76	136	1.00	6.64	189.3		6.75
B	2.884	128	1.36	6.30	188	Twll	8.75'
MW05							
T	12.04	9110	3400	5.17	665.0		4.75
1729 M	10.01	9456	38.60	5.47	670.8		5.85'
B	8.12	8590	46.84	5.59	654.3	–	7.85
MW09	1.89	146	9.51	8.16	306		
T	~~1.60~~	~~1 mS~~	~~9.50~~	~~5.34~~	~~385~~	7.60	~~7.00~~ 8.30
M	1.53	142	9.51	8.72	330		~~11.00~~ 9.00
B	1.30	135	10.88	9.4	285	–	11.00

		Baseline 8/8/09 0900 Am	8/8/09 1825	8/9/2005 0705		0705am 1200
MW01		9.48	9.46	9.48		9.46
02	~~9.48~~	4.70	4.70	4.70		4.66
03	~~4.70~~	3.34	3.24	3.35		3.17
04	~~3.34~~	7.55	6.04	6.58		6.06
05	~~7.55~~	3.48	3.47	4.39		4.16
06	~~3.48~~	3.80	3.71	3.84		3.82
07	~~3.80~~	5.74	5.68	~~9.70~~	5.70	5.67
08		7.55	7.34	7.19		7.13
09		7.36	7.40/~~5.5 TD TIC~~	7.68		7.70
IW01		—	7.40/5.5 TD TIC	~~9.48~~	8.11	
MW88-5		9.22	9.21	9.24		

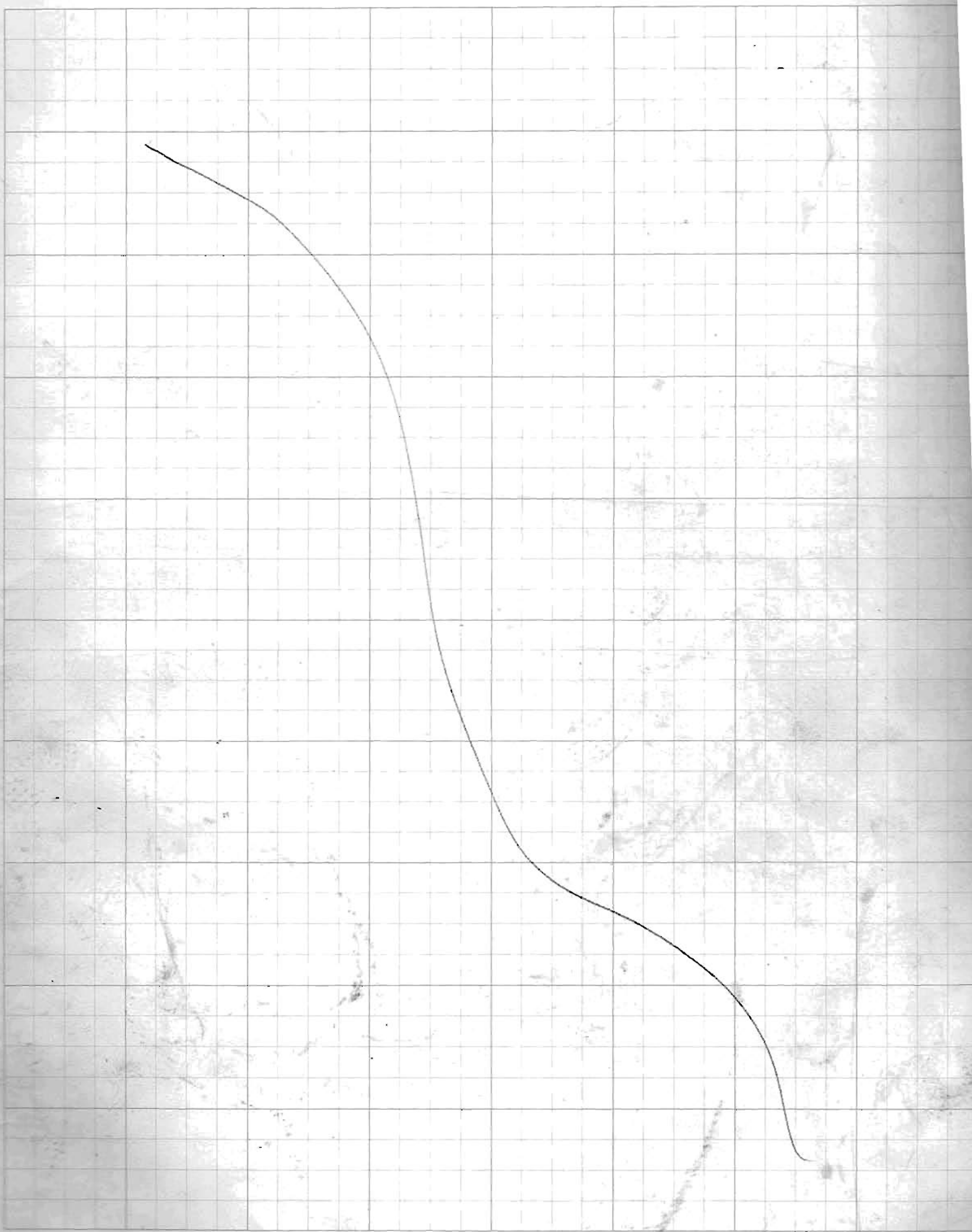
8/9/2009 ~~Road~~ Round #3 Continued

Loc/Time	Temp	EC (ms/cm)	DO (mg/L)	pH	ORP	DTW	DT Reading
MW04 T	1.83	135	9.10	7.18	242.1		6.40
T	~~2.88~~	~~[illegible]~~	~~10.13~~	~~[illegible]~~	~~251.8~~	6.42	~~5.00~~
1800 M	1.80	132	7.98	7.07	244.5		7.00
B	1.77	157	7.44	7.22	222.9		9.00
MW06							
1809 T	6.41	132	1.18	7.83	216.4	3.72	4.40
M	3.47	128	0.51	8.52	202		6.40
B	2.17	119	0.66	8.82	204		8.2
MW07							
1825 T	0.96	183	2.48	9.32	60.1	5.68	6.5
M	0.74	183	1.50	9.61	63.2		8.0
B	0.60	183	1.12	9.78	64.0		9.3
MW07							
1835 T	4.82	117	1.47	8.86	157	4.72	5.0
M	4.18	122	1.12	9.04	154		6.5
B	1.49	132	0.62	9.66	144		8.0
MW08	0.58	161	1.96	10.19	135	7.16	8.00
1845							

Cleanup site Mob to shack Aron Arrives

8/10/2009 2nd day Injection

Loc/time	temp	EC (mS/cm)	DO mg/L	pH	ORP (mV)	DTW	DTRd.
MW05 1256							
Top ~~Foot~~	24.89	22.51	44.98	-0.25	581.8	Troll	3.0
mid	24.78	22.33	46.57	-6.43	583		5.0
Bot	24.61	22.57	45.36	-6.40	582		7.0
MW03/1312		mS/cm					
*TOP	11.98	0.387	5.55	4.61	407.4	3.15'/Troll	4.0'
M	4.93	3.599	7.88	1.22	584.7		5.0'
B	3.37	3.820	6.81	1.55	580.5		8.5
MW04 1318						6.50	
TOP	2.00	0.143	10.71	6.61	185.0		7.0
M	1.46	0.157	7.23	6.54	~~179~~ 157		8.0
B	1.25	0.165	6.31	6.85	148.1		9.1
MW08 1326						7.05'	
TOP	1.56	0.225	2.79	7.41	194		7.30
Bottom	0.63	0.173	3.29	7.31	172.2		8.50'
*MW06 1330						3.68	~~4.0~~
TOP	6.22	4.023	3.43	2.24	585		4.0
M	3.70	5.871	1.50	2.22	623		6.0
Bottom	3.10	5.912	1.21	2.60	632		8.6
MW07 1337						5.69	24P
TOP	1.62	0.216	2.51 ~~4.51~~	8.66	4.0		6.45
M	0.90	0.143	2.12	8.43	10.5		7.5
B	0.59	0.189	1.55	8.62	11.1		9.3
MW02 1349						4.61	
TOP	6.15	0.134	1.85	8.56	167		5.0
Mid	2.40	0.156	1.20	7.92	120.0		7.0
Bott	1.72	0.140	0.94	7.94	127.2		8.0
MW09 1401						7.40	
Top	2.18	0.154	15.31	6.86	232	▽	7.8
M	~~1.47~~ 2.58	0.142	11.30	7.58	213.6		~~9.00~~ 8.5
Bott	~~1.41~~ 21	0.121	10.16	7.50	210.2		~~11.00~~ 10.5 24P



Sunday 8/9/2009 2145 Logger test stops + reformat
for 8/10/2009 injection + baseline.

MW09 start time ~~8/9/~~ 8/10 1 AM #142308
Water Level 4.___ temp ____
this Logger ~~has~~ has limited memory 11 Hour @ 20 sec ≤

MW05
Water Level ____ temp ____ # ______

MW03
~~MW05~~ Water Level ____ temp ____ #

system settings data collect DTWA, + data
points every 20 seconds. ALL

Logger notes

C° spike @ FOCMW05 1300 direct delivery of products

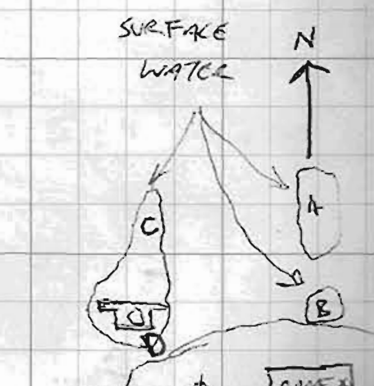
Loc/time	temp C°.	mS/cm EC	mg/L DO	pH	ORP	DTW	DTRd.
MW05	no readings due to 1200 direct product deliv—						
MW03/1600						3.25	
Top	11.96	1.097	~~8.~~6.02	1.45	541		4.5~~.00~~
mid	4.81	4.086	8.40	0.05	581		6.5 ~~7.00~~
Bot.	3.69	~~4.~~ 4.73	8.11	-0.49	580		8.5 ~~9~~.00
MW04 /1611						6.49	
TOP	2.09	0.138	10.01	5.00	197.2		7
M	1.41	0.161	8.00	4.98	162		8
Bot	1.23	0.167	6.20	5.36	144.0		9.5
MW06 1619-1625						3.62	
TOP	8.40	5.091	3.02	0.91	624		4
Mid	3.82	7.54	3.04	0.77	631.5		6
Bot	3.21	7.376	1.32	0.92	6300		8
MW07 1626-1636						5.65	
TOP	1.40	0.198	3.08	8.54	17.3		6
mid	1.14	0.195	2.07	8.54	16.6		7.5
Bott	0.66	0.191	1.60	8.74	18.6		9.~~0~~5 .00

Soapy water WASH pH 11.00 /switched new 11.00 pH* shot

Loc/time	temp C°.	mS/cm EC	mg/L DO	pH	ORP	DTW	DTRd.
MW02 1632-1645						4.64	
TOP	5.88	0.115	2.01	8.40	125		5.00
Mid	2.23	0.147	1.33	8.73	96.1		6.50
Bott	1.39	0.140	4.37	4.35	113.0		8.3

PARAMETER MEASUREMENTS IN SURFACE WATER PONDS NEAR ISO INJECTION AREA

LOCATION	TIME	TEMP	µS/cm	DO	PH	ORP
POND A	1800	15.78	0.082	6.70	8.05	250
POND B	1805	16.55	6.35	20.65	7.37	566
POND C	1810	16.30	0.195	23.01	8.08	70
POND D	1820	22.01	0.112	18.19	8.05	75



Tuesday 8/11/2009
AM replace pumps + Test
parameters start next page.

Tuesday

	Temp	EC	DO	PH	ORP
POND B 1528	16.89	6.669	1.4	1.46	402
POND A 1540	12.37	0.094	3.54	5.28	148.3
POND ~~A~~B 1AB 1622	19.101	7.051	0.92	2.21	318.3
POND ~~A~~B 1AB 1636	18.49	6.611	0.96	2.26	312

See previous page for site map of these ponded water Location.

bubbles of oxidant was observed on 8/10/09 @ Location B.

- Location B is ady broken clay tile + steel material possible culvert exit.

2, 3, 4, 5, 6, 7, 8, 9

Loc/Time	Temp C°	EC Mg/l	DO ug/l	PH	ORP	DTW	DTRd.
MW03	1542	/ Logger				3.46	
T	12.84	3.487	0.70	0.99	598.6		4.00
1542 M	4.90	6.040	0.87	0.47	599		6.00
B	2.96	6.437	0.84	0.22	595		8.50
MW09	1520					7.38	
T	1.96	0.148	8.65	5.44	163.1		7.6
✓ M	1.84	0.146	8.01	5.38	178.4		8.0
B	1.32	0.143	8.00	5.51	180		9 ~~8.5~~
	move	transducer down@		1524			
MW06	1550					4.10	~~4.5~~
T	5.08	16.53	1.70	-0.11	513		4.5
✓ M	3.80	16.11	1.58	-0.05	514		6.5
B	3.54	~~18~~ 15.87	1.52	0.08	514		8.5
MW02	1558					4.71	
T	6.37	0.124	1.61	5.50	145.9		5
✓ M	2.14	0.159	0.76	6.11	98.1		7
B	1.79	0.153	0.86	6.23	98.7		~~9~~ 8.2
MW04	1617					6.35	
T	2.57	0.121	11.25	5.50	205		6.5
✓ M	1.78	0.140	8.625	5.72	152		7.5
B	1.34	0.161	5.14	6.59	120.1		9.0
MW05	1630	— 1640	Troll + 1713	remainder of YSI		3.44	
T	21.45	32.65	15.3	0.43	495.2		4
✓ M	12.44	28.72	28.58	0.78	495.7		6
B	11.423	28.01	~~27.90~~ 26.01	0.73	497.0		~~8~~ 7.0
MW07	1700					5.69	~~6.0~~
✓ T	1.45	0.207	3.26	8.57	10.9		~~7.5~~ 6
M	0.65	0.194	1.77	9.76	-9.1		~~9.0~~ 7.5
B	0.70	0.193	1.69	9.78	-8.4		9.0
MW08	1735					6.92	10
✓ T	0.87 ~~1.50.81~~	0.181	1.81	8.46	108.3		7.0
B	0.63	0.172	2.02	8.42	119.9		~~9.0~~ 8.8

8/12 Trolls

MW05 T A.16, P 2.16, LD 5.068 0817 = 1017
Down Load new data @ 30 sec.
MW09 T 1.52 P 1.66 LD 5.201
Download ALL DATA @ 2 min.

Move to 88MW5
T 1.15 P 2.50 LDTW 5.78 0839-1039

MW03 moved to MW04 then stopped test @ 0848 = 1049
Download ALL DATA @ 1.54 min
New test @ MW04

MW04 MW04 8122009 Phase 2 10:53 = 0853
Temp 1.93 Pressure 1.31 DTW 3.022

* Sampled MW08 @ 0900 prior to injection @ MW09

Insitu YSI Water Quality readings correspond to Injection at the Converted MW09. Injection will take place througout the day.

Field Test Kit results are contained ~~at~~ in Arons book. Water levels + ~~Field~~ Test Kit samples were collected prior to injection.

Injection ICOMW09 ± 0930

Loc/Time	Temp	EC	DO	PH	ORP	DTW	DTR
MW04		mS/cm				6.27	
~~Loc~~ T	2.54	0.147	6.25	5.53	185		7.0
0932 M	1.89	0.160	~~8.~~ 4.68	5.55	181		8.0
B	1.77	0.168	4.16	5.53	177		9.0
MW05						3.70	
3.70 T	20.58	25.67	8.65	8.16	473		4
0939 M	11.68	23.10	18.06	8.90	477		6
0940 B	5.37	25.05	28.10	6.70	487.3		8
MW01						9.33	
T	2.10	0.103	~~6.2~~ 5.92	7.02	262.7		9.5
0948 M	1.76	0.079	0.40	6.97	234.5		11.5
B	1.66	0.079	0.79	6.94	211		13.5
88 MW05						9.03	Logger
T	~~1.05~~ 1.06	~~0.212~~ 0.187	0.38	8.08	-47.3		9.5
0955 M	0.99	0.177	0.18	7.55	-20.0		11.0
1000 B	0.94	0.181	0.15	7.42	-7.7		13.0
distrib Logger + pull out							
MW08							
T	DRY						
1010 M							
B							
MW02						5.65	
1020 T	1.57	0.235	0.27	7.52	-48.4		6.00
M	1.30	0.217	0.22	7.26	-30.4		8.00
B	0.9	0.213	0.21	7.10	-21.9		9.00
MW07	Rerun / ALL switched meter due to ORP in WASH bucket						
T	1.08	0.208	9.14	7.01	-11.9		
1031 M	AOK on Neg. ORP SP/MH						
B							

1034 Cracks in Ground / steam

ISCO MW01 + MW09

1031 - 1120 Review Tools.

1120

Loc/Time	Temp	EC	DO	PH	ORP	DTW	DTR
MW0 6						3.95	
T	9.64	18.47	3.53	1.99	464.9		4.0
1125 M	6.22	19.24	2.56	1.92	463.9		6.0
B	3.01	18.06	2.13	1.89	~~468.0~~ 470 DSP		8.0
MW0 2						4.40	
T	5.882	0.155	2.90	6.07	~~14~~ 121		4.75
1135 M	2.50	0.167	1.49	6.57	80.0		6.00
✓ B	2.03	0.164	1.33	6.67	75.0		8.00
MW0 3	19.	4.468	1.42	1.90	603	~~2.74~~ 2.74	
T							3.5
1140 M	10.88	8.~~231~~ 259 DSP	1.12	1.85	593		5.5
✓ B	5.84	8.461	1.09	1.95	565		7.5
MW0 4	~~3.07~~					6.15	
1147 T ✓	3.07	0.148	11.00	6.43	177.7		7
1151 M	1.76	0.161	5.01	6.30	124.7		8
Troll B	1.50	0.168	~~2~~ 3.76	6.28	115.0		9
MW0 5						2.95	
1153 T	21.88	24.20	13.70	1.31	461		4.0
~~1158~~ M ✓	13.07	22.74	19.63	1.34	481		6.0
1158 B	5.33	23.38	34.00	1.19	484		8.0
MW0 8						8.25	
~~T~~							
1202 M	2.16	0.255	3.1	7.10	104.4		9.0
✓ ~~B~~							
88 MW0 5						8.75	
1205 T	1.29	0.172	28.92	7.48	~~54~~ 75		9.5
Troll M	0.72	0.157	24.00	6.93	77		11
✓ 1210 B	0.69	0.156	17.52	6.87	80.2		13

7 5.36

Loc/Time	Temp	EL	DO	PH.	ORP	DTW	DTRd
~~MW02~~ 1213							
Top	0,84	0,163	12,67	7,51	35.5	5,36	6.00
Mid	0,73	~~11.9~~ 0,205	~~2.8~~ 1.71	7,20	39.8		8.00
Bott.	0,71	0,204	1,71	7.20	39.4		9.0
MW06 ~~1350~~	14:45					~~3.70~~	~~4.0~~
T	12,75	0.278	8.00	0.85	457.5	3.70	4.0
M	7.45	19.32	2.26	0.70	454	3.70	6.0
B	2,21	17.57	1.40	0.58	469	3.70	8.5
MW05	14:40						
T	30.40	15.8	8.5	1.5	483	2.7	3.0
M	21.52	25.65	13.65	1.05	485	2.7	5.0
B	6.30	22.40	34.12	0.78	477	2.7	7.5
MW0.8	15:05						
T	1.74	0,204	3.25	7.19	89	7.81	8.5
M	NA	NA	NA	NA	NA	NA	NA
IW-01	14:30						
T	46.45	63.04	1.39	0.21	693	3.8	4.0
B	19.50	46.99	3.63	0.27	688	3.8	9.3
M	29.25	52.75	0.53	0.18	691.5	3.8	8.0
MW-07	14:50						
T	0.88	0.233	4.80	6.85	11.4	5.50	6.0
M	0.97	0.220	2.70	6.78	10.7	5.50	7.5
B	0.76	0.211	1.48	6.81	15.9	5.50	9.0
MW-02	15:00						
T	6.62	0.132	4.60	6.99	174	4.48	5.0
M	2.65	0.170	2.30	6.46	90	4.48	7.0
B	1,86	0.167	1,21	6.45	85	4.48	8.5
88 ~~MW-05~~ 88	15:08						
T	0.78	0.149	69.00 ~~72.00~~	6.54	138	9.10	9.65
M	0.70	0.144	63.00	6.06	149	9.10	11.0
B	0.73	0.160	56.00	6.02	145.9	9.10	14.0
second note @ MW-88							
B	1.08	0.162	46.00	5.50	265.2	9.10	14.0
MW-04	15:20						
T	2.86	0.148	14.75	7.50	138	6.53	7.0
M	2.05	0.162	9.55	6.55	130	6.53	8.0
B	1.80	0.172	7.20	6.38	116.5	6.53	9.5

12:29

Location/Time	Temp	EC	DO	pH	ORP	DTW	DTRP
MW-05	15:25					2.80	
T	20.45	5.75	0.91	1.48	606	2.80	3.0
M	10.81	11.75	0.61	1.23	575	2.80	5.0
B	7.92	12.82	0.71	0.89	608.2	2.80	7.0
B_2	6.32	12.74	0.80	0.77	604.4	2.80	9.0
MW-01	15:45						
T	2.31	0.134	5.20	5.17	140.5	9.26	9.5
M	1.73	0.092	2.30	5.82	120.1	9.26	11.0
B	1.45	0.084	1.79	6.06	112	9.23	13.5

15:51 COMPLETE ROUND OF MEASUREMENTS, BEGIN CLEAN UP FOR THE DAY

1600 – begin cleanup + shut down for DAY 1730 MOB TO OFFICE.

8/13 DAY ONE POST Injection. 3.34 – .4

Saturday day 3 water
Wednesday 7 soil water
Following Wednes 14 water

Water levels/Field lab test kits/Parameters + pulled VOA's @ MW 7 6 2 each –

Loc/Time	Temp C°	EC ms/cm	DO	Ph	ORP	DTW	DTRd.
MW01	11:00						
T	~~2.21~~ 2.16	0.081	~~2.04~~ 1.33	-2.0	~~160~~ 145.1	9.46	10.00
√ M	1.74	0.078	0.50	-2.4	136	9.46	12.00
B	1.68	0.077	0.23	-2.7	127.5	9.46	13.5
MW02	11:15	(sheen observed on water in decon bucket after deconning probe)				4.70	-
T	6.99	0.107	0.55	5.15	112	4.70	5.0
√ M	3.06	0.160	0.32	-3.0	125	4.70	6.5
B	2.28	0.167	1.50	-3.0	124.8	4.70	8.0
MW03	11:30					2.85	~~3.5~~
T	18.32	0.056	2.71	-10.0	227	2.85	3.5
M	13.62	21.38	0.58	-10.0	221	2.85	5.0
√ B	9.80	19.5	0.38	-10.0	219.9	2.85	7.0
B_2	3.32	16.85	0.39	-10.0	254	2.85	8.5
MW0~~3~~4	11:37						
T	2.84	0.137	9.55	-8	80	7.30	7.5
√ M	2.74	0.146	7.20	-8	83.8	7.30	9.0
B	NA	NA	NA	NA	NA	NA	NA
MW05	11:43						
T	25.0	27.64	8.88	1.0 - 3.0	296	3.65	4.0
√ M	10.49	20.94	25.6	5.01	355.7	3.65	6.0
B	5.38	19.99	35.35	-3.0	368.9	3.65	7.5
MW06	11:50						
T	12.32	21.93	6.89	8.58	389	4.11	4.5
√ M	6.30	22.10	0.54	-8	425	4.11	6.0
B	2.50	19.78	0.25	-9	429.5	4.11	8.5
MW07	11:55						
T	1.58	0.266	4.20	-3	242.1	5.69	6.0
√ M	1.19	0.246	0.22	-3.0	209	5.69	7.5
B	0.86	0.214	1.31	-3	225	5.69	9.0
MW-08	12:00						
√ T	1.23	0.171	1.68	-5	194	6.96	7.5
M	0.93	0.196	1.58	-5	197	6.96	8.5
B	NA	NA	NA	NA	NA	NA	NA

8/13/09

LOCATION/TIME	TEMP	EC	DO	PH	ORP	DTW	DTR
MW-88	12:10						
T	1.42	0.114	58.00	-7	196	9.21	9.5
M	1.16	1.120	57.0	-7	203.7	9.21	11.0
✓ B	1.10	0.114	51.0	-7	207	9.21	13.0
IW-01	12:15						
T	35.5	43.7	4.4	-10	396	4.25	5.0
✓ M						~~4.25~~	
B							

NOTE IN WELL VAULT TOP OF CAP.

Day 3 Sampling

8/15 purge 08/04 Both went dry 1300-1400
purge and sample 05, 07, 06 2 ✓
08/04/07/06 1300-1700 ~~Ø~~ Problem 3 ✓
1300-1800 with Quenching samples discarded 4 ✓
6.0 1800-2200 return ~~+ purge~~ resample 5 ✓
07, 06 + purge + sample 05. 6 ✓
Gray VOA's are problematic ~~at to~~ 7 ✓
05, 06, 07 ≈ 30 min to 1 hrs to Fill voa's 8 ✓
green VOA LID's +/- 10 min
8/16 sample 08/04

purge + sample 03, 02
1000

green voa's @ 08/04 NO problem
VOA's @ 02 45 min to 1 hour @ 200 mL/min
~~1400~~ 200 x 60 = 12,000 mL / 4 liters per gal. 3
1445 12L = 3 gallons
5 1/100

parameters = 1.5 gallons total 4.5-5

---

check 88 MW05 transducer @ 1645 temp @
1.8°C up from start @ 1.0°C
Trolls ~~do~~ prior to Injection @ 9

Mark would like to continue monitoring

Need to clean + down Load additional Troll data.

Mark suggested purge @ MW08/MW04 at COB day 6
Soil + GW = 3 days scoped / Bristol 2 days

Additional purge water Container

ship sample 8/17/09

1100 water levels, set p[illegible]
1130

ID ICOMW08 # GW13 + MUC #25 Date 8/15/2009

Vol	DTW	PH	Cond	Turb	D.O	Temp	ORP

Rite in the Rain
ALL-WEATHER WRITING PAPER

8/18/2009

EXCAVATE 3 EXCAVATIONS to +/- 4-4.5'

Pit 1 includes MW02, 06, 07

Pit 2 includes MW08, MW09

Pit 3 includes MW03, MW04, MW05

Pit 1 - GW entry to Pit

Pit 2 - dry

Pit 3 - GW entry

Find gray pipe cab to +/- 1.7' to 2.5'

~~Fill~~ Pound white 5" +/- 6" into pit bottom
backfill w/2 bags bentonite chips
& +/- 30 bags of silica sand.

water continues to fill Pit #1 set gray
pipes for 8/19 sampling.

Purge MW08 & MW04 ~~set~~

Long day back to ~~offi~~ camp +/- 2000

See Aaron Notes For Trench/EXCAVATION

depths.

Follow notes removed soil to sample depth
@ 7 day + 28 Location.

Verified & Marked sample depth measure
down @ ALL LOCATIONS.

8/19/2009 Day 7 ~~Groun~~ Groundwater & Soil Sampling Event

Sampling conducted at 1st excavation containig pipes @ HA 6, 2, 7. GW has filled pit to +/- 1" below top of 4" gray PVC pipe set 8/18/2009. Samples collected with 3" stainless steel (SS) Hand auger, (SS) bowels + spoons. Sample information listed below.

Sample ID	MW or SB AECOM HA LOCATION	MOC # 11	Depth (target) BGS (ft)	TIME
09NCMOCSB16	ICOMW06 HA06		5.0'-6.0'	1010

PEAT Saturated, brown, trace SILT + clays, cohesive, non plastic, NO fuel odor, tundra peat bog.

notes: pipe contained GW, pumped pipe prior to sampling +/- < 1 gal eatime 1' interval collected homogenized filled 2-4oz + 1 8oz - methol 1-vial @ 4oz tared Amber jar.

09NCMOCSB20	ICOMW02 HA02	3	6'-7.0'	1035

* PEAT with SILT Saturated brown to grayish dark brown mostly organic plant material, little SILT + CLAY, trace sand fine to medium, cohesive, non plastic. Tundra peat bog. NO FUEL SMELL.

note pipe was dry (good bottom seal)

Decon HA move sampling + PLYwood 1045 Bristol delivers beach sand. move several 1.5'/2.0' boulders from spoil pile.

See next page.

8/19

Sample ID	ICOMW07 HA07	MOC	Depth	Time
09NCMOCSB17	ICOMW07/HA7	#12	6.575	1225 ~~1205~~

PEAT with SILT, Saturated, brown to brownish gray. mostly medium fiberous to fine grained highly compressed Peat to Organic SILT (OL). Trace fine sand. The Sample interval was very dense. Hand auger could only be advanced +/- 0.25' per attempt 1' interval required 4 HA attempts. Dense/firm/fine grained possibly frozen. Collected Samples per plan. Depth BGS to GW = 2.65' Sheen on pit Strong fuel odor. note sample interval capped by SILT!

1230 to 1300 Lunch
1300 to 1320 Set up purge @ ICOMW03

09NCMOCSB19 ICOMW09/HA09 MOC# 14 5.5-6.5 1345

PEAT Dry, brown, mostly fiberous to plant fibers, trace sand, trace SILT + CLAY, cohesive non plastic, tundra, peat bog. Collect samples per plan. pit is dry no GW. SLIGHT organic ordor

09NCMOCSB18 ICOMW08/HA8 MOC#13 4.5-5.5' 1615

PEAT, Dry SAME AS ABOVE with trace gravel (medium) few gravel, trace SILT + clay, faint petro odor. Duplicate Sample Collected

09NCMOCSB 21 ICOMW08 HA08 MOC#13 4.5-5.5 1620

Assist VOA Collection @ MW03
1350 to 1600 6X 4 VOA's 24 VOA's 130 min
problems with 20-25 mph wind + LIDS.

8/19

Sample ID	boring or MW Location	MOC	depth	Time
09NCMOCSB14	ICOMW04 HA4	MOC# 9	6-7.0	1700
09NCMOCSB 14 MS/MSD	HA04		SAA	SAA.

Peat moist to wet, brown, mostly fibrous organic material, Trace silt + clay, cohesive. nonplastic. Tundra, Peat bog.

09NCMOCSB15 ICOMW05 MOC#10 5.0'-6.0' 1750
HA05
PEAT, Damp to moist, Fiberous, light brown to yellowish brown, strong petroleum odor. Tundra peat bog. Decon of augers produced sheen on wash bucket.

Dinner 1800 to 1840 Return to Site

09NCMOCSB13 ICOMW03 MOC 5.0-6.5 1935
HA03r #8

PEAT Dry to Moist, brown, ALL fiberous + Plant organic matter, cohesive thick, moderately dense moderate organic odor.

Sampling For Soil Complete / clean up /

ID	SOIL SAMPLE	FILL	ML	PEAT
MW 2	6-7	0-4.5	Ø	4.5-7.0
3	5-6.5	0-4.5	4.5-5	5-6.5
4	6-7.5	0-3.5	3.5-5	5-7.0
5	5-6	0-5.0	Ø	5-8
6	5-6 ~~6.5-7.5~~	0-4.8	Ø	4.8-8.0
7	6.5-7.5	0-2.7	2.7'-3.8'	3.8/8.0
8	4.5'-5.5	0-3.7'	3.7'-4.5'	4.5-6
9	5.5-6.5'	0-2.5'	2.5-4.0	4-8

8/20/2009

Note checked email 0700 Email from Molly
USACE Interested SILT Samples
Majority of baseline w Peat.
Suggest collection now or never @
pit bottom @ HA8 + HA9 or pit side wall
at HA7. Molly confirms collection at
3-4 locations. prep list for next 2-day event (moc# + SB accordingly)
put Hold on backfill return + collect.
Silty Samples @ Locations ID Above
see following Sample Info -

09NCMOCSB.	~~MOC~~ ICOSBMW HA	~~DEPTH~~ MOC	Depth	Time
09NCMOCSB22	ICOMW09	moc 14 ✓	4.0-4.5	0900

SILT Dry to moist, gray to grayish brown, mostly SILT + CLAY, trace medium to fine sand cohesive, nonplastic, color, particles, texture suggest non organic particles. Fluvial organic/fuel odor

09NCMOCSB23	ICOMW08	moc ~~18~~ 3	3.7-4.4'	0910

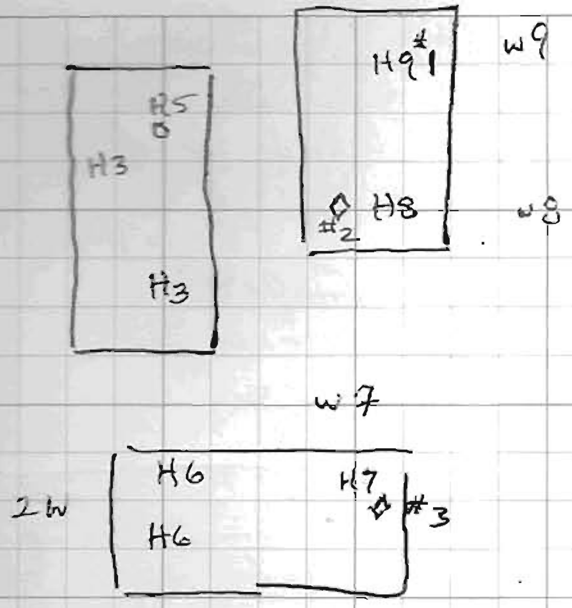
SILT SAME AS ABOVE, ~~He~~

09NCMOCSB2~~3~~4	ICOMW07	moc#12	2.5'-2.75'	0920

SILT, moist brown mostly SILT + CLAY trace medium to fine sand, cohesive non plastic, particles + texture suggest non organic particles, strong organic/fuel odor

~~$~~ notes sample sidewall of Pit +/- 3" Above present +/- 24 hr EXCAVATION water level @ 2.65 BGS.

See map next page.



W * WELL

H HAND AUGER PIPE #

8/25/2009

Day 14 Groundwater
AM safety meeting Topic Eyes, hands, back
PPE

[signature] Lance Preuss ACCOM
[signature] Allen Johnson AECOM
[signature] Russell James BERS

0605 Meet Breakfast AM safety briefing.
0700 LOAD + SHUTTLE TO AIRPORT
0745 Arrive Bering Air verify EQPT CARGO
0845 FLIGHT DEPARTS

0933 Arrive NE CAPE

UNLOAD/PREP

~~Sampl~~ collected BS GWC 88MW4 - pumped 12.5-13 gallons dry, 30 min later topped of the.

Complete sampling 1830
1900 Board plane
1940 Arrive Bering Air.
14 hrs 2000 Arrive back @ Nugget stage EQPT. 0700 - 2000 - 13 HRS

Product sheen + droplets identified @ MW02
- attempt product gauge tube + bailer no luck
- estimated thickness 1/16 to 3/8

lowered dedicated pump from mid point to ~~[illegible]~~ 1' below mid point. pump is now 1' from bottom riser 2'. Lowflow purge at this pumping rate eliminated product or ~~sheen~~ sheen of purge bucket after initial 5 min purge.
IS well screened across GW interface?

- Locked ALL WELLS!
- Sample event generated 15-20 gallons purge water - 1 drum is not used now, 2/3 full both others

Ph 2.65 / lowest

- needs bubble wrap
  bottles - GW
  2 Saranex
- 5 gallons potable water (WASH)
  2 more drum buckets w/LIDS need (5) 1 at site

Rite in the Rain
ALL-WEATHER WRITING PAPER

8/10/09 NE CAPE, AK ISCO Injections and monitoring
weather
personnell: Aaron
Mark
Scott
Lance

0600: Breakfast
0620: Group Safety meeting lead by Chuck (Bristol)
Daily scope of work
Demobilization
0630 Review of work Plan, H&S plan and JHAs, MSDS for chemicals on site, procedures for ISCO injection and monitoring
0800 Post calibrate YSI meters (see post calibration sheet)
calibrate YSI meters (see calibration sheet)
0900 complete meter calibration. Begin mobilization out to work area.
0920 Area site walk and safety orientation with Lance
Go over PPE, monitoring, chemicals and chemical storage, water, eyewash stations, fire fighting equipment, monitoring procedures.
0940 Don PPE for round of groundwater level gauging.
1003 Truck (Sunnex) and all PPE on. Begin water level measurements

LOCATION	TIME	DTW
ISCO MW-01	10:05	9.45
02	10:07	4.63
03	10:08	3.48
04	10:09	6.47
05	10:10	4.05
06	10:11	3.62
07	10:13	5.66
08	10:15	6.89
09	10:17	7.35
88	10:19	9.22

10:20 complete round of groundwater level gauging
10:25 collect ~~water~~ sample with bailers from MW-02 and MW-07 for iron testing
1035 MW-02 and MW-07 iron samples collected. Reviewing data logger data from yesterday.
1045 Attend site H&S meeting (attending Mark, Scott, Lance, Aaron). Assume all liquids clear treat all as oxidant, neutralizer, water dilution, generator kill switches, pull black cord 240 V. Report large changes in parameter values, strong acids.

8/10/09 NE CAPE, AK

1050 Complete safety meeting. (potential for H_2S gas)

1100 Begin sampling other monitoring wells for iron.

collected MW-06 (slight yellow hue)

collected MW-04 (clear)

collected MW-05 (red colored water)

Lance collects MW-09 (clear)

collected MW-03 (yellow hue of water)

Lance collects MW-08 (clear)

MW-02 has sediment and brownish tinge

MW-07 was clear

1120 complete sample collection

1125 begin sample analysis

Begin analyzing MW-02 for iron using DR/890 Colorimeter

zero with sample. Dilute sample 3:12 (sample : water)

mix FerroVer® Iron Reagent with 10 mL of diluted sample in vial

check zero of water reading blank as 0

read sample = 1.09 mg/L

TOTAL ~~Ferrous~~ IRON

LOCATION	STANDARD (mg/L)	SAMPLE (mg/L)	COMMENT (sample volume: water volume)	FINAL VALUE
MW-02	0.00	1.09	3:12 Dilusion	5.45
MW-03	0.00	~~2.37~~ 1.93	3:9 DILUSION	7.72
MW-04	0.00	0.77	3:9 Dilusion	3.08
MW-05	0.00	3.30/3.30/2.30	2:20 Dilusion/1:20/1:1000	2302
MW-06	0.00	3.30/3.30/2.38	3:9/3:15 dilusion/1:10/1:20	49.98
MW-07	0.00	3.11	3:15 dilusion	18.66
MW-08	0.00	0.01/2.00	2:10 dilusion/no dilusion	2.00
MW-09	0.00	0.18/0.90	3:9 dilusion/no dilusion	0.90

Ferrous Fe

~~LOCATION~~	STANDARD (mg/L)	SAMPLE (mg/L)	COMMENT (sample volume: water volume)	FINAL VALUE
MW-02	0.0	1.36	NO DILUSION	1.36
MW-03	0.0	0.49	NO DILUSION	0.49
MW-04	0.00	1.02	NO DILUSION	1.02
MW-05	0.00	1.57	NO DILUSION	1.57
MW-06	0.00	3.30/3.30/0.19/2.72	NO DILUSION/10:15 Dilusion/1:10/no dilusion	2:1 dilusion 4.08
MW-07	0.00	3.30/3.30/1.50	NO DILUSION/1:2/1:5	9.0
MW-08	0.00	0.43	NO DILUSION	0.43
MW-09	0.00	0.29	NO DILUSION	0.29

8/10/07 NE CAPE, AK

Sodium persulfate PPM (mg/L)

location	sodium persulfate ppm (mg/L) LOW RANGE	HIGH RANGE
MW-02		14
MW-03		21
MW-04	7.0	
MW-05		>70
MW-06		28
MW-07		14
MW-08	5.0	
MW-09	3.5	

HYDROGEN PEROXIDE TESTING

LOCATION	H_2O_2 (mg/L)	HIGH/LOW RANGE	# of drops
MW-02	2.8	low	14
MW-03	1.8	low	9
MW-04	2.2	low	11
MW-05	3.0	low/high	3/15
MW-06	3.8	low	19
MW-07	2.4	low	12
MW-08	2.4	low	12
MW-09	1.8	low	9

1658 complete sample analysis of groundwater samples
1700 Begin decon equipment
1715 complete decon of equipment. Begin helping remove one of the pumps for the injection system, impellers have likely unscrewed themselves.
1800 Begin taking parameters in near by surface water locations to look for day lighting injection chemicals.
1815 complete parameter sets, cleanup at site, remove ppe.
1825 head back to camp for dinner.
1915 Return up to site, begin clean up.
2010 Begin bottle inventory

12 40 oz VOA (methanol preserved)
36 unpreserved 1 liter ambers
27 HCl preserved 1 liter ambers
18 8 oz soil jars
16 4 oz soil jar (9 solid lid, 7 septum lid)

72 40 oz VOA HCl preserved
69 40 oz VOA HCl preserved
1 Nitric Acid preserved 500 mL poly
72 40 oz VOA HCl preserved

8/10/09 NE CAPE, AK

20:30 complete bottle inventory.

GW bottles needed each sampling event

		Total needed for all events		
		HAVE		NEED
60	40 oz VOA (HCl preserved)	213	240	27
20	1 liter Ambers (HCl preserved)	27	80	53
10	250 ml poly (unpreserved)	0	40	40
10	250 mL poly (Nitric Acid preserved)	1	40	39

Soil bottles needed each sampling event

10	4 oz wide mouth ambers jars (methanol preserved)	7 ~~0~~	40	40
10	8 oz wide mouth clear jars (unpreserved)	18	40	22
10	4.0 oz wide mouth clear jars (unpreserved)	9 ~~16~~	40	24

2045 Begin assisting with pump repairs.

2140 put pumps at mechanic shop and head back to camp.

2145 Returned to camp demob truck.

2230 complete work for the day.

8/10/09

8/11/09 NE CAPE, AK ISCO INJECTIONS + MONITORING

personell: Aaron Jambasic
Mark
Scott
Lance

weather: morning fog 40°F

06:00 Breakfast

06:20 Group safety meeting

06:45 Post calibration of YSI 556 meters (see calibration form)

07:10 Pre calibrate YSI 556 meters, calibrate ok (see calibration form)

0738 complete calibration.

0740 Begin testing surface water samples from near injection area

Total IRON

Location	standard	sample (mg/L)	comment (sample volume : water volume)	Final value (mg/L)
POND A	0.00	0.74	1:10 dilusion	7.4
POND B	0.00	3.30 / 1.65	1:10 dilusion / 1:100	165

Ferrous IRON

Location	standard	sample (mg/L)	comment (sample volume : water volume)	Final value (mg/L)
POND A	0.00	0.6	no dilusion	0.6
POND B	0.00	3.30 / 2.40	no dilusion / 1:4 dilusion	9.6

SODIUM PERSULFATE

LOCATION	RANGE HIGH/LOW	CONC (mg/L)
POND A	LOW	0
POND B	HIGH	>70

HYDROGEN PEROXIDE TEST

LOCATION	CONC (mg/L)	RANGE HIGH/LOW	# of DROPS
POND A	0.8	LOW	4
POND B	14.4	LOW	72

0858 Complete testing of surface water samples, POND B IS THE LOCATION WERE INJECTION CHEMICAL DAYLIGHTING IS SUSPECTED

0900 Work on bottle order

8/11/09 NE CAPE AK

0905 Bottle order

GW Analyte	Bottle	HAVE ON HAND	NEED FOR 3, 7, 14 SAMPLING	ORDER (FOR 3, 7, 14)	day 28 NEED	ORDER
GRO/Benzene/Naph	6, 40 ml VOA (HCl preserved)	213	180	0	60	72
DRO/RRO	2, 1 liter amber (HCl preserved)	27	60	43	20	20+5
SULFATE	250 ml poly (unpreserved)	0	0	0	10	10+5
METALS	250 ml poly (Nitric Acid)	1	0	0	10	10+5
SOIL						
GRO/Benzene/Naph	4oz (rubber septum, unpreserved)	7?	10	20	10	10+5
DRO/RRO	8oz (jar, unpreserved)	18	10	0	10	10+5
TOC	4oz (jar unpreserved)	9	0	~~10~~ 0	10	10+5
TRIP BLANKS			4 sets	4 sets	2 set	2 sets
TEMP BLANKS			14	14	6	6
COOLERS		7	14	~~14~~ 7	6	6

1030 complete bottle order.

1110 give ~~Eric~~ Eric (Bristol) the bottle order goes through, identifies on hand inventory and materials needed to order. Eric will place order for monitoring days 3, 7, 14 not 28.

1130 Break for lunch.

1230 Mob out to site for monitoring and sample collects, c check up of the pumps and injection into alternate well location.

1245 Don PPE discuss H+S

1255 Begin GW gauging

location	time	DTW (ft)	water color
MW-02	12:57	4.69	slight yellow/clear
MW-03	12:58	3.58	slight yellow/slightly cloudy
MW-04	12:59	6.49	clear/colorless
MW-05	13:00	3.91	brownish red/cloudy
MW-06	13:01	3.93	brownish red/clear
MW-07	13:02	5.72	clear/colorless/some sediment
MW-08	13:03	6.84	clear/colorless
MW-09	13:04	7.28	clear/colorless
160MW-01	12:56	9.52	NA
MW-88	13:05	9.27	NA

13:07 complete gauging / begin collecting groundwater samples with bailer

8/11/09 NE CAPE, AK

1350 COMPLETE GW SAMPLE COLLECTION / BEGIN ANALYZING SAMPLES

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	final value (mg/L)
MW-02	0.00	2.02	3:12	10.1
MW-03	0.00	2.88	3:12	14.4
MW-04	0.00	0.26	3:9	1.04
MW-05	0.00	3.30/3.30/3.30	1:1000 / 1:2000 / 1:10000	> 33,003
MW-06	0.00	3.30/0.23	1:1000/1:10000	2300
MW-07	0.00	2.91	1:5	17.46
MW-08	0.00	1.99	no dilusion	1.99
MW-09	0.00	0.64	no dilusion	0.68

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	FINAL VALUE (mg/L)
MW-02	0.00	3.30/1.31	no dilusion / 2:3	2.18
MW-03	0.00	1.28	no dilusion	1.28
MW-04	0.00	0.91	no dilusion	0.91
MW-05	0.00	3.30/3.30/3.30	no dilusion/1:4/1:10	36.3
MW-06	0.00	3.30/0.83	1:100/1:1000	830
MW-07	0.00	3.13	1:5	18.78
MW-08	0.00	0.47	no dilusion	0.47
MW-09	0.00	0.23	no dilusion	0.23

SODIUM PERSULFATE

LOCATION	RANGE HIGH/Low	CONC mg/L
MW-02	HIGH	14
MW-03	HIGH	>70
MW-04	Low	6.3
MW-05	HIGH	>70
MW-06	HIGH	>70
MW-07	HIGH	10
MW-08	Low	5.0
MW-09	Low	2.5

HYDROGEN PEROXIDE

LOCATION	CONC (mg/L)	RANGE HIGH/LOW	# OF DROPS
MW-02	2.2	low	11
MW-03	15.2	low	76
MW-04	3.4	low	17
MW-05	5.2	low	26
MW-06	6.0	HIGH	6
MW-07	2.2	low	11
MW-08	1.4	low	7
MW-09	1.4	low	7

1700 Complete sample analysis / Decon and put away equipment

5/11/09

17:30 Set up to survey well and seep locations

LOCATION	STAFF HEIGHT (ft)	ELEVATION
MW-06	2.49	65.42
POND B	4.39	63.52
Top of Ground TEMP WELL	9.49	58.42
TOC TEMP WELL	6.81	61.1

17:45 complete survey. Get bottles to sample MW-8

18:00 begin clean-up at the site for the night

18:30 return to camp.

5/11/09

[signature]

8/12/09 NE CAPE, AK

PERSONNEL: AARON J
MARK
LANCE
SCOTT

WEATHER: mid 40°F (cloudy, showers)

0600 BREAKFAST

06:20 GROUP H+S MEETING TOPIC AGGRESSIVE DRIVING

0640 POST CALIBRATE YSI METERS (SEE CALIBRATION SHEET)
PRE CALIBRATE YSI METERS (SEE CALIBRATION SHEET)

0745 COMPLETE CALIBRATION OF METERS, CALIBRATE OK. BEGIN MOBILIZATION OUT TO SITE

0800 up at site. Discuss H+S.

0810 Don PPE.
Collect groundwater levels

LOCATION	TIME	DTW (ft)	water color
CO MW-01	0829	9.52	~~slight yellow~~ (AJ) NA
MW-02	0831	4.69	slight yellow/clear
MW-03	0832	3.11	yellow/clear
MW-04	0832	6.70	slight yellow hue/clear
MW-05	0833	3.65	red
MW-06	0834	3.97	red
MW-07	0835	5.71	clear/colorless
MW-08	0830	7.43	(AJ) ~~clear~~/not clear/colorless
MW-09	0836	8.18	clear colorless
MW-88	0838	9.27	clear colorless
injection well IW-01	0839	3.64	NA

0841 Gauging complete/begin gw sample collection with bailer for field chem analysis.

0915 complete sample collection

0920 Begin analysis of samples for Total Iron, Ferrous Iron and hydrogen peroxide, Persulfate testing will not be performed due to low testing supplies.

8/12/09 NE Cape, AK

0920

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	FINAL VALUE (mg/L)
MW-02	0.0	2.25	1:4 dilusion	11.25
MW-03	0.0	3.30/3.30/0.69	1:4 dilusion/1:10/1:100	3.45
MW-04	0.0	0.84	1:4	4.2
MW-05	0.0	1.21	AS ~~1:5~~ 1:10000	12,101
MW-06	0.0	0.0/3.30/3.30	1:10000/1:1000/1:5000	>16,503 / <33000
MW-07	0.0	3.30/2.65	1:5/1:10	29.15
MW-08	0.0	3.07	no dilusion	3.07
MW-09	0.0	1.90	no dilusion	1.90
MW-88	0.0	3.30/2.81	no dilusion/1:10	30.91

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	FINAL VALUE (mg/L)
MW-02	0.05	2.84	1:1 dilusion	5.68
MW-03	0.0	3.30/0.99	no dilusion/1:10	10.89
MW-04	0.0	2.66	no dilusion	2.66
MW-05	0.0	1.44	AS ~~1:5~~ 1:1000	1441
MW-06	0.0	1.33	1:1000	1331
MW-07	0.0	3.27	1:5	19.82
MW-08	0.0	0.66	no dilusion	0.66
MW-09	0.0	0.72	no dilusion	0.72
MW-88	0.0	2.36	no dilusion	2.36

HYDROGEN PEROXIDE

LOCATION	CONC (mg/L)	RANGE high/low	# of Drops
MW-02	1.8	low	9
MW-03	14.0	high	14
MW-04	3.0	high	3
MW-05	9.0	HIGH	9
MW-06	7.0	HIGH	7
MW-07	4.0	HIGH	4
MW-08	>100.0	HIGH	>100
MW-09	1.8	low	9
MW-88	2.2	low	11

1245 Break for lunch / sample analysis complete

1330 Resume work after lunch and putting on PPE. Begin collecting parameter measurements at well locations (see Lina's Field notes for recorded values.

8/12/09 NE CAPE, AK

15:50 COMPLETE PARAMETER MEASUREMENTS AT WELLS
BEGIN CLEAN UP AT SITE FOR THE DAY, DECON AND PUT
AWAY ALL EQUIPMENT AND SUPPLIES.
1730 COMPLETE CLEAN UP AT SITE, HEAD BACK TO CAMP
1740 RETURN TO CAMP DEMOB TRUCK. COMPLETE WORK FOR THE DAY

8/12/09

[illegible]

"Rite in the Rain"

8/13/09 NE CAPE, AK

PERSONNEL: Aaron Jorgensen

SCOTT

LANCE

MARK

WEATHER: CLOUDY SHOWERS; MID 40'S °F

0600 BREAKFAST

0620 HTS MEETING WITH BRISTOL, COMMUNICATION SAFETY TOPIC

0640 POST CALIBRATE YSI 556 METERS (SEE CALIBRATION SHEET)
ONE OF THE METER pH PROBE HAD VERY LITTLE VARIABILITY, SENSOR MAY BE BROKEN.

0700 PRE CALIBRATION YSI 556 METERS (SEE CALIBRATION SHEET)
ONE OF THE METERS pH PROBE WAS DRIFTING, KEPT BEING OUT OF RANGE DURING pH CALIBRATION, ACCEPTED ANYWAY TO PULL INTO RANGE, AFTER MANY ROUNDS OF CALIBRATION pH STILL DRIFTING ~ 0.4 ~~to~~ 0.8 UNITS AROUND THE STANDARD VALUE. LABEL METER AND CASE OF METER WITH DRIFTING pH PROBE

0830 COMPLETE METER CALIBRATION

1000 ORDERING ADDITIONAL SUPPLIES FOR FIELD TEST KITS
3 pH Probe for YSI 556
1 Total Iron - FerroVer® Iron Reagent Cat. 21057-69
1 Hydrogen Peroxide Kit - Cat No. 22917-00
1 bottle Ammonium Molybdate Cat. 1933-32
1 bottle Sodium Thiosulfate Titrant Cat No. 24087-32
will send you a list of supplies sending back
ERIC OLSON (GREENVILLE, FL) 864-277-3102

1020 ORDERED SUPPLIES FROM ERIC.

1045 HEAD UP SITE FOR COLLECTION OF WATER LEVELS, PARAMETERS, AND GW SAMPLES FOR FIELD TESTING.

1050 AT SITE DON PPE DISCUSS HTS

1105 Begin collecting parameters at well locations, and DTW measurements

1220 complete parameter collection / Begin sample collection (see Lance's field notes)

1320 complete sample collection complete
Break for lunch.

1400 Begin analysis of samples

8/13/08 NE CAPE, AK

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENTS (sample volume : water volume)	Final value
MW-01	0.00	3.30 / 0.98	no dilution / 1:10	10.78
MW-02	0.00	3.10	~~3:12~~ / 5:30	~~15.5~~ 21.7
MW-03	0.0	3.30/3.30/0.6/1.63	1:50 / 0.5:50 / 0.1:100 / 0.1:50	816.63
MW-04	0.0	~~2.12~~ 1.73	3:12	8.65
MW-05	0.00	0.82	0.01:100	8200.82
MW-06	0.00	0.04 / 1.85	0.1:500 / 0.1:100	1851.85
MW-07	0.00	3.30 / 1.53	1:10 / 1:30	47.43
MW-08	0.00	3.30 / 1.15	no dilution / 5:5	2.30
MW-09	— NOT COLLECTED (INJECTION LOCATION) —			
MW-88	0.0	0.22	1:10	2.42
MW-02 (Deep)				

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	FINAL VALUE
MW-01	0.00	3.30 / 0.98	no dilution / 5:20	4.9
MW-02	0.00	2.12	12.5 : 12.5	4.24
MW-03	0.00	1.55	3:30	17.05
MW-04	0.00	3.30 / 1.55	no dilusion / 5:25	9.3
MW-05	0.00	0.00/3.30/0.00/0.79	0.1:100 / 0.3/30 / 0.1:50 / 0.1:25	198.29
MW-06	0.00	0.00/0.00/1.48	0.1:100 / 0.1:50 / 0.5:50	149.48
MW-07	0.00	3.03	5:25	18.18
MW-08		1.73	no dilusion	1.73
MW-09	— NOT COLLECTED (INJECTION LOCATION) —			
MW-88	0.0	0.71	no dilusion	0.71
MW-02 (Deep)	0.0	3.29	15:15	6.58

HYDROGEN PEROXIDE

LOCATION	CONC (mg/L)	RANGE HIGH/LOW	# OF DROPS
MW-01	1.2	low	6
MW-02	5	HIGH	5
MW-03	18.0	HIGH	18
MW-04	3.0	HIGH	3
MW-05	15.0	HIGH	15
MW-06	33.0	HIGH	33
MW-07	4.0	HIGH	4
MW-08	0.0	LOW	0
MW-09	— not (collected injection well) —		
MW-88	0.8	low	4
MW-02 (Deep)	7.0	HIGH	7

8/13/09

1054 HAVING TROUBLE GETTING A VALUE ON SAMPLES RUN WITH IRON KIT WHEN SAMPLES ARE DARK RED. HAD BEEN COMPARING DILUTED SAMPLE TO THE UNDILUTED SAMPLE AS A BLANK, STARTED USING DILUTED SAMPLE AS BLANK AT MW-06 FERROUS IRON AFTER 3rd dilution

1800 Repeat the Dark red samples MW-05 and MW-06 from 8/13 and 8/12

TOTAL IRON

DATE	LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume)	FINAL VALUE
8/12	MW-05	0.00	3.30 ~~0.01:100~~	0.01:100	>33000
8/12	MW-06	0.00	3.30 ~~0.01:100~~	0.01:100	>33000
8/13	MW-05	0.00	3.30	0.01:100	>33000
8/13	MW-06	0.00	3.30/3.30	0.1:100/0.01:100	>33000

FERROUS IRON

DATE	LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (sample volume : water volume	FINAL VALUE
8/12	MW-05	0.00	1.32	0.01:100	13,201.32
8/12	MW-06	0.00	1.44	0.01:100	14,401.44
8/13	MW-05	0.00	~~0.89~~ 1.16	0.1:100	1161
8/13	MW-06	0.00	3.30/1.18	1:100/0.05:50	1181

1800 Break for dinner

1815 resume analysis of samples

1915 complete sample analysis / clean up for the day

8/15/09

8/14/08 NE CAPE, AK

ISO INJECTION AND MONITORING

PERSONNEL AARON

LANCE

MARK

SCOTY

WEATHER: CLOUDY, RAINING 40°F MID

0600 BREAKFAST

0620 GROUP H+S MEETING – CHEMICAL, DEMOB

0630 POST CALIBRATE THE YSI (SEE CALIBRATION SHEET)

0705 BEGIN DEMOB, PACKING UP MATERIALS, RINSING BUCKETS, BARREL, AND SECONDARY CONTAINMENT USED FOR INJECTIONS AND PACK UP SKID AND HOSES & GET COMPRESSED GAS CYLINDERS TO BRISTOL.

1200 BREAK FOR LUNCH

1230 RETURN TO PACKING UP AND DECON ISCO INJECTION AREA AND CONNEX BOX AND PACKAGING ALL MATERIALS AND SUPPLIES.

ALL CHEMICAL CONTAINING ~~CHEMICAL~~ CONTAINER WERE TRIPLE RINSED CLEAN.

1530 BEGIN INVENTORYING AND PREPPING FOR 3 DAY MONITORING, TOMORROW BOTTLE INVENTORY AND SAMPLE KIT PREP FOR EACH DAY, GATHER AND INVENTORY ALL SUPPLIES.

1730 COMPLETE PACKING UP OF ISCO AREA AND PREP FOR THIRD DAY MONITORING.

1735 O_2 CALCULATION AND DATA ENTRY OF MINIMUM VALUE COLLECTED PREVIOUSLY.

1800 Break for Dinner.

8/14/08

8/15/09 NE CAPE, AK ISCO INJECTION AND MONITORING

PERSONNEL AARON J.

MARK

LANCE

SCOTT

WEATHER: mostly cloudy mid 40°F

0600 BREAKFAST

0620 GROUP H&S MEETING WITH BRISTOL.

0645 CALIBRATION OF YSI 556 FOR 3rd day GW monitoring event today.
(see calibration sheet.)

0710 complete calibration of meter

0755 Review SAP for sampling. Prep for sampling

0930 TESTING THIOSULFATE VOLUME NEED TO QUENCH FIELD SAMPLES DURING COLLECTION FOR PRESERVATION.

1050 UP AT SITE PREPING FOR SAMPLING
EXAMPLE SAMPLE NAME: MW-08 08/15/09 09NCMOCGW13 LOC ID MOC25
EX: ICO MW-08 = MOC# 25 8/15/09 G (Time)

1058 Collect round of GW levels

LOCATION	TIME	DTW	NOTE
ICO MW-01	10:59	9.35	HAD BAILER IN WELL HAD TO REMOVE WILL MEASURE AGAIN AT END
MW-02	11:00	4.77	
MW-03	11:01	3.48	
MW-04	11:02	6.98	
MW-05	11:03	3.84	
MW-06	11:04	4.27	
MW-07	11:05	5.60	
MW-08	11:05	6.65	
MW-09	11:06	8.07	MEASURING POINT TOC 0.1' HIGHER THAN PREVIOUS, ADD COUPLING FOR INJECTION
MW-88	11:07	9.09	
IW-01	11:10	4.27	
ICO MW-01	11:08	9.35	

11:11 COMPLETE GW MEASUREMENTS BEGIN SET UP ON MW-08

11:15 Deploy all pumps into sampling wells.

11:50 All pumps deployed.

1200 Break for lunch

1230 Add sodium Thiosulfate to VOAs and liter bottles to stop oxidation?
1.4 mL / 40 mL vial
35 mL / 1 liter bottle

8/15/08

12:47 mix sodium Thiosulfate solution 350 g to 500 mL H_2O

13:20 All pumps set at mid point of water column for sampling

PUMP ADJUSTMENT

LOCATION	Depth to Pump (feet from TOC)
MW-02	6.84
MW-03	6.5
MW-04	8.31
MW-05	6.15
MW-06	6.75
MW-07	7.60
MW-08	8.0

LMRC BEGIN PURGING AT MW-08 (SEE SAMPLE SHEETS FOR DETAILS.)

FIELD TEST KIT ANALYSIS RESULTS

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT (VI/VF)	FINAL VALUE
MW-02	0.00	3.30 | 3.27	2 mL/10 mL 1mL/10mL	32.7
MW-03	0.00	3.30 | 0.71	1 mL/150 | 0.1 mL/100 mL	710
MW-04	0.00	1.65	2 mL/10 mL	8.25
MW-05	0.00	0.55	100 mL/200 mL	1100
MW-06	0.00	1.26	100 mL/200 mL	2520
MW-07	0.00	3.30/0.75	0.5 mL/10 mL 1 mL/30 mL	45
MW-08	0.00	2.86	5 mL/10 mL	5.72

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT → initial VI/VF final	FINAL VALUE
MW-02	0.00	2.63	12.5 mL/~~12.5~~ 25 mL	5.26
MW-03	0.00	3.27	1 mL/100 mL	327
MW-04	0.00	0.78	5 mL/25 mL	0.78
MW-05	0.00	0.37	100 mL/200 mL	740
MW-06	0.00	0.93	100 mL/~~200 mL~~ 150 mL	1395
MW-07	0.00	1.31	5 mL/50 mL	13.1
MW-08	0.00	0.92	no dilution	0.92

8/15/08

SODIUM PERSULFATE

LOCATION	RANGE LOW/HIGH	CONC (mg/L)	
MW-02	LOW	0	SAMPLE YELLOW NOT ORANGE
MW-03	HIGH	70* (350)* 5mL/25mL	
MW-04	LOW	5.6	
MW-05	HIGH	14* (1400)* 25mL/25mL	
MW-06	HIGH	>70/25* 0.25mL/25mL (2500)	
MW-07	LOW	2.1	
MW-08	LOW	4.2	

HYDROGEN PEROXIDE

LOCATION	CONC (mg/L)	RANGE HIGH/LOW	# OF DROPS
MW-02	5	HIGH	5
MW-03	4	HIGH	4
MW-04	3	HIGH	3
MW-05	2	HIGH	2
MW-06	24.0	HIGH	24
MW-07	4.0	HIGH	4
MW-08	5.0	HIGH	5

1750 WHEN SODIUM THIOSULFATE IS ADDED TO THE PRESERVED SAMPLE BOTTLE IT REACTS WITH THE HCl to form a yellow precipitate. MARK AND SCOTT DECIDE TO NOT ADD SODIUM THIOSULFATE TO BOTTLE AND JUST RELY PRESERVATIVE AND ALLOW TEMP TO BE THE REGULATOR TO INHIBIT FURTHER OXIDIZATION OF SAMPLES.

MW-07 AND MW-06 (MS/MSD) WILL NEED TO BE RECOLLECTED. MW-08 AND MW-04 WENT DRY WHILE PURGING, WILL ALLOW TO RECHARGE OVER NIGHT AND COLLECT SAMPLE IN THE MORNING.

1800 BREAK FOR DINNER.

1830. RETURN UP TO SITE TO RECOLLECT MW-07 AND MW-06 AND CONTINUE SAMPLING OTHER WELLS.

1900 HAVE TROUBLE GETTING NO BUBBLES IN VOA VIALS DUE TO LOW QUALITY LIDS. PURGED AND SAMPLING MW-05.

ALL WELL LOCATIONS PURGED SO FAR HAVE SLOW RECHARGE AND MAXIMUM DRAW DOWN WAS EXCEEDED BUT PUMPING AT SLOW SPEED POSSIBLE FOR CONTROLLER.

2240 COMPLETE SAMPLING, CLEAN UP AT SITE FOR THE DAY. MW-05, MW-07 AND MW-06 COLLECTED, MW-04 AND MW-08 PURGED DRIED AND WILL BE SAMPLED TOMORROW.

2245 SAMPLES PLACED IN REFRIDGERATOR.

END WORK FOR THE DAY.

In LF 4/4 9nl Wel
[illegible]

8/15/09

08/15/09

8/15/09

08/16/09 NE CAPE, AK ISCO INJECTION AND MONITORING

PERSONNEL: AARON JAMBROSIC

MARK

SCOTT

LANCE

WEATHER: CLOUDY MID 40's °F

0600 BREAKFAST

0620 GROUP H&S MEETING WITH BRISTOL

0645 BEGIN POST CALIBRATION AND CALIBRATION OF TURBIDITY METER AND YSI 556 (SEE CALIBRATION SHEET).

0730 METERS CALIBRATE OK.

0830 GET ICE FOR COOLERS, EMPTY PURGE WATER BUCKETS INTO OVER PACKED PURGE WATER DRUM.

0900 ARRIVE AT A MONITORING LOCATION FOR CONTINUATION OF DAY 3 GW MONITORING EVENT. GO OVER H&S, CHEMICALS OF CONCERN, PPE, CUTS, STRAINS, TRIP HAZARDS, UNEVEN SURFACE, REMOTE LOCATION, LOW pH IN GW.

0903 DON PPE.

0905 MEASURE GW LEVELS AND ADJUST PUMPS TO MIDPOINT OF WATER COLUMN AT SAMPLE LOCATIONS.

LOCATION	TIME	DTW	PUMP LOCATION	NOTE
MW-01	0905	9.32	NA	not sampled
MW-02	0906	4.67	6.9	SHEEN
MW-03	0907	3.16	6.35	
MW-04	0908	7.22	8.5	
MW-05	0909	4.65	NA	ALREADY SAMPLED
MW-06	0910	5.63	NA	ALREADY SAMPLED
MW-07	0911	5.61	NA	ALREADY SAMPLED
MW-08	0912	7.30	8.35	
MW-09	0913	8.11	NA	MEASURING POINT 0.1' higher than survey due to coupler / not sampled
MW-88	0914	9.65	NA	SHEEN / NOT SAMPLED
IW-01	0915	4.82	NA	NOT SAMPLED

0935 COMPLETE GW GAUGING AND PUMP PLACEMENT.

0940 SET UP TO SAMPLE AT MW-08 AND MW-04. (See sample forms for details)

1000 Begin sampling MW-08

1025 complete sampling MW-08

1030 Begin Sampling MW-04

1050 Complete sampling MW-04 / begin set up at MW-03.

1052 Begin purging MW-03. initial depth 3.11 ft. (water is dark red).

1120 End purging begin sampling MW-3. Have trouble with VOAs, liquid, bad caps make getting no bubbles very difficult

8/16/09

1200 Complete sampling MW-03. Pull pumps at MW-08, MW04 and MW-03 and Decon and put away. All samples labeled and on ice in cooler.

1204 set up on MW-02.

1205 Break for lunch.

1315 Begin purging MW-02

1445 end sampling MW-02. Begin clean up.

1530 complete clean up demob down at camp.

1550 begin field kit sample analysis. (SEE TABLE ON 8/15/09 for results).

1720 complete sample analysis for 8/15/09 and 8/16/09 (3rd day monitoring event)

Begin analyzing SODIUM PERSULFATE samples FROM 8/12 and 8/13 NOT analyzed previously because we ran out of supplies for the kit, samples were refridgerated until more arrived.

SODIUM PERSULFATE

LOCATION	DATE	RANGE (HIGH/LOW)	CONC (mg/L)	
MW-02	8/12/09	HIGH	14	
MW-03		HIGH	>70	
MW-04		LOW ~~HIGH~~	5.6	
MW-05		HIGH	14* (1400)	* 0.25 mL / 25 mL
MW-06		HIGH	14* (1400)	* 0.25 mL / 25 mL
MW-07		Low	7.0	
MW-08		LOW	2.1	
MW-09		LOW	1.4	
MW-88		HIGH	10	
MW-01	8/13/09	LOW	0	
MW-02		LOW	7.0	
MW-03		HIGH	>70* / 14* (1400)	*5/25 mL *0.25 mL / 25 mL
MW-04		LOW	5.6	
MW-05		HIGH	25* (2500)	0.25 mL / 25 mL
MW-06		HIGH	30* (3000)	0.25 mL / 25 mL
MW-07		LOW	7.0	
MW-08		LOW	1.4	
MW 09	NOT COLLECT, INJECTION WELL			
MW-88		LOW	2.1	
MW-02 bottom		LOW	7.0	

1830 complete persulfate analysis clean up. Complete work for the day.

8/16/09

8/16/09 NE CAPE AK.

8/16/09

8/17/09 NE CAPE AK SCO INJECTION + MONITORING

PERSONNEL: AARON JANUSWIC
MARK
SCOTT
LANCE

0600 BREAKFAST

0620 GROUP BRISTOL SAFETY MEETING. CAUTION WHILE CAMP IS BREAKING DOWN AND DEMOBING, LOT OF PEOPLE MOVING AROUND.

MARK AND SCOTT LEAVING ON A PLANE TODAY. SURVEYORS COMING IN. DIGGING HOLES FOR SOIL SAMPLING TODAY TO BOTTOM OF FILL, SAMPLE WEDNESDAY.

0640 POST CALIBRATION OF YSI 556 (SEE CALIBRATION SHEET) + turbidity meter

0650 complete post calibration of meters YSI 556 and turbidity.

Begin packing up trailer.

0930 Begin transferring contents of sample conex to chemical conex and clean out

1030 other conex all AECOM materials now in chemical conex, system conex, job box and fish totes.

1100 walk survey locations

1200 Lunch.

1220 MARK AND SCOTT DEPARTING SITE ON FLIGHT.

1300 PREPARE ALL LABELS FOR DAY SEVEN SOIL AND GW SAMPLING

1500 REVIEW BORING LOG FOR SOIL SAMPLING AND PRE-SAMPLING EXCAVATION

LOCATION	SAMPLE INTERVAL	~~FILL~~	FILL	ML	PEAT
MW-02	6-7	~~0-4.5~~			
MW-03	5-6.5	~~0-3.5~~	0-4.5		
MW-04	6-7.5	~~0-5.0~~	0-3.5		
MW-05	5-6	~~0-4.8~~	0-5.0		
MW-06	5-6	~~0-2.7~~	0-4.8		
MW-07	6.5-7.5	~~0-3.7~~	0-2.7		
MW-08	4.5-5.5		0-3.7		
MW-09	5.5-6.5		0-2.5		

1800 BREAK FOR DINNER. COMPLETE OF WORK FOR THE DAY.

- TOMORROW EXCAVATE HOLES FOR WEDSDAY SOIL SAMPLING
- GAUGE ALL WELLS FOR WATER LEVEL
- INVENTORY JOB BOX
- PURGE MW-4 AND MW-8 DRY SO WILL RECOVER FOR WEDNESDAY SAMPLING
- INGRAVE WELL MONUMENTS WITH LOCATION NAMES
- DOWN LOAD AND REMOVE TROLL GW

[signature] 8/17/09

Rite in the Rain

8/17/09

8/17/09

8/18/09 NE CAPE, AK ISCO INJECTION AND MONITORING

PERSONNEL: AARON JAMBROSIC
LANCE PHELPS

WEATHER: PARTLY CLOUDY MID 30's °F - mid 40's °F

06:00 BREAKFAST

06:20 SAFETY MEETING WITH BRISTOL, EXCAVATION SAFETY, PPE, COMMUNICATION EYE CONTACT, AND COLD STRESS GOING TO BE COLD AND WINDY DRESS APPROPRIATELY.

06:45 PREP FOR EXCAVATION.

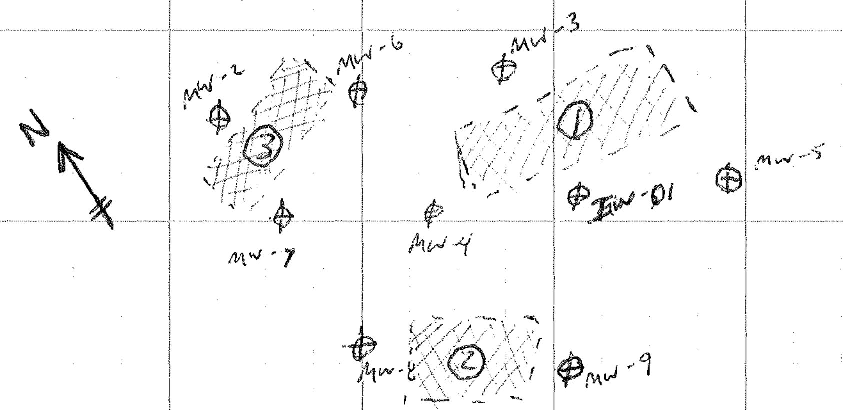
07:50 CALIBRATE YSI 556 (SEE CALIBRATION SHEET) and turbidity meter

08:15 meters calibrate ok

08:30 drive up to site, pick up survey equipment for excavation of soil pits for hand auger soil samples.

0840 Delineate excavation locations, go over scope and H+S

0856 Begin excavating locations to 4 feet (bgs)



09:03 at Excavation 1 hit GW at 3.5 ft end excavation

09:10 Begin excavation 2.

09:22 End excavation 2 3.6 feet (bgs) at north end 3.8 ft (bgs at south end) right at upper contact with Peat below the Fill.

09:25 move back to excavation 1 to take a little deeper, still in fill with large rocks. Excavate to 4.2 feet (bgs) contact with Peat

09:28 excavate 1 to 4.2 feet top of contact with peat and fill. excavation complete move to location 3

09:35 Begin excavating 3
GW flowing in at 2.8 feet at contact with fill and silt
contact with silt and peat at 3.45 feet

09:45 complete excavation at 3 to 4 feet bgs. Excavating Complete

GW in excavation 1 has product on the surface.

~~GM~~ Fill - greyish brown, fine to boulders up to 2.5' Ø angular. Mostly cobbles and boulders

ML silt - grey SILT

peat - dark brown, organics, roots, and silt.

08/18/09 NE CAPE, AK [illegible] INJECTION AND MONITORING

LOCATION	TIME	DTW (ft)	NOTES
MW-02	09:18	4.85	
MW-03	09:22	3.21	
MW-04	09:58	7.50	
MW-05	09:35	4.78	
MW-06	09:19	4.28	
MW-07	09:59	5.68	
MW-08	09:25	7.31	
MW-09	09:33	8.25	
MW-88-5	09:58	9.15	
IW-01	09:56	6.18	
MW-01	09:57	6.42	
88-MW-3	12:07	11.28	
88-MW-1	12:12	15.80	
26	12:20	34.44	TD = 42.0 Site 26 well not on maps (26 written on well cap) well monument lid broken 6.25" monument
22 MW-03	12:25	31.26	
22 MW-02	12:26	27.05	
17 MW-01	12:33	11.21	
TEMP WELL	1240	2.51	

12:45 COMPLETE GW GAUGING. LANCE BEGINS DOWNLOADING THE [illegible] AT MW-88-5
AARON SETS UP TO PURGE MW-8 AND MW-4

14:00 SET CASINGS FOR DAY 28 SOIL SAMPLE. DROVE 0.5' PVC PIPE 0.5' INTO GROUND IN EXCAVATION WITHIN 5' OF EACH WELL LOCATION.

14:10 BEGIN SET TO PURGE MW-08

1422 BEGIN PURGING MW-08 INITIAL DTW = 7.30 FLOW RATE = 120 mL/min

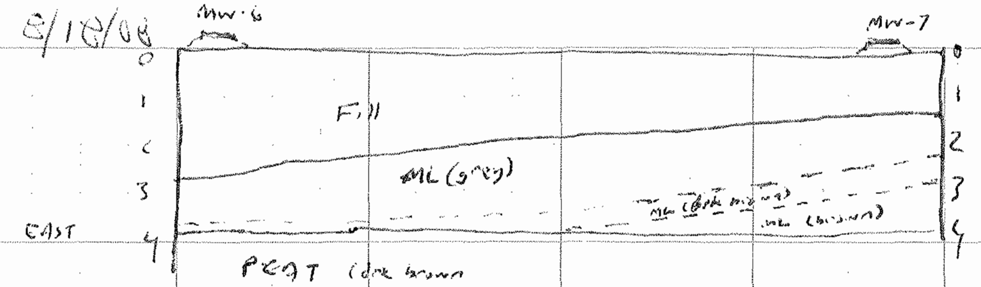
TIME	DTW	TEMP °C	COND mS/cm	DO (mg/L)	pH	ORP	Turbidity
14:32	below pump	4.62	0.175	4.66	5.87	104.4	74.01
14:35	below pump	5.19	0.178	6.42	5.95	99.9	124.6
14:38	below pump	5.43	0.178	5.87	5.92	104.3	NA

14:38 well runs dry end purging.
Begin set up at MW-04

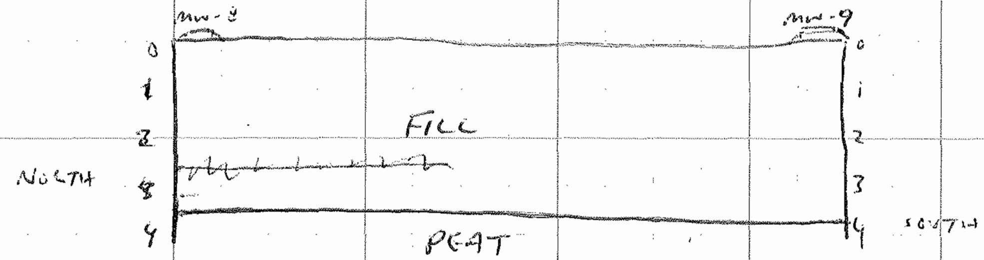
14:48 Begin purging MW-04 flow rate = 120 mL/min

TIME	DTW	TEMP °C	COND mS/cm	DO (mg/L)	pH	ORP	Turbidity
14:58	Below pump	4.86	0.118	5.35	5.90	107.2	18.17
15:01	Below pump	4.90	0.215	5.35	5.88	113.9	35.83
15:04	Below pump	4.56	0.212	4.96	5.94	115.6	39.44

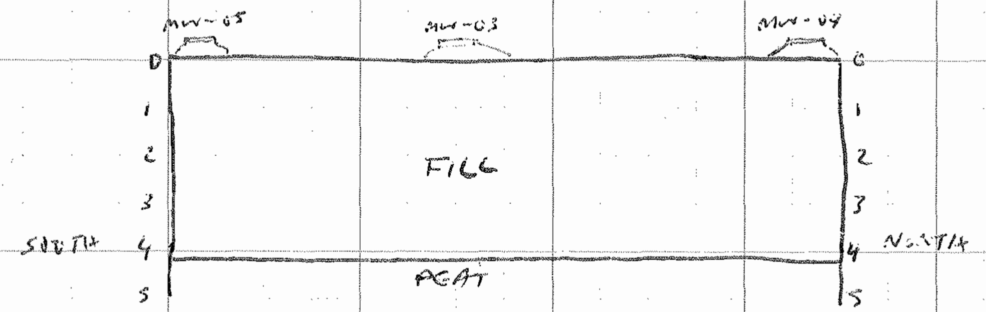
8/18/08



EXCAVATION (3)



EXCAVATION (2)



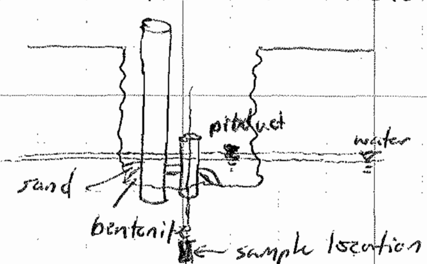
EXCAVATION (1)

1530 EXCAVATION COMPLETE. Placed and measured all 6" pvc pipes for day 2B hand auger sampling. Collected GW level measurements from KC wells. Go to get previous not in site wide GW gauging to gauge the existing wells.

150 continue GW gauging.

1504 WELL RUNS DRY. END PURGING. CLEAN UP AT MW-04

1505 LANCE AND RUSSELL HAVE INSTALLED PVC PIPES FOR SOIL SAMPLES TOMORROW 8/19.



PVC pipe driven into ground 0.3'
Bentonited at base and sand, pump out water in casing so that hand auger samples are not pulled up through product layer on water surface.

1558 Begin surveying

			Δ
MW-02	6.51	7.81	3.3

8/18/09 NE CAPE, AK

1558 Begin surveying ground elevation and bottoms of excavations in casing to determine additional depth to sample.

LOCATION	Target sample	Ground Surface	DAY 28 Excavation Bottom	Δ GS/EB28	DAY 28 ADDITIONAL DEPTH TO SAMPLE	DAY 7 EB	Δ GS/EB7	DAY 7 ADDITIONAL DEPTH TO SAMPLE
HA-2	6-7'	6.51	9.81	3.3	2.7	10.20	3.69	2.31
HA-3	5-6.5'	4.62	8.68	4.06	0.94	8.92	4.30	0.7
HA-4	6-7.5'	4.63	8.85	4.22	1.78	9.09	4.46	1.54
HA-5	5-6'	4.50	8.73	4.23	0.77	9.09	4.59	0.41
HA-6	5-6'	5.33	9.88	4.55	0.45	10.00	4.67	0.33
HA-7	6.5-7.5	5.76	10.15	4.39	2.01	10.17	4.41	2.09
HA-8	4.5-5.5'	4.35	7.39	3.04	1.46	7.59	3.24	1.26
HA-9	5.5-6.5'	3.98	7.49	3.54	1.96	7.53	3.55	1.95

1630 Complete surveying

1645 Begin hand augering holes closer to the sample depth. Depths are sited on surveying pole and include the height of the instrument. All TOC measurements are referenced to the 6" PVC riser installed for the 28 day soil sampling.

DAY 7 BORINGS

LOCATION	TARGET DEPTH	CURRENT DEPTH	CURRENT DEPTH FROM TOC	Target TOC
HA-2	12.51	11.88	6.6	7.1
HA-3	9.62	~~8.92~~ 9.22	~~4.9~~ 5.2	5.6
HA-4	10.63	10.4	~~5.2~~ 6.0	~~5.75~~ 6.2
HA-5	9.50	9.03	4.9	5.4
HA-6	10.33	10.00	4.6	5.05 ~~0.45~~
HA-7	12.26	11.62	6.35	7.0
HA-8	8.85	~~9.07~~ 8.57	5.7	5.9
HA-9	9.48	9.05	6.15	

DAY 28 BORINGS

LOCATION	TARGET DEPTH	CURRENT DEPTH	CURRENT DEPTH FROM TOC	Target TOC
HA-2	12.51	11.73	6.5	7.28
HA-3	9.62	9.43	5.5	5.6
HA-4	10.63	10.13	5.3	~~5.75~~ 6.2
HA-5	9.5	8.73	4.6	5.4
HA-6	10.33	~~10.03~~ 9.88	4.6	5.05 ~~0.45~~
HA-7	12.26	11.82	6.5	7.0
HA-8	8.85	8.34	5.4	5.9
HA-9	9.45	9.04	6.2	6.6

3 borings HA-3 HA-4 and HA-5 are within 4-5 feet of injection well

2 borings HA-8 and HA-9 are 12-12.5 feet from the injection well

3 borings HA-2, HA-6 and HA-7 are within 17-21.5 feet of the injection well.

8/18/09 NC Cape AK

~~17~~50 Break for Dinner
1850 Return to hand auguring sample location to just above target sample interval
2035 complete hand augering to just above sample target depth at all 7th day and 28th day soil sample locations.
2040 Gauge MW-02 and MW-04

MW-04	7.98	original DTW	7.3'
MW-08	7.62	original DTW	7.50'

2045 Begin Decon and clean up at site
2120 Complete decon and clean up head back to camp.
2125 Demob equipment. End work for the day.

8/18/09

8/19/09 NE CAPE, AK ISCO INJECTION AND MONITORING

PERSONNEL: AARON JAMBROSIC

LANCE PHEUSS

WEATHER PARTLY CLOUDY MID 40 °F

0600 BREAKFAST

0620 ALL HAND H+S MEETING WITH BRISTOL.

0640 POST CALIBRATE YSI 556 AND TURBIDITY METER (SEE CALIBRATION SHEETS)

PRE CALIBRATE METER (SEE CALIBRATION SHEET)

0700 COMPLETE METER CALIBRATION.

0715 PREP FOR SAMPLING, GET HOT SOAPY WATER FOR DECON, SCALE, FORMS AND SUPPLIES.

0830 Collect all bottle ware up at site

Conduct H+S meeting, don PPE

0840 collect round of GW levels and remove troll from MW-08.

LOCATION	TIME	DTW	TD	PUMP DEPTH	Pump adjusted from bottom
MW-02	0841	4.77	8.94	6.8	2.1
MW-03	0842	4.16	9.50	6.8	2.7
MW-04	0843	7.61	9.70	8.65	1.05
MW-05	0844	5.09	8.45	6.76	1.67
MW-06	0845	4.44	9.10	7.75	2.35
MW-07	0846	5.66	9.60	7.6	2.0
MW-08	0847	7.85	9.35	8.6	0.75
~~MW-09~~	0848	8.25	NS	NS	
~~MW-01~~	0849	9.45	NS	NS	
IW-01	0850	6.85	NS	NS	
MW-88-5	08:52	9.17	NS	NS	

NS - not sampled

0850 Remove troll from MW-08

0915 Begin sampling MW-08. 09NCMCCGW28 @ 0915 MCC-24

0920 MW-08 runs dry 6 40ml VOA and 1/2 of 1 liter amber collect, allow to recharge and move to MW-04

0935 Begin sampling MW-04. initial DTW 7.55 ft.

0945 Complete sampling at MW-04. 09NCMCC24 @ 09:35 MCC-19

Label and package and put bottles in coolers

1000 Begin set up on MW-05, initial DTW = 5.02 feet

1034 Begin purging MW-05 at 130 ml/min.

1050 Check flow, now 85 ml/min

1127 complete sampling MW-05

1145 Begin set up on MW-03.

8/19/09 NE CAPE AK

1100 set up on MW-3. begin placing rest of pumps in wells at depth
1215 back for lunch
13:15 back up at site
13:20 begin purging MW-03
13:58 begin sampling MW-03
15:38 begin purging MW-06 while lance continues to fill bottles at MW-03
16:10 begin sampling MW-06
16:50 complete sampling MW-06. set up on MW-02
17:08 Begin purging MW-02
17:35 End purging begin sampling MW-02
17:55 complete sampling MW-02
18:05 Begin setup on MW-07
18:10 Attempt to collect remaining sample at MW-06 after allowing to recharge. obtain ~250 mL.
1815 Back for dinner
1915 Back out at site attempt to collect more volume from MW-08. collect ~125 mL.
19:22 Begin purging MW-07
19:55 begin sampling MW-07
20:12 complete sampling MW-07
20:13 attempt to recover additional volume from MW-08
20:15 minimal volume recovered ~40 mL.
20:16 Begin clean up at the site, decon pumps and equipment.
21:25 Unload equipment at conex boxes.
22:20 Samples all in refrigerator, stocked job box, equipment put in conexs and job box, truck unloaded.

Check with Chuck (Bristol Land) plane tomorrow at 2pm. Tomorrow, pack samples. Run test kit chemistry on water samples collected today, pack for departure.

EOD.

8/19/09

08/20/09 NE CAPE AK.

personnel: Aaron Jandreau, Lena Phuss   weather: cloudy, showers mid 30's°F - mid 40's

0600 Breakfast

0620 All hands meeting, chuck decides not to have all hands safety meeting today.

0630 Post calibrate YSI 556 and turbidity meter, post calibrate ok (see calibration sheets).

0700 Pack for departure and tent tear down.

0750 Begin field chemistry sample analysis of groundwater samples

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT DILUSION (VI/VT)	FINAL VALUE
MW-02	0.00	3.30 / 3.30	1mL/10mL / 0.1/10mL	>330
MW-03	0.00	0.40	0.1ml/100mL	400
MW-04	0.00	1.23	2mL/10mL	6.15
MW-05	0.00	0.75	0.1mL/200mL	1500
MW-06	0.00	0.60	0.1mL/150mL	900
MW-07	0.00	3.30 / 0.99	1mL/30mL / 0.1/10mL	99
MW-08	0.00	3.30 / 0.52	5mL/10mL / 0.1/10mL	52

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	COMMENT DILUSION (VI/VT)	FINAL VALUE
MW-02	0.00	3.07	12.5mL/25mL	6.14
MW-03	0.00	2.12	1mL/100mL	212
MW-04	0.00	0.02 / 0.02	5ml/25ml / no dilusion	0.02
MW-05	0.00	0.26	0.1mL/200mL	520
MW-06	0.00	0.37	0.1mL/150mL	555
MW-07	0.00	1.49	3mL/30mL	14.9
MW-08	0.0	0.14	no dilusion	0.14

PERSULFATE

LOCATION	RANGE HIGH/LOW	CONC (mg/L)	dilusion (VI/VT)
MW-02	HIGH	10.	
MW-03	HIGH	70	
MW-04	LOW	4.2	
MW-05	HIGH	10* (1000)	0.25mL/25mL
MW-06	HIGH	10* (500)	0.5mL/25mL
MW-07	HIGH	21.0	
MW-08	HIGH	14.0	

HYDROGEN SULFIDE

LOCATION	CONC (mg/L)	RANGE (HIGH/LOW)	# OF DROPS
MW-02	0.0 *	HIGH	0
MW-03	3.0	HIGH	3
MW-04	2.0	HIGH	2
MW-05	4.0	HIGH	4
MW-06	4.0	HIGH	4
MW-07	4.0	HIGH	4
MW-08	3.0	HIGH	3

*MW-02 turned blue when sulfide reagent add but no change when 45 drops add at high range. diluted sample 15ml/30ml still no change with 45 drops added.

8/20/09 NE Cape AK.

11:15 complete field kit chemistry testing. begin packing up sample bottles

1300 Plane arrives pack up plane with equipment and samples. Samples will ship on to labs. Equipment will be stored in Nome for day 14 event.
Flight flies first from NE Cape to Savoonga to drop off family with sick child to see doctor, then continues on to Nome.

1800 Arrive in Nome, store and stage equipment, get additional ice for samples, prepare samples for shipment.

20:30 EOD

08/20/09

8/25/09 NE CAPE AK ISCO injection monitoring.

14th Day Monitoring Event

Personnel: Aaron Jambrosic (AECOM)

Lance Bheuss (AECOM)

Russell James (Bristol)

WEATHER partly cloudy high 30's °F to mid 40's °F wind 0-10 mph

0600 Breakfast / Safety meeting

0700 Calibrating meters

complete meter calibration

load to airport

08:50 Depart to Island

Arrive at Island. Begin moving equipment out to site

09:45 Collect round of GW level measurements.

Location	time	DTW	TD	Pump adjusted	MOC
MW-01	09:45	9.51	NS		
02	0946	4.91	8.99	4.03/2 = 2.01	MOC-21
03	09:47	3.80	8.50	4.70/2 = 2.35	MOC-17
04	09:48	7.51	8.70	2.81/2 = 1.40	MOC-19
05	09:49	5.02	8.45	3.43/2 = 1.72 up	MOC-16
06	09:50	4.18	9.10	4.92/2 = 2.46	MOC-20
07	09:51	5.56	8.60	4.04/2 = 2.02	MOC-18
08	09:52	7.34	9.75	2.01/2 = 2.0	MOC-24
09	09:53	8.31	NS		
IW-01	09:54	7.14	NS		
MW-BB-5	09:55	9.24	NS		

0956 complete GW level collection. set up on MW-08

through down flow cell on YSI, will collect all purge water in unpreserved bottle due to well tending to run dry so have enough volume

10:27 well runs dry, have 1.5 liter collected during purging

11:00 set up on MW-02, product in well, will sample last. move to MW-06

11:30 Begin purging MW-06

1205 Begin sampling MW-06

1220 complete sampling MW-06. clean up at location and begin set up on MW-07

1245 Break for lunch

1315 Return back to work and begin purging MW-07

1340 end purge begin sampling MW-07

1355 complete sampling MW-07 clean up at location and begin test kit analysis

8/25/09
13:53 of field samples while Lance and Russell complete sampling.

Total Iron

Location	Standard	Sample (mg/L)	Comment (VI/VF dilution)	Final Value
02	0.00	3.30/3.30/1.74	0.1 mL/10 mL / 0.1 mL/20 mL / 0.01 mL/10 mL	1740
03	0.00	0.88	0.1 mL/10 mL	88
04	0.00	2.27	1 mL / 10 mL	22.7
05	0.00	0.35/~~2.55~~ (AD)	0.1 mL / 200 mL	700
06	0.00	0.34/0.55	0.1 mL / 150 mL / 0.1 mL/100 mL	550
07	0.0	3.30 / 1.57	0.1 mL/10 mL / 0.05 mL/10 mL	314
08	0.0	0.40	0.1 mL / 10 mL	40

Ferrous Iron

Location	Standard	Sample (mg/L)	Comment (dilution VI/VF)	Final Value
02	0.00	3.30 / 2.04	11.5 mL/25 mL / 2.5 mL/25 mL	102
03	0.00	1.40	2.5 mL/25 mL	14
04	0.00	2.59	no dilution	2.59
05	0.00	0.23	0.1 mL / 200 mL	460
06	0.00	0.53/0.41	0.1 mL / 150 mL / 0.1 mL/100 mL	410
07	0.0	3.11	2.5 mL/25 mL	31.1
08	0.0	0.20	no dilution	0.2

Sodium Persulfate / Hydrogen Peroxide

Location	Range High/Low	Conc. (mg/L)	Note	Location	Conc (mg/L)	Range High/Low	# of Drops
MW-02	Low	2.8	Yellow not orange	02	0 *	Low/High	0
MW-03	Low	7.0	Yellowish orange	03	4	High	4
MW-04	Low	7.0		04	5	High/~~Low~~ (AD)	5
MW-05	High	21.0	Yellow not orange	05	0	High/Low	0
MW-06	High	28.0	Yellow not orange	06	0	High/Low	0
MW-07	~~High~~ Low	4.2	Yellow not orange	07	3	High	3
MW-08	Low	1.4	Yellow not orange	08	1.6	Low	8

Notes:

* MW-05 hydrogen sulfide tests, sample turned blue but show no change when Sodium Thiosulfate drops were add, add 40 drops, tried sample twice, no change

* MW-06 reacts same as MW-5 when testing for hydrogen peroxide

* MW-02 reacts the same as MW-5 and MW-6. Sample turns a teal blue when ammonium Molybdate and sulfite add but no color change when sodium thiosulfate drops add. MW-5 MW-6 and MW-02 samples were tested at Low and High range for hydrogen peroxide, neither had a response.

8/25/09

17:25 Complete test kit analyses of samples. Begin clean up at site. Lance and Russell have completed sampling and are cleaning up at the site. Lance is pumping out water from well vaults.

1600 Attempt sample collection at MW-08 after allowing to recharge since 10:30 am. obtained 1 liter of sample and well runs dry. Use collected purge volume for rest of sample.

1840 Drum all purge water in drums and overpacks, load all supplies on plane and in job box.

1857 Plane loaded prepare for departure.

1950 Arrive back in Nome

CQ 8/25/09

9/11/09 NE CAPE AK

DAY 28 SOIL + GW MONITORING

PERSONNEL : Aaron Jambusic, BOB SCHLOSSER, (AECOM)

RUSSELL JAMES, ERIC (BRISTOL)

WEATHER : MOSTLY CLOUDY, 40°F

0630 CALIBRATE METERS YSI 556's (3) and turbidity meters

0700 METERS CALIBRATE OK.

0705 BREAKFAST AND SAFETY MEETING, COC's, oxidants, low pH, cold stress, ranch location,

0800 LOAD SUPPLIES TRAVEL TO BERING AIR

0845 DEPART FOR NE CAPE

0945 ARRIVE NE CAPE, EUGENE WAITING, UNLOAD SUPPLIES HEAD UP TO SITE.

1000 BEGIN MEASURING GW LEVELS.

LOCATION	TIME	DTW	TD	Pump adjustment	MOL
ICVMW-01	10:04	9.56	NS		
MW-02	10:05	5.38	8.94	1.8	21
MW-03	10:06	4.29	9.50	2.6	17
MW-04	10:07	7.65	9.70	1.0	19
MW-05	10:08	5.35	8.45	1.5	16
MW-06	10:09	4.80	9.10	2.5	20
MW-07	10:10	5.49	9.60	2.05	18
MW-08	10:11	7.24	9.35	0.3	24
MW-09	10:12	8.36	NS		
ICW-01	10:13	7.59	NS		
MW-88-5	10:14	9.29	NS		

10:15 COMPLETE GW GAUGING BEGIN SET UP ON MW-08 AND SETTING PUMP ADJUSTMENTS.

10:51 Begin purging MW-08. Collecting all purge water in unpreserved Liter due to low recharge. will use if needed.

11:04 well was dry. ~2.5 liters collected, collected additional 0.5 liter from tubing line, not through flow cell. Allow to recharge and will reattempt sample collection.

11:15 Begin set up on MW-07

11:40 Begin purging MW-07

12:15 END PURGING BEGIN SAMPLING MW-07. MS/MSD and Duplicate collected.

9/11/09 NE CAPE AK

13:00 COMPLETE SAMPLING MW-07
13:30 BEGIN PURGING MW-06
14:00 END PURGING BEGIN SAMPLING MW-06
14:22 COMPLETE SAMPLING MW-06.
BEGIN SET UP ON MW-02.
14:35 BEGIN PURGING MW-02
15:00 END PURGING / BEGIN SAMPLING MW-02
15:12 COMPLETE SAMPLING MW-02. BEGIN CLEAN UP AND
ASSISTING WITH SOIL SAMPLING
1600 Attempt collect additional volume from MW-02. 0.5 Liters
collected
1640 Reattempt sample collection at MW-08, minimal volume
received ~40 mL
Packing up and demobing while waiting for MW-08 to recharge.
Eric (Bristol) begins treatment of purge water through GAC.
1800 Pack up all material, get all supplies out of job box, load
plane
1830 Depart NE Cape for Nome
1915 Arrive at Nome, unload plane, organize supplies, take
samples back to hotel, travel check out and read.
1945 Store straight in room, complete work for the day

9/11/09

C [signature]

9/12/09 NE CAPE AK.

PERSONNEL: AARON JAMBROSIC, BOB SCHLOSSER (AECOM)
RUSSELL JAMES, ERIC (BRISTOL)

WEATHER: CLOUDY 40°F

10:30 begin packaging samples and prepping for shipment to lab. fill out COC's
Begin running test kit analysis

TOTAL IRON

LOCATION	STANDARD	SAMPLE (mg/L)	DILUTION VI/VF	FINAL VALUE
02	0.0	3.30 / 0.45	0.1 mL/10 mL / 0.01 mL/10 mL	450
03	0.0	1.65	0.1 mL / 10 mL	165
04	0.0	1.44	0.1 mL / 10 mL	144
05	0.0	1.64	0.1 mL / 10 mL	164
06	0.0	0.12 / 1.19	0.05 mL/50 mL / 0.1 mL / 10 mL	119
07	0.0	0.48	0.1 mL / 100 mL	480
08	0.0	0.24	0.1 mL / 10 mL	24

FERROUS IRON

LOCATION	STANDARD	SAMPLE (mg/L)	DILUTION VI/VF	FINAL VALUE
02	0.0	3.03	2.5 mL / 25 mL	30.3
03	0.0	3.27	no dilution	3.27
04	0.0	2.83	no dilution	2.83
05	0.0	1.64	2.5 mL / 25 mL	16.4
06	0.0	2.88	2.5 mL / 25 mL	28.8
07	0.0	1.5	0.25 mL / 25 mL	150
08	0.0	0.00	no dilution	0.0

SODIUM PERSULFATE

LOCATION	RANGE (HIGH/LOW)	CONC (mg/L)	NOTE
02	HIGH	14	YELLOW NOT ORANGE
03	LOW	5.6	
04	HIGH	35	
05	HIGH	21	YELLOW NOT ORANGE
06	HIGH	17	
07	HIGH	21	
08	LOW	4.2	

HYDROGEN PEROXIDE

LOCATION	CONC (mg/L)	RANGE (HIGH/LOW)	# OF DROPS
02	2.6	low	13
03	1.6	low	8
04	2.2	low	11
05	2.6	low	13
06	3.0	low	15
07	2.2	low	11
08	1.4	low	7

9/12/09 NE CAPE AK.

13:30 COMPLETE FIELD KIT SAMPLE ANALYSIS.

BEGIN PACKAGING SAMPLES AND ALL EQUIPMENT FOR SHIPMENT.

1500 break for lunch.

1530 Resume packing and shipping of supplies

1640 Drop off all supplies at NAC To be shipped to FedEx in anchorage, Aaron stays and ships materials, Eric, Russell, and Bob go to Alaska airlines to ship all samples out to Test America Laboratories via Alaska Airlines Goldstreak shipping air cargo.

1730 complete shipping of equipment and samples. ~~Complete~~

1740 Schedule flights out for tomorrow 9/13/09 at alaska Airlines

1745 return to Nugget Inn.

complete work for the day.

EOD.

9/12/09

APPENDIX B

Data Verification Report

CONTENTS

TABLES

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ACRONYMS AND ABBREVIATIONS

%	percent
ADEC	Alaska Department of Environmental Conservation
AK	Alaska Method
Bristol	Bristol Environmental Remediation Services, LLC
CoC	chain-of-custody
DQO	data quality objective
DRO	diesel range organics
FD	field duplicate
GRO	gasoline range organics
HTRW	hazardous, toxic, and radioactive waste
ID	identification
ISCO	in-situ chemical oxidation
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MB	method blank
MDL	method detection limit
mm	millimeter
MS	matrix spike
MSD	matrix spike duplicate
NE Cape	Northeast Cape
NP	not preferred
QC	quality control
QSM	Quality Systems Manual
RL	reporting limit
RPD	relative percent difference
RRO	residual range organics
SAP	sampling and analysis plan
SDG	sample delivery group
SW	EPA Solid Waste Method
TestAmerica	TestAmerica Laboratories, Inc.
TOC	total organic carbon
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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1.0 INTRODUCTION

This Data Verification Report has been completed on the submitted data packages in accordance with an agreement between Bristol Environmental Remediation Services, LLC (Bristol), and the U.S. Army Corps of Engineers (USACE). As per this agreement, all laboratory results were generated as part of work on the in-situ chemical oxidation (ISCO) Phase I and Intrusive Drum Removal/Landfill Cap – Northeast Cape (NE Cape), St. Lawrence Island, Alaska. The USACE assigned this project to Bristol under Contract number W911KB-09-C-0013.

Data verification was performed on the data collected as part of the NE Cape ISCO Study and Drum Removal. Data verification is a process for evaluating the completeness, correctness, consistency, compliance with method procedures and quality control (QC) requirements, and identification of anomalous data. The reported project sample values, as well as any method laboratory control samples extracted or prepared with the project samples were reviewed. Specifically, the following items were reviewed in this data verification:

- Sample receipt conditions:
  - Sample preservation
  - Cooler temperatures upon receipt
  - Chain-of-custody (COC) condition/correspondence to submitted sample set
  - Presence/absence of custody seals
- Extraction and analytical procedures:
  - Holding times
  - Method blanks (MBs)
  - Laboratory control samples (LCS)/laboratory control sample duplicates (LCSDs)
  - Matrix spike (MS)/matrix spike duplicate (MSD)
  - Duplicate samples
  - Surrogate recoveries
- Sampling procedures:
  - Field blanks
  - Trip blanks
  - Equipment blanks
  - Field duplicate samples
- Correspondence to method criteria and project data quality objectives (DQOs)

Unless otherwise discussed in this document, the above parameters were within Sampling and Analysis Plan (SAP)/method criteria and were within SAP-specified control limits.

No information on internal standards, calibrations, instrument tunes, chromatograms, quantitation reports, spectra, summaries identifying any analytical irregularities and the subsequent corrective action taken by the laboratories, or results from any other analytical procedures, other than those listed above, were reviewed per SAP requirements and they are not addressed in this report.

Data verification was performed in accordance with:

- The ISCO Phase I and Intrusive Drum Removal/Landfill Cap – NE Cape SAP, Revision 1 (July 2009)
- EM 200-1-6, Chemical Quality Assurance of Hazardous, Toxic, and Radioactive Waste (HTRW) Projects (USACE, 1997)
- U.S. Department of Defense Quality Systems Manual (QSM), Version 3, Final (DoD, 2009)
- ER 1110-1-263, Chemical Data Quality Management for HTRW Remedial Activities (USACE, 1998)
- Alaska Department of Environmental Conservation (ADEC) Technical Memorandum: *Environmental Laboratory and Quality Assurance Requirements* (Updated March 2009)

Precision and accuracy were assessed by comparing surrogate, MS/MSD and LCS/LCSD recoveries and relative percent differences (RPDs) to the SAP-specified control limits. The frequency of QC samples was compared to the frequency specified in the SAP. MS/MSDs performed on non-project samples are not applicable and were not evaluated.

The reviewed data sets include data collected for the NE Cape ISCO Study and Drum Removal in August 2009 and analyzed by TestAmerica Laboratories, Inc. (TestAmerica). Both the Anchorage, Alaska, and Tacoma, Washington, TestAmerica laboratories were used as presented in Table 1. TestAmerica analyzed the samples for the following compounds:

- The volatile organic compounds (VOCs) benzene and naphthalene by EPA SW-846 method 5035B/8260B
- Gasoline range organics (GRO) by ADEC method Alaska Method (AK)101
- Diesel range organics (DRO) and residual range organics (RRO) by ADEC method Alaska Method AK102/103

- TestAmerica-Tacoma transferred twelve samples from Sample Delivery Group (SDG) 14753 to TestAmerica in West Sacramento for analyses of the following:

  Total organic carbon (TOC) by SW-846 9060

The laboratory work order number are presented in Table 1.

Table 1: Laboratory Work Order Number

Primary Laboratory	Primary Laboratory Work Order No.	Subcontract Laboratory Work Order No.
TestAmerica-Tacoma	580-14560-1	N/A
TestAmerica-Tacoma	580-14753-1	G9H060205
TestAmerica-Tacoma	580-14864-1	N/A
TestAmerica-Tacoma	580-15053-1	N/A
TestAmerica-Tacoma	580-15084-1	N/A
TestAmerica-Tacoma	580-15087-1	N/A
TestAmerica-Tacoma	580-15185-1	N/A
TestAmerica-Tacoma	580-15434-1	N/A
TestAmerica-Tacoma	580-15437-1	N/A
TestAmerica-Anchorage	ASG0063	N/A

N/A not applicable

The following data qualifiers were used to identify data points when data verification determined that results should be qualified because of a potential bias in the result or a deviation from method or SAP QC procedures:

- J – The analyte was positively identified; the quantitation is an estimation.
- U – The analyte was analyzed for, but not detected at the method detection limit (MDL).
- R – The data are unusable because of deficiencies in the ability to analyze the sample and meet QC criteria.
- B – The analyte was detected above one-half the reporting limit in an associated blank.
- M – A matrix effect was present.
- QH, QL, one or more QC criteria, such as a surrogate or LCS recovery failed with high or low bias.
- NP – A second, more technically valid result was reported. NP-qualified results should be disregarded.

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2.0 DATA VERIFICATION

A total of 78 samples which included 26 soil samples (includes three field duplicates), 36 water samples (includes five field duplicates), and 8 trip blanks were collected from July through September 2009 and submitted to TestAmerica for analysis.

Field sample number, corresponding laboratory number, and analyses, are presented in Table 2.

Table 2: Sample Identification and Analysis Water and Soil Samples

Field Sample Identification	Laboratory Sample Number	Benzene and Naphthalene (8260B)	GRO (AK101)	DRO/RRO (AK102/AK103)	DRO/(AK102)	Total Organic Carbon (9060)	Metals (As, Cr, Pb) by 6020	Sulfate (300)	Remarks
Soil									
09NCMOCSB01	580-14560-1				x				
09NCMOCSB02	580-14560-2				x				
09NCMOCSB03	580-14560-3				x				
09NCMOCSB04	580-14560-4				x				
09NCMOCSB05	580-14753-1	x	x	x		x			
09NCMOCSB06	580-14753-2	x	x	x		x			
09NCMOCSB07	580-14753-3	x	x	x		x			
09NCMOCSB08	580-14753-4	x	x	x		x			
09NCMOCSB09	580-14753-5	x	x	x		x			
09NCMOCSB10	580-14753-6	x	x	x		x			
09NCMOCSB11	580-14753-7	x	x	x		x			MS/MSD VOCs, GRO, DRO/RRO, TOC
09NCMOCSB12	580-14753-8	x	x	x		x			FD of 09NCMOCSB11
Trip Blank	580-14753-9	x							
09NCMOCSB13	580-15084-1	x	x	x		x			
09NCMOCSB14	580-15084-2	x	x	x		x			MS/MSD VOCs, GRO, DRO/RRO, TOC
09NCMOCSB15	580-15084-3	x	x	x		x			
09NCMOCSB16	580-15084-4	x	x	x		x			
09NCMOCSB17	580-15084-5	x	x	x		x			
09NCMOCSB18	580-15084-6	x	x	x		x			
09NCMOCSB19	580-15084-7	x	x	x		x			MS/MSD TOC
09NCMOCSB20	580-15084-8	x	x	x		x			
09NCMOCSB21	580-15084-9	x	x	x		x			FD of 09NCMOCSB18
09NCMOCSB22	580-15084-10	x	x	x		x			

Field Sample Identification	Laboratory Sample Number	Benzene and Naphthalene (8260B)	GRO (AK101)	DRO/RRO (AK102/AK103)	DRO/(AK102)	Total Organic Carbon (9060)	Metals (As, Cr, Pb) by 6020	Sulfate (300)	Remarks
09NCMOCSB23	580-15084-11	x	x	x		x			
09NCMOCSB24	580-15084-12	x	x	x		x			
Trip Blank	580-15084-13	x	x						
09NCMOCSB25	580-15434-1	x	x	x		x			
09NCMOCSB26	580-15434-2	x	x	x		x			
09NCMOCSB27	580-15434-3	x	x	x		x			
09NCMOCSB28	580-15434-4	x	x	x		x			
09NCMOCSB31	580-15434-5	x	x	x		x			FD of 09NCMOCSB26 MS/MSD TOC
09NCMOCSB32	580-15434-6	x	x	x		x			MS/MSD VOCs, GRO, DRO/RRO
09NCMOCSB33	580-15434-7	x	x	x		x			
09NCMOCSB34	580-15434-8	x	x	x		x			
09NCMOCSB29	580-15434-9	x	x	x		x			
09NCMOCSB35	580-15434-10								On hold; not reported
Trip Blank	580-15434-11	x	x						
Water									
09NCMOCGW01	ASG00063-01				x				
09NCMOCGW02	ASG00063-02				x				
09NCMOCGW03	ASG00063-03				x				
09NCMOCGW04	580-14864-1	x	x	x			x	x	
09NCMOCGW05	580-14864-2	x	x	x			x	x	
09NCMOCGW06	580-14864-3	x	x	x			x	x	MS/MSD VOCs, GRO, DRO/RRO, Metals, Sulfate
09NCMOCGW07	580-14864-4	x	x	x			x	x	
09NCMOCGW08	580-14864-5	x	x	x			x	x	
09NCMOCGW09	580-14864-6	x	x	x			x	x	
09NCMOCGW10	580-14864-7	x	x	x			x	x	FD of 09NCMOCGW09
09NCMOCGW11	580-14864-8	x	x	x			x	x	
Trip Blank	580-14864-9	x	x						
09NCMOCGW12	580-15053-1	x	x	x					
09NCMOCGW13	580-15053-2	x	x	x					FD of 09NCMOCGW12
09NCMOCGW14	580-15053-3	x	x	x					
09NCMOCGW15	580-15053-4	x	x	x					

Field Sample Identification	**Laboratory Sample Number**	**Benzene and Naphthalene (8260B)**	**GRO (AK101)**	**DRO/RRO (AK102/AK103)**	**DRO/(AK102)**	**Total Organic Carbon (9060)**	**Metals (As, Cr, Pb) by 6020**	**Sulfate (300)**	**Remarks**
09NCMOCGW16	580-15053-5	x	x	x					MS/MSD VOCs, GRO, DRO/RRO
09NCMOCGW17	580-15053-6	x	x	x					
09NCMOCGW18	580-15053-7	x	x	x					
09NCMOCGW19	580-15053-8	x	x	x					
09NCMOCGW20	580-15053-9	x	x	x					
Trip Blank	580-15053-10	x	x						
09NCMOCGW21	580-15087-1	x	x	x					
09NCMOCGW22	580-15087-2	x	x	x					
09NCMOCGW23	580-15087-3	x	x	x					FD of 09NCMOCGW21 MS/MSD VOCs, GRO, DRO/RRO
09NCMOCGW24	580-15087-4	x	x	x					
09NCMOCGW25	580-15087-5	x	x	x					
09NCMOCGW26	580-15087-6	x	x	x					
09NCMOCGW27	580-15087-7	x	x	x					
09NCMOCGW28	580-15087-8	x	x	x					
Trip Blank	580-15087-9	x	x						
09NCMOCGW31	580-15185-1	x	x	x					
09NCMOCGW32	580-15185-2	x	x	x					FD of 09NCMOCGW31
09NCMOCGW33	580-15185-3	x	x	x					MS/MSD VOCs, GRO, DRO/RRO
09NCMOCGW34	580-15185-4	x	x	x					
09NCMOCGW35	580-15185-5	x	x	x					
09NCMOCGW36	580-15185-6	x	x	x					
09NCMOCGW37	580-15185-7	x	x	x					
09NCMOCGW38	580-15185-8	x	x	x					
Trip Blank	580-15185-9	x	x						
09NCMOCGW41	580-15437-1	x	x	x			x	x	
09NCMOCGW42	580-15437-2	x	x	x			x	x	
09NCMOCGW43	580-15437-3	x	x	x			x	x	
09NCMOCGW44	580-15437-4	x	x	x			x	x	
09NCMOCGW45	580-15437-5	x	x	x			x	x	
09NCMOCGW46	580-15437-6	x	x	x			x	x	

Field Sample Identification	Laboratory Sample Number	Benzene and Naphthalene (8260B)	GRO (AK101)	DRO/RRO (AK102/AK103)	DRO/(AK102)	Total Organic Carbon (9060)	Metals (As, Cr, Pb) by 6020	Sulfate (300)	Remarks
09NCMOCGW47	580-15437-7	x	x	x			x	x	FD of 09NCMOCGW41 MS/MSD VOCs, GRO, DRO/RRO, Metals, Sulfate
09NCMOCGW48	580-15437-8	x	x	x			x	x	
Trip Blank	580-15437-9	x	x						

FD field duplicate

2.1 SAMPLE RECEIPT CONDITIONS

All samples were received within 0 to 6 degrees Celsius and in good condition.

The following analysis was requested on the COC form, but not provided:

Work Order	Sample No	Lab No.	Analyses
580-14753-1	Trip Blank	580-14753-9	GRO

Samples shipped with this trip blank contained GRO concentrations well above the reporting limit (RL), and the lack of a trip blank will not affect data usability.

The custody form was not signed by the sampler for sample delivery groups (SDGs) 580-14560, 580-15053, 580-15434, or ASG0063; however, the sampler's name was noted on either the COC form or the shipping airbill, and the coolers were shipped with two custody seals. The missing signatures on the COC forms will not affect data usability.

The custody form did not indicate the sampler relinquish date and time for SDG 580-15437. The date indicated on the custody seal was used as the relinquish date. The missing information will not affect data usability.

Many sample bottles included in SDG 15434-1 did not have sample identifications (IDs) on the containers. The laboratory identified the samples using collection time.

Holding times from collection to analysis were evaluated using the following criteria:

Analyte	Method	Matrix	Holding Time
VOCs	SW8260B	Soil	14 days to analysis
GRO	AK101	Soil	28 days to analysis
DRO/RRO	AK102/103	Soil	14 days to extraction, extracts analyzed 40 days after extraction
TOC	SW9060	Soil	28 days to analysis
VOCs	SW8260B	Water	14 days to analysis
GRO	AK101	Water	28 days to analysis
DRO/RRO	AK102/103	Water	14 days to extraction, extracts analyzed 40 days after extraction
Metals	6020	Water	180 days
Sulfate	300.0	Water	28 days to analysis

2.2 BENZENE AND NAPHTHALENE ANALYSIS

TestAmerica analyzed soil and water samples for benzene and naphthalene by method SW-846 8260B. The analytical batches are summarized in Table 3.

Table 3: Benzene and Naphthalene QC Batches

QC Batch	QC Batch Dates
Soil	
580-47755	8-5-09
580-49649	9-3-09
580-50455	9-17-09
Water	
580-48207	8-13-09
580-48286	8-14-09
580-48996	8-25-09
580-49247	8-27-09
580-49349	8-29-09
580-49813	9-8-09
580-50444	9-2-09
580-50043	9-11-09
580-50620	9-21-09
580-50785	9-23-09

Required QC for an analytical batch of up to 20 samples includes an MB, LCS, and MS/MSD pair. An MB and LCS and MS/MSD pair were performed with each batch, though not all MS/MSDs were from project samples as noted below.

SDG 14864 had project samples initially analyzed in batch 48207, which included most samples from this SDG. All QC, including a project MS/MSD, were within acceptance criteria. Samples 09NCMOCGW09, -10 and -11 required dilutions and reanalysis and were analyzed in batch 48286. The samples were reanalyzed within holding times. No MS was performed on project samples in batch 48286, which is a deviation from QSM guidelines. However, LCS spike recoveries were within limits and the data is usable for its purpose of establishing initial concentrations of contaminants before treatment.

SDG 15053 had project samples initially analyzed in batch 48996, which included most samples from this SDG. All QC, including a project MS/MSD, met acceptance criteria. Samples 09NCMOCGW16, -18 and -19 required dilutions and reanalysis, and were analyzed in batch 49247. The samples were reanalyzed within holding times. No MS was performed on project samples in batch 49247, which is a deviation from QSM guidelines. However, LCS spike recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants during treatment.

SDG 15185 had project samples initially analyzed in batch 49813, which included most samples from this SDG. The MS/MSD was performed on sample 09NCMOCGW33, which had naphthalene concentrations greater than 4 times the spike amount. The MSD failed to meet acceptance criteria due to the presence of high target analyte, naphthalene. The benzene recoveries for the MS/MSD met acceptance criteria. All other QC were within method acceptance criteria. No qualification was necessary due to the high concentrations of target analyte in the failed MSD. Samples 09NCMOCGW31 and -32 required dilutions and reanalysis and were analyzed in batch 50043. The samples were reanalyzed outside of holding times as noted below. No matrix spike was performed on project samples in batch 50043, which is a deviation from QSM guidelines. However, LCS and LCSD spike recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants during treatment.

SDG 15437 had project samples initially analyzed in batch 50620, which included most samples from this SDG. All QC, including a project MS/MSD, met acceptance criteria. Samples 09NCMOCGW42, -44, -45, -46, -47 and -48 were reanalyzed in batch 50785 due to required dilutions or sample carryover. No matrix spike was performed on project samples in batch 50785, which is a deviation from QSM guidelines. However, LCS recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants after treatment.

The following items were reviewed and met SAP/method criteria, and were within SAP control limits: MBs, LCS recoveries, and the MS/MSD RPDs.

Headspace was observed in three of the VOC vials for sample 09NCMOCGW08 at sizes ranging from 5 to 14 millimeters (mm). It was assumed that the sample with the smallest air bubble was used for analysis and associated results were qualified as estimated (J). Headspace was also observed in one vial for the following samples:

Sample ID	Air Bubble Size
09NCMOCGW07	14 mm
09NCMOCGW11	6 mm
Trip Blank SDG (580-15053)	4 mm
Trip Blank SDG (580-15185)	7 mm
Trip Blank SDG (580-15437)	6+ mm

It was assumed that vials with no headspace were used for analysis and no further qualifiers were assigned.

Holding times were exceeded for all samples in SDG 580-15084-1 by three to four days due to instrument malfunction. Results were qualified as estimated (QL) and may be associated with a low bias. While there is potential for low bias, the results are still usable for project purposes in determining the presence of naphthalene.

Naphthalene concentrations for the original run for samples 09NCMOCGW21 and 09NCMOCGW22 exceeded the calibration range and were qualified as not preferred (NP) because a reanalysis within the calibration range was available.

Naphthalene results were analyzed six days outside the holding time for samples 09NCMOCGW21, 09NCMOCGW22, 09NCMOCGW25, 09NCMOCGW26, and 09NCMOCGW27. Results reported outside the holding time were qualified as estimated (QL) to indicate a potential low bias. While holding times were exceeded, the results are still usable as estimates.

Naphthalene results were analyzed three days outside the holding time for samples 09NCMOCGW31 and 09NCMOCGW32. Results reported outside the holding time were qualified as estimated (QL) to indicate potential low bias.

Surrogate recoveries were outside control limits as follows:

Sample No.	Surrogate	Recovery	Acceptance Limits
Soil:			
09NCMOCSB05	Trifluorotoluene	64	75-125
09NCMOCSB06	Trifluorotoluene	38	75-125
09NCMOCSB07	Trifluorotoluene	73	75-125
09NCMOCSB08	Trifluorotoluene	188	75-125
09NCMOCSB08	Toluene-d8	189	85-115
09NCMOCSB10	Trifluorotoluene	184	75-125
09NCMOCSB11	Trifluorotoluene	149	75-125
09NCMOCSB12	Trifluorotoluene	186	75-125
09NCMOCSB13	Trifluorotoluene	149	75-125
09NCMOCSB15	Trifluorotoluene	182	75-125
09NCMOCSB15	Toluene-d8	127	85-115
09NCMOCSB16	Trifluorotoluene	66	75-125
09NCMOCSB18	Trifluorotoluene	72	75-125
09NCMOCSB19	Trifluorotoluene	50	75-125
09NCMOCSB19	Toluene-d8	117	85-115
09NCMOCSB20	Trifluorotoluene	56	75-125
09NCMOCSB21	Trifluorotoluene	56	75-125
09NCMOCSB21	Toluene-d8	123	85-115
09NCMOCSB23	Trifluorotoluene	140	75-125
09NCMOCSB24	Trifluorotoluene	137	75-125
09NCMOCSB24	Toluene-d8	138	85-115
09NCMOCSB25	Toluene-d8	123	85-115
09NCMOCSB26	Trifluorotoluene	161	75-125
09NCMOCSB28	Trifluorotoluene	152	75-125
09NCMOCSB28	Toluene-d8	131	85-115
09NCMOCSB31	Trifluorotoluene	139	75-125
09NCMOCSB31	Toluene-d8	123	85-115
09NCMOCSB32	Trifluorotoluene	162	75-125
09NCMOCSB33	Toluene-d8	123	85-115
09NCMOCSB29	Trifluorotoluene	139	75-125
Water:			
09NCMOCGW21	Fluorobenzene	66	80-120
09NCMOCGW21	Trifluorotoluene	818	80-120
09NCMOCGW21	Toluene-d8	830	85-120
09NCMOCGW22	Fluorobenzene	47	80-120
09NCMOCGW22	Trifluorotoluene	637	80-120
09NCMOCGW22	Toluene-d8	896	85-120
09NCMOCGW23	Fluorobenzene	500	80-120
09NCMOCGW23	Toluene-d8	167	85-120
09NCMOCGW24	4-Bromofluorobenzene	123	75-120
09NCMOCGW26	Trifluorotoluene	121	80-120
Trip Blank	Trifluorotoluene	79	80-120

Per Table 5-2 of the SAP, results associated with one or more failed QC criteria, such as a surrogate, are QH or QL qualified to indicate a high or low bias, respectively. Only detected results are qualified when a high bias exists while all results associated with a low bias are qualified. If both high and low surrogate recoveries were observed, all associated results were qualified Q with no indication of bias. For dilutions reported without surrogate recoveries, surrogate results for the original run were used for qualification since the same extract was used and the same bias would exist. Recoveries for surrogates not listed in the SAP were reported for some samples. Since these results were not required by the SAP, they were not reviewed.

MS/MSD recoveries were outside control limits as follows:

Sample No.	Analyte	Recovery	Acceptance Limits
09NCMOCSB11	Benzene	38/42	75-125
09NCMOCSB11	Naphthalene	NE	
09NCMOCSB14	Naphthalene	NE	
09NCMOCGW23	Naphthalene	175/235	55-140
09NCMOCGW33	Naphthalene	NE	

NE – Not evaluated. Sample concentration is >4x spike concentration.

A total of three soil and five water MS/MSDs were collected and analyzed for these parameters. For both matrixes, the majority of spiked samples were in control and qualification was limited to the spiked samples. Benzene results for sample 09NCMOCSB11 and naphthalene results for sample 09NCMOCGW23 were M qualified to indicate a matrix effect was present.

2.3 GRO ANALYSES

TestAmerica analyzed soil and water samples for GRO by ADEC method AK101. The sample analytical batches are summarized in Table 4.

Table 4: GRO QC Batches

QC Batch	QC Batch Date
Soil	
580-47721	8-5-09
580-49121	8-26-09
580-50596	9-21-09
Water	
580-48257	8-13-09
580-49058	8-25-09
580-49452	8-31-09
580-49163	8-26-09
580-49452	9-1-09
580-50606	9-21-09

Required QC for an analytical batch of up to 20 samples includes an MB, LCS, and MS/MSD pair. An MB, LCS, and MS/MSD pair were performed with each batch.

The following items were reviewed and met SAP/method criteria and were within SAP control limits: LCS recoveries, MS/MSD recoveries, and RPDs.

The holding time was exceeded for the following sample:

Sample ID	Lab No.	Days Outside Hold Time
Trip Blank	580-15053	1

Results were qualified as estimated (QL) and may be associated with a low bias.

GRO was detected in the MB at a concentration greater than the MDL, but less than 1/2 the RL as follows:

Batch No.	Units	Concentration	Comments
580-47721	mg/kg	0.64	Associated sample concentrations> RL

Qualification was not required.

Surrogate recoveries were outside SAP control limits as follows:

Sample No.	Surrogate	Recovery	Acceptance Limits
09NCMOCSB06	Trifluorotoluene	45	50-150
09NCMOCSB08	Trifluorotoluene	262	50-150
09NCMOCSB08	4-Bromofluorobenzene	289	50-150
09NCMOCSB10	Trifluorotoluene	344	50-150
09NCMOCSB11	Trifluorotoluene	198	50-150
09NCMOCSB11	4-Bromofluorobenzene	245	50-150
09NCMOCSB12	Trifluorotoluene	233	50-150
09NCMOCSB12	4-Bromofluorobenzene	155	50-150
09NCMOCSB13	Trifluorotoluene	171	50-150
09NCMOCSB13	4-Bromofluorobenzene	271	50-150
09NCMOCSB15	Trifluorotoluene	169	50-150
09NCMOCSB15	4-Bromofluorobenzene	284	50-150
09NCMOCSB16	4-Bromofluorobenzene	297	50-150
09NCMOCSB18	4-Bromofluorobenzene	1090	50-150
09NCMOCSB19	4-Bromofluorobenzene	243	50-150
09NCMOCSB21	Trifluorotoluene	184	50-150
09NCMOCSB21	4-Bromofluorobenzene	471	50-150
09NCMOCSB22	Trifluorotoluene	168	50-150
09NCMOCSB22	4-Bromofluorobenzene	196	50-150
09NCMOCSB23	Trifluorotoluene	189	50-150
09NCMOCSB24	Trifluorotoluene	184	50-150
09NCMOCSB24	4-Bromofluorobenzene	1790	50-150
09NCMOCSB25	Trifluorotoluene	226	50-150
09NCMOCSB25	4-Bromofluorobenzene	384	50-150
09NCMOCSB26	Trifluorotoluene	235	50-150
09NCMOCSB26	4-Bromofluorobenzene	235	50-150
09NCMOCSB28	Trifluorotoluene	225	50-150
09NCMOCSB28	4-Bromofluorobenzene	289	50-150
09NCMOCSB31	Trifluorotoluene	224	50-150
09NCMOCSB31	4-Bromofluorobenzene	256	50-150
09NCMOCSB32	Trifluorotoluene	275	50-150
09NCMOCSB33	Trifluorotoluene	200	50-150
09NCMOCSB33	4-Bromofluorobenzene	222	50-150
09NCMOCSB34	Trifluorotoluene	158	50-150
09NCMOCSB34	4-Bromofluorobenzene	145	50-150
09NCMOCSB29	Trifluorotoluene	193	50-150

09NCMOCSB29	4-Bromofluorobenzene	212	50-150
Water:			
09NCMOCGW22	4-Bromofluorobenzene	154	50-150
09NCMOCGW32	4-Bromofluorobenzene	152	50-150
09NCMOCGW42	4-Bromofluorobenzene	165	50-150
09NCMOCGW43	4-Bromofluorobenzene	157	50-150

Detected results associated with high recoveries were qualified QH to indicate that one or more QC criteria failed, with a high bias. All results associated with low recoveries were qualified QL to indicate that one or more QC criteria failed, with a low bias. Only one sample had a low surrogate recovery with the remainder exceeding surrogate recovery limits. Matrix interference is suspected in both cases. Sample results are usable as estimates for ISCO study purposes, though the accuracy of the results is questionable.

MS/MSD GRO recoveries were outside control limits for sample 09NCMOCSB11. The sample GRO concentration was greater than four times the spike concentration, and evaluation of recoveries is not required. No qualifiers were assigned.

2.4 DRO/RRO ANALYSES

TestAmerica analyzed the soil and water samples for DRO/RRO by ADEC method AK102/103. QC batches are summarized in Table 5.

Table 5: DRO/RRO QC Batches

QC Batch	QC Batch Date
Soil	
580-46874 (DRO only)	7-22-09
580-47734	8-5-09
580-49119	8-26-09
580-50657	9-22-09
Water	
9070075	7-26-09
580-48117	8-11-09
580-48999	8-24-09
580-50480	9-18-09
580-49270	8-27-09
580-49666	9-3-09
580-50656	9-22-09

Required QC for a batch of up to 20 samples includes an MB, LCS/LCSD, and MS/MSD pair. An MB and LCS/LCSD were analyzed with each batch. An MS/MSD was included in the majority of batches, and the SAP-required frequency was met.

The following items were reviewed and met SAP/method criteria, and were within SAP control limits: MS/MSD RPDs. MS/MSDs were not analyzed in batches 9070075, 46874, and 50480 due to insufficient sample quantities or because MS/MSD was not specified on the CoC form. The LCS/LCSD recoveries and RPDs met control limits.

Insufficient preservation was used for sample 09NCMOCGW09 (one 1-liter amber). The hydrogen ion concentration was adjusted at the laboratory prior to preparation using hydrochloric acid. A QL qualifier was assigned to the DRO and RRO results to indicate potential low bias.

Several samples in SDG 580-15053 were re-extracted between 19 and 23 days outside the holding time because the LCS for the original sample set was outside control limits. The holding time to extraction was exceeded by >2x the hold time. The LCS control limit exceedance was considered to be less of an impact on data quality, and the original results should be reported. Results for the re-extraction are qualified as NP.

Surrogate recoveries were outside SAP control limits as follows:

Sample No.	Surrogate	Recovery	Acceptance Limits
09NCMOCSB06	n-Triacontane-d62	189	50-150
09NCMOCSB09	n-Triacontane-d62	151	50-150
09NCMOCSB11	n-Triacontane-d62	189	50-150
09NCMOCSB12	n-Triacontane-d62	179	50-150
09NCMOCSB24	n-Triacontane-d62	156	50-150
09NCMOCGW04	n-Triacontane-d62	866	50-150
09NCMOCGW04	o-Terphenyl	821	50-150
09NCMOCGW12	n-Triacontane-d62	159	50-150

Detected results associated with high recoveries were qualified QH to indicate that one or more QC criteria failed, with a high bias. The RRO result for sample 09NCMOCGW12 was also associated with a high LCS/LSCD RPD (discussed below with SDG 580-15053); the final RRO qualifier for this sample, with the combined QC outliers, is a Q with an unknown bias.

Surrogates were diluted out in the analysis of the following samples:

Soil:	Dilution Factor	Water:	
09NCMOCSB02	50	09NCMOCGW04	10
09NCMOCSB04	50	09NCMOCGW05	10
09NCMOCSB07	50	09NCMOCGW06	10
09NCMOCSB08	50	09NCMOCGW07	10
09NCMOCSB10	50	09NCMOCGW08	10
09NCMOCSB13	10	09NCMOCGW09	10
09NCMOCSB15	50	09NCMOCGW10	10
09NCMOCSB16	50	09NCMOCGW15	10
09NCMOCSB18	50	09NCMOCGW16	10
09NCMOCSB19	50	09NCMOCGW20	10
09NCMOCSB21	50	09NCMOCGW21	10
09NCMOCSB22	50	09NCMOCGW22	10
09NCMOCSB25	100	09NCMOCGW23	10
09NCMOCSB26	50	09NCMOCGW24	10
09NCMOCSB28	100	09NCMOCGW25	10
09NCMOCSB31	100	09NCMOCGW26	10
09NCMOCSB33	100	09NCMOCGW27	10
09NCMOCSB29	100	09NCMOCGW28	10
		09NCMOCGW31	10
		09NCMOCGW32	10
		09NCMOCGW33	10
		09NCMOCGW34	10
		09NCMOCGW35	10
		09NCMOCGW36	10
		09NCMOCGW37	10
		09NCMOCGW38	10

Recoveries could not be evaluated. No qualifiers were required.

An alternate surrogate from that specified in the SAP was used for samples analyzed at the TestAmerica-Anchorage laboratory. The surrogate 1-Chlorooctadecane was used. Recoveries were with laboratory control limits of 50 to 150 percent (%), and no data qualifiers were assigned.

DRO/RRO were detected in the MB at a concentration greater than the MDL, but less than 1/2 the RL as follows:

Batch No.	Analyte	Units	Concentration
580-46874	DRO	mg/kg	4.8
580-50657	DRO	mg/kg	6.17
580-49666	DRO	mg/L	0.0342
580-49666	RRO	mg/L	0.0385

DRO and RRO concentrations in associated samples were greater than the RL and greater than 10 times the concentration detected in the method blank, thus qualification was not required.

LCS recoveries were outside control limits as follows:

Batch No.	Analyte	Recovery (%)	Acceptance Limits
48117/SDG 14864	RRO	121/132	60-120 (lab limit, none in SAP)
48999/SDG15053	DRO	-/66; RPD 34	75-125; RPD <20
48999/SDG15053	RRO	RPD 45	20
49666/SDG15185	DRO	RPD 38	20
49666/SDG15185	RRO	RPD 27	20

Qualifiers were assigned as follows:

- Batch 48117: All detected RRO results for samples included in this batch were QH qualified due to the high bias.
- Batch 48999: All DRO results for samples included in this batch were detected and QL qualified due to the low bias.
- Batch 48999: All detected RRO results for samples included in this batch were qualified with a Q to indicate one or more QC criteria failed with an unknown bias.
- Batch 49666: All detected DRO/RRO results for samples included in this batch were qualified with a Q to indicate one or more QC criteria failed with an unknown bias.

MS/MSD recoveries were outside control limits as follows:

Sample No.	Analyte	Recovery	Acceptance Limits
09NCMOCSB11	DRO/RRO	NE	
09NCMOCSB14	DRO	-74/1	75-125
09NCMOCSB14	RRO	NE	
09NCMOCSB32	DRO	NE	
09NCMOCSB32	RRO	148/289; RPD 42	60-120; RPD <21
09NCMOCGW06	DRO	NE	
09NCMOCGW06	RRO	190/-	60-120 (lab limit, none in SAP)
09NCMOCGW16	DRO/RRO	NE	
09NCMOCGW23	DRO/RRO	NE	
09NCMOCGW33	DRO	NE	
09NCMOCGW33	RRO	121/46	53-118 (lab limit, none in SAP)
09NCMOCGW47	RRO	119/-	53-118 (lab limit, none in SAP)

NE = Not evaluated. Sample concentration is >4x spike concentration.
-	Within control limits

A total of three soil and five water MS/MSDs were collected and analyzed for these parameters.

For soils, the one DRO MS/MSD outside control limits had a sample concentration 3.6 times the spike concentration, and the one RRO MS/MSD outside control limits had a sample concentration 1.5 times the spike concentration. No qualifiers were assigned to the DRO result due to the high analyte concentration. The RRO result for sample 09NCMOCSB32 was M qualified to indicate a matrix effect was present. No other qualifiers were assigned since the majority of MS/MSD results were either in control, or the sample concentration was too high for evaluation.

For waters, the matrix was considered to be changing during the course of the pilot study investigation (day 3, day 7, day 14, etc.), so qualification was limited to the single data sets collected at the same time frame. For samples 09NCMOCGW06 and 09NCMOCGW47, the RRO result for the spiked sample only were M qualified to indicate a matrix effect was present. Other RRO results in the data set were not qualified because the MSD recovery and MS/MSD RPD were within control limits. Both the MS and MSD recoveries for sample 09NCMOCGW33 were outside of control limits and all

RRO results collected with this sample (SDG 580-15185-1) were M qualified to indicate a matrix effect was present. Since both high and low exceedances were observed, bias is unknown.

2.5 METALS ANALYSES (ARSENIC, CHROMIUM, AND LEAD)

TestAmerica analyzed water samples for the metals by SW-846 method 6020. QC batches are summarized in Table 6.

Table 6: Metals QC Batches

QC Batch	QC Batch Date
Water	
580-49209	8/27/09
580-50906	9-25-09

Required QC for a batch of up to 20 samples includes an MB, LCS, and MS/MSD pair. An MB, MS/MSD, and LCS were analyzed per batch.

The following items were reviewed and met SAP criteria, and were within laboratory control limits: MS/MSD recoveries and RPDs, and LCS recoveries.

The laboratory included laboratory duplicate results in the analytical data package. Laboratory duplicates were not required by the SAP with precision being reported through MS/MSD pair RPDs and field duplicate RPDs. Laboratory duplicate results were not reviewed.

Chromium was detected in the MB at a concentration greater than the MDL, but less than the RL as follows:

Batch No.	Analyte	Units	Concentration	MDL	RL
580-49209	Chromium	mg/L	0.0018	0.00037	0.002
580-50906	Arsenic mg/L		0.0013	0.00024	0.002

Associated results were detected at concentrations >RL, but less than ten times the concentration in the method blank; sample results were B flagged with a potential high bias. The results were used as a measurement of treatment effectiveness and are usable for that purpose with qualification. The affected samples are listed in Section 2.9.

2.6 TOTAL ORGANIC CARBON ANALYSES

TestAmerica analyzed soil samples for TOC by SW-846 method 9060. Laboratories used and QC batches are summarized in Table 7.

Table 7: Total Organic Carbon QC Batches

Lab	QC Batch	QC Batch Date
Soil:		
TestAmerica-West Sacramento	9219575	8-9-09
TestAmerica-Tacoma	580-50534	9-18-09
TestAmerica-Tacoma	580-50639	9-21-09
TestAmerica-Tacoma	580-50865	9-24-09
TestAmerica-Tacoma	580-50999	9-25-09

Required QC for a batch of up to 20 samples includes an MB and a laboratory duplicate. An MB, LCS, and MS/MSD pair were analyzed per batch, with the exception of batch 580-50865. The method QC requirement was met for all other batches. Samples submitted under SDG 580-15434 included an MS/MSD pair, but they were extracted in two separate batches, 580-50865 and 580-50999, on successive days. The MS/MSD submitted with SDG 580-15434 was analyzed in batch 580-50999. The MS/MSD recoveries for batch 580-50999 are further described below. The LCS in batch 580-50865 met acceptance limits. Batch precision could not be evaluated for project samples in batch 580-50865. Sample results from SDG 580-15434 were used to determine the effectiveness of the ISCO treatment and results are usable for that purpose. Sample 09NCMOCSB31 was M qualified due to out-of-control recoveries. Soil matrix heterogeneity at the site may have impacted the accuracy and precision of the sample.

SDG 580-14753 had the TOC analyses of twelve samples subcontracted to TestAmerica-West Sacramento for analyses. All results from this SDG were reported without qualification. All other TOC analyses were performed by TestAmerica-Tacoma.

The following items were reviewed and met SAP criteria and were within laboratory control limits: MB and LCS recoveries.

Holding times were exceeded for all samples analyzed for TOC in SDG 580-15084 by two to five days due to instrument failure. Results were detected and were qualified as estimated (QL). Results may be associated with a low bias.

MS/MSD recoveries were outside control limits as follows:

Sample No.	Analyte	Recovery	Acceptance Limits
09NCMOCSB31	TOC	147/-	76-128
09NCMOCSB31	TOC	RPD 32	<28

A total of four MS/MSD pairs were analyzed, and results for three of the four were in control. Sample 09NCMOCSB31 was M qualified to indicate a matrix effect was present.

2.7 SULFATE

TestAmerica analyzed water samples for sulfate by EPA Method 300.0. QC batches are summarized in Table 8.

Table 8: Sulfate QC Batches

QC Batch	QC Batch Date
Water	
580-48614	8-14-09
580-49693	9-2-09
580-51063	9-28-09

Required QC for a batch of up to 20 samples includes an MB and LCS, an MB and LCS/LCSD, and MS/MSD. Samples from SDG 14864 were initially analyzed on 8-14-09 in QC batch 580-48614. Samples 09NCMOCGW04 and -05 exceeded the calibration range and were diluted and reanalyzed on 9-2-09 in QC batch 49693. Sample 09NCMOCGW06, which was also the MS/MSD sample in batch 580-580-48614, was used as the batch duplicate for 49693 and it met acceptance criteria for duplicate precision. All QC met acceptance criteria in both batches. Sample results are accepted without qualification for QC other than holding times for the out-of-range samples that required reanalysis at a dilution. The diluted sample results are qualified QL due to low potential bias from holding time exceedence.

The following items were reviewed and met SAP criteria, and were within laboratory control limits: MB, and LCS/LCSD recoveries and RPDs.

Sulfate concentrations for samples 09NCMOCGW04 and 09NCMOCGW05 exceeded the calibration range. These results were reanalyzed one day outside hold time. Original results were qualified as NP and the second set of results should be reported. Results analyzed outside the hold time were qualified as estimated (QL) and may be associated with a low bias.

MS/MSD recoveries for sulfate were outside control limits for sample 09NCMOCGW47. The sample concentration was greater than four times the spike concentration, and evaluation of MS/MSD recoveries is not required. No data qualifiers were assigned.

2.8 FIELD QA/QC

Field QC samples included field duplicate pairs and MS/MSD pairs. The same methods used to analyze the investigative samples were used to analyze the field QC samples.

2.8.1 Field Sample Duplicates

Comparison of field sample duplicate results to the associated parent sample results provides precision information for the overall sample collection and analytical process, including possible variability related to sample collection, handling, shipping, storage, preparation, and analysis. The RPD between the primary (parent) sample and field duplicate sample also accounts for the variation of target analyte concentrations within a matrix. This variability is assessed by evaluating the calculated RPDs between the field duplicates and the associated parent samples. In cases where a target analyte was not detected above the RL in both the field duplicate and parent sample, an RPD would not be valid, and therefore was not calculated. The RPD assessment criterion for the MS/MSD RPD provided in the SAP was used to evaluate the field duplicates.

2.8.1.1 FIELD DUPLICATE FREQUENCIES

Field sample duplicate pairs are required by the SAP at a rate of 10%. Field duplicates were collected for each method and matrix at the following frequencies:

- Three field duplicate pairs were collected for the soil matrix and submitted to the laboratory for analysis for benzene, naphthalene, GRO, RRO, and TOC, at a frequency of 12%.
- Three field duplicate pairs were collected for the soil matrix and submitted to the laboratory for analysis for DRO, at a frequency of 10%.
- Five field duplicate pairs were collected for the water matrix and submitted to the laboratory for analysis for benzene, naphthalene, GRO, and RRO, at a frequency of 14%.
- Five field duplicate pairs were collected for the water matrix and submitted to the laboratory for analysis for DRO, at a frequency of 13%.
- Two field duplicate pairs were collected for the water matrix and submitted to the laboratory for analysis for arsenic, chromium, lead, and sulfate, at a frequency of 14%.

2.8.1.2 FIELD DUPLICATE RPDS

Table 9 lists the RPDs calculated between field duplicate and parent sample results for target analytes that were detected above the RL in both the parent and field duplicate sample.

Table 9: Field Sample Duplicate Pair Results

Parent Sample ID (Laboratory Sample ID)	Field Duplicate Sample ID (Laboratory Sample ID)	Compound	Units	Parent Field Sample	Field Duplicate	RPD (%)
Soil:						
09NCMOCSB11 (580-14753-7)	09NCMOCSB12 (580-14753-8)	Benzene	µg/kg	4300	1100	**119**
		Naphthalene	µg/kg	270000	48000	**140**
		GRO	mg/kg	1600	350	**128**
		DRO	mg/kg	6500	910	**151**
		RRO	mg/kg	5300	5300	0
		Total Organic Carbon	mg/kg	261000	238000	9
09NCMOCSB18 (580-15084-6)	09NCMOCSB21 (580-15084-9)	Benzene	µg/kg	490	1300	**91**
		Naphthalene	µg/kg	190000	460000	**83**
		GRO	mg/kg	1000	5900	**142**
		DRO	mg/kg	77000	95000	21
		RRO	mg/kg	7600	9900	26
		Total Organic Carbon	mg/kg	150000	150000	0
09NCMOCSB26 (580-15434-2)	09NCMOCSB31 (580-15434-5)	Benzene	µg/kg	1400	2000	**35**
		Naphthalene	µg/kg	270000	280000	4
		GRO	mg/kg	1900	2000	5
		DRO	mg/kg	170000	150000	13
		RRO	mg/kg	7600	8100	6
		Total Organic Carbon	mg/kg	200000	200000	0
Water:						
09NCMOCGW09 (580-14864-6)	09NCMOCGW10 (580-14864-7)	Benzene	µg/L	72	74	3
		Naphthalene	µg/L	380	330	14
		GRO	mg/L	2.6	2.4	8
		DRO	mg/L	24	20	18
		RRO	mg/L	2.3	2.0	14
		Arsenic	mg/L	0.0052	0.0036	**36**
		Chromium	mg/L	0.016	0.012	**29**
		Lead	mg/L	0.013	0.01	**26**
		Sulfate	mg/L	25	27	8
09NCMOCGW12 (580-15053-1)	09NCMOCGW13 (580-15053-2)	Benzene	µg/L	69	70	1
		Naphthalene	µg/L	120	88	**31**
		GRO	mg/L	39	29	29
		DRO	mg/L	11	13	17
		RRO	mg/L	1.3	1.0	26
09NCMOCGW21 (580-15087-1)	09NCMOCGW23 (580-15087-3)	Benzene	µg/L	4.8	3.0	**46**
		Naphthalene	µg/L	78	50	**44**
		GRO	mg/L	0.81	0.70	15
		DRO	mg/L	20	24	18
		RRO	mg/L	1.8	2.7	**40**
09NCMOCGW31 (580-15185-1)	09NCMOCGW32 (580-15185-2)	Benzene	µg/L	71	71	0
		Naphthalene	µg/L	290	290	0

Parent Sample ID (Laboratory Sample ID)	Field Duplicate Sample ID (Laboratory Sample ID)	Compound	Units	Parent Field Sample	Field Duplicate	RPD (%)
		GRO	mg/L	2.5	2.8	11
		DRO	mg/L	20	28	**33**
		RRO	mg/L	1.7	1.8	6
09NCMOCGW41 (580-15437-1)	09NCMOCGW47 (580-15437-7)	Benzene	µg/L	32	32	0
		Naphthalene	µg/L	2.9	3.7	24
		GRO	mg/L	1.5	1.5	0
		DRO	mg/L	9.8	11	12
		RRO	mg/L	0.92	1.2	26
		Arsenic	mg/L	0.0034	0.0036	6
		Chromium	mg/L	0.0054	0.0057	5
		Lead	mg/L	0.0003	0.00028	7
		Sulfate	mg/L	3100	4800	**43**

Note: **Bold** exceeds MS/MSD RPD criteria in SAP; MS/MSD criteria is being used as blind duplicate precision
ID = identification

RPDs which exceed SAP criteria are shown in bold font in Table 9.

For soil samples, the RPD exceeds the SAP MS/MSD RPD criteria for benzene for all duplicate pairs. Because of the observed imprecision, all detected benzene results for soil samples were qualified J.

For soil samples, the RPD exceeds the SAP MS/MSD RPD criteria for naphthalene, GRO, and DRO, for two of the three duplicate pairs. These duplicate pairs are representative of pretreatment conditions (09NCMOCSB11) and day 7 conditions (09NCMOCSB18). All detected pretreatment and day 7 samples for naphthalene, GRO, and DRO, were qualified J (SDGs 580-14753 and 580-15084).

For soil samples, the RPD exceeds the SAP MS/MSD RPD criteria for RRO for one of the three duplicate pairs. This duplicate pair is representative of day 7 conditions. Because of the observed imprecision, all detected RRO results for day 7 soil samples were qualified J (SDG 580-15084).

For water samples, the RPD exceeds the SAP MS/MSD RPD criteria for the following sample sets:

Parent Sample	SDG	Description	Analyte
09NCMOCGW09	580-14864	Pre-treatment	Arsenic Chromium Lead
09NCMOCGW12	580-15053	Day 3	Naphthalene
09NCMOCGW21	580-15087	Day 7	Benzene Naphthalene RRO
09NCMOCGW31	580-15185	Day 14	DRO
09NCMOCGW41	580-15437	Day 28	Sulfate

All detected results for the affected analyte were qualified J in the associated SDG, which contains samples collected under the same set of conditions as the duplicate pair.

2.8.2 Matrix Spikes and Matrix Spike Duplicates

The MS/MSD samples are spiked in the laboratory with known concentrations of target analytes. The MS/MSD sample results provide information on possible matrix effects encountered during sample extraction, digestion, and analysis. Analytical results from MS/MSD samples are used to evaluate the sample matrix, method efficiency and applicability, accuracy, and precision. Accuracy was assessed by calculating the percent recovery of the target analytes added to the primary sample; precision was assessed by calculating the RPD for the MS/MSD sample pairs.

MS/MSD sample pairs are required by the SAP at a rate of one MS/MSD pair per 20 samples per matrix. MS/MSD sample pairs were collected at the following frequencies:

- Three MS/MSD pairs from the soil matrix were analyzed by the laboratory for benzene, naphthalene, GRO, and RRO at a frequency of 12%.
- Three MS/MSD pairs from the soil matrix were analyzed by the laboratory for DRO at a frequency of 10%. Four MS/MSD pairs from the soil matrix were analyzed by the laboratory for TOC at a frequency of 15%.
- Five MS/MSD pairs from the water matrix were analyzed by the laboratory for benzene, naphthalene, GRO, and RRO at a frequency of 14%.
- Five MS/MSD pairs were collected for the water matrix and submitted to the laboratory for analysis for DRO, at a frequency of 13%.
- Two MS/MSD pairs from the water matrix were analyzed by the laboratory for sulfate and metals at a frequency of 14%.

MS and MSD recoveries and RPDs are discussed in Sections 2.2 through 2.7. Some extraction batches did not include project MS/MSD samples, which is a deviation from the QSM. The failure to include the MS/MSD in the batches, including the impact to data quality, is also addressed in sections 2.2 through 2.7 under the individual analyses,

2.8.3 Trip Blanks

Aqueous and soil trip blanks are included in shipments containing surface or ground water samples which are submitted to the laboratory for VOC and GRO analyses. Trip blanks are collected to assess the potential for VOC cross-contamination introduced by sample bottles or during sample handling during field operations, shipping, or storage at the laboratory.

GRO was detected in the trip blank at a concentration greater than the MDL, but less than half of the RL with soil samples shipped on 21 August in SDG 15084. GRO was reported at less than ten times the trip blank result in sample 09NCMOCSB23. The sample result is B flagged to indicate trip blank contamination.

Benzene was detected in the trip blank at a concentration greater than the MDL, but less than 1/2 the RL in water samples shipped on 21 August 2009 in SDG 15087. Benzene was analyzed at a 10X dilution due to previous foaming problems. After accounting for the dilution factor, benzene was detected at concentrations < RL in sample 09NCMOCGW26. Benzene results in this sample are UB qualified to indicate they are indistinguishable from the trip blank contamination.

Naphthalene was detected in the trip blank at a concentration greater than the MDL (0.95 µg/L), but less than the RL with water samples shipped on 12 September 2009 in SDG 15437. Naphthalene was detected at concentrations less than ten times the reported trip blank result in samples 09NCMOCGW41, -GW44, and-GW47 Affected samples were B flagged to indicate trip blank contamination.

GRO was detected in the trip blank at a concentration greater than the MDL, but less than the RL with soil samples shipped on 12 September 2009 in SDG 15434. GRO was detected at concentrations greater than the RL in all associated samples, except samples 09NCMOSB27 and –SB32. The GRO results for these samples are UB qualified to indicate they are indistinguishable from the trip blank contamination.

2.9 SAMPLE QUALIFIERS

Sample qualifiers are presented in Table 10.

Table 10: Sample Qualifiers

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
09NCMOCSB05	580-14753-1	Benzene	Low surrogate recovery	QL	Low
09NCMOCSB06	580-14753-2	Naphthalene			
09NCMOCSB07	580-14753-3				
09NCMOCSB16	580-15084-4				
09NCMOCSB18	580-15084-6				
09NCMOCSB20	580-15084-8				
Trip Blank	580-15087-9				
09NCMOCSB08	580-14753-4	Benzene	High surrogate recovery	QH	High
09NCMOCSB10	580-14753-6	Naphthalene			
09NCMOCSB11	580-14753-7				
09NCMOCSB12	580-14753-8				
09NCMOCSB13	580-15084-1				
09NCMOCSB15	580-15084-3				
09NCMOCSB23	580-15084-11				
09NCMOCSB24	580-15084-12				
09NCMOCSB25	580-15434-1				
09NCMOCSB26	580-15434-2				
09NCMOCSB28	580-15434-4				
09NCMOCSB31	580-15434-5				
09NCMOCSB32	580-15434-6				
09NCMOCSB33	580-15434-7				
09NCMOCSB29	580-15434-9				
09NCMOCGW23	580-15087-3				
09NCMOCGW24	580-15087-4				
09NCMOCGW26	580-15087-6				
09NCMOCSB19	580-15084-7	Benzene	High and low surrogate recoveries	Q	Unknown
09NCMOCSB21	580-15084-9	Naphthalene			
09NCMOCGW21	580-15087-1				
09NCMOCGW22	580-15087-2				

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
09NCMOCSB13 09NCMOCSB14 09NCMOCSB15 09NCMOCSB16 09NCMOCSB17 09NCMOCSB18 09NCMOCSB19 09NCMOCSB20 09NCMOCSB21 09NCMOCSB22 09NCMOCSB23 09NCMOCSB24 Trip Blank	580-15084-1 580-15084-2 580-15084-3 580-15084-4 580-15084-5 580-15084-6 580-15084-7 580-15084-8 580-15084-9 580-15084-10 580-15084-11 580-15084-12 580-15084-13	Benzene Naphthalene	Holding time exceedence	J/UJ	Low
09NCMOCGW08	580-14864-5	Benzene Naphthalene	Headspace in sample vials	J	Low
09NCMOCGW21 09NCMOCGW22 (Batch 49349)	580-15087-1 580-15087-2	Naphthalene	Exceeds calibration range	NP	N/A
09NCMOCGW21 09NCMOCGW22 09NCMOCGW25 09NCMOCGW26 09NCMOCGW27 (Batch 49813)	580-15087-1 580-15087-2 580-15087-5 580-15087-6 580-15087-7	Naphthalene	Holding time exceedence	QL	Low
09NCMOCGW31 09NCMOCGW32	580-15185-1 580-15185-2	Naphthalene	Holding time exceedence	QL	Low
09NCMOCSB11	580-14753-7	Benzene	Low MS/MSD recovery	M	Low
09NCMOCGW23	580-15087-3	Naphthalene	High MS/MSD recovery	M	High
09NCMOCGW41 09NCMOCGW44 09NCMOCGW47	58015437	Napthalene	Trip blank contamination	B	High
09NCMOCSB26	580-15087-6	Benzene	Trip blank contamination	UB	High
Trip Blank	580-15053-10	GRO	Holding time exceedence	QL	Low
09NCMOCSB06	580-14753-2	GRO	Low surrogate recovery	QL	Low

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
09NCMOCSB08	580-14753-4	GRO	High surrogate recovery	QH	High
09NCMOCSB10	580-14753-6				
09NCMOCSB11	580-14753-7				
09NCMOCSB12	580-14753-8				
09NCMOCSB13	580-15084-1				
09NCMOCSB15	580-15084-3				
09NCMOCSB16	580-15084-4				
09NCMOCSB18	580-15084-6				
09NCMOCSB19	580-15084-7				
09NCMOCSB21	580-15084-9				
09NCMOCSB22	580-15084-10				
09NCMOCSB23	580-15084-11				
09NCMOCSB24	580-15084-12				
09NCMOCSB25	580-15434-1				
09NCMOCSB26	580-15434-2				
09NCMOCSB28	580-15434-4				
09NCMOCSB31	580-15434-5				
09NCMOCSB32	580-15434-6				
09NCMOCSB33	580-15434-7				
09NCMOCSB34	580-15434-8				
09NCMOCSB29	580-15434-9				
09NCMOCGW22	580-15087-2				
09NCMOCGW32	580-15185-2				
09NCMOCGW42	580-15437-2				
09NCMOCGW43	580-15437-3				
09NCMOCSB23	580-15084-11	GRO	Trip blank contamination	UB	High
09NCMOCSB27	580-15434-3				
09NCMOCSB32	580-15434-8				
09NCMOCSB06	580-14753-2	DRO/RRO	High surrogate recovery	QH	High
09NCMOCSB09	580-14753-5				
09NCMOCSB11	580-14753-7				
09NCMOCSB12	580-14753-8				
09NCMOCSB24	580-15084-12				
09NCMOCGW04	580-14864-8				
09NCMOCGW09	580-14864-6	DRO/RRO	Insufficient preservation	QL	Low
09NCMOCGW12	580-15053-1	DRO	High surrogate recovery; low LCSD recovery	J	Unknown
09NCMOCSB02	580-14560-2	DRO	No surrogate reported due to sample dilution	X	Unknown
09NCMOCSB04	580-14560-4				
09NCMOCSB07	580-14753-3				
09NCMOCSB08	580-14753-4				
09NCMOCSB09	580-14753-5				
09NCMOCSB10	580-14753-6				
09NCMOCSB11	580-14753-7				

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
09NCMOCSB01 09NCMOCSB02 09NCMOCSB03 09NCMOCSB04	580-14560-1 580-14560-2 580-14560-3 580-14560-4	DRO	Contamination reported in the method blank	B	High
09NCMOCGW12	580-15053-1	RRO	High surrogate recovery; high RPD between LCS and LCSD	Q	Unknown
09NCMOCGW04 09NCMOCGW05 09NCMOCGW06 09NCMOCGW07 09NCMOCGW08 09NCMOCGW09 09NCMOCGW10 09NCMOCGW11	580-14864-1 580-14864-2 580-14864-3 580-14864-4 580-14864-5 580-14864-6 580-14864-7 580-14864-8	RRO	High LCS/LCSD recovery	QH	High
09NCMOCGW13 09NCMOCGW14 09NCMOCGW15 09NCMOCGW16 09NCMOCGW17 09NCMOCGW18 09NCMOCGW19 09NCMOCGW20	580-15053-2 580-15053-3 580-15053-4 580-15053-5 580-15053-6 580-15053-7 580-15053-8 580-15053-9	DRO	Low LCSD recovery	QL	Low
09NCMOCGW13 09NCMOCGW14 09NCMOCGW15 09NCMOCGW16 09NCMOCGW17 09NCMOCGW18 09NCMOCGW19 09NCMOCGW20	580-15053-2 580-15053-3 580-15053-4 580-15053-5 580-15053-6 580-15053-7 580-15053-8 580-15053-9	RRO	High RPD between LCS and LCSD	Q	Unknown
09NCMOCSB32	580-15434-6	RRO	High MS/MSD recoveries	M	High
09NCMOCGW06 09NCMOCGW47	580-14864-3 580-15437-7	RRO	High MS recovery	M	High
09NCMOCGW31 09NCMOCGW32 09NCMOCGW33 09NCMOCGW34 09NCMOCGW35 09NCMOCGW36 09NCMOCGW37 09NCMOCGW38	580-15185-1 580-15185-2 580-15185-3 580-15185-4 580-15185-5 580-15185-6 580-15185-7 580-15185-8	RRO	High MS and low MSD recovery	M	Unknown

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
09NCMOCGW31 09NCMOCGW32 09NCMOCGW33 09NCMOCGW34 09NCMOCGW35 09NCMOCGW36 09NCMOCGW37 09NCMOCGW38	580-15185-1 580-15185-2 580-15185-3 580-15185-4 580-15185-5 580-15185-6 580-15185-7 580-15185-8	DRO/RRO	High RPD between LCS and LCSD	Q	Unknown
09NCMOCGW13 09NCMOCGW14 09NCMOCGW15 09NCMOCGW16 09NCMOCGW17 09NCMOCGW18 09NCMOCGW19 09NCMOCGW20 (Batch 508-50480)	580-15053-2 580-15053-3 580-15053-4 580-15053-5 580-15053-6 580-15053-7 580-15053-8 580-15053-9	DRO/RRO	Hold time exceedence for re-extraction	NP	Low
09NCMOCSB13 09NCMOCSB14 09NCMOCSB15 09NCMOCSB16 09NCMOCSB17 09NCMOCSB18 09NCMOCSB19 09NCMOCSB20 09NCMOCSB21 09NCMOCSB22 09NCMOCSB23 09NCMOCSB24	580-15084-1 580-15084-2 580-15084-3 580-15084-4 580-15084-5 580-15084-6 580-15084-7 580-15084-8 580-15084-9 580-15084-10 580-15084-11 580-15084-12	Total organic carbon	Hold time exceedence	QL	Low
09NCMOCSB31	580-15434-5	Total organic carbon	High MS recovery and high MS/MSD RPD	M	High
09NCMOCGW04 09NCMOCGW05 (Batch 49693)	580-14864-1 580-14864-2	Sulfate	Hold time exceedence	J	Low
09NCMOCGW04 09NCMOCGW05 (Batch 48614)	580-14864-1 580-14864-2	Sulfate	Exceeds calibration range	NP; use other result	Unknown
All Soil Samples	SDGs: 580-14735 580-15084 580-15434	Benzene	High field duplicate RPD	J	Unknown
Soil samples in affected SDGs	SDGs: 580-14753 580-15084	Naphthalene GRO DRO	High field duplicate RPD	J	Unknown
Soil samples in affected SDGs	SDGs: 580-15084	RRO	High field duplicate RPD	J	Unknown

Field Sample Identification	Laboratory Sample Number	Compounds Affected	Reason	Flag	Bias
Water samples in affected SDG	SDG: 580-14864	Arsenic Chromium Lead	High field duplicate RPD	J	Unknown
09NCMOCGW04 09NCMOCGW05 09NCMOCGW06 09NCMOCGW07 09NCMOCGW08 09NCMOCGW09 09NCMOCGW10 09NCMOCGW11	SDG 580-14864	Chromium	Method Blank Contamination	B	High
09NCMOCGW41 09NCMOCGW42 09NCMOCGW43 09NCMOCGW44 09NCMOCGW46 09NCMOCGW47 09NCMOCGW48	SDG 580-15437	Arsenic	Method Blank Contamination	B	High
Water samples in affected SDG	SDG: 580-15053	Naphthalene	High field duplicate RPD	J	Unknown
Water samples in affected SDG	SDG: 580-15087	Benzene Naphthalene RRO	High field duplicate RPD	J	Unknown
Water samples in affected SDG	SDG: 580-15185	DRO	High field duplicate RPD	J	Unknown
Water samples in affected SDG	SDG: 580-15437	Sulfate	High field duplicate RPD	J	Unknown

B detected in blank
H high bias
J estimated value
L low bias
M matrix effect
N/A not applicable
NP not preferred
Q quality control failure
U not detected

(Intentionally Blank)

3.0 SUMMARY

This report evaluates the analytical data generated during the NE Cape ISCO Study and Drum Removal conducted from July through September 2009. This assessment evaluated whether program objectives and DQOs were met. The assessment reviewed sample receipt conditions, extraction and analytical procedures, sampling procedures, and correspondence to method criteria and project DQOs. The following conclusions were drawn based on this assessment of the analytical data:

- Sample receipt conditions were acceptable based on temperatures upon receipt and COC correspondence to submitted sample set. Minor errors and omissions were observed in the sample documentation, but sufficient information was provided and data usability was not affected. Qualification did occur for benzene and naphthalene results in one sample due to the presence of air bubbles in all three sample vials.
- Analyses and extractions were performed within holding times, with the following exceptions:
  - The benzene and naphthalene holding time was exceeded for 13 soil samples.
  - The naphthalene holding time was exceeded for 7 water samples.
  - The holding time for GRO was exceeded for one trip blank.
  - The holding time for TOC was exceeded for 12 soil samples.
  - The holding time for sulfate was exceeded for 2 water samples.
- Extraction and analytical procedures were acceptable based on MBs, LCS/LCSDs, MS/MSDs, and surrogates. However, sample qualification occurred for the following:
  - One or more surrogate recoveries outside control limits for 28 samples analyzed for benzene and naphthalene, 26 samples analyzed for GRO, and 6 samples analyzed for DRO/RRO.
  - MS/MSD recoveries outside control limits, indicating a matrix effect for one benzene soil result, one naphthalene water result, one RRO soil result, 11 RRO water results, and one total organic soil result.
  - High LCS/LCSD recoveries or RPDs for 25 RRO results.
  - High LCS/LCSD recoveries or RPDs for 16 DRO results.
- Three benzene results and one GRO result were qualified due to their presence in the associated trip blank.
- Imprecision was observed in the field duplicate pairs for benzene, naphthalene, GRO, DRO, and RRO in soil samples and for arsenic, chromium, lead, benzene, naphthalene, DRO, RRO, and sulfate in water samples.

Based on this review, the analytical data generated during the NE Cape ISCO Study and Drum Removal are complete, correct, consistent, compliant with method procedures and QC requirements, and are usable as qualified.

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4.0 REFERENCES

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APPENDIX C

Test Pit Logs

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *11 Jul 2009*
Equipment Contractor:	*Bristol*
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: *3,404,042* Easting: *1,810,789*
Top of Test Pit Elevation:	*64.0 ft*
Hole Number, Field:	*TP1*
Permanent:	*TP1*
Operator:	*M. Thompson*
Inspector:	*R. Schlosser*
Type of Equipment:	*Catipillar 322B Excavator*
Test Pit Orientation:	*digging N-S*

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	*14*	*5*	*6.5 ft*	*NE*	*Grab*

Surface Condition: Grass with cobbles

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks
0–1				ML/FILL	SILT / FILL	0–1	silty loam, occasional angular gravels and cobbles, 3% gravel, 0% sand, 97% fines.
1–3				ML	SILT	1–3	silty loam as above but no gravel or cobbles, exposed drum at 2 ft bgs, no visible sheen or odor.
3–4		52.1	18.5			3–4	visible dark staining (dark yellow brown [10YR 3/3 - 3/4]) in silty loam at 3 ft bgs.
4–5		556.0	144.0			4–5	dark brown, soft, dry, low to no plasticity, slight petroleum odor, some peat.
5–6		902.0	200.0	OL	Organic SILT	5–6.5	light brown gray to gray brown (10YR 6/2 - 5/2) fines with peat and organics, 30% peat, 70% fines, staining and occasional light gray mottling, appears to be fill, drums and debris, strong petroleum odor. groundwater at 6.5 ft bgs.

Bottom of Exploration 6.5 ft
Groundwater Not Encounted (NE)
Backfilled trench in reverse order of excavation as closely as possible.
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

AECOM

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *11 Jul 2009*
Equipment Contractor: *Bristol*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,965* Easting: *1,810,811*	Top of Test Pit Elevation: *70.0 ft*
Hole Number, Field: *TP2*	Permanent: *TP2*
Operator: *M. Thompson*	Inspector: *R. Schlosser*
Type of Equipment: *Catipillar 322B Excavator*	Test Pit Orientation: *digging W-E*

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	*10*	*4.5*	*10.0 ft*		*Grab*

Surface Condition: Grass with rocks

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–3.5				OL	Organic SILT	dark brown to dark yellow brown (10YR 3/3 - 3/4) silty loam, with abundant organic material to 1.5 ft bgs, earthy, occasional small pebbles with occasional rocks, 5% gravel, 0% sand, 95% fines.
3.5–4.5		740.0	160.0	OL	Organic SILT with Gravel	light gray to gray brown (10YR 5/1 - 5/2) stained clayey silt, abundant large angular gravels, 3% gravel, 0% sand, 97% fines.
4.5–7		1040.0	420.0			as above with low plasticity and soft.
7–8.5		720.0	140.0	OL	Organic SILT	dark brown to dark yellow brown (10YR 3/3 - 3/4) silty loam, 100% fines, abundant peat, soft, no large fractions, stained, strong petroleum odor.
8.5–10		580.0	204.0			becoming clayey silt at 8.5 ft bgs.
10						Bottom of Exploration 10.0 ft Seep encountered at silty clayey zone at 4.5 ft bgs and 9 ft bgs after completion of trench/pit. Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *11 Jul 2009*
Equipment Contractor: *Bristol*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,927* Easting: *1,810,922*	Top of Test Pit Elevation: *72.1 ft*
Hole Number, Field: *TP3*	Permanent: *TP3*
Operator: *M. Thompson*	Inspector: *R. Schlosser*
Type of Equipment: *Catipillar 322B Excavator*	Test Pit Orientation: *digging N-S*

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	*6*	*4.5*	*11.4 ft*	*11.0 ft*	*Grab*

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks (Surface Condition: Gravel and grass)
0–3.5				ML/FILL	**Gravelly SILT / FILL**	gravelly silt / silty gravel (10YR 4/4), with abundant 50-80 mm angular gravel, occasional cobbles, 20% gravel, 0% sand, 80% fines, abundant scattered organics, grades to gravelly silt. Oxidation zone below fill (3.5 ft bgs).
2–2.5		bkgd	bkgd			
3.5–5				ML	**Clayey SILT with Gravel and Cobbles**	light brown gray to gray brown (Munsell 104R 6/2 -5/2) clayey silt, 100% fines, no to low plasticity, appears partially frozen, moist, slight petroleum odor.
4–4.5		420.0	48.0			
5–5.5				PT	**PEAT**	dark yellow brown (10YR 4/6 - 3/4) peat, very coarse grain matter.
5.5–8.5				ML	**Clayey SILT with Gravel and Cobbles**	light medium gray clayey silt, 100% fines, low plasticity, waxy when smeared, dry, very slight petroleum odor.
6–6.5		32.0	4.0			
7.5–8		41.0	17.0			
8.5–10.5				PT	**PEAT**	dark yellow brown to very dark gray brown (Munsell 104R 3/2 - 3/4) peat.
8.5–9		51.0	4.8			
10.5–11.4				ML	**Clayey SILT with Gravel and Cobbles**	dark gray (10YR 3/2 - 3/4) clayey silt, 100% fines, low plasticity, moderately compact, micaceous, moist, slight petroleum odor. (Groundwater ▼ 11.0 ft)
11.4						Bottom of Exploration 11.4 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. bkgd = background

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TEST PIT LOG

Project:	Main Operations Complex Area Phase I ISCO North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	12 Jul 2009
Equipment Contractor:	Bristol
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,404,043 Easting: 1,810,852
Top of Test Pit Elevation:	66.1 ft
Hole Number, Field:	TP4
Permanent:	TP4
Operator:	M. Thompson
Inspector:	R. Schlosser
Type of Equipment:	Catipillar 322B Excavator
Test Pit Orientation:	digging N-S
Bucket Width:	4.5
Test Pit Length:	10
Test Pit Width:	4.5
Test Pit Depth:	7.5 ft
Depth to Groundwater:	7.5 ft
Type of Samples:	Grab

Surface Condition: Grass

Depth (ft)	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0 – 3	1.2 (at ~2.0–2.5)	2.3 (at ~2.0–2.5)	ML/FILL	Gravelly SILT / FILL	silt fill (10YR 4/4 - 3/3), slightly mottled, large angular cobbles and gravels throughout, 15% gravel, 0% sand, 85% fines, moderate plasticity, soft, moist.
3 – 5					becoming less clay with low plasticity, no visible contamination or odor.
5 – 6.5	138.0	17.0	ML	Clayey SILT with Gravel and Cobbles	gray to light gray (10YR 5/1 - 7/1) clayey silt, low plasticity, occasional organics, slight moisture, slight to moderate petroleum odor and light staining.
6.5 – 7.5	1280.0	205.0	ML	Clayey SILT with Gravel and Cobbles	dark yellow brown (10YR 3/4 - 4/4) clayey silt, sharp contact with above ML at 6.5 ft bgs, abundant peat, strong petroleum odor at capillary fringe, wet at 7.5 ft bgs.
7.5					Bottom of Exploration 7.5 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

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AECOM

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *12 Jul 2009*
Equipment Contractor: *Bristol*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,865* Easting: *1,810,911*	Top of Test Pit Elevation: *74.2 ft*
Hole Number, Field: *TP5* Permanent: *TP5*	Operator: *M. Thompson*
Inspector: *R. Schlosser*	Type of Equipment: *Catipillar 322B Excavator*
Test Pit Orientation: *digging N-S*	

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	*10*	*4.5*	*10.4 ft*	*10.0 ft*	*Grab*

Surface Condition: Grass

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks
0				ML/FILL	Gravelly SILT with Sand / FILL	0	light gray gravelly silt (10YR 3/3 - 3/4), gravels to 130 mm, occasional cobbles, occasional sand, 20% gravel, trace sand, 80% fines, no odor or visible contamination.
2–2.5		40.0	bkgd				
3.5		30.0	bkgd	PT	PEAT	3.5	dark yellow brown (10YR 3/6) peat.
4				ML	Clayey SILT with Gravel and Cobbles	4	light gray to medium gray clayey silt, 100% fines. grades to dark brown clayey silt with gravels and cobbles towards 6 ft bgs.
6				ML	SILT with Clay	6	dark brown clayey silt with gravels and cobbles, low to moderate plasticity, becoming more clayey towards base of unit, moist.
6.5–7		60.0	3.2				
8				ML	SILT with Gravel and Cobbles	8	increased percentage of gravel and cobbles, 15% gravel, 85% fines.
9		30.0	bkgd	ML	Clayey SILT with Gravel and Cobbles	9	light gray (10YR 5/1) clayey silt, mottled (5YR 4/4), oxidized zones, occasionally very clayey, 100% fines, moderate plasticity, moist, no odor.
10						10	Wet at 10.0 ft bgs.
10.4						10.4	Bottom of Exploration 8.0 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. bkgd = background

AECOM

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *12 Jul 2009*
Equipment Contractor: *Bristol*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,855* Easting: *1,810,807*	Top of Test Pit Elevation: *74.1 ft*
Hole Number, Field: *TP6*	Permanent: *TP6*
Operator: *M. Thompson*	Inspector: *R. Schlosser*
Type of Equipment: *Catipillar 322B Excavator*	Test Pit Orientation: *digging N-S*

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	*10*	*5*	*8.0 ft*	*7.4 ft*	*Grab*

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks (Surface Condition: Grass)
0				GM/FILL	Silty GRAVEL / FILL	silty gravel, occasional areas of red brown iron oxidation, abundant angular gravels to 130 mm with occasional cobbles, 75% gravel, trace sand, 25% fines, no to very little plasticity, moderately soft, matrix moist, no odor or staining.
3.5		10.0	3.0			
5				ML	SILT with Gravel	grades to dark gray (10YR 4/1) silt with gravel, occasional clay, 10% gravel, trace sand, 90% fines, no plasticity, lamination beds, partially frozen, moist.
6.5		30.0	13.0			
7				PT	PEAT	thin (3-inch) dark brown peat bed.
7.25				ML	Clayey SILT with Gravel and Cobbles	clayey silt, 100% fines.
8						Abundant water draining in pit at 8 ft bgs, water has strong petroleum odor and sheen. Water level at 7.4 ft bgs after equilibrated, sheen on water. Bottom of Exploration 8.0 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

TEST PIT LOG

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	12 Jul 2009
Equipment Contractor:	Bristol
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,811 Easting: 1,810,774
Top of Test Pit Elevation:	75.8 ft
Hole Number, Field:	TP7
Permanent:	TP7
Operator:	M. Thompson
Inspector:	R. Schlosser
Type of Equipment:	Catipillar 322B Excavator
Test Pit Orientation:	digging N-S
Bucket Width:	4.5
Test Pit Length:	12
Test Pit Width:	4
Test Pit Depth:	8.0 ft
Depth to Groundwater:	7.0 ft
Type of Samples:	Grab

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks Surface Condition: Grass
0				GM/FILL	Silty GRAVEL / FILL	0	grassy roots with silty gravel (10YR 3/3), 60% gravel, trace sand, 40% fines.
2						2	very dark brown organic rich zones.
3				ML	Clayey SILT	3	highly oxidized silt, dark red brown just below light gray brown (10YR 4/2) mottled yellow brown (10YR 5/4) with abundant angular gravel clasts, abundant angular cobbles, 25% gravels, 0% sand, 75% fines, no odor or visible staining.
5				ML	Gravelly SILT	5	light gray (10YR 4/1) silt with gravels throughout, 40% gravels, 0% sand, 60% fines, strong petroleum odor, appears to be some perched water at 5 ft bgs.
7						7	water at 7 ft bgs.
7.5–8		325.0	70.0				
8						8	Bottom of Exploration 8.0 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

AECOM TEST PIT LOG	Project: Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska	Page 1 of 1
		Date: 13 Jul 2009
	Equipment Contractor: Bristol	Elevation Datum: ☒ MSL ☐ other
	Location: Northing: 3,403,875 Easting: 1,810,752	Top of Test Pit Elevation: 72.4 ft

Hole Number, Field:	Permanent:	Operator:	Inspector:
TP8	TP8	M. Thompson	R. Schlosser
		Type of Equipment: Catipillar 322B Excavator	Test Pit Orientation: digging E-W

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	12	4	10.0 ft	NE	Grab

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks (Surface Condition: Grass)
0						0	grass and roots.
0.5				GM/FILL	Silty GRAVEL / FILL	0.5	dark yellow brown (10YR 3/3 -3/4) silty gravel, silt matrix with abundant angular gravel clasts, occasional cobbles, 60% gravel, 0% sand, 40% fines, hard digging.
3.5		728.0	220.0			3.5	increased gravel: 65% gravel, 0% sand, 35% fines.
4				PT	PEAT	4	thin peat band.
4.5		1750.0	350.0	ML	SILT with Gravel	4.5	seep at ~4 ft bgs on top of ML silt, strong odor. dark gray (10YR 4/1) silt, with occasional gravel.
7				PT	PEAT	7	peat zone with staining and odor.
8				PT/OL	PEAT / Organic SILT	8	peat becoming dark brown to yellow brown organic silt.
9		40.0	4.0	ML	SILT with Clay	9	medium to light gray silt, clayey in part to very clayey, dense, clean, uniform, tight, slight lamination, partially frozen, slight odor. no water in pit when dug.
10						10	Bottom of Exploration 10.0 ft Groundwater Not Encounted (NE) Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

AECOM

TEST PIT LOG

Project:	Main Operations Complex Area Phase I ISCO North East Cape, St. Lawrence Island, Alaska
Page 1 of 1	Date: 13 Jul 2009
Equipment Contractor: Bristol	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,403,856 Easting: 1,810,639	Top of Test Pit Elevation: 74.6 ft
Hole Number, Field: TP9	Permanent: TP9
Operator: M. Thompson	Inspector: R. Schlosser
Type of Equipment: Catipillar 322B Excavator	Test Pit Orientation: digging N-S

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	12	5	10.0 ft	NE	Grab

Surface Condition: Large gravel and cobbles with clayey silt matrix

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks
0–5				GM/FILL	Silty GRAVEL / FILL	0–5	large gravel and cobbles with clayey silt matrix, demolition remains, concrete, rebar.
5				PT	PEAT	5	thin peat layer
5.2–6		5.2	2.1	GM	Silty, Sandy GRAVEL		silty sandy gravel, highly oxidized red brown zone to 6 ft bgs, predominantly 40-100 mm angular gravel, 75% gravel, trace sand, 25% fines, slight odor from 5.5 ft to 10 ft bgs.
6						6	as above but 20-40 mm angular gravels in a yellow brown silt and sand matrix, abundant organics throughout.
8		176.0	69.0			8	becoming more sandy with depth; 75% gravel, 5% sand, 20% fines.
9.5		305.0	1605.0				70% gravel, 10% sand, 20% fines. Less organics towards total depth.
10						10	Bottom of Exploration 10.0 ft Groundwater Not Encounted (NE) Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

TEST PIT LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *13 Jul 2009*
Equipment Contractor:	*Bristol*
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: *3,403,781* Easting: *1,810,634*
Top of Test Pit Elevation:	*76.2 ft*
Hole Number, Field:	*TP10*
Permanent:	*TP10*
Operator:	*M. Thompson*
Inspector:	*R. Schlosser*
Type of Equipment:	*Catipillar 322B Excavator*
Test Pit Orientation:	*digging NW-SE*
Bucket Width:	*4.5*
Test Pit Length:	*10*
Test Pit Width:	*5*
Test Pit Depth:	*10.0 ft*
Depth to Groundwater:	*NE*
Type of Samples:	*Grab*

Surface Condition: Surface soil with grass

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–1						surface soil with grass.
1–4.5		19.0	34.0	GM/FILL	Silty, Sandy GRAVEL / FILL	silty gravel with dark yellow brown sandy silt matrix, gravels 5 mm-10 cm intermixed, sand predominately medium grain, scattered silt throughout, 60% gravel, 25% sand, 15% fines, dense, becoming less silty with depth, moist.
4.5–6				GW	Well-graded Sandy GRAVEL with Cobbles	light to medium gray (10YR 4/2 - 4/1) sandy gravel, predominantly 5 mm - 5 cm well graded angular gravel clasts and occasional cobbles, medium to course grain sand, 60% gravel, 30% sand, 10% fines.
6–9.5		742.0	151.0			slight odor from diesel, gravels stained light to medium gray from abundant diesel.
9.5–10		1605.0	192.0	ML	SILT with Sand	light gray silt, trace gravel, 10% sand, 90% fines.

Bottom of Exploration 10.0 ft
Groundwater Not Encounted (NE)
No visible water in hole when pit initially dug.
Backfilled trench in reverse order of excavation as closely as possible.
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

AECOM

TEST PIT LOG

Project: **Main Operations Complex Area Phase I ISCO**
North East Cape, St. Lawrence Island, Alaska

Date: **16 Jul 2009**

Equipment Contractor: **Bristol**

Elevation Datum: ☒ MSL ☐ other

Location: Northing: **3,403,945** Easting: **1,810,643**

Top of Test Pit Elevation: **69.2 ft**

Hole Number, Field: **TP11** Permanent: **TP11**

Operator: **M. Thompson**

Inspector: **R. Schlosser**

Type of Equipment: **Catipillar 322B Excavator**

Test Pit Orientation: **digging NW-SE**

Bucket Width:	Test Pit Length:	Test Pit Width:	Test Pit Depth:	Depth to Groundwater:	Type of Samples:
4.5	10	5	10.0 ft	NE	Grab

Surface Condition: Surface soil with occasional gravel

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0				GM/FILL	Silty GRAVEL / FILL	surface soil with occasional gravels throughout.
1.5				ML/FILL	Sandy SILT / FILL	yellow brown (10YR 3/4) sandy silt.
3				GM/FILL	Silty GRAVEL / FILL	light gray silty gravel, 70% gravel, trace sand, 30% fines.
3.5		78.0	3.2	PT	PEAT	thin peat layer.
				ML	Gravelly SILT	light gray silt with scattered gravels, 10% gravel, 10% sand, 80% fines, areas of dark red brown slight oxidation.
6				PT	PEAT	organic rich and peat.
7		720.0	3.5	ML	Clayey SILT with Gravel and Cobbles	light to medium gray (10YR 7/1 - 6/1) clayey silt, 0% gravel, trace sand, 100% fines, occasional zones that have high clay content, moderate plasticity, tight, dense, occasionally sticky, partially frozen, slight to very slight odor.
		1300.0	25.0			
10						Bottom of Exploration 10.0 ft Groundwater Not Encounted (NE) No visible water in open pit. Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

TEST PIT LOG

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	16 Jul 2009
Equipment Contractor:	Bristol
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,904; Easting: 1,810,757
Top of Test Pit Elevation:	69.6 ft
Hole Number, Field:	TP12
Permanent:	TP12
Operator:	M. Thompson
Inspector:	R. Schlosser
Type of Equipment:	Catipillar 322B Excavator
Test Pit Orientation:	digging S-N
Bucket Width:	4.5
Test Pit Length:	10
Test Pit Width:	5
Test Pit Depth:	5.0 ft
Depth to Groundwater:	
Type of Samples:	Grab

Surface Condition: Grass

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–0.5						grass
0.5–3		bkgd	bkgd	GM/FILL	Silty GRAVEL with Sand / FILL	silty gravel fill with yellow brown silt matrix, angular gravels, scattered sand, 60% gravel, 10% sand, 30% fines.
3–3.5						as above but dark yellow brown.
3.5–4.5		1058.0	201.0	SP/FILL	Poorly-graded Gravelly SAND / FILL	brown gravelly sand, coarse to very coarse sand, stained from diesel, odor, wet, perched water at 4 ft bgs.
4.5–5						4-inch pipe, sand as above used for bedding pipe.

Bottom of Exploration 5.0 ft
Water running in pit from perched zone at 4 ft bgs.
Backfilled trench in reverse order of excavation as closely as possible.
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
bkgd = background

TEST PIT LOG

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	16 Jul 2009
Equipment Contractor:	Bristol
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,904 Easting: 1,810,757
Top of Test Pit Elevation:	69.6 ft
Hole Number, Field:	TP13
Permanent:	TP13
Operator:	M. Thompson
Inspector:	R. Schlosser
Type of Equipment:	Catipillar 322B Excavator
Test Pit Orientation:	digging E-W
Bucket Width:	4.5
Test Pit Length:	10
Test Pit Width:	5
Test Pit Depth:	7.0 ft
Depth to Groundwater:	
Type of Samples:	Grab

Surface Condition: Silty gravel

Depth (ft)	Lithology	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–3.5				GM/FILL	Silty GRAVEL with Sand / FILL	silty gravel, poorly graded gravels to 25 cm, occasional sand throughout, moderately dense, slight moisture.
3.5–4				PT	PEAT	dark yellow brown clayey silty peat, tight, dry.
4–7				ML	Gravelly, Clayey SILT with Sand	red brown silt with scattered clay and gravels, perched water zone at 4 ft bgs, abundant water flowing throughout silty peat at 4 ft bgs.
5		555.0	125.0			
7		1635.0	238.0			
7						Bottom of Exploration 7.0 ft Backfilled trench in reverse order of excavation as closely as possible. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.

APPENDIX D

Soil Boring Logs

AECOM

EXPLORATION LOG

Project: *Main Operations Complex Area Phase I ISCO*
North East Cape, St. Lawrence Island, Alaska

Page 1 of 1

Date: *2 Aug 2009*

Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,403,925* Easting: *1,810,739*

Top of Hole Elevation: **

Hole Number, Field: *ICOIW01* Permanent: *ICOIW01*

Driller: *R. Roberson*

Inspector: *R. Schlosser*

Type of Hole: ☒ other *Injection Well*
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *9.8 ft WD*

Depth Drilled: *10.5 ft*

Total Depth: *10.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *8.3 in Hollow Stem Auger*

Type of Equipment: *Mobile B-61 Auger Rig*

Type of Samples: *Driven Split Spoon*

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0						GM/FILL	Silty, Sandy GRAVEL / FILL	medium to dark brown silty, sandy, gravel, 25-75mm gravel clasts, hard packed, trace cobbles, moist from surface water.
5	1	100	2, 2, 2, 2	1450.0	260.0	ML	SILT	medium brown to yellow brown silt, low plasticity, soft, dry.
5.8						PT	PEAT	medium brown, coarse, increasing silt with depth, cold, moist.
7	2	100	3, 3, 4, 5	140.0	28.0			
7.7						GM	Silty, Sandy GRAVEL	medium gray and dark yellow brown silty sandy gravel, saturated, slight sheen.
8.2						PT	PEAT	dark brown, fine peat, increasing silt with depth.
8.8						OL	Organic SILT	abundant organics, scattered peat.
9	3	100	6, 8, 9					
9.4						ML	SILT	medium to dark gray silt, low to medium plasticity, clayey, wet.
9.8						GM	Silty, Sandy GRAVEL	65% gravel, 25% coarse to fine grain sand, 10% fines, angular gravel clasts 75-100mm with sand and silt matrix.

Bottom of Exploration 10.5 ft
Groundwater Encountered While Drilling (WD): at depth 9.80 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *20 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,903* Easting: *1,810,726*	Top of Hole Elevation: **
Hole Number, Field: *ICOMW01* Permanent: *ICOMW01*	Driller: *R. Roberson*
Inspector: *R. Schlosser*	
Type of Hole: ☒ other *Monitoring Well (Temporary)* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *13.2 ft WD*
Depth Drilled: *17.5 ft*	Total Depth: *17.5 ft*
Hammer Weight: *340 lbs*	Split Spoon I.D: *2.5 in*
Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig*
Type of Samples: *Driven Split Spoon*	

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–4						SP/GM	Poorly-graded Gravelly SAND with Cobbles / Silty GRAVEL with Sand and Cobbles	medium to course sand, moderately compact, gravels 20-70 mm, occasional large cobbles, silty in part, dry.
4–5	1	100	5, 2	350.0	95.0	ML	SILT	medium brown to olive brown silt, uniform, tight, occasional clay / sand / roots, dry.
5–6			4, 5	630.0	150.0	PT	PEAT	dark brown peat, uniform, fine, silty, dry.
6–7	2	100	7, 6	320.0	81.0			occasional sand
7–8			8, 9	620.0	168.0	ML /PT	SILT with Clay / PEAT	medium brown to mottled light gray silt, clayey in part, peat organics throughout, dry.
8–9	3	100	2, 5	850.0	130.0			tight, occasional peat, slight moisture, strong odor.
9–10			4, 5	200.0	37.0	ML/SM	Clayey SILT with Sand / Silty SAND with Gravel	olive gray to medium gray clayey silt, moderate plasticity, occasional sand, occasional angular gravel clasts 5-30 mm, moist.
10–12	4	33	6, 8, 8, 11	480.0	68.0			olive gray, slight plasticity, occasional pebbles, occasional organics, slightly saturated to moist.
12–13	5	50	7, 8	200.0	40.0			probable capillary fringe.
13–14			9, 11			GM	Silty GRAVEL	silty gravel, angular gravel 5-30 mm, scattered pebbles and sand, pushed cobble or gravel beginning at 13.0 feet. wet/saturated at 13.2 feet.
14–16	6	100	8, 6, 12, 10	420.0	90.0			

Bottom of Exploration 17.5 ft
Groundwater Encountered While Drilling (WD): at depth 13.20 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	21 Jul 2009
Drilling Agency:	☐ Alaska District ☒ Other Denali Drilling
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,946 Easting: 1,810,741
Top of Hole Elevation:	**
Hole Number, Field:	ICOMW02
Permanent:	ICOMW02
Driller:	R. Roberson
Inspector:	R. Schlosser
Type of Hole:	☒ other Monitoring Well (Temporary) ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	4.5 ft WD
Depth Drilled:	9.0 ft
Total Depth:	9.0 ft
Hammer Weight:	340 lbs
Split Spoon I.D:	2.5 in
Size and Type of Bit:	8.3 in Hollow Stem Auger
Type of Equipment:	Mobile B-61 Auger Rig
Type of Samples:	Driven Split Spoon

Depth (ft)	Lithology	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks
0–9									0–9	Auger to 9 ft bgs to set temporary well ICOMW02. Wet at 4 ft bgs, sloppy peat, saturated. Unable to log rest of hole because of mud. See ICOSB02 for lithology.
9									9	Bottom of Exploration 9.0 ft Groundwater Encountered While Drilling (WD): at depth 4.50 ft Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. ** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

AECOM

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	28 Jul 2009
Drilling Agency:	☐ Alaska District ☒ Other Denali Drilling
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,928 Easting: 1,810,746
Top of Hole Elevation:	**
Hole Number, Field:	ICOMW03
Permanent:	ICOMW03
Driller:	R. Roberson
Inspector:	R. Schlosser
Type of Hole:	☒ other Monitoring Well; ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	6.0 ft WD
Depth Drilled:	10.5 ft
Total Depth:	10.5 ft
Hammer Weight:	340 lbs
Split Spoon I.D:	2.5 in
Size and Type of Bit:	8.3 in Hollow Stem Auger
Type of Equipment:	Mobile B-61 Auger Rig
Type of Samples:	Driven Split Spoon

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–4.5						GM/FILL	Silty, Sandy GRAVEL / FILL	sandy silty gravel with large cobbles.
4.5–5	1	100	1	490.0	93.0	ML	SILT	dark brown silt, few pebbles, occasional organics.
5–6.5			2, 3, 2	2010.0	307.0	PT	PEAT	medium dark brown, fine interbedded silt lenses, moist, strong hydrocarbon odor.
6.5–7	2	100	2	309.0	35.0	GM	Silty GRAVEL	dark brown, saturated.
7–8.5			2, 4, 5	318.0	32.0	PT-OL	PEAT with Organic Silt	dark brown silty peat, saturated.
8.5–9.5	3	100	2, 9	940.0	100.0			
9.5–10.5			6	40.0	5.0	GM	Silty GRAVEL	medium to dark gray silty gravel, occasional sand, grades to light gray silt, partially frozen.

Bottom of Exploration 10.5 ft
Groundwater Encountered While Drilling (WD): at depth 6.00 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

AECOM

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *28 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,929* Easting: *1,810,736*	Top of Hole Elevation: **
Hole Number, Field: *ICOMW04* Permanent: *ICOMW04*	Driller: *R. Roberson*
Inspector: *R. Schlosser*	
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *6.0 ft WD*
Depth Drilled: *10.5 ft*	Total Depth: *10.5 ft*
Hammer Weight: *340 lbs*	Split Spoon I.D: *2.5 in*
Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig*
Type of Samples: *Driven Split Spoon*	

Depth (ft)	Lithology	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Depth (ft)	Description and Remarks
0–3.5							GM/FILL	Silty, Sandy GRAVEL / FILL		gravel with silt and sand matrix, very hard drilling in road.
3.5–5.5		1	20	1, 4, 6, 5						LOST CORE: Only 0.4-ft recovered, cobbles in shoe.
5.5–5.8							OL/ML	Organic SILT / SILT		dark brown.
5.8–9		2	100	1, 1, 2, 3	250.0	1500.0	PT	PEAT	6 ▼	dark brown silty in part, silt lenses, saturated to moist, very strong petroleum odor.
		3	100	6, 7, 8, 8	950.0	165.0				
9–9.5					140.0	24.0	ML	Gravelly, Clayey SILT with Sand		medium to dark gray silt, moderately dense, frozen (ice crystals in matrix).
9.5–10.5							GM	Silty GRAVEL		Auger to 10.5 ft to set well.
10.5										Bottom of Exploration 10.5 ft Groundwater Encountered While Drilling (WD): at depth 6.00 ft Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. ** Top of hole elevation not measured; see well log for top of PVC casing elevation.

AECOM

EXPLORATION LOG

Project:	Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska
Page	1 of 1
Date:	29 Jul 2009
Drilling Agency:	☐ Alaska District ☒ Other Denali Drilling
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,921 Easting: 1,810,742
Top of Hole Elevation:	**
Hole Number, Field:	ICOMW05
Permanent:	ICOMW05
Driller:	R. Roberson
Inspector:	R. Schlosser
Type of Hole:	☒ other Monitoring Well ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	7.0 ft WD
Depth Drilled:	9.0 ft
Total Depth:	9.0 ft
Hammer Weight:	340 lbs
Split Spoon I.D:	2.5 in
Size and Type of Bit:	8.3 in Hollow Stem Auger
Type of Equipment:	Mobile B-61 Auger Rig
Type of Samples:	Driven Split Spoon

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–4.5						GM/FILL	Silty, Sandy GRAVEL / FILL	gravel, silt, and sand with occasional cobbles.
4.5–5	1	100	2			GM	Silty GRAVEL	medium gray, dense, moist, slight petroleum odor.
5–8			2, 2, 2	590.0	240.0	PT	PEAT	medium to dark brown, stiff, fine peat, grades to silt, moist, strong petroleum odor.
	2	100	2, 2, 3	820.0	140.0			
8–8.5			4	68.0	10.0	ML	Gravelly, Clayey SILT with Sand	medium gray silt, occasional clay, dense, dry to slightly moist.
8.5–9								Auger to 9 ft to set well.

Groundwater symbol at 7 ft.

Bottom of Exploration 9.0 ft
Groundwater Encountered While Drilling (WD): at depth 7.00 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

AECOM

Project: *Main Operations Complex Area Phase I ISCO*
North East Cape, St. Lawrence Island, Alaska

Date: *30 Jul 2009*

Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,403,938* Easting: *1,810,741*

Top of Hole Elevation: **

Hole Number, Field: *ICOMW06* Permanent: *ICOMW06*

Driller: *R. Roberson*

Inspector: *R. Schlosser*

Type of Hole: ☒ other *Monitoring Well*
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *5.0 ft WD*

Depth Drilled: *9.5 ft*

Total Depth: *9.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *8.3 in Hollow Stem Auger*

Type of Equipment: *Mobile B-61 Auger Rig*

Type of Samples: *Driven Split Spoon*

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–3						GM	Silty GRAVEL with Sand	silty gravel with occasional sandy fill, gravels 100 mm, dense, moist, saturated from surface runoff.
3–4.8						GM	Silty GRAVEL	silty gravel, gravel clasts 75 mm in medium gray sandy silt, wet.
4–6	1	100	2, 2, 1, 2	145.0 630.0	42.0 124.0			
4.8–6.2						PT	PEAT	medium to dark brown, very silty, moist to damp, strong diesel odor.
6–8	2	100	2, 3, 3, 4	116.0	35.0			
6.2–7								increasing silt with depth, saturated.
7–8						PT	PEAT	moist
8–9.5	3	100	2, 2, 5			ML /SM	SILT with Clay / Silty SAND	medium to dark gray clayey silt, partially frozen, diesel odor.

Bottom of Exploration 9.5 ft
Groundwater Encountered While Drilling (WD): at depth 5.00 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
** Top of hole elevation not measured; see well log for top of PVC casing elevation.

AECOM

EXPLORATION LOG

Project:	Main Operations Complex Area Phase I ISCO North East Cape, St. Lawrence Island, Alaska
Page 1 of 1	Date: 30 Jul 2009
Drilling Agency:	☐ Alaska District ☒ Other Denali Drilling
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: 3,403,938 Easting: 1,810,733
Top of Hole Elevation:	**
Hole Number, Field: ICOMW07	Permanent: ICOMW07
Driller: R. Roberson	Inspector: R. Schlosser
Type of Hole: ☒ other Monitoring Well ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 6.0 ft AD
Depth Drilled: 10.0 ft	Total Depth: 10.0 ft
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in
Size and Type of Bit: 8.3 in Hollow Stem Auger	Type of Equipment: Mobile B-61 Auger Rig
Type of Samples: Driven Split Spoon	

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–2.7						GM/FILL	Silty GRAVEL with Sand / FILL	silty gravel, gravel clasts 10-75mm with sand and silt matrix.
2.5–4.5	1	100	2, 5, 4, 6			ML	Clayey SILT with Gravel and Cobbles	medium gray clayey silt, cold tight.
						PT	PEAT	medium to dark brown, coarse to fine grain sand, silt, occasional pebbles, ice crystals observed, moderate petroleum odor.
4.5–6.5	2	100	6, 5, 5, 7	650.0	50.0			increasing silt with depth, frozen
								interbedded peat and silt
6.5–8.5	3	50	2, 3, 1, 1	1150.0	229.0			frozen to 7.5 ft
				240.0	114.0			
								wet to saturated
8.5–10	4	100	2, 1, 3			ML	Gravelly, Clayey SILT with Sand	medium to dark gray, occasional gravel 25-75mm.
10								Bottom of Exploration 10.0 ft Groundwater Encountered After Drilling (AD): at depth 6.00 ft Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. ** Top of hole elevation not measured; see well log for top of PVC casing elevation.

EXPLORATION LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *31 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,930* Easting: *1,810,729*	Top of Hole Elevation: **
Hole Number, Field: *ICOMW08*	Permanent: *ICOMW08*
Driller: *R. Roberson*	Inspector: *R. Schlosser*
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *5.5 ft WD*
Depth Drilled: *10.0 ft*	Total Depth: *10.0 ft*
Hammer Weight: *340 lbs*	Split Spoon I.D: *2.5 in*
Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig*
Type of Samples: *Driven Split Spoon*	

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–3.7						GM/FILL	**Silty, Sandy GRAVEL / FILL**	**65% gravel, 35% silt and sands, driller indicates material is "soft" at 3.0 ft bgs.**
3.7–4.5	1	100	2, 4, 5, 4			ML	**Gravelly, Clayey SILT with Sand**	**medium to dark gray silt, some organics, trace sand and pebbles, low plasticity, strong petroleum odor.**
4.5–6.0				1050.0	190.0	PT	**PEAT**	**dark brown to dark yellow brown peat, coarse, soft, organics include very coarse stems, silty, cold, moist.**
6.0–8.5	2	100	7, 6, 5, 7	89.0	17.0	OL	**Organic SILT**	**very dark brown, dense, low to medium plasticity, abundant organics, trace sand, increasing silt with depth, slight moisture, slight odor.**
8.5–9.5	3	100	3, 3, 3, 5	48.0	10.0	ML	**Gravelly, Clayey SILT with Sand**	**medium to dark gray, soft to moderately dense, low to medium plasticity, scattered yellow brown oxide lenses and very thin lenses of very fine grain sand, very cold, possibly frozen.**
9.5–10								**Auger to 10 ft to set well.**
10								**Bottom of Exploration 10.0 ft** **Groundwater Encountered While Drilling (WD): at depth 5.50 ft** **Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.** **** Top of hole elevation not measured; see well log for top of PVC casing elevation.**

AECOM

EXPLORATION LOG

Project:	Main Operations Complex Area Phase I ISCO North East Cape, St. Lawrence Island, Alaska
Page 1 of 1	Date: 1 Aug 2009
Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,403,919 Easting: 1,810,731	Top of Hole Elevation: **
Hole Number, Field: ICOMW09 Permanent: ICOMW09	Driller: R. Roberson
Inspector: R. Schlosser	
Type of Hole: ☒ other Monitoring Well ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 9.5 ft WD
Depth Drilled: 12.5 ft	Total Depth: 12.5 ft
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in
Size and Type of Bit: 8.3 in Hollow Stem Auger	Type of Equipment: Mobile B-61 Auger Rig
Type of Samples: Driven Split Spoon	

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–2.5						GM/FILL	Silty, Sandy GRAVEL / FILL	medium to dark brown.
2.5–4	1	100	2, 4, 5, 4			ML	Gravelly, Clayey SILT with Sand	medium to dark brown, low plasticity, scattered organics, little sand, cold, dry.
4–4.5						PT/ML	PEAT / SILT	medium to dark yellow brown peat, coarse plant fragments, thin lenses of silt (as described above).
4.5–6	2	100	5, 4, 4, 5	1300.0	180.0	PT	PEAT	medium to dark yellow brown, coarse plant fragments.
6–8	3	100	1, 3, 6, 8	450.0	60.0			fine grained peat, trace sand and pebbles, scattered large organic stems, moist, strong petroleum odor.
8–10	4	50	7, 7, 7, 6	82.0	12.0	ML	SILT	medium to dark gray clayey silt, low plasticity, waxy surface, scattered organics, dry, slight petroleum odor
10–11						ML	SILT with Sand and Gravel	clayey silt with sand and gravel, 50 mm gravel, fine grained poorly graded sand, trace yellow brown oxide staining at 11 ft bgs
11–12	5	0	2, 22, 15			GM	Silty GRAVEL	No recovery

Bottom of Exploration 12.5 ft
Groundwater Encountered While Drilling (WD): at depth 9.50 ft
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
~~** Top of hole elevation not measured; see well log for top of PVC~~ casing elevation.

EXPLORATION LOG

AECOM

Project: **Main Operations Complex Area Phase I ISCO**
North East Cape, St. Lawrence Island, Alaska

Date: **18 Jul 2009**

Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**

Elevation Datum: ☒ MSL ☐ other

Location: Northing: **3,403,914** Easting: **1,810,761**

Top of Hole Elevation: **69.0 ft**

Hole Number, Field: **ICOSB01** Permanent: **ICOSB01**

Driller: **R. Roberson**

Inspector: **R. Schlosser**

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **13.5 ft WD**

Depth Drilled: **14.0 ft**

Total Depth: **14.0 ft**

Hammer Weight: **340 lbs**

Split Spoon I.D: **2.5 in**

Size and Type of Bit: **8.3 in Hollow Stem Auger**

Type of Equipment: **Mobile B-61 Auger Rig**

Type of Samples: **Driven Split Spoon**

Surface Condition: Disturbed soil with gravel and cobbles

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–4						GM/FILL	Silty GRAVEL / FILL	dark yellow brown (10YR 3/3 - 3/4) silty gravel, very tight and dense, 75% gravel, trace sand, 25% fines.
4–7				6200.0	58.0	PT	PEAT	dark brown silty peat, soft, strong odor from 5-7 ft bgs.
5–6.5	1	100	2, 3, 2	5400.0	48.0			
6.2–6.4				7500.0	42.0			light gray silt layer from 6.2-6.4 ft bgs.
6.5–8	2	100	3, 3, 4					
7–8.5				650.0	29.0	CL	Silty CLAY	dark yellow brown to brown clay, silty in part, soft, uniform, strong odor. Sharp contact with peat at 7 ft bgs.
8–9.5	3	100	2, 5, 5	4230.0	41.0			
8.5–10				750.0	37.0	CL/ML	SILT / lean CLAY	light gray silty clay to clayey silt, sandy in part, slight to moderate plasticity, moderately soft, uniform.
9.5–11	4	100	3, 4, 5					
10–11				4260.0	58.0	ML	Clayey SILT with Sand	light gray to medium gray clayey silt, frozen, sandy in part.
11–12.5	5	100	3, 6, 5	14.5	2.5	ML	Clayey SILT with Sand	medium to dark gray, occasional organics, occasional yellowish brown to red orange oxidation, doesn't appear saturated, strong odor from 11-12 ft bgs.
12.5–14	6	100	6, 4, 9	3700.0	24.0			
13.5–14				5600.0	21.0	ML	Gravelly SILT	gravelly silt, gravel clasts 5-25 mm, saturated.

Bottom of Exploration 14.0 ft
Groundwater Encountered While Drilling (WD): at depth 13.50 ft
Hole backfilled with medium bentonite chips to 1 ft bgs.
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
bgs = below ground surface

AECOM

EXPLORATION LOG

Project: **Main Operations Complex Area Phase I ISCO**
North East Cape, St. Lawrence Island, Alaska

Date: **18 Jul 2009**

Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**

Elevation Datum: ☒ MSL ☐ other

Location: Northing: **3,403,949** Easting: **1,810,741**

Top of Hole Elevation: **67.0 ft**

Hole Number, Field: **ICOSB02** Permanent: **ICOSB02**

Driller: **R. Roberson**

Inspector: **R. Schlosser**

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **WD**

Depth Drilled: **10.0 ft**

Total Depth: **10.0 ft**

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	2.5 in	8.3 in Hollow Stem Auger	Mobile B-61 Auger Rig	Driven Split Spoon

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks (Surface Condition: Bare soil)
0						GM/ML	Silty GRAVEL / Gravelly SILT	per driller: gravelly silt, silty gravel ends at 4 ft bgs.
4	1	100	1, 1	2600.0	22.0			4-5 ft bgs: silty gravel (Native? Fill?) as above, strong odor, perched water at 4 ft bgs.
5			2			PT	PEAT with Sand	dark brown peat, silty in part, sandy in part, soft, some odor.
5.5	2	100	1	2400.0	140.0			grades to poorly graded sand (SP) at 5.5 ft bgs and then grades back to peat at 5.8
5.8			5, 5	4750.0	46.0			peat as above
7	3	0						lost / no recovery, driller dropped inner bit and fell from 7-9 ft bgs.
9	4	100	1, 1	3800.0	29.0	ML/PT	SILT / PEAT	dark brown silt and peat, slight sheen on sample, saturated from up hole when extracted
10								Bottom of Exploration 10.0 ft Groundwater Encountered While Drilling (WD) Hole backfilled with bentonite chips to 1 ft bgs. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. bgs = below ground surface

EXPLORATION LOG

AECOM

Project:	*Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *19 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,948* Easting: *1,810,737*	Top of Hole Elevation: *67.0 ft*
Hole Number, Field: *ICOSB03* Permanent: *ICOSB03*	Driller: *R. Roberson* Inspector: *R. Schlosser*
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *NE* Depth Drilled: *11.0 ft* Total Depth: *11.0 ft*
Hammer Weight: *340 lbs* Split Spoon I.D: *2.5 in* Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig* Type of Samples: *Driven Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–3.5							GM/FILL	Silty GRAVEL / FILL	auger to 5 ft, drill through gravelly silt fill.
3.5–7.5					1305.0 (5–7 ft)	258.0 (5–7 ft)	OL	Organic SILT	very dark brown organic silt, slight to moderate platicity, soft, strong odor.
7.5–9		1 (7–9 ft)	100	3, 3, 3, 2	520.0	130.0	ML	Clayey SILT with Gravel and Cobbles	medium to dark gray clayey silt, frozen to partially frozen with visible ice crystals, no odor. 7-9 ft split spoon: drive spoon, driller reports had to push 1.3 ft to get to the bottom, pull sampler and shoe only full, clean and run to bottom for sample.
9–11		2	50	2, 2, 2, 2	375.0	150.0	ML	Gravelly Sandy SILT	medium gray sandy gravelly silt, saturated, frozen.
11									Bottom of Exploration 11.0 ft Groundwater Not Encounted (NE) Plug entire boring with medium bentonite chips to 1 ft bgs. Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet. bgs = below ground surface

AECOM

EXPLORATION LOG

Project: Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska	Page 1 of 1	Date: 17 Jul 2009
Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling	Elevation Datum: ☒ MSL ☐ other	
Location: Northing: 3,403,901 Easting: 1,810,732	Top of Hole Elevation: 70.0 ft	

Hole Number, Field: ICOSB04	Permanent: ICOSB04	Driller: R. Roberson	Inspector: R. Schlosser
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 13.7 ft WD	Depth Drilled: 14.5 ft	Total Depth: 14.5 ft

Hammer Weight	Split Spoon I.D.	Size and Type of Bit	Type of Equipment	Type of Samples
340 lbs	2.5 in	8.3 in Hollow Stem Auger	Mobile B-61 Auger Rig	Driven Split Spoon

Depth (ft)	Sample	Recovery (%)	Blow Count	FID (ppm)	PID (ppm)	Symbol	Classification ASTM: D 2487 or D 2488	Description and Remarks
0–2						GM/FILL	Silty GRAVEL with Cobbles / FILL	auger to 4 ft through silty gravel with cobbles (fill), 65% gravel, 5% sand, 30% fines, low plasticity, moderate moisture.
2–4						SP/FILL	Poorly-graded SAND with Gravel / FILL	hit poorly graded sand and gravel from pipline trench, running east to west, 5% gravel, 90% sand, 5% fines, slight moisture.
4–5	1	100	3, 4	1050.0	240.0	ML	Clayey SILT	dark brown clayey silt, occasional gravel, occasionally sandy, some scattered organics, 10% gravel, trace sand, 90% fines, low to medium plasticity, moderate moisture, strong odor.
5–6.5	1	100	5, 5	530.0	200.0	PT	PEAT	medium to dark brown peat, trace sand, 10% fines, uniform, moderately dense for peat, dry, cold, very strong odor.
6.5–7	2	50	8, 15	2150.0	850.0	ML	Gravelly SILT	dark yellow brown (10YR 3/3 - 3/4) gravelly silt, 10-40 mm gravels, strong odor, pushed cobble down at 6.5 ft bgs.
7–8	2	50	12, 4					LOST: no recovery, auger to catch up to 8 ft bgs.
8–10	3	0	1, 5, 6, 7			SP	Poorly-graded SAND	poorly gradded sand, damp at 10 ft during augering, no recovery.
10–11	4	100	6, 6, 5, 6	810.0	370.0	ML	SILT	silt, trace sand, 100% fines, dry to damp.
11–13.7	4 / 5	100	8, 18			ML/ML	Gravelly SILT / Clayey SILT	gray brown to medium gray silty gravel to gravelly silt and clayey silt to silty clay, 10% gravel, trace sand, 90% fines, partially frozen, soft, dry to moist, pushed to 12.5 ft bgs.
13.7–14.5	5	100	21, 18	610.0	150.0	CL	Gravelly, Silty CLAY with Sand	dark gray gravelly silty clay, sandy in part, 30% gravel, trace sand, 70% fines, medium plasticity, stiff, moderately dense, wet.

Bottom of Exploration 14.5 ft
Groundwater Encountered While Drilling (WD): at depth 13.70 ft
Water in auger at 9.25 ft bgs after penetration of gravel at 13.7 ft bgs.
Plug entire boring with medium bentonite chips to 1 ft bgs.
Horizontal survey datum: NAD83 AK Zone 9 in U.S. feet.
bgs = below ground surface

APPENDIX E

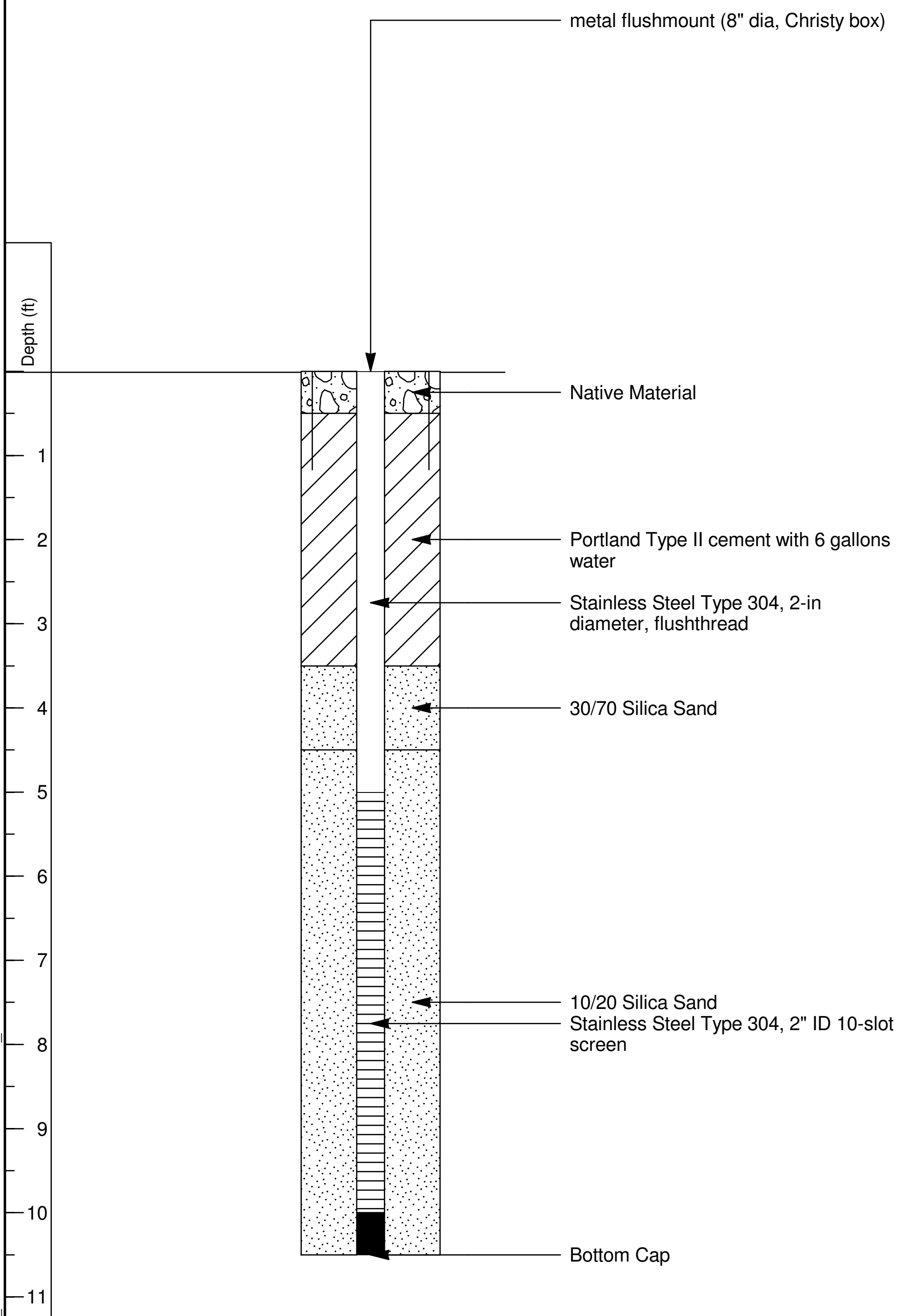
Well Completion Logs

AECOM	Project: **Main Operations Complex Area Phase I ISCO** **North East Cape, St. Lawrence Island, Alaska**	Page 1 of 1 Date: **2 Aug 2009**
# MONITORING WELL LOG	Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**	Elevation Datum: ☒ MSL ☐ other
	Location: Northing: **3,403,925 ft** Easting: **1,810,739 ft**	Top of Hole Elevation: **

Hole Number, Field: **ICOIW01**	Permanent: **ICOIW01**	Driller: **R. Roberson**	Inspector: **R. Schlosser**

Type of Hole: ☒ other **Injection Well** ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: **9.80 ft WD**	Depth Drilled: **10.5 ft**	Total Depth: **10.5 ft**

Hammer Weight: **340 lbs**	Split Spoon I.D: **2.5 in**	Size and Type of Bit: **8.3 in Hollow Stem Auger**	Type of Equipment: **Mobile B-61 Auger Rig**	Type of Samples: **Driven Split Spoon**



NOTE:

1) Top of PVC Casing Elevation: 69.5372'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

5 feet - 2-in stainless steel Type 304 riser casing
5 feet - 2-in stainless steel Type 304 0.01-in slot wire wrap screen
3.5 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 10.5 ft
Groundwater Encountered While Drilling (WD): at depth 9.80 ft on 8/2/2009

AECOM

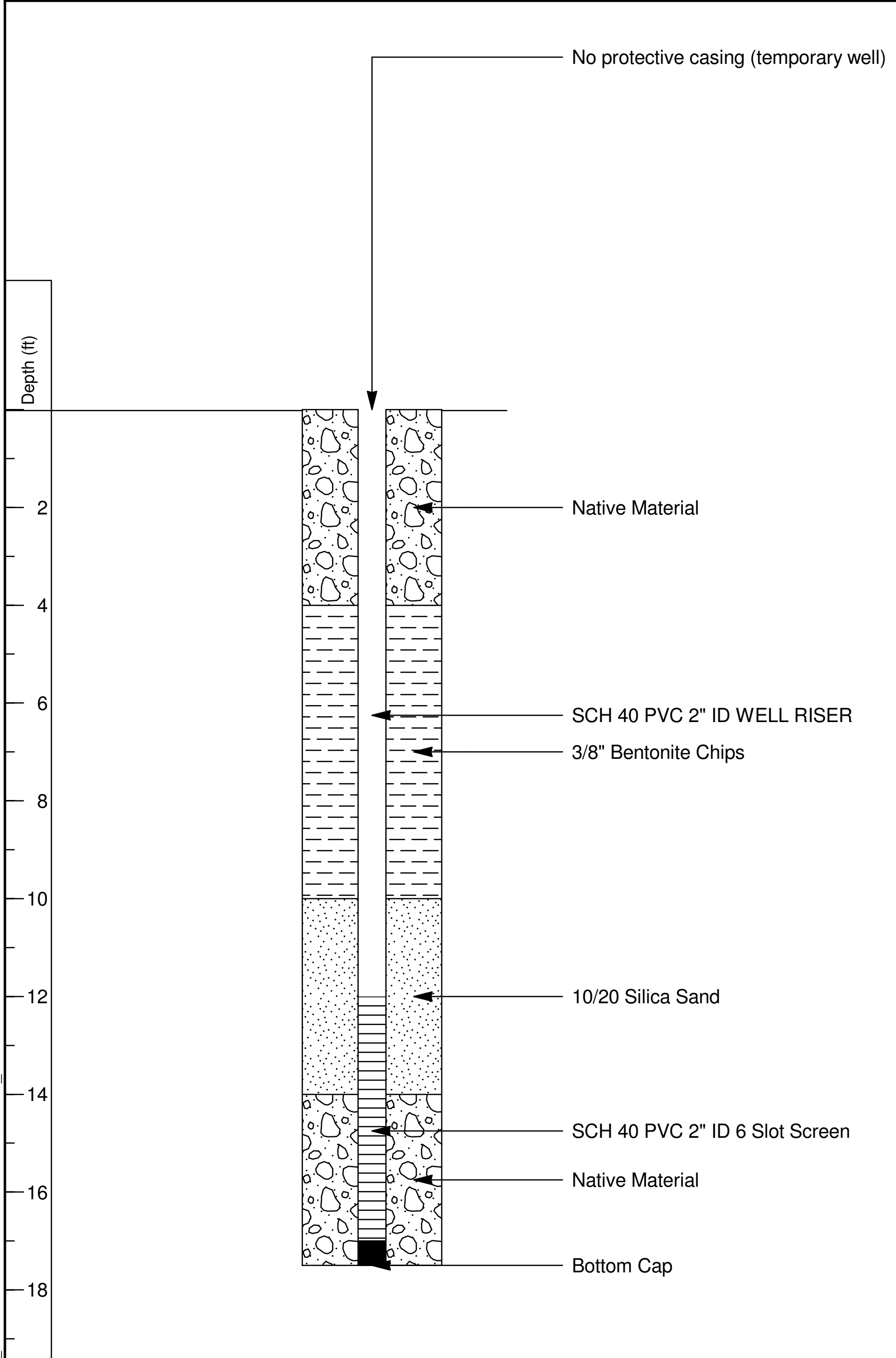
MONITORING WELL LOG

Project: **Main Operations Complex Area Phase I ISCO** North East Cape, St. Lawrence Island, Alaska		Page 1 of 1 Date: **20 Jul 2009**
Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**		Elevation Datum: ☒ MSL ☐ other
Location: Northing: **3,403,903 ft** Easting: **1,810,726 ft**		Top of Hole Elevation: **

Hole Number, Field:	Permanent:	Driller:	Inspector:
ICOMW01	**ICOMW01**	**R. Roberson**	**R. Schlosser**

Type of Hole: ☒ other **Monitoring Well (Temporary)** ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater:	Depth Drilled:	Total Depth:
	13.20 ft WD	**17.5 ft**	**17.5 ft**

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	**2.5 in**	**8.3 in Hollow Stem Auger**	**Mobile B-61 Auger Rig**	**Driven Split Spoon**



NOTE:

1) Top of PVC Casing Elevation: 70.661'
Temporary well; No surface completion
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

12 feet - 2-inch SCH 40 PVC Riser Casing
5 feet - 2-inch SCH 40 PVC Screen with 0.006-inch Slots
3 cubic feet - 10/20 Sand Filter Pack Material
4 cubic feet - 3/8-inch Bentonite Chips

Bottom of Exploration 17.5 ft
Groundwater Encountered While Drilling (WD): at depth 13.20 ft on 7/20/2009

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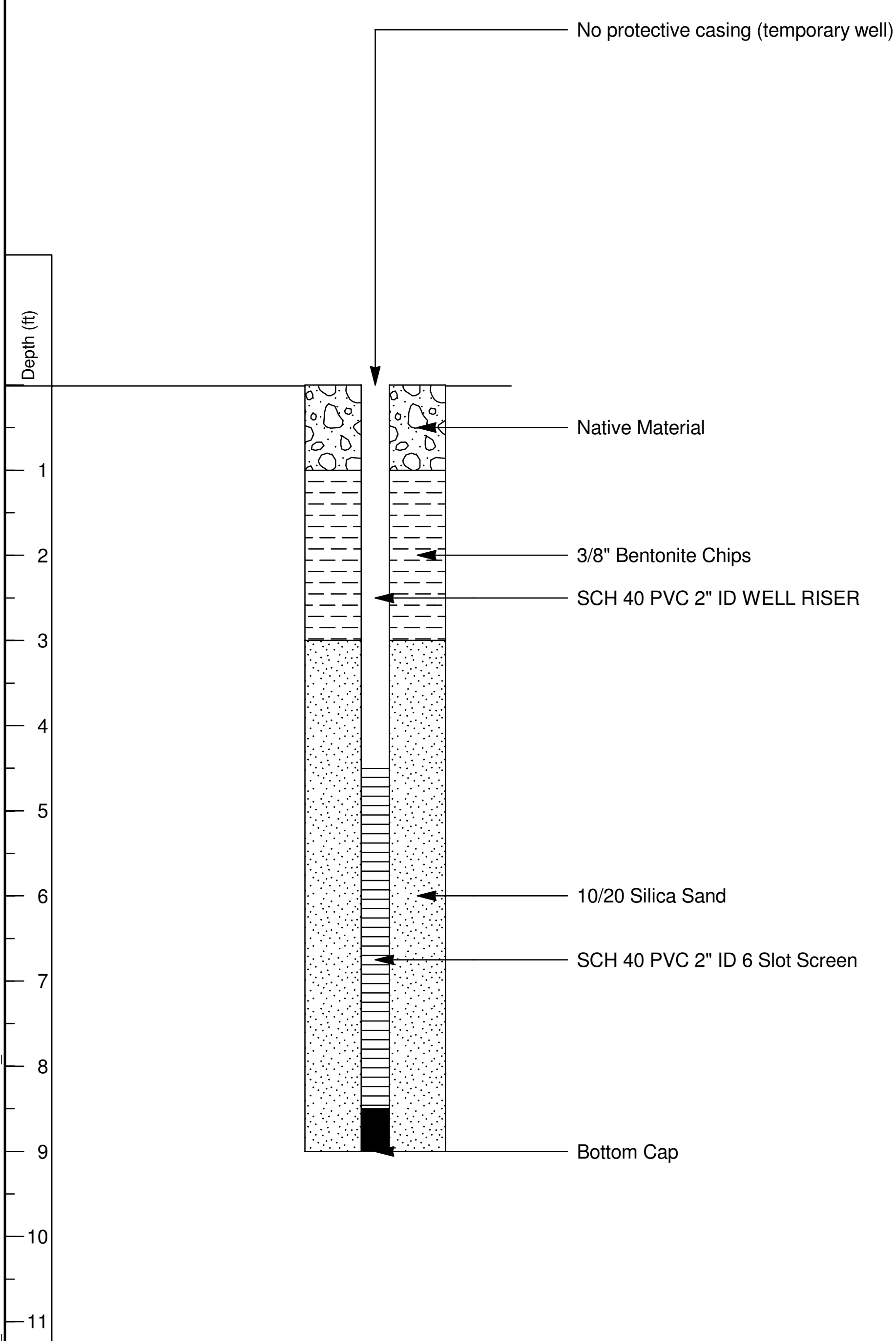
MONITORING WELL LOG

Project: **Main Operations Complex Area Phase I ISCO** North East Cape, St. Lawrence Island, Alaska	Page 1 of 1	Date: **21 Jul 2009**
Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**	Elevation Datum: ☒ MSL ☐ other	
Location: Northing: **3,403,946 ft** Easting: **1,810,741 ft**	Top of Hole Elevation: **	

Hole Number, Field:	Permanent:	Driller:	Inspector:
ICOMW02	**ICOMW02**	**R. Roberson**	**R. Schlosser**

Type of Hole: ☒ other **Monitoring Well (Temporary)** ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: **4.50 ft WD**	Depth Drilled: **9.0 ft**	Total Depth: **9.0 ft**

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	**2.5 in**	**8.3 in Hollow Stem Auger**	**Mobile B-61 Auger Rig**	**Driven Split Spoon**



NOTE:

1) Top of PVC Casing Elevation: 67.2682'
Temporary well; No surface completion
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

4.5 feet - 2-inch SCH 40 PVC Riser Casing
4 feet - 2-inch SCH 40 PVC Pre-Packed Screen with 0.006-inch Slots and 10/20 Silica Sand
5 cubic feet - 10/20 Sand Filter Pack Material
2 cubic feet - 3/8-inch Bentonite Chips

Bottom of Exploration 9.0 ft
Groundwater Encountered While Drilling (WD): at depth 4.50 ft on 7/21/2009

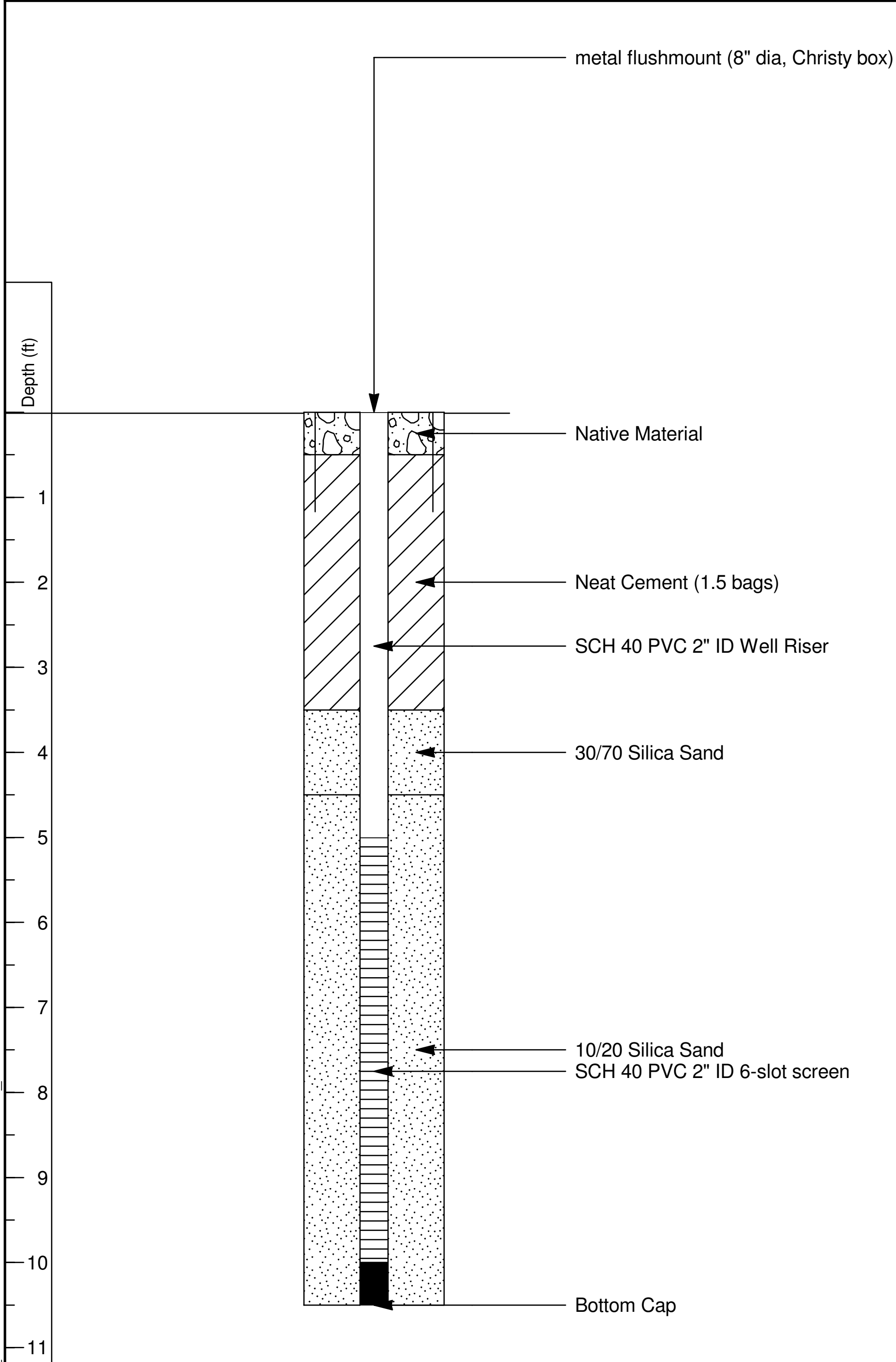
MONITORING WELL LOG

Project: **Main Operations Complex Area Phase I ISCO** North East Cape, St. Lawrence Island, Alaska		
		Date: **28 Jul 2009**
Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**		Elevation Datum: ☒ MSL ☐ other
Location: Northing: **3,403,928 ft** Easting: **1,810,746 ft**		Top of Hole Elevation: **
Hole Number, Field: **ICOMW03** Permanent: **ICOMW03**	Driller: **R. Roberson**	Inspector: **R. Schlosser**
Type of Hole: ☒ other **Monitoring Well** ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: **6.00 ft WD**	Depth Drilled: **10.5 ft** / Total Depth: **10.5 ft**

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	**2.5 in**	**8.3 in Hollow Stem Auger**	**Mobile B-61 Auger Rig**	**Driven Split Spoon**

NOTE:

1) Top of PVC Casing Elevation: 69.3095'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing



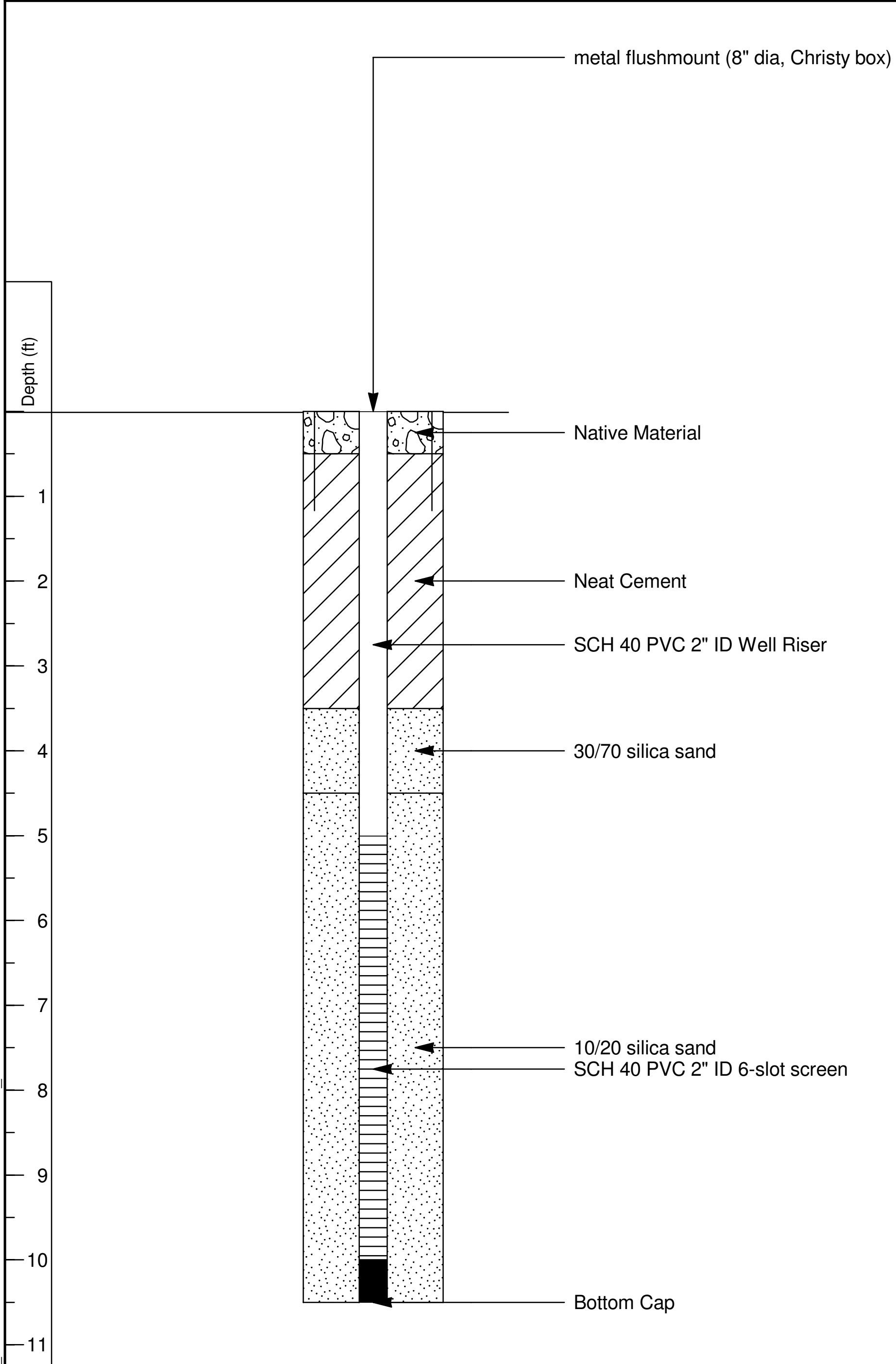
SUMMARY OF MATERIALS USED

5 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 10.5 ft
Groundwater Encountered While Drilling (WD): at depth 6.00 ft on 7/28/2009

MONITORING WELL LOG

Project:	*Main Operations Complex Area Phase I ISCO* North East Cape, St. Lawrence Island, Alaska
Page 1 of 1	Date: 28 Jul 2009
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,929 ft* Easting: *1,810,736 ft*	Top of Hole Elevation: **
Hole Number, Field: *ICOMW04* Permanent: *ICOMW04*	Driller: *R. Roberson*
Inspector: *R. Schlosser*	
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *6.00 ft WD*
Depth Drilled: *10.5 ft*	Total Depth: *10.5 ft*
Hammer Weight: *340 lbs*	Split Spoon I.D: *2.5 in*
Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig*
Type of Samples: *Driven Split Spoon*	



NOTE:

1) Top of PVC Casing Elevation: 69.3055'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

5 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
4 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 10.5 ft
Groundwater Encountered While Drilling (WD): at depth 6.00 ft on 7/28/2009

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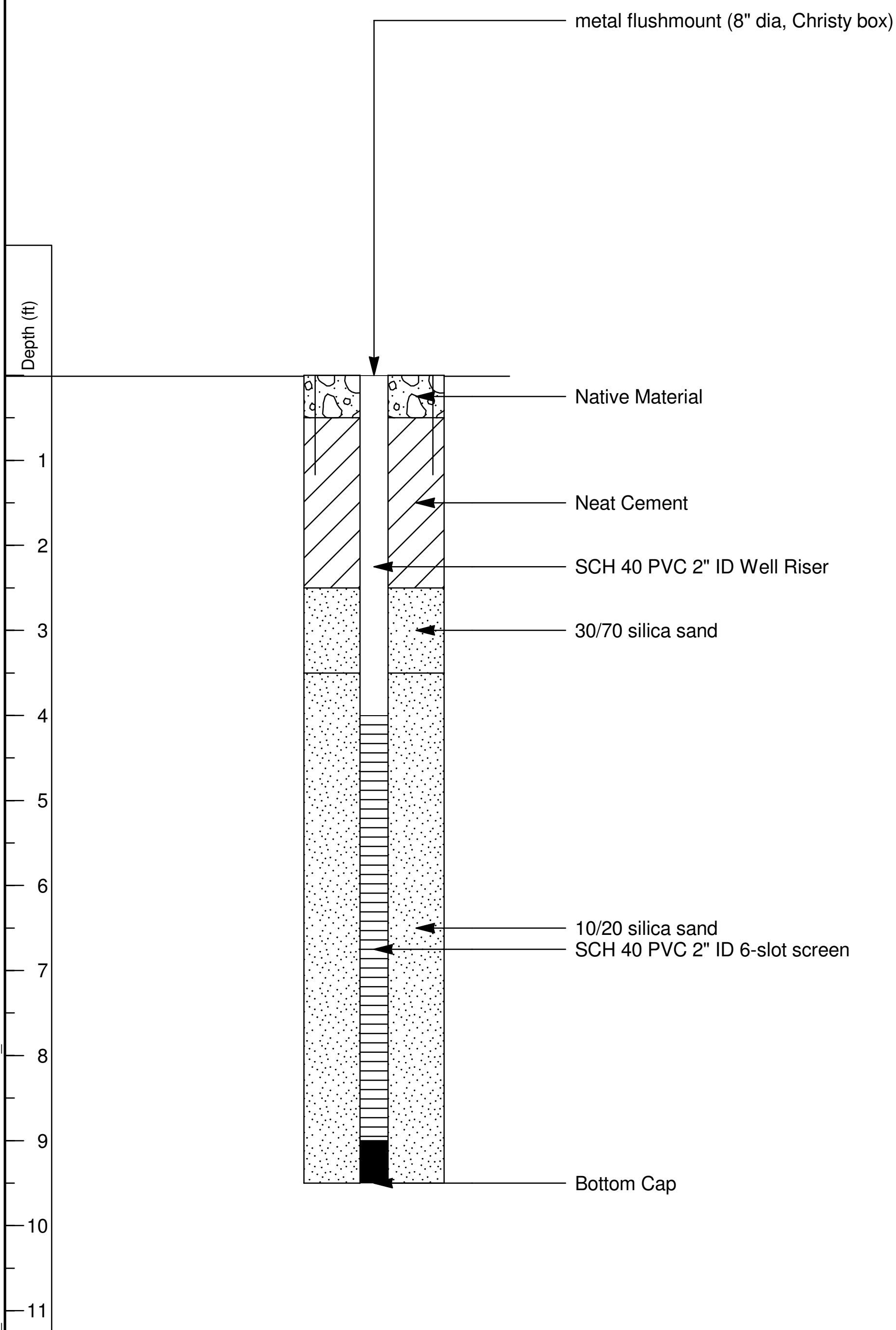
MONITORING WELL LOG

Project: **Main Operations Complex Area Phase I ISCO** **North East Cape, St. Lawrence Island, Alaska**		Page 1 of 1 Date: **29 Jul 2009**
Drilling Agency: ☐ Alaska District ☒ Other **Denali Drilling**		Elevation Datum: ☒ MSL ☐ other
Location: Northing: **3,403,921 ft** Easting: **1,810,742 ft**		Top of Hole Elevation: **

Hole Number, Field:	Permanent:	Driller:	Inspector:
ICOMW05	**ICOMW05**	**R. Roberson**	**R. Schlosser**

Type of Hole: ☒ other **Monitoring Well** ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater:	Depth Drilled:	Total Depth:
	7.00 ft WD	**9.0 ft**	**9.0 ft**

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	**2.5 in**	**8.3 in Hollow Stem Auger**	**Mobile B-61 Auger Rig**	**Driven Split Spoon**



NOTE:

1) Top of PVC Casing Elevation: 69.3523'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

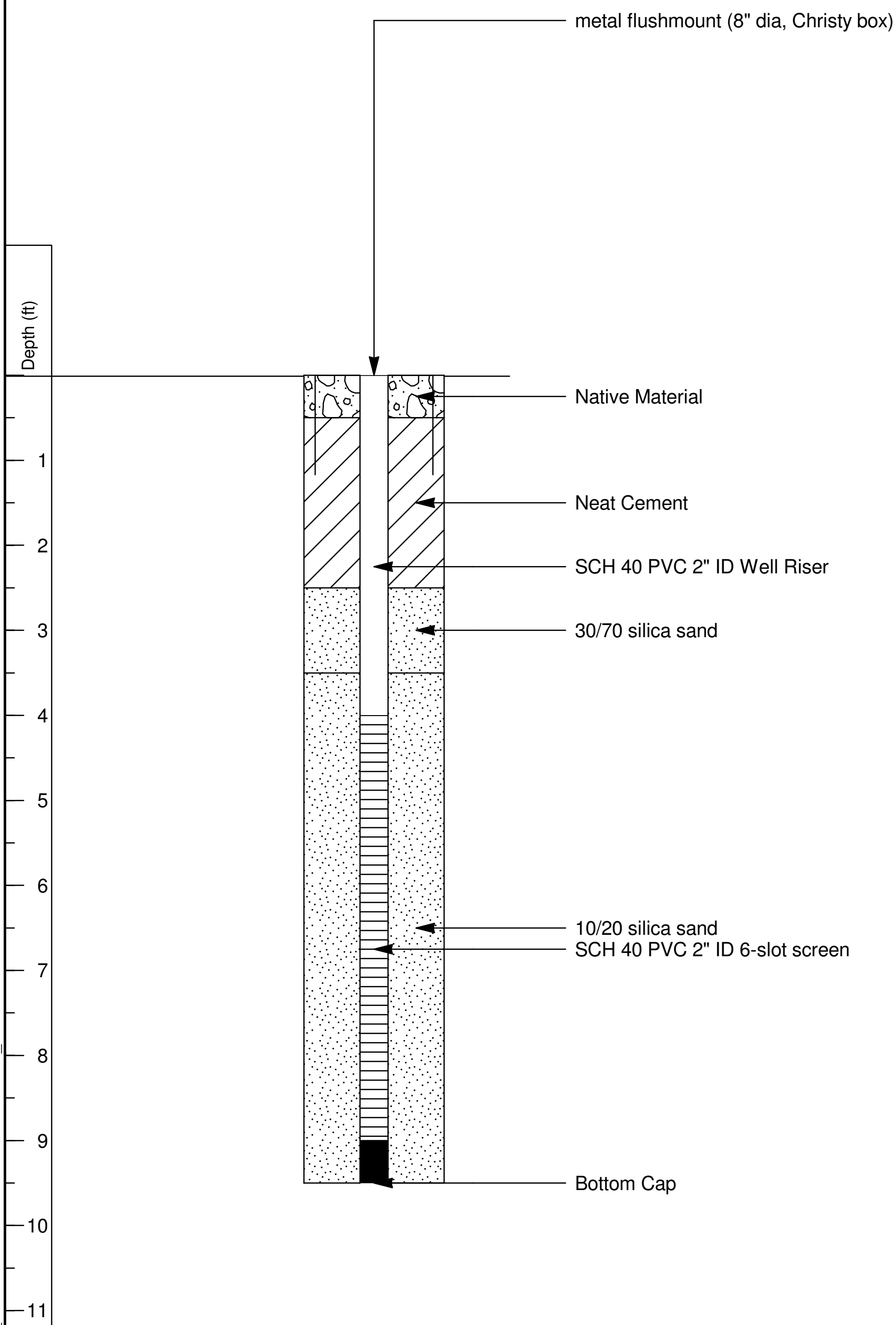
SUMMARY OF MATERIALS USED

4 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3.5 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 9.0 ft
Groundwater Encountered While Drilling (WD): at depth 7.00 ft on 7/29/2009

MONITORING WELL LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *30 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,938 ft* Easting: *1,810,741 ft*	Top of Hole Elevation: **
Hole Number, Field: *ICOMW06*	Permanent: *ICOMW06*
Driller: *R. Roberson*	Inspector: *R. Schlosser*
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *5.00 ft WD*
Depth Drilled: *9.5 ft*	Total Depth: *9.5 ft*
Hammer Weight: *340 lbs*	Split Spoon I.D: *2.5 in*
Size and Type of Bit: *8.3 in Hollow Stem Auger*	Type of Equipment: *Mobile B-61 Auger Rig*
Type of Samples: *Driven Split Spoon*	



NOTE:

1) Top of PVC Casing Elevation: 68.4904'
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

4 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 9.5 ft
Groundwater Encountered While Drilling (WD): at depth 5.00 ft on 7/30/2009

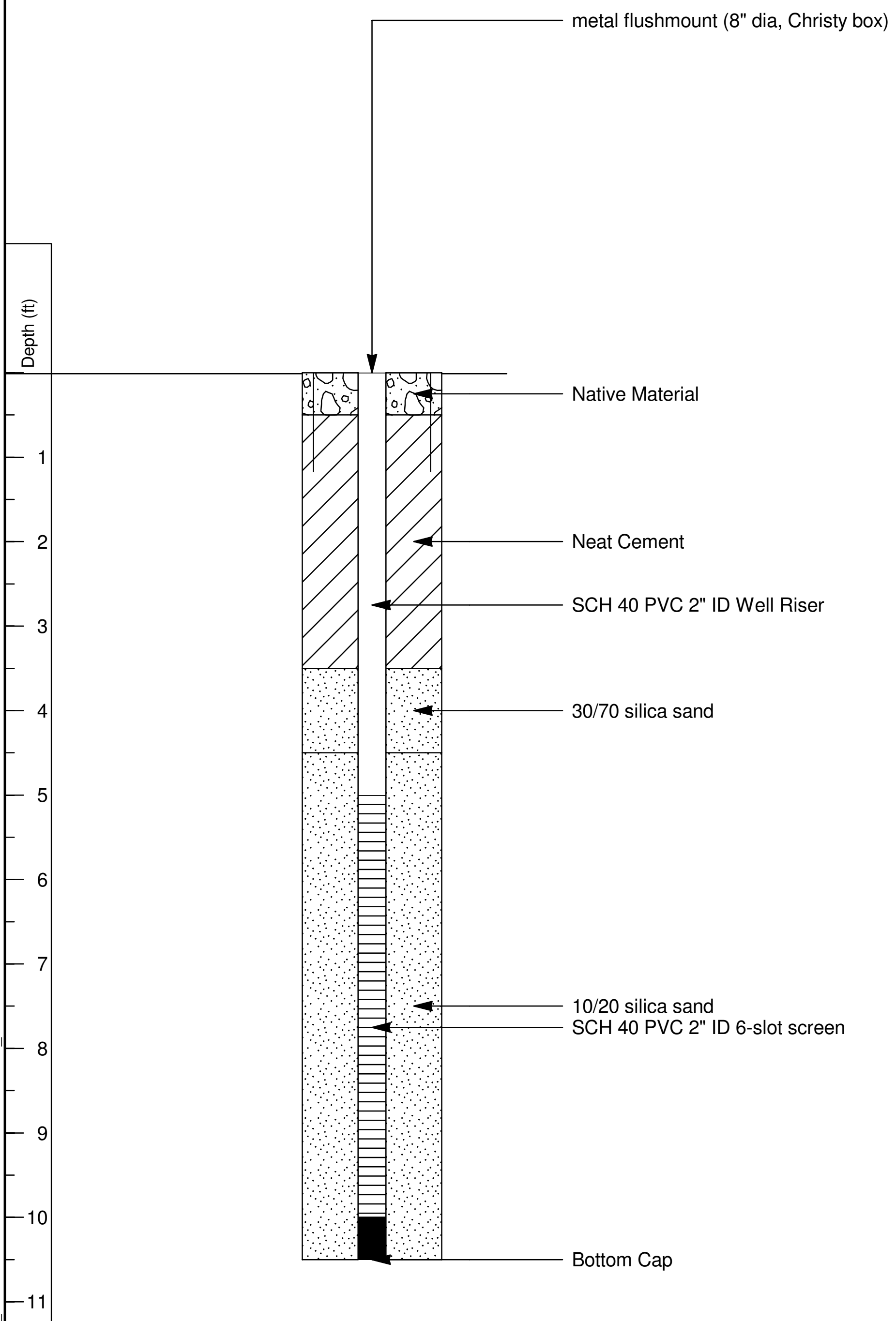
MONITORING WELL LOG

Project: *Main Operations Complex Area Phase I ISCO, North East Cape, St. Lawrence Island, Alaska*		Page 1 of 1	Date: *30 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*		Elevation Datum: ☒ MSL ☐ other	
Location: Northing: *3,403,938 ft* Easting: *1,810,733 ft*		Top of Hole Elevation: **	
Hole Number, Field: *ICOMW07*	Permanent: *ICOMW07*	Driller: *R. Roberson*	Inspector: *R. Schlosser*
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *6.00 ft AD*	Depth Drilled: *10.0 ft*	Total Depth: *10.0 ft*

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	*2.5 in*	*8.3 in Hollow Stem Auger*	*Mobile B-61 Auger Rig*	*Driven Split Spoon*

NOTE:

1) Top of PVC Casing Elevation: 68.0299'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing



SUMMARY OF MATERIALS USED

5 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 10.0 ft
Groundwater Encountered After Drilling (AD): at depth 6.00 ft on 7/30/2009

AECOM

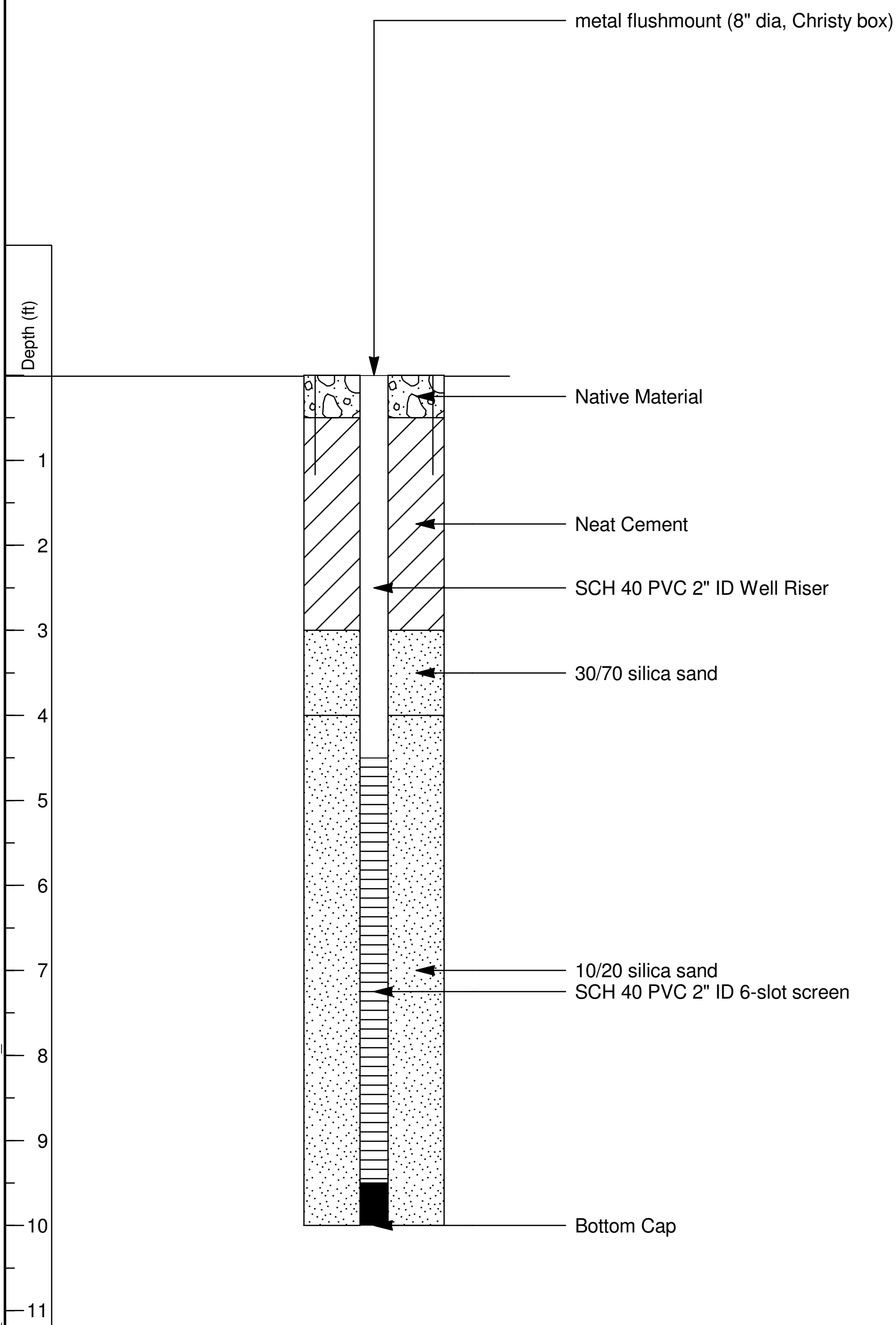
MONITORING WELL LOG

Project:	*Main Operations Complex Area Phase I ISCO* *North East Cape, St. Lawrence Island, Alaska*
Page 1 of 1	Date: *31 Jul 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other
Location: Northing: *3,403,930 ft* Easting: *1,810,729 ft*	Top of Hole Elevation: **

Hole Number, Field:	Permanent:	Driller:	Inspector:
ICOMW08	*ICOMW08*	*R. Roberson*	*R. Schlosser*

Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater:	Depth Drilled:	Total Depth:
	5.50 ft WD	*10.0 ft*	*10.0 ft*

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	*2.5 in*	*8.3 in Hollow Stem Auger*	*Mobile B-61 Auger Rig*	*Driven Split Spoon*



NOTE:

1) Top of PVC Casing Elevation: 69.4053'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

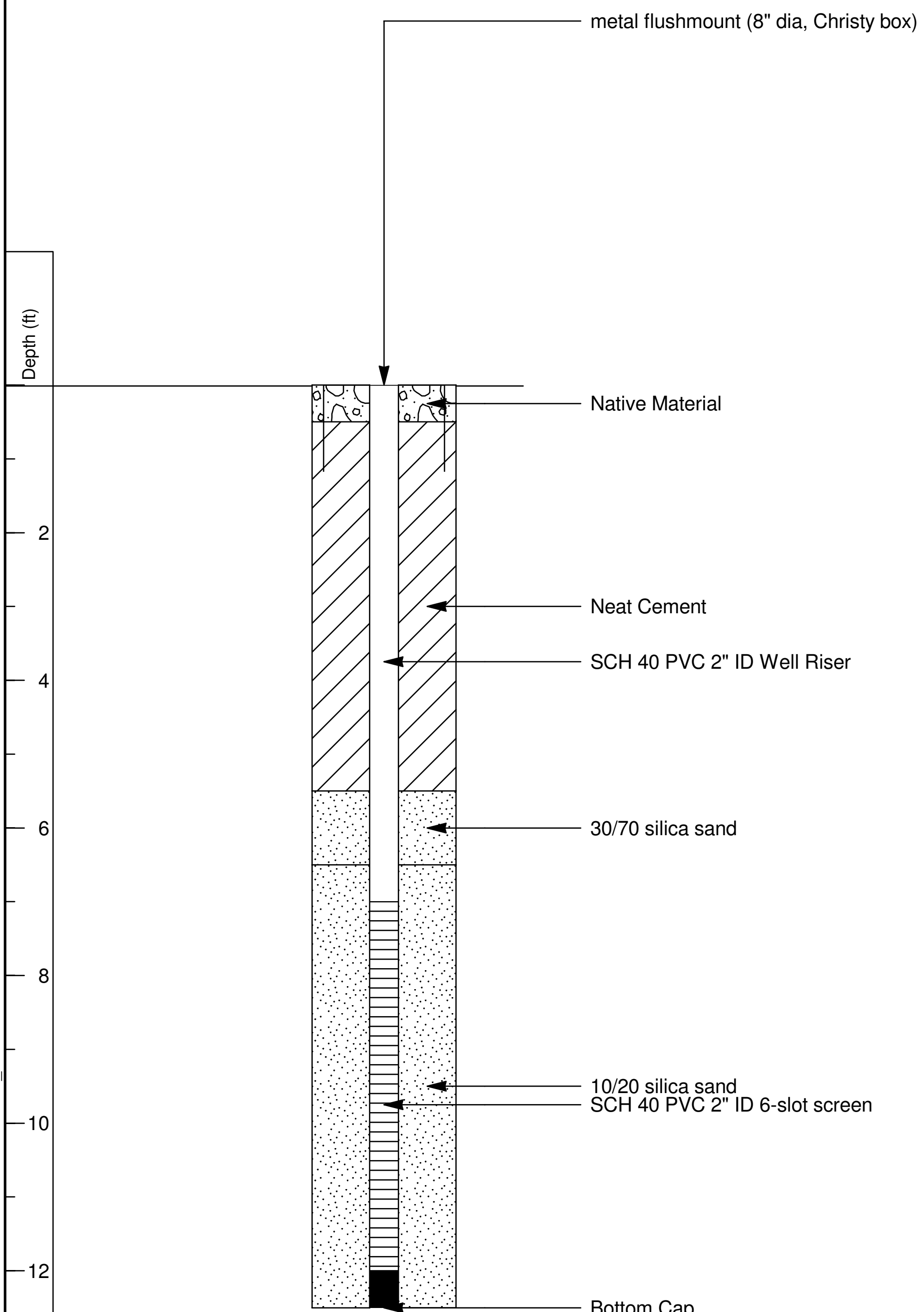
4.5 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 10.0 ft
Groundwater Encountered While Drilling (WD): at depth 5.50 ft on 7/31/2009

MONITORING WELL LOG

Project: **Main Operations Complex Area Phase I ISCO** North East Cape, St. Lawrence Island, Alaska	Page 1 of 1	Date: *1 Aug 2009*
Drilling Agency: ☐ Alaska District ☒ Other *Denali Drilling*	Elevation Datum: ☒ MSL ☐ other	
Location: Northing: *3,403,919 ft* Easting: *1,810,731 ft*	Top of Hole Elevation: **	
Hole Number, Field: *ICOMW09* Permanent: *ICOMW09*	Driller: *R. Roberson*	Inspector: *R. Schlosser*
Type of Hole: ☒ other *Monitoring Well* ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: *9.50 ft WD*	Depth Drilled: *12.5 ft* / Total Depth: *12.5 ft*

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	*2.5 in*	*8.3 in Hollow Stem Auger*	*Mobile B-61 Auger Rig*	*Driven Split Spoon*



NOTE:

1) Top of PVC Casing Elevation: 69.8701'
Flushmount with cement apron.
** Top of hole elevation not measured; see top of PVC casing elevation.
BTIC - Below Top of Inner Casing

SUMMARY OF MATERIALS USED

7 feet - 2-in SCH 40 PVC riser casing
5 feet - 2-in SCH 40 PVC 0.006-in slot screen
3 cubic feet - 10/20 Sand Filter Pack Material

Bottom of Exploration 12.5 ft
Groundwater Encountered While Drilling (WD): at depth 9.50 ft on 8/1/2009

NE_CAPE_WELL USACE ISCO LOGS.GPJ ACE_ANC.GDT 3/3/10

APPENDIX F

Groundwater Sampling Forms

BASELINE AND PRE-ISCO

CLIENT: BRISTOL
LOCATION: NE CAPE ISCO PICO
PROJECT #: 112642-20

ENTER WELL LOCATION: ICOMW01

INSPECTION

Label on well?	YES	NO (circled)	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES	NO (circled)	Standing water present?	YES	NO (circled)
Condition of well:	NEW		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy		Air Temperature:	~45° F	

Notes: TEMPORARY WELL Installed 7/20/09. Developed 7/21/09 and sampled immediately after development. parameters taken prior to sampling

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/21/09 Time: AM/PM

Depth to Water: 9.35 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Length of Well: 16.00 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 7/21/09 Begin Time: AM/PM Purging Equipment: Mini Typoon w/controller
End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

See Below

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: HIGH LOW (circled)
If low, recovery time:
Actual volume purged: 80 gallons
Actual purge flow rate: <250 ml/min ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity (NTU)~~ Salinity +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1755		~10.0	10.83	0.148	0.07	0.88	5.61	-55.3	N/A
1802			10.15	0.147	0.07	0.47	6.08	-57.9	N/A
1805			9.54	0.149	0.07	0.51	5.19	-57.2	N/A
1810			9.20	0.149	0.07	0.39	5.15	-55.1	N/A
1815			8.84	0.149	0.07	0.35	5.16	-56.0	N/A
			8.62	0.149	0.07	0.36	5.08	-55.4	N/A
									N/A
Sampled after development - purged total ~35 gals									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 7/21/09 Time: 18 AM/PM Method: Low Flow w/Mini Typoon

Appearance of Sample: Clear Actual sample flow rate: ~100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: @1800 1-1L amber, FOR DRO/RRO/ AK102/AK103
09NCMOCGW01

SAMPLING PERSONNEL

Name: R. Schlosser Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape Isco Pilot
PROJECT #: 11264-20

TD

ENTER WELL LOCATION: ICCMW02

INSPECTION

Label on well? **YES** NO
Is reference mark visible? **YES** NO
Condition of well: New
Weather: Cloudy
Notes: Well makes about 275 ml/min. Temporary well

Is cap locked? YES **NO**
Standing water present? YES **NO**
Any indication of surface runoff in well? YES **NO**
Air Temperature: ~45°F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/22/09 Time: 1615 AM/PM

Depth to Water: ~~9.21~~ 5.21
Length of Well: 9.80

Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 7-22-09 Begin Time: 1624 AM/PM End Time: 1735 AM/PM
Purging Equipment: Mini-Typhoon
Decontamination: PRE STEAM CLEANED DI WATER **OTHER**

CALCULATION OF 3 CASING VOLUMES

9.8	ft	Length of well
5.21	ft	- depth to water (before purge start)
4.59	ft	= length of water column
~2.25		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH **LOW**
If low, recovery time: Sustained @ <100 ml/min
Actual volume purged: 7 gallons
Actual purge flow rate: <100 ml ml/min or L/min

Notes: Temporary Well

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity~~ Salinity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1624		5.21							N/A
1645		5.78	5.35	0.219	0.10	1.77	4.83	114.3	N/A
1655		5.75	5.36	0.220	0.10	1.53	4.75	128.7	N/A
1702		5.70	5.39	0.221	0.10	1.40	4.81	134.2	N/A
1709		5.80	5.42	0.225	0.11	1.26	4.71	137.3	N/A
1715		5.60	5.44	0.225	0.11	1.07	4.96	141.4	N/A
1725		5.81	5.49	0.233	0.11	0.95	4.50	141.0	N/A
1735		5.90	5.48	0.233	0.11	1.28	4.27	138.9	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 7/22/09 Time: 1745 AM/PM Method: Mini Typhoon

Appearance of Sample: Slightly cloudy, yellow tint
Actual sample flow rate: <100 ml ml/min or L/min

SAMPLE BOTTLE COLLECTED: 09NCMICCGW03 - Collect 1-1L amber btl pres. w/HCL for DRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: M. Heaston / R. Schlesser
Company: AECOM

WL 01 - 9.36
WL 02 - 5.20

CLIENT: Bristol
LOCATION: NE Cape Esco Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: 88MW-5

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	OK		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy		Air Temperature:	~45°	

Notes: pH reading high, calibrated @ room temp. appeared

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/22/09 Time: AM/PM

Depth to Water: 9.08 1350
Length of Well: 15.1

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 7/22/09 Begin Time: 1340 AM/PM End Time: AM/PM
Purging Equipment: Mini Typhoon
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

15.1	ft	Length of well
9.08	ft	- depth to water (before purge start)
~6'	ft	= length of water column
3		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 7 gallons
Actual purge flow rate: < 150 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) 6.02 +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity~~ (NTU) Salinity +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1415	3	9.18	11.26	0.374	0.16	0.55	1.68	-66.2	N/A
1425	3.5	9.29	11.17	0.364	0.17	0.51	1.67	-71.2	N/A
1433	7	9.48	11.05	0.387	0.18	0.37	1.87	-66.2	N/A
1439	7.2		10.97	0.355	0.17	0.44	1.95	-73.9	N/A
1442	7.3		10.79	0.363	0.17	0.40	1.85	-70.7	N/A
1446			10.48	0.362	0.17	0.38	1.85	-70.1	N/A
1453	+	9.43	10.10	0.359	0.17	0.39	2.00	-80.3	N/A
1501		9.43	9.81	0.355	0.17	0.32	1.90	-85.6	N/A
1510		9.43	9.60	0.362	0.17	0.26	1.91	-87.1	N/A
1525		9.43	9.39	0.366	0.17	0.14	1.87	-82.0	N/A
Final:	~~See Back for~~			FINAL ABOVE					N/A

SAMPLE COLLECTION

~~See Back~~

Date: Time: AM/PM Method: Mini Typhoon

Appearance of Sample: yellow tint, organic residue on H_2O surface (purge water
Actual sample flow rate: < 150 ml ml/min or L/min

SAMPLE BOTTLE COLLECTED: 09NCMOCGW02 - 1 l amber for DRO/RRO, AK102/AK103, pres w/ HCL

SAMPLING PERSONNEL

Name: M. Heaston, R. Schlosser Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape
PROJECT #: 112624.2

ENTER WELL LOCATION: ICOMW09

INSPECTION

Label on well? **YES** NO
Is reference mark visible? **YES** NO
Condition of well: Good
Weather: clear to partly cloudy
Is cap locked? **YES** NO
Standing water present? YES **NO**
Any indication of surface runoff in well? YES **NO**
Air Temperature: 40°-45°

Notes: Sampling begun post Recovery of Purge on 8/06/2009. Well purged Dry 8/6/09 pm. 8/06/2009 3 liter Ambers filled during pm recovery 2-250 mL + VOA's filled 8/7/2009 Am.

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/6/2009 Time: 1030 AM/PM
8/7/2009 Time 7.61 Am
Depth to Water: 7.58
Length of Well: 11.90
Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED **DI WATER** OTHER

WELL PURGING

Date: 8/6/2009
Begin Time: 1500 8/6/2009 AM/**PM**
End Time: 0830 8/7/2009 **AM**/PM
Purging Equipment:
Decontamination: PRE STEAM CLEANED **DI WATER** OTHER

CALCULATION OF 3 CASING VOLUMES

11.90	ft	Length of well
7.58	ft	- depth to water (before purge start)
4.32	ft	= length of water column
2.12		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH **LOW**
If low, recovery time: 12 Hours
Actual volume purged: gallons
Actual purge flow rate: ml/min or L/min

Notes: WELL Purged Dry @ Low Flow, 2 HRS Recovery Allowed for Collection of 3-liter Ambers @ 1700 to 2000.

Time	Volume (gallons)	Depth to Water (feet)	pH (SU)	Conductivity (umhos/cm)	Turbidity (NTU)	D.O. (mg/L)	Temp (°C)	ORP	Ferrous Iron (mg/L)
1040 LFP		±0.33'	+/- 0.1	+/- 3%	+/- 10%	+/- 10%	+/- 5°	+/- 10 mV	
Start: 1105	0.5	~~12.9~~ 10.5	~~10.55~~ 6.68	0.256	81.2	12.95	6.50	129	N/A
1118	0.70	10.83	5.70	0.254	73.2	11.40	6.61	114	N/A
1130	1.0	11.41	5.68	0.258	50.1	7.08	5.94	106	N/A
	Dry @ 1135								N/A
1340	1.05	11.51	5.62	0.256	40.1	7.02	5.84	106	N/A
	Pumped	Dry @	Low Flow						N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/7/2009 Time: 0830 **AM**/PM
Method: Typhoon + PVC Bailer
Appearance of Sample: Clear
Actual sample flow rate: 100 mL/min ml/min or L/min
SAMPLE BOTTLE COLLECTED: 3-1 Liter Amber, 2-250 mL Poly, 6 VOA's HCL

SAMPLING PERSONNEL

Name: [signature]
Company: Aecom.

CLIENT: Bristol
LOCATION: NE Cape
PROJECT #: 1126 2412

ENTER WELL LOCATION: ~~ISC~~ LYP ICOMW02

INSPECTION

Label on well? (YES) NO — Is cap locked? (YES) NO
Is reference mark visible? (YES) NO — Standing water present? YES (NO)
Condition of well: Good — Any indication of surface runoff in well? YES (NO)
Weather: Sunny 50-60° — Air Temperature: 50°-60°

Notes: WELL ICOMW02 was included due to lack of H2O +/- 9" @ ICOMW08, + poor production well was very turbid + failed to clean up.

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 09 08 06 Time: AM/(PM)

Depth to Water: 4.60
Length of Well: 8.90
Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 09/08/06 August 6, 2009 Begin Time: 1550 AM/(PM) End Time: 1640 AM/(PM)
Purging Equipment: Typoon pump low flow
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

8.90	ft	Length of well
4.60	ft	- depth to water (before purge start)
4.30	ft	= length of water column
2.107		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: 12 Hrs.
Actual volume purged: 4.5 gal gallons
Actual purge flow rate: 200 min ml/min or L/min
1 gal = 10 min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1550	0.1	4.75	6.07	0.245	600	8.54	6.81	127	N/A
1602	1.0	5.00	5.21	0.253	225	6.41	6.40	125	N/A
1618	2.0	5.25	5.19	0.258	225	3.01	5.21	119	N/A
1624	3.5	5.50	5.17	0.258	124	3.03	5.17	117	N/A
1637	4.0	6.02	5.16	0.260	104	2.99	5.15	116	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 09/08/06 Time: 1640 AM/(PM) Method: Typoon Pump

Appearance of Sample: turbid
Actual sample flow rate: 200 ml/min ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 VOC's / 2-250mL Poly / 3-1 Liter Amber X 2

SAMPLING PERSONNEL

Name: [signature] Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape Isco Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW03

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	Cloudy		Air Temperature:	40°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/4/09 Time: 0950 AM/PM

Depth to Water: 3.08 Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE

Length of Well: 9.50 TOC Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/4/09 Begin Time: 1600 AM/PM Purging Equipment: Mini Typhoon w/ control

End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER Dedicated pump

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
3.08	ft	- depth to water (before purge start)
6.42	ft	= length of water column
5.97		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW

If low, recovery time:

Actual volume purged: 6.0 gallons

Actual purge flow rate: ≤100 ml/min or L/min

Notes:

Time	Volume (gallons) Running Total	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1600	.5	4.25	5.29	0.218	15.5	1.16	6.06	214	N/A
1620	2	4.52	5.32	0.226	15.4	0.58	7.13	207.5	N/A
1640	3.5	4.64	5.33	0.225	10.3	0.18	7.64	202.0	N/A
1655	4.5	4.80	5.34	0.223	9.02	0.61	7.53	200.4	N/A
1710	6.0	4.62	5.30	0.222	8.04	2.49	7.5	204.0	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1730 AM/PM Method: Typhoon mini w/ controler

~~09NCMOCGW04 @ 1730~~ RAS 8/4/09 09NCMOCGW05 @ 1730

Appearance of Sample: Clear Actual sample flow rate: ml/min or L/min

SAMPLE BOTTLE COLLECTED:
6 - 40ml vial w/HCL (GRO AK101, Benz, Naph.
1 - 250 ml poly - Sulfates
1 - 250 ml w/HNO3 - Metals
2) 1 lt Amber DRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: R. Schlosser Company: AECOM

L38
.49
1242
5520
.69.05

CLIENT: Bristol
LOCATION: NE Cape ISCO
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW04

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: New- GOOD
Weather: Windy, cloudy
Notes:

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 40°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: 905 AM/PM

Depth to Water: 7.33
Length of Well: 9.71

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/5/09
Begin Time: 0915 AM/PM
End Time: 1000 AM/PM
Purging Equipment: Peristaltic, 12 volt
Decontamination: PRE STEAM CLEANED DI WATER OTHER
New tubing

CALCULATION OF 3 CASING VOLUMES

9.71	ft	Length of well
7.33	ft	- depth to water (before purge start)
1.38	ft	= length of water column
.67		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW
If low, recovery time: Purged dry @ 10 AM
Sample @ 1500 7.55
Actual volume purged: 2.5 gallons
Actual purge flow rate: <100 ml/min or L/min

Notes: Well ran dry, wait for recovery and sample.
Sample # 09NCMOCGW07

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 0915	Initial	7.33	5.84	0.236	NT	9.98	4.1	168	N/A
0948	1.0	9.00	5.71	0.218		12.28	3.64	189	N/A
1000	1.5	Dry	5.73	0.210		13.01	4.13	189.8	N/A
— Come back to well after recovery to sample									N/A
1500	1.0	7.55	5.94	0.179	15.6	9.65	5.21	187.4	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/5/09 Time: 1500 AM/PM
Method: Peristaltic, so low of flow ~50 ml/min

Appearance of Sample: Yellowish
Actual sample flow rate: ml/min or L/min

SAMPLE BOTTLE COLLECTED:
2-1lt Amber pres w/ HCL for DRO/RRO AK102/AK103
1-250 ml poly for Sulfates
1-250 ml poly w/ HNO3 for metals
6-40 ml vials pres w/ HCL for GRO AK101, Benzene, Naphthalene

SAMPLING PERSONNEL

Name: R. Schlosser
Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape ISCO Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW05

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	New		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy 40°		Air Temperature:	40°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/4/09 Time: 0900 AM/PM

Depth to Water: 3.08
Length of Well: 9.50

Measured with: ELECTRONIC TAPE / CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

WELL PURGING

Date: ~~1350~~ 8/4/09 Begin Time: 1350 AM/PM
End Time: AM/PM

Purging Equipment: Mini Typhoon w/control
Decontamination: PRE STEAM CLEANED DI WATER OTHER Dedicated pump

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
3.80	ft	- depth to water (before purge start)
5.70	ft	= length of water column
2.79		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Rms 8/4/09

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 7.3 gallons
Actual purge flow rate: <100 ml ml/min or L/min

Notes: Sample # ~~09NEMOCGW03~~ 09NCMOCGW04
Very low flow - YSI flow through affected by sun

Time	Volume (gallons) TOTAL (Running)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: ~~1410~~ 1350	.5	3.08	5.15	0.196	317.1	0.64	8.17	201.4	N/A
1410 ~~1350~~	1	2.99	5.15	0.194	182.6	0.75	9.41	197.3	N/A
1440 ~~1410~~	2.5	3.50	5.12	0.192	28.9	1.76	9.50	201.0	N/A
~~1430~~ 1500	6.0	4.00	5.14	0.191	14.9	3.05	10.28	203.5	N/A
1525	6.2	4.00	5.16	0.192	12.9	3.07	11.04	206.3	N/A
1535	7.1	>4.00	5.15	0.192	17.1	4.15	9.72	210.5	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1545 AM/PM Method: Mini Typhoon w/control

Appearance of Sample: Clear
Actual sample flow rate: <100 ml/min or L/min

SAMPLE BOTTLE COLLECTED:
6 - 40ml vials w/HCL for GRO AK101, Benzene Naphthalene
2 - 1L Amber w/HCL for DRO/RRO AK102/AK103
1 - 250 ml poly for Sulfates 1 - 250ml w/nitric for metals

SAMPLING PERSONNEL

Name: R. Schlosser K. Proess Company: AECOM

CLIENT: BRISTOL
LOCATION: NE CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ENTER WELL LOCATION: IRONWOOD

INSPECTION

Label on well?	YES (circled) / NO		Is cap locked?	YES / NO (circled)	
Is reference mark visible?	YES (circled) / NO		Standing water present?	YES (circled) / NO	
Condition of well:	Good Newly Const.		Any indication of surface runoff in well?	YES / NO (circled)	
Weather:	Windy		Air Temperature:	40°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: 0905 AM/PM

Depth to Water: 4.03
Length of Well: 9.20

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 8/5/09 Begin Time: 0915 AM/PM End Time: AM/PM

Purging Equipment: Peristaltic
Decontamination: PRE STEAM CLEANED DI WATER OTHER
New Tubing

CALCULATION OF 3 CASING VOLUMES

9.20	ft	Length of well
4.03	ft	- depth to water (before purge start)
5.17	ft	= length of water column
2.6 gals		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: ~4 HRS
Actual volume purged: gallons
Actual purge flow rate: ml/min or L/min

Notes: Sample #. 09NCMOCGW08

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 0915	Initial	NT	5.92	0.169	NT	22.1	5.26	119	N/A
0945	1.5		5.86	0.161		8.6	5.28	172	N/A
1005	2.0		6.00	0.170		9.79	4.53	176	N/A
1025	2.5 ~~Dry~~		6.15	0.178		9.60	5.24	147.8	N/A
1030	Dry								N/A
Well purged dry - Sampled after recovery									N/A
									N/A
1600	1.0	6.98	5.94	0.179	13.5	9.65	5.24	148.1	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/5/09 Time: 1600 AM/PM Method: Geo pump - peristaltic

Appearance of Sample: Slight yellow tint
Actual sample flow rate: ~250 ml/min or L/min

SAMPLE BOTTLE COLLECTED:
1-250 ml poly - sulfates 1-250 ml w/ HNO3 for metals
6-40 ml vials w/HCL - GRO RRO AK101, Benzene, Naphthalene
2-1 lt Amber w/HCL for GRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: R. Schlosser Company: ABZOM

CLIENT: Bristol
LOCATION: NE CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW07

INSPECTION

Label on well? YES NO — Is cap locked? YES NO
Is reference mark visible? YES NO — Standing water present? YES NO
Condition of well: Good — Any indication of surface runoff in well? YES NO
Weather: Raining — Air Temperature: 40°
Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: AM/PM

Depth to Water: 5.68 — Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 9.60 — Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/5/09 Begin Time: 1020 AM/PM — Purging Equipment: Mini Typoon w/ Control
End Time: 1130 AM/PM — Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.60 ft Length of well — Yield: HIGH LOW
5.68 ft - depth to water (before purge start) — If low, recovery time:
3.92 ft = length of water column
~2.5 gallons x conversion factor (2" well) 0.49 — Actual volume purged: ~9.0 gallons
Gallons = 3 casing volumes — Actual purge flow rate: ~100 ml/min or L/min

Notes: Sample# 09NCMOCGW06 & 09NCMOCGW06 MS/MSD

Time	Volume (gallons) Running Total	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1020	.5	5.78	5.68	0.257	380	1.01	2.96	156.6	N/A
1035	1	5.91	5.65	0.257	31.1	0.71	2.90	108	N/A
1045	2.5	5.82	5.67	0.263	10.6	0.31	2.55	95.0	N/A
1055	5.5	5.92	5.70	0.266	7.1	0.19	3.19	83.4	N/A
1105	6.5	5.92	5.72	0.267	4.8	0.41	4.23	76.0	N/A
1115	7.5	5.92	5.73	0.268	4.3	0.27	4.52	71.5	N/A
1125	8.5	5.92	5.73	0.268	3.6	0.31	4.33	68.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1130 AM/PM — Method: Mini Typoon w/ controller

Appearance of Sample: yellow tint — Actual sample flow rate: ~100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: FOR Sampled & MS/MSD
6-40ml vial w/ HCL - GRO, Benz, Naph AK101
2-1 lt Amber w/ HCL - AK102/AK103 - DRO/RRO
1-250 ml poly - Sulfates
1-250 ml poly w/ HNO3 for Metals

SAMPLING PERSONNEL

Name: R. Schlosser — Company: AECOM

DAY 3 SAMPLING FORMS

19
32

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW02

INSPECTION

Label on well? (YES) NO — Is cap locked? (YES) NO

Is reference mark visible? (YES) NO — Standing water present? YES (NO)

Condition of well: Good — Any indication of surface runoff in well? YES NO

Weather: Clear, Sunny, Calm — Air Temperature: 55-65° LGP 8/17

Notes: Sample of 09NCMOCGW19 + MOC # 3/2 purge rate @ 85 mL a min @ 1415

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/16/2009 Time: 1305 AM/(PM)

Depth to Water: 4.67 — Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE

Length of Well: 8.49 — Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/16/2009 Begin Time: 1315 AM/(PM) — Purging Equipment: Mini Typoon & Low Flow Cont.

End Time: 1350 AM/(PM) — Decontamination: PRE STEAM CLEANED DI WATER (OTHER)

CALCULATION OF 3 CASING VOLUMES

8.49 ft Length of well — Yield: (HIGH) LOW

4.67 ft - depth to water (before purge start) — If low, recovery time:

ft = length of water column

x conversion factor (2" well) 0.49 — Actual volume purged: gallons

Gallons = 3 casing volumes — Actual purge flow rate: 112 (ml/min) or L/min

Notes: Gray VOA Vial trap air in Septum
Filling 6 VOA's 1410 to 1445 +/- 7 gallons of additional purge*

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1315		LGP 8/16/09							N/A
1327		~~4.54~~	3.85	1.237	34.70	3.20	9.33	193	N/A
1332		4.48	4.14	1.106	32.78	2.29	9.11	157	N/A
1337		4.95	4.50	0.987	33.61	1.81	9.22	127	N/A
1340		4.95	4.60	0.927	33.80	1.55	9.08	~~115~~ 120.9	N/A
1344		4.96	4.86	0.899	32.60	1.51	9.23	96.9	N/A
1347		4.98	4.97	0.880	34.70	1.50	9.29	93.7	N/A
1350		4.98	5.02	0.876	34.61	1.49	9.43	91.6	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1350 AM/(PM) — Method: Mini Typhoon & Low flow controller.

Appearance of Sample: clear — Actual sample flow rate: 120 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres LGP 8/16 1545

SAMPLING PERSONNEL

Name: Lance G. Preuss — Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW03

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: Good
Weather: clear, sunny, calm
Notes: Sample # 09NEMOCGW18 + moc #30 31 AAP 8/17/09

Is cap locked? (YES) NO
Standing water present? YES (NO)
Any indication of surface runoff in well? YES NO
Air Temperature: 50°-60°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/16/2009 Time: 1052 (AM)/PM

Depth to Water: 3.12
Length of Well: 9.50

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/16/2009 Begin Time: 1052 (AM)/PM
End Time: AM/PM
Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER (OTHER)

CALCULATION OF 3 CASING VOLUMES

9.50 ft Length of well
3.12 ft - depth to water (before purge start)
ft = length of water column
x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: (HIGH) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 160 (ml/min) or L/min

Notes:

Time	Volume (~~gallons~~) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1052	setting Flow to 200 (160) ml a min this is the min								N/A
1104	1,360	4.03	1.68	14.46	12.77	1.79	17.57	393.6	N/A
1107	1696	4.03	1.69	14.48	10.07	1.57	17.62	392.9	N/A
1110	2816	4.03	1.73	14.47	9.86	1.52	17.83	391.1	N/A
1113		4.03	1.73	14.46	9.96	1.34	17.93	391.7	N/A
1116		4.03	1.73	14.48	10.63	1.28	18.04	392.6	N/A
1119		4.03	1.70	14.51	10.02	1.27	18.06	394.4	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/09 Time: 1120 (AM)/PM
Method: Mini Typhoon.

Appearance of Sample: clear, red
Actual sample flow rate: 160 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres ✓ AAP 8/16/2009 1555 Gray Caps BFree

SAMPLING PERSONNEL

Name: Lance G. Preuss
Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW04

INSPECTION

Label on well? **YES** NO
Is reference mark visible? **YES** NO
Condition of well: Good
Weather: cloudy wind 5-10mph N
Notes: 09WCMOCGW14 + MOC#26

Is cap locked? **YES** NO
Standing water present? YES **NO**
Any indication of surface runoff in well? YES NO
Air Temperature: 40-48°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: ~~1700~~ 1344 AM/**PM**

Depth to Water: 6.98
Length of Well: 9.71
Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009
Begin Time: 1354 AM/**PM**
End Time: 1436 AM/**PM**
Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER **OTHER**

CALCULATION OF 3 CASING VOLUMES

Purged Dry

9.71	ft	Length of well
6.98	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH **LOW**
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 100 ml ml/min or L/min
120 min 1404

Notes: pump @ 8.31 (Intake)

Time	Volume (~~gallons~~ mL)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
44									
Start: ~~1350~~	Intial		~~5.62~~	~~0.204~~					N/A
1404 ~~1354~~	200mL	77.10	5.62	0.204	23.51	4.87	5.28	90.8	N/A
1409	2500		5.67	0.208	24.59	4.02	5.45	85.8	N/A
1413	2900	77.10	5.68	0.211	23.87	3.66	5.86	87.6	N/A
1417	3300	77.10	5.67	0.210	22.91	3.58	5.97	90.1	N/A
1421	3700	77.10	5.66	0.212	21.89	3.50	6.00	90.9	N/A
	Prep	to Sample		well dry @	1435	1-VOA filled	recover		N/A
1436	4200	#77.10							N/A
1625									N/A
1050									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1050 **AM**/PM
Method: mini Typhoon / Low Flow controler

Appearance of Sample: clear
Actual sample flow rate: 100 **ml/min** or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss
Company: AECOM

Duplicate ZLP 8/17/09 ~~09NCMOCGW17MOC30~~ ~~17~~ ~~18~~ Dup 20

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW05

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good / New		Any indication of surface runoff in well?	YES	NO
Weather:	cloudy, CALM		Air Temperature:	40°	

Notes: 09NCMOCGW17MOC ~~29~~ 30 Duplicate 09NCMOCGW20MOC 30

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: ~~8/19~~ 1930 AM/PM

Depth to Water: 3.87 Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 8.45 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1924 AM/PM Purging Equipment: Mini Typoon & Low Flow Cont
End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.45	ft	Length of well	Yield:	HIGH LOW
3.87	ft	- depth to water (before purge start)	If low, recovery time:	
	ft	= length of water column		
		x conversion factor (2" well) 0.49	Actual volume purged:	gallons
	Gallons	= 3 casing volumes	Actual purge flow rate: 100	ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (~~umhos/cm~~) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1924	Initial								N/A
1934	1000	4.41	1.36	18.92	66.65	16.50	14.41	410.6	N/A
1937		>5.6	1.32	19.29	21.36	16.39	14.88	417.3	N/A
1940		>5.6	1.10	19.17	18.79	14.16	15.08	413.6	N/A
1943		>5.6	1.30	19.08	15.76	14.38	14.89	410.9	N/A
1946		>5.6	1.29	19.06	18.57	14.65	14.82	411.5	N/A
									N/A
2020	to 2150	Filling VOA's (12) bad caps							N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/15/2009 Time: 2150 Dup 2140 AM/PM Method: Mini Typoon & Low Flow Controller

Appearance of Sample: Dark red Actual sample flow rate: 80~100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pre
6-40mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW06

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: Good
Weather: Overcast Fog WIND 8-15 N
Notes: TOP OF Pump e 5.50 MS/MSD LOCATION ~~[illegible]~~ + MOC 28 09NCMOCGW106

Is cap locked? (YES) NO
Standing water present? YES (NO)
Any indication of surface runoff in well? YES NO
Air Temperature: 40-42°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: 1540 AM/PM

Depth to Water: ~~9.20~~ 4.01
Length of Well: 9.20

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1540 AM/(PM)
End Time: AM/PM

Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER (OTHER)

CALCULATION OF 3 CASING VOLUMES

9.20	ft	Length of well
4.01	ft	- depth to water (before purge start)
5.19	ft	= length of water column
1.60		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 100 ml/min or L/min

Notes: Clear, no solids but reddish colored.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1540	begin			mS/cm					N/A
1550	1000mL	75.50	1.21	20.87	63.96	2.51	9.66	419.7	N/A
1555	1500	75.50	1.17	21.11	68.01	2.45	9.93	417.8	N/A
1600	2000	75.50	1.12	21.23	80.30	2.52	9.65	420.1	N/A
1605	2500	75.50	1.07	20.68	79.2	2.65	8.24	423.9	N/A
1610	3000	75.50	1.01	20.60	76.0	2.47	8.23	423	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final: 1615		76.50	1.00	20.61	73.0	2.49	8.24	425	N/A

SAMPLE COLLECTION

Date: 5/18/09 Time: ~~1615~~ 2020 AM/(PM) ~~1715~~ 2010
Method: Mini Typhoon/Low Flow Controller

Appearance of Sample: Clear, brownish red.
Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss
Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW07

INSPECTION

Label on well?	(YES) NO		Is cap locked?	(YES)	NO
Is reference mark visible?	(YES) NO		Standing water present?	YES	(NO)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	cloudy 40-50°		Air Temperature:	45-50°	

Notes: 09NCMWGW15 + MEC 37

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: AM/(PM)

Depth to Water: 5.60 Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Length of Well: 9.60 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1451 AM/PM Purging Equipment: Mini Typoon & Low Flow Cont
End Time: 1540 AM/PM Decontamination: PRE STEAM CLEANED DI WATER (OTHER)

CALCULATION OF 3 CASING VOLUMES

9.60	ft	Length of well	
5.60	ft	- depth to water (before purge start)	
4.0	ft	= length of water column	
		x conversion factor (2" well) 0.49	
	Gallons	= 3 casing volumes	

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 120ml/min ml/min or 100ml/m L/min

Notes: pump @ 7.60

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1451	Initial								N/A
1456	500mL	5.70	6.55	0.387	139	2.72	4.03	-56	N/A
1501	1000mL	5.72	6.36	0.386	136	1.73	3.66	-52	N/A
1506	1500mL	5.75	6.58	0.410	59.34	1.66	4.39	-65	N/A
1511	2000ml	5.76	6.62	0.415	33.64	1.52	4.17	-60.4	N/A
1515	2400mL	5.76	6.64	0.415	21.31	1.43	4.12	-65.0	N/A
									N/A
1540	Sampling Complete								N/A
1800	Talked to M. Hearston 1540 samples need to be discarded								N/A
due to problem with Quenching + HCL, Recollection									N/A
Final: 2200									N/A

SAMPLE COLLECTION

Date: 8/15/09 Time: ~~1540~~ 2200 AM/(PM) Method: Mini Typoon & Low Flow

Appearance of Sample: Clear Actual sample flow rate: 100mL/min ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1Liter Amber HCL Pres
6-40mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW08

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	cloudy, Light mist + Rain		Air Temperature:	45-50°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: AM/PM

Depth to Water: 6.65 11:05
Length of Well: 9.35

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: AM/PM End Time: AM/PM

Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.35	ft	Length of well	Yield:	HIGH	LOW
6.65	ft	- depth to water (before purge start)	If low, recovery time:		
2.70	ft	= length of water column			
1.30		x conversion factor (2" well) 0.49	Actual volume purged:		gallons
Gallons		= 3 casing volumes	Actual purge flow rate:	1 120 mL/min, 2 80 mL/min	ml/min or L/min

Notes: 09NCMCCGW13 + MUC#25

Time	Volume (~~gallons~~) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1305	540	~~9.05~~	5.69	0.191	95	19.01	3.76	89.9	N/A
1315		6.75							N/A
set	Low purge rate 80 mL min.								N/A
1320	580	7.06	5.61	0.191	90.91	4.10	4.95	88.6	N/A
1325	980	7.20	5.70	0.194	95.61	4.21	5.11	80.3	N/A
1330	1380	9.20	5.71	0.196	90.10	~~17.87~~ 4.21	5.60	84.1	N/A
		WELL	became	dry @ 80 mL/min with pump @ TD.					N/A
									N/A
1000									N/A
1025									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1000 AM/PM Method: Mini Typhoon + Low flow controller

Appearance of Sample: Clear

Actual sample flow rate: <100 mL ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres ✓ LMP 8/16/2009
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW089

INSPECTION

Label on well? (YES) NO — Is cap locked? (YES) NO
Is reference mark visible? (YES) NO — Standing water present? YES (NO)
Condition of well: Good — Any indication of surface runoff in well? YES NO
Weather: Clear to P.C 45-60° — Air Temperature: 45-60°
Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: (AM)/PM

Depth to Water: 6.89 — Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Length of Well: 9.35 — Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: AM/PM — Purging Equipment: Mini Typoon & Low Flow Cont
End Time: AM/PM — Decontamination: PRE STEAM CLEANED DI WATER (OTHER)

CALCULATION OF 3 CASING VOLUMES

9.35 ft Length of well — Yield: HIGH (LOW)
6.89 ft - depth to water (before purge start) — If low, recovery time:
2.49 ft = length of water column
1.2215 x conversion factor (2" well) 0.49 — Actual volume purged: 1.25 gallons
Gallons = 3 casing volumes — Actual purge flow rate: 225 (ml/min) or L/min
Notes: WELL HAS POOR Recovery, Purged Dry @ Low Flow

Time	Volume (~~gallons~~) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1955	0,500	6.99	5.76	0.118	450	1.92	2.7	239	N/A
2000	1625	7.46	5.69	0.111	440	1.45	3.20	227.2	N/A
2005	1850	8.01	5.62	0.117	350	0.82	4.13	198.	N/A
2010	3,475	8.50	5.57	0.118	206	0.62	4.06	186.5	N/A
2015	5,100	9.00	5.57	0.190	169	0.56	4.58	181.6	N/A
									N/A
	WELL Purged Dry SAMPLES COLLECT FOLLOWING AM								N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: Time: (AM)/PM — Method: Mini Typoon + Low Flow Control
Appearance of Sample: SLIGHTLY TURBID. — Actual sample flow rate: 225 mL/min ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss — Company: AECOM

DAY 7 SAMPLING FORMS

CLIENT: USACE / Bristol
LOCATION: NE Cape AK
PROJECT #:

ENTER WELL LOCATION: IECMW002

INSPECTION

Label on well? ~~YES~~ NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: partly cloudy, mid 40's F windy
Notes: 09NECMOCGW2 ~~17~~ MOC#-~~17~~ 21 8/20/09 8/20/09

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: mid 40's °F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 17:05 AM/PM

Depth to Water: 4.73
Length of Well: 8.94

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/19/2009 Begin Time: 17:08 AM/PM End Time: 17:35 AM/PM
Purging Equipment: mini Typhoon / Low FL
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

___	ft	Length of well
___	ft	- depth to water (before purge start)
___	ft	= length of water column
___		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: ___ gallons
Actual purge flow rate: 100 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 17:08									N/A
17:18		4.88	3.70	2.927	14.79	1.48	8.96	184.1	N/A
17:21		5.00	3.62	2.875	16.76	1.31	8.83	167.5	N/A
17:24		5.10	3.81	2.869	11.15	1.05	8.54	170.9	N/A
17:27		5.05	3.82	2.846	9.25	1.05	8.09	167.7	N/A
17:30		5.05	3.85	2.639	8.53	0.96	8.17	167.1	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 17:35 AM/PM
Method: mini typhoon w/ low flow controller

Appearance of Sample: turbid yellowish brown, sheen clears up with purging
Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Aaron Jamgochian
Company: AECOM

CLIENT: USACE [illegible]
LOCATION: NC CAPE AK
PROJECT #:

ENTER WELL LOCATION: ICCMW003

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	[illegible] 40's °F high wind		Air Temperature:	mid 40's °F	

Notes: 09NCMOCGW2 3 MOC # 17

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 8/19/2009 Time: 13:18 AM/PM

Depth to Water: 3.89
Length of Well: 9.50
Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING
Date: 8/19/2009 Begin Time: 13:20 AM/PM End Time: 15:56 AM/PM
Purging Equipment: Mini Typhoon/Low FL
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 150 ml/min or L/min

Notes: FIELD Duplicate collected @ MW03
Time 1400 Sample ID: 09NC~~MOC~~GW21

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:20									N/A
13:30		4.81	1.62	9.940	7.90	1.25	14.60	347.4	N/A
13:33		4.91	1.62	9.984	6.82	1.25	14.92	356.5	N/A
13:36		5.06	1.67	9.989	5.98	1.17	15.11	347.3	N/A
13:39		5.07	1.66	9.995	5.74	1.22	15.66	351.4	N/A
13:42		5.13	1.68	9.966	5.90	1.28	15.11	353.3	N/A
13:45			1.68	9.964	5.83	1.24	15.19	350.2	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 8/19/2009 Time: 1350 AM/PM
Method: mini typhoon with low flow controller

Appearance of Sample: reddish orange/clear
Actual sample flow rate: 150 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 24 ~~6~~ 40 mL VOA HCL [illegible] collected.
8 ~~2~~ 1 Liter Amber MS/MSD collected.

SAMPLING PERSONNEL
Name: [illegible]
Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE Cape, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW04

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:			Any indication of surface runoff in well?	YES	NO (circled)
Weather:			Air Temperature:	~40°F	

Notes: 09NCMOCGW24 MOC# 19

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/18/2009 Time: 14:45 AM/PM

Depth to Water: 7.50 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE

Length of Well: 9.70 Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING

Date: 8/18/2009 Begin Time: 14:48 AM/PM Purging Equipment: Mini Typhoon / Low FL

End Time: 09:45 08/19/09 AM/PM Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: HIGH LOW (circled)

If low, recovery time:

Actual volume purged: gallons

Actual purge flow rate: 120 ml/min (circled) or L/min

Notes: 15:04 well can dry, will allow to recharge over night and collect sample in morning of 08/19/09. @ 20:40 DTW = 7.98 ft.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ (mS/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:48									N/A
14:58		below pump	5.90	0.118	18.27	5.35	4.36	107.2	N/A
15:01		below pump	5.88	0.215	35.83	5.35	4.90	113.9	N/A
15:04		below pump	5.94	0.212	39.44	4.96	4.56	115.6	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 09:35 AM/PM Method: mini typhoon with low flow controller

Appearance of Sample: turbid, no light brown Actual sample flow rate: 120 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40mL VOA HCL
2 1 Liter Amber

SAMPLING PERSONNEL

Name: Aaron Jimbrossi / Lance Pearson Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE Cape, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW05

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: good
Weather: mostly sunny, mid 40°F high winds
Notes: 09NCMOCGW25 MOC # 16

Is cap locked? YES NO
Standing water present? (YES) NO
Any indication of surface runoff in well? YES (NO)
Air Temperature: mid 40°F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 1032 AM/PM

Depth to Water: 5.02
Length of Well: 8.45

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/19/2009 Begin Time: 1034 AM/PM
End Time: 11:27 AM/PM

Purging Equipment: Mini Typhoon / Low FL
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

____ ft Length of well
____ ft - depth to water (before purge start)
____ ft = length of water column
____ x conversion factor (2" well) 0.49
____ Gallons = 3 casing volumes

Yield: HIGH → LOW
If low, recovery time:
Actual volume purged: ____ gallons
Actual purge flow rate: ____ ml/min or L/min

Notes:

Time	~~Volume (gallons)~~ Flow rate mL/min	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1034									N/A
1044	130	5.68	1.47	15.87	43.58	11.96	11.20	381.1	N/A
1047	130	5.73	1.48	15.97	36.37	12.96	11.18	378.0	N/A
1050	85	5.79	1.49	15.99	35.95	14.28	11.25	370.6	N/A
1053	85	5.76	1.51	16.11	35.61	14.72	11.38	366.3	N/A
1056	85	5.80	1.48	16.40	33.55	14.58	11.73	365.4	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 11:00 AM/PM
Method: Mini typhoon, low flow controller

Appearance of Sample: reddish orange / clear
Actual sample flow rate: 85 (ml/min) or L/min

maximum draw down exceeded but pumping at lowest possible rate for pump.

SAMPLE BOTTLE COLLECTED: 6 40mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Aaron Jankovic
Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE Cape, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW06

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	mostly sunny, mid 40's °F, high winds		Air Temperature:	mid 40's °F	
Notes:	09NCMOCGW26		MOC # 20		

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 15:35 AM/PM

Depth to Water: 4.41
Length of Well: 9.10

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING

Date: 8/19/2009 Begin Time: 15:38 AM/PM End Time: 16:55 AM/PM

Purging Equipment: Mini Typhoon / LOW FL
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 150 ml/min (circled) or L/min

Notes: maximum draw down exceeded but pumping as slow as possible with pump

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 15:38									N/A
15:48		below pump	1.24	13.22	54.70	3.23	12.21	358.5	N/A
15:51		below pump	1.26	13.70	72.02	2.94	12.43	356.2	N/A
15:54		below pump	1.29	13.80	71.52	2.69	12.56	356.9	N/A
15:57		below pump	1.22	13.01	58.79	3.41	11.25	366.8	N/A
16:00		below pump	1.15	11.72	49.07	3.20	10.81	366.1	N/A
16:03		below pump	1.10	12.56	56.72	3.08	10.69	366.1	N/A
16:06		below pump	1.13	12.67	47.46	3.01	11.04	360.6	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 16:10 AM/PM

Method: mini typhoon with low flow controller

Appearance of Sample: reddish orange yellow

Actual sample flow rate: 150 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Aaron Jindrosic

Company: AECOM

CLIENT: USACE / BRISTOL
LOCATION: NE CAPE AK
PROJECT #:

ENTER WELL LOCATION: ICCMW007

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	mostly cloudy mid 40's °F		Air Temperature:	mid 40's °F	
Notes:	09NCMOCGW2 7		MOC # 18		

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 18:05 AM/PM

Depth to Water: 5.65
Length of Well: 9.60

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING

Date: 8/19/2009 Begin Time: 19:22 AM/PM End Time: 20:12 AM/PM
Purging Equipment: Mini Typhoon / LOW FL
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

______	ft	Length of well
______	ft	- depth to water (before purge start)
______	ft	= length of water column
______		x conversion factor (2" well) 0.49
______	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time: ______
Actual volume purged: ______ gallons
Actual purge flow rate: 160 ml/min (circled) or L/min

Notes: ______

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1922									N/A
1932		5.77	6.26	0.944	7.53	2.13	5.56	-49.4	N/A
1935		5.81	6.33	0.871	3.42	1.96	3.98	-50.7	N/A
1938		5.-3	6.37	0.833	2.76	1.67	3.19	-61.1	N/A
1941		5.81	6.40	0.828	2.45	1.45	3.77	-68.9	N/A
1944		5.82	6.38	0.825	3.60	1.33	4.11	-71.2	N/A
1947		5.83	6.35	0.809	2.01	1.20	3.98	-73.8	N/A
1950		5.83	6.37	0.799	1.81	1.15	4.21	-77.6	N/A
1953		5.87	6.35	0.790	1.81	1.13	4.20	-79.0	N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 19:55 AM/PM
Method: mini typhoon + low flow controller

Appearance of Sample: Turbid yellowish brown clears up with purging
Actual sample flow rate: 160 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Laura Pruss / Aaron Jandernoa
Company: AECOM

CLIENT:
LOCATION:
PROJECT #:

ENTER WELL LOCATION: ICOMW08

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:			Air Temperature:	~40° F	

Notes: 09NCMOCGW28 MOC# 24

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/18/2009 Time: 14:22 AM/PM

Depth to Water: 7.30 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Length of Well: 9.35 Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING

Date: 8/18/2009 Begin Time: 14:22 AM/PM Purging Equipment: Mini Typhoon/LOW FL
End Time: 20:15 08/19/09 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

___ ft	Length of well	Yield:	HIGH	LOW (circled)
___ ft	- depth to water (before purge start)	If low, recovery time:	> 12 hours	
___ ft	= length of water column			
___	x conversion factor (2" well) 0.49	Actual volume purged:	___	gallons
Gallons	= 3 casing volumes	Actual purge flow rate:	124	ml/min (circled) or L/min

Notes: 14:38 well was dry will allow well to recharge over night and collect sample in the morning of 08/19/09 @ 20:40 DTW = 7.42 ft

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ (mS/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:22									N/A
14:32		below pump		0.175	74.41	4.66	4.62	104.4	N/A
14:35		below pump		0.178	124.6	6.42	5.19	99.7	N/A
14:38		below pump		0.178	Dry	5.87	5.43	104.5	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 09:15 AM/PM Method: mini typhoon with low flow controller

Appearance of Sample: light brown, very turbid Actual sample flow rate: 120 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 Liter Amber

SAMPLING PERSONNEL

Name: Aaron Jacobovitz / Lance Brewss Company: AECOM

DAY 14 SAMPLING FORMS

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ENTER WELL LOCATION: ICOMW 02
09NCMOCGW32
DUP
09NCMOCGW31 1540

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: P.CLOUDY
Notes: WIND ____ MPH

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 40

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 1505 AM/PM

Depth to Water: 4.95
Length of Well: 8.94

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 15805 AM/PM End Time: 1537 AM/PM
Purging Equipment: mini Typhoon
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.94 ft Length of well
4.95 ft - depth to water (before purge start)
ft = length of water column
x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 180 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1505		4.95	Initial purge	Product droplets	Lower pump			1' TOP	N/A
1515		5.61	4.39	13786/9.34	9.6	0.82	8.31	29.	N/A
1520		5.45	4.39	13786/9.36	9.6	0.80	8.32	28.0	N/A
1524		5.37	4.43	13775/9.5	5.75	0.62	8.48	19.1	N/A
1528		5.29	4.44	13959/9.6	5.80	0.58	8.91	19.8	N/A
1532		5.24	4.45	13959/9.5	4.65	0.50	8.71	22.8	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1540 DUP 1535 AM/PM 1605 END
Method: mini Typhoon & Low Flow controler
Appearance of Sample: Clear
Actual sample flow rate: 188 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jombrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ENTER WELL LOCATION: ICOMW 03
09NCMOCGW33
MS/MSD collected

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	P. CLOUDY		Air Temperature:	46	
Notes:	WIND 0-10 MPH WEST				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: AM/PM

Depth to Water: 4.58
Length of Well: 9.50

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 1330 AM/PM (PM circled) Purging Equipment: Mini Typhoon/LF Cont.
End Time: 1350 AM/PM (PM circled) Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well	Yield:	HIGH (circled)	LOW
4.58	ft	- depth to water (before purge start)	If low, recovery time:		
	ft	= length of water column			
		x conversion factor (2" well) 0.49	Actual volume purged:		gallons
	Gallons	= 3 casing volumes	Actual purge flow rate:	136 / 120 @ 1340	ml/min (circled) or L/min

Notes:

Time	Volume (gallons) ML	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) uS^cm/mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1330	Initial	4.58	3.29	3659/2.8	6.69	3.34	13.81	313.1	N/A
1335		4.85	3.31	3626/2.77	6.73	3.33	13.73	306.2	N/A
1340	1200	4.95	3.29	3699/2.86	4.95	2.66	13.19	308.1	N/A
1345	1800	5.05	3.31	3793/2.87	4.95	2.59	12.42	303.7	N/A
1350	2400	5.11	3.29	3802/2.91	4.21	2.47	12.76	305.5	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1355 AM/PM Method: mini Typhoon & Low Flow controller

Appearance of Sample: clear Actual sample flow rate: 120 ML ml/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/
2-1 Liter Amber w/HCL FOR GRO/RRO AK

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM.

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND ICOMW04
PROJECT #: 112624.20 ENTER WELL LOCATION: 09NCMOCGW34

INSPECTION

Label on well? **YES** NO — Is cap locked? **YES** NO
Is reference mark visible? **YES** NO — Standing water present? YES NO
Condition of well: Good — Any indication of surface runoff in well? YES **NO**
Weather: P. CLOUDY — Air Temperature: 40
Notes: WIND 0-10 MPH

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 10:55 AM/PM

Depth to Water: 7.45 Ft — Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Length of Well: 9.70 — Decontamination: PRE STEAM CLEANED **DI WATER** OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 11:00 AM/PM — Purging Equipment: Mini Typhoon + L/F Cont.
End Time: AM/PM — Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.70 ft Length of well — Yield: HIGH LOW
7.45 ft - depth to water (before purge start) — If low, recovery time:
2.25 ft = length of water column
1.76g x conversion factor (2" well) 0.49 — Actual volume purged: gallons
Gallons = 3 casing volumes — Actual purge flow rate: ~~200~~ 100 ml/min or L/min

Notes:

Time	~~Volume (gallons)~~ Flow Rate	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start:									N/A
1107	100ml/min	8.11	5.51	.508	12.0	12.1	6.06	29.2	N/A
1112	100ml/min	8.22	5.52	.517	11.9	11.1	6.01	27.9	N/A
1118	100ml/min	9.39	5.54	.525	12.5	11.8	7.26	33.7	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1125 AM/PM — Method: mini Typhoon & Low Flow controler

Appearance of Sample: Clear — Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth.
1-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 05
ENTER WELL LOCATION: 09NCMOCGW35

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	(NO)
Weather:	P. CLOUDY		Air Temperature:	46-50	
Notes:	WIND 5-10 W MPH				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 1159 (AM)/PM

Depth to Water: 5.03 Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE

Length of Well: 8.45 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 12:02 AM/(PM) Purging Equipment: Mini Typhoon + L/F Cont.

End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.45	ft	Length of well	Yield:	HIGH (LOW)	
5.03	ft	- depth to water (before purge start)	If low, recovery time:		
3.42'	ft	= length of water column			
~~0.168~~		x conversion factor (2" well) 0.49	Actual volume purged:	3/4	gallons
1.68	Gallons	= 3 casing volumes	Actual purge flow rate:	134	ml/min or L/min

Notes:

Time YSI Time	Volume (gallons) ML	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) MScm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1200	Initial	5.35	3.02	8.074	65.8	7.32	9.20	306.1	N/A
1205	680	< Pump	2.94	8.065	59.5	7.81	9.49	312.6	N/A
1210	1360	< Pump	2.93	7.883	39.7	7.28	9.56	298.1	N/A
1215	2040	< Pump	2.92	7.976	41.2	6.98	9.56	290.1	N/A
1220	3400	< Pump	2.94	8.073	33.4	7.03	9.52	289.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1225 AM/PM Method: mini Typhoon & Low Flow Controler

Appearance of Sample: clear, slight tint. Actual sample flow rate: 34x4 136 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Naphth. 2-1 Liter Amber w/HCL for GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 06
ENTER WELL LOCATION: 09NCMOCGW36

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	(YES)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	(NO)
Weather:	P. CLOUDY		Air Temperature:	40	
Notes:	WIND 6-10 MPH				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 11:15 AM/PM

Depth to Water: 5.59 * Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Length of Well: see TT 9.10 Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 11:30 AM/PM Purging Equipment: Mini Typhoon + LF Cont.
End Time: 12:20 AM/PM Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

9.10	ft	Length of well	Yield:	(HIGH) LOW	
5.59	ft	- depth to water (before purge start)	If low, recovery time:		
	ft	= length of water column			
		x conversion factor (2" well) 0.49	Actual volume purged:		gallons
	Gallons	= 3 casing volumes	Actual purge flow rate:	110	(ml/min) or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 11:30									N/A
11:46			1.86	3.651	90.85	2.94	9.35	320.8	N/A
11:49		* 5.59	1.81	3.686	122.7	3.52	9.28	327.8	N/A
11:52		below pump	1.73	3.778	158.4	3.74	9.40	333.4	N/A
11:55		below pump	1.73	3.725	135.6	3.31	9.35	333.8	N/A
11:58		below pump	1.70	3.709	160.8	3.37	9.23	334.6	N/A
12:01		below pump	1.69	3.698	133.0	3.27	8.92	339.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 12:05 AM/PM Method: mini Typhoon & Low Flow Controller

Appearance of Sample: yellowish brown and turbid Actual sample flow rate: 110 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA'S /HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber—w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM.

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 07

ENTER WELL LOCATION: 09NEMOCGW37

INSPECTION

Label on well? (YES) NO

Is reference mark visible? (YES) NO

Condition of well: Good

Wether: P. CLOUDY

Notes: WIND 6-10 MPH

Is cap locked? (YES) NO

Standing water present? YES NO

Any indication of surface runoff in well? YES (NO)

Air Temperature: 40

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 12:44 AM/PM

Depth to Water: 5.57

Length of Well: 9.60

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE

Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 13:15 AM/PM End Time: 13:53 AM/PM

Purging Equipment: Mini Typhon + L/F Cont

Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

9.60	ft	Length of well
5.57	ft	- depth to water (before purge start)
4.03	ft	= length of water column
1.9		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: (HIGH) LOW

If low, recovery time:

Actual volume purged: gallons

Actual purge flow rate: 140 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:15						~~4.4~~	~~4.4~~		N/A
13:19		5.66	5.64	1.972	11.13	1.61	4.85	-12.8	N/A
13:28		5.65	5.68	1.979	8.49	0.87	4.45	-17.2	N/A
13:31		5.65	5.65	1.977	~~14.48~~ 7.86	0.78	4.26	-10.6	N/A
13:34		5.65	5.60	1.990	8.83	0.81	4.57	-5.6	N/A
13:37		5.65	5.63	2.005	7.09	0.79	4.75	-9.5	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 13:40 AM/PM

Method: mini Typhoon & Low Flow controller

Appearance of Sample: yellowish brown and turbid, clear up with purging

Actual sample flow rate: 140 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber-w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrocil Company: AECOM

CLIENT: Bristol
LOCATION: N.E CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 08
ENTER WELL LOCATION: 09NCMOCGW38

INSPECTION

Label on well? YES / NO — YES
Is reference mark visible? YES / NO — YES
Condition of well: Good
Weather: P. CLOUDY
Notes: WIND 0-10 MPH

Is cap locked? YES / NO — YES
Standing water present? YES / NO — YES
Any indication of surface runoff in well? YES / NO — NO
Air Temperature: 40

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 09:52 AM/PM

Depth to Water: 07.34
Length of Well: 9.35

Measured with: ELECTRONIC TAPE / CHALK & STEEL TAPE — ELECTRONIC TAPE
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER — DI WATER

WELL PURGING

Date: 8/25/2009 Begin Time: 10:10 AM/PM End Time: 18:00 AM/PM
Purging Equipment: Mini Typhoon + L/F Contr.
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER — DI WATER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: HIGH / LOW — LOW
If low, recovery time: >12 hours
Actual volume purged: ______ gallons
Actual purge flow rate: 100 ml/min or L/min

Notes: Will well was dry allow for recharge and next sample collection.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 10:10									N/A
10:20		below pump	4.72	0.134	42.85	~~4.174~~ 4.61	4.07	124.3	N/A
10:23		below pump	4.75	0.135	44.80	5.07	4.27	122.7	N/A
10:26		below pump	4.75	0.135	37.60	4.65	4.11	120.7	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 10:30 AM/PM
Method: mini Typhoon & Low Flow Controller

Appearance of Sample: ______
Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's /HCL GRO/DRO AK101 Benzene/Napth. 2-1 Liter Amber — w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preass / Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW03
ENTER WELL LOCATION: 09NCMOCGW43

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy 45°		Air Temperature:	45°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: AM/PM

Depth to Water: 4.38 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Length of Well: 9.50 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 1220 AM/PM (PM circled) Purging Equipment: Mini Typhon + LF Contr
End Time: 1255 AM/PM (PM circled) Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
4.38	ft	- depth to water (before purge start)
5.12	ft	= length of water column
2.5		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: not purged dry
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 ml/min (circled) or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1230	Initial	4.38	3.75	1,661	6.75	3.47	7.76	278.3	N/A
1240	.75	4.68	3.82	1,668	6.09	0.94	7.94	283.5	N/A
1245	1.25	4.82	3.81	1,771	4.05	0.87	7.93	284.4	N/A
1250	2.00	4.83	3.81	1,787	2.99	0.47	7.93	287.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 1255 AM/PM (PM circled) Method: Mini Typhon + LF Controler

Appearance of Sample: sl ~~foamy~~ sl foamy appearance. Actual sample flow rate: ~100 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL Poly-Sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW04
ENTER WELL LOCATION: 09NCMOCGW44

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy		Air Temperature:	45°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/1/2009 Time: AM/PM

Depth to Water: 7.65
Length of Well: 9.70

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled) Dedicated pump & tubing

WELL PURGING

Date: 9/1/2009 Begin Time: 1100 AM (circled)/PM End Time: 1140 AM/PM
Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.70	ft	Length of well
7.65	ft	- depth to water (before purge start)
2.05	ft	= length of water column
0.90		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: 2 hrs
Actual volume purged: 1 gallons
Actual purge flow rate: ~40 ml/min (circled) or L/min

Notes: Had to wait for recharge of well to collect DRO/RRO Samples.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1105	Initial	7.67	5.32	.517	8.45	1.05	5.22	47.2	N/A
1120	0.6	8.20	5.32	.584	7.84	1.97	5.68	40.2	N/A
1130	0.8	8.26	5.56	.610	6.64	1.19	5.51	33.1	N/A
1140	0.9	8.29	5.65	.608	6.25	1.08	5.39	34.8	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/1/2009 Time: 1140 AM/PM (circled)
Method: Mini Typhon + LF Controler

Appearance of Sample: Clear
Actual sample flow rate: ~40 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly-sulfate, 1-250 mL w/ HNO_3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

DAY 28 SAMPLING FORMS

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW02

ENTER WELL LOCATION: MOC-21 — 09NCMOCGW42

INSPECTION

Label on well?	(YES) NO		Is cap locked?	(YES) NO
Is reference mark visible?	(YES) NO		Standing water present?	YES (NO)
Condition of well:	Good		Any indication of surface runoff in well?	YES (NO)
Weather:	mostly cloudy		Air Temperature:	~40 °F

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 14:27 AM/PM

Depth to Water: 5.1
Length of Well: 8.94

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 14:35 AM/PM End Time: 15:15 AM/PM

Purging Equipment: MINI TYPHON + LF Contr.
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: (HIGH) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 120 (ml/min) or L/min

Notes: blebs of product in sample line

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:35									N/A
14:45		5.60	5.82	3.436	41.79	0.22	7.49	-78.9	N/A
14:48		5.66	5.86	3.420	17.59	0.15	7.46	-58.3	N/A
14:51		5.70	5.88	3.432	10.33	0.15	7.49	-82.8	N/A
14:54		5.70	5.90	3.378	7.86	0.13	7.72	-79.7	N/A
14:57		5.71	5.89	3.367	7.12	0.14	7.76	-75.4	N/A
15:00		5.75	5.95	3.356	5.10	0.13	7.51	-79.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 15:00 AM/PM Method: MINI TYPHON + LF Controller

Appearance of Sample: yellow brown blebs of product.
Actual sample flow rate: 120 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL POLY - SULFATE, 1-250 mL w/HNO3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/DRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW03
ENTER WELL LOCATION: 09NCMOCGW43

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy 45°		Air Temperature:	45°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/1/2009 Time: AM/PM

Depth to Water: 4.38
Length of Well: 9.50

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/1/2009 Begin Time: 1220 AM/PM (PM circled)
End Time: 1255 AM/PM (PM circled)
Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
4.38	ft	- depth to water (before purge start)
5.12	ft	= length of water column
2.5		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: not purged dry
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 ml/min (circled) or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1230	Initial	4.38	3.75	1.661	6.75	3.47	7.76	278.3	N/A
1240	.75	4.68	3.82	1.668	6.09	0.94	7.94	283.5	N/A
1245	1.25	4.82	3.81	1.771	4.05	0.87	7.93	284.4	N/A
1250	2.00	4.83	3.81	1.787	2.99	0.47	7.93	287.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/1/2009 Time: 1255 AM/PM (PM circled)
Method: Mini Typhon + LF Controler

Appearance of Sample: sl foamy sl tannic appearance
Actual sample flow rate: ~100 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL Poly-Sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW04

ENTER WELL LOCATION: 09NCMOCGW44

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	YES	(NO)
Condition of well:	Good		Any indication of surface runoff in well?	YES	(NO)
Weather:	Cloudy		Air Temperature:	45°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: AM/PM

Depth to Water: 7.65
Length of Well: 9.70

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (OTHER) Dedicated pump & tubing

WELL PURGING

Date: 9/12009 Begin Time: 1100 (AM)/PM End Time: 1140 AM/PM
Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

9.70	ft	Length of well
7.65	ft	- depth to water (before purge start)
2.05	ft	= length of water column
0.90		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: 2 hrs
Actual volume purged: 1 gallons
Actual purge flow rate: ~40 (ml/min) or L/min

Notes: Had to wait for recharge of well to collect DRO/RRO Samples.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1105	Initial	7.67	5.32	.517	8.45	1.05	5.22	47.2	N/A
1120	0.6	8.20	5.32	.584	7.84	1.97	5.68	40.2	N/A
1130	0.8	8.26	5.56	.610	6.64	1.19	5.51	33.1	N/A
1140	0.9	8.29	5.65	.608	6.25	1.08	5.39	34.8	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/12009 Time: 1140 AM/(PM) Method: Mini Typhon + LF Controller

Appearance of Sample: Clear
Actual sample flow rate: ~40 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly-sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for DRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW05
ENTER WELL LOCATION: 09NCMOCGW45

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: Good
Weather: Cloudy
Notes:

Is cap locked? (YES) NO
Standing water present? YES (NO)
Any indication of surface runoff in well? YES (NO)
Air Temperature: 45°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 845 (AM)/PM

Depth to Water: 5.35
Length of Well: 8.45

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 1345 AM/(PM) End Time: 1405 AM/(PM)

Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

8.45 ft Length of well
5.35 ft - depth to water (before purge start)
3.10 ft = length of water column
1.75 x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: 15 min
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 (ml/min) or L/min

Notes: purged dry - had to let recharge for sulfates & DRO/RRO bottle fill

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1345	Initial	5.40	3.45	2.274	17.6	3.88	7.66	322.2	N/A
1350	.75	5.62	3.46	2.261	16.4	2.69	8.27	324.6	N/A
1355	1.1	5.96	3.56	1.825	16.1	2.81	7.95	313.5	N/A
1400	1.4	6.35	3.58	1.768	16.1	2.89	7.70	306.5	N/A
1405	1.7	7.24	3.58	1.792	16.0	2.87	7.59	301.5	N/A
1407	2.0	7.81	3.58	1.793	16.0	2.87	7.59	302.6	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 1405 AM/(PM) Method: Mini Typhon + LF Controller

Appearance of Sample: sl tannic color, sl odor. Actual sample flow rate: (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly - sulfate, 1-250 mL w/ HNO_3 for metals
6-40 mL VOA vials w/ HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/ HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW06
ENTER WELL LOCATION: 09NCMOCGW46
MOC-20

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: mostly cloudy
Notes:

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: ~40 F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 13:27 AM/PM

Depth to Water: 4.40
Length of Well: 9.10
Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 13:30 AM/PM End Time: 14:22 AM/PM
Purging Equipment: MINI TYPHON + LF Controller
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

_____ ft Length of well
7?. ft - depth to water (before purge start)
_____ ft = length of water column
_____ x conversion factor (2" well) 0.49
_____ Gallons = 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: _____ gallons
Actual purge flow rate: 130 ml/min or L/min

Notes: well nearly running dry but [illegible] quickly recharged

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:30									N/A
13:45		5.30	3.79	1.402	42.31	0.49	9.20	242.1	N/A
13:48		5.50	3.49	1.341	54.34	0.44	9.23	250.4	N/A
13:51		below pump	3.29	1.272	44.36	0.45	9.18	261.5	N/A
13:54		below pump	3.16	1.268	62.81	0.41	8.90	263.7	N/A
13:57		below pump	3.12	1.267	73.94	0.40	8.59	265.1	N/A
14:00		below pump	3.09	1.243	73.90	0.44	8.48	269.1	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 14:00 AM/PM Method: MINI TYPHON + LF Controller

Appearance of Sample: cloudy turbid
Actual sample flow rate: 130 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 1-250 ML POLY-SULFATE, 1-250 ML w/HNO3 for metals
6-40 ML VOA VIALS W/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW07

ENTER WELL LOCATION: 09NCMOCGW47

MOC-18

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Clear		Air Temperature:	40°F	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 11:36 AM/PM

Depth to Water: 5.48
Length of Well: 9.60

Measured with: ELECTRONIC TAPE (circled) / CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED / DI WATER (circled) / OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 11:40 AM/PM End Time: 13:00 AM/PM

Purging Equipment: MINI TYPHON + LF Contr.
Decontamination: PRE STEAM CLEANED / DI WATER (circled) / OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
5.48	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" wall) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH / LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 160 ml/min (circled) or L/min

Notes: Duplicate 09NCMOCGW41 and ms/msd collected
Dup 09NCMOC41 @ 11:00

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 11:40									N/A
11:50		5.51	6.28	3.403	21.85	0.68	5.05	-75.5	N/A
11:53		5.53	6.25	3.424	18.28	0.53	5.09	-95.3	N/A
11:56		5.52	6.24	3.492	15.70	0.40	5.18	-94.8	N/A
11:59		5.52	6.28	3.472	11.58	0.32	5.30	-87.3	N/A
12:02		5.52	6.27	3.472	09.16	0.30	5.30	-86.0	N/A
12:05		5.53	6.30	3.442	08.34	0.24	5.32	-106.1	N/A
12:08		5.51	6.35	3.435	08.43	0.23	5.33	-104.6	N/A
12:11		5.52	6.33	3.44	09.64	0.25	5.31	-107.1	N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 12:15 AM/PM Method: MINI TYPHON + LF Controller

Appearance of Sample: yellow and turbid, cleared up with purging

Actual sample flow rate: 160 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 3-500 ML POLY-SULFATE, 3-500 ML w/HNO3 for metals
2-6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
8-1 Lt Amber w/HCL for GRO/RRO AK101/AK102
AJ 9/11/09

SAMPLING PERSONNEL
Name: Aaron Jambrosic Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW08
ENTER WELL LOCATION: 09NCMOCGW48
MOC-24

INSPECTION

Label on well? YES / NO — YES (circled)
Is reference mark visible? YES / NO — YES (circled)
Condition of well: Good
Weather: [illegible] ~46°F
Notes:

Is cap locked? YES / NO — YES (circled)
Standing water present? YES / NO — NO (circled)
Any indication of surface runoff in well? YES / NO — NO (circled)
Air Temperature: 46°F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 10:45 AM/PM

Depth to Water: 7.11
Length of Well: 9.35
Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 10:51 AM/PM End Time: 16:40 AM/PM
Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
7.1	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: [illegible] ml/min (circled) or L/min

Notes: 11:04 [illegible]

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 10:51									N/A
11:41			5.36	0.176	13.41	0.66	3.65	132.4	N/A
11:54			5.37	0.176	[illegible]	0.6[illegible]	3.64	130.1	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 10:55 AM/PM Method: Mini Typhon + LF Controller

Appearance of Sample: turbid cloudy brown
Actual sample flow rate: 140 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL POLY-SULFATE, 1-250 mL w/HNO3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

APPENDIX G

Bench Study

Table G-1: Soil Oxidant Demand Test Results (g/Kg)

Test Condition	Peat Soils (OL/OH)	Organic Silts (OL/ML)	Silts (ML)
Sodium Persulfate Only	13.4	15.7	14.4
Sodium Persulfate + Iron EDTA	14.4	15.3	7.5
Sodium Persulfate + Hydrogen Peroxide	11.4	15.9	14.9

Table G-2: Bench Scale Treatability Study Laboratory Analyses

Analysis	Groundwater	Soil
DRO/RRO	AK 102/103	AK 102/103
GRO	AK 101	AK 101
BTEX & Naphthalene	EPA 8260b	EPA 8260b
Metals: As, Cr, Pb	EPA 6010b Metals	EPA 6010b Metals
Total Iron	SM 6010B	SM 6010B
Ferrous Iron	HACH Method 8146	N/A
Hexavalent Chromium	SM 218.6 Cr(VI)	7196a Cr(VI)
Sulfate	SM 4500	N/A
Alkalinty (as $CaCO_3$)	EPA 310.1	N/A
TOC	EPA 415.1	N/A

NOTE:

1. N/A – not applicable
2. DRO – diesel range organics.
3. RRO – residual range organics
4. GRO – gasoline range organics
5. BTEX – benzene, toluene, ethylbenzene, xylene
6. TOC – total organic carbon
7. AK – Alaska
8. SIM – Selected Ion Mode
9. EPA – Environmental Protection Agency
10. As – arsenic, Cr – chromium, Pb – lead
11. $CaCO_3$ – calcium carbonate

Table G-3: Experimental Setup – Activated Sodium Persulfate

Sample Type	2% S_2O_8 - Low		10% S_2O_8 - High		Control
Activators	300 ppm Fe	8% H_2O_2	300 ppm Fe	8% H_2O_2	NS
Ground Water Volume (mL)	1000	840	1000	840	1000
Soil Mass (g)	500.38	503.61	501.94	500.33	505.25
FMC Klozur Sodium Persulfate (g)	24.75	24.7	123.94	123.98	NS
FeEDTA Mass (g)	6.02	NS	30.18	NS	NS
8% H_2O_2 Solution Volume (mL)	NS	160	NS	160	NS

NOTE:

1. S_2O_8 – persulfate
2. g - grams
3. 8% H_2O_2 solution was made by diluting a 50% H_2O_2 stock solution with site groundwater.
4. NS - Not Sampled

Table G-4: Catalyzed hydrogen peroxide Reaction - Experimental Setup

Sample Type	**5% H_2O_2**				**10% H_2O_2**				**Control**
Study Period (hours)	1	3	5	7	1	3	5	7	NS
Groundwater Volume (mL)	900	900	900	900	800	800	800	800	1000
H_2O_2 Solution Volume (mL)	100	100	100	100	200	200	200	200	NS
Soil Mass (grams)	500.29	501.34	503.6	500.09	500.24	503.81	504.01	502.48	500.37
FeEDTA Mass in given Groundwater Vol (grams)	0.2271	0.2268	0.228	0.2274	0.454	0.4587	0.4576	0.4535	NS

NOTE:

1. H2O2 solutions were made by diluting a 50% H2O2 stock solution with site groundwater.

2. Fe concentrations in given FeEDTA mass; 30ppm for the 5% H_2O_2 and 60ppm for the 10% H_2O_2.

2. NS - Not Sampled

Table G-5: Groudwater Analytical Results, Treatability Bench Study

Compound	Sample Dates	Sampling Event (Week)	Benzene (ug/L)	Naphthalene (ug/L)	GRO (C6-C10)	DRO (nC10- <nC25)	RRO (nC25-nC36)	Hexavalent chromium	Arsenic	Lead	Chromium	Total Iron	Ferrous Iron	Sulfate	Alkalinity	Total Organic Carbon
Untreated Control	8/21/2009	Login Baseline	0.51 J	0.064 U	0.14	11	2.1	0.007 HJ	0.0074 J	0.0077 J	0.012 J	24	35	N/A	80	65
	9/14/2009	0	0.057 U	0.064 U	ND	0.9 B	0.21 *B	0.0037 UH	0.012 J	0.0017 U	0.0033 U	N/A	30	1.5	67	21 H
	9/23/2009	1	0.057 U	5	0.42	28 *B	11 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	0.064 U	6.1	46	9.9	0.091 H	1 J	2	2.5	N/A	20	13	23	160
	10/22/2009	5	N/A	N/A	N/A	10 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.057 U	15	11	16 B	4	0.046 JH	0.7	1.2	1.4	N/A	16	1.3	180	150
EDTA + 2% S208	9/23/2009	1	0.41 J	5.4	0.24	17 *B	5.6 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.14 J	4.1 J	0.58	2	7.7	0.084 JH	0.15	0.11	0.18	N/A	31	39000	N/A	8200
	10/22/2009	5	N/A	N/A	N/A	27 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.31 J	14	2.6	7.5 B	2.2	0.035 JH	0.42 J	0.76	1.0	N/A	30	28000	N/A	1600
EDTA + 10% S208	9/23/2009	1	0.38	4.6	0.35	98 *B	37 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	11	0.68	140	32	0.19 JH	0.66	0.79	1.7	N/A	23	160000	N/A	9900
	10/22/2009	5	N/A	N/A	N/A	200 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.44 J	14	5.2	20 B	4.6	0.036 JH	0.92	1.3	1.5	N/A	18	180000	N/A	7300
8% H2O2 + 2% S208	9/23/2009	1	0.33	5.5	0.19	22 *B	9.7 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	7.5	0.43	170	42	0.13 JH	0.94 J	1.6	2.4	N/A	28	53000	N/A	1300
	10/22/2009	5	N/A	N/A	N/A	55 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.72 J	11	3.3	7.7 B	2.3	0.043 JH	0.48 J	0.97	1.3	N/A	20	65000	N/A	660
8% H2O2 + 10% S208	9/23/2009	1	0.37	5.5	0.98	150 *B	61 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	0.064 U	0.67	250	69	0.23 JH	0.93	0.69	1.9	N/A	10	220000	N/A	1600
	10/22/2009	5	N/A	N/A	N/A	230 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.83 J	3.4	0.84	14 B	2.8	0.048 JH	1.1	0.83	1.7	N/A	5	220000	N/A	1600
Catalyzed Hydrogen Peroxide																
CHP Control	11/19/2009	0 hr	0.11 UH	0.13 UH	0.03 U	7.1	1.9	0.0046 JH	0.017 J	0.042	0.05	N/A	32	N/A	48	32
5% H2O2 + 30 mg/L Fe	11/19/2009	1 hr	0.11 UH	0.13 UH	0.042 J	41	35	0.10 H	0.47 J	1.2	1.6	N/A	174	N/A	NA	3600
	11/19/2009	3 hr	0.11 UH	0.13 UH	0.03 U	13	6.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	0.11 UH	0.13 UH	0.055 J	21	17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	0.11 UH	0.13 UH	0.03 U	32	23	0.24 H	0.39 J	1.0	1.3	N/A	169	N/A	NA	3800
10% H2O2 + 60 mg/L Fe	11/19/2009	1 hr	0.11 UH	0.13 UH	0.032 J	230	160	0.20 H	0.57 J	1.9	2.3	N/A	301	N/A	NA	4700
	11/19/2009	3 hr	0.11 UH	0.13 UH	0.055 J	630	360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	0.11 UH	0.13 UH	0.040 J	340	240	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	0.11 UH	0.13 UH	0.033 J	87	63	0.14 H	0.34 J	1.3	1.3	N/A	287	N/A	NA	3000

Notes:
1. Units are mg/L unless specified otherwise
2. Laboratory unable to perform alkalinity analysis - sample pHs exceed limit
3. N/A = Not Analyzed

Flags:
B - Compound was found in both blanks and samples
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
* - LCS or LCSD exceeds the control limits
H - Sample was prepped or analyzed beyond the specified holding time
ND or U - Result is less than the MDL. Where U, MDL listed in table

Table G-6: Soil Analytical Results, Treatability Bench Study

Compound	Sample Date	Sampling Event - week	Benzene (ug/Kg)	Naphthalene (ug/Kg)	GRO (C6-C10)	DRO (nC10- <nC25)	RRO (nC25- nC36)	Arsenic	Chromium	Total Iron	Lead	Hexavalent chromium
Untreated Control	8/26/2009	Login Baseline	7 U	3900	730	15000	2900	6.5	23	15000	27	0.72
	9/14/2009	0	64 U	150 U	260	12000 B	3000	5.9	19 B	12000 B	11	0.3 JB
	9/23/2009	1			33	15000 B	4300 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	9.7 U	620	410	17000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5				17000	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	10 U	610	36 B	15000	5300	3.9 J	12	8200	9.0	0.74 J
EDTA + 2% S208	9/23/2009	1			59	14000 B	5200 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	7.9 U	530	98	16000 B	6200 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5				8900	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	12 U	1400	36 B	16000	7600	5.6 J	17	12000	13	0.67 J
EDTA + 10% S208	9/23/2009	1			27	6600 B	1900 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	8.2 U	1000	170	7100 B	2600 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5				5800	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	9 U	900	20 B	12000	4900	3.1 J	10	12000	10	0.74
8% H202 + 2% S208	9/23/2009	1			61	15000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	9 U	1300	320	13000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5				9700	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	12 U	1300	45 B	15000	7000	4.7 J	16	11000	12	0.51 J
8% H202 + 10% S208	9/23/2009	1			73	8800 B	2500 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	44 U	4200	1700	12000 B	5000 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5				8500	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	8.6 U	430	25 B	15000	6700	2.6 J	11	7300	8.9	1
Catalyzed Hydrogen Peroxide												
CHP Control	11/19/2009	0 hr	8.3 U	750	57	14000 B	6800 *	5.3 J	19 B	13000 B	15	0.42 J
5% H2O2 + 30 mg/L	11/19/2009	1 hr	12 U	30 U	77	170 B	220 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	3 hr	12 U	520	54	7900 B	7600 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	51 U	2400	950	1200 B	870 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	7.8 U	89 J	24	530 B	560 *	N/A	N/A	N/A	N/A	N/A
10% H2O2 + 60 mg/L	11/19/2009	1 hr	25 U	140 J	430	4700 B	5400 *	2.7 J	13 B	9600 B	11	N/A
	11/19/2009	3 hr	27 U	120 J	460	7400 B	7700 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	19 U	410	460	9500 B	9700 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	22 U	360	420	5600 B	5900 *	6.8 J	26 B	21000 B	27	N/A

NOTES:

1. Units are mg/Kg unless specified otherwise
2. N/A = Not Analyzed

Flags:

B - Compound was found in both blanks and samples
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
* - LCS or LCSD exceeds the control limits
H - Sample was prepped or analyzed beyond the specified holding time
ND or U - Result is less than the MDL. Where U, MDL listed in table

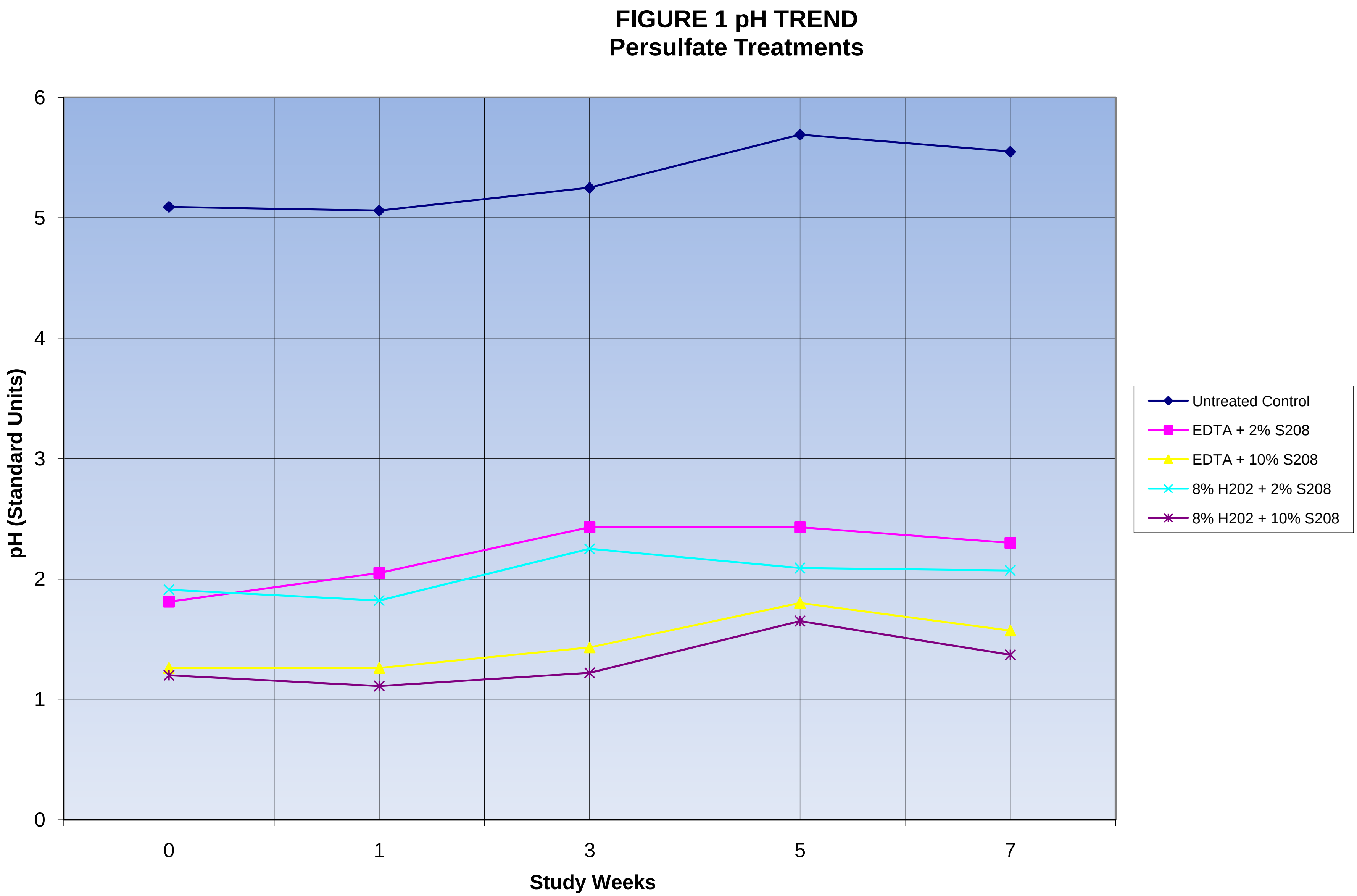


FIGURE 1 pH TREND
Persulfate Treatments
pH (Standard Units)
0
1
2
3
4
5
6
0
1
3
5
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

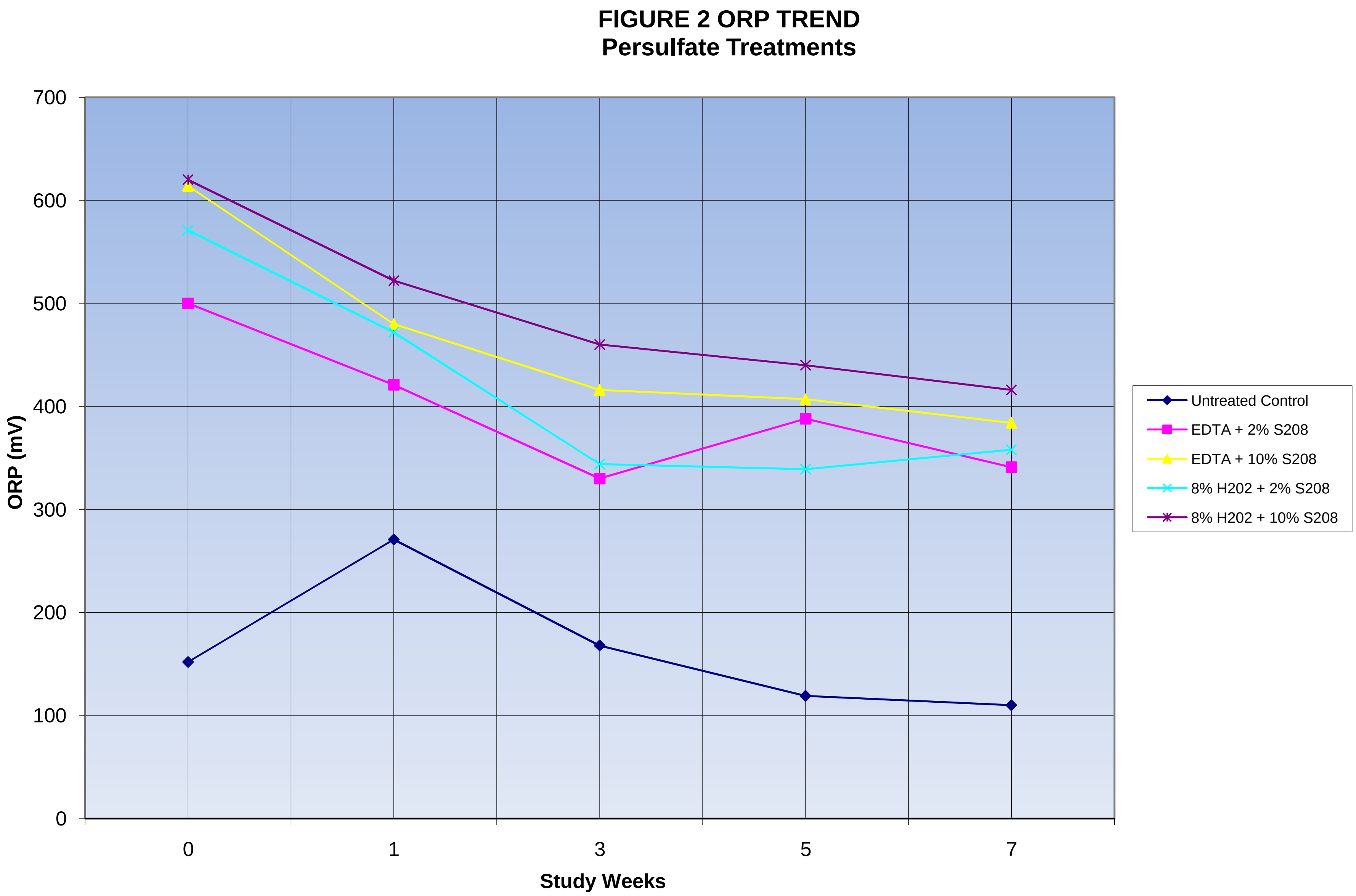


FIGURE 2 ORP TREND
Persulfate Treatments
700
600
500
400
300
200
100
0
ORP (mV)
0
1
3
5
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

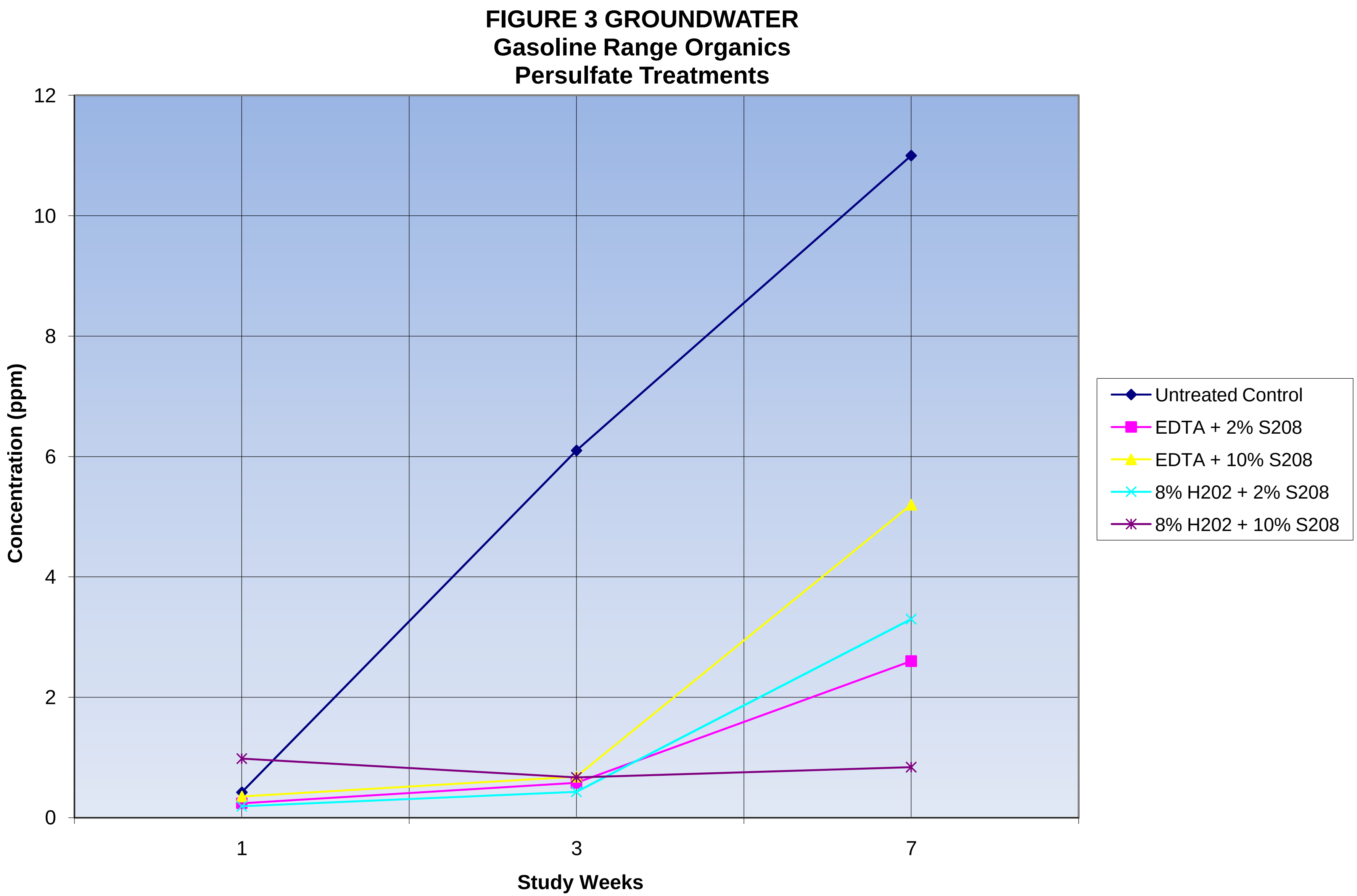


FIGURE 3 GROUNDWATER
Gasoline Range Organics
Persulfate Treatments
Concentration (ppm)
0
2
4
6
8
10
12
1
3
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

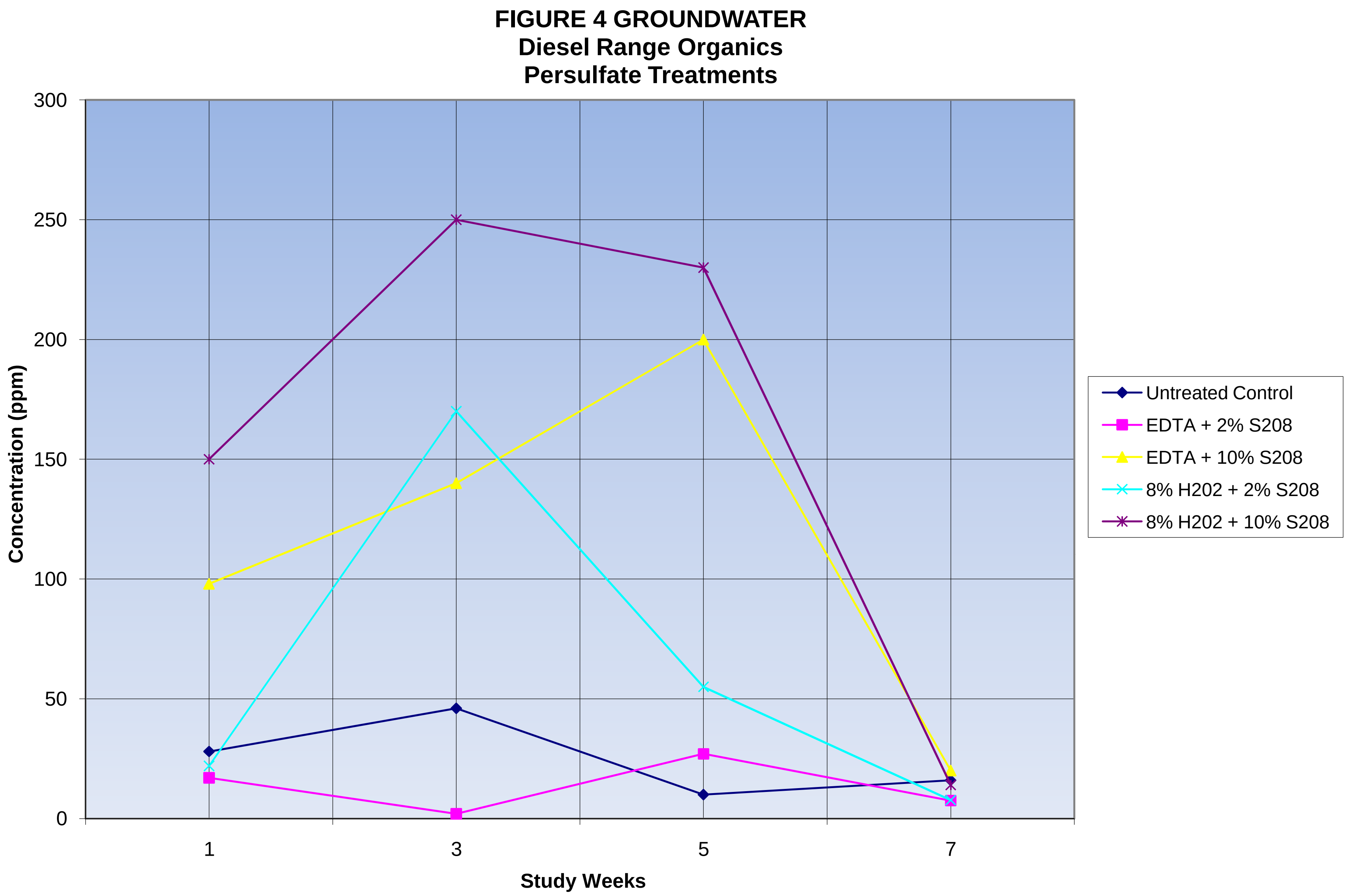


FIGURE 4 GROUNDWATER
Diesel Range Organics
Persulfate Treatments
Concentration (ppm)
300
250
200
150
100
50
0
1
3
5
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

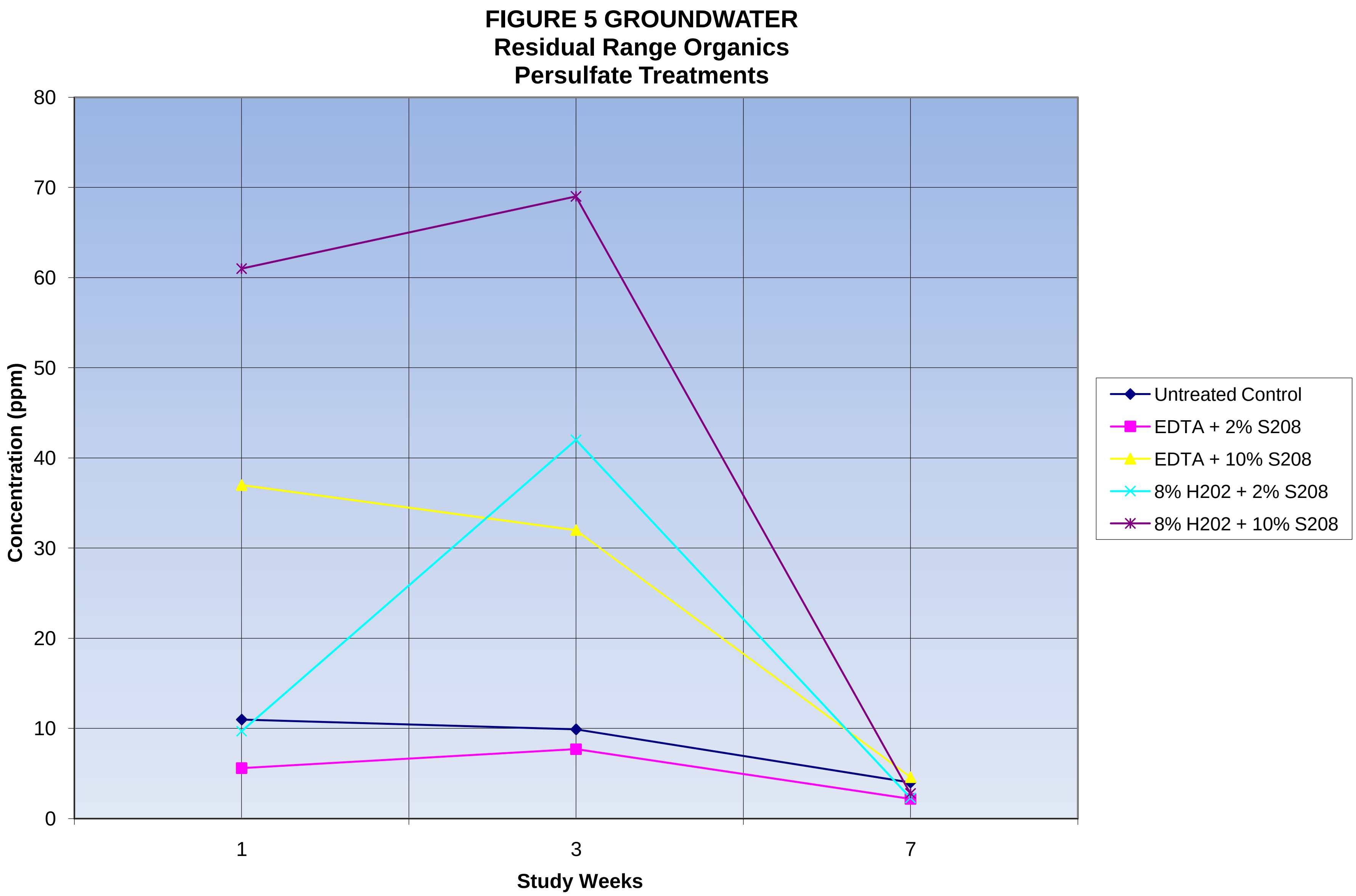


FIGURE 5 GROUNDWATER
Residual Range Organics
Persulfate Treatments
Concentration (ppm)
0
10
20
30
40
50
60
70
80
1
3
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

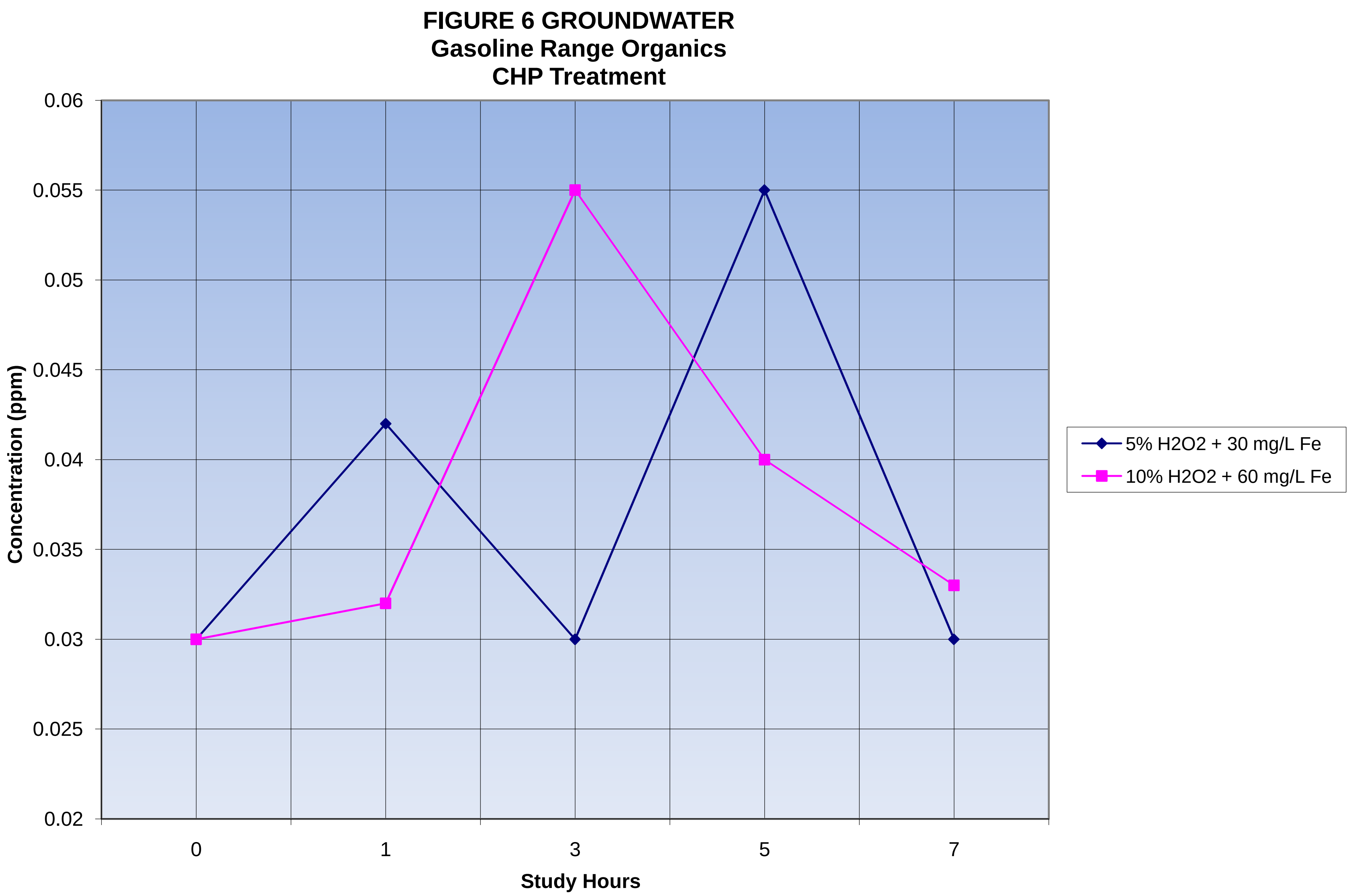


FIGURE 6 GROUNDWATER
Gasoline Range Organics
CHP Treatment
0.06
0.055
0.05
0.045
0.04
0.035
0.03
0.025
0.02
Concentration (ppm)
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

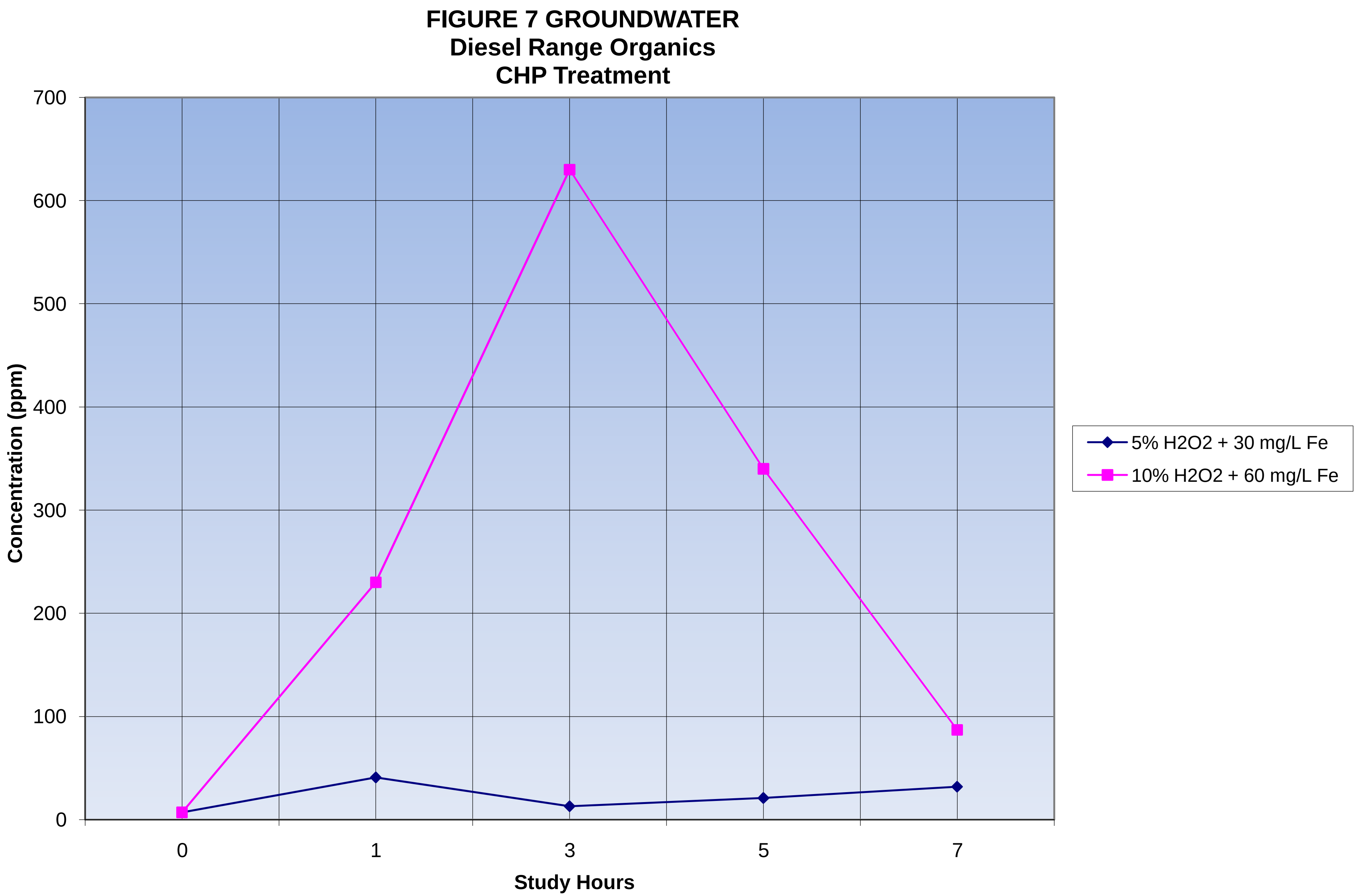


FIGURE 7 GROUNDWATER
Diesel Range Organics
CHP Treatment
Concentration (ppm)
700
600
500
400
300
200
100
0
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

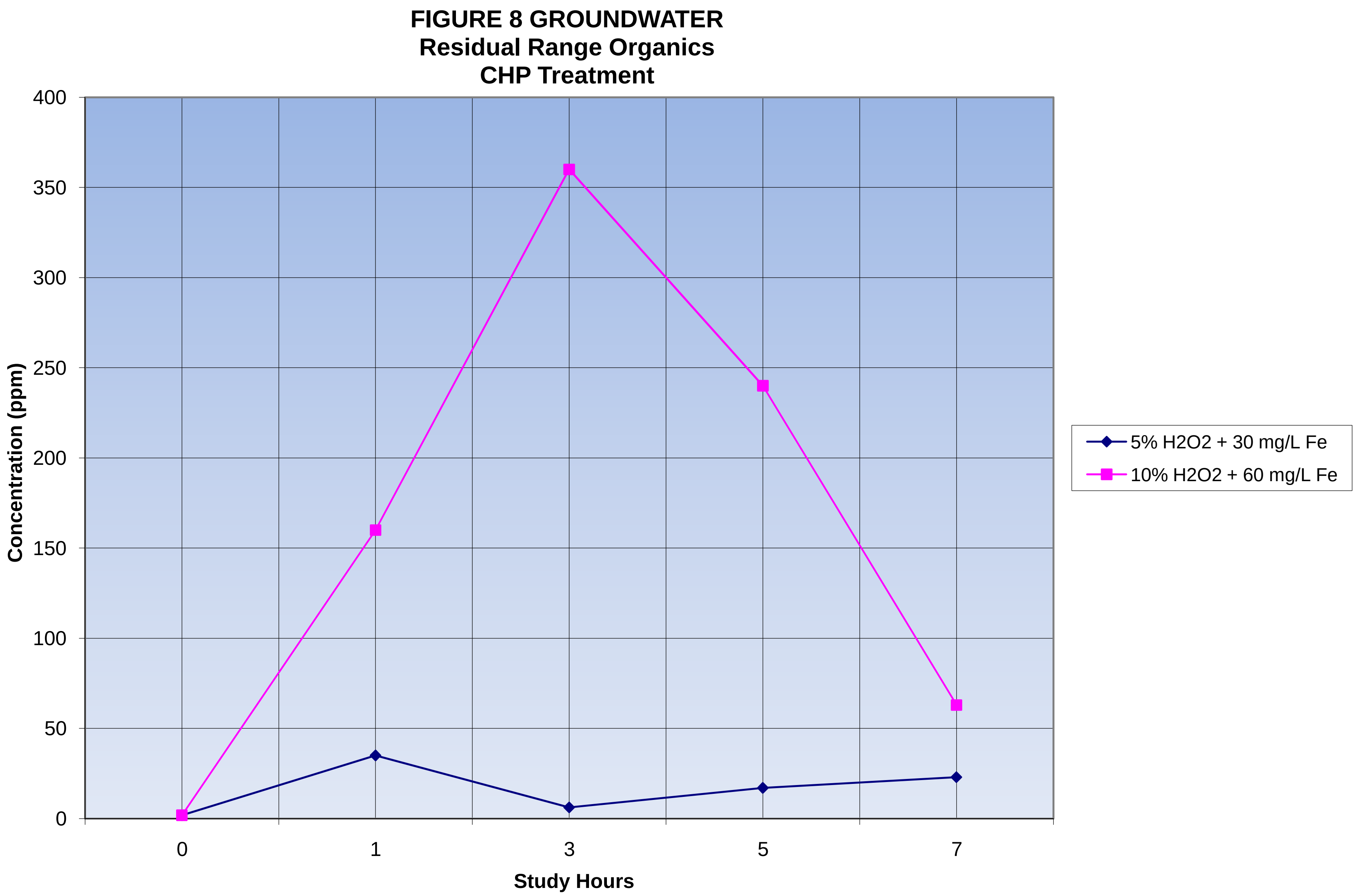


FIGURE 8 GROUNDWATER
Residual Range Organics
CHP Treatment
Concentration (ppm)
400
350
300
250
200
150
100
50
0
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

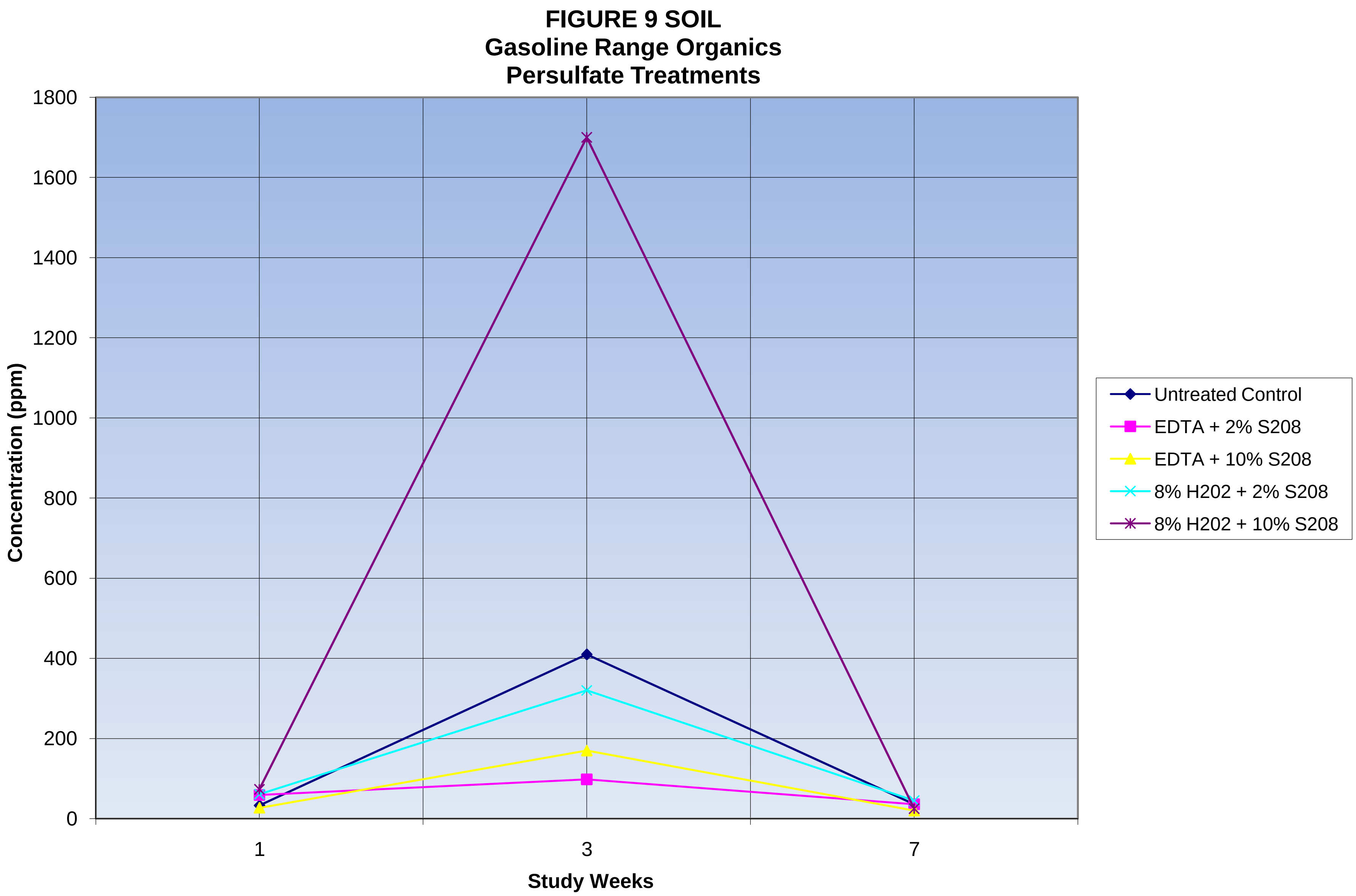
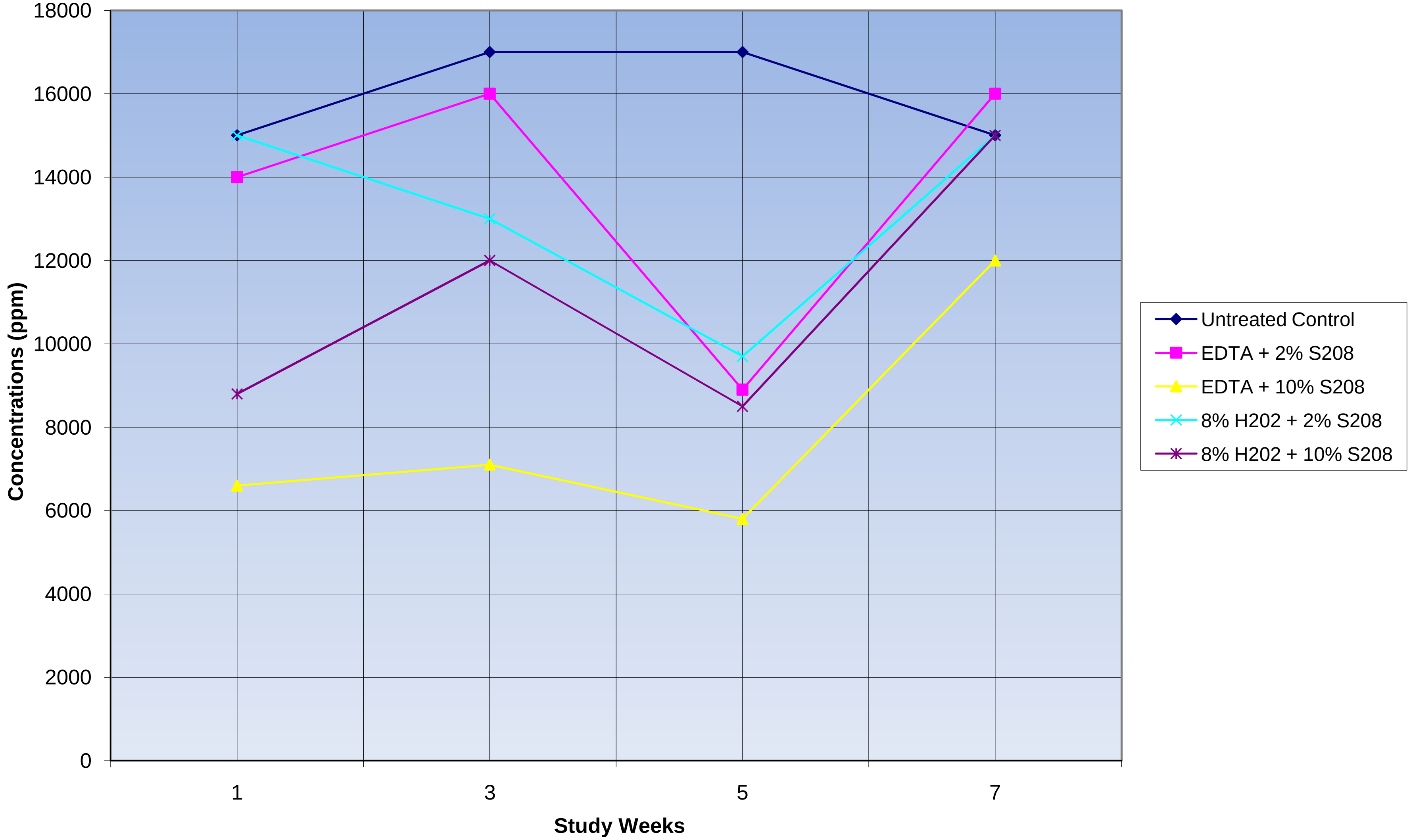


FIGURE 9 SOIL
Gasoline Range Organics
Persulfate Treatments
Concentration (ppm)
1800
1600
1400
1200
1000
800
600
400
200
0
1
3
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

FIGURE 10 SOIL
Diesel Range Organics
Persulfate Treatments



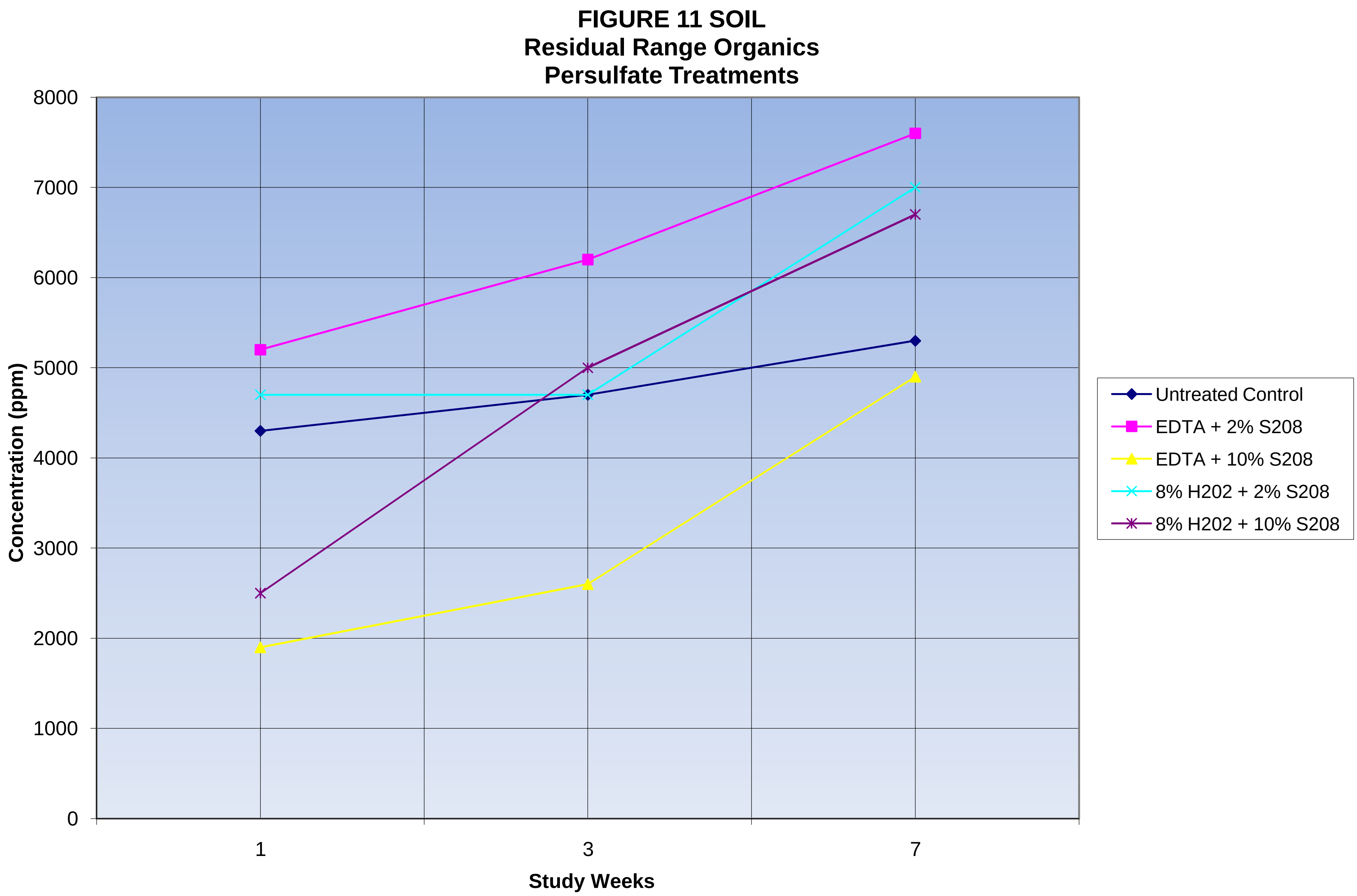


FIGURE 11 SOIL
Residual Range Organics
Persulfate Treatments
Concentration (ppm)
8000
7000
6000
5000
4000
3000
2000
1000
0
1
3
7
Study Weeks
Untreated Control
EDTA + 2% S208
EDTA + 10% S208
8% H202 + 2% S208
8% H202 + 10% S208

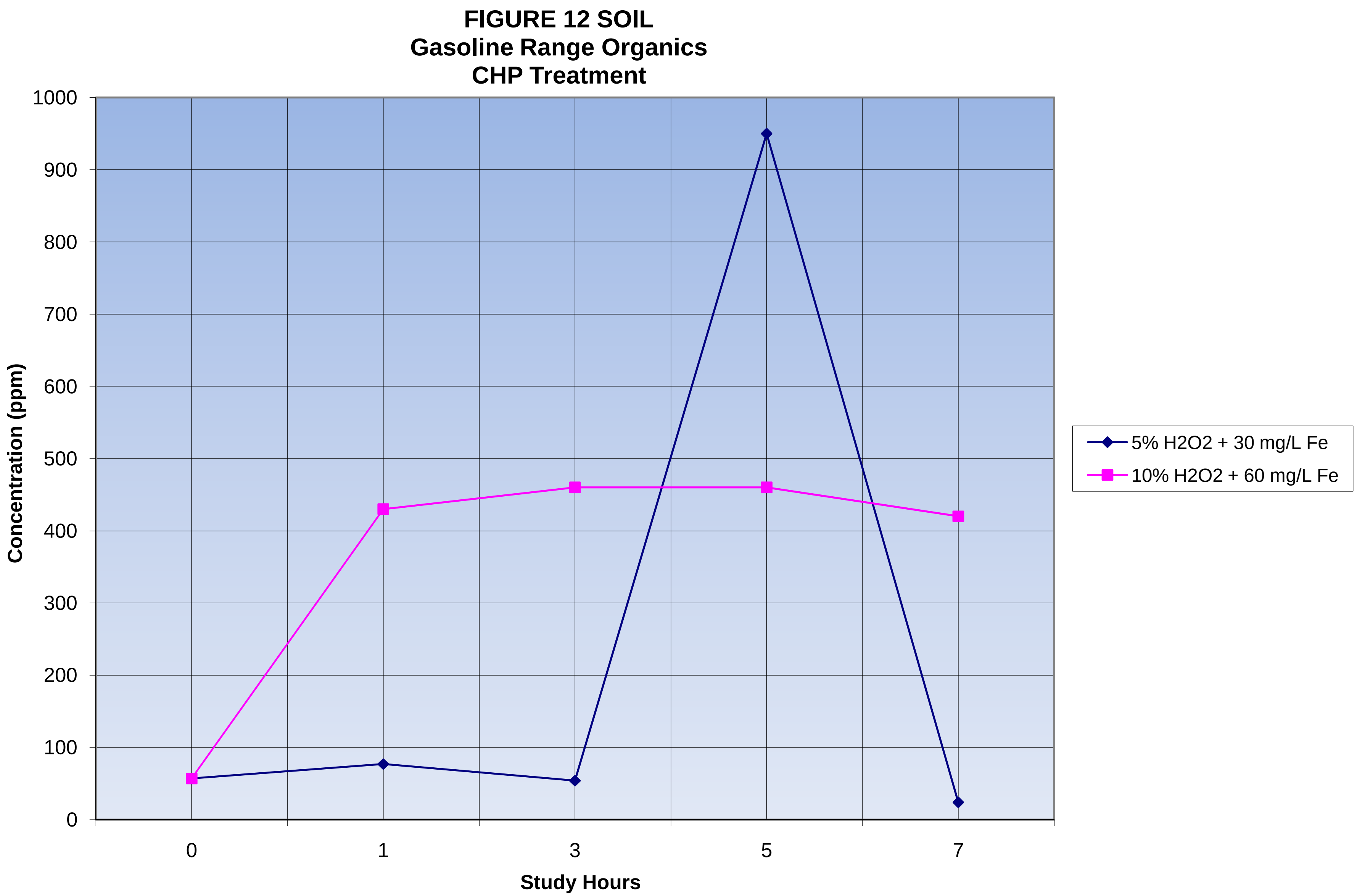


FIGURE 12 SOIL
Gasoline Range Organics
CHP Treatment
Concentration (ppm)
0
100
200
300
400
500
600
700
800
900
1000
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

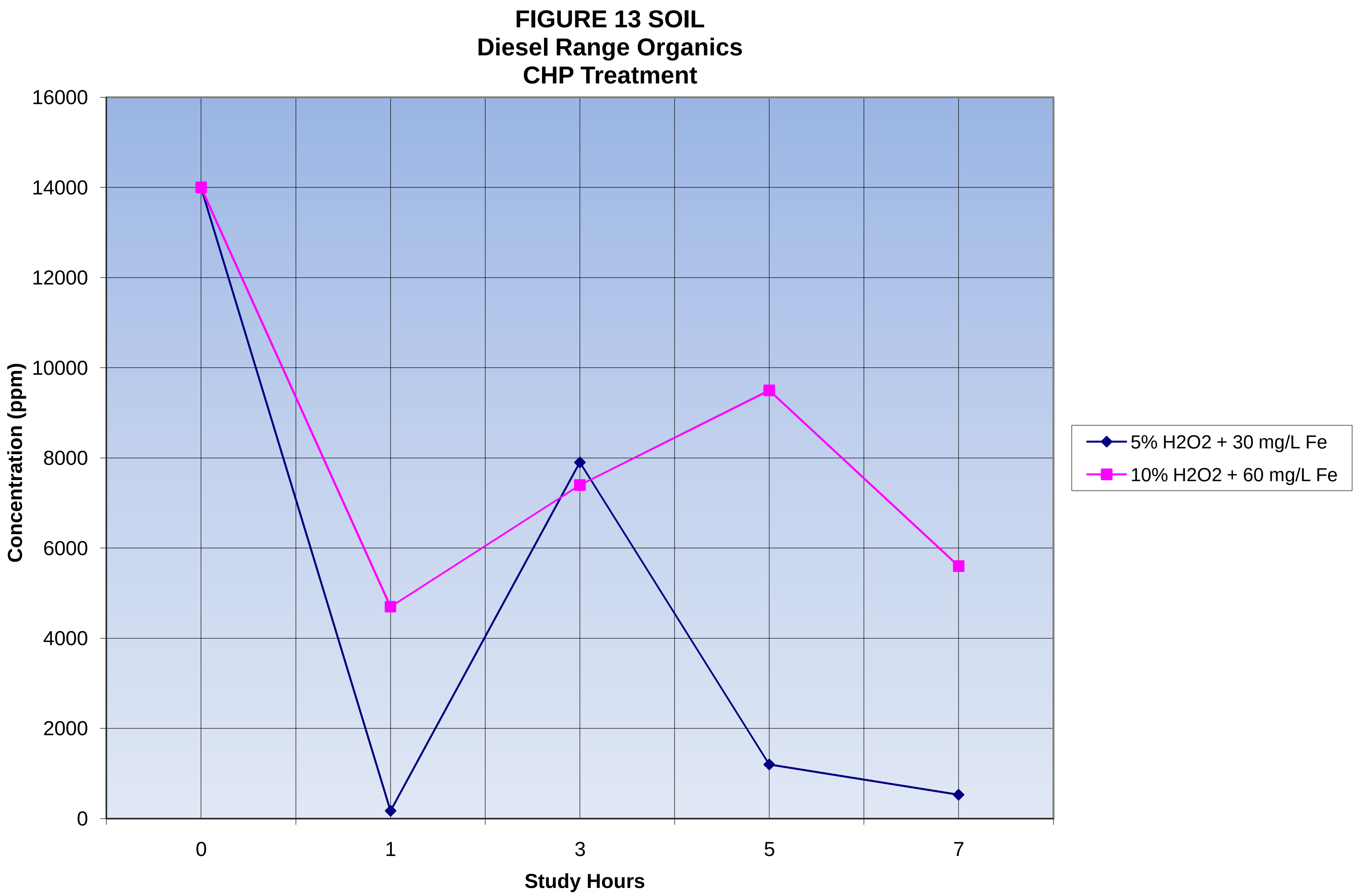


FIGURE 13 SOIL
Diesel Range Organics
CHP Treatment
Concentration (ppm)
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

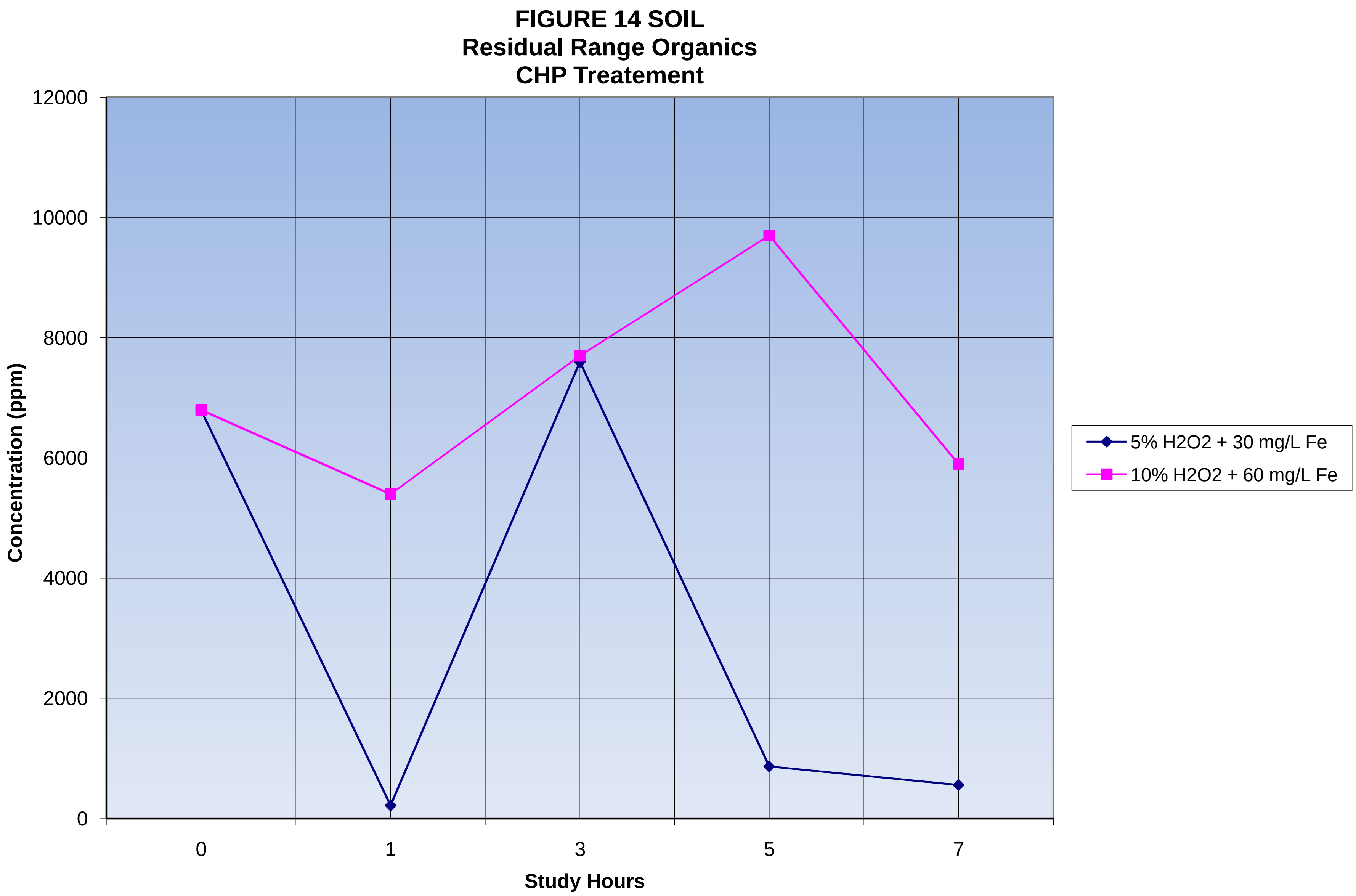


FIGURE 14 SOIL
Residual Range Organics
CHP Treatement
12000
10000
8000
6000
4000
2000
0
Concentration (ppm)
0
1
3
5
7
Study Hours
5% H2O2 + 30 mg/L Fe
10% H2O2 + 60 mg/L Fe

APPENDIX H

Phase I ISCO Study
(Provided on CD)

APPENDIX I

Contaminant Mass Calculations

Table I-1: Baseline Contaminant Mass Estimate

Contaminant Mass Estimate (DRO)

Representative Well	Zone (feet)	Strata Thickness (m)	Radius (m)	Soil DRO Conc. (mg/kg)	Soil Volume (cu. M.)	Soil Mass (kg)	Mass (kg)	Mass (lb)
ICOMW03	4 - 10	1.5	1.5	170000	10.5975	10597.5	1801.575	3765.29175
ICOMW04	4 - 10	1.5	1.5	17000	10.5975	10597.5	180.1575	376.529175
ICOMW05	4 - 10	1.5	1.5	130000	10.5975	10597.5	1377.675	2879.34075
ICOMW06	4 - 10	1.5	1.5	110000	10.5975	10597.5	1165.725	2436.36525
ICOMW07	4 - 10	1.5	1.5	13000	10.5975	10597.5	137.7675	287.934075
ICOMW08	4 - 10	1.5	1.5	240000	10.5975	10597.5	2543.4	5315.706
ICOMW09	4 - 10	1.5	1.5	6500	10.5975	10597.5	68.88375	143.9670375
ICOMW02	4 - 10	1.5	1.5	13000	10.5975	10597.5	137.7675	287.934075
Totals:					**84.78**	**84780**	**7412.95125**	**15493.06811**

Table I-2: Day 28 Contaminant Mass Estimate

Contaminant Mass Estimate (DRO)

Representative Well	Zone (feet)	Strata Thickness (m)	Radius (m)	Soil DRO Conc. (mg/kg)	Soil Volume (cu. M.)	Soil Mass (kg)	Mass (kg)	Mass (lb)
ICOMW03	4 - 10	1.5	1.5	360000	10.5975	10597.5	3815.1	7973.559
ICOMW04	4 - 10	1.5	1.5	6400	10.5975	10597.5	67.824	141.75216
ICOMW05	4 - 10	1.5	1.5	390000	10.5975	10597.5	4133.025	8638.02225
ICOMW06	4 - 10	1.5	1.5	170000	10.5975	10597.5	1801.575	3765.29175
ICOMW07	4 - 10	1.5	1.5	370	10.5975	10597.5	3.921075	8.19504675
ICOMW08	4 - 10	1.5	1.5	360000	10.5975	10597.5	3815.1	7973.559
ICOMW09	4 - 10	1.5	1.5	150000	10.5975	10597.5	1589.625	3322.31625
ICOMW02	4 - 10	1.5	1.5	17000	10.5975	10597.5	180.1575	376.529175
Totals:					**84.78**	**84780**	**15406.32758**	**32199.22463**

APPENDIX J

Site Photographs

Photograph 1, July, 2009, north: Test Pit excavation, 2 cubic yard bucket.

Photograph 2, July, 2009, southwest: Test Pit Excavation, CAT 322b.

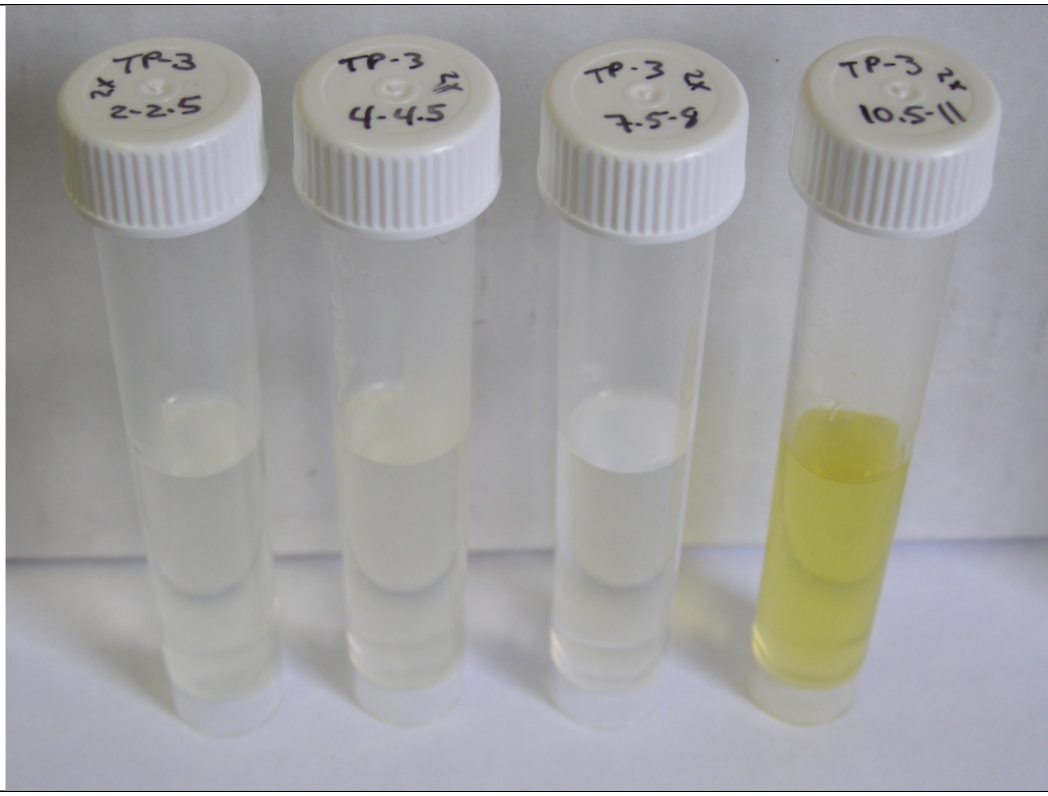
Photograph 3, July, 2009: Test Pit 1.

Photograph 4, July, 2009: Test Pit 2, illustrating seep.

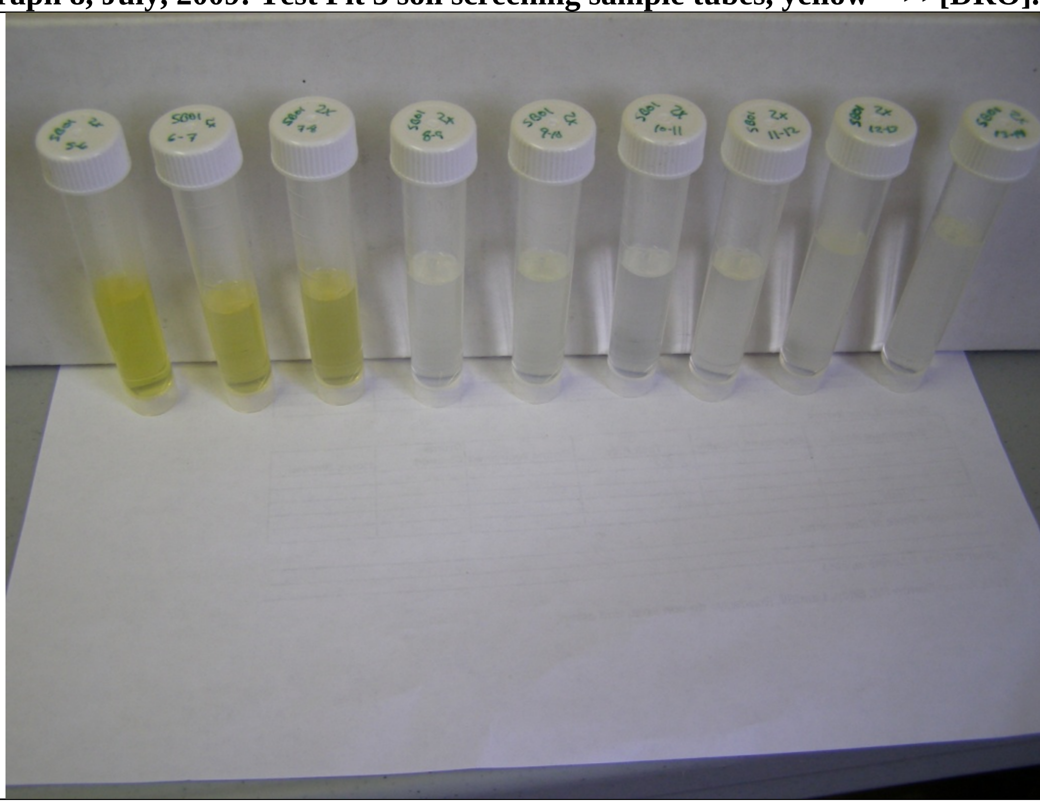
Photograph 5, July, 2009: Test Pit 3.

Photograph 6, July, 2009: Test Pit 4.

Photograph 7, July, 2009, northwest: Soil boring installation via hollow stem auger.

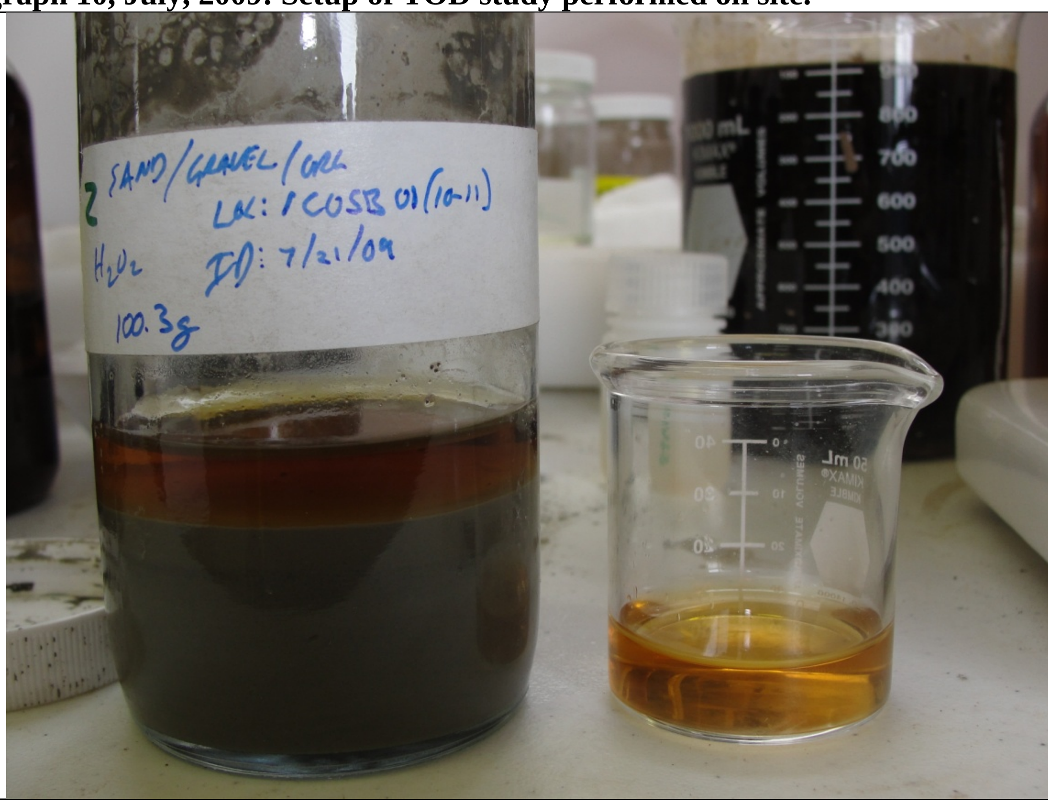


Photograph 8, July, 2009: Test Pit 3 soil screening sample tubes, yellow = >>[DRO].

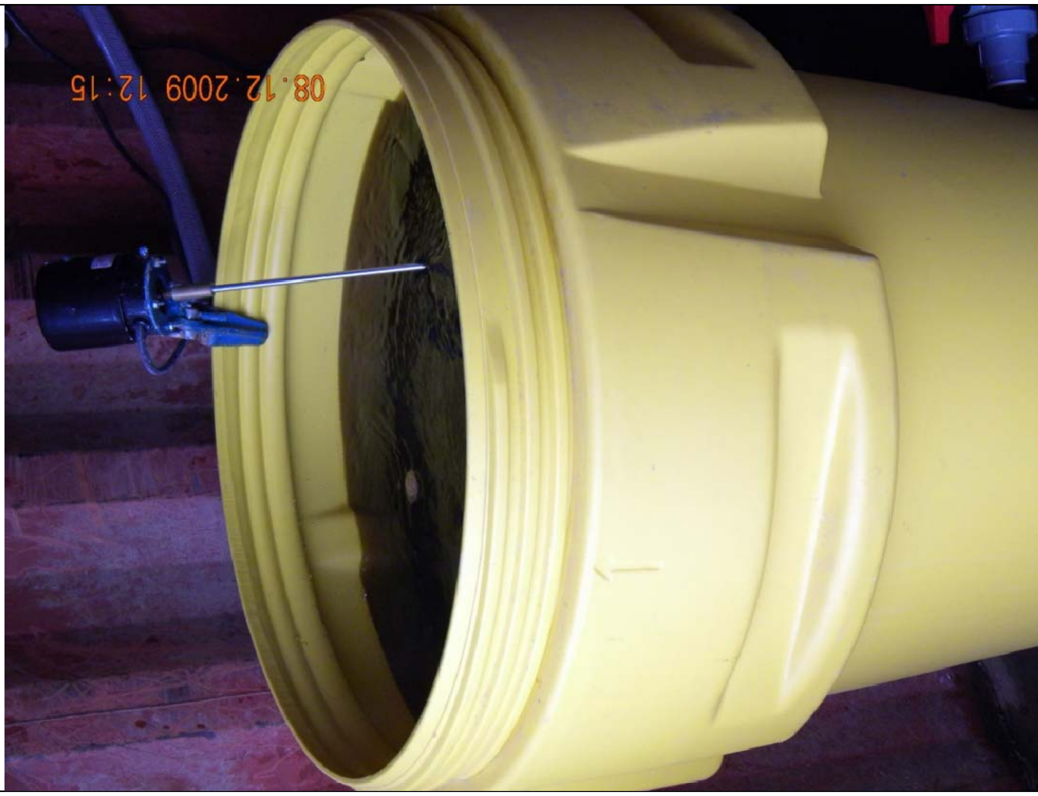


Photograph 9, July, 2009: Soil boring SB-01 soil screening sample tubes, yellow = >>[DRO].

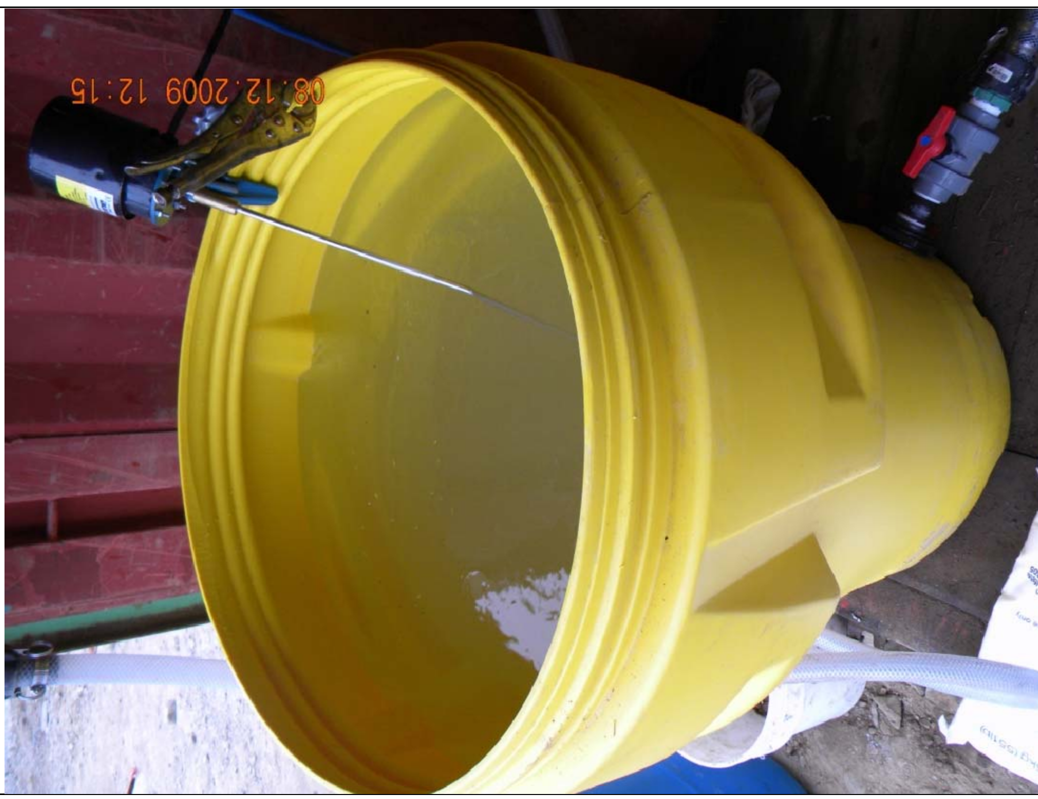
Photograph 10, July, 2009: Setup of TOD study performed on site.



Photograph 11, July, 2009: ICOOSB01 (10 – 11 ft bgs), TOD reaction vessel, organic silts.



Photograph 13, 8/12/2009: Iron mixing station.



Photograph 12, 8/12/2009: Sodium persulfate mixing station.

Photograph 14, 8/12/2009: Injection tree.

Photograph 15, August, 2009, west: Field Scientist at hydrogen peroxide dilution station.

Photograph 16, 8/07/2009: View of ISCO Pilot Study Injection System Setup.

Photograph 17, 8/12/2009: Field scientist conducting performance monitoring.

Photograph 18, 8/12/2009, southeast: Injection fluid breakout via sidewall seep.

Photograph 19, 8/10/2009, southwest: From injection fluid breakout point, back towards injection point.

Photograph 20, 8/20/2009, east: Overview of access casings in ISCO Study area.

Photograph 21, August, 2009: Post-ISCO HA-3 soils at 5.6 feet below ground surface.

Photograph 22, August, 2009: Post ISCO HA-5 at 5.05 feet below ground surface.

Photograph 23, August, 2009: Post ISCO HA-5 at 5.4 feet below ground surface.

APPENDIX K

Technical Memorandum
(Provided on CD)

U.S. Army Corps of Engineers, Alaska District

In-Situ Chemical Oxidation (Phase I) and Intrusive Drum Removal/Landfill Cap

Northeast Cape, St. Lawrence Island, Alaska

Contract No. W911KB-09-C-0013

FUDS Property No. F10AK0969-03

MAIN OPERATION COMPLEX AREA Phase I *In Situ* Chemical Oxidation

TECHNICAL MEMORANDUM

DRAFT
MARCH 2010

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Draft
TECHNICAL MEMORANDUM

MAIN OPERATIONS COMPLEX AREA PHASE I *IN SITU* CHEMICAL OXIDATION NORTHEAST CAPE

St. Lawrence Island, Alaska

Prepared for:

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March 2010

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ACRONYMS AND ABBREVIATIONS

%	percent
ATS	AECOM Technical Services, Inc.
bgs	below ground surface
COC	chemical of concern
DI	deionized
DRO	diesel range organics
FeEDTA	iron ethylenediaminetetraacetic acid
ft	feet or foot
GRO	gasoline range organics
ISCO	in-situ chemical oxidation
MOC	Main Operations Complex
ORP	oxidation-reduction potential
OVA	organic vapor analyzer
ROI	radius of influence

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1.0 INTRODUCTION

This Technical Memorandum presents results of the Phase I In-Situ Chemical Oxidation (ISCO) testing conducted between 7 July and 11 September 2009 at the Main Operations Complex (MOC) Area of the Northeast Cape Site located on St. Lawrence Island, Alaska.

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2.0 OBJECTIVES

The primary objectives of the Phase I ISCO effort were to evaluate the feasibility of ISCO technology for application in an isolated location, and to evaluate the ability of ISCO to achieve remediation goals for the chemicals of concern (COCs) and corresponding media of concern. Table 1, in the Tables Section at the back of this document, summarizes the remediation goals for the COCs and corresponding media of concern.

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3.0 PHASE I ISCO EVALUATION

Phase I ISCO evaluation activities performed included the following work components:

- Evaluate site hydrogeologic conditions
- Test pit based site characterization
- Bench scale soil oxidant demand testing
- Bench scale treatability testing
- Pilot study design and construction
- Inject chemical oxidant
- Monitor performance

The Phase I ISCO test results are discussed in the following sections.

3.1 HYDROGEOLOGIC EVALUATION

To evaluate hydrogeologic conditions at the site, existing monitoring wells at the Main Operations Area (MOC) were gauged for depth to water. Wells included in the gauging effort were MW88-1, MW88-3, MW88-4, MW88-5, MW88-10, MW16-1, MW16-2, MW16-3, 18MW1, 17MW1, 22MW2, 22MW3, 20MW1, and 26MW1. Based on the data collected, a groundwater elevation contour map was generated in the field to evaluate regional groundwater flow direction and gradient. Figure 1 displays the groundwater elevation contour map generated from water level data collected on 23 July 2009. Based on the groundwater contours, the groundwater flow direction is approximately northwest across the MOC area. In addition to water level gauging, slug tests were conducted at a subset of the existing monitoring wells to evaluate conductivity and permeability. Wells where slug testing was performed include 20MW1, MW88-5, ICOMW01, and ICOMW02. Table 2 summarizes the conductivity values obtained from slug testing activities at the site.

3.2 TEST PIT SITE CHARACTERIZATION

To rapidly evaluate the lithology and characterize soil conditions within the Phase I ISCO area, AECOM Technical Services, Inc. (ATS) conducted test pit excavations within a localized area of the MOC. Twelve test pits were excavated to evaluate lithologic and pre-ISCO soil contaminant conditions. An excavator was used to dig each test pit to an approximate depth of 10 feet (ft) below land surface, or to the water table, whichever was encountered first. Figure 2 shows the approximate bounds of the Phase I ISCO area. The locations of the test pits installed during the characterization effort are illustrated on Figure 3. Soil excavated from the test pits was visually evaluated, logged, screened with an organic vapor analyzer (OVA) equipped with a flame ionization detector and photoionization detector, and the sidewalls of the test pits were photographed. Table 3 summarizes the OVA readings collected during the test pitting effort. Soil samples were collected to characterize soil contamination at locations where OVA readings and/or visual inspection suggested the presence of petroleum impacts. Selected soil samples underwent field-screening analysis for diesel range organics (DRO) using a siteLAB field test kit; however, it was determined that screening kit results were biased significantly low. This determination was made by submitting split soil samples to the offsite contract analytical laboratory and comparing field test kit results to lab analytical results. A spike test comparison was also made by adding identical volumes of neat diesel to a deionized (DI) water saturated sample of clean drillers sand and to a DI water saturated native peat (field screened as DRO-free) sample, and demonstrating that the signal was surpressed in the peat sample as indicated by a 50 percent (%) reduction in measured DRO.

During the test pitting efforts, a thin, shallow water bearing zone was observed at TP2, TP7, TP8, and TP12 at an approximate depth of 4.5 ft below ground surface (bgs). Observation of this shallow water-bearing zone during the test pitting efforts provided an initial indication that multiple aquifers were likely present within the Phase I ISCO area. After test pit characterization activities were completed, the test pits were backfilled with excavated material in reverse order of excavation.

3.3 PRE-ISCO SOIL BORING AND MONITORING WELL INSTALLATION

Upon completion of the test pitting efforts, four soil borings and two monitoring wells were installed in the vicinity of the proposed Phase I ISCO demonstration site. Figure 3 shows the location of the four soil borings and two monitoring wells installed as a part of the characterization effort. The soil borings were designated as ICOSB01, ICOSB02, ICOSB03, and ICOSB04, and the monitoring wells were designated as ICOMW01 and ICOMW02. Screening samples for soil were collected from ICOSB01, ICOSB02, ICOSB03 and ICOSB04. Screening samples from these locations were submitted for offsite analysis to confirm the appropriateness of the proposed Phase I ISCO site. Data obtained from these screening samples are summarized in Table 4.

During the installation of ICOSB01, saturated soils were initially encountered at a depth of approximately 13.5 ft bgs; however, groundwater levels were observed to rise to a depth of approximately 7 ft bgs within the augers. A similar observation was also noted during the installation of ICOSB04, providing an indication of confined aquifer, conditions. The indication of a deeper (approximately 13 to 14 ft bgs) confined aquifer coupled with the observation of a previously unreported thin, shallow/perched water-bearing zone, prompted a closer look at the potential for multiple aquifers within the Phase I ISCO study area. To evaluate the potential for multiple water-bearing zones, two monitoring wells were installed. ICOMW01 was constructed as a deeper monitoring well with a screened interval corresponding to approximately 12 to 17 ft bgs. This well was intended to isolate the confined aquifer observed during the installation of ICOSB01 and ICOSB04. ICOMW02 was constructed as a shallow monitoring well with a screened interval corresponding to approximately 3.5 to 8.5 ft bgs, and was intended to isolate the shallow/perched water-bearing zone noted in the area during test pitting activities. Existing monitoring well MW88-5 is screened from 6.5 to 16.5 ft bgs, with a sand pack from 4.5 to 16.5 ft bgs, and has the potential to be screened across multiple water bearing zones. Screening samples of groundwater were collected from ICOMW01, ICOMW02, and MW88-5. Screening samples from these locations were submitted for offsite analysis to confirm the appropriateness of the proposed Phase I ISCO site. Data obtained from these screening samples are summarized in Table 4. Analytical results for DRO in groundwater collected from ICOMW01, ICOMW02, and MW88-5 suggested that the bulk of groundwater contamination resides within the shallow/perched water interval (ICOMW02). Based on these screening data, the decision was made to evaluate ISCO in the upper portion of the lithology where the greatest impacts to both soil and groundwater were observed.

3.4 PHASE I ISCO SOIL BORING, INJECTION, AND MONITORING WELL INSTALLATION

Based on the characterization information obtained during the test pitting and pre-ISCO soil and groundwater screening efforts noted above, the Phase I ISCO study was constructed to target the shallow soil and groundwater impacts identified. Figure 4 shows the installed configuration of the Phase I ISCO study monitor and injection wells. The primary injection well was identified as ICOIW01. The Phase I ISCO study monitoring wells were sequentially identified as ICOMW02 through ICOMW09. During well installation, soil borings were continuously screened using an OVA, and samples from the interval displaying the highest OVA readings were submitted for offsite laboratory analysis. Table 5 summarizes the OVA readings from the borings associated with the Phase I ISCO monitoring wells. Offsite analytical data associated with soil samples submitted to the offsite laboratory are presented in the performance-monitoring section below.

3.5 OXIDANT DEMAND TESTING

Prior to performing oxidant injections at the site, bench scale testing to evaluate the natural oxidant demand of site soils was conducted. This testing was conducted on site using soil and groundwater media obtained during the test pit characterization efforts described above. Table 6 summarizes the results of the oxidant demand testing.

3.6 OXIDANT INJECTIONS

3.6.1 Injectate Solution Composition and Volume

Individual solutions of hydrogen peroxide, sodium persulfate, and iron activator, (iron ethylenediaminetetraacetic acid [FeEDTA]) were prepared for injection in a sequential pulse fashion. Oxidant injections were conducted as an alternating pulse sequence where small batches of hydrogen peroxide solution were staggered between small batches of a combined sodium persulfate and FeEDTA activator solution. Injection volumes totaled approximately 1,090 gallons of oxidant/activator solution at ICOIW01 and 646 gallons of oxidant/activator solution at ICOMW09. The concentration of hydrogen peroxide in the injectate solution ranged between approximately 8% and 12%. The total mass of hydrogen peroxide injected at ICOIW01 was approximately 1,320 pounds, and the approximate total mass of hydrogen peroxide injected at ICOMW09 was 944 pounds. The concentration of sodium persulfate in the injectate ranged between 13% and 18%, and the total mass of sodium persulfate injected was approximately 660 pounds at ICOIW01 and 932 pounds at ICOMW09. The maximum concentration of iron delivered via injection was 1,640 parts per million. Approximately 51 pounds of FeEDTA was injected in ICOIW01, and approximately 43 pounds of FeEDTA was delivered to ICOMW09.

Injection activities were halted before target volumes were achieved due to the observation of oxidant short circuiting through the side wall in a low-lying area immediately adjacent to the Phase I ISCO study area. Short circuiting of injection fluids was originally noted while injecting into ICOIW01. Following this observation, injection activities were transitioned to ICOMW09 in an effort to achieve the target volumes and mass of oxidants estimated for the Phase I ISCO study area. Unfortunately, short circuiting of injected fluids was once again observed through the side wall in the same low-lying area immediately adjacent to the Phase I ISCO study area. As a result, no further injection activities were attempted.

Literature values for peat total porosity range upwards of 80%. An estimated 50% reduction in total porosity was anticipated due to silts, sands, and frozen zones in the injection interval. An estimated mobile porosity range was extracted from the United States Environmental Protection Agency guidance document, *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater*, September 1998, by selecting from the 30 to 50% mobile porosity range for peat as an upper bound and a value from the 1% to 30% mobile porosity range for silt as a lower bound value. Based on the 1,090-gallon volume of injectate applied to the subsurface at ICOIW01 across a 5-ft screen interval, the theoretical radius of influence (ROI) of the injection was expected to range between 4.8 and 9.6 ft based on a total porosity of 40%, and a mobile porosity in the range of one-half to one-eighth of the total porosity. Similarly, based on the 646-gallon volume of injectate applied to the subsurface at ICOMW09, the theoretical ROI was calculated to be between 3.7 and 7.4 ft.

3.7 PERFORMANCE MONITORING

The monitoring plan for the pilot study consisted of three discrete sampling periods:

- Baseline monitoring
- Injection performance monitoring
- Post-Injection performance monitoring

Each component of the monitoring plan is described further below.

3.7.1 Baseline Monitoring

Baseline sampling of soil and groundwater media was conducted prior to the initiation of ISCO injection activities. Baseline soil samples were collected from the smear zone soils during monitoring well installation. Following well installation and development activities, and prior to injection activities, baseline groundwater samples were collected from all monitoring wells. Results obtained during baseline monitoring are presented in conjunction with post injection monitoring results below.

3.7.2 Injection Monitoring

Groundwater data from the monitoring wells within the target injection ROI and immediately downgradient, were collected while oxidant/activator solution was being injected. Field parameters, including electrical conductivity, oxidation-reduction potential (ORP), dissolved oxygen, hydrogen ion concentration, and temperature were used as a qualitative means to evaluate injection ROI during injection activities. Table 7 contains the vertically discrete down-hole water quality field parameters collected during the injection event. Based on the field parameter data collected during the injection event, the injected oxidant combination was evident at monitoring wells ICOMW03, ICOMW05, and ICOMW06. Electrical conductivity data at these locations displayed a greater than tenfold increase, and ORP levels at these locations were observed to exceed 400 millivolts during the injection process. These locations also displayed the greatest concentrations of total iron, ferrous iron, sodium persulfate, and hydrogen peroxide, based on field test kit results for these parameters. These data suggest that the ROI achieved by the injection was approximately 10 ft, which agrees well with the calculated theoretical ROI derived from the injected volumes.

3.7.3 Post-Injection Monitoring

Post injection performance monitoring of groundwater was conducted on a schedule corresponding to 3, 7, 14, and 28 days following the completion of oxidant injections. In addition to groundwater samples, soil samples were also collected in conjunction with the day 7 and day 28 post injection sampling event, to evaluate the gross efficacy of the applied ISCO process on soils located within the pilot study area. Baseline soils were collected at depths ranging from 5.5 to 7.5 ft below surface, and subsequent samples were collected from the same depth interval for each sampling event. Table 8 contains the groundwater baseline and performance monitoring data, and Table 9 contains the soil baseline and performance monitoring data. Performance monitoring soil sample locations are shown on Figure 4.

Groundwater analytical results at day 3 indicated an immediate significant increase in concentrations of DRO, gasoline range organics (GRO), residual range organics, and benzene for most sampling locations. This response may be due to desorption of fuels from the highly organic soils. However, it was noted that concentrations of the groundwater COCs were decreasing by day 7, potentially due to aqueous phase oxidation of desorbed COCs. By day 28, concentrations were at or slightly below baseline levels, and the oxidants were mostly consumed. This response is attributed to a continual shift of petroleum hydrocarbons from the highly organic soil matrix into the aqueous phase, with the concomitant oxidation of a portion of this petroleum hydrocarbon mass in the presence of the injected oxidants. The significant source mass sorbed to the highly organic soils may have led to an apparent equilibrium between aqueous phase oxidation and desorption from the soil matrix, and thus the static groundwater concentrations. Additionally, the aquifer system was under dosed with oxidants, given the apparent preferential path and release to the surface described in previous sections, thus reducing the system’s capacity for aqueous phase oxidative treatment. Target cleanup goals were met by day 28 for GRO at ICOMW08. Target cleanup goals for groundwater were not met at the locations sampled for the remaining COCs.

Analytical results for soil suggest a significant decreasing trend for benzene and naphthalene from baseline to day 7, which may be a function of aggressive initial oxidation effects. However, benzene results are variable through day 28, and DRO and naphthalene apparently increased through day 28. These results may be attributed to variation in the soil types over short lateral distances (e.g., horizontal horizon). These variations are problematic because pre-injection baseline soil samples may have had lower starting concentrations than the soils sampled post ISCO. Thus, the same relative reduction would not seem to be as effective in the soils with higher starting concentrations. Target cleanup goals were met by day 28 for DRO at ICOMW07 and ICOMW04; however, these results may be attributable to soil sample heterogeneity. Target cleanup goals for soil were not met at the locations sampled for the remaining COCs.

3.8 BENCH SCALE TREATABILITY TESTING

In addition to the field demonstration effort, a bench scale treatability study was also conducted. A treatability study would normally be conducted prior to the formulation of a field study work plan; however, project schedule and limitations (frozen ground versus manual sampling versus cost) on the ability to collect representative samples prior to the summer field season committed this phase to be performed while ISCO-related site characterization and performance sampling was underway.

The objective of the bench scale treatability study was to supplement the *in-situ* approach by varying oxidant dosages and examining catalyzed hydrogen peroxide, iron-activated persulfate, and hydrogen-peroxide-activated sodium persulfate, as independent treatability scenarios. Evaluation of oxidant effectiveness and oxidant efficiencies in the bench scale tests typically help refine the design of the pilot study work plan.

The bench scale treatability test was conducted at an offsite laboratory and completed in parallel with field ISCO testing. This testing was conducted using site soil and groundwater media obtained during the test pit characterization, ISCO soil boring, and well installation efforts discussed above. Bulk samples of soil were collected in plastic-bag-lined, 5-gallon pails, and bulk groundwater samples were collected in 15-gallon poly containers. Soil and groundwater samples were packed in coolers and shipped to ATS's treatability lab facility in Orlando, Florida. Table 10 and Table 11 contain the results of the bench scale treatability testing efforts.

Visual observations of the soil matrix in the reaction vessels with significant peat soil indicated that, over time, bulk organic matter was reduced in volume, and fiber size appeared to decrease. Total organic carbon analytical results for groundwater were significantly greater compared to baseline, supporting the concept of oxidation of the soil matrix and its conversion to soluble organic carbon compounds. Desorption of COCs is likely continuous as the soil organic matter degrades and releases sorbed petroleum hydrocarbon. Increasing contaminant concentrations in groundwater for multiple COCs is similar in response to the post-ISCO monitoring results from the field effort. Higher concentrations of oxidants appear to result in greater concentrations of COCs for both activated persulfate and catalyzed hydrogen peroxide systems. This result may be due to either desorption of contaminants from organic matter as it is degraded, or creation of matrix interference due to the reaction between higher oxidant concentrations and the soil organic matter.

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4.0 CONCLUSIONS AND RECOMMENDATIONS

Characterization efforts associated with the Phase I ISCO unveiled a number of key items related to the MOC area's site conceptual model. These items included the observation of locally extensive peat and organic silt layers within the shallow site lithology, the presence of a shallow perched water-bearing zone, the observation of locally confined aquifer conditions at greater depths, and the presence of, at least locally, higher than expected DRO concentrations in soils. The greatest concentrations of DRO observed in the Phase I ISCO area of the site appear to correspond well with the peat layers and the shallow perched water aquifer identified in the area of study.

The primary objectives of the Phase I ISCO effort was to evaluate the feasibility of ISCO technology for application in an isolated location, and to evaluate the ability of ISCO to achieve remediation goals for the COCs and corresponding media of concern. The results of the treatability study did not suggest that the tested oxidant scenarios were more effective than the approach selected for the field application. The response observed in the treatability study appears to confirm the observed field response to chemical oxidation of highly organic silts and peat. The application of ISCO at this isolated location proved to be challenging due to a number of unforeseen conditions in the field. Some of the conditions include the presence of high organic soils (peats and organic silts), the presence of permafrost and or semi-permafrost zones, and the observation of preferential flow zones. Despite these challenges, the overall process was demonstrated to be manageable and implementable. With regard to ISCO's ability to achieve remediation goals for the COCs and corresponding media of concern, it appears that it will be difficult to reach cleanup goals using ISCO in areas where peat or organic silts predominate the lithology because these layers have been demonstrated to retain high concentrations of contamination (especially DRO), and the natural organics that comprise these materials exhibit significant competition for the oxidants. Based on the results obtained during the Phase I ISCO testing, it does not appear that ISCO is well suited to achieve remediation goals for the COCs and corresponding media of concern in areas where peat or organic silts predominates the lithology.

Targeting soils that are not predominantly peat for further evaluation is recommended for Phase II ISCO, and could result in greater reductions of COCs by elimination of competing organic demand. Implementation of Phase II ISCO in the southern and/or eastern portion of the MOC area, for example, around SB13B1 and upgradient near MW88-10, could potentially be addressed using ISCO. Implementing ISCO in a portion of the MOC that is further away from the wetland boundaries also mitigates the potential for oxidant breakthrough via a sidewall seep.

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5.0 REFERENCES

Environmental Protection Agency, United States (EPA). 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*. EPA/600/R-98/128. Office of Research and Development. September.

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TABLES

Table 1: Phase I ISCO Remediation Goals

Table 1: Phase I ISCO Remediation Goals

Contaminant of Concern	Soil Cleanup Level (mg/Kg)	Groundwater Cleanup Level (mg/L)
Diesel Range Organics (DRO)	9,200	1.5
Gasoline Range Organics (GRO)	N/A	1.3
Residual Range Organics (RRO)	N/A	1.1
Naphthalene	120	N/A
Benzene	2	0.005

Notes: N/A – Not Applicable

Table 2: Main Operations Complex Area Slug Testing Results

Table 2: Main Operations Complex Area Slug Testing Results

Well	Test #	K (ft/day)
20MW1	1	8.96
	2	8.96
	3	7.24
	Average	**8.39**
MW 88-5	1	0.556
	2	0.611
	3	0.561
	4	0.51
	5	0.51
	6	0.533
	Average	**0.547**
MW 88-3	Unable to create enough drawdown for test	
MW 88-10	Unable to create enough drawdown for test	
ICOMW01	1	1.368
	2	1.625
	3	1.872
	Average	**1.62**
ICOMW02	1	1.45
	2	1.76
	3	1.77
	4	3.64
	5	1.66
	6	1.87
	Average	**2.03**

Table 3: Test Pit Soil Headspace Screening Readings

Table 3: Test Pit Soil Headspace Screening Readings

Test Pit Location	Depth (ft bgs)	FID Reading (ppm)	PID Reading (ppm)
TP1	3.0-4.0	52.1	18.5
	4.0-5.0	556	144
	5.0-6.0	902	200
TP2	3.5-4.0	740	160
	6.0-6.5	1,040	420
	7.0-7.5	720	140
	9.5-10.0	580	204
TP3	2.0-2.5	bkg	bkg
	4.0-4.5	42	48
	6.0-6.5	3.2	4
	7.5-8.0	41.5	16.8
	8.5-9.0	51	4.8
	10.5-11.0	37.5	2.9
TP4	2.0-2.5	1.2	2.3
	5.0-5.5	138	17
	7.0-7.5	1,280	205
TP5	2.0-2.5	40	bkg
	3.5-4.0	30	bkg
	6.5-7.0	60	3.2
	9.0-9.5	30	bkg
TP6	3.5-4.0	10	3
	6.5-7.0	30	15
TP7	3.5-4.0	11	1.4
	7.5-8.0	327	70
TP8	3.5-4.0	1,925	380
	7.5-8.0	1,750	350
	9.5-10	40	4
TP9	5.5-6.0	3.2	2.1
	8.0-8.5	17.6	69
	9.5-10	305	94
TP10	4.0-4.5	19	34
	6.5-7.0	742	151
	9.5-10	305	192
TP11	3.5-4.0	78	3.2
	7.0-7.5	720	3.5
	9.5-10	1,300	2.5
TP12/13	2.0-2.5	bkg	bkg
	3.5-4.0	1058	201
	4.5-5.0	555	125
	6.5-7.0	1,635	238

Notes:
ft bgs - feet below ground surface
ppm - parts per million
bkg - reading was less than or equal to background
FID - flame ionization detector
PID - photoionization detector

Table 4: Screening Sample Analytical Data

Table 4: Screening Sample Analytical Data

Sample Location	Depth Interval (ft bgs)	DRO (mg/Kg)
ICOSB01	5-6	98 B
ICOSB02	5-6	130,000 B, X
ICOSB03	9-11	13,000 B
ICOSB04	5-6	260,000 B,X
Sample Location	**Screen Interval (ft bgs)**	**DRO (mg/L)**
ICOMW01	12-17	1.18
ICOMW02	3.5-8.5	32.8
MW88-5	6.5-16.5	7.53

Notes:

B - Compound was found in blank and sample.

X - Surrogate not quantitated due to high dilution

Table 5: Soil Boring Headspace Screening Readings

Table 5: Soil Boring Headspace Screening Readings

Location	Depth (ft bgs)	FID Reading (ppm)	PID Reading (ppm)
ICOSB01	4.0-5.0	6,200	58
	5.0-6.0	5,400	48
	6.0-7.0	7,500	42
	7.0-8.0	650	29
	8.0-9.0	4,230	41
	9.0-10.0	750	37
	10.0-11.0	4,260	58
	11.0-12.0	25	2.5
	12.0-13.0	3,700	24
	13.0-14.0	5,600	21
ICOSB02	4.0-5.0	2,600	22
	5.0-6.0	24,000	140
	6.0-7.0	4,750	46
	9.0-10	3,800	29
ICOSB03	5.0-7.0	1,305	258
	7.0-9.0	530	130
	9.0-11.0	375	150
ICOSB04	4.0-5.0	1,050	240
	5.0-6.0	530	200
	6.0-7.0	2,150	850
	10.0-12.0	810	370
	12.5-14.5	610	150
ICOMW01	4.0-5.0	350	95
	5.0-6.0	630	150
	6.0-7.0	320	81
	7.0-8.0	620	168
	8.0-9.0	850	130
	9.0-10.0	200	37
	10.0-12.0	480	68
	12.0-13.0	200	40
	14.0-16.0	420	90
ICOMW02	See ICOSB02		
ICOMW03	4.5-5.0	490	93
	5-6.5	2,010	3.7
	6.5-7.0	309	35
	7.0-8.5	318	32
	8.5-9.5	740	100
	9.5-10	40	5
ICOMW04	6-7.5	250	1500
	7.5-9.0	950	165
	9-9.5	140	24
ICOMW05	5.0-6.0	590	240
	6.5-8.0	820	140
	8-8.5	68	10
ICOMW06	4.0-5.0	145	42
	5.0-6.0	630	124
	6.0-7.0	116	35
ICOMW07	5.5-6.5	650	50
	6.5-7.5	1,150	229
	7.5-8.5	240	114
ICOMW08	4.5-5.5	1,050	190
	5.5-6.5	89	17
	7.5-9.5	48	10
ICOMW09	5-5-6.5	1,300	180
	6.5-8.0	450	60
	9.0-10.0	82	12

Notes:
ft bgs-feet below ground surface
ppm-parts per million

Table 6: Soil Oxidant Demand Test Results (g/kg)

Table 6: Soil Oxidant Demand Test Results (g/Kg)

Test Condition	Peat Soils (OL/OH)	Organic Silts (OL/ML)	Silts (ML)
Sodium Persulfate Only	13.4	15.7	14.4
Sodium Persulfate + Iron EDTA	14.4	15.3	7.5
Sodium Persulfate + Hydrogen Peroxide	11.4	15.9	14.9

Table 7: Discrete Vertical Water Quality Summary

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW02	5.1	8/9/2009	13:13	4.75	5.5	0.112	1.03	5.82	224.6				
	6.3	8/9/2009	13:13	4.75	4.82	0.109	0.97	6.20	212.0				
	8.3	8/9/2009	13:13	4.75	5.05	1.99	3.01	6.60	176.0				
	5.0	8/9/2009	16:00	4.71	5.5	0.112	3.01	6.62	239.0				
	6.5	8/9/2009	16:00	4.71	3.19	0.132	1.00	7.32	202.0				
	8.1	8/9/2009	16:00	4.71	1.53	0.131	1.00	7.51	201.0				
	5.0	8/9/2009	18:35	4.72	4.82	0.117	1.47	8.86	157.0				
	6.5	8/9/2009	18:35	4.72	4.18	0.122	1.12	9.04	154.0				
	8.0	8/9/2009	18:35	4.72	1.49	0.132	0.62	9.66	144.0				
	5.0	8/10/2009	13:49	4.61	6.15	0.134	1.85	8.56	167.0				
	7.0	8/10/2009	13:49	4.61	2.4	0.156	1.20	7.92	120.0	5.45	1.36	2.8	14
	8.0	8/10/2009	13:49	4.61	1.72	0.14	0.94	7.94	127.2				
	5.0	8/10/2009	16:32	4.64	5.88	0.115	2.01	8.40	125.0				
	6.5	8/10/2009	16:32	4.64	2.23	0.147	1.33	8.73	96.1				
	8.3	8/10/2009	16:32	4.64	1.39	0.14	4.37	4.35	113.0				
	5.0	8/11/2009	15:58	4.71	6.37	0.124	1.61	5.5	145.9				
	7.0	8/11/2009	15:58	4.71	2.14	0.159	0.76	6.11	98.1	5.45	1.36	2.8	14
	8.2	8/11/2009	15:58	4.71	1.79	0.153	0.86	6.23	98.7				
	5.0	8/12/2009	11:35	3.95	5.88	0.155	2.90	6.07	121				
	7.0	8/12/2009	11:35	3.95	2.5	0.167	1.49	6.57	80	11.25	5.68	1.8	14
	8.2	8/12/2009	11:35	3.95	2.03	0.164	1.33	6.67	75				
	5.0	8/12/2009	15:30	4.48	6.62	0.132	4.60	6.99	174				
	7.0	8/12/2009	15:30	4.48	2.65	0.17	2.30	6.46	90				
	8.5	8/12/2009	15:30	4.48	1.86	0.167	1.21	6.45	85.0				
	5.0	8/13/2009	11:15	4.70	6.99	0.107	0.55	5.15	112.00				
	7.0	8/13/2009	11:15	4.70	3.06	0.16	0.32	-3.00	125.00	21.7	4.24	5	7
	8.5	8/13/2009	11:15	4.70	2.88	0.167	1.50	-3.00	124.8				

Notes:

ft btc - feet below top of casing
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TEMP (c) - temperature degrees Celsius
EC (mS/cm) - electrical conductivity in milliSiemens per centimeter
DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW03	4.5	8/9/2009	12:33	3.34	7.14	0.128	2.3	5.58	200.0				
	6.5	8/9/2009	12:33	3.34	6.58	0.134	1.14	5.66	205.0				
	8.5	8/9/2009	12:33	3.34	3.44	0.131	1.25	5.70	241.0				
	5.0	8/9/2009	15:06	troll	5.92	0.128	1.14	5.89	190.9				
	7.2	8/9/2009	15:06	troll	4.35	0.132	1.23	5.70	183.6				
	9.2	8/9/2009	15:06	troll	2.78	0.135	1.5	5.77	184.0				
	4.8	8/9/2009	17:19	3.22	6.92	0.133	1.12	6.69	243.1				
	6.8	8/9/2009	17:19	3.22	4.76	0.136	1	6.64	189.3				
	8.8	8/9/2009	17:19	3.22	2.84	0.128	1.36	6.3	188				
	4.0	8/10/2009	13:12	3.15	11.98	0.387	5.55	4.01	407.4				
	6.0	8/10/2009	13:12	3.15	4.93	3.599	7.88	1.22	584.7	7.72	0.49	1.8	21
	8.5	8/10/2009	13:12	3.15	3.37	3.82	6.81	1.55	580.5				
	4.5	8/10/2009	16:00	3.25	11.96	1.097	8.602	1.45	541.0				
	6.5	8/10/2009	16:00	3.25	4.81	4.086	8.4	0.05	581.0				
	8.5	8/10/2009	16:00	3.25	3.69	4.73	8.11	-0.49	580.0				
	4.0	8/11/2009	15:42	3.46	12.84	3.487	0.7	0.99	598.6				
	6.0	8/11/2009	15:42	3.46	4.9	6.04	0.87	0.47	599.0	14.4	1.28	15.2	>70
	8.5	8/11/2009	15:42	3.46	2.96	6.437	0.84	0.22	595				
	3.5	8/12/2009	11:40	2.74	19	4.468	1.42	1.90	603.0				
	5.5	8/12/2009	11:40	2.74	10.88	8.259	1.12	1.85	593.0	690.69	10.89	14	>70
	7.5	8/12/2009	11:40	2.74	5.84	8.461	1.09	1.95	565				
	3.0	8/12/2009	15:25	2.80	20.45	5.75	0.91	1.48	606.0				
	5.0	8/12/2009	15:25	2.80	10.81	11.75	0.61	1.23	595.0				
	7.0	8/12/2009	15:25	2.80	7.92	12.82	0.71	0.89	608.2				
	9.0	8/12/2009	15:25	2.80	6.32	12.74	0.8	0.77	604.4				
	3.5	8/13/2009	11:30	2.85	18.32	0.056	2.71	-10.00	227.0				
	5.0	8/13/2009	11:30	2.85	13.62	21.38	0.58	-10.00	221.0	816.63	17.05	18	1400
	7.0	8/13/2009	11:30	2.85	9.8	19.5	0.38	-10.00	219.9				
	8.5	8/13/2009	11:30	2.85	3.32	16.85	0.39	-10.00	254.0				

Notes:

ft btc - feet below top of casing
DTW - depth to water in feet
TEMP (c) - temperature degrees Celsius
EC (mS/cm) - electrical conductivity in milliSiemens per centimeter
DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW04	6.8	8/9/2009	12:19	6.51	1.69	0.141	8.77	5.67	235.2				
	8.0	8/9/2009	12:19	6.51	1.84	0.133	9.04	5.49	247.0				
	9.2	8/9/2009	12:19	6.51	1.26	0.146	8.7	5.63	249.3				
	6.6	8/9/2009	15:28	6.40	2.08	0.133	10.33	6.23	383.0				
	7.8	8/9/2009	15:28	6.40	1.52	0.142	8.11	7.74	336.0				
	9.1	8/9/2009	15:28	6.40	1.34	0.145	7.89	7.83	304.0				
	6.4	8/9/2009	18:00	6.42	1.83	0.135	9.1	7.18	242.1				
	7.0	8/9/2009	18:00	6.42	1.8	0.132	7.98	7.07	244.5				
	9.0	8/9/2009	18:00	6.42	1.77	0.157	7.44	7.22	222.9				
	7.0	8/10/2009	13:18	6.50	2	0.143	10.71	6.61	185.0				
	8.0	8/10/2009	13:18	6.50	1.46	0.157	7.23	6.54	157.0	3.08	1.02	2.2	7
	9.1	8/10/2009	13:18	6.50	1.25	0.165	6.31	6.85	148.1				
	7.0	8/11/2009	16:11	6.49	2.09	0.138	10.01	5.00	197.2				
	8.0	8/11/2009	16:11	6.49	1.41	0.161	8	4.98	162.0				
	9.5	8/11/2009	16:11	6.49	1.23	0.167	6.2	5.36	144.0				
	6.5	8/11/2009	16:17	6.35	2.57	0.121	11.25	5.50	205.0				
	7.5	8/11/2009	16:17	6.35	1.78	0.14	8.25	5.72	152.0	1.04	0.91	3.4	6.3
	9.0	8/11/2009	16:17	6.35	1.34	0.161	5.14	6.59	120.1				
	7.0	8/12/2009	9:32	6.27	2.54	0.147	6.25	5.53	185.0				
	8.0	8/12/2009	9:32	6.27	1.89	1.66	4.68	5.55	181.0				
	9.0	8/12/2009	9:32	6.27	1.77	0.168	4.16	5.53	177.0				
	7.0	8/12/2009	11:47	6.15	3.07	0.148	11	6.43	177.7				
	8.0	8/12/2009	11:47	6.15	1.76	0.161	5.01	6.30	124.7				
	9.0	8/12/2009	11:47	6.15	1.5	0.168	3.76	6.28	115.0				
	7.0	8/12/2009	15:20	6.53	2.86	0.148	14.75	7.50	138.0				
	8.0	8/12/2009	15:20	6.53	2.05	0.162	9.55	6.55	130.0	4.2	2.66	3	5.6
	9.5	8/12/2009	15:20	6.53	1.8	0.172	7.2	6.38	116.5				
	7.5	8/13/2009	11:37	7.30	2.84	0.137	9.55	-8.00	80.0				
	8.0	8/13/2009	15:20	NA	NA	NA	NA	NA	NA	8.65	9.3	3	5.6
	9.5	8/13/2009	15:20	7.30	2.74	0.146	7.2	-8.00	83.8				

Notes:

ft btc - feet below top of casing
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DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW05	4.0	8/9/2009	12:41	3.48	6.84	0.115	6.8	4.57	477.1				
	6.0	8/9/2009	12:41	3.48	5.38	0.108	2.15	4.68	440.0				
	8.0	8/9/2009	12:41	3.48	4.08	0.105	1.25	4.90	370.0				
	5.5	8/9/2009	15:16	4.16	11.05	1.866	37.58	3.32	582.0				
	6.5	8/9/2009	15:16	4.16	7.7	1.46	35.01	3.27	575.0				
	7.7	8/9/2009	15:16	4.16	7.13	1.289	40.3	2.98	582.0				
	4.8	8/9/2009	17:29	troll	12.04	9.11	34.00	5.17	668.0				
	5.9	8/9/2009	17:29	troll	10.01	9.456	38.6	5.47	670				
	7.9	8/9/2009	17:29	troll	8.12	8.59	46.84	5.59	654.3				
	3.0	8/10/2009	12:56	troll	24.89	22.51	44.98	-0.25	581.8				
	5.0	8/10/2009	12:56	troll	24.78	22.33	46.57	-0.43	583.0	2302	1.57	3	>70
	7.0	8/10/2009	12:56	troll	24.61	22.57	45.36	-0.40	582.0				
	4.0	8/11/2009	16:30	3.44	21.45	32.05	15.3	0.43	495.2				
	6.0	8/11/2009	16:30	3.44	12.44	28.72	28.58	0.78	495.7	>33000	36.3	5.2	>70
	8.0	8/11/2009	16:30	3.44	11.23	28.01	26.01	0.73	497.0				
	4.0	8/12/2009	9:39	3.70	20.58	25.67	8.65	8.16	473.0				
	6.0	8/12/2009	9:39	3.70	11.68	23.1	18.06	8.90	477.0				
	8.0	8/12/2009	9:39	3.70	5.37	25.05	28.1	6.70	487.3				
	4.0	8/12/2009	11:53	2.95	21.88	24.2	13.7	1.31	461.0				
	6.0	8/12/2009	11:53	2.95	13.07	22.74	19.63	1.34	481.0				
	8.0	8/12/2009	11:53	2.95	5.33	23.38	34	1.19	484.0				
	3.0	8/12/2009	14:40	2.70	30.4	15.8	8.5	1.50	483.0				
	5.0	8/12/2009	14:40	2.70	21.52	25.65	13.65	1.05	485.0	>33000	13200	9	1400
	7.0	8/12/2009	14:40	2.70	6.3	22.4	34.12	0.78	477.0				
	4.0	8/13/2009	11:43	3.65	25	27.04	2	296.00	483.0				
	6.0	8/13/2009	11:43	3.65	10.49	20.94	5.01	255.70	485.0	>33000	1160	15	2500
	7.5	8/13/2009	11:43	3.65	5.38	19.99	-3	368.90	477.0				

Notes:

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DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW06	5.0	8/9/2009	13:06	3.84	5.38	0.126	1.91	6.22	188.0				
	7.1	8/9/2009	13:06	3.84	2.7	0.122	0.77	6.51	156.0				
	9.1	8/9/2009	13:06	3.84	2.45	0.121	1.01	6.58	146.0				
	4.7	8/9/2009	15:50	3.85	5.74	0.089	8.78	6.32	218.2				
	6.7	8/9/2009	15:50	3.85	3.55	0.127	2	7.14	218.5				
	8.2	8/9/2009	15:50	3.85	2.39	0.12	0.9	7.48	217.4				
	4.4	8/9/2009	18:09	3.72	6.41	0.132	1.48	7.83	216.4				
	6.4	8/9/2009	18:09	3.72	3.47	0.128	0.51	8.52	202.0				
	8.2	8/9/2009	18:09	3.72	2.17	0.119	0.66	8.82	204.0				
	4.0	8/10/2009	13:30	3.68	6.22	4.023	3.43	2.24	585.0				
	6.0	8/10/2009	13:30	3.68	3.7	5.871	1.5	2.22	623.0				
	8.0	8/10/2009	13:30	3.68	3.1	5.912	1.21	2.60	632.0				
	4.0	8/10/2009	16:19	3.62	8.4	5.091	3.02	0.91	624.0				
	6.0	8/10/2009	16:19	3.62	3.82	7.54	3.04	0.77	631.5	49.98	4.08	3.8	28
	8.0	8/10/2009	16:19	3.62	3.21	7.376	1.32	0.92	630.0				
	4.5	8/11/2009	15:50	4.10	5.08	16.53	1.7	-0.11	513.0				
	6.5	8/11/2009	15:50	4.10	3.8	16.11	1.58	-0.05	514.0	2300	831	6	>70
	8.5	8/11/2009	15:50	4.10	3.54	15.87	1.52	0.08	514.0				
	4.0	8/12/2009	11:25	3.95	9.64	18.47	3.53	1.99	464.9				
	6.0	8/12/2009	11:25	3.95	6.22	19.24	2.56	1.92	463.9				
	8.0	8/12/2009	11:25	3.95	3.01	18.06	2.13	1.89	470.0				
	4.0	8/12/2009	14:45	3.70	12.75	0.278	8	0.85	459.5				
	6.0	8/12/2009	14:45	3.70	7.45	19.32	2.86	0.70	454.0	>33000	14400	7	1400
	8.5	8/12/2009	14:45	3.70	2.21	17.57	1.4	0.58	469.0				
	4.5	8/13/2009	11:50	4.11	12.32	21.93	6.89	8.58	389.00				
	6.0	8/13/2009	11:50	4.11	6.3	22.1	0.54	-8	425.00	>33000	1180	33	3000
	8.5	8/13/2009	11:50	4.11	2.5	19.78	0.25	-4	429.00				

Notes:

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pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW07	6.5	8/9/2009	12:58	5.70	0.83	0.188	2.27	7.01	77.0				
	7.6	8/9/2009	12:58	5.70	0.86	0.184	1.48	6.97	73.0				
	9.6	8/9/2009	12:58	5.70	0.61	0.18	9.9	6.82	133.0				
	6.0	8/9/2009	16:09	5.72	0.82	0.2	4.87	5.40	151.0				
	7.9	8/9/2009	16:09	5.72	0.93	0.184	1.08	7.05	77.0				
	9.9	8/9/2009	16:09	5.72	0.62	0.185	1.2	7.14	106.0				
	6.5	8/9/2009	18:25	5.68	0.96	0.183	2.48	9.32	60.1				
	8.0	8/9/2009	18:25	5.68	0.74	0.183	1.5	9.61	63.2				
	9.3	8/9/2009	18:25	5.68	0.60	0.183	1.12	9.78	64.00				
	6.5	8/10/2009	13:37	5.69	1.62	0.216	2.51	8.66	4.0				
	7.5	8/10/2009	13:37	5.69	0.98	0.193	2.12	8.43	10.5				
	9.3	8/10/2009	13:37	5.69	0.59	0.189	1.55	8.62	11.1				
	6.5	8/10/2009	16:32	5.65	1.4	0.198	3.08	8.54	17.3				
	7.5	8/10/2009	16:32	5.65	1.14	0.195	2.07	8.54	16.6	18.66	9	2.4	14
	9.0	8/10/2009	16:32	5.65	0.66	0.191	1.6	8.74	18.6				
	6.5	8/11/2009	17:00	5.69	1.45	0.207	3.26	8.57	10.9				
	7.5	8/11/2009	17:00	5.69	0.65	0.194	1.77	9.76	-9.1	17.46	18.78	2.2	10
	9.0	8/11/2009	17:00	5.69	0.7	0.193	1.69	9.78	-8.4				
	6.0	8/12/2009	10:20	5.65	1.57	0.235	0.27	7.52	-48.4				
	6.0	8/12/2009	10:20	5.65	1.08	0.208	9.14	7.01	-11.9				
	8.0	8/12/2009	10:20	5.65	1.3	0.217	0.22	7.26	-30.4				
	9.0	8/12/2009	10:20	5.65	0.9	0.213	0.21	7.1	-21.9				
	6.0	8/12/2009	12:13	5.36	0.84	0.163	12.67	7.51	35.5				
	8.0	8/12/2009	12:13	5.36	0.73	0.205	1.71	7.2	39.8				
	9.0	8/12/2009	12:13	5.36	0.71	0.204	1.71	7.2	39.4				
	6.0	8/12/2009	14:50	5.50	0.88	0.233	4.8	6.85	11.4				
	7.5	8/12/2009	14:50	5.50	0.97	0.22	2.7	6.78	10.7	29.15	19.62	4	7
	9.0	8/12/2009	14:50	5.50	0.76	0.211	1.48	6.81	15.9				
	6.0	8/13/2009	11:55	5.69	1.58	0.26	4.2	-3	242.0				
	7.5	8/13/2009	11:55	5.69	1.19	0.246	0.22	-3	209.0	47.43	18.18	4	7
	9.0	8/13/2009	11:55	5.69	0.86	0.214	1.31	-3	225.0				

Notes:

ft btc - feet below top of casing
DTW - depth to water in feet
TEMP (c) - temperature degrees Celsius
EC (mS/cm) - electrical conductivity in milliSiemens per centimeter
DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 7: Discrete Vertical Water Quality Summary

Location	Interval (ft btc)	DATE	TIME	DTW (ft)	TEMP (°C)	EC (mS/cm)	DO (mg/L)	pH (su)	ORP (mV)	Total Iron Conc. (mg/L)	Ferrous Iron Conc. (mg/L)	Hydrogen Peroxide Conc. (mg/L)	Sodium Persulfate Conc. (mg/L)
ICOMW08	8.0	8/9/2009	13:54	7.19	0.69	1.54	2.29	6.49	194.7				
	7.5	8/9/2009	16:25	7.22	6.51	0.163	1.86	5.99	192.0				
	8.9	8/9/2009	16:25	7.22	0.53	0.158	2.2	6.03	193.0				
	8.0	8/9/2009	18:45	7.16	0.58	0.161	1.96	10.19	135.0				
	7.3	8/10/2009	13:26	7.05	1.56	0.225	2.79	7.41	194.0	2	0.43	2.4	5
	8.5	8/10/2009	13:26	7.05	0.63	0.173	3.29	7.31	172.2				
	7.1	8/11/2009	17:35	6.92	0.87	0.181	1.81	8.46	108.3				
	8.8	8/11/2009	17:35	6.92	0.63	0.172	2.02	8.42	119.9				
	Well Sampling	8/11/2009	20:15	6.89	4.58	0.19	0.56	5.57	181.60	1.99	0.47	1.4	5
	NA	8/12/2009	10:10	DRY	NA	NA	NA	NA	NA				
	9.0	8/12/2009	12:02	8.25	2.16	0.255	3.1	7.10	104.4				
	9.0	8/12/2009	15:05	7.81	1.74	0.204	3.25	7.19	89.0	3.07	0.66	>100	2.1
	7.5	8/13/2009	12:00	6.96	1.23	0.171	1.68	-5.00	194.0				
	8.5	8/13/2009	12:00	6.96	0.93	0.196	1.58	-5.00	197.0	2.3	1.73	0	1.4

Notes:

ft btc - feet below top of casing
DTW - depth to water in feet
TEMP (c) - temperature degrees Celsius
EC (mS/cm) - electrical conductivity in milliSiemens per centimeter
DO (mg/L) - dissolved oxygen in milligrams per liter
pH (su) - pH in standard units
ORP (mV) - oxidation-reduction potential in millivolts
mg/L - milligrams per liter

Table 8: Phase I ISCO Study Groundwater Results

Table 8: Phase I ISCO Study Groundwater Results

Well ID	Sampling Event	Benzene (ug/L)	Naphthalene (ug/L)	GRO (mg/L)	DRO (mg/L)	RRO (mg/L)
Groundwater cleanup levels		*5*	*NA*	*1.3*	*1.5*	*1.1*
ICOMW03	Baseline	0.74 J	29	0.37	**21**	**1.7**
	Day 3	1.3	49	**14**	**2.7 L**	**1.6 L**
	Day 7	3 J,X	50 X	0.70	**24 D**	**2.7 D**
	Day 14	2.4	87	0.81	**18 X**	**1.5 X**
	Day 28	2.5	110	0.8	**14**	**1.2**
ICOMW04	Baseline	**63**	74	0.92	**11**	**2**
	Day 3	**86**	34	**21**	**20 L**	0.76 L
	Day 7	**56 X**	7.4 X	0.54	**7.9 D**	**1.2 D**
	Day 14	**53**	4.6	0.54	**5.7 X**	**1.7 X**
	Day 28	**70**	7	0.66	**9.5**	**1.7**
ICOMW05	Baseline	1.1	31	0.29	**13**	**1.9**
	Day 3	4.6	81	**23**	**22 L**	**1.8 L**
	Day 7	**6.1 J**	83 H	0.93	**18 D**	**2.4 D**
	Day 14	**11**	100	0.85	**9.9 X**	**1.5 X**
	Day 28	**34**	68	1.1	**14**	**2.1**
ICOMW06	Baseline	4.9	100	0.97	**19**	**2.3**
	Day 3	1.7	57	**11**	**18 L,X,D**	**2.4 L,X,D**
	Day 7	1.7 J	58 H,X	0.62	**19 D**	**2.8 D**
	Day 14	1.7	56	0.56	**17 X**	**2.3 X**
	Day 28	2.1	51	0.37	**18**	**2.2**
ICOMW07	Baseline	**45**	4	**1.4**	**8.5**	**1.2**
	Day 3	**34**	4.6	**32**	**12 L,X,D**	**2.0 L,X,D**
	Day 7	**36**	6.7 J,H	**1.8**	**10 D**	**1.4 D**
	Day 14	**40**	4.9	**1.4**	**9.1 X**	**1.4 X**
	Day 28	**32**	3.7	**1.5**	**11**	**1.2**
ICOMW08	Baseline	**69**	120	**39**	**11 L**	**1.3 L,I,X**
	Day 3	**70**	88	**29**	**13 L**	1.0 L
	Day 7	**76**	90	**1.5**	**10 D**	**2.0 D**
	Day 14	**43**	ND (1.0)	0.63	**8.6 X**	**1.6 X**
	Day 28	**32**	16	0.91	**9.5**	**1.4**
ICOMW02	Baseline	**72**	380	**2.6**	**24 X**	**2.3 L,X**
	Day 3	**86**	300	**54**	**21 L**	**1.3 L**
	Day 7	**46 X**	340 H,X	**2.8 X**	**18 D,X**	**1.6 D,X**
	Day 14	**71**	290 H	**2.8**	**28 X**	**1.8 X**
	Day 28	**97**	260	**3.1**	**110**	**4.5**
ICOMW09	Baseline	**57**	33	0.88	**5.7 X**	0.78 L,X

Notes:

B-Compound was found in the blank and sample

D-Samples were diluted due to presence of target analytes. The dilution made quantitition of surrogate recoveries impractical

H-Sample analyzed past recommended 14 day holding time.

I-Indicates the presence of an interference, recovery is not calculated.

J-Result is an estimate. The reported concentration is between the method MDL and PQL.

L-Result is an estimate due to the LCS/LCSD exceeding the method RPD limit.

X-Surrogate recovery outside of acceptance limits due to target analyte interference.

ND (value)-Analyte not detected above (reporting limit)

NA-Not analyzed

Table 9: Phase I ISCO Study Soil Results

Table 9: Phase I ISCO Study Soil Results

Well ID	Sampling Event	Benzene (ug/Kg)	Naphthalene (mg/Kg)	DRO (mg/Kg)	RRO (mg/Kg)	GRO (mg/Kg)	TOC (mg/Kg)
Soil Cleanup Criteria		*2,000*	*NA*	*9,200*	*NA*	*NA*	*NA*
ICOMW03	Baseline	1,000	120	**170,000**	7,200	1000 B,X	213,000 Q
	Day 7	520 H	610 H,X	**330,000** D	13,000 D	9000 X	400,000 H
	Day 28	230	310	**360,000** X	16,000 X	3100 X	410,000
ICOMW04	Baseline	930	81	**17,000**	4,400	470 B	185,000 Q
	Day 7	95 H	15 H	4,600	5,400	170	200,000 H
	Day 28	240	9	6,400	2,500	98 X	180,000
ICOMW05	Baseline	1,000	93	**130,000**	7,700	680 B	199,000 Q
	Day 7	240 H	600 H,X	**250,000** D	17,000 D	7,500 X	290,000 H
	Day 28	260	440	**390,000** X	24,000 X	3,800 X	260,000
ICOMW06	Baseline	580	240	**110,000**	8,400	2,100 B	215,000 Q
	Day 7	1,000 H	64	**77,000**	6,800	490 X	150,000 H
	Day 28	1,400	270	**170,000** X	7,600	1900 X	200,000
ICOMW07	Baseline	270	25	**13,000**	2,800	480 B	190,000 Q
	Day 7	ND (69) H	ND (0.17) H	540	6,300	6.7 J	240,000 H
	Day 28	ND (110)	ND (0.26)	370	3,000	12 J	150,000
ICOMW08	Baseline	**3,600**	300	**240,000**	5,300	4,400 B	453,000 Q
	Day 7	490 H	190 H,X	**77,000** D	7,600 D	1,000 X	150,000 H
	Day 28	**3,700**	460	**360,000** X	20,000 X	3,200 X	250,000
ICOMW09	Baseline	**4,300**	270	6,500	5,300	1,900 B	261,000 Q
	Day 7	220 H	65 H,X	**44,000** D	11,000 D	270 X	260,000 H
	Day 28	**2,000**	280	**150,000** X	8,100 J,X,Q	2,000 X	200,000
ICOMW02	Baseline	*NA*	*NA*	**13,000**	*NA*	*NA*	*NA*
	Day 7	280 H,X	3,100 H,X	2,700	11,000	73	300,000 H
	Day 28	750	760	**17,000**	3,000	26 X	320,000

Notes:

X-Surrogate recovery outside of acceptance limits due to target analyte interference.

H-Sample analyzed past recommended 14 day holding time.

J-Result is an esimate. The reported concentration is between the method MDL and PQL.

D-Samples were diluted due to presence of target analytes. The dilution made quantitition of surrogate recoveries impractical

B-Compound was found in blank and sample.

Q-Reporting limit elevated due to sample dilution.

ND (value)-Analyte not detected above (reporting limit)

NA-Not analyzed

Table 10: Groundwater Analytical Results, Treatability Bench Study

Table 10 - Groudwater Analytical Results, Treatability Bench Study

Compound	Sample Dates	Sampling Event (Week)	Benzene (ug/L)	Naphthalene (ug/L)	GRO (C6-C10)	DRO (nC10-<nC25)	RRO (nC25-nC36)	Hexavalent chromium	Arsenic	Lead	Chromium	Total Iron	Ferrous Iron	Sulfate	Alkalinity	Total Organic Carbon
Activated Sodium Persulfate																
Untreated Control	8/21/2009	Login Baseline	0.51 J	0.064 U	0.14	11	2.1	0.007 HJ	0.0074 J	0.0077 J	0.012 J	24	35	N/A	80	65
	9/14/2009	0	0.057 U	0.064 U	ND	0.9 B	0.21 *B	0.0037 UH	0.012 J	0.0017 U	0.0033 U	N/A	30	1.5	67	21 H
	9/23/2009	1	0.057 U	5	0.42	28 *B	11 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	0.064 U	6.1	46	9.9	0.091 H	1 J	2	2.5	N/A	20	13	23	160
	10/22/2009	5	N/A	N/A	N/A	10 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.057 U	15	11	16 B	4	0.046 JH	0.7	1.2	1.4	N/A	16	1.3	180	150
EDTA + 2% S208	9/23/2009	1	0.41 J	5.4	0.24	17 *B	5.6 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.14 J	4.1 J	0.58	2	7.7	0.084 JH	0.15	0.11	0.18	N/A	31	39000	N/A	8200
	10/22/2009	5	N/A	N/A	N/A	27 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.31 J	14	2.6	7.5 B	2.2	0.035 JH	0.42 J	0.76	1.0	N/A	30	28000	N/A	1600
EDTA + 10% S208	9/23/2009	1	0.38	4.6	0.35	98 *B	37 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	11	0.68	140	32	0.19 JH	0.66	0.79	1.7	N/A	23	160000	N/A	9900
	10/22/2009	5	N/A	N/A	N/A	200 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.44 J	14	5.2	20 B	4.6	0.036 JH	0.92	1.3	1.5	N/A	18	180000	N/A	7300
8% H202 + 2% S208	9/23/2009	1	0.33	5.5	0.19	22 *B	9.7 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	7.5	0.43	170	42	0.13 JH	0.94 J	1.6	2.4	N/A	28	53000	N/A	1300
	10/22/2009	5	N/A	N/A	N/A	55 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.72 J	11	3.3	7.7 B	2.3	0.043 JH	0.48 J	0.97	1.3	N/A	20	65000	N/A	660
8% H202 + 10% S208	9/23/2009	1	0.37	5.5	0.98	150 *B	61 *B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	0.057 U	0.064 U	0.67	250	69	0.23 JH	0.93	0.69	1.9	N/A	10	220000	N/A	1600
	10/22/2009	5	N/A	N/A	N/A	230 B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	0.83 J	3.4	0.84	14 B	2.8	0.048 JH	1.1	0.83	1.7	N/A	5	220000	N/A	1600
Catalyzed Hydrogen Peroxide																
CHP Control	11/19/2009	0 hr	0.11 UH	0.13 UH	0.03 U	7.1	1.9	0.0046 JH	0.017 J	0.042	0.05	N/A	32	N/A	48	32
5% H2O2 + 30 mg/L Fe	11/19/2009	1 hr	0.11 UH	0.13 UH	0.042 J	41	35	0.10 H	0.47 J	1.2	1.6	N/A	174	N/A	NA	3600
	11/19/2009	3 hr	0.11 UH	0.13 UH	0.03 U	13	6.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	0.11 UH	0.13 UH	0.055 J	21	17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	0.11 UH	0.13 UH	0.03 U	32	23	0.24 H	0.39 J	1.0	1.3	N/A	169	N/A	NA	3800
10% H2O2 + 60 mg/L Fe	11/19/2009	1 hr	0.11 UH	0.13 UH	0.032 J	230	160	0.20 H	0.57 J	1.9	2.3	N/A	301	N/A	NA	4700
	11/19/2009	3 hr	0.11 UH	0.13 UH	0.055 J	630	360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	0.11 UH	0.13 UH	0.040 J	340	240	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	0.11 UH	0.13 UH	0.033 J	87	63	0.14 H	0.34 J	1.3	1.3	N/A	287	N/A	NA	3000

Notes:
1. Units are mg/L unless specified otherwise
2. Laboratory unable to perform alkalinity analysis - sample pHs exceed limit
3. N/A = Not Analyzed

Flags:
B - Compound was found in both blanks and samples
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
* - LCS or LCSD exceeds the control limits
H - Sample was prepped or analyzed beyond the specified holding time
ND or U - Result is less than the MDL. Where U, MDL listed in table

Table 11: ISCO Treatability Study Soil Results Summary

Table 11: ISCO Treatability Study Soil Results Summary

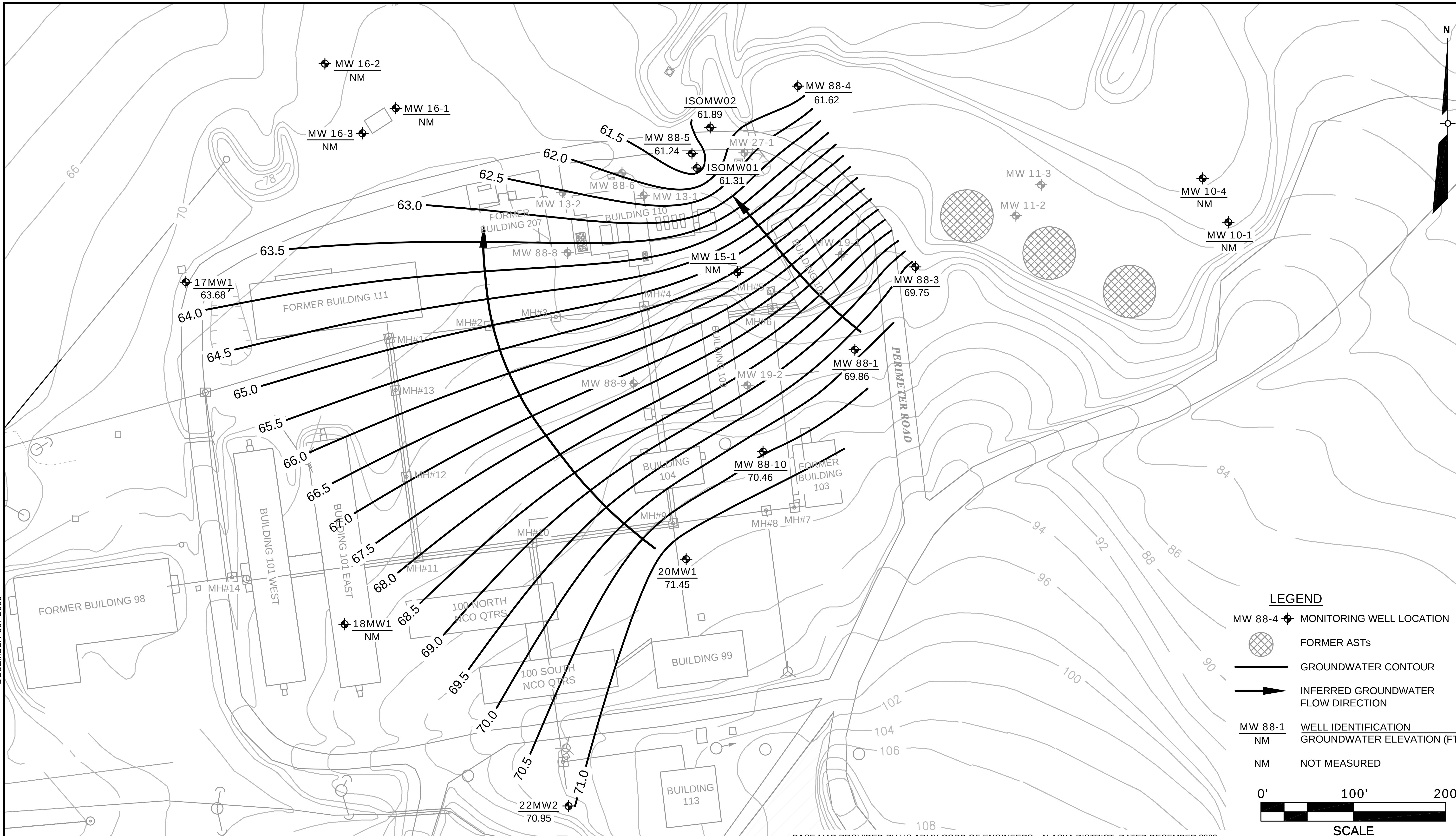
Compound	Sample Date	Sampling Event (Week)	Benzene (ug/Kg)	Naphthalene (ug/Kg)	GRO (C6-C10)	DRO (nC10-<nC25)	RRO (nC25-nC36)	Arsenic	Chromium	Total Iron	Lead	Hexavalent chromium
Activated Sodium Persulfate												
Untreated Control	8/26/2009	Login Baseline	7 U	3900	730	15000	2900	6.5	23	15000	27	0.72
	9/14/2009	0	64 U	150 U	260	12000 B	3000	5.9	19 B	12000 B	11	0.3 JB
	9/23/2009	1			33	15000 B	4300 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	9.7 U	620	410	17000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5	N/A	N/A	N/A	17000	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	10 U	610	36 B	15000	5300	3.9 J	12	8200	9.0	0.74 J
EDTA + 2% S208	9/23/2009	1	N/A	N/A	59	14000 B	5200 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	7.9 U	530	98	16000 B	6200 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5	N/A	N/A	N/A	8900	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	12 U	1400	36 B	16000	7600	5.6 J	17	12000	13	0.67 J
EDTA + 10% S208	9/23/2009	1	N/A	N/A	27	6600 B	1900 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	8.2 U	1000	170	7100 B	2600 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5	N/A	N/A	N/A	5800	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	9 U	900	20 B	12000	4900	3.1 J	10	12000	10	0.74
8% H202 + 2% S208	9/23/2009	1	N/A	N/A	61	15000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	9 U	1300	320	13000 B	4700 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5	N/A	N/A	N/A	9700	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	12 U	1300	45 B	15000	7000	4.7 J	16	11000	12	0.51 J
8% H202 + 10% S208	9/23/2009	1	N/A	N/A	73	8800 B	2500 B	N/A	N/A	N/A	N/A	N/A
	10/8/2009	3	44 U	4200	1700	12000 B	5000 B	N/A	N/A	N/A	N/A	N/A
	10/22/2009	5	N/A	N/A	N/A	8500	N/A	N/A	N/A	N/A	N/A	N/A
	11/10/2009	7	8.6 U	430	25 B	15000	6700	2.6 J	11	7300	8.9	1
Catalyzed Hydrogen Peroxide												
CHP Control	11/19/2009	0 hr	8.3 U	750	57	14000 B	6800 *	5.3 J	19 B	13000 B	15	0.42 J
5% H2O2 + 30 mg/L Fe	11/19/2009	1 hr	12 U	30 U	77	170 B	220 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	3 hr	12 U	520	54	7900 B	7600 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	51 U	2400	950	1200 B	870 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	7.8 U	89 J	24	530 B	560 *	N/A	N/A	N/A	N/A	N/A
0% H2O2 + 60 mg/L F	11/19/2009	1 hr	25 U	140 J	430	4700 B	5400 *	2.7 J	13 B	9600 B	11	N/A
	11/19/2009	3 hr	27 U	120 J	460	7400 B	7700 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	5 hr	19 U	410	460	9500 B	9700 *	N/A	N/A	N/A	N/A	N/A
	11/19/2009	7 hr	22 U	360	420	5600 B	5900 *	6.8 J	26 B	21000 B	27	N/A

NOTES:
1. Units are mg/Kg unless specified otherwise
2. N/A = Not Analyzed

Flags:
B - Compound was found in both blanks and samples
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
* - LCS or LCSD exceeds the control limits
H - Sample was prepped or analyzed beyond the specified holding time
ND or U - Result is less than the MDL. Where U, MDL listed in table

FIGURES

Figure 1: MOC Area Groundwater Contour Map July 23, 2009



BASE MAP PROVIDED BY US ARMY CORP OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 1

MOC AREA GROUNDWATER CONTOUR MAP
JULY 23, 2009

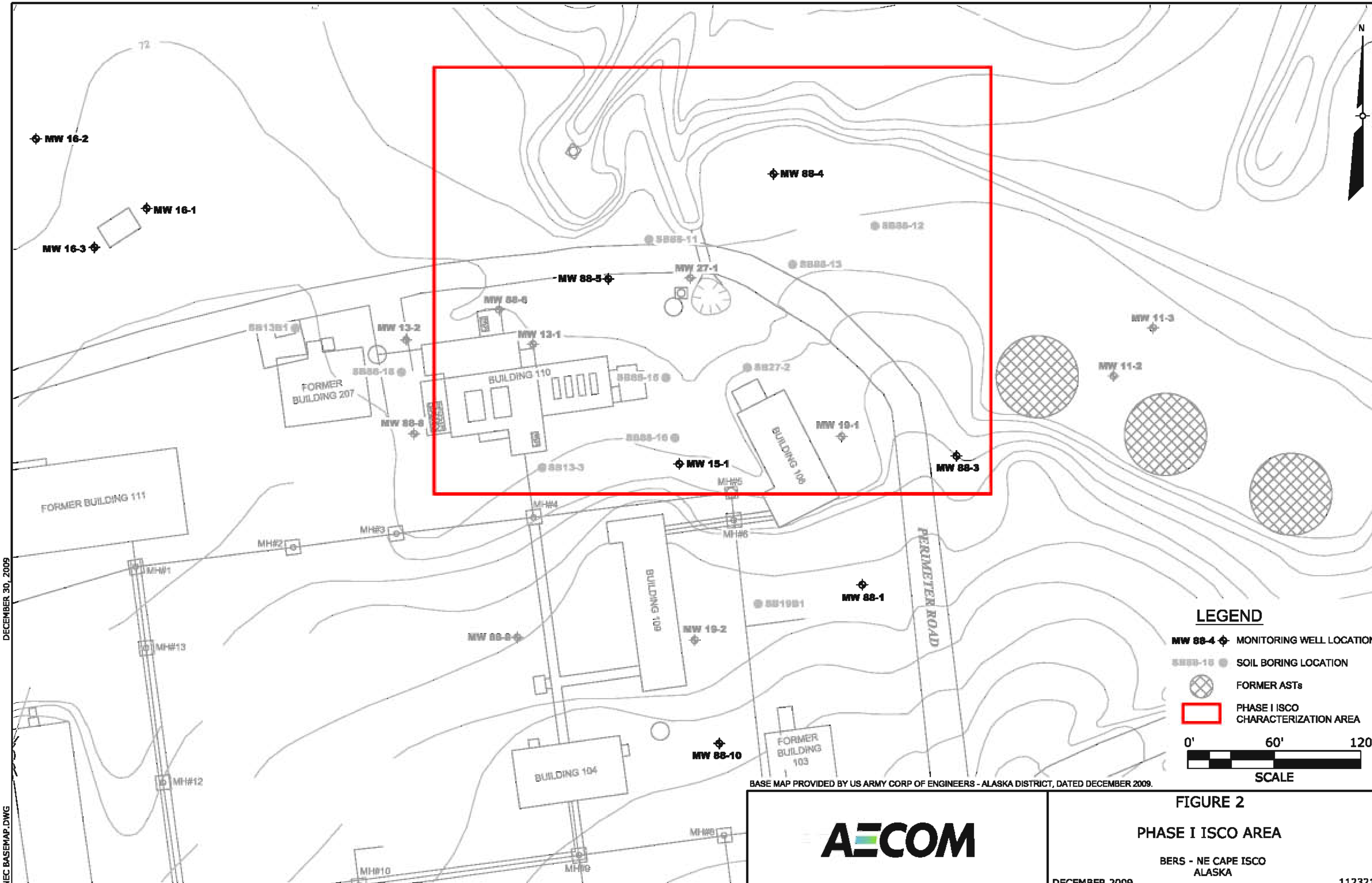
BERS - NE CAPE ISCO
ALASKA

DECEMBER 2009 112321

DECEMBER 30, 2009

NEC BASEMAP.DWG

Figure 2: Phase I ISCO Area



BASE MAP PROVIDED BY US ARMY CORP OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

AECOM

FIGURE 2

PHASE I ISCO AREA

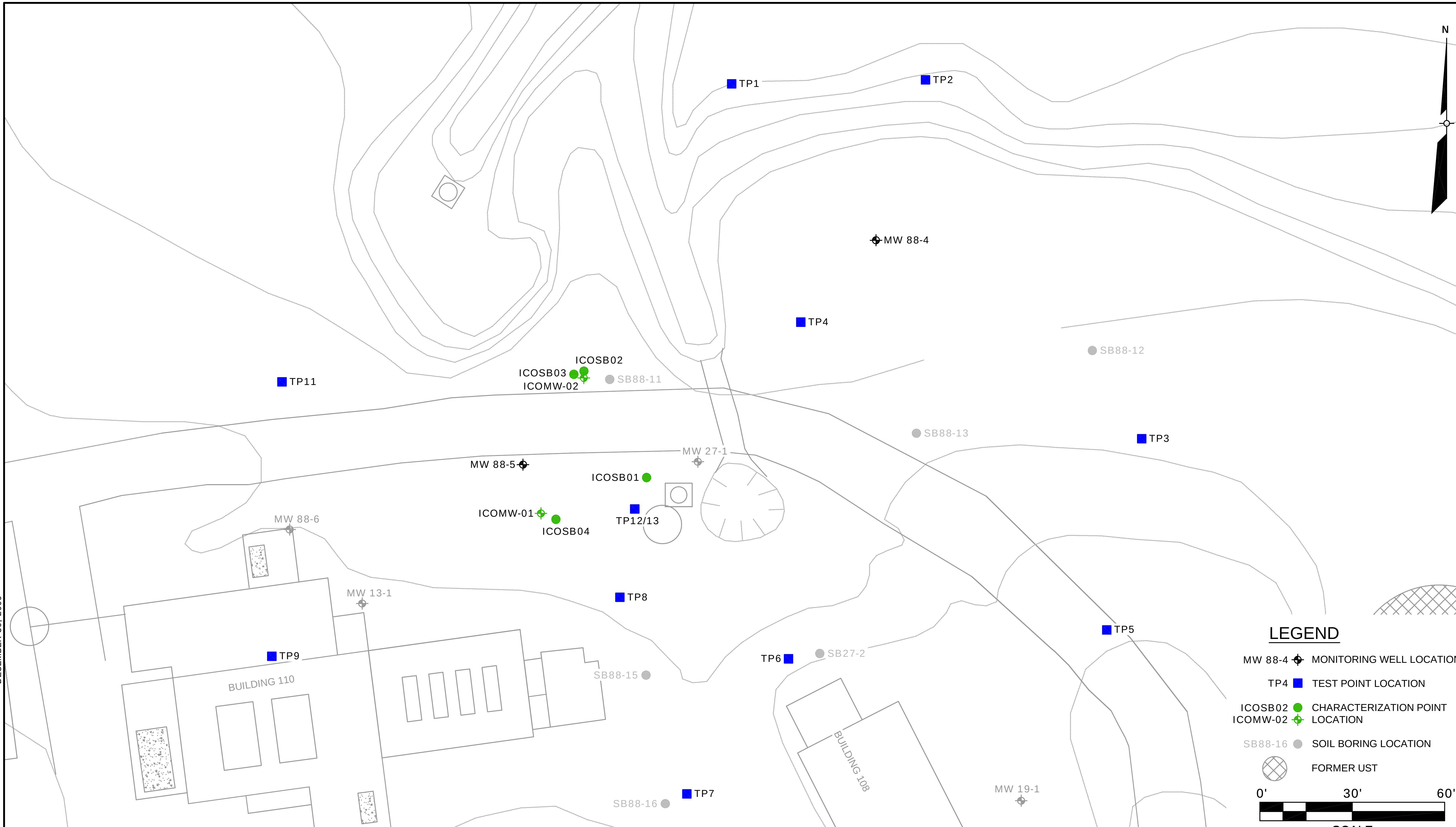
BERS - NE CAPE ISCO
ALASKA

DECEMBER 2009 112321

DECEMBER 30, 2009

NEC BASEMAP.DWG

Figure 3: Phase I ISCO Characterization Locations



BASE MAP PROVIDED BY US ARMY CORP OF ENGINEERS - ALASKA DISTRICT, DATED DECEMBER 2009.

FIGURE 3

PHASE I ISCO CHARACTERIZATION LOCATIONS

BERS - NE CAPE ISCO
ALASKA

DECEMBER 2009

112321

DECEMBER 30, 2009

NEC BASEMAP.DWG

Figure 4: Phase I ISCO Study Monitoring and Injection Wells

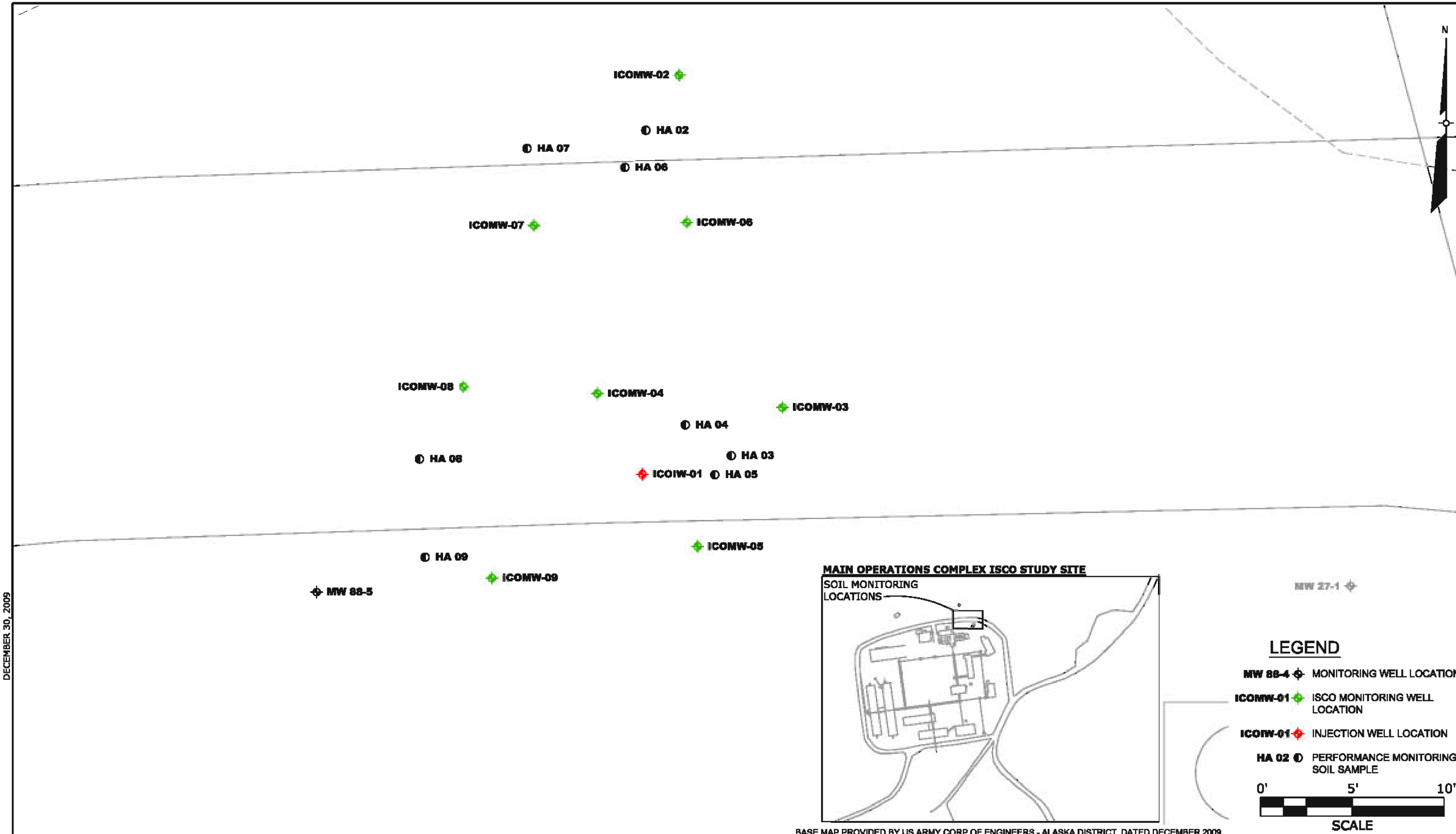


FIGURE 4
PHASE I ISCO STUDY
MONITORING AND INJECTION WELLS

BERS - NE CAPE ISCO
ALASKA

112321

DECEMBER 30, 2009

NEC BASEMAP.DWG

Figure 5: Phase I ISCO Study Soil Monitoring Locations

Attachment A
Deviations from the Work Plan

The following summarizes deviations and additions to the Work Plan. Where appropriate, the original Work Plan detail is provided first in *italics* and is followed by an explanation of the deviation (a.).

Deviations from the Work Plan (Field)

Section 3.5: *The detailed well layout for the pilot study will include an adjacent pair of injection wells and up to seven monitoring wells.*

a. Following a teleconference between AECOM Technical Services, Inc. (ATS), Bristol Environmental Remediation Services, LLC., and the United States Army Corps of Engineers, a single injection well was installed in the upper aquifer system identified during test pit and soil boring activities. Please see Section 3.4 of the Technical Memorandum for further discussion of injection well installation activities.
b. During the injection event, the short circuiting of oxidants solutions into the adjacent wetland area via a sidewall seep mandated a cessation of injection at the established injection well ICOIW01. Another attempt at injection was made via the conversion of monitor well ICOMW09 to an injection location.

Section 3.5.1: *Injection wells will be installed as a vertical pair with the shallow well screened from approximately 1 foot above the groundwater table to 4 feet below the groundwater table and the deeper well screened from approximately 4 to 9 feet below the groundwater table. Injection wells will be completed with 5 feet of 2-inch diameter stainless steel wire wrapped screen, 2-inch diameter stainless steel well casing, and will be grouted in place with neat cement.*

a. Based on observations of contaminant distribution, a shallow injection well screened from 5 feet (ft) to 10 ft below ground surface (bgs) was installed. The injection well was completed with 5 ft of 2-inch diameter stainless steel wire wrapped screen, 2-inch diameter stainless steel well casing, and was grouted in place with neat cement.

Section 3.5.2: *Monitoring wells for the pilot study will be screened from approximately one foot above to 9 feet below the groundwater surface interface.*

a. Monitor wells for the pilot study were screened from approximately 5 ft to approximately 10 ft bgs.

Deviations from the Work Plan (Treatability Study)

Section 2.0, Page A2: *Sampling points for sodium persulfate reaction vessels are set at 1, 2, 3, and 4 weeks to monitor the reaction of the oxidants with the chemicals of concern at both 2X and 5X concentrations.*

a. Sampling points for sodium persulfate reaction vessels were at 1, 3, 5, and 7 weeks to monitor the reaction of the oxidants with the chemicals of concern at both 2X and 5X concentrations. The submitted Attachment 1, Analytical Matrix indicated a 1, 3, 5, 7 week sampling interval while the submitted text had not been updated to indicate the proposed interval.

Additions to the Work Plan

Based on observations of soil and groundwater during the test pit excavation activities, ATS installed four soil borings (ICOSB01 through ICOSB04) and two monitor wells (ICOMW01 and ICOMW02) in the in-situ chemical oxidation study area that were not proposed as part of the Work Plan but were necessary to confirm field conditions. The four soil screening samples split with the off-ite laboratory to confirm the Site-Lab soil screening results were an addition to the Work Plan. Groundwater samples collected from the two newly installed monitor wells and from existing monitor well MW88-5, and submitted for offsite laboratory analysis, were also an addition to the Work Plan.

Attachment B
Test Pit Logs

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study - Main Ops Complex Area, NE Cape, St Lawrence Island, AK			
Trench Number: TP 13	Project Number: 112642.02	Elevation and Datum: Unknown	Location: Pilot Plot
Equipment Supplier: Bristol	Operator: Maze Thompson	Date and Time Started: 7/16/09 0930	Date and Time Completed: 7/16/09 0900
Equipment Type: Cat 322 B	Trench Orientation: East West, Begin on N End of TP12	Total Depth: 7.0	Total Number of Samples: 2

Bucket Width	Trench Length	Trench Width	No. Of Samples	Bulk	Ss	Drive	Hand Auger
46	10.0	5.0		2	—	—	—

Geologist or Hydrogeologist/Date	Check by/Date
R.M. Schlosser 7/16/09	

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	G	S	F	COMMENTS
	1	silty gravel as in					Description taken 10 feet
		TP12, gravels to 25 cm,					from N end of trench.
FILL	2	occ sand throughout,	GP/				
		med dense, st moist,	GM				headspace sample
	3	4.0 clayey silt dk yel	(FILL				4.5
		brn, tight, dry,					PID 125 FID 555
Silty Peat	4	@ 4' is perched water					
		zone, slnt flow throughout					
	5	peaty silt just above at					
ML		4', Silt w/ sort					
SILT	6	clay & gravels to TD					headspace 6.5-7.0
		@ 7.0 - (red brn)					PID 238 FID 1635
	7	Test pit backfilled					
		immediately after					
		completion!					

TP12 intersects pit 13 on north end

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study - Main Ops Complex Area, NE Cape, St Lawrence Island, AK			
Trench Number: TP12	Project Number: 112642.02	Elevation and Datum: Unknown	Location: Pilot Plot
Equipment Supplier: Bristol	Operator: Maze Thompson	Date and Time Started: 7/16/09 0800	Date and Time Completed: 7/16/09 0830
Equipment Type: Cat 322B	Trench Orientation: north digging south	Total Depth: 6	Total Number of Samples:

Bucket Width	Trench Length	Trench Width	No. Of Samples	Bulk	Ss	Drive	Hand Auger
42	~10'	5		2	—	—	—

Geologist or Hydrogeologist/Date: R.M. Schlosser 7/16/09

Check by/Date:

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	surface grass -0.5,					Description taken 12 feet
		silty gravel fill, ang					from N end of trench.
FILL	2	gravels & cbl yel/brn silt	GM	60	10	30	
GM		matrix, scat sand,	FILL				
	3	@ 3' dk yel brn - @					
		3.5' brn stained from					2-2.5
SP	4	diesel, odor, ~~sm~~ gravelly	SP	95	5	tr	headspace ~~4.5-5~~ Plus
FILL		sand, wet, perched H_2O					PID Bkg FID Bkg
	5	@ 4.5 sand vcs-csgr					
		@ 4.5 find 4" pipe; sand					
	6	above used for bedding pipe					
		~~the~~ pipe bedded @ 4' bgs.					headspace 3.5-4
	7	TD @ 5', Water					PID 201 FID 1058
TD		from perched zone @					
		4.5 running in pit.					
	9	Backfill hole in reverse order					

photo looking north pre-pit

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem OX Pilot Study, Main Ops Complex Area, N.E. Cape, St Lawrence Island AK					
Trench Number: TP11	Project Number: 112642.02	Elevation and Datum: Unknown		Location: Pilot Plot	
Equipment Supplier: Bristol	Operator: Maze-Thompson	Date and Time Started: 7/13/09 0920		Date and Time Completed: 7/13/09 1000	
Equipment Type: 322 B CAT	Trench Orientation: SE digging NW	Total Depth: ~10'		Total Number of Samples: 3	
Bucket Width: 4.5 / Trench Length: ~10'	Trench Width: ~5'	No. Of Samples — Bulk: 3	Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser 7/13/09		Check by/Date:			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
FILL	1	surface soil w/occ					Description taken 1/2 feet
ML		gravels throughout.	ML	65	tr	35	from 1/2 end of trench.
	2	sandy silt yel brn 10YR 3/4					
GM		@ 3' lt gy silty gravel,	GM	70	tr	30	
FILL	3	@ 3.5' thin peat layer					
		then into @ 3.7' lt gy					headspace 3.5-4 (ppm)
PEAT	4	silt w/ scattered gravels,	PEAT	—	—	—	FID = 78 PID = 3.2
		areas sl oxidized (dk red brn)					
ML	5	@ 6' org rich & peat to	ML	10	10	80	
		7', 7' lt-m gy (10YR 7/1-6/1)					
	6	clayey silt, tight, part					
PEAT		frozen, sl odor, tight,	PEAT				
	7	dense to TD, v sl					headspace 7-7.5 (ppm)
		odor, occ zones that					FID-720 PID-3.5
	8	have high clay cntnt,					
ML		mod plasticity, occ sticky,	ML	—	tr	100	
	9						
		no visible H_2O in					headspace 9.5-10 (ppm)
	10	open pit					FID - 1300 PID - 2.5

TD @ 10'

Hole backfilled in reverse order

#1 Looking north The dig

photo looking NW at completed hole.

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study, Main Ops Complex Area, NE Cape, St Lawrence Island, AK			
Trench Number: TP10	Project Number: 112642.02	Elevation and Datum: Unknown	Location: Pilot Plot
Equipment Supplier: Beistel	Operator: Maze Thompson	Date and Time Started: 7/13/09 0840	Date and Time Completed: 7/13/09 0910
Equipment Type: CAT 322B	Trench Orientation: NW-SE	Total Depth: ~10.0	Total Number of Samples: 3
Bucket Width: 45 / Trench Length: ~10'	Trench Width: ~5'	No. Of Samples: Bulk 3 / Ss —	Drive — / Hand Auger —
Geologist or Hydrogeologist/Date: R. M. Schlossee 7/13/09		Check by/Date:	

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	surface soil w/ grass to					Description taken 8 feet
		1", silty gravel, gravels					from NW end of trench.
	2	5mm - 10cm intermixed,					
Fill		matrix, sandy silt gleyed					
GW	3	brn, pred. m gr sand w/	GM	60	25	15	
		scat silt throughout,					
Fill		becoming less silty					headspace 4-4.5 (ppm)
GM/ML	4	w/ depth, moist, dense					FID = 19 PID = 34
GP	5		GP/GW	60	30	10	
GW		@ 6', sl odor in					
	6	sandy gravel, lt-mgy					
		(10YR4/1) from diesel,					headspace 6.5-7 (ppm)
	7	~~to FD~~ pred well graded					FID-742 PID-151
		gravels w/ 5mm-5cm					
	8	ang gravel clasts & occ					
		cobbles, m-cs gr sand					
	9	color a/a matrix					
		@ 9.5', ltgy silt w/	ML	tr	10	90	headspace 9.5-100 (ppm)
ML	10	occ.					FID-1605 PID 192

TD @ 10.0 - no visible H_2O in hole when pit initially dug

#1 looking west along

#2 btm of pit looking at NW corner of pit

FIELD LOG OF TRENCH/PIT

Project Name: In Situ ChemOX Pilot Study, Main Ops Complex Area, NE Cape, St Lawrence Island, AK							
Trench Number: TP9		Project Number: 112642.02	Elevation and Datum: Unknown			Location: Pilot Plot	
Equipment Supplier: Bristol		Operator: Blaze Thompson	Date and Time Started: 7/13/09 0835			Date and Time Completed: 7/13/09 0900	
Equipment Type: Cat 322 B		Trench Orientation: South Digging N	Total Depth: ~10.0			Total Number of Samples: 3	
Bucket Width: 4.5	Trench Length: ~12'	Trench Width: ~5'	No. Of Samples	Bulk: 3	Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser			Check by/Date:				

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	surface, large gravel &					Description taken 6 feet
		cobbles w/ clayey silt matrix					from N end of trench.
	2	demo remains, concrete, rebar	FILL				
		to 5' @ 5' silty sandy	Conc &				
FILL	3	gravel, oxidized red brn	Rubble				
		pred 40-100mm ang gravel,					
	4	highly oxidized to 6'					
		becoming silty sandy gravel					
	5	20-40mm gravels ang in					
PEAT / OXIDIZED ZONE		a yel brn silt & sand matrix	GM	75	tr	25	headspace 5.5-6
	6	abnt org throughout,					FID = 5.2ppm PID = 2.1ppm
		becoming more sandy					
GM	7	w/ depth, less org to TD					
		sl odor @ 5.5' to TD					
	8						
			GM	75	5	20	headspace 8-8.5
	9						FID = 176ppm PID = 69ppm
GM Sandy	10	@ 9.5' incr sand content gravels a/a	GM	70	10	20	headspace 9.5-10 FID = 305ppm Pid = 1605ppm

TD @ 10.0

photo 1 looking north pre-dig

photo - looking north completed PIT

Hole back filled in reverse order

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study, Main Ops Complex Area, N.E. Cape, St Lawrence Island AK			
Trench Number: TP8	Project Number: 112642 02	Elevation and Datum: Unknown	Location: Pilot Plot
Equipment Supplier: Bristol	Operator: MAZE Thompson	Date and Time Started: 7/12/09 / 1100	Date and Time Completed: 7/12/09 1140
Equipment Type: CAT 322B	Trench Orientation: West digging East.	Total Depth: ~10.0	Total Number of Samples: 3
Bucket Width: 4' / Trench Length: ~12'	Trench Width: 4'	No. Of Samples: Bulk 3 / Ss —	Drive — / Hand Auger —
Geologist or Hydrogeologist/Date: R.M. Schlosser 7/12/09		Check by/Date:	

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	0-0.5 grass and roots,					Description taken 10 feet
		dk yel brn (10YR3/3-3/4)	GM	60	—	40	from W end of trench.
	2	silt matrix w/abunt ang	(FILL)				
FILL GM		gravel clasts and occ					
	3	cobbles, hd digging, @ -					headspace 3.5-4
Seep @ 4.0 on		4.0 thin peat band then	GM	65	-	35	FID 728 pid 220
top of	4	@ 4.0 dk gy (10YR4/1) silt					
PEAT ML silt		w/occ gravels. @ 7.0 peat					
strong odor	5	zone w/ staining and	ML	20	tr	80	
ML dk brn		odor @ 8.0 in peat, becoming					
	6	org silt, dk brn - yel brn					
		@ 9.0 - med - lt gy silt,					headspace 7.5-8
	7	clayey IPT, partially frozen,					FID 1750 PID 350
PEAT		dense, clean, uniform,	ML	-	-	100	
	8	sl lam, no odor, tight					
ML lt gy		no H2O in pit when dug					
	9						headspace 9.5-10
		lt gy clayey silt 2/2					FID 40 PID 4 ppm
	10						

TD @ 10.0

photo predig looking ~~south~~ north

photo ~~of~~ ~~north~~ south wall from west end of Pit

Hole backfilled in reverse order

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem ox Pilot Study, Main Ops Complex Area. N.E. Cape, St Lawrence Island AK						
Trench Number: TP 7		Project Number: 112642.02	Elevation and Datum: Unknown		Location: Pilot Plot	
Equipment Supplier: Bristol		Operator: Marc Thompson	Date and Time Started: 7/12/09 / 1015		Date and Time Completed: 7/12/09 1050	
Equipment Type: CAT 322B		Trench Orientation: South Digging North	Total Depth: ~8.0'		Total Number of Samples: 2	
Bucket Width: 4 ft	Trench Length: ~12'	Trench Width: 4'	No. Of Samples	Bulk: 2	Ss: —	Drive: — / Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser 7/12/09			Check by/Date:			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	surface to 0.5 grass, roots					Description taken 12 feet
		w/ silty gravel (10YR3/3-					from N end of trench.
FILL	2	3/4) @ 2' org rich zones	GM				
GM		v dk brn. @ 3' highly ox	(FILL	60	tr	40	
	3	silts, dk red brn, just below					
		lt gy brn (10YR4/2) mot					headspace 3.5-4
ML + gravel	4	yel brn (10YR5/4) w abnt	ML	25	—	75	FID PID
mottled		gravel clasts, angthroughout					
lt gy - dk brn	5	no odor or visible staining,					
		abnt cobbles > 1° angular @	ML	40	—	60	
ML lt gy	6	5' silt becom lt g (10YR4/1)					
w/ gravel		w/ gravels throughout,					headspace 7.5-8'
	7	strong pet. odor, water @ 7.0					FID 325 PID 70
		to TD					
	8	TD @ 8.0'					
		* appears to be some perched					
		water @ ~5.0					

(Cap fringe)

Backfilled with soil from hole in reverse order

photo looking west Predig
photo of excavator looking South TP6 @ right
photo of completed pit looking south

FIELD LOG OF TRENCH/PIT

Project Name: In Situ ChemOx Pilot Study - Main Ops Complex Area, St Lawrence Island AK, NE CAPE						
Trench Number: TP6		Project Number: 112642.02	Elevation and Datum: Unknown		Location: Pilot Plot	
Equipment Supplier: Bristol		Operator: Maze Thompson	Date and Time Started: 7/12/09 / 0930		Date and Time Completed: 7/12/09 / 1005	
Equipment Type: 322 B Cat		Trench Orientation: South digging North	Total Depth: ~8'		Total Number of Samples: 2	
Bucket Width: 4.5'	Trench Length: ~10	Trench Width: 5'	No. Of Samples — Bulk: 2	Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser 7/12/09			Check by/Date:			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	surface grass w/ dk gel brn					Description taken 10 feet
		silt w/ ang gravels, prec					from S end of trench.
FILL	2	~~gravelly silt~~ silty gravel		75	tr	25	
GM		(FILL), occ areas of red					
	3	brn fe ox, matrix moist,	GM				headspace 3.5-4'
		no-v little plasticity, mod	(FILL)				FID 10ppm PID ~~10ppm~~ 3ppm
	4	st, about ang gravels to					
		130mm w/ occ cobbles					
	5	no odor or staining @ 5'					
ML		silt becoming dk gy (10YR4/1)	ML	10	tr	90	
DK GY	6	w gravels a/a, but less					
		%, occ clay cnt, moist,					
	7	partially frozen, non plastic	PEAT	–	–	–	
PEAT		lam beds @ 7'-3" v thin					headspace 6.5-7'
	8	peat bed, dk brn, returning to					FID -30ppm pid - 13ppm
clayey silt		~~clay~~ @ 8' abnt H_2O draining	ML	–	–	100	
ML		in pit w/ strong pet odor					
DK BRN		and sheen. After measurement					
		H_2O @ ~7' Bgl, sheen on H_2O					

TD hole @ 8'

Photo looking west, Pre-dig
photo looking ~~west~~ ~~south~~ north @ completed trench

Soil returned to Pit as close to order it was removed

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem ox Pilot Study - Main Ops Complex Area, St. Lawrence Island, NE Cape			
Trench Number: TP5	Project Number: 112642.02	Elevation and Datum: Unknown	Location: Pilot Plot
Equipment Supplier: Bristol	Operator: Maze Thompson	Date and Time Started: 7/12/09 0900	Date and Time Completed: 7/12/09 0930
Equipment Type: Cat 322B	Trench Orientation: South digging North	Total Depth: ~10'	Total Number of Samples: 4

Bucket Width	Trench Length	Trench Width	No. Of Samples	Bulk	Ss	Drive	Hand Auger
4.5	~10'	4.5		4	—	—	—

Geologist or Hydrogeologist/Date: R M. Schlosser

Check by/Date:

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	0	Surface grass and roots to .5'	SM	20	tr	80	Description taken 10 feet
	1	gravelly silt 10YR 3/3-3/4 w	(FILL)				from S end of trench.
	2	gravels to 13cm in occ					
		cobble (FILL), occ					
	3	sand @ 2' lt gy					headspace 2-2.5
		silt w/ gravels & cobbles	OH				FID-40 pid-bkd
PEAT	4	a/a, no odor or visible	PEAT	–	tr	–	v coarse ~~peat~~ peat
ML		contamination, @ 3.5' peat					
LT GY	5	to 4' dk yel brn (10YR 3/6)					
		@ 4' lt gy-med gr clayey	ML	–	–	100	headspace 3.5-4
	6	silt, then grading to dk yel@6					FID 3ppm pid Bkd.
ML		brn clayey silt w/ gravels -	(10YR 2/2)				
DK BRN	7	and cobbles, becoming more					
no odor		clayey, moist, low-mod					headspace 6.5-7
	8	plastic @ 9' incr % of	ML	15	–	85	FID=60ppm PID=3.2 ppm
slight odor		gravel & cobbles @ 9'					
@ 9'	9	lt gy clayey silt sl moist					
		(10YR 5/1) mottled (5YR 4/4)					headspace 9-9.5
red brn	10	oxidized zones, occ v clayey	ML	–	–	100	FID=3ppm PID=Bkgd

ML w/ gravel

moist, mod plastic, no odor

TD @ ~10'

wet @ ~10' BGL

Photo looking west predig

Photo looking @ east side of pit

Return soil to hole as close to existing as possible

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox, Pilot Study - Main Ops Complex Area NE. Cape, St Lawrence Island, AK						
Trench Number: TP4		Project Number: 112462.02	Elevation and Datum: Unknown		Location: MOC AREA	
Equipment Supplier: Bristol		Operator: MAze Thompson	Date and Time Started: 7/11/09 1400		Date and Time Completed: 7/11/09 1450	
Equipment Type: Cat 322B.		Trench Orientation: N-S	Total Depth: ~7.5		Total Number of Samples	
Bucket Width: 4½	Trench Length: ~10'	Trench Width: 4½	No. Of Samples — Bulk: 3	Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser			Check by/Date			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
		Surface, grass, 0.5 clayey					Description taken 10 feet
	1	Silt fill 10YR (4/4 - 3/3)					from N end of trench.
		slightly mottled, large					
FILL		ang cobbles and gravels					
ML &	2	throughout, moist, low-	ML	15	–	85	
GRAVEL	3	mod plasticity, sft, @ 3.0'	(FILL)				headspace - 2-2.5
		becoming less clay w/ v low					FID 1.2ppm - PID 2.3ppm
FILL	4	plasticity. no visible					
ML		contamination or odor @					
	5	5' gray - lt gy (10YR 5/1 - 7/1)	ML	–	–	100	
ML		clayey silt, low plasticity,					headspace 5-5.5
lt gy	6	sl moist w/ occ org, st-mod					FID 138ppm PID=17ppm
		pet odor and H string. @					
ML	7	6.5 Sharp contact w/ dk					
yel brn		yel brn (10YR 3/4 - 4/4) clayey	ML	–	–	100	
		silt w/ abnt peat, strong					headspace 7-7.5
		pet odor @ cap fringe.					FID 128ppm PID 205ppm
		TD. @ 7.5'					

Wet @ 7.5'

Trench backfilled w/ material removed from hole in ~~reve~~ order as close as possible to existing

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem ox Pilot Study - Main Ops Complex Area N.E Cape, St Lawrence Island, AK						
Trench Number: TP3		Project Number: 112642.02	Elevation and Datum: Unknown		Location: MOC AREA	
Equipment Supplier: Bristol		Operator: Maze Thompson	Date and Time Started: 7/11/09 1120		Date and Time Completed: 7/11/09 1345	
Equipment Type: Cat 322B		Trench Orientation: N-S	Total Depth: 11'		Total Number of Samples: 6	
Bucket Width: 4 ft	Trench Length: 6'	Trench Width: 4 ft	No. Of Samples	Bulk: 6 / Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser			Check by/Date			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	Surface gravel and grass.					Description taken 10 feet
		silty gravel (10YR 4/4)	ML/CL				from N end of trench.
FILL	2	w/ abnt 50-80mm ang	(FILL	20	—	80	headspace 2-2.5
ML/OL		gravels and occ cobbles (FILL)					FID bkgd - PID bkg.
&	3	abnt sect org, grading to	oxidation zone				
GRAVEL		gravelly silt @ 3.5'	below fill				headspace 4-4.5'
ML	4	clayey silt lt brn gy-gy	ML	—	—	100	FID 420 ppm PID 48 ppm
BRN		brn (10YR 6/2 - 5/2), appears					
	5	partially frozen, sl pet odor,	OH	PEAT			
PEAT		moist, non-low plasticity,					
ML	6	@ 5' peat, dk yel brn	ML	—	—	100	
		(10YR 4/6 - 3/4) v coarse org					headspace 6-6.5
LT-M GY	7	matter @ 5.5' back to ML					FID ~~32~~ 32 ppm PID 4.0 ppm
		a/a, lt-med gy, low plasticity					
	8	dry, occ waxy when smeared,					headspace 7.5-8'
		v slight pet odor,	OH	PEAT			FID 41 ppm PID 17 ppm
	9	@ 8.5' - another peat layer					headspace 8.5-9'
PEAT		a/a dk yel brn - v dk gy brn	ML	—	—	100	FID 51 ppm PID 4.8 ppm
		(10YR 3/2 - 3/4) @ 10.5' dk gy -					
ML DK BRN	10 / 11	gy 10YR 4/1 - 3/1) clayey silt, moist, mod compact, low plasticity, micaceous, sl pet odor.					headspace 10.5-11 pid 2.9 ppm FID 37.5 ppm

TD @ 11' - wet @ 11.5'

predig photo looking east.
photo of pit - east side

Trench backfilled as close to reverse order as possible

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study - Main Ops Complex Area, N.E. Cape; St Lawrence Island, Ak					
Trench Number: TP2	Project Number: 112642.02	Elevation and Datum: Unknown		Location: MOC Area	
Equipment Supplier: Bristol	Operator: MAZe Thompson	Date and Time Started: 7/11/09 1030		Date and Time Completed: 7/11/09 1055	
Equipment Type: 322 B CAT	Trench Orientation: W-E	Total Depth: 10'		Total Number of Samples: 4	
Bucket Width: 45" / Trench Length: ~10'	Trench Width: 45"	No. Of Samples / Bulk: 4	Ss: —	Drive: —	Hand Auger: —
Geologist or Hydrogeologist/Date: R.M. Schlosser		Check by/Date:			

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
	1	Surface - grass w/rxs.	FILL				Description taken 5 feet
FILL		Silty loam w/abnt org	(OL)	5	-	95	from W end of trench.
OL	2	mat to 1.5' dk brn-dk yel					
		brn 10YR 3/3-3/4 earthy, occ					headspace 3.5-4'
	3	small pebbles w/occ rxs @					FID 740ppm PID 160ppm
		3.5' lt ~~brn~~ gy-gy brn 10YR					
	4	10YR 5/1-5/2 stained clayey					
		silt, abnt lrge gravels,	OL	3	-	97	
	5	ang - appears to be fill					
		to ~3-4' @ 4.5', lt gy-~~[illegible]~~					
	6	10YR 2/2 w/low plasticity, sft,					
OL		@ 7' silty loam w/abnt					headspace 6-6.5
	7	peat, sft, stained w/	OL	-	-	100	FID 1040ppm PID 420ppm
		strong pet. odor, no lower					
	8	~~fractions, strong [illegible]~~					headspace 7-7.5'
		becoming clayey silt					FID 720ppm PID 140ppm
	9	@ 8.5', dk brn - dk yel					
		brn, 10YR 3/3-3/4					headspace 9.5-10.0
	10	TD @ 10'					FID 580ppm PID 204ppm

Trench orientation digging from west to east.

* Note - Seeps @ silty clayey zone @ 4.5' and 9' after completion of trench/pit.

Pit backfilled w/ material from hole as closely to reverse order as possible

Take 3 photos 1 - pretrench looking

Photo looking NE, Photo looking SE

FIELD LOG OF TRENCH/PIT

Project Name: In Situ Chem Ox Pilot Study. Main Ops Complex Area St. Lawrence Island, NE Cape								
Trench Number: TP1		Project Number: 112642.02	Elevation and Datum: Unknown			Location: Pilot Plot		
Equipment Supplier: Bristol		Operator: Maze Thompson	Date and Time Started: 7/11/09 0715			Date and Time Completed: 7/11/09 0950		
Equipment Type: 322 B Cat		Trench Orientation: N-S	Total Depth: 6.5'			Total Number of Samples: 3		
Bucket Width: .45	Trench Length: ~14'	Trench Width: ~5'	No. Of Samples	Bulk: 3	Ss: —	Drive: —	Hand Auger: —	
Geologist or Hydrogeologist/Date: R.M. Schlosser 7/11/09			Check by/Date:					

SOIL DESCRIPTION

LITHOLOGY	DEPTH (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	S	F	COMMENTS
FILL		Surface - grass w/ cobbles.	FILL	3	—	97	Description taken 10 feet
ML gravel	1	Silty loam, occ ang gravels	ML				from N end of trench.
		and cobbles, @ 2' exposed					
	2	drum, no visible sheen or					
		odor @ 3' visible dk					
FILL ML	3	staining, in silty loam	FILL	3	-	97	
		(10YR 3/4 - 3/3) dk yel brn-	ML				headspace 3-4'
	4	dk brn, sft, dry, low-no					FID 52.1 ppm
		plasticity, slight petroleum					PID 18.5 ppm
	5	odor, (FILL), some peat					headspace 4-5'
		@ 5' clayey silt, lt brn	~~FILL~~	—	—	70	FID - 556 ppm
OL	6	gy-gy brn (10YR 6/2 - 5/2)	OL 30% peat/org				PID - 144 ppm
		cont peat and org, appears					headspace 5-6'
		to be fill, strong pet odor					FID - 902 ppm
		w/staining occ mottled					PID - 200 ppm
		lt gy 7/1, drum & debris					
		@ 6' - GW @ 6.5'					
		TD @ 6.5'					
		Trench back filled first in first cut					

Trench orientation
digging North to South.

Took 5 photos #1 predig
#2 4-5' - staining - looking south
#3 5-6' - looking south
#4 completed trench looking E
#5 Completed trench looking W

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC AREA	LocID: ISCO N.E CAPE, MOC AREA / ICCMW07	
Project Name: NE CAPE ISCO	Project Number: 112642.02	Sheet: 1 of 1
Drilling Equipment: Mobil B61	Date/Time Started: 9/30/09 1515	Total Depth (feet): 9.5
Drilling Contractor: Denali Drilling	Date/Time Finished: 9/30/09 / 1730	Depth to Water (feet): unknown
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8/4	Ambient PID (ppm): 0.0
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Fill GM, silty gravel, gravel clasts, 1/2"-3" w/ sand & silt matrix, mgy c 2.7	Fill GM	2.7		2.5 / Rec 2.0	2 5 4		Headspace
	2.7 clayey silt, mgy, cold tight.	ML	3.5					
	3.5 - peat, m-dk brn, coarse to fine loc., silty, occ pebbles, mod pet odor, ice crystals visible in matrix, blow cnts 4.5-6.5 show frozen peat, becoming more silty w/ depth, to intbd peats and silts from 5.5-6.5 frozen to 7.5 @ 8.5 wet saturated peat.	Peat			4.5 / Rec 2.2 / 6.5 / Lost 7.5 / 8.5	6 6 5 5 7 2 3 1 1	5.5-6.5 1600 / 6.5-7.5 1615 / 7.5-8.5 1620	Depth FID PID 5.5-6.5 650 5.0 6.5-7.5 1150 229 7.5-8.5 240 114
5								
		Peat	8.5 Not 9.0					
	@ 9.5 silt ML m-dk gy, w/ occ gravel 1"x3"	ML			10.0	2 1 3		
10	water in augers to 6' after drilling hole,							
	Set well - Btm of sump 10.5							
15								

USCS NAME: Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
SN = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

Attachment C
Soil Boring and Well Completion Logs

EARTH TECH

Borehole Log (Shallow)

Site: MOC AREA	LocID: IS05B01	
Project Name: Insitu Chemox Pilot	Project Number: 112642.01 02.7000	Sheet: 1 of 1
Drilling Equipment: Mobil B61 Auger	Date/Time Started: 7/18/09 1000	Total Depth (feet): 14.0
Drilling Contractor: Denali Drilling	Date/Time Finished: 7/18/09 1330	Depth to Water (feet): ~13.5
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.2
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	FID ppm ~~Sample Time~~	Remarks (sample details, odor, etc.)
0	Surface-disturbed soil							
	w/gravel & Cobbles.		Auger to 5.0					
	- v tight dense silty	GM						
	gravel w/ dk yel brn	(Fill)						75% gravels to sand, 25% fines
	10YR 3/3-3/4 silt matrix							headspace 4-5' fid 58 pid 6200
	occ sand in matrix	4.0	4.0	~~5~~	5.0			
5	@ 4.0 peat, silty,					2		headspace 5-6 pid - 48 - fid 5400 strong odor
	v dk brn - dk brn, sft,	Peat	25	~~6.5~~	6.0	3 2	625	Peat, fine; headspace 6-7 fid 42 pid 7500
	w/ lt gy silt layer 6.0-6.4	7.0				3 3		headspace 7-8.0
			20		8.0	4	620	pid 29 fid 650
	@ 7.0 sharp contact w/					2		BZ - Bkg. strong odor
	peat - dk yel brn - brn					5		headspace 8.0-9.0
	clay, sft, uniform silty IP	ML	140		9.5	5	1750	pid 41 fid 4230
	@ 8.5 lt gy silty clay -					3		headspace 9-10 pid 37 fid 750
10	clayey silt, sl-mod plastic,	10.0	2.5			4	Bkg	headspace 10-11.0
	mod sft, uniform, sndy IP.	ML Frozen			11.0	5		pid - 58 fid - 4260
	@ 10.0 Frozen clayey silt,	ML				3		headspace 11.0 - 12.5 strong odor
	lt gy - m gy, sandy IP,	Frozen	Bkg		12.5	6 5	Bkg	pid 2.5 fid - 14.5 BZ - BKG
	@ 11.0 clayey silt 2/2, m-dk					6		headspace 12.5 - 14.0
	gy, occ org, occ yel brn -		Bkg	∇		4		
	rd brn ox, doesn't appear sat	GM			14.0	9	Bkg	pid 24 fid - 3700
	@ 13.5 gravelly silt, sat, gravel							headspace.
15	clast 5-25 mm,							13-14 pid 21 fid 5600

TD @ 14.0 Hole backfilled w/ medium bent. chips to 1'

USCS NAME: Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin

S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

@ 13.5 wet, wl in augers @ ~7.5' BGL

Form F-1009
6/7/03

EARTH TECH

Borehole Log (Shallow)

Site: MOC AREA	LocID: ICOSB02	
Project Name: Insitu Chem ox Pilot	Project Number: 126412.01 02	Sheet: 1 of 1
Drilling Equipment: Mobil B61	Date/Time Started: 7/18/09 1530	Total Depth (feet): ~~7/18/09~~ 10'
Drilling Contractor: Denali Drilling	Date/Time Finished: 7/18/09 1700	Depth to Water (feet): 4' - PERCHED
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): ~~8 1/2~~ 8 1/4	Ambient PID (ppm): 0.0
Drilling Fluid: NONE	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	PID (ppm) Spoon	Number	Recovered Length (feet)	Blow Count	FID Sample Time	Remarks (sample details, odor, etc.)
0–4	Surface, loam soil. Pre-driller, gravelly silt + silty gravel ends @ 4'	GM ML FILL	Auger to 4' through FILL					
4–5	@ 4'-5' silty gravel a/a, native? FILL	FILL	22		4'	1, 1	525	headspace 4-5 pid 22 fid 2600 strong odor; Perched H_2O @ 4'
5–7	@ 5' Peat, dk brn, silty, IP, sft some odor, sdy IP, grading to SP @ 5.5-5.8' back to peat to 7'	Peat, SP, PEAT 7'	50		5', 7'	2, 1, .5, .5	1200	headspace 5'-6' pid 140 fid 24%; headspace 6'-7' pid 46 fid 4150
7–9	LOST 7'-9', driller dropped inner bit and fell from 7'-9'.	NR			NR			
9–10	9'-10' silt & peat dk brn, sl sheen on sample when extracted - saturated from up hole. TD @ 10'. Hole backfilled w/ bent. chips to 1'	ML Peat 10'	9' 22		9', 10'	1, 1	750	headspace 9'-10' pid 29 fid 3800

USCS NAME: Consistency/Density (predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+))/ (predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)); Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness (predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64))/(predominantly coarse: cohesive,cohesionless); Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
SN = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

BORING LOG

CLIENT: Bristol | PROJECT: InSitu Chem OX / Blint NECAPE | HOLE NO. ICOMW01 | SHEET 1 OF 1

BORING METHOD: HSA - Mobil B61 | DRILLER/COMPANY: R Roberson/Denali Drlg

DATE: 7/20/09 | TIME: 1500 | TOTAL DEPTH: 17.5 | ENGINEER/GEOLOGIST: R.M. Schlosser

Headspace Samples

Depth	Fid ppm	Pid ppm
9-10	200	37
10-12	480	68
12-13	200	40
14-16	420	90

12.2, 5, #7, 10 1/2

CONSISTENCY/DENSITY/HARDNESS	% GRAVEL	% SAND	% FINES	PLASTICITY	MOISTURE	DEPTH SCALE	WELL CONST.	GRAPHIC LITHOLOGY LOG	USCS CODE	ROCK OR SOIL DESCRIPTION	SAMPLE DEPTH	BLOW COUNTS
						1			SP GM FILL	Auger to 4.0 SP sand m-cs gr w/ gravels 20-70 mm, occ large cobbles, dry, mod compact, silty IP.		
						2–4				Headspace Samples (see table below). Sample 4-5 olive brn Fid 4250, pid 180	4	3, 2
SFF	0	0	100	L	dry	5			ML	med brn silt, uniform, tight dry, occ clay, occ sand, roots	SP Rec 2'	4, 5
SFT	0	tr	100	–	dry	6			PEAT	dk brn, fine, silty, strong odor, uniform, dry. sample 5-6, occ sand. 6-8 fid 500 pid 180 - contact, moist	6.0 SP Rec 2'	7, 6, 8
SFT-S stiff	0	tr	100	L	dm	7–8			ML Peat	Silt med brn - mot light gy, clayey IP, scat org throughout, dry. sl moist, tight. strong odor, occ peat. 8-10 spoon. pid 160, FID 480	8.0 Rec 2'	9, 2, 3, 4
St	0-5	tr	100	L-M	M	9–10			SM ML	Clayey silt. olive gy - mdk gy, occ v clayey loc, mod plasticity, occ 5-30mm gravel clasts, ang, occ sdy, moist. 10-12 very poor recovery (~8") clayey silt a/a, occ pebbles, sl saturated - moist, sl plastic, olive gy a/a, occ org. 10-12 pid 160 Fid 520 - probably cap fringe @ 12.4-13.2	10.0 NR 12.0	5, 6, 8, 8, 11
Stf-med stiff	15	tr	85	M	M	13			ML GM GM	pid 12-14 65 FID 65 @ 13.1 → silty gravel, pushed cobble or gravel beginning @ 13.0 - silty w/ 5-30mm ang gravels, w/ scat pebble and sand. wet @ ~13.2 ; saturated	NR 14.0	7, 8, 9, 11
dense	65	25	10	M	W	14–17	LOST 13-14			- Set 0.006 slotted screen @ 17.0 - 12.0. Sump @ 17.5. Sand 10/20 17.5 - 10.0 - 3 bags. Native surged to 14.0 ~~10/20 sand to~~ Chips to 4.0 - 4 bags. water @ ~9.2 after drilling ni angl..	Rec 2' 16.0	8, 6, 12, 10

Headspace Samples

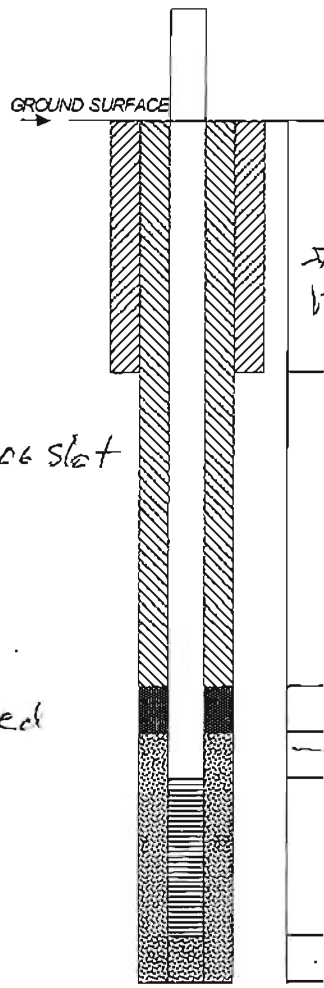
Depth	Fid ppm	PID ppm
4-5	350	95
5-6	630	150
6-7	320	81
7-8	620	168
8-9	850	130

WELL COMPLETION RECORD

JOB NO.: 1126420I WELL NO. ICCMW01 HYDROGEOLOGIST: R.M. Schlosser

CLIENT: BRISTOL DRILLER: R. ROBERSON

WELL LOCATION: Chemox Pilot AREA DATE/TIME: 7/20/09 1800



RMS 8/3/09

Well Head Elevation ~~UNK~~ ~ ~~66.58~~ 68.23

Ground Surface Elev. ~~UNK~~ ~ 6~~7~~.61

Well Head Completion Method NONE – TEMPORARY WELL

Drilling Method/Rig Type HSA / Mobil B-61

DETAILS OF CONSTRUCTION

Date Completed 7/20/09

Borehole Diameter (in.) 7 3/4

Type and Size of Casing (in.) 2" pvc

Type and Size of Screen (in.) pvc. ~~5~~' .006 slot

Screen Perforation Diameter (in.) ~~.006~~ 5'

Screen Length (ft.) 10º

Centralizer Depths (ft.) —

Completion Technique

1. Type of Filter Pack and Placement Method
   10/20 Silica Sand poured
2. Type of Bentonite and Placement Method
   3/8" Chips – poured
3. Type of Grout Mixture and Placement Method
   None

Description of Potential Problems With Well:
None.

Surface Casing: Type NONE Diameter ~~2'~~ Length

MATERIALS

Cement (sks.) NONE

Filter Pack Material (ft.^{3}) 3 ft^3

Casing Material (ft.) 12

Bentonite (ft.^{3}) 4 ft^3

Top of Bentonite Seal 4º ft.

Top of Filter Pack 10º ft.

Top of Screen 12º ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 17º ft.

Bottom of Hole 17º ft.

Development Technique
Surge & Pump.

* Temporary well
no surface completion

GROUT
BENTONITE
FILTER PACK

EARTH TECH | AECOM

BORING LOG

CLIENT Bristol PROJECT INSITU CHEMOX PILOT HOLE NO. ICOMW02 SHEET 1 OF 1

BORING METHOD HSA - Mobil B61 DRILLER/COMPANY E Roberson / Denali Drlg

DATE 7/21/09 TIME 0800 TOTAL DEPTH 9.0 ENGINEER/GEOLOGIST P.M. Schlosser

CONSISTENCY/DENSITY/HARDNESS	GEOLOGIC STRUCTURE % GRAVEL	% SAND	% FINES	PLASTICITY	MOISTURE	DEPTH SCALE	LITHOLOGY STRUCTURE TYPE- INFILL	GRAPHIC LITHOLOGY LOG	USCS CODE	ROCK OR SOIL DESCRIPTION	SAMPLE DEPTH	SAMPLE TYPE
						1						
						2				Auger to 9' to set temporary well		
						3						
						4				Wet @ 4.5 sloppy peat, saturated.		
						5						
						6				unable to log rest of hole because of mud see ICOSB02 for lithology		
						7						
						8						
						9				TD @ 9'. Set 2" well Sump 8.5 9.0 .006 slot screen 2" 4.5-8.5 (Prepack) 10/20 Silica sand. 9.0-3.0 3/8" chips (bentonite to 1') 3.0-1.0		

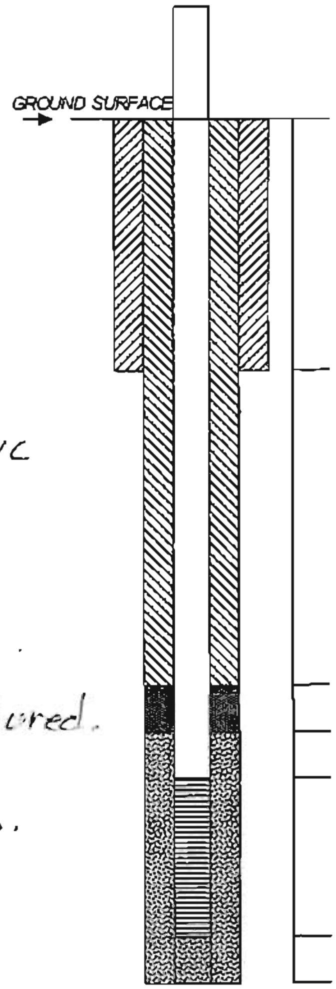
WELL COMPLETION RECORD

JOB NO.: 112642.01 WELL NO. ICCMW02 HYDROGEOLOGIST: R.M. Schlosser

CLIENT: Bristol DRILLER: R. Roberson

WELL LOCATION: Chemox Pilot Area DATE/TIME: 7/21/09 0700

* Temporary well



8/3/09 RMS

Well Head Elevation: TOIC ~ 64.23

Ground Surface Elev.: Chk ~ 64.55

Well Head Completion Method: None - TEMPORARY WELL

Drilling Method/Rig Type: HSA/Mobil B61

Surface Casing: Type None; Diameter ___; Length ___

8/2/09 Surface completion done, flush mount.

DETAILS OF CONSTRUCTION

Date Completed: 7/21/09

Borehole Diameter (in.): 7 3/4

Type and Size of Casing (in.): 2" PVC

Type and Size of Screen (in.): .010 Slot PVC

Screen Perforation Diameter (in.): 2"

Screen Length (ft.): 5' *

Centralizer Depths (ft.): N/A

Completion Technique

1. Type of Filter Pack and Placement Method
   10/20 Silica Sand / Poured.
2. Type of Bentonite and Placement Method
   3/8" Bentonite Pellets.
3. Type of Grout Mixture and Placement Method
   None

Description of Potential Problems With Well:
~~None~~ - Completed across Peat zone, will be difficult to develop.

Development Technique: ___

MATERIALS

Cement (sks.): None

Filter Pack Material (ft^3): 5 ft^3

Casing Material (ft.): 4

Bentonite (ft^3): 2 ft^3

Top of Bentonite Seal: 1.5 ft.

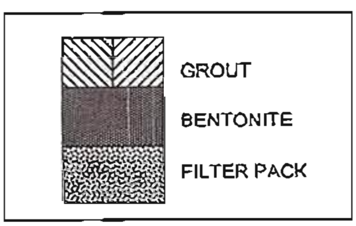
Top of Filter Pack: 3.5 ft.

Top of Screen: 4.5 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen: 8.5 ft.

Bottom of Hole: 9.5 ft.



* Prepack screen w/10/20 Silica Sand

157
Sample #5

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC AREA	LocID: ICOMW03	
Project Name: NECAPE MOC ISCO	Project Number: 112642.02	Sheet: 1 of 1
Drilling Equipment: Mobil B-61	Date/Time Started: 7/28/09 0730	Total Depth (feet): 10.5
Drilling Contractor: Denali Drlg	Date/Time Finished: 7/28/09 1430	Depth to Water (feet): ~6.0
Driller: R Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.1
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Auger through Fill, sandy silty gravel w/ large Cobbles. 4.5' Fill Drive spoon @ 4.5-6.5	Fill						headspace Depth PID ppm FID ppm 4.5-5.0 93 490 5-6.5 307 2010 6.5-7.0 35 309 7.0-8.5 32 318 8.5-9.5 100 440 drive spoon 4.5-6.5
	4.5 silt dk brn, w/ seat org & pebbles @ 5.0 peat mod dk brn, v silty, moist, fine lntb silt lenses. strong pet. odor, P.S. pull 6.5-8.5 Top 6.5-7.0 very wet saturated silty peat. - 7.0-8.5 silty peat - org silt v dk brn @ 6.5-7.0 gravelly silt dk brn saturated @ 7.0-8.5 silty peat - v silty tight sl moist @ 9.0 mod gy - dk gy silty gravel, sandy FP, grading to lt gy silt @ 9.0, partial frozen auger to 10.5 to set well gravels to 2 1/2" in spoon. Sump 10.5-10.0 ~~10/20 Sand around prepack up to~~	ML Peat GM ML - Peat GM	6.5 7.0 9.5 10.0		4.5 Rec 2.0 6.5 8.5 10.0	1 2 3 2 2 2 4 5 2 9 6	5-6.5 0800 6.5-7.5 0830 7.5-8.5 0900 8.5-9.5 1000 9.5-10 1030	pid BZ Fid 340 4.5-5.0 pid & fid BZ ~ 0.5 ppm pid 138 1750 Fid 5.5-6.5 drive spoon 6.5-8.5 pid fid bz = ~3 ppm pid 37 fid 107 @ 8.5 drivespoon 8.5- pid 58 Fid 220 pid-Fid BZ ~ 0.5 ppm
5								
10								
15								

9.5-10" 40 Fid 5 pid

USCS NAME: Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
SB = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

driller ran bit to cleanout hole TD @ 10.5
Sump 10.5-10.0
Screen 10.0-5.0 .006 prepack w/ 10/20
10/20 Sand to 4.5 - 3 bags   grout - neat cement 3.5 - 5
?bentonite 4.5-3.5

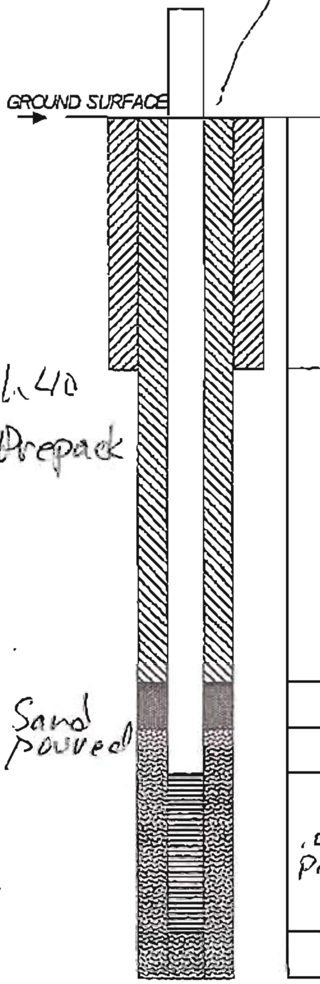
WELL COMPLETION RECORD

JOB NO.: 112647.02 WELL NO. ICCMW03 HYDROGEOLOGIST: R. Schlosser

CLIENT: Bristol DRILLER: R. Roberson

WELL LOCATION: MOC AREA NE CAP ISCO DATE/TIME: 7/28/09 1430

Flush mount 8" Boart Longyear Christi-Box, Cemented



Well Head Elevation ~~Unknown~~ ≈ 66.20 8/3/09 RAS

Ground Surface Elev. ~~Unknown~~ ≈ 66.52

Well Head Completion Method Flush mount 8" Cristy Box

Drilling Method/Rig Type HSA / Mobil

Surface Casing: Type ~~8"~~ Metal 8" Christy Box

Diameter 8"

Length 14" in ground

DETAILS OF CONSTRUCTION

Date Completed 7/28/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) 2" PVC Sch 40

Type and Size of Screen (in.) 2" PVC, .006 Prepack

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5

Centralizer Depths (ft.) NA

Completion Technique

1. Type of Filter Pack and Placement Method
   10/20 Sand & 30/70 Sand poured
2. Type of Bentonite and Placement Method
   N/A
3. Type of Grout Mixture and Placement Method
   Neat Cement Poured

Description of Potential Problems With Well:
None.

MATERIALS

Cement (sks.) 1 1/2 bags 94#

Filter Pack Material (ft^3) 3

Casing Material (ft.) 5

Bentonite (ft^3) None

Top of ~~Bentonite~~ Seal Neat Cement ft.

Top of Filter Pack 3.5 ft.

Top of Screen 5.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 10.0 ft.

Bottom of Hole 10.5 ft.

Development Technique
Pump & Surge

EARTH TECH | AECOM

EARTH TECH

Borehole Log (Shallow)

Site: MOC AREA ISC	LocID: ICC MW[illegible]	
Project Name: NE CAPE MOC ISC	Project Number: 112642.02	Sheet: 1 of 1
Drilling Equipment: Mobil B-61	Date/Time Started: 7/28/09 1400	Total Depth (feet): 10.5
Drilling Contractor: Denali Drlg	Date/Time Finished: 7/28/09 1700	Depth to Water (feet): ~6.5
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.0 ppm
Drilling Fluid: None	Logged By: R.M. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Auger through fill, gravel, silt and sand matrix to 3.5, mod hd in old perimeter rd.	Fill						
	3.5 - 5.5 cobbles in shoe only recovered 0.4 pid 6ppm Fid 10 ppm - auger to 5.5 to try and get cobbles cleared, peat in very btm of shoe. 5.5 - 5.7 ML-OL, dk brn	? ML? NR			3.5 Rec 0.4 5.5	1 4 6 5		split spoon 3.5 - 5.5 rec 0.4 Fid pid BZ - 0.0 ppm
5	5.7 - 7.5 silty peat, v dk brn, st moist, v silty loc, strong pet. odor - to 9.0 peat becoming silty, v cold - partially frozen - strong pet odor,	ML PEAT			Rec 2.0 7.5	1 1 2 3	6-7.5 1445	split spoon 5.5 - 7.5 140 pid 650 fid of peat.
	@ 9.0 grading to ML-SM - m-dk gy silt, mod dense, partially frozen, mod odor, moist occ, probably frozen, ice crystals in matrix, after further examination	ML	9.0		Rec 2.0 9.5	6 7 8 8	7.5-9.0 1500 9-9.5 1515	split spoon 7.5 - 9.5 pid @ peat silt contact 20ppm pid 75 fid
10	Auger to 10.5 to set well Set Sump 10.5 - 10.0 Top of Screen @ 5.0 10/20 Sand - to 4.5 30/70 to 3.5	GM	9.5		TM			auger to 10.5 to set well in silt.
								headspace samples FID / PID
								~~4.5-5~~ 6-7.5 — 250 — 1500
								~~5-6.5~~ 7.5-9.0 — 950 — 165
15								~~6.5-7.0~~ 9-9.5 — 140 — 24

USCS NAME; Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

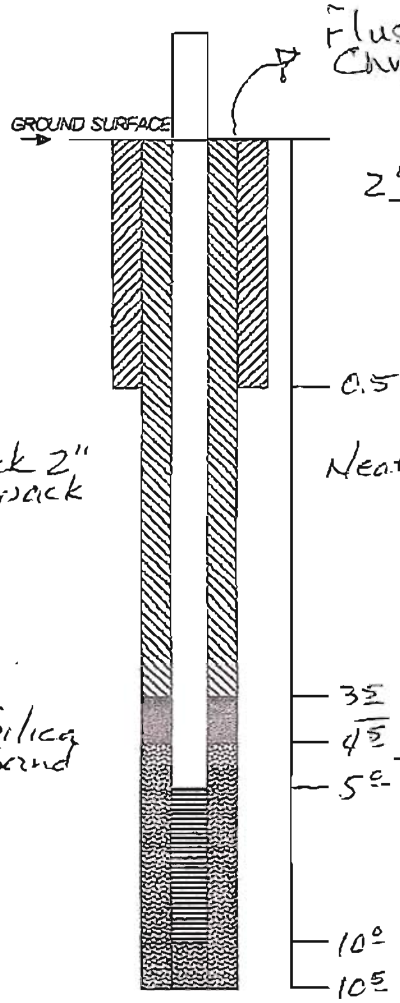
WELL COMPLETION RECORD

JOB NO.: 112642.02 WELL NO. ICCMO004 HYDROGEOLOGIST: R. Schlosser

CLIENT: Bristol DRILLER: R. Roberson

WELL LOCATION: ISCO MOC-AREA DATE/TIME: 7/28/09 1700

Flush mount 8" Boart Longyear Christi Box, Cemented



Well Head Elevation Unk 8/3/09 ~ 66.34

Ground Surface Elev. Unk ~ 66.64

Well Head Completion Method

2" plug w/ 8" Cristi Box

Drilling Method/Rig Type HSA / Mobil B-61

Surface Casing: Type Metal Flush mnt

Diameter 8"

Length 14" in ground

DETAILS OF CONSTRUCTION

Date Completed 7/28/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) PVC 2"

Type and Size of Screen (in.) PVC prepack 2" w/ 3" overpack

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5.0

Centralizer Depths (ft.) N/A

Completion Technique

1. Type of Filter Pack and Placement Method
   10/20 Silica Sand & 30/70 Silica Sand
2. Type of Bentonite and Placement Method
   None
3. Type of Grout Mixture and Placement Method
   Neat Cement

Description of Potential Problems With Well:
None.

MATERIALS

Cement (sks.) 1 - 94#

Filter Pack Material ($ft.^3$) 4

Casing Material (ft.) ~5

Bentonite ($ft.^3$) None

Top of Bentonite Seal None ft.

Top of Filter Pack 3.5 ft.

Top of Screen 5.0 ft.

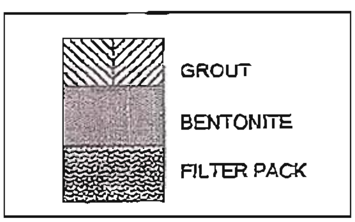
NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 10.0 ft.

Bottom of Hole 10.5 ft.

Development Technique

Pump & Surge.



EARTH TECH | AECOM

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC AREA	LocID: ICOMW05	
Project Name: NE CAPE MOC ISCO	Project Number: 112642.02	Sheet: 1 of 1
Drilling Equipment: MOBIL B-61	Date/Time Started: 7/29/09 - 0930	Total Depth (feet): 9.0
Drilling Contractor: Denali Drlg	Date/Time Finished: 7/29/09 1430	Depth to Water (feet): ~7.0
Driller: R. Roberson		Water Added (gal):
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.0
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Auger 4.5 through Fill, gravel silt & sand w/occ cobbles.	Fill GM						4.5-5.0 pid 73 Fid 250
5	4.5-5.0 silty gravel m gy, sl pet odor, dense, mod moist	GM	4.5 5.0	5-6.5 1000	4.5 Rec 2.0 6.5	2 2 2 2		splitspoon 4.5-6.5 peat 5.0-6.5 pid 105 - 750 Fid
	5-8.0 peat m-dk brn, strong pet odor, stiff moist @ 6.0, fine peat, becoming siltier w/ depth..	Peat Peat		6.5-8 1100	Rec 2.0 8.5	2 3 3 4		Splitspoon 6.5-8.5
	@ 8.0 sharp contact 8.0-8.5 silt, clayey LP, med gy, dry-sl moist dense.	ML	8.0 8.5	8-8.5 1115				
10	Auger to 9.0 to set well							*No pid reading 6.5-8.5 FID flame out from moisture and rain
	See well completion diagram							Headspace Samples Depth FID PID 5-6 590 240 6.5-8 820 140 8-8.5 10 68
15								

USCS NAME: Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin

S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis

BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

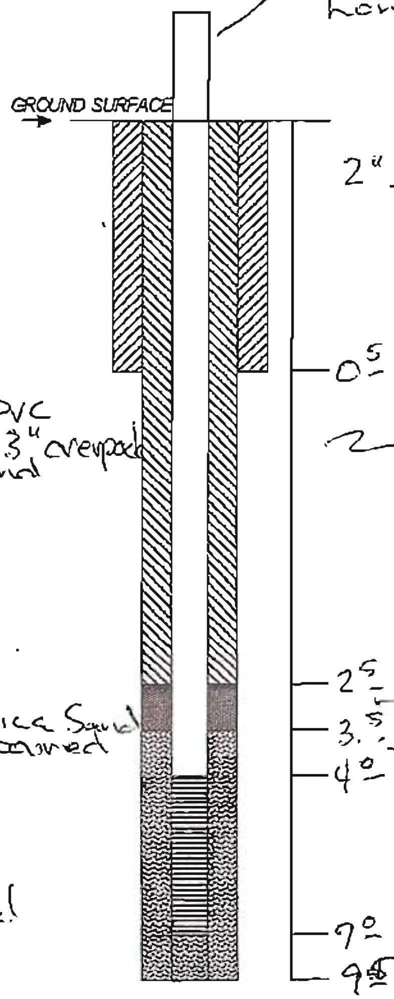
WELL COMPLETION RECORD

JOB NO.: 112642.02 WELL NO. ICOMW05 HYDROGEOLOGIST: R. Schlosser

CLIENT: Bristol DRILLER: R Roberson

WELL LOCATION: ISCO MOC AREA DATE/TIME: 7/29/09 1430

Flush mount 8" Boart Longyear Christi. Box, Cemented



8/3/09 RMS

Well Head Elevation ~~Unk~~ → 66.20

Ground Surface Elev. ~~Unk~~ → 66.67

Well Head Completion Method

2" screw plug, 8" Christi. box

Drilling Method/Rig Type HSA / Mob. B-61

Surface Casing: Type 1-94#

Diameter 8"

Length 14" in ground

DETAILS OF CONSTRUCTION

Date Completed 7/29/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) PVC 2"

Type and Size of Screen (in.) Prepack 2" w/ 3" PVC overpack w/ ~~Holez~~ Sand

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5.0

Centralizer Depths (ft.) N/A

Completion Technique

1. Type of Filter Pack and Placement Method
10/20 Silica Sand and 30/70 Silica Sand Poured
2. Type of Bentonite and Placement Method
None
3. Type of Grout Mixture and Placement Method
Neat Cement - Poured

Description of Potential Problems With Well:
None

Development Technique

MATERIALS

Cement (sks.) 1 94#

Filter Pack Material (ft^3) 3.5

Casing Material (ft.) ~5

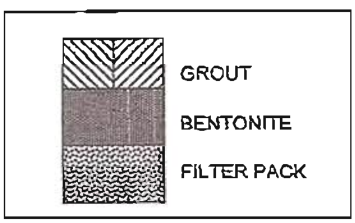
~~Bentonite (ft^3)~~ None

Top of ~~Bentonite~~ Seal 0.5 ft.

Top of Filter Pack 2.5 ft.

Top of Screen 4.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE



Bottom of Screen 9.0 ft.

Bottom of Hole 9.5 ft.

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC AREA	LocID: ICOMW06	
Project Name: NELAPE ISCO MOC AREA	Project Number: 112642.20	Sheet: 1 of 1
Drilling Equipment: MOBIL B-61	Date/Time Started: 7/30/09 / 0830	Total Depth (feet): 9.5
Drilling Contractor: Denali Drilling	Date/Time Finished: 7/30/09 / 1200	Depth to Water (feet): ~5'
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8¼"	Ambient PID (ppm): 0.2
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Silty Gravel, ~~occ~~ occ sdy Fill, gravels to 4" dense, moist, wet @ 3.0 @ 4.0 Saturated from surface runoff, @ 3.0 native silty gravel 1-3" gravel clasts in mdgy sandy silt matrix,	Fill GM	3.0					
		GM	4.8	4-5	4.0 Rec 2.0	2 2	4-5 930	strong
5					6.0	1 2	5-6 1000	diesel odor headspace samples
	4.8 Peat, m-dk brn, v silty, moist-damp, uniform v strong diesel odor. @ 6.0-7.0 Saturated, becoming silty w/depth (moist 7-8)	Peat			Rec 2.0 8.0	2 3 3	6-7 1030	Depth FID PID 4.5 145 42 5-6 630 124 6-7 116 35
	@ 8.5 Clayey Silt, m-dk gy, ang contact w peat, partially Frozen	ML SM	8.5		Rec 1.5 9.5	4 2 2 5		
10	TD @ 9.5	TD	9.5					diesel odor
	Set well @ 9.5 - SI 9.0-4.0							
15								

Sump 9.5-9.0; 10/20 Sand 9.5-4.5 30/70 Sand to 2.5' grout to 0.5'

USCS NAME: Consistency/Density (predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin

S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis

BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

WELL COMPLETION RECORD

JOB NO.: 112642.02 WELL NO. ICCMW06 HYDROGEOLOGIST: R. Schlosser

CLIENT: Bristol DRILLER: R. Roberson

WELL LOCATION: ISCO MOC AREA N.E. CAPE DATE/TIME: 7/30/09 1100

8/3/09 RLS

Well Head Elevation ~~Unk~~ ~65.42

Ground Surface Elev. ~~Unk~~ ~65.59

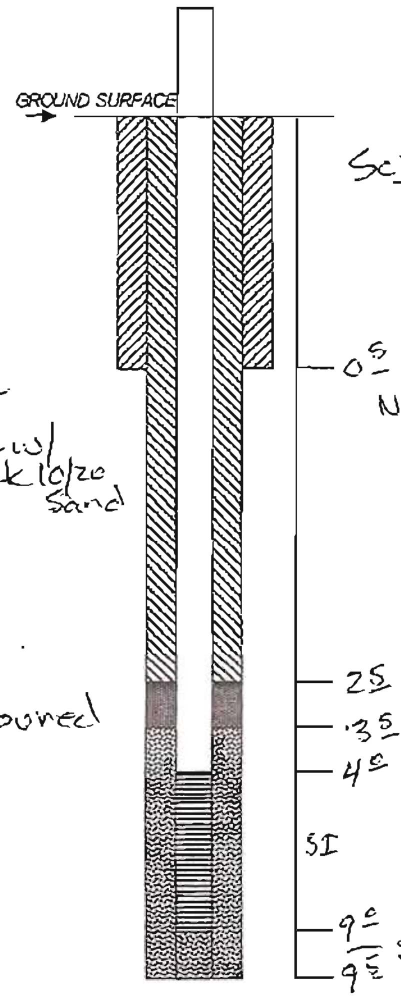
Well Head Completion Method Screw cap w/ 8" Christbox, flush mount

Drilling Method/Rig Type HSA / Mobil 61

Surface Casing: Type ~~Bzzrt~~ Metal Longyear

Diameter 8"

Length 1.0'



DETAILS OF CONSTRUCTION

Date Completed 7/30/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) 2" Sch 40 PVC

Type and Size of Screen (in.) 2" Sch 40 PVC w/ 3/4" overpack 10/20 Sand

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5.0

Centralizer Depths (ft.) None

Completion Technique

1. Type of Filter Pack and Placement Method
10/20 Sand & 30/70 Sand poured

2. Type of Bentonite and Placement Method
None used

3. Type of Grout Mixture and Placement Method
Neat Cement poured

Description of Potential Problems With Well:
None

Development Technique
Surge & Pump.

MATERIALS

Cement (sks.) 1 sk

Filter Pack Material (ft.³) 3

Casing Material (ft.) 5'

Bentonite (ft.³) None

Top of Bentonite Seal None ft.

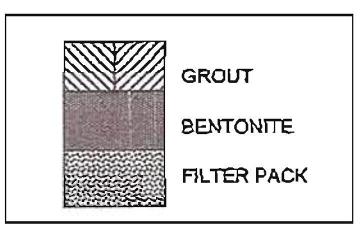
Top of Filter Pack 2.5 ft.

Top of Screen 4.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 4.0 ft.

Bottom of Hole 9.5 ft.



EARTH TECH | AECOM

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC AREA	LocID: ISCO N.E CAPE, MOC AREA ICCMW07	
Project Name: NE CAPE ISCO	Project Number: 112642.02	Sheet: 1 of 1
Drilling Equipment: Mobil B61	Date/Time Started: 9/30/09 1515	Total Depth (feet): 8.5 10.0 RAS
Drilling Contractor: Denali Drilling	Date/Time Finished: 9/30/09 1730	Depth to Water (feet): unknown
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.0
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Fill GM, silty gravel, gravel clasts, 1/2"-3" w/ sand & silt matrix, mgy @ 2.7	Fill GM			2.5			
	2.7 ~~3.8~~ clayey silt, mgy, cold tight.	ML	2.7		Rec. 2.0	2, 5, 4		Headspace
	3.8 - peat, m-dk brn, coarse to fine loc., silty, occ pebbles, mod pet odor, ice crystals visible in matrix, blow cnts 4.5-6.5 show frozen peat, becoming more silty w/depth, to intbd peats and silts from 5.5-6.5 frozen to 7.5 @ 8.5 wet saturated peat.	Peat	3.8		4.5	6		Depth FID PID
5					Rec. 2.2	6, 5	5.5-6.5 1600	5.5-6.5 650 50
					6.5	5, 7	6.5-7.5 1615	6.5-7.5 1150 229
					Lost 7.0	2, 3		7.5-8.5 240 114
		Peat	8.5 wet		8.5	1, 1	7.5-8.5 1620	
		ML	9.0			2, 1, 3		
10	@ 9.0 silt ML m-dk gy, w/ occ. gravel 1"x3" water in augers to 6' after drilling hole. Set well - Btm of sump 10.5		10.0		10.0			
15								

USCS NAME: Consistency/Density (predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin

S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis

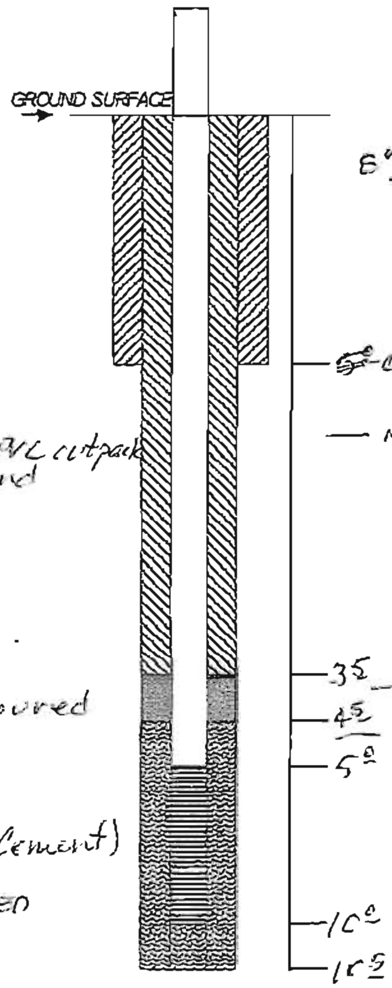
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

WELL COMPLETION RECORD

JOB NO.: 112642.02 WELL NO. ICOMW07 HYDROGEOLOGIST: R Schlosser

CLIENT: Bristol DRILLER: R Roberson

WELL LOCATION: ISCO MCC AREA NE CAPE DATE/TIME: Started 7/30/09 1700 Completed 7/31/09 1030



Well Head Elevation ~64.82

Ground Surface Elev. ~65.41

Well Head Completion Method 8" Brainthwaygray Christ. Box cemented

Drilling Method/Rig Type HSA / Mobil B-61

Surface Casing: Type Flushmnt 8"

Diameter 8"

Length 14"

DETAILS OF CONSTRUCTION

Date Completed 7/31/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) 2" Sch 40 PVC

Type and Size of Screen (in.) 2" PVC w/ 3" PVC outpack w/ 10/20 Sand

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5.0

Centralizer Depths (ft.) None

Completion Technique

1. Type of Filter Pack and Placement Method
   10/20 Silica & 30/70 Silica Poured
2. Type of Bentonite and Placement Method
   None
3. Type of Grout Mixture and Placement Method (Neat Cement)
   6 gals H2O to 94# PORTLAND - POURED

Description of Potential Problems With Well:

None evident

Development Technique

MATERIALS

Cement (sks.) 1

Filter Pack Material (ft^3) 3

Casing Material (ft.) ~5

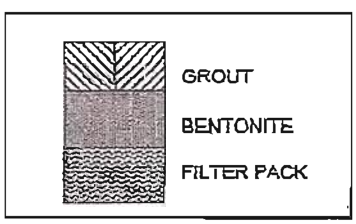
Bentonite (ft^3) None

Top of ~~Bentonite~~ Neat Cement Seal 0.5 ft.

Top of Filter Pack 3.5 ft.

Top of Screen 5.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE



Bottom of Screen 10.0 ft.

Bottom of Hole 10.5 ft.

EARTH TECH

Borehole Log (Shallow)

Site: MCC ISCO PILOT AREA	LocID: ICOMW0A	
Project Name: NE. CAPE Isco Pilot	Project Number: 112624.02	Sheet: 1 of 1
Drilling Equipment: Mobil B-61	Date/Time Started: 7/31/09 1330	Total Depth (feet): 10.0
Drilling Contractor: Denali Drlg	Date/Time Finished: 7/31/09 1650	Depth to Water (feet): ~5.0
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.0
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	PID (ppm) Spoon	Number	Recovered Length (feet)	Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Auger to ~~to~~ 3.5 ~~through~~ fill, driller reports getting soft at 3.0 - Fill GM, 65% gravel 35% silt & sand							
	splitspoon 3.5 - 5.5				3.5			
	~~@~~ 3.5-4.5 m-dk gy silt, some org and scat org, tr sand, and pebbles, strong pet odor @ contact, ML, low plasticity	ML	3.5 / 4.5		Rec 2.0 / 5.5	2 4 5 4		~~spoon~~ 3.5-5.5 Fid 1440 140 @ contact; sharp contact
5	@ 4.5 peat, dk brn-dk yel brn, coarse, sft, silty PT - strong odor, v coarse stems (plant) ~~tr~~ pebbles. cold, moist @ 6.0	Peat	6.0		Rec 2.0 / 7.5	7 6 5 7		Fid 25 pid & spoon @ contact w/OL
	@ 6.0 v dk brn, sl moist, dense, ~~silt~~, abnt org, tr sand, sl odor, ~~sl~~ low-med plasticity, OL, becoming ~~silty~~ siltier w/depth. @ 8.5	OL / possible vf peat	8.5		Rec 2.0 / 9.5	3 3 3 5		Fid spoon 7.5-9.5; Fid 39, pid 7.0 sharp contact w/OL & ML
10	m-dk gy, sft-med dense, l-m plastic, scat yel brn ox lams w/ v thin lams of vf sand v, cold, possibly frozen	ML						TD @ 9.5
	Set 0.01 Screen 9.5-4.5 → .010 prepack 2", w/ 3' outer pack w/ 20/40 sand							Headspace Samples
	Sump 10.0-9.5							Depth FID PID
	10/20 Sand to 4.0							4.5-5.5 1050 190
	30/20 Sand to 3.0							5.5-6.5 89 17
15	neat cement to 0.5'							7.5-9.5 48 10

USCS NAME: Consistency/Density (predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)/ (predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)); Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness (predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64))/(predominantly coarse: cohesive,cohesionless); Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin

S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis

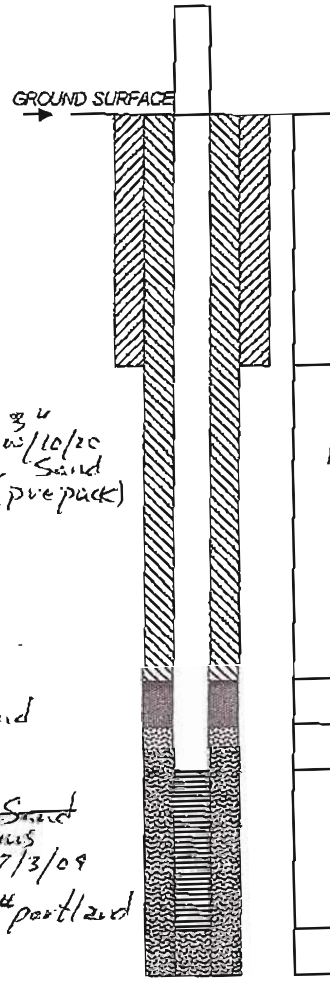
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

WELL COMPLETION RECORD

JOB NO.: 112642.02 WELL NO. ICOMW08 HYDROGEOLOGIST: R. Schlosser

CLIENT: Bristol DRILLER: R. Roberson

WELL LOCATION: ISCO MCC PILOT AREA DATE/TIME: 7/31/09 1630



Well Head Elevation ~~Unk.~~ 8/3/09 RWS ~ 66.30

Ground Surface Elev. ~~Unk~~ ~ 66.64

Well Head Completion Method: 8" Flush mount Bolt longyear

Drilling Method/Rig Type: HSA / Mobil B-61

DETAILS OF CONSTRUCTION

Date Completed: 7/31/09

Borehole Diameter (in.): 8 1/4

Type and Size of Casing (in.): 2" Sch 40 PVC

Type and Size of Screen (in.): 2" Sch 40 PVC w/ 3" Sch 40 outside w/ 10/20 Sand (prepack)

Screen Perforation Diameter (in.): .006

Screen Length (ft.): 5.0

Centralizer Depths (ft.): NONE

Completion Technique

1. Type of Filter Pack and Placement Method

   10/20 Silica Sand & 30/70 Silica Sand

2. Type of Bentonite and Placement Method: None.

   ~~10/20 Silica Sand & 30/70 Silica Sand~~ RWS 7/3/09

3. Type of Grout Mixture and Placement Method

   Neat Cement 6 gal H2O & 94# portland

Description of Potential Problems With Well:

None Evident

Development Technique

Surface Casing: Type Metal

Diameter 8"

Length 14"

MATERIALS

Cement (sks.) 1

Filter Pack Material (ft.^{3}) 3

Casing Material (ft.) ~5

Bentonite (ft.^{3}) None

Top of ~~Bentonite~~ Neat Cement Seal 0.5 ft.

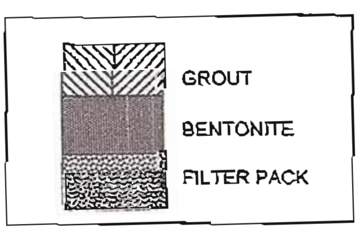
Top of Filter Pack 3.0 ft.

Top of Screen 4.5 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 9.5 ft.

Bottom of Hole 10.0 ft.



EARTH TECH | AECOM

EARTH TECH

Borehole Log (Shallow)

Site: ISCO MOC PILOT	LocID: ICOMW09	
Project Name: ST LAWRENCE ISLAND MOC ISCO	Project Number: 112624.02	Sheet: 1 of 1
Drilling Equipment: Mobil B61	Date/Time Started: 8/1/09 1000	Total Depth (feet): 12.5
Drilling Contractor: Denali Drlg	Date/Time Finished: 8/1/09 1200	Depth to Water (feet): ~9.5
Driller: R. Roberson		Water Added (gal):
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 1.2 ppm
Drilling Fluid: None	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	Samples: PID (ppm) Spoon	Samples: Number	Samples: Recovered Length (feet)	Samples: Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Fill, sandy, silty gravel m-dk brn GM FILL @ m-dk yel brn, dry, cold, postfrozen, non plastic. scat org. ML silt, ~~little sand~~	ML	2.5		2.5 Rec 2.0 4.5	2 4 5 4		262 FID 120 PID
	Peat m-dk yel brn, coarse plant frags, sharp contact w/ ML silt above 4-4.5, thin lams silt a/a.	Peat	4.5					BZ 0.2 ppm PID 1.9 ppm FID
5	moist @ 6.0 cold, fine grained peat, tr sand & pebbles scat lrg stems. strong pet odor				Rec 2.5 6.5	5 4 4 5		pid - BS FID - 748
					Rec 2.0 8.2	1 3 6 8		
	m-dk gy, dry, l plasticity, uniform, scat org, wxy on slivs, scat org, sl pet odor, clayey silt	ML	9.0		Rec 1'	7 7 7		pid @ contact 8.2 FID 47 BZ 0.3 ppm PID
10	@ 10.5 large 2" gravel in clayey silt a/a, moist, cold, small SP sand fine gravel around gravel clast, tr yel brn ox @ 11' above spoon in cobble, v. little water in hole prior to driving spoon hit gravel @ 11.0 water in hole to 9.5 immediately after	GM	11.0 ▽ Set		10.5 NR 12.0	6 2 22 15		pid 8 Fid 10.5 TD @ 12.0
15								

Headspace Samples

Depth	PID	FID (ppm)
5.5-6.5	180	1300
6.5-8.0	60	450
9.0-10.0	12	82

USCS NAME: Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

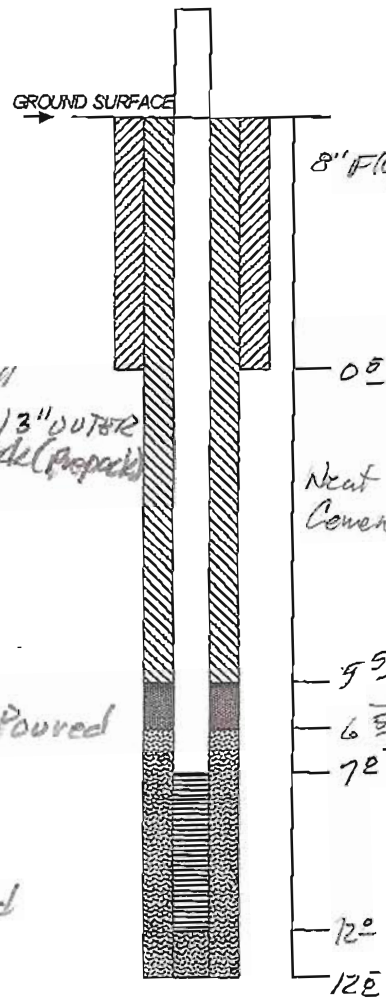
Set screen @ 12.0
Sump 12.5-12.0
12.0-7.0 2" pvc w/ 3" pvc 006 slot screen prepacked w/ 80 silica sand.
10/20 SAND to

WELL COMPLETION RECORD

JOB NO.: 112624.02 WELL NO. ICOMW09 HYDROGEOLOGIST: R Schlosser

CLIENT: BRISTOL DRILLER: R. Roberson

WELL LOCATION: NE CAPE ICOMOC AREA DATE/TIME: Start 8/1/09 1700 Completed 8/2/09 0900



Well Head Elevation ~66.45

Ground Surface Elev. ~67.04

Well Head Completion Method

8" Flush mount, metal w/ cement apron

Drilling Method/Rig Type HSA - B-61 Mobil

Surface Casing: Type Metal

Diameter 8"

Length 14"

DETAILS OF CONSTRUCTION

Date Completed 8/2/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) PVC Sch 40 2"

Type and Size of Screen (in.) Sch 40 PVC 2" w/ 3" outer w/ #50 Sand pack (Prepack)

Screen Perforation Diameter (in.) .006

Screen Length (ft.) 5.0

Centralizer Depths (ft.) None

Completion Technique

1. Type of Filter Pack and Placement Method

10/20 Silica & 30/70 Silica Sand, Poured

2. Type of Bentonite and Placement Method

None

3. Type of Grout Mixture and Placement Method

94# portland to 6 gal H_2O, Poured

Description of Potential Problems With Well:

None evident

Development Technique

Surge and pumping

MATERIALS

Cement (sks.) 1

Filter Pack Material (ft.³) 3

Casing Material (ft.) ~7.0

Bentonite (ft.³) None

Top of ~~Bentonite~~ Grout Seal 0.5 ft.

Top of Filter Pack 5.5 ft.

Top of Screen 7.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 12.0 ft.

Bottom of Hole 12.5 ft.

EARTH TECH | AECOM

E A R T H TECH

Borehole Log (Shallow)

Site: ISCO PILOT AREA	LocID: ICOIW01	
Project Name: NE CAPE ISCO MOC AREA PILOT	Project Number: 112624.02	Sheet: 1 of 1
Drilling Equipment: Mobil B-61	Date/Time Started: 8/2/09 1000	Total Depth (feet): 10.5
Drilling Contractor: Denali Drilling	Date/Time Finished: 8/2/09 1430	Depth to Water (feet): ~9.8
Driller: R. Roberson		Water Added (gal): None
Drilling Method: HSA	Borehole Diameter (in): 8 1/4	Ambient PID (ppm): 0.2
Drilling Fluid: NONE	Logged By: R. Schlosser	Checked By:

Depth (feet)	USCS Lithologic Description	USCS Type	PID (ppm) Spoon	Number	Recovered Length (feet)	Blow Count	Sample Time	Remarks (sample details, odor, etc.)
0	Auger through fill, m-dk brn silt & sand matrix w/ 1-4" ang gravel clasts, moist from surf water, hard packed in permafrost GM (FILL), ~~[illegible]~~. Driller through fill at 5.0	Fill (GM)						
5	m brn-yel brn, dry, tr pebble, l plasticity, sft ML	ML	5.0 5.8		5.0 Rec 2.0	2 2 2		pid 190 FID 435 BZ - PID/FID - BKG
	@ 5.8 peat brown, coarse peat, @ 6.5 becoming v. silty, moist, cold @ 7.7	Peat			7.0	2		strong pet odor pid 18 FID 20 @ GM interface
	m gy & dk yel brn silty sandy gravel, sat @, sl sheen, sharp contact w/ dk brn, plastic w/ abnt org, with fine peats to 8.2 becoming v silty, at ~~to 9.2~~ abnt org & scat peat	GM / Peat / OL	7.7 8.2		Rec 2.0 9.0	3 3 4 5 6		BZ - PID/FID BKG pid 12 FID 48
10	@ 9.4 m-dk gy silt, l-m plasticity, wet, clayey, grading to	ML / GM	9.4 9.8 TD	2	Rec 1.5 10.5	8 9		Set .010 ~~[illegible]~~ wire wrapped type 304 SS screen 10.0 - 5.0 Sump 10.5 - 10.0
	@ 9.8 3/4-1" ang gravel clasts w/ sand and silt matrix, 65% gravels 25% cs-f gr sand 10% fines, wet (GM)		TD in GM @ 10.5					Headspace sample 5.8 - 7.0 pid 280 fid 1450 7.0 - 9.0 pid 28 Fid ~~[illegible]~~ 190
15								

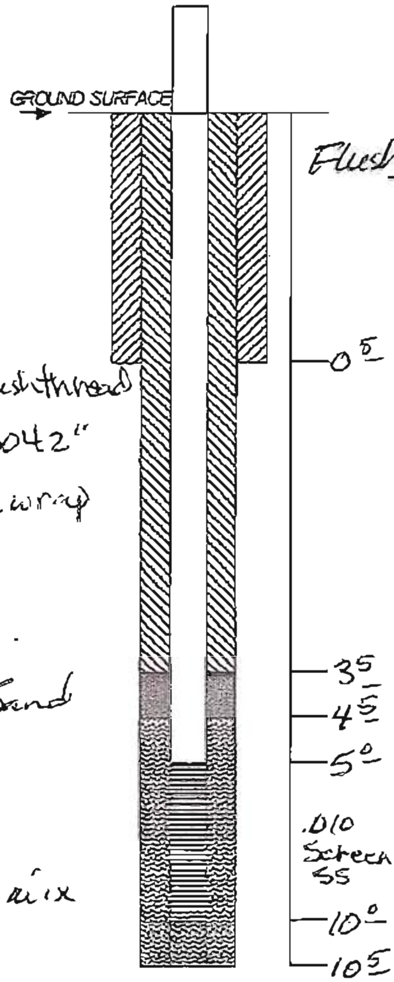
USCS NAME; Consistency/Density [predominantly fine: very soft(n=0-1),soft(n=2-4),medium stiff(n=5-8),stiff(n=9-15),very stiff(n=16-30),hard(n=31+)]/ [predominantly coarse: very loose(n=0-4),loose(n=5-10),medium dense(n=11-30),dense(n=31-50),very dense(n=51+)]; Moisture (dry, moist, wet); Color; Gradation (relative percentages of soil components-no modifiers); Plasticity/Cohesiveness [predominantly fine: nonplastic(thread=none),slightly plastic(t=1/4-1/8),low plasticity(t=1/8-1/16),medium plasticity(t=1/32),high plasticity(t=1/64)]/[predominantly coarse: cohesive,cohesionless]; Stratification/Structure (blocky, massive, lensed, etc.)(contacts: sharp, gradational)(bedding: horizontal, inclined); Cementation (none, weak, moderate, strong); Other Descriptive Elements; Geologic Origin
S# = Sample Number; SP = Spoon Driven; SD = Sample Depth; ST = Sample Time; A = Analysis
BZ = Breathing Zone; BG = Background; BH = Borehole; CB = Cuttings Bin

WELL COMPLETION RECORD

JOB NO.: 112642.20 WELL NO ICOIW01 HYDROGEOLOGIST: R. Schlosser

CLIENT: BRISTOL DRILLER: R. ROBERSON

WELL LOCATION: ISCO PILOT MOC AREA, ST. LAWRENCE IS. NE CAPE DATE/TIME: 8/2/09 1330



Well Head Elevation ~66.45

Ground Surface Elev. ~67.00

Well Head Completion Method
Flush mount, salcrete apron ~18"

Drilling Method/Rig Type HSA / Mobil B-61

Surface Casing: Type Steel Boot/Lug(?)
Diameter 8"
Length 14"

DETAILS OF CONSTRUCTION

Date Completed 8/2/09

Borehole Diameter (in.) 8 1/4

Type and Size of Casing (in.) SS Type 304 2" Flush thread

Type and Size of Screen (in.) .010 SS Type 304 2"

Screen Perforation Diameter (in.) .010 Wire wrap

Screen Length (ft.) 5.0

Centralizer Depths (ft.) None

Completion Technique

1. Type of Filter Pack and Placement Method
10/20 Silica Sand & 30/70 Silica Sand

2. Type of Bentonite and Placement Method
None USED

3. Type of Grout Mixture and Placement Method
94# portland Type II w/ 6 gal H_2O mix

Description of Potential Problems With Well:
none evident

MATERIALS

Cement (sks.) 1

Filter Pack Material (ft^3) 3.5

Casing Material (ft.) ~5.0

Bentonite (ft^3) None

Top of Bentonite Seal None ft.

Top of Filter Pack 3.5 ft.

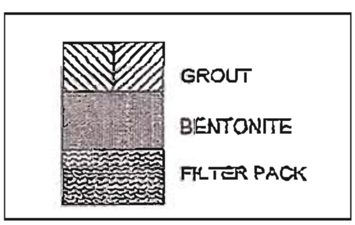
Top of Screen 5.0 ft.

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

Bottom of Screen 10.0 ft.

Bottom of Hole 10.5 ft.

Development Technique
Surging & Pumping.



EARTH TECH | AECOM

Attachment D
Groundwater Sampling Forms

Baseline and Pre-ISCO Groundwater Sampling Forms

CLIENT: Bristol
LOCATION: NE Cape Isco Pilot
PROJECT #: 112642-20

ENTER WELL LOCATION: ICOMW01

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: New
Weather: Cloudy
Notes: Temporary Well Installed 7/20/09 - Developed 7/21/09 and sampled immediately after development - parameters taken prior to sampling

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: ~45° F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/21/09 Time: AM/PM

Depth to Water: 9.35
Length of Well: 16.00

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 7/21/09 Begin Time: AM/PM End Time: AM/PM
Purging Equipment: Mini Typoon w/controller
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

See Below

ft	Length of well
ft	- depth to water (before purge start)
ft	= length of water column
	x conversion factor (2" well) 0.49
Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 80 gallons
Actual purge flow rate: <250 ml/min ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity (NTU)~~ Salinity +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1755		~16.0	10.83	0.148	0.07	0.88	5.61	-55.3	N/A
1802			10.15	0.147	0.07	0.47	6.08	-57.9	N/A
1805			9.54	0.149	0.07	0.5	5.19	-57.2	N/A
1810			9.20	0.149	0.07	0.39	5.15	-55.1	N/A
1815			8.84	0.149	0.07	0.35	5.16	-56.0	N/A
			8.62	0.149	0.07	0.36	5.08	-55.4	N/A
									N/A
Sampled after development - purged total ~35 gals									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 7/21/09 Time: 18 AM/PM
Method: Low Flow w/Mini Typoon

Appearance of Sample: Clear
Actual sample flow rate: ~100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: @1800 1-1L amber, for DRO/RRO) AK102/AK103
09NCMOCEW01

SAMPLING PERSONNEL

Name: R. Schlosser
Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape Isco Pilot
PROJECT #: 112640.20

TD

ENTER WELL LOCATION: ICCMW02

INSPECTION

Label on well? **YES** NO
Is reference mark visible? **YES** NO
Condition of well: New
Weather: Cloudy
Notes: Well makes about 275 ml/min, Temporary well

Is cap locked? YES **NO**
Standing water present? YES **NO**
Any indication of surface runoff in well? YES **NO**
Air Temperature: ~45° F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/22/09 Time: 1615 AM/**PM**
Depth to Water: ~~9.21~~ 5.21
Length of Well: 9.80
Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 7-22-09 Begin Time: 1624 AM/PM End Time: 1735 AM/PM
Purging Equipment: Mini-Typhoon
Decontamination: PRE STEAM CLEANED DI WATER **OTHER**

CALCULATION OF 3 CASING VOLUMES

9.8	ft	Length of well
5.21	ft	- depth to water (before purge start)
4.59	ft	= length of water column
~2.25		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH **LOW**
If low, recovery time: Sustained @ <100ml/min
Actual volume purged: 7 gallons
Actual purge flow rate: <100ml ml/min or L/min

Notes: Temporary Well

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity~~ Salinity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1624		5.21							N/A
1645		5.78	5.35	0.219	0.10	1.77	4.83	114.3	N/A
1655		5.75	5.36	0.220	0.10	1.53	4.75	128.7	N/A
1702		5.70	5.39	0.221	0.10	1.40	4.81	134.2	N/A
1709		5.80	5.42	0.225	0.11	1.26	4.71	137.3	N/A
1715		5.60	5.44	0.225	0.11	1.07	4.76	141.4	N/A
1725		5.51	5.49	0.233	0.11	0.95	4.50	141.0	N/A
1735		5.90	5.48	0.233	0.11	1.28	4.27	138.9	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 7/22/09 Time: 1745 AM/PM Method: Mini Typhoon
Appearance of Sample: Slightly cloudy, yellow tint
Actual sample flow rate: <100ml ml/min or L/min
SAMPLE BOTTLE COLLECTED: 09NCMICCGW03 - Collect 1-1L amber btl pres. w/HCL for DRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: M. Heaston / R. Schlesser
Company: AECOM

WL 01 - 9.36
WL 02 - 5.20

CLIENT: Bristol
LOCATION: NE Cape Esco Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: 88MW-5

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	OK		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy		Air Temperature:	~45°	

Notes: pH reading high, calibrated @ room temp. appeared

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 7/22/09 Time: AM/PM

Depth to Water: 9.08 1350
Length of Well: 15.1
Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 7/22/09 Begin Time: 1340 AM/PM
End Time: AM/PM
Purging Equipment: Mini Typhoon
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

15.1	ft	Length of well
9.08	ft	- depth to water (before purge start)
~6.0	ft	= length of water column
3		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 7 gallons
Actual purge flow rate: < 150 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) 6.02 +/- 0.1	Conductivity (umhos/cm) +/- 3%	~~Turbidity~~ (NTU) Salinity +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1415	3	9.18	11.26	0.374	0.16	0.55	1.68	-66.2	N/A
1425	3.5	9.29	11.17	0.364	0.17	0.51	1.67	-71.2	N/A
1433	7	9.49	11.05	0.387	0.18	0.37	1.87	-66.2	N/A
1439	7.2		10.97	0.355	0.17	0.44	1.95	-73.9	N/A
1442	7.3		10.79	0.363	0.17	0.40	1.85	-70.7	N/A
1446			10.48	0.362	0.17	0.38	1.85	-70.1	N/A
1453	7	9.43	10.10	0.359	0.17	0.39	2.00	-80.3	N/A
1501		9.43	9.81	0.355	0.17	0.32	1.90	-85.6	N/A
1510		9.43	9.60	0.362	0.17	0.26	1.81	-87.1	N/A
1525		9.43	9.39	0.366	0.17	0.14	1.87	-82.0	N/A
Final:	See Back for			FINAL ABOVE					N/A

SAMPLE COLLECTION ~~See Back~~

Date: Time: AM/PM Method: Mini Typhoon

Appearance of Sample: yellow tint, organic residue on H_2O surface (purge water
Actual sample flow rate: < 150 ml ml/min or L/min

SAMPLE BOTTLE COLLECTED: 09NCA10C-GW02 - 1 l amber for DRO/RRO, AK102/AK103, pres w/ HCL

SAMPLING PERSONNEL

Name: M. Herston, R. Schlosser
Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape
PROJECT #: 112624.2

ENTER WELL LOCATION: ICOMW09

INSPECTION

Label on well? (YES) NO — Is cap locked? (YES) NO
Is reference mark visible? (YES) NO — Standing water present? YES (NO)
Condition of well: Good — Any indication of surface runoff in well? YES (NO)
Weather: Clear to Partly cloudy — Air Temperature: 40°-45°

Notes: Sampling begun post Recovery of Purge on 8/06/2009. Well purged Dry 8/6/09 pm. 8/06/2009 3 liter Ambers filled during pm Recovery 2-250mL+VOA's Filled 8/7/2009 Am.

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/6/2009 — Time: 1030 AM/PM
8/7/2009 — Time 7.61 Am
Depth to Water: 7.58 — Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Length of Well: 11.90 — Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/6/2009 — Begin Time: 1500 8/6/2009 AM/(PM) — Purging Equipment:
End Time: 0830 8/7/2009 (AM)/PM — Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

11.90	ft	Length of well
7.58	ft	- depth to water (before purge start)
4.32	ft	= length of water column
2.12		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: 12 Hours
Actual volume purged: ______ gallons
Actual purge flow rate: ______ ml/min or L/min

Notes: WELL Purged Dry @ Low Flow, 2 HRS Recovery Allowed for Collection of 3-liter Ambers @ 1700 to 2000

Time	Volume (gallons)	Depth to Water (feet)	pH (SU)	Conductivity (umhos/cm)	Turbidity (NTU)	D.O. (mg/L)	Temp (°C)	ORP	Ferrous Iron (mg/L)
1040 LFP		~~+/-0.33'~~	~~+/- 0.1~~	+/- 3%	+/- 10%	+/- 10%	+/- 5°	+/- 10 mV	
Start: 1105	0.5	~~12.90~~ 10.5	~~10.56~~ 5.68	0.256	81.2	12.95	6.50	129	N/A
1118	0.70	10.83	5.70	0.254	73.2	11.40	6.61	114	N/A
1130	1.0	11.41	5.68	0.258	50.1	7.08	5.99	106	N/A
	Dry @ 11	35							N/A
1340	1.05	11.51	5.62	0.256	40.1	7.02	5.84	106	N/A
	Pumped	Dry @	Low Flow						N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/7/2009 — Time: 0830 (AM)/PM — Method: Typoon + PVC Bailer
Appearance of Sample: Clear — Actual sample flow rate: 100mL/min ml/min or L/min
SAMPLE BOTTLE COLLECTED: 3-1 Liter Amber, 2-250 mL Poly, 6 VOA's HCL

SAMPLING PERSONNEL

Name: [signature] — Company: Acom

CLIENT: BRISTOL
LOCATION: NE CAPE
PROJECT #: 11262412

ENTER WELL LOCATION: ~~ISC~~ LYP ICOMW02

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	Sunny 50-60°		Air Temperature:	50°-60°	

Notes: WELL ICOMW02 was included due to lack of H_2O +/- 9" @ ICOMW08, + poor production well was very turbid + failed to clean up.

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 090806 Time: AM/PM

Depth to Water: 4.60
Length of Well: 8.90

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 09/08/06 August 6, 2009
Begin Time: 1550 AM/PM
End Time: 1640 AM/PM
Purging Equipment: Typoon pump low flow
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.90	ft	Length of well
4.60	ft	- depth to water (before purge start)
4.30	ft	= length of water column
2.107		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time: 12 Hrs.
Actual volume purged: 4.5 gal gallons
Actual purge flow rate: 200 ml/min ml/min or L/min
1 gal = 10 min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1550	0.1	4.75	6.07	0.245	600	8.54	6.81	127	N/A
1602	1.0	5.00	5.21	0.253	225	6.41	6.40	125	N/A
1618	2.0	5.25	5.19	0.258	225	3.01	5.21	119	N/A
1624	3.5	5.50	5.17	0.258	124	3.03	5.17	117	N/A
1637	4.0	6.02	5.16	0.260	104	2.99	5.15	116	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 09/08/06 Time: 1640 AM/PM Method: Typoon Pump

Appearance of Sample: turbid
Actual sample flow rate: 200 ml/min ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 VOC's / 2-250mL Poly / 3-1 Liter Amber X 2

SAMPLING PERSONNEL

Name: [signature] Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape Isco Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW03

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy		Air Temperature:	40°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/4/09 Time: 0950 AM/PM

Depth to Water: 3.08 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE

Length of Well: 9.50 TOC Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/4/09 Begin Time: 1600 AM/PM Purging Equipment: Mini Typhoon w/ control

End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled) Dedicated pump

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
3.08	ft	- depth to water (before purge start)
6.42	ft	= length of water column
5.97		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW (circled)

If low, recovery time:

Actual volume purged: 6.0 gallons

Actual purge flow rate: ≤100 ml/min or L/min

Notes:

Time	Volume (gallons) Running Total	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1600	.5	4.25	5.29	0.218	15.5	1.16	6.06	214	N/A
1620	2	4.52	5.32	0.226	15.4	0.58	7.13	207.5	N/A
1640	3.5	4.64	5.33	0.225	10.3	0.18	7.64	202.0	N/A
1655	4.5	4.80	5.34	0.223	9.02	0.61	7.53	200.4	N/A
1710	6.0	4.62	5.30	0.222	8.04	2.49	7.5	204.0	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1730 AM/PM Method: Typhoon mini w/ controler

~~09NCMOCGW04 @ 1730~~ RAS 8/4/09 09NCMOCGW05 @ 1730

Appearance of Sample: Clear Actual sample flow rate: ml/min or L/min

SAMPLE BOTTLE COLLECTED:
6 - 40 ml vial w/HCL (GRO AK101, Benz, Naph.
1 - 250 ml poly - sulfates
1 - 250 ml w/HNO3 - metals
2) 1 lt Amber DRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: R. Schlosser Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape ISCO
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW04

L38
.49
1242
5520
.69.05

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: New - Good
Weather: Windy, cloudy
Notes:

Is cap locked? (YES) NO
Standing water present? YES* (NO)
Any indication of surface runoff in well? YES NO
Air Temperature: 40°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: 905 (AM)/PM

Depth to Water: 7.33
Length of Well: 9.71

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/5/09 Begin Time: 0915 (AM)/PM End Time: 1000 (AM)/PM

Purging Equipment: Peristaltic, 12 volt
Decontamination: PRE STEAM CLEANED DI WATER OTHER New tubing

CALCULATION OF 3 CASING VOLUMES

9.71	ft	Length of well
7.33	ft	- depth to water (before purge start)
1.38	ft	= length of water column
.67		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: Purged dry @ 10 AM Sample @ 1500 7.55
Actual volume purged: 2.5 gallons
Actual purge flow rate: <100 ml/min or L/min

Notes: Well ran dry, wait for recovery and sample.
Sample # 09NCMOCGW07

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 0915	Initial	7.33	5.84	0.236	NT	9.98	4.1	168	N/A
0948	1.0	9.00	5.71	0.218		12.28	3.64	189	N/A
1000	1.5	Dry	5.73	0.210		13.01	4.13	189.8	N/A
— Come back to well after recovery to sample									N/A
1500	1.0	7.55	5.94	0.179	15.6	9.65	5.21	187.4	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/5/09 Time: 1500 AM/PM
Method: Peristaltic, so low of flow ~50 ml/min
Appearance of Sample: Yellowish
Actual sample flow rate: ml/min or L/min

SAMPLE BOTTLE COLLECTED:
2-1lt Amber pres w/ HCL for DRO/RRO AK102/AK103
1-250 ml poly for Sulfates
1-250ml poly w/ HNO3 for metals
6-40ml vials pres w/ HCL for GRO AK101, Benzene, Naphthalene

SAMPLING PERSONNEL
Name: R. Schlosser
Company: AECOM

CLIENT: Bristol
LOCATION: NE Cape ISCO Pilot
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW05

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: New
Weather: Cloudy 40°
Notes:

Is cap locked? YES (NO)
Standing water present? YES (NO)
Any indication of surface runoff in well? YES (NO)
Air Temperature: 40°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/4/09 Time: 0900 AM/PM

Depth to Water: 3.08
Length of Well: 9.50

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: ~~1350~~ 8/4/09 Begin Time: 1350 AM/PM
End Time: AM/PM

Purging Equipment: Mini Typhoon w/ control
Decontamination: PRE STEAM CLEANED DI WATER (OTHER) Dedicated pump

CALCULATION OF 3 CASING VOLUMES

9.50 ft Length of well
3.80 ft - depth to water (before purge start)
5.70 ft = length of water column
2.79 x conversion factor (2" well) 0.49
Gallons = 3 casing volumes RLRS 8/4/09

Yield: HIGH (LOW)
If low, recovery time:
Actual volume purged: 7.3 gallons
Actual purge flow rate: <100 ml ml/min or L/min

Notes: Sample # ~~09NEMOCGW03~~ 09NCMOCGW04
Very low flow - YSI flow through affected by sun

Time	Volume (gallons) TOTAL (Running)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1350 ~~1410~~	.5	3.08	5.15	0.196	317.1	0.64	8.17	201.4	N/A
1410 ~~1350~~	1	2.99	5.15	0.194	182.6	0.75	9.91	197.3	N/A
1440 ~~1410~~	2.5	3.50	5.12	0.192	28.9	1.76	9.50	201.0	N/A
~~1450~~ 1500	6.0	4.00	5.14	0.191	14.9	3.05	10.28	203.5	N/A
1525	6.2	4.00	5.16	0.192	12.9	3.07	11.04	206.3	N/A
1535	7.1	>4.00	5.15	0.192	17.1	4.15	9.72	210.5	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1545 AM/PM Method: Mini Typhoon w/ control

Appearance of Sample: Clear
Actual sample flow rate: <100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 - 40ml vials w/ HCL for GRO AK101, Benzene Naphthalene
2 - 1L Amber w/ HCL for DRO/RRO AK102/AK103
1 - 250 ml poly for Sulfates 1-250ml w/ nitric for metals

SAMPLING PERSONNEL

Name: R. Schlosser K. Pruess
Company: AECOM

CLIENT: BRISTOL
LOCATION: NE CAPE ST. LAWRENCE
PROJECT #: 112624.20 ISLAND

ENTER WELL LOCATION: IRONWOOD

INSPECTION					
Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good Newly Const.		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Windy		Air Temperature:	40°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: 0905 AM/PM

Depth to Water: 4.03
Length of Well: 9.20

Measured with: ELECTRONIC TAPE / CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

WELL PURGING

Date: 8/5/09 Begin Time: 0915 AM/PM End Time: AM/PM

Purging Equipment: Peristaltic
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER New Tubing

CALCULATION OF 3 CASING VOLUMES

9.20	ft	Length of well	
4.03	ft	- depth to water (before purge start)	
5.17	ft	= length of water column	
2.6 gals		x conversion factor (2" well) 0.49	
	Gallons	= 3 casing volumes	

Yield: HIGH / LOW
If low, recovery time: ~4 HRS
Actual volume purged: ______ gallons
Actual purge flow rate: ______ ml/min or L/min

Notes: Sample # 09NCMOCGW08

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 0915	Initial	NT	5.92	0.169	NT	22.1	5.26	119	N/A
0945	1.5		5.86	0.161		8.6	5.28	172	N/A
1005	2.0		6.00	0.170		9.79	4.53	176	N/A
1025	2.5 ~~Dry~~		6.15	0.178		9.60	5.24	147.8	N/A
1030	Dry								N/A
Well purged dry - Sampled after recovery									N/A
									N/A
1600	1.0	6.98	5.94	0.179	13.5	9.65	5.24	148.1	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/5/09 Time: 1600 AM/PM Method: Geo pump - peristaltic

Appearance of Sample: Slight yellow tint
Actual sample flow rate: ~250 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 1-250 ml poly - sulfates 1-250ml w/ HNO3 for metals
6-40 ml vials w/ HCL - GRO DRO AK101, Benzene, Naphthalene
2-1 lt Amber w/ HCL for GRO/RRO AK102/AK103

SAMPLING PERSONNEL

Name: R. Schlosser Company: ABZOM

CLIENT: Bristol
LOCATION: NE CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW07

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	Raining		Air Temperature:	40°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/5/09 Time: AM/PM

Depth to Water: 5.68 Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 9.60 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/5/09 Begin Time: 1020 AM/PM Purging Equipment: Mini Typoon w/ Control
End Time: 1130 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.60	ft	Length of well
5.68	ft	- depth to water (before purge start)
3.92	ft	= length of water column
~2.5 gallons		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: ~9.0 gallons
Actual purge flow rate: ~100 ml/min or L/min

Notes: Sample# 09NCMOCGW06 & 09NCMOCGW06 MS/MSD

Time	Volume (gallons) Running Total	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1020	.5	5.78	5.68	0.257	380	1.01	2.96	156.6	N/A
1035	1	5.91	5.65	0.257	31.1	0.71	2.90	108	N/A
1045	2.5	5.82	5.67	0.263	10.6	0.31	2.55	95.0	N/A
1055	5.5	5.92	5.70	0.266	7.1	0.19	3.19	83.4	N/A
1105	6.5	5.92	5.72	0.267	4.8	0.41	4.23	76.0	N/A
1115	7.5	5.92	5.73	0.268	4.3	0.27	4.52	71.5	N/A
1125	8.5	5.92	5.73	0.268	3.6	0.31	4.33	68.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/4/09 Time: 1130 AM/PM Method: Mini Typoon w/ controller

Appearance of Sample: yellow tint Actual sample flow rate: ~100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: FOR Sampled & MS/MSD
6-40ml vial w/ HCL - GRO, Benz, Naph AK101
2-1 lt Amber w/ HCL - AK102/AK103 - DRO/RRO
1-250 ml poly - Sulfates
1-250 ml poly w/ HNO3 for Metals

SAMPLING PERSONNEL

Name: R. Schlosser Company: AECOM

Day 3 Post-ISCO Sampling Forms

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW02

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	Clear, Sunny, Calm		Air Temperature:	55-65°	

Notes: Sample # 09NCMOCGW19 + MOC # 31/2 LGP 8/17 purge rate @ 85 mL a minute 1445

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/16/2009 Time: 1305 AM/PM (PM circled)

Depth to Water: 4.67
Length of Well: 8.49

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/16/2009 Begin Time: 1315 AM/PM (PM circled) LGP
End Time: 1350 AM/PM (PM circled)

Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

8.49	ft	Length of well
4.67	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time:
Actual volume purged: ______ gallons
Actual purge flow rate: 112 ml/min (circled) or L/min

Notes: Gray VOA Vial trap air in Septum
Filling 6 VOA's 1410 to 1445 +/- 7 gallons of additional purge *

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1315		LGP 8/16/09							N/A
1327		~~4.5~~ 4.94	3.85	1.237	34.70	3.20	9.33	193	N/A
1332		4.98	4.14	1.106	32.78	2.29	9.11	157	N/A
1337		4.95	4.50	0.987	33.61	1.81	9.22	127	N/A
1340		4.95	4.60	0.927	33.80	1.55	9.08	~~115~~ 120.9	N/A
1344		4.96	4.86	0.899	32.60	1.51	9.23	96.9	N/A
1347		4.98	4.97	0.880	34.70	1.50	9.29	93.7	N/A
1350		4.98	5.02	0.876	34.61	1.49	9.43	91.6	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1350 AM/PM (PM circled)
Method: Mini Typhoon & Low flow controller

Appearance of Sample: clear
Actual sample flow rate: 120 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres ✓ LGP 8/16 1545

SAMPLING PERSONNEL

Name: Lance G. Preuss
Company: AECOM

18

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW03

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: clear, sunny, calm
Notes: Sample # 09NCMOCGW18 + moc #30 31 AAP 8/17/09

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 50°-60°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/16/2009 Time: 1052 AM/PM

Depth to Water: 3.12
Length of Well: 9.50

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/16/2009 Begin Time: 1052 AM/PM
End Time: AM/PM

Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.50 ft Length of well
3.12 ft - depth to water (before purge start)
ft = length of water column
x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 160 ml/min or L/min

Notes:

Time	Volume (gallons) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1052	setting flow to 200 160 ml/min this is the min								N/A
1104	1,360	4.03	1.68	14.46	12.77	1.79	17.57	393.6	N/A
1107	1696	4.03	1.69	14.48	10.07	1.57	17.62	392.9	N/A
1110	2816	4.03	1.73	14.47	9.84	1.52	17.87	391.1	N/A
1113		4.03	1.73	14.46	9.96	1.34	17.93	391.7	N/A
1116		4.03	1.73	14.49	10.03	1.28	18.04	392.6	N/A
1119		4.03	1.70	14.51	10.02	1.27	18.06	394.4	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/09 Time: 1120 AM/PM Method: Mini Typhoon.

Appearance of Sample: clear, red

Actual sample flow rate: 160 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres ✓ AAP 8/16/2009 1555 Bray Caps Bfree

SAMPLING PERSONNEL
Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW04

INSPECTION

Label on well? **YES** NO
Is reference mark visible? **YES** NO
Condition of well: Good
Weather: cloudy wind 5-10mph N
Notes: 09WCMOCGW14 + MOC#26

Is cap locked? **YES** NO
Standing water present? YES **NO**
Any indication of surface runoff in well? YES NO
Air Temperature: 40-48°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: ~~1700~~ 1344 AM/**PM**

Depth to Water: 6.98
Length of Well: 9.71

Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1354 AM/**PM**
End Time: 1436 AM/**PM**

Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER **OTHER**

CALCULATION OF 3 CASING VOLUMES

Purged Dry

9.71	ft	Length of well
6.98	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH **LOW**
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 100 mL ml/min or L/min
120 min 1404

Notes: pump PC 8.31 (Intake)

Time 44	Volume (~~gallons~~ mL)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1350	Initial		~~5.62~~	~~0.204~~					N/A
1404 ~~1354~~	2000mL	77.10	5.62	0.204	23.51	4.87	5.28	90.8	N/A
1409	2500		5.67	0.208	24.59	4.02	5.45	95.8	N/A
1413	2900	77.10	5.68	0.211	23.87	3.66	5.86	87.6	N/A
1417	3300	77.10	5.67	0.210	22.91	3.58	5.97	90.1	N/A
1421	3700	77.10	5.66	0.212	21.89	3.50	6.00	96.9	N/A
	Prep	to Sample		well dry @	1435	1-VOA filled	recover		N/A
1436	4200	#77.10							N/A
1025									N/A
1050									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1050 **AM**/PM
Method: mini Typhoon / Low Flow controller

Appearance of Sample: clear
Actual sample flow rate: 100 **ml/min** or L/min

SAMPLE BOTTLE COLLECTED: 2-1Liter Amber HCL Pre
6-40mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss
Company: AECOM

Duplicate 02NCMOCGW20 MOC30 8/17/09 ~~17~~ ~~18~~ Dup 20

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW05

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good / New		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	cloudy, CALM		Air Temperature:	40°	

Notes: 09NCMOCGW17 MOC ~~29~~ 30 Duplicate 09NCMOCGW20 MOC 30

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 8/15/2009 Time: ~~8~~ 1930 AM/PM

Depth to Water: 3.87
Length of Well: 8.45
Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled)

WELL PURGING
Date: 8/15/2009 Begin Time: 1924 AM/PM End Time: AM/PM
Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

8.45 ft Length of well
3.87 ft - depth to water (before purge start)
ft = length of water column
x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 100 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (~~umhos/cm~~) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1924	Initial								N/A
1934	1000	4.41	1.36	18.92	66.65	16.50	14.41	410.6	N/A
1937		>5.6	1.32	19.29	21.36	16.39	14.88	417.3	N/A
1940		>5.6	1.30	19.17	18.79	14.16	15.08	417.6	N/A
1943		>5.6	1.30	19.08	15.76	14.38	14.89	410.9	N/A
1946		>5.6	1.29	17.06	18.57	14.65	14.82	411.5	N/A
									N/A
2020	to 2150	Filling VOA's (12)	had caps						N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 8/15/2009 Time: 2150 AM/PM Dup 2140
Method: Mini Typoon & Low Flow Controler

Appearance of Sample: Dark red
Actual sample flow rate: 80-100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL
Name: Lance G. Preuss Company: AECOM

16

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW06

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	Overcast Fog WIND 8-15 N		Air Temperature:	40-42°	

Notes: TOP OF PUMP 85.50 MS/MSD LOCATION ~~09NEMOCGW06~~ + MOC 28 09NEMOCGW106

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: 1540 AM/PM

Depth to Water: ~~9.20~~ 4.01
Length of Well: 9.20

Measured with: ELECTRONIC TAPE / CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1540 AM/PM
End Time: AM/PM
Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

CALCULATION OF 3 CASING VOLUMES

9.20	ft	Length of well	Yield:	HIGH LOW
4.01	ft	- depth to water (before purge start)	If low, recovery time:	
5.19	ft	= length of water column		
1.60		x conversion factor (2" well) 0.49	Actual volume purged:	gallons
	Gallons	= 3 casing volumes	Actual purge flow rate:	100 ml/min or L/min

Notes: Clear, no solids but (some) colored.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1540	begin			mS/cm					N/A
1550	1000 mL	75.50	1.21	20.87	63.96	2.51	9.66	419.7	N/A
1555	1500	75.50	1.17	21.11	68.01	2.45	9.97	417.8	N/A
1600	2000	75.50	1.12	21.23	80.30	2.52	9.65	420.1	N/A
1605	2500	75.50	1.07	20.68	79.2	2.65	8.24	423.9	N/A
1610	3000	75.50	1.01	20.60	76.0	2.47	8.23	423	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final: ~~1610~~ 1715		76.50	1.00	20.61	73.0	2.49	8.24	425	N/A

SAMPLE COLLECTION

Date: 5/18/09 Time: 2020 AM/PM ~~1715~~ 2010
Method: Mini Typhoon/Low Flow Controller

Appearance of Sample: Clear, brownish red.
Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW07

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	cloudy 40-50°		Air Temperature:	45-50°	

Notes: 09NCMWGW15 + MEC 37

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: AM/PM

Depth to Water: 5.60 Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Length of Well: 9.60 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: 1451 AM/PM Purging Equipment: Mini Typoon & Low Flow Cont.
End Time: 1540 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

9.60	ft	Length of well	Yield:	HIGH	LOW
5.60	ft	- depth to water (before purge start)	If low, recovery time:		
4.0	ft	= length of water column			
		x conversion factor (2" well) 0.49	Actual volume purged:		gallons
	Gallons	= 3 casing volumes	Actual purge flow rate:	120ml/min	ml/min or
				100ml/min	L/min

Notes: pump @ 7.60

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1451	Initial								N/A
1456	500mL	5.70	6.55	0.387	139	1.77	4.03	-56	N/A
1501	1000mL	5.72	6.36	0.386	136	1.73	3.66	-52	N/A
1506	1500mL	5.75	6.58	0.410	59.34	1.66	4.39	-65	N/A
1511	2000mL	5.76	6.62	0.415	33.64	1.52	4.17	-60.4	N/A
1515	2400mL	5.76	6.64	0.415	21.31	1.43	4.12	-65.0	N/A
									N/A
1540	Sampling Complete								N/A
1800	Talked to M. Hearston 1540 samples need to be discarded								N/A
	due to problem with Quenching + HCL, Recollection								N/A
Final: 2200									N/A

SAMPLE COLLECTION

Date: 8/15/09 Time: ~~1540~~ 2200 LGP AM/PM Method: Mini Typoon & Low Flow

Appearance of Sample: Clear Actual sample flow rate: 100ml/min ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW08

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	cloudy, Light mist + Rain		Air Temperature:	45-50°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: AM/PM

Depth to Water: 6.65 11:05 Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 9.35 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: ______ AM/PM Purging Equipment: Mini Typoon & Low Flow Cont
End Time: ______ AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.35	ft	Length of well	
6.65	ft	- depth to water (before purge start)	
2.70	ft	= length of water column	
1.30		x conversion factor (2" well) 0.49	
	Gallons	= 3 casing volumes	

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: ______ gallons
Actual purge flow rate: 1 120 mL/min. 2 80 mL/min. ml/min or L/min

Notes: 09NCMCCGW13 + MDC#25

Time	Volume (~~gallons~~) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1305	540	9.05	5.69	0.191	95	19.01	3.76	89.9	N/A
1315		6.75							N/A
sett	Low purge rate 80 mL min.								N/A
1320	580	7.06	5.61	0.191	90.91	4.10	4.45	88.6	N/A
1325	980	7.20	5.70	0.194	95.61	4.21	5.1	88.3	N/A
1330	1380	7.20	5.71	0.196	90.1	~~17.8~~ 4.21	5.60	84.1	N/A
		WELL	became	dry @ 80 mL/min	with pump @ TD.				N/A
									N/A
1000									N/A
1025									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/16/2009 Time: 1000 AM/PM Method: Mini Typhoon + Low flow Controller

Appearance of Sample: Clear Actual sample flow rate: ≈100 mL ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres ✓ AMP 8/16/2009
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE
PROJECT #: 112642.20

ENTER WELL LOCATION: ICOMW089 (~~088~~) ZAP

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: Clear to P.C 45-60°
Notes:

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 45-60°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/15/2009 Time: AM/PM

Depth to Water: 6.89
Length of Well: 9.35

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/15/2009 Begin Time: AM/PM End Time: AM/PM
Purging Equipment: Mini Typoon & Low Flow Cont
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.35	ft	Length of well
6.89	ft	- depth to water (before purge start)
2.49	ft	= length of water column
1.215		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 1.25 gallons
Actual purge flow rate: 225 ml/min or L/min

Notes: WELL HAS POOR RECOVERY, Purged Dry @ Low Flow

Time	Volume (~~gallons~~) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1955	0,500	6.99	5.76	0.118	450	1.92	2.7	239	N/A
2000	1625	7.46	5.69	0.111	440	1.45	3.20	227.2	N/A
2005	1850	8.01	5.62	0.117	350	0.82	4.13	198.	N/A
2010	3,475	8.50	5.57	0.118	206	0.62	4.06	186.5	N/A
2015	5,100	9.00	5.57	0.190	169	0.56	4.58	181.6	N/A
									N/A
	WELL Purged Dry SAMPLES COLLECT FOLLOWING AM								N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: Time: AM/PM Method: Mini Typoon + Low Flow Controler

Appearance of Sample: SLIGHTLY TURBID. Actual sample flow rate: 225 ml/min ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-1 Liter Amber HCL Pres
6-40 mL VOA's HCL Pres

SAMPLING PERSONNEL

Name: Lance G. Preuss Company: AECOM

Day 7 Post-ISCO Sampling Forms

CLIENT: USACE / Bristol
LOCATION: NE Cape AK
PROJECT #:

ENTER WELL LOCATION: ICCMW02

INSPECTION

Label on well?	~~YES~~	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	partly cloudy mid 40's °F windy		Air Temperature:	mid 40's °F	

Notes: 09NEMOCGW27 ~~17~~ 8/20/09 MOC#-~~17~~ 21 8/20/09

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 8/19/2009 Time: 17:05 AM/PM

Depth to Water: 4.73
Length of Well: 8.94

Measured with: ~~ELECTRONIC TAPE~~ CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING
Date: 8/19/2009 Begin Time: 17:08 AM/PM End Time: 1755 AM/PM
Purging Equipment: Mini Typhoon / LOW FL
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

___	ft	Length of well
___	ft	- depth to water (before purge start)
___	ft	= length of water column
___		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time:
Actual volume purged: ___ gallons
Actual purge flow rate: 100 ml/min (circled) or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 17:08									N/A
17:18		4.98	3.70	2.927	14.74	1.48	8.96	184.1	N/A
17:21		5.00	3.82	2.875	16.76	1.31	8.83	167.5	N/A
17:24		5.10	3.81	2.869	11.15	1.05	8.54	170.9	N/A
17:27		5.05	3.82	2.846	9.25	1.05	8.09	167.7	N/A
17:30		5.05	3.85	2.837	8.53	0.96	8.17	167.1	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 8/19/2009 Time: 17:35 AM/PM
Method: mini typhoon w/ low flow controller

Appearance of Sample: turbid yellowish brown, sheen clears up with purging
Actual sample flow rate: 100 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL
Name: Aaron Jamerson Company: AECOM

CLIENT: USACE [illegible]
LOCATION: NE Cape AK
PROJECT #:

ENTER WELL LOCATION: ICCMW03

INSPECTION

Label on well? (YES) NO — Is cap locked? YES (NO)
Is reference mark visible? (YES) NO — Standing water present? (YES) NO
Condition of well: Good — Any indication of surface runoff in well? YES (NO)
Weather: [illegible] 40's °F high wind — Air Temperature: mid 40's °F
Notes: 09NCMOCGW23 MOC# 17

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 8/19/2009 Time: 13:18 AM/PM

Depth to Water: 3.89
Length of Well: 9.50
Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED (DI WATER) (OTHER)

WELL PURGING
Date: 8/19/2009 Begin Time: 13:20 AM/PM End Time: 15:56 AM/PM
Purging Equipment: Mini Typhoon/Low FL
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: (HIGH) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 150 ml/min or L/min

Notes: Field Duplicate collected @ MW03 Time 1400 Sample ID = 09NC[illegible]GW21

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:20									N/A
13:30		4.81	1.62	9.940	7.90	1.25	14.60	347.4	N/A
13:33		4.91	1.62	9.984	6.82	1.25	14.92	356.5	N/A
13:36		5.06	1.67	9.989	5.90	1.17	15.11	347.3	N/A
13:39		5.07	1.66	9.995	5.79	1.22	15.26	351.4	N/A
13:42		5.13	1.68	9.966	5.90	1.28	15.14	353.3	N/A
13:45			1.68	9.964	5.83	1.24	15.19	350.2	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 8/19/2009 Time: 1350 AM/PM
Method: mini typhoon with low flow controller

Appearance of Sample: reddish orange / clear
Actual sample flow rate: 150 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 24 ~~6~~ 40mL VOA HCL — [illegible] collected
8 ~~2~~ 1 Liter Amber — MS/MSD collected.

SAMPLING PERSONNEL
Name: [illegible] — Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE Cape, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW04

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	(YES)	NO
Condition of well:			Any indication of surface runoff in well?	YES	(NO)
Weather:			Air Temperature:	~40°F	

Notes: 09NCMOCGW24 MOC# 19

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/18/2009 Time: 14:45 AM/PM

Depth to Water: 7.50 Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Length of Well: 9.70 Decontamination: PRE STEAM CLEANED (DI WATER) (OTHER)

WELL PURGING

Date: 8/18/2009 Begin Time: 14:48 AM/PM Purging Equipment: Mini Typhoon / LOW FL
End Time: 09:45 08/19/09 AM/PM Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	Yield:	HIGH	(LOW)
ft	- depth to water (before purge start)	If low, recovery time:		
ft	= length of water column			
	x conversion factor (2" well) 0.49	Actual volume purged:		gallons
Gallons	= 3 casing volumes	Actual purge flow rate:	120	(ml/min) or L/min

Notes: 15:04 well was dry will allow to recharge over night and collect sample in morning at 08/19/09. @ 20:40 DTW = 7.98 ft.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ (mS/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:48									N/A
14:58		below pump	5.90	0.118	18.27	5.35	4.36	107.2	N/A
15:01		below pump	5.88	0.215	35.83	5.35	4.94	113.9	N/A
15:04		below pump	5.94	0.212	39.44	4.96	4.56	115.6	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 09:35 AM/PM Method: mini typhoon with low flow controller.

Appearance of Sample: turbid w/ light brown Actual sample flow rate: 120 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 6 40mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Aaron Jacobson / Lance Pearson Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE CAPE, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW05

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: good
Weather: mostly sunny, mid 40°F high winds
Notes: 09NCMOCGW25 MOC # 16

Is cap locked? YES NO
Standing water present? (YES) NO
Any indication of surface runoff in well? YES (NO)
Air Temperature: mid 40°F

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 1032 AM/PM

Depth to Water: 5.02
Length of Well: 8.45

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

WELL PURGING

Date: 8/19/2009 Begin Time: 1034 AM/PM
End Time: 11:27 AM/PM

Purging Equipment: Mini Typhoon / Low FL
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: (HIGH) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: ml/min or L/min

Notes:

Time	~~Volume (gallons)~~ Flow rate ml/min	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1034									N/A
1044	130	5.68	1.47	15.87	43.58	11.96	11.20	381.1	N/A
1047	130	5.73	1.48	15.97	36.37	12.96	11.18	378.0	N/A
1050	85	5.79	1.49	15.99	35.95	14.28	11.25	370.6	N/A
1053	85	5.76	1.51	16.11	35.61	14.72	11.38	366.3	N/A
1056	85	5.80	1.48	16.40	33.55	14.58	11.73	365.4	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 11:00 AM/PM
Method: Mini typhoon, low flow controller

Appearance of Sample: reddish orange/clear
Actual sample flow rate: 85 (ml/min) or L/min

maximum draw down exceeded but pumping at lowest possible rate for pump.

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL

Name: Aaron Jankovic
Company: AECOM

CLIENT: USACE / Bristol
LOCATION: NE Cape, AK
PROJECT #:

ENTER WELL LOCATION: ICCMW06

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES	NO (circled)
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES (circled)	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	mostly sunny, mid 40's °F, high winds		Air Temperature:	mid 40's °F	
Notes:	09NCMOCCGW26		MOC # 20		

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 15:35 AM/PM

Depth to Water: 4.41
Length of Well: 9.10

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

WELL PURGING

Date: 8/19/2009 Begin Time: 15:38 AM/PM
End Time: 16:55 AM/PM

Purging Equipment: Mini Typhoon / LOW FL
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER (circled)

CALCULATION OF 3 CASING VOLUMES

___	ft	Length of well
___	ft	- depth to water (before purge start)
___	ft	= length of water column
___		x conversion factor (2" well) 0.49
___	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time: ___
Actual volume purged: ___ gallons
Actual purge flow rate: 150 ml/min (circled) or L/min

Notes: maximum draw down exceeded but pumping as slow as possible with pump

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 15:38									N/A
15:48		below pump	1.24	13.22	54.70	3.23	12.21	358.5	N/A
15:51		below pump	1.24	13.30	72.02	2.94	12.43	356.2	N/A
15:54		below pump	1.29	13.30	71.52	2.69	12.56	356.9	N/A
15:57		below pump	1.22	13.01	58.79	3.41	11.25	366.8	N/A
16:00		below pump	1.15	11.72	44.07	3.20	10.81	366.1	N/A
16:03		below pump	1.10	12.56	56.72	3.68	10.64	366.1	N/A
16:06		below pump	1.13	12.67	47.46	3.01	11.04	360.6	N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 16:10 AM/PM
Method: mini typhoon with low flow controller

Appearance of Sample: reddish orange/yellow
Actual sample flow rate: 150 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 Liter Amber

SAMPLING PERSONNEL

Name: Aaron Jindrosic Company: AECOM

CLIENT: USACE / BRISTOL
LOCATION: NE CAPE AK
PROJECT #:

ENTER WELL LOCATION: ICCMW07

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	mostly cloudy mid 40's °F		Air Temperature:	mid 40's °F	
Notes:	09NEMOCGW27		MOC # 18		

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/19/2009 Time: 18:05 AM/PM

Depth to Water: 5.65
Length of Well: 9.60

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/19/2009 Begin Time: 19:22 AM/PM End Time: 20:12 AM/PM

Purging Equipment: Mini Typhoon / LOW FL
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 160 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1922									N/A
1932		5.77	6.26	0.944	7.53	2.13	5.52	-49.4	N/A
1935		5.81	6.33	0.871	3.42	1.96	3.98	-58.7	N/A
1938		5.83	6.39	0.833	2.76	1.67	3.19	-61.1	N/A
1941		5.81	6.40	0.828	2.45	1.45	3.77	-68.9	N/A
1944		5.82	6.38	0.825	3.60	1.39	4.11	-71.2	N/A
1947		5.83	6.35	0.809	2.01	1.20	3.98	-73.8	N/A
1950		5.83	6.37	0.799	1.81	1.15	4.21	-77.6	N/A
1953		5.87	6.35	0.740	1.81	1.13	4.20	-79.0	N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/19/2009 Time: 19:55 AM/PM

Method: mini typhoon + low flow controller.

Appearance of Sample: Turbid yellowish brown clears up with purging

Actual sample flow rate: 160 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 Liter Amber

SAMPLING PERSONNEL

Name: Lauren Pruss / Aaron Jacobsen

Company: AECOM

CLIENT:
LOCATION:
PROJECT #: ENTER WELL LOCATION: ICCMW008

INSPECTION

Label on well? YES NO — Is cap locked? YES NO
Is reference mark visible? YES NO — Standing water present? YES NO
Condition of well: good — Any indication of surface runoff in well? YES NO
Weather: — Air Temperature: ~40° F
Notes: 09NCMOCGW28 MOC # 24

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 8/18/2009 Time: 14:22 AM/PM

Depth to Water: 7.30 — Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 9.35 — Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING
Date: 8/18/2009 Begin Time: 14:22 AM/PM Purging Equipment: Mini Typhoon/LOW FL
End Time: 20:15 08/19/09 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

ft	Length of well	
ft	- depth to water (before purge start)	
ft	= length of water column	
	x conversion factor (2" well) 0.49	
Gallons	= 3 casing volumes	

Yield: HIGH LOW
If low, recovery time: > 12 hours
Actual volume purged: gallons
Actual purge flow rate: 124 ml/min or L/min

Notes: 14:38 well ran dry - will allow well to recharge over night and collect sample in the morning of 08/19/09 @ 20:40 DTW = 7.42 ft

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity ~~(umhos/cm)~~ (mS/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:22									N/A
14:32		below pump		0.175	74.41	4.66	4.62	104.4	N/A
14:35		below pump		0.178	124.6	6.42	5.19	99.7	N/A
14:38		below pump		0.178	Dry	5.87	5.43	104.3	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 8/19/2009 Time: 09:15 AM/PM Method: mini typhoon with low flow controller

Appearance of Sample: light brown, very turbid — Actual sample flow rate: 120 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40 mL VOA HCL
2 1 liter Amber

SAMPLING PERSONNEL
Name: Aaron Jacobowic / Lance Bravss — Company: AECOM

Day 14 Post-ISCO Sampling Forms

CLIENT: Bristol

LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND

PROJECT #: 112624.20

ICOMW 02

ENTER WELL LOCATION: 09NCMOCGW32

DUP 09NCMOCGW31 1540

INSPECTION

Label on well? **YES** NO — Is cap locked? **YES** NO

Is reference mark visible? **YES** NO — Standing water present? YES NO

Condition of well: Good — Any indication of surface runoff in well? YES **NO**

Weather: P.CLOUDY — Air Temperature: 40

Notes: WIND ____ MPH

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 1505 AM/**PM**

Depth to Water: 4.95 — Measured with: **ELECTRONIC TAPE** CHALK & STEEL TAPE

Length of Well: 8.94 — Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 15805 AM/**PM** — Purging Equipment: mini Typhoon

End Time: 1532 AM/PM — Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.94	ft	Length of well
4.95	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: **HIGH** LOW

If low, recovery time: ____

Actual volume purged: ____ gallons

Actual purge flow rate: 180 **ml/min** or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1505		4.95	Initial purge		Product droplets	Laker pump		1' TOP	N/A
1515		5.61	4.39	13786/9.34	9.6	0.82	8.31	29	N/A
1520		5.45	4.39	13786/9.36	9.6	0.80	8.32	28.0	N/A
1524		5.37	4.43	13975/9.5	5.75	0.62	8.48	19.1	N/A
1528		5.29	4.44	13959/9.6	5.80	0.58	8.91	19.8	N/A
1532		5.24	4.45	13959/9.5	4.65	0.50	8.71	22.8	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1540 DUP 1535 AM/**PM** 1605 END — Method: mini Typhoon & Low Flow controler

Appearance of Sample: Clear — Actual sample flow rate: 188 **ml/min** or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth. 2-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic — Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 03
ENTER WELL LOCATION: 09NCMOCGW33
MS/MSD collected

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	P. CLOUDY		Air Temperature:	46	
Notes:	WIND 0-10 MPH WEST				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: AM/PM

Depth to Water: 4.58 Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Length of Well: 9.50 Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 1330 AM/PM Purging Equipment: Mini Typhoon/LF Cont.
End Time: 1350 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well	Yield: HIGH LOW
4.58	ft	- depth to water (before purge start)	If low, recovery time:
	ft	= length of water column	
		x conversion factor (2" well) 0.49	Actual volume purged: gallons
	Gallons	= 3 casing volumes	Actual purge flow rate: 136 ml/min or L/min

Notes: 120 @ 1340

Time	Volume (gallons) mL	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) uS^cm/mS^cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1330	Intial	4.58	3.29	3659/2.8	6.69	3.34	13.81	313.1	N/A
1335		4.85	3.31	3626/2.77	6.73	3.33	13.73	306.2	N/A
1340	1200	4.95	3.29	3699/2.86	4.95	2.66	13.19	308.1	N/A
1345	1800	5.05	3.31	3793/2.87	4.95	2.59	12.47	303.7	N/A
1350	2400	5.11	3.29	3802/2.91	4.21	2.47	12.76	305.5	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1355 AM/PM Method: mini Typhoon & Low Flow controller

Appearance of Sample: clear Actual sample flow rate: 120 mL ml/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/ 2-1 Liter Amber w/HCL for GRO/RRO AK

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW04
ENTER WELL LOCATION: 09NCMOCGW34

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	P. CLOUDY		Air Temperature:	40	
Notes:	WIND 0-10 MPH				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 10:55 AM/PM

Depth to Water: 7.45 ft
Length of Well: 9.70

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 11:00 AM/PM Purging Equipment: Mini Typhoon + L/F Cont.
End Time: AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.70	ft	Length of well
7.45	ft	- depth to water (before purge start)
2.25	ft	= length of water column
		x conversion factor (2" well) 0.49
1.76g	Gallons	= 3 casing volumes

Notes:

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: ~~200~~ 100 ml/min (circled) or L/min

Time	~~Volume (gallons)~~ Flow Rate	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start:									N/A
1107	100ml/min	8.11	5.51	.508	12.0	12.1	6.06	28.2	N/A
1112	100ml/min	8.92	5.52	.517	11.9	11.1	6.01	27.9	N/A
1118	100ml/min	9.39	5.54	.525	12.5	11.8	7.26	33.7	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1125 AM/PM Method: mini Typhoon & Low Flow controler

Appearance of Sample: Clear Actual sample flow rate: 100 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 05
ENTER WELL LOCATION: 09NCMOCGW35

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: P.CLOUDY
Notes: WIND 5-18 W MPH
Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 46-50

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 1154 AM/PM

Depth to Water: 5.03
Length of Well: 8.45
Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 12:02 AM/PM
End Time: AM/PM
Purging Equipment: Mini Typhoon + L/F Cont.
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

8.45 ft Length of well
5.03 ft - depth to water (before purge start)
3.42' ft = length of water column
~~0.168~~ x conversion factor (2" well) 0.49
1.68 Gallons = 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: 3/4 gallons
Actual purge flow rate: 134 ml/min or L/min

Notes:

Time YSI Time	Volume (gallons) ML	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1200	Initial	5.35	3.02	8.074	65.8	7.32	9.20	306.1	N/A
1205	680	< Pump	2.94	8.065	59.5	7.81	9.49	312.6	N/A
1210	1360	< Pump	2.93	7.883	39.7	7.28	9.56	278.1	N/A
1215	2040	< Pump	2.92	7.976	41.2	6.98	9.56	290.1	N/A
1220	3400	< Pump	2.94	8.073	33.4	7.03	9.52	289.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 1225 AM/PM
Method: mini Typhoon & Low Flow controler

Appearance of Sample: clear, slight tint.
Actual sample flow rate: 34x4 136 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA'S /HCL GRO/DRO AK101 Benzene/Naph. 2-1 Liter Amber w/HCL for GRO/RRO AK-102/103

SAMPLING PERSONNEL

Name: Lance Preuss / Aaron Jambrosic Company: AECOM.

CLIENT: Bristol
LOCATION: N.E CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 06
ENTER WELL LOCATION: 09NCMOCGW36

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: P.CLOUDY
Notes: WIND 6-10 MPH

Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 40

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 11.15 AM/PM

Depth to Water: 5.59 *
Length of Well: 9.10

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 11:30 AM/PM End Time: 12:20 AM/PM
Purging Equipment: Mini Typhoon+LF Cont.
Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

9.10 ft Length of well
5.59 ft - depth to water (before purge start)
ft = length of water column
x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Notes:

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 110 ml/min or L/min

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 11:30									N/A
11:46			1.86	3.651	90.85	2.94	9.35	320.8	N/A
11:49		* 5.59	1.81	3.686	122.7	3.52	9.28	327.8	N/A
11:52		below pump	1.73	3.738	158.4	3.74	9.40	333.4	N/A
11:55		below pump	1.73	3.725	135.6	3.31	9.15	333.8	N/A
11:58		below pump	1.70	3.709	160.8	3.37	9.23	334.6	N/A
12:01		below pump	1.69	3.698	133.0	3.27	8.92	337.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 12.05 AM/PM
Method: mini Typhoon & Low Flow controller

Appearance of Sample: yellowish brown and turbid
Actual sample flow rate: 110 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA'S/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber—W/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM.

CLIENT: Bristol
LOCATION: N.E. CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 07
ENTER WELL LOCATION: 09NEMOCGW37

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	P. CLOUDY		Air Temperature:	40	
Notes:	WIND 6-10 MPH				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 12:44 AM/PM

Depth to Water: 5.57
Length of Well: 9.60

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 13:15 AM/PM
End Time: 13:53 AM/PM
Purging Equipment: Mini Typhon & L/F Cont
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.60	ft	Length of well
5.57	ft	- depth to water (before purge start)
4.03	ft	= length of water column
1.9		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH (circled) LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 140 ml/min or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:15						~~1.41~~	~~4.8~~		N/A
13:25		5.66	5.64	1.972	11.13	1.61	4.85	-12.8	N/A
13:28		5.65	5.68	1.979	8.49	0.87	4.45	-17.2	N/A
13:31		5.65	5.65	1.977	~~14.78~~ 7.86	0.78	4.26	-10.6	N/A
13:34		5.65	5.60	1.990	8.67	0.81	4.57	-5.6	N/A
13:37		5.65	5.65	2.005	7.09	0.79	4.75	-9.5	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 13:40 AM/PM
Method: mini Typhoon & Low Flow controller

Appearance of Sample: yellowish brown and turbid, clear up with purging
Actual sample flow rate: 140 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA'S/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrocil Company: AECOM

CLIENT: Bristol
LOCATION: N.E CAPE MOC# ST. LAW. ISLAND
PROJECT #: 112624.20

ICOMW 08

ENTER WELL LOCATION: 09NCMOCGW38

INSPECTION

Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	P. CLOUDY		Air Temperature:	40	
Notes:	WIND 0-10 MPH				

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 8/25/2009 Time: 09:52 AM/PM

Depth to Water: 07.34
Length of Well: 9.75

Measured with: ELECTRONIC TAPE CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 8/25/2009 Begin Time: 10:10 AM/PM Purging Equipment: Mini Typhoon + L/F Cont.
End Time: 18:00 AM/PM Decontamination: PRE STEAM CLEANED DI WATER OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time: >12 hours
Actual volume purged: ______ gallons
Actual purge flow rate: 100 ml/min or L/min

Notes: 10:?? well was dry after [illegible] for recharge and [illegible] sample collection.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 10:10									N/A
10:20		below pump	4.72	0.134	42.85	~~4.174~~ 4.61	4.07	124.3	N/A
10:23		below pump	4.75	0.135	44.80	5.07	4.27	122.7	N/A
10:26		below pump	4.75	0.135	37.60	4.65	4.11	120.7	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 8/25/2009 Time: 10:30 AM/PM Method: Mini Typhoon & Low Flow controler

Appearance of Sample: ______ Actual sample flow rate: 100 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 6 40ML VOA's/HCL GRO/DRO AK101 Benzene/Napth.
2-1 Liter Amber w/HCL FOR GRO/RRO AK102/103

SAMPLING PERSONNEL

Name: Lance Preuss/Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW03

ENTER WELL LOCATION: 09NCMOCGW43

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: Good
Weather: Cloudy 45°
Notes:

Is cap locked? (YES) NO
Standing water present? YES (NO)
Any indication of surface runoff in well? YES (NO)
Air Temperature: 45°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: AM/PM

Depth to Water: 4.38
Length of Well: 9.50

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 1220 AM/(PM)
End Time: 1255 AM/(PM)

Purging Equipment: Mini Typhon + LF Controller
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
4.38	ft	- depth to water (before purge start)
5.12	ft	= length of water column
2.5		x conversion factor (2" well) 0.49
Gallons		= 3 casing volumes

Notes:

Yield: HIGH (LOW)
If low, recovery time: not purged dry
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 (ml/min) or L/min

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1230	Initial	4.38	3.75	1,661	6.75	3.47	7.76	278.3	N/A
1240	.75	4.68	3.82	1,668	6.09	0.94	7.94	283.5	N/A
1245	1.25	4.82	3.81	1,771	4.05	0.87	7.93	284.4	N/A
1250	2.00	4.83	3.81	1,787	2.99	0.47	7.93	287.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 1255 AM/(PM) Method: Mini Typhon + LF Controller

Appearance of Sample: sl ~~foamy~~ appearance sl foamy

Actual sample flow rate: ~100 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly - sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic

Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW04
ENTER WELL LOCATION: 09NCMOCGW44

INSPECTION

Label on well? YES (circled) NO
Is reference mark visible? YES (circled) NO
Condition of well: Good
Weather: Cloudy
Notes:

Is cap locked? YES (circled) NO
Standing water present? YES NO (circled)
Any indication of surface runoff in well? YES NO (circled)
Air Temperature: 45°

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: AM/PM

Depth to Water: 7.65
Length of Well: 9.70

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER (circled)
Dedicated pump & tubing

WELL PURGING

Date: 9/11/2009 Begin Time: 1100 AM/PM End Time: 1140 AM/PM
Purging Equipment: Mini Typhon + LF Controller
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.70 ft Length of well
7.65 ft - depth to water (before purge start)
2.05 ft = length of water column
0.90 x conversion factor (2" well) 0.49
Gallons = 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: 2 hrs
Actual volume purged: 1 gallons
Actual purge flow rate: ~40 ml/min or L/min

Notes: Had to wait for recharge of well to collect DRO/RRO Samples.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1105	Initial	7.67	5.32	.517	8.45	1.05	5.22	47.2	N/A
1120	0.6	8.20	5.32	.584	7.84	1.97	5.68	40.2	N/A
1130	0.8	8.26	5.56	.610	6.64	1.19	5.51	33.1	N/A
1140	0.9	8.29	5.65	.608	6.25	1.08	5.39	34.8	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/1 /2009 Time: 1140 AM/PM (circled)
Method: Mini Typhon + LF Controller

Appearance of Sample: Clear
Actual sample flow rate: ~40 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL POLY-SULFATE, 1-250 mL w/HNO3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

Day 28 Post-ISCO Sampling Forms

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW02
ENTER WELL LOCATION: 09NCMOCGW42
MOC-21

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	YES	(NO)
Condition of well:	Good		Any indication of surface runoff in well?	YES	(NO)
Weather:	mostly cloudy		Air Temperature:	~40 °F	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 14:27 AM/PM

Depth to Water: 5.1
Length of Well: 8.94
Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 14:35 AM/PM End Time: 15:15 AM/PM
Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well	
5.1	ft	- depth to water (before purge start)	
	ft	= length of water column	
		x conversion factor (2" well) 0.49	
	Gallons	= 3 casing volumes	

Yield: (HIGH) LOW
If low, recovery time:
Actual volume purged: ______ gallons
Actual purge flow rate: 120 (ml/min) or L/min

Notes: blobs of product in purge line

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 14:35									N/A
14:45		5.60	5.82	3.436	41.79	0.22	7.49	-78.9	N/A
14:48		5.66	5.86	3.420	17.59	0.15	7.46	-58.3	N/A
14:51		5.78	5.88	3.432	10.33	0.15	7.49	-82.8	N/A
14:54		5.70	5.90	3.378	7.86	0.13	7.72	-79.7	N/A
14:57		5.71	5.89	3.367	7.12	0.14	7.76	-75.4	N/A
15:00		5.75	5.95	3.358	5.10	0.13	7.51	-77.8	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 15:00 AM/PM Method: Mini Typhon + LF Controler

Appearance of Sample: yellow hue blobs of product. Actual sample flow rate: 120 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL POLY - SULFATE, 1-250 mL w/HNO_3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/DRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

CLIENT: Bristol
LOCATION: N.E Cape St. Lawrence Island
PROJECT #: 112624.20

ICOMW03
ENTER WELL LOCATION: 09NCMOCGW43

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Cloudy 45°		Air Temperature:	45°	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/1/2009 Time: AM/PM

Depth to Water: 4.38
Length of Well: 9.50

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING

Date: 9/1/2009 Begin Time: 1220 AM/PM (PM circled)
End Time: 1255 AM/PM (PM circled)

Purging Equipment: Mini Typhon + LF Contr.
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

9.50	ft	Length of well
4.38	ft	- depth to water (before purge start)
5.12	ft	= length of water column
2.5		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW (circled)
If low, recovery time: not purged dry
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 ml/min (circled) or L/min

Notes:

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1230	Initial	4.38	3.75	1.661	6.75	3.47	7.76	278.3	N/A
1240	.75	4.68	3.82	1.668	6.09	0.94	7.94	283.5	N/A
1245	1.25	4.82	3.81	1.771	4.05	0.87	7.93	284.4	N/A
1250	2.00	4.83	3.81	1.787	2.99	0.47	7.93	287.9	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/1/2009 Time: 1255 AM/PM (PM circled)
Method: Mini Typhon + LF Controler

Appearance of Sample: Sl foamy ~~Sl tannic appearance~~
Actual sample flow rate: ~100 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly-sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCl GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW04

ENTER WELL LOCATION: 09NCMOCGW44

INSPECTION

Label on well?	(YES)	NO	Is cap locked?	(YES)	NO
Is reference mark visible?	(YES)	NO	Standing water present?	YES	(NO)
Condition of well:	Good		Any indication of surface runoff in well?	YES	(NO)
Weather:	Cloudy		Air Temperature:	45°	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: AM/PM

Depth to Water: 7.65 Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE

Length of Well: 9.70 Decontamination: PRE STEAM CLEANED DI WATER (OTHER) Dedicated pump & tubing

WELL PURGING

Date: 9/ 12009 Begin Time: 1100 (AM)/PM Purging Equipment: Mini Typhon + LF Contr.

End Time: 1140 AM/PM Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

9.70	ft	Length of well	
7.65	ft	- depth to water (before purge start)	
2.05	ft	= length of water column	
0.90		x conversion factor (2" well) 0.49	
	Gallons	= 3 casing volumes	

Yield: HIGH (LOW)

If low, recovery time: 2 hrs

Actual volume purged: 1 gallons

Actual purge flow rate: ~40 (ml/min) or L/min

Notes: Had to wait for recharge of well to collect DRO/RRO Samples.

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1105	Initial	7.67	5.32	.517	8.45	1.05	5.22	47.2	N/A
1120	0.6	8.20	5.32	.584	7.84	1.97	5.68	40.2	N/A
1130	0.8	8.26	5.56	.610	6.64	1.19	5.51	33.1	N/A
1140	0.9	8.29	5.65	.608	6.25	1.08	5.39	34.8	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/ 12009 Time: 1140 AM/(PM) Method: Mini Typhon + LF Controler

Appearance of Sample: Clear Actual sample flow rate: ~40 (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL poly-sulfate, 1-250 mL w/HNO3 for metals
6-40 mL VOA vials w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW05
ENTER WELL LOCATION: 09NCMOCGW45

INSPECTION

Label on well? (YES) NO
Is reference mark visible? (YES) NO
Condition of well: Good
Weather: Cloudy
Notes:

Is cap locked? (YES) NO
Standing water present? YES (NO)
Any indication of surface runoff in well? YES (NO)
Air Temperature: 45°

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 9/11/2009 Time: 845 (AM)/PM

Depth to Water: 5.35
Length of Well: 8.45

Measured with: (ELECTRONIC TAPE) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING
Date: 9/11/2009 Begin Time: 1345 AM/(PM) End Time: 1405 AM/(PM)
Purging Equipment: MINI TYPHON + LF Contr.
Decontamination: PRE STEAM CLEANED (DI WATER) OTHER

CALCULATION OF 3 CASING VOLUMES

8.45 ft Length of well
5.35 ft - depth to water (before purge start)
3.10 ft = length of water column
x conversion factor (2" well) 0.49
1.75 Gallons = 3 casing volumes

Yield: HIGH (LOW)
If low, recovery time: 15 min
Actual volume purged: 2 gallons
Actual purge flow rate: ~100 (ml/min) or L/min

Notes: purged dry - had to let recharge for silicates & DRO/RRO bottle fill

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 1345	Initial	5.40	3.45	2.274	17.6	3.88	7.66	322.2	N/A
1350	.75	5.62	3.46	2.261	16.4	2.69	8.27	324.6	N/A
1355	1.1	5.96	3.56	1.825	16.1	2.81	7.95	313.5	N/A
1400	1.4	6.35	3.58	1.768	16.1	2.89	7.70	306.5	N/A
1405	1.7	7.24	3.58	1.792	16.0	2.87	7.59	301.5	N/A
1407	2.0	7.81	3.58	1.793	16.0	2.87	7.59	302.6	N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 9/11/2009 Time: 1405 AM/(PM) Method: MINI TYPHON + LF Controller

Appearance of Sample: sl tannic color, sl odor. Actual sample flow rate: (ml/min) or L/min

SAMPLE BOTTLE COLLECTED: 1-250 ml POLY - SULFATE, 1-250 ml w/HNO3 for metals
6-40 ml VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL
Name: Aaron Jambrosic Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW06

ENTER WELL LOCATION: MOC-20

09NCMOCGW46

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	mostly cloudy		Air Temperature:	~90 F	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING
Date: 9/11/2009 Time: 13:27 AM/PM

Depth to Water: 4.40
Length of Well: 9.10

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER OTHER

WELL PURGING
Date: 9/11/2009 Begin Time: 13:30 AM/PM End Time: 14:22 AM/PM
Purging Equipment: MINI TYPHON + LF Controller
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
7.1	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 130 ml/min (circled) or L/min

Notes: well went nearly dry but 1st quickly recharged

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 13:30									N/A
13:45		5.30	3.79	1.402	42.31	0.49	9.20	242.1	N/A
13:48		5.50	3.41	1.341	54.14	0.44	9.23	250.4	N/A
13:51		below pump	3.29	1.292	44.36	0.45	9.18	261.5	N/A
13:54		below pump	3.16	1.268	62.81	0.41	8.90	263.7	N/A
13:57		below pump	3.12	1.267	73.94	0.40	8.59	265.1	N/A
14:00		below pump	3.09	1.243	73.60	0.44	9.48	269.1	N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION
Date: 9/11/2009 Time: 14:00 AM/PM Method: MINI TYPHON + LF Controller

Appearance of Sample: cloudy turbid
Actual sample flow rate: 130 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED:
1-250 mL POLY-SULFATE, 1-250 mL w/HNO3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL
Name: Aaron Jambrosic Company: AECOM

CLIENT: BRISTOL
LOCATION: N.E CAPE ST. LAWRENCE ISLAND
PROJECT #: 112624.20

ICOMW07

ENTER WELL LOCATION: 09NCMOCGW47

MOC-18

INSPECTION

Label on well?	YES (circled)	NO	Is cap locked?	YES (circled)	NO
Is reference mark visible?	YES (circled)	NO	Standing water present?	YES	NO (circled)
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO (circled)
Weather:	Clear		Air Temperature:	40°F	

Notes:

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 11:36 AM/PM

Depth to Water: 5.48
Length of Well: 9.60

Measured with: ELECTRONIC TAPE (circled) CHALK & STEEL TAPE
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 11:40 AM/PM End Time: 13:00 AM/PM
Purging Equipment: MINI TYPHON + LF Controller
Decontamination: PRE STEAM CLEANED DI WATER (circled) OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
7^	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH LOW
If low, recovery time:
Actual volume purged: gallons
Actual purge flow rate: 160 ml/min (circled) or L/min

Notes: Duplicate 09NCMOCGW41 and ms/msd collected
Dup 09NCMOC41 @ 11:00

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) mS/cm +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 11:40									N/A
11:50		5.51	6.28	3.403	21.25	0.68	5.05	-75.5	N/A
11:53		5.53	6.25	3.424	18.28	0.53	5.09	-75.3	N/A
11:56		5.52	6.24	3.492	15.70	0.40	5.18	-94.8	N/A
11:59		5.52	6.28	3.472	11.59	0.32	5.30	-87.3	N/A
12:02		5.52	6.27	3.472	09.16	0.30	5.30	-86.0	N/A
12:05		5.53	6.30	3.442	08.34	0.24	5.32	-106.1	N/A
12:08		5.51	6.35	3.435	08.43	0.23	5.33	-104.6	N/A
12:11		5.52	6.33	3.44	09.64	0.25	5.31	-107.1	N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 12 15 AM/PM Method: MINI TYPHON + LF Controller

Appearance of Sample: yellow and turbid, clears up with purging
Actual sample flow rate: 160 ml/min (circled) or L/min

SAMPLE BOTTLE COLLECTED: 3 ~~250~~ 500 ML POLY - SULFATE, 3 - ~~250~~ 500 ML W/HNO3 for metals
2 ~~4~~ 6 - 40 ML VOA VIALS W/HCL GRO AK101 Benzene, Napthlene
~~8~~ 2 - 1 Lt Amber W/HCL for GRO/RRO AK101/AK102
AJ 9/11/09

SAMPLING PERSONNEL

Name: Aaron Jambrosic
Company: AECOM

CLIENT: BRISTOL

LOCATION: N.E CAPE ST. LAWRENCE ISLAND

PROJECT #: 112624.20

ICOMW08

ENTER WELL LOCATION: 09NCMOCGW48

MOC-24

INSPECTION					
Label on well?	YES	NO	Is cap locked?	YES	NO
Is reference mark visible?	YES	NO	Standing water present?	YES	NO
Condition of well:	Good		Any indication of surface runoff in well?	YES	NO
Weather:	[illegible] ~40°F		Air Temperature:	40°F	
Notes:					

STATIC WATER LEVEL JUST PRIOR TO PURGING

Date: 9/11/2009 Time: 10:45 AM/PM

Depth to Water: 7.11

Length of Well: 9.35

Measured with: ELECTRONIC TAPE / CHALK & STEEL TAPE

Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

WELL PURGING

Date: 9/11/2009 Begin Time: 10:51 AM/PM End Time: 16:40 AM/PM

Purging Equipment: Mini Typhon + LF Contr.

Decontamination: PRE STEAM CLEANED / DI WATER / OTHER

CALCULATION OF 3 CASING VOLUMES

	ft	Length of well
7.11	ft	- depth to water (before purge start)
	ft	= length of water column
		x conversion factor (2" well) 0.49
	Gallons	= 3 casing volumes

Yield: HIGH / LOW

If low, recovery time:

Actual volume purged: gallons

Actual purge flow rate: 140 ml/min or L/min

Notes: 11:49 well [illegible] dry

Time	Volume (gallons)	Depth to Water (feet) <0.33'	pH (SU) +/- 0.1	Conductivity (umhos/cm) +/- 3%	Turbidity (NTU) +/- 10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5°	ORP +/- 10 mV	Ferrous Iron (mg/L)
Start: 10:51									N/A
11:41			5.36	0.176	13.41	4.66	3.65	132.4	N/A
11:49			5.37	0.176	dry	4.63	3.64	130.1	N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
									N/A
Final:									N/A

SAMPLE COLLECTION

Date: 9/11/2009 Time: 16:55 AM/PM Method: Mini Typhon + LF Controller

Appearance of Sample: turbid, cloudy, brown

Actual sample flow rate: 140 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 1-250 mL POLY-SULFATE, 1-250 mL w/HNO3 for metals
6-40 mL VOA VIALS w/HCL GRO AK101 Benzene, Napthlene
2-1 Lt Amber w/HCL for GRO/RRO AK101/AK102

SAMPLING PERSONNEL

Name: Aaron Jambrosic

Company: AECOM

APPENDIX L

ADEC Checklists
(Provided on CD)

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 2, 2009

CS Report Name: NE Cape St. Lawrence Island

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tacoma

Laboratory Report Number: 580-14560

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

   (•) Yes ( ) No Comments:

   All samples were analyzed by TestAmerica-Tacoma

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

   ( ) Yes ( ) No Comments:

   Not Applicable

2. Chain of Custody (COC)

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

   (•) Yes ( ) No Comments:

   b. Correct analyses requested?

   (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(●) Yes ( ) No Comments:

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

(●) Yes ( ) No Comments:

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

(●) Yes ( ) No Comments:

All samples were received in good condition.

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

( ) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected? Explain.

Comments:

Data quality is sufficient for project purposes.

4. Case Narrative

a. Present and understandable?

(●) Yes ( ) No Comments:

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

(●) Yes ( ) No Comments:

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes. The method blank had reportable results between the MDL and PQL, sample results were flagged B. The method blank also had surrogate recoveries above the method acceptance limit, no sample results were impacted. Samples 14560-2 and-4 were diluted due to presence of target analytes, the dilution made quantitation of surrogates impractical.

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

(•) Yes ( ) No Comments:

c. All soils reported on a dry weight basis?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

Comments:

Sample analysis and reporting was acceptable for project purposes.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

The method blank had positive results reported between the MDL and PQL. Affected sample results are B flagged.

iii. If above PQL, what samples are affected?

Comments:

The positive result was below the PQL.

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

(•) Yes ( ) No Comments:

v. Data quality or usability affected? Explain.

Comments:

Sample results are usable for project purposes. The sample results were greater than 10 times the concentration reported in the method blank.

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

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

Not applicable

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

Comments:

Not applicable

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

○ Yes ● No Comments:

No data flags were assigned based on Laboratory sample recoveries.

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

Comments:

Sample results are usable for project purposes without qualification.

c. Surrogates – Organics Only

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

● Yes ○ No Comments:

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

○ Yes ● No Comments:

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

● Yes ○ No Comments:

Samples 58-14560-2 and -4 were diluted and suitable surrogate results were not obtained. The extraction method blank reported surrogate recoveries exceeding method acceptance limits. Data flags (X)were assigned to sample results indicating surrogate recoveries were outside of acceptance limits.

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

Comments:

Sample results are usable for project purposes. The flagged results are considered estimates.

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

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

○ Yes ● No Comments:

Samples were submitted for DRO analysis only.

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

○ Yes ○ No Comments:

Not applicable

iii. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Not applicable

e. Field Duplicate

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

○ Yes ● No Comments:

.

ii. Submitted blind to lab?

○ Yes ○ No Comments:

Not applicable

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ○ No Comments:

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

Comments:

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Samples were collected with disposable equipment that was not reused.

ii. If above PQL, what samples are affected?

Comments:

iii. Data quality or usability affected? Explain.

Comments:

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 5, 2009

CS Report Name: NE Cape Landfill and ISCO Study

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tacoma

Laboratory Report Number: 580-14753

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?
      - [x] Yes - [ ] No Comments:

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?
      - [x] Yes - [ ] No Comments:

      TOC samples were sub-contracted to TestAmerica-West Sacramento for analyses.

2. Chain of Custody (COC)

   a. COC information completed, signed, and dated (including released/received by)?
      - [x] Yes - [ ] No Comments:

   b. Correct analyses requested?
      - [x] Yes - [ ] No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

All samples were received in good condition.

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

(•) Yes ( ) No Comments:

Custody seals were not present on cooler per the cooler receipt form.

e. Data quality or usability affected? Explain.

Comments:

Sample results are usable for project purposes.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes. Some results are considered estimates due minor QC issues.

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

(•) Yes ( ) No Comments:

c. All soils reported on a dry weight basis?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

Comments:

Sample analyses were performed within holding times and reporting limits met project data quality objectives.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

iii. If above PQL, what samples are affected?

Comments:

The GRO method blank had positive results between the MDL and PQL. All sample result were more than 1000 times the concentration found in the method blank.

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

(•) Yes ( ) No Comments:

Affected samples are assigned a B.

v. Data quality or usability affected? Explain.

Comments:

Sample results are unaffected by the positive method blank result.

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

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

Comments:

Not applicable

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

○ Yes ○ No Comments:

Laboratory control samples met control limits for accuracy and precision.

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

Comments:

Sample results are usable for project purposes.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

Some sample surrogate recoveries were outside of method acceptance limits.

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

◉ Yes ○ No Comments:

Samples with surrogate recoveries outside of method acceptance limits are flagged X. 8260 sample results with only one surrogate out of method acceptance limits may not be flagged.

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

Comments:

All sample results are usable for project purposes. Some results are considered estimates due to minor QC issues such as surrogate recoveries.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

iii. All results less than PQL?

(•) Yes ( ) No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

(•) Yes ( ) No Comments:

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

( ) Yes (•) No Comments:

GRO, DRO, Benzene and Naphthalene results did not meet precision limits.

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

Comments:

Data quality objectives for precision were not met for some analytes. TOC and RRO results were within RPD limits.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Samples were collected with disposable equipment.

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 7, 2009

CS Report Name: NE Cape ISCO Study and Drum Removal

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tacoma

Laboratory Report Number: 580-14864

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

      (•) Yes ( ) No Comments:

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

      ( ) Yes ( ) No Comments:

      Not applicable

2. Chain of Custody (COC)

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

      (•) Yes ( ) No Comments:

   b. Correct analyses requested?

      (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Sample 09NCMOCGW09 was received without preservative. The laboratory added sufficient preservative prior to extraction and analysis.

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

( ) Yes ( ) No Comments:

All samples were received in good condition with minor exceptions. Samples MOCGW07, -GW08 and –GW11 were received with bubbles in one or more VOA vials. Sample containers without bubbles or the smallest bubbles were used for analysis.

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

(•) Yes ( ) No Comments:

The sample times on 09NDMOCGW10 bottles were 1640, the CoC had 1650. Data unaffected. Sample 09NCMOCGW09 had 2 preserved polys submitted and 09NCMOCGW10 had 2 unpreserved polys submitted. The samples were field duplicates and the mis-labeling did not affect sample results.

e. Data quality or usability affected? Explain.

Comments:

The minor errors in sample times and identification were resolved prior to analysis. Samples with bubbles greatest than 6 mm were not analyzed. Sample results were unaffected.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

The 8260 LCS had low TFT (surrogate) recovery. All other surrogates were within limits. No further action required.

c. Were all corrective actions documented?

○ Yes ○ No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes. Samples analyses past recommended holding times were flagged and are considered estimates.

5. Samples Results

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

◉ Yes ○ No Comments:

b. All applicable holding times met?

○ Yes ◉ No Comments:

The initial sulfate analysis was within holding time though the result exceeded the upper calibration range. Samples were reanalyzed past holding time with similar results. The affected samples are flagged E and are considered estimates.

c. All soils reported on a dry weight basis?

○ Yes ○ No Comments:

All samples were water samples.

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

◉ Yes ○ No Comments:

e. Data quality or usability affected?

Comments:

Some samples were reanalyzed past holding times (sulfate). Results are considered estimates.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

Metals analysis had reportable chromium below the PQL. Sample results are flagged B.

iii. If above PQL, what samples are affected?

Comments:

The blank chromium result was less than the PQL. Sample results were mostly less than 10 times the method blank result, all chromium results were B flagged.

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

(•) Yes ( ) No Comments:

Affected results are B flagged.

v. Data quality or usability affected? Explain.

Comments:

Chromium sample results are usable and considered estimates.

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

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

Comments:

Not applicable

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

○ Yes ○ No Comments:

Not applicable

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

Comments:

Data quality objectives were met for laboratory QC accuracy and precision.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not applicable

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

Comments:

Data quality objectives were met for sample surrogate recoveries.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

iii. All results less than PQL?

◉ Yes ○ No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

◉ Yes ○ No Comments:

ii. Submitted blind to lab?

◉ Yes ○ No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

◉ Yes ○ No Comments:

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

Comments:

Data quality objectives were met for field duplicate analyses.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by:	Marty Hannah
Title:	Project Chemist
Date:	October 7, 2009
CS Report Name:	NE Cape ISCO Study and Drum Removal
Report Date:	
Consultant Firm:	Bristol Environmental Remediation Services
Laboratory Name:	TestAmerica-Tacoma
Laboratory Report Number:	580-15053
ADEC File Number:	
ADEC RecKey Number:	

1. Laboratory

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

      (•) Yes ( ) No Comments:

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

      ( ) Yes ( ) No Comments:

      Not applicable

2. Chain of Custody (COC)

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

      (•) Yes ( ) No Comments:

      Relinquished by name was typed.

   b. Correct analyses requested?

      (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

Three coolers were shipped, all were within range.

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for sample shipment and preservation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

The DRO and RRO LCS/LCSD failed RPD limits. Samples were re-extracted past holding time with passing QC but marginal comparison on sample results.

c. Were all corrective actions documented?

(•) Yes ( ) No Comments:

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

Comments:

DRO/RRO sample results are considered estimates. They are still usable for project purposes.

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

( ) Yes (•) No Comments:

The trip blank was analyzed 14 days past holding time. DRO/RRO samples were re-extracted past holding time.

c. All soils reported on a dry weight basis?

( ) Yes ( ) No Comments:

All samples were water samples.

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

(•) Yes ( ) No Comments:

All samples were water samples.

e. Data quality or usability affected?

Comments:

Data quality objectives were met with noted exceptions.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not applicable

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

The DRO/RRO LCS/LCSD failed to meet RPD limits but all were within acceptance limits.

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

Comments:

All DRO/RRO samples were affected. Samples were re-extracted past holding time with passing QC but marginal comparison of sample results.

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

(•) Yes ( ) No Comments:

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

Comments:

Overall data quality for laboratory QC accuracy and precision was met with noted exceptions.

c. Surrogates – Organics Only

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

(•) Yes ( ) No Comments:

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

( ) Yes (•) No Comments:

DRO/RRO samples had surrogate recoveries outside of acceptance limits due to target analytes or high dilutions.

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

(•) Yes ( ) No Comments:

Samples with surrogate recoveries outside of method acceptance limits are flagged X and are considered estimates.

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

Comments:

Samples with failed surrogate recoveries are still usable for project purposes, their results are considered estimates.

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

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

iii. All results less than PQL?

(•) Yes ( ) No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

The trip blank was analyzed 14 days past holding time. The result was non-detect and is considered an estimate.

e. Field Duplicate

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

(•) Yes ( ) No Comments:

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

(•) Yes ( ) No Comments:

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

Comments:

Data quality objectives were met for field duplicate precision.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 12, 2009

CS Report Name: NE Cape ISCO Study and Drum Removal

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tcoma

Laboratory Report Number: 580-15084

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

      (•) Yes ( ) No Comments:

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

      ( ) Yes ( ) No Comments:

      Not applicable

2. Chain of Custody (COC)

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

      (•) Yes ( ) No Comments:

   b. Correct analyses requested?

      (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

The cooler temperature blank measured 0.6 degrees upon receipt at the laboratory.

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Some samples were not shipped in inner plastic bags.

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

( ) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for sample shipment and documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

Some samples were reanalyzed at a dilution due to high target analytes.

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

Comments:

Overall project data quality objectives were met with some minor QC issues.

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

( ) Yes (•) No Comments:

Benzene and naphthalene by 8260 and TOC samples were analyzed past holding time.

c. All soils reported on a dry weight basis?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

Comments:

Project data quality objectives were met for timely analyses and reporting levels.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks.

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

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

The naphthalene and DRO/RRO MS/MSD failed to meet recovery limits.

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

○ Yes ◉ No Comments:

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

Comments:

Sample MOCSB14 (15084-2) did not meet 8260 and AK102/103 recovery limits.

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

○ Yes ◉ No Comments:

The results are flagged for failed surrogate recoveries and analyses outside of holding times.

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

Comments:

Overall data quality for laboratory accuracy and precision was met. The sample matrix and presence of high concentrations of target analytes makes the MS/MSD recoveries difficult to evaluate. The concentrations of target analytes were greater than 4 times the spike concentration.

c. Surrogates – Organics Only

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

(•) Yes ( ) No Comments:

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

( ) Yes (•) No Comments:

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

(•) Yes ( ) No Comments:

Samples with failed or non-reported surrogate recoveries are flagged X and are considered estimates. Samples were diluted due to presence of high concentrations of target analytes.

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

Comments:

Overall data quality objectives were met for surrogate recoveries.

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

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

iii. All results less than PQL?

◉ Yes ○ No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

◉ Yes ○ No Comments:

ii. Submitted blind to lab?

◉ Yes ○ No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ◉ No Comments:

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

Comments:

The field duplicates failed to meet 50% RPD limits for (waiting to hear from mark Heaston)

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 12, 2009

CS Report Name: NE Cape ISCO Study and Drum Removal

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tacoma

Laboratory Report Number: 580-15087

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

      (•) Yes ( ) No Comments:

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

      ( ) Yes ( ) No Comments:

      Not Applicable

2. Chain of Custody (COC)

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

      (•) Yes ( ) No Comments:

   b. Correct analyses requested?

      (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

All samples were received in good condition.

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

(•) Yes ( ) No Comments:

Some sample labels were incomplete. The information was obtained from the chain of custody.

e. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for sample shipment and documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were performed.

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

Comments:

Sample results are usable for project purposes with some qualifications. Qualified results may be considered estimates.

5. Samples Results

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

◉ Yes ○ No Comments:

b. All applicable holding times met?

○ Yes ◉ No Comments:

Naphthalene by method 8260 was initially analyzed within holding time but with concentrations that exceeded the instrument calibration range. Samples were reanalyzed at a dilution outside of holding times.

c. All soils reported on a dry weight basis?

○ Yes ○ No Comments:

All samples were water samples.

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

◉ Yes ○ No Comments:

e. Data quality or usability affected?

Comments:

Overall data quality objectives were met with some samples analyzed outside of holding times. The sample results from analyses outside of holding times are considered estimates.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No Comments:

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks.

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

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

◉ Yes ○ No Comments:

A single LCS was analyzed for some 8260 batch analyses along with MS/MSD.

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

○ Yes ○ No Comments:

Not applicable

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

○ Yes ◉ No Comments:

The 8260 MS/MSD failed to meet recovery limits.

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

○ Yes ◉ No Comments:

The 8260 MS/MSD failed to meet RPD limits.

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

Comments:

Sample 15087-3 (MOCGW23) for 8260 is considered an estimate due to its failed MS/MSD. The result has already been flagged for surrogate recoveries outside of acceptance limits.

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

◉ Yes ○ No Comments:

Yes, the results are flagged for failed surrogate recoveries.

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

Comments:

Overall project data quality objectives have been met for laboratory accuracy and precision. LCS recoveries met acceptance limits, MS/MSD recoveries for 8260 and DRO/RRO failed to meet method acceptance limits.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

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

◉ Yes ○ No Comments:

Samples with failed surrogate recoveries are flagged X and are considered estimates.

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

Comments:

Samples with failed surrogate recoveries are flagged X and are considered estimates.

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

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

iii. All results less than PQL?

○ Yes ○ No Comments:

Yes, benzene was reported between the MDL and PQL in the trip blank.

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

◉ Yes ○ No Comments:

ii. Submitted blind to lab?

◉ Yes ○ No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ◉ No Comments:

The field duplicate did not met RPD criteria for RRO, benzene and naphthalene.

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

Comments:

The primary and duplicate samples were analyzed at a dilution which may have led to poor precision.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Flags are used to identify sample results with minor QC issues. A key is at the bottom of each reduced data table to clearly identify the QC issue.

Laboratory Data Review Checklist

Completed by:	Marty Hannah
Title:	Project Chemist
Date:	October 12, 2009
CS Report Name:	NE Cape ISCO Study and Drum Removal
Report Date:	
Consultant Firm:	Bristol Environmental Remediation Services
Laboratory Name:	TestAmerica-Tacoma
Laboratory Report Number:	580-15185
ADEC File Number:	
ADEC RecKey Number:	

1. Laboratory

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not Applicable

2. Chain of Custody (COC)

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

◉ Yes ○ No Comments:

b. Correct analyses requested?

◉ Yes ○ No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected? Explain.

Comments:

Project data quality objectives were met for sample shipment and documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes. Some results have been qualified for holding times and DRO/RRO samples were analyzed at a dilution so surrogate recoveries were not reported.

5. Samples Results

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

◉ Yes ○ No Comments:

b. All applicable holding times met?

○ Yes ◉ No Comments:

Naphthalene was analyzed within holding time, the results exceeded the calibration range. The samples were reanalyzed at a dilution outside of holding time.

c. All soils reported on a dry weight basis?

○ Yes ○ No Comments:

All samples were water samples.

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

◉ Yes ○ No Comments:

e. Data quality or usability affected?

Comments:

Overall data quality objectives were met for timely analyses and reporting levels.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No Comments:

The DRO/RRO method blank had positive results below the PQL. Sample results were greater than 10 times greater than the method blank results. No flags were assigned.

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

No data flags were assigned to the data table, the laboratory report had flagged the results.

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not applicable

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

The naphthalene and DRO/MS/MSDs did not meet recovery or RPD limits due to high concentrations of target analytes, which were greater than 4 times the spike amount. All LCS/LCSDs met recovery limits so matrix interference is implied.

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

Comments:

Samples were not affected by the failed MS/MSD recoveries.

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

○ Yes ◉ No Comments:

No flags were assigned based on failed MS/MSD recoveries.

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

Comments:

Sample results are usable for project purposes.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

DRO/RRO surrogates were not reported due to sample dilution.

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

◉ Yes ○ No Comments:

DRO/RRO sample results are flagged X due to surrogates not being reported due to dilution.

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

Comments:

Sample results are usable for project purposes. Flagged results are considered estimates.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

iii. All results less than PQL?

◉ Yes ○ No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

◉ Yes ○ No Comments:

ii. Submitted blind to lab?

◉ Yes ○ No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ◉ No Comments:

The DRO RPD was 33%, all other results met RPD limits.

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

Comments:

Project data quality objectives were met for field duplicates.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Data flags have been properly assigned to sample results.

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 13, 2009

CS Report Name: NE Cape ISCO Study and Drum Removal

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Tacoma

Laboratory Report Number: 580-15434

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

Not applicable

2. Chain of Custody (COC)

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

(•) Yes ( ) No Comments:

b. Correct analyses requested?

(•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Additional methanol was added to some samples due to the soil being composed of mostly peat.

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

(•) Yes ( ) No Comments:

All samples were received in good condition.

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

(•) Yes ( ) No Comments:

Sample labels were incomplete and did not fully match CoC.

e. Data quality or usability affected? Explain.

Comments:

Project data quality objectives were met for sample shipment and documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Some surrogates were outside of control limits or not reported due to dilutions and the MS/MSD failed for DRO/RRO. The method blank had positive results below the PQL. Samples not affected.

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes. Some are qualified as estimates due to minor QC issues.

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

(•) Yes ( ) No Comments:

c. All soils reported on a dry weight basis?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

Comments:

Project data quality objectives were met for timely analyses and reporting levels.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

The DRO method blank had positive results between the MDL and PQL. All sample results were greater than 10 times the concentration in the method blank. No flags were assigned based on method blank results.

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

No data flags were assigned.

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks.

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

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

The DRO/RRO and TOC MS/MSD failed to meet acceptance limits. Heterogeneous sample matrix is suspected.

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

○ Yes ◉ No Comments:

The DRO/RRO and TOC MS/MSD failed to meet soil RPD limits.

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

Comments:

Sample results were not flagged based on MS/MSD recoveries.

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

○ Yes ◉ No Comments:

No data flags were assigned based on MS/MSD recoveries.

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

Comments:

Overall project data quality objectives were met for laboratory QC precision and accuracy.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

○ Yes ◉ No Comments:

Most GRO samples had high surrogate recoveries (200%+).DRO/RRO samples were diluted due to high concentrations of target analytes thus the surrogates were not reported due to the dilutions.

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

◉ Yes ○ No Comments:

Affected samples are flagged X.

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

Comments:

Overall data quality objectives were met for surrogates. Some results will be considered estimates due to their surrogate recoveries.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

iii. All results less than PQL?

(•) Yes ( ) No Comments:

The trip blank had positive GRO results below the PQL.

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for trip blanks.

e. Field Duplicate

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

(•) Yes ( ) No Comments:

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

(•) Yes ( ) No Comments:

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

Comments:

Data quality objectives were met for field duplicate precision.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by:	Marty Hannah
Title:	Project Chemist
Date:	October 12, 2009
CS Report Name:	NE Cape ISCO Study and Drum Removal
Report Date:	
Consultant Firm:	Bristol Environmental Remediation Services
Laboratory Name:	TestAmerica-Tacoma
Laboratory Report Number:	580-15437
ADEC File Number:	
ADEC RecKey Number:	

1. Laboratory

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

   (•) Yes ( ) No Comments:

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

   ( ) Yes ( ) No Comments:

   Not applicable

2. Chain of Custody (COC)

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

   (•) Yes ( ) No Comments:

   b. Correct analyses requested?

   (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

All samples were received in good condition.

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

( ) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for sample shipment and documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Arsenic was reported in the method blank below the MDL but less than 5 times reported in the samples. The RRO MS/MSD failed to meet recovery limits due to high target analytes.

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

Sample results are usable for project purposes.

5. Samples Results

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

- [x] Yes - [ ] No Comments:

b. All applicable holding times met?

- [x] Yes - [ ] No Comments:

c. All soils reported on a dry weight basis?

- [ ] Yes - [ ] No Comments:

All samples were water samples.

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

- [x] Yes - [ ] No Comments:

Sample 15437-3 was analyzed at a 1000 dilution but had results between the MDL and PQL. The sample result is J flagged.

e. Data quality or usability affected?

Comments:

Data quality objectives were met for timely analyses and reporting levels.

6. QC Samples

a. Method Blank

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

- [x] Yes - [ ] No Comments:

ii. All method blank results less than PQL?

- [x] Yes - [ ] No Comments:

The arsenic method blank had positive results below the PQL but some sample results were less than 5 times the blank concentration. Sample results are flagged B.

iii. If above PQL, what samples are affected?

Comments:

See note above.

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

(•) Yes ( ) No Comments:

Affected samples are flagged B.

v. Data quality or usability affected? Explain.

Comments:

Data quality objectives were met for method blanks with the noted exception.

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

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

( ) Yes (•) No Comments:

The RRO MS/MSD exceeded recovery limits.

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

(•) Yes ( ) No Comments:

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

Comments:

Sample results were not affected due to high target analyte in the MS/MSD sample.

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

○ Yes ◉ No Comments:

No data flags were assigned based on QC recoveries.

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

Comments:

Overall data quality objectives were met for laboratory QC accuracy and precision.

c. Surrogates – Organics Only

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not applicable

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

Comments:

Data quality objectives were met for surrogates.

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

iii. All results less than PQL?

(•) Yes ( ) No Comments:

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

A 7 mm bubble was noted in one of the trip blank VOA vials.

e. Field Duplicate

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

(•) Yes ( ) No Comments:

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

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

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

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

( ) Yes (•) No Comments:

The field duplicate met RPD precision limits on all analytes except sulfate.

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

Comments:

Data quality objectives were met for field duplicate precision.

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

○ Yes ○ No ◉ Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

Laboratory Data Review Checklist

Completed by: Marty Hannah

Title: Project Chemist

Date: October 7, 2009

CS Report Name: NE Cape ISCO Study and Drum Removal

Report Date:

Consultant Firm: Bristol Environmental Remediation Services

Laboratory Name: TestAmerica-Anchorage

Laboratory Report Number: ASG0063

ADEC File Number:

ADEC RecKey Number:

1. Laboratory

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

   (●) Yes ( ) No Comments:

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

   ( ) Yes ( ) No Comments:

   Not applicable

2. Chain of Custody (COC)

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

   (●) Yes ( ) No Comments:

   Relinquished by was typed, not signed.

   b. Correct analyses requested?

   (●) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

Samples were for DRO only. Samples were received with some ice in the samples.

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

(•) Yes ( ) No Comments:

Two of the three samples were received partly frozen.

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

( ) Yes ( ) No Comments:

No discrepancies were noted except for partially frozen samples.

e. Data quality or usability affected? Explain.

Comments:

Data quality was unaffected from being partially frozen. All results are usable for project purposes.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

No discrepancies were noted.

c. Were all corrective actions documented?

( ) Yes ( ) No Comments:

No corrective actions were required.

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

Comments:

5. Samples Results

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

(•) Yes ( ) No Comments:

b. All applicable holding times met?

(•) Yes ( ) No Comments:

c. All soils reported on a dry weight basis?

( ) Yes ( ) No Comments:

Water samples only.

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

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

Comments:

Data quality objectives were met for timely analyses and reporting levels.

6. QC Samples

a. Method Blank

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

(•) Yes ( ) No Comments:

ii. All method blank results less than PQL?

(•) Yes ( ) No Comments:

iii. If above PQL, what samples are affected?

Comments:

Not applicable

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

○ Yes ○ No Comments:

No data flags were assigned.

v. Data quality or usability affected? Explain.

Comments:

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

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

◉ Yes ○ No Comments:

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

○ Yes ○ No Comments:

Not applicable

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

◉ Yes ○ No Comments:

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

◉ Yes ○ No Comments:

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

Comments:

Not applicable

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

○ Yes ○ No Comments:

Not applicable

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

Comments:

Data quality objectives were met for laboratory accuracy and precision.

c. Surrogates – Organics Only

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

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

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

( ) Yes ( ) No Comments:

Not applicable

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

Comments:

Data quality objectives were met for surrogate recoveries.

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

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

( ) Yes ( ) No Comments:

Not applicable, samples were submitted for DRO analyses only.

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

( ) Yes ( ) No Comments:

Not applicable

iii. All results less than PQL?

( ) Yes ( ) No Comments:

Not applicable

iv. If above PQL, what samples are affected?

Comments:

Not applicable

v. Data quality or usability affected? Explain.

Comments:

Not applicable

e. Field Duplicate

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

○ Yes ◉ No Comments:

A laboratory duplicate analysis was performed on sample ASG0063-3. It met RPD limits.

ii. Submitted blind to lab?

○ Yes ○ No Comments:

Not applicable

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

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

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

◉ Yes ○ No Comments:

The duplicate met precision criteria

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

Comments:

All results are usable for project purposes without qualification.

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

○ Yes ○ No ● Not Applicable

i. All results less than PQL?

○ Yes ○ No Comments:

Not applicable

ii. If above PQL, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected? Explain.

Comments:

Not applicable

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

a. Defined and appropriate?

● Yes ○ No Comments:

No flags were assigned to any data from this SDG.

APPENDIX M

Comments and Response to Comments

Main Operations Complex Area Phase I In Situ Chemical Oxidation Summary Report Draft: March 2010

Contaminated Site: Northeast Cape, St. Lawrence Is., AK
ADEC File #: 475.38.013
Reviewer: ADEC – Curtis Dunkin
Date Submitted: May 24, 2010

1.	Section 2.4.2 page 5	Spelling: "Lead is also elevated [at] various…"		This correction was made.	
2.	2.4.3 page 5	Please insert Table 1; as well as other tables throughout document.		Tables will be left in the appendix	
3.	Section 3.0 page 7	Misspelling: "…execution of efforts are provide[d] in…"		This correction was made.	
4.	Sections 3.3 and 3.4 page 9	The bench scale tests should have been conducted prior to the pilot study, even if this resulted in delaying the pilot study for one year. The soil lithology test pits and soil profile characterization should have also been completed thoroughly prior to the bench scale test in order to collect representative soils to be used in the bench scale for the purpose of determining potential effectiveness of the ISCO.		Comment acknowledged; schedule was outside the control of AECOM	
5.	Section 3.7.1 page 12	The report does not have a comprehensive table of all soil and water baseline sampling data - please include.		Comparable analytical data from the field pilot is presented in new tables (Tables 16 and 17). These tables that are analogous to Tables 8 and 9 presented in Appendix K .	

6.	Section 3.6.2 page 12 and table H-1	Narrative states that oxidant injections were conducted using an alternating pulse sequence of batch volumes <100 gallons, however table H-1 states totalizer volumes of up to 1,144 gallons. Please clarify in this section. Table H-1 states on the top of page 1 of 4 and 3 of 4 total chemical and total injected volumes that do not correlate with the slug/batch and totalizer volumes. Please clarify/correct.		Table presents the cumulative volumes of chemical solution and / or flush water delivered at that time for each batch and the total volume of liquid delivered for all batches. Please note that Pages 1 and 2 of 4 are data for ICOIW01 (see text just below Location ID column header), while Pages 3 and 4 of 4 are data for ICOMW09. Thus, total chemical and injection volumes are indicated for two different injection locations. Upon review, it was noted that the total injected volume for ICOIW01 was short 30 gallons. The revision is made and a new table is included.	
7.	Section 3.11 pages17-18	For the same reasons in comment #4 above, delineating the soil profile, lithology, and general depth to ground water variations would have allowed for better decision making for pilot study location(s) and would have provided the necessary and much needed information required to conduct an ISCO study successfully.		Comment acknowledged; schedule was outside the control of AECOM	
8.	Section 6.2.2 page 32	Misspelling: (last paragraph) "…greater than 400 mV in nearly all reaction[s]."		This correction was made.	
9.	Section 6.3.2.1	Completion of the bench scale study prior to the pilot study would have confirmed the peat's extensive oxidant demand, which resulted in gross		Comment acknowledged; schedule was outside the control of AECOM	

	page 37	increases in COC's in groundwater. The bench scale study would have also determined that the soils at NECape are not well-suited to ISCO due to the fact that oxidants are mainly desorbing the DRO resulting in increased groundwater contamination, while being spent on oxidizing the peat material.			
10	Section 6.3.2.1 page 37 Table H-2	Stated pH ranges on page 37 do not correlate with pH ranges stated in Table H-2 – also unclear since there is not a table for baseline groundwater data. pH ranges for treated samples range between negative ten (-10) and +9.66. Please clarify. Please explain rationale and justify negative pH ranges. Please explain why N/A is entered in the data cells for ICOMW04 on 8/13/09. pH and DO data for the 8/13/09 sampling event of ICOMW05 appears to be switched – please correct.		Correlations are not expected. Section 6.3.2.1 discusses treatability bench study testing activities conducted in Orlando, Florida. Table H-2 presents data on field monitoring that occurred during injection activities on St. Lawrence Island. The negative pH ranges are recorded as indicated by the meter at the time of monitoring, but it is acknowledged that these values are not of practical use. This is most likely a function of interference across the electrode due to the extreme redox conditions present. Data was not collected at the 8 foot interval on 8/13/09; N/A was entered as a place holder. ORP, DO, and pH for the 8/13/09 sampling event were offset. This was corrected in Table H-2.	
11	Tables G-8 and H-2	The treatability study evaluated analytes and water quality criteria that were not included in the pilot study. Please explain.		Table G-5 presents comprehensive analytical data from the bench testing effort where Table H-2 presents field screening data associated with the pilot test.	

				Comparable analytical data from the field pilot is presented in new tables (Tables 16 and 17). These tables are analogous to Tables 8 and 9 presented in Appendix K .	
12	Section 6.6.2.1 page 44	Misspelling second paragraph "…in the upper few fee[t] of the…"		This correction was made.	
13	Section 6.6.2.4 page 46	Misspelling: "These result[s] suggest…"		This correction was made.	
14					
15					
16					
17					
		--- END ---			

REVIEW COMMENTS **PROJECT: W911KB-09-C-0013 ISCO (Phase I) and Intrusive Drum Removal/Landfill Cap**
DOCUMENT: Draft ISCO Summary Report **Location: NE Cape, Alaska**

U.S. ARMY CORPS OF ENGINEERS	**DATE: April 2010** **REVIEWER: Aaron Shewman** **PHONE: 753-5558**	**Action taken on comment by: Mark Heaston / Scott Pittenger of AECOM**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Page 11, Section 3.5.2	Please state the total number of monitoring wells installed.		The following text was inserted into the front of section 3.5.2: A total of 9 monitoring wells were installed as a part of the Phase I ISCO activities.	
2.	Page 17, Section 3.11.1	Please state the total number of monitoring wells installed, and one of the installed monitoring wells was subsequently used as an injection well when short-circuiting occurred via the original injection well.		The following bullet was added to section 3.11.1 to better quantify the first deviation: • A total of nine monitoring wells were installed. Monitoring well ICOMW09 was subsequently used as an injection well after short-circuiting occurred during injection at ICOIW01.	
3.	Page 24, Section 5.1.1	Choose and use only one monitoring well labeling scheme for MW16-1 (aka 16MW1), MW16-2 (aka 16MW2), and MW16-3 (aka 16MW3).		This correction was made.	
4.	Page 26, Section 5.3	First paragraph, please summarize results shown in Table 13 in the text of this section of the report.		The following text was inserted in the first paragraph of section 5.3: Screening results for DRO in soils measured 98 mg/Kg 130 mg/Kg, 13 mg/Kg, and 260 mg/Kg in samples collected from ICOSB01, 02, 03, and 04 respectively.	
5.	Page 27	Last sentence of first paragraph, replace “these” with “this” because this sentence refers to only one monitoring well.		This correction was made.	
6.	Page 40, Section 6.4	At a minimum this should refer to other sections of the report that address Work Plan Section 3.5. Another option would be to add a brief summary here.		The following text was inserted into the beginning of Section 6.4:	

REVIEW COMMENTS **PROJECT: W911KB-09-C-0013 ISCO (Phase I) and Intrusive Drum Removal/Landfill Cap**
DOCUMENT: Draft ISCO Summary Report Location: NE Cape, Alaska

U.S. ARMY CORPS OF ENGINEERS	**DATE: April 2010** **REVIEWER: Aaron Shewman** **PHONE: 753-5558**	**Action taken on comment by: Mark Heaston / Scott Pittenger of AECOM**

Item No.	**Drawing Sheet No., Spec. Para.**	**COMMENTS**	**REVIEW CONFERENCE** **A - comment accepted** **W - comment withdrawn** **(if neither, explain)**	**CONTRACTOR RESPONSE**	**USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)**
				Details regarding the design and construction of the pilot study injection and monitoring well network are provided in Section 3.5.	
7.	Page 42, Section 6.5.1	Describe the dilution method used to go, for example, from an initial concentration of 16%-36% sodium persulfate to 13%-18%. Also describe for iron.		The following text was inserted in section 6.5.1: Dilution of the higher concentration persulfate solutions to delivered concentrations was accomplished by combining liquid volumes of iron solution via an in line mixer, thus achieving the delivery concentration of both reagents via dilution with the other.	
8.	Page 51, Section 7.0	Second paragraph, ninth line, add “in” between “resulting” and “excessive”		This correction was made	
9.	Page 53, Section 8.0	First paragraph, fifteenth line, I assume “geotechnical” should be replaced with “geophysical”.		This correction was made	
10.	Figure 8	Please add a general groundwater flow direction arrow as on Figure 5.		This addition was made to Figure 8.	
11.	Figures 10 and 11	Please show all well screens and DRO sample results, label or define TP as test pits, SB as soil boring, etc. Also could add inferred peat layer between pits and wells since this is an important feature.		A note was added to Figures 10 & 11 indicating DRO data is summarized in Tables 2, 3, 13, and 15. A definition was added that explains the abbreviations used on the Figures and the screen intervals for the MW will be incorporated into the figures.	
12.					
13.					

REVIEW COMMENTS **PROJECT: W911KB-09-C-0013 ISCO (Phase I) and Intrusive Drum Removal/Landfill Cap**
DOCUMENT: Draft ISCO Summary Report **Location: NE Cape, Alaska**

U.S. ARMY CORPS OF ENGINEERS	**DATE: April 2010** **REVIEWER: Aaron Shewman** **PHONE: 753-5558**	**Action taken on comment by: Mark Heaston / Scott Pittenger of AECOM**

Item No.	**Drawing Sheet No., Spec. Para.**	**COMMENTS**	**REVIEW CONFERENCE** A - comment accepted W - comment withdrawn (if neither, explain)	**CONTRACTOR RESPONSE**	**USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)**
14.					
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23.					
24.					
25.					
		--- END ---			

REVIEW COMMENTS **PROJECT: W911KB-09-C-0013 NE Cape**
DOCUMENT: *In Situ* Chemical Oxidation Summary Report, March 2010 **Location: NE Cape, Alaska**

U.S. ARMY CORPS OF ENGINEERS	DATE: April 2010 REVIEWER: Ronald Scrudato PHONE: 845 598 2413 cell	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	SCRUDATO RESPONSE
1.	ISCO Summary	I have previously commented on the ISCO bench and pilot scale assessments conducted at the MOC at the NEC, SLI and my comments continue to focus on the relative timing of the bench/pilot tests and the selection of the site chosen by AECOM to conduct the ISCO.		Comment acknowledged	
2.	summary	The site selected to conduct the pilot is underlain by multiple layers of peat and organic-rich silts and sands. These deposits were evident at the time the trenches and injection points were being installed during the pilot scale phase of the program. Despite the presence of the high organic layers of sediments/soils, AECOM decided to conduct the ISCO pilot scale demonstration in deposits well known to serve as oxidant sinks (oxidant consumers) and knew, or should have known, that the bulk of the oxidizing reagents would be rapidly consumed due to the reaction with the peat and organic rich sediments.		The selected area had the highest contaminant concentrations ever measured for the site, suggesting this area is a primary source area. The purpose of the pilot study was to demonstrate the feasibility of ISCO to provide remediation of the target contaminants of concern, and the area of highest contaminant concentrations should be the most appropriate for such a test.	Despite the presence of the extensive peat deposits, the COE and Bristol decided to continue with the pilot demonstration which was destined to fail due to the presence of the peat deposits. Had there been an assessment of the suitability of the ISCO process based on Bench Scale assessment conducted prior to the field assessments, the efforts and costs of the pilot scale demo would have been avoided. The decisions to continue with the pilot demonstration were made by the COE with guidance from Bristol without the advice or consultation of the RAB.
3.	Summary	AECOM should have followed NORMAL procedures and conducted the bench (lab) scale assessments PRIOR to attempting to demonstrate the technology in the field. Without benefit of the large oxidant demand of the peat and organic sediments that were evident in the results of the		Comment acknowledged. It should be noted by the reviewer that the schedule was not set by AECOM, and the performance timeline made a	The issue was whether ISCO was a viable remedial alternative in the area selected by the COE at the NEC for the 2009

U.S. ARMY CORPS OF ENGINEERS	DATE: April 2010 REVIEWER: Ronald Scrudato PHONE: 845 598 2413 cell	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	SCRUDATO RESPONSE
		bench scale assessments, it is likely they would have selected another section of the MOC to conduct the pilot.. Within the area of the Pilot, the trenches and drill holes used to conduct the pilot, encountered 3-5 feet of peat deposits throughout the ISCO demonstration area.		NORMAL procedural order impossible.	demonstration. Had the bench scale assessment been conducted prior to the pilot scale, field program, it would have clearly demonstrated that ISCO was not a viable technology for the area of the NEC selected by the COE and Bristol to conduct the ISCO technology assessment due to the presence of extensive peat deposits which are known to be oxidant consumers.
4.	Summary	As noted by AECOM, the peat deposits serve as "sponges" for the petroleum products and because of the association and the far greater amount of organic matter associated with the peat, little of the associated contaminants of concern (COCs) were reduced-the peat overwhelmed the amount of available oxidant supplied as a part of the pilot.		Comment acknowledged	
5.	Summary	The use of catalyzed oxidation is to use a reagent and a catalyst to create the desired reactions. Depending on the selected chemicals, the two chemicals may react instantaneously when they come in contact and therefore produce the super oxidants desired to break down the organic contaminants. Use of the same injection points in the relatively impermeable sediments also resulted in the reactions between the reagents and catalysts to occur near the point of injection and therefore did not get far into the downgradient		Comment acknowledged	

REVIEW COMMENTS	PROJECT: W911KB-09-C-0013 NE Cape DOCUMENT: *In Situ* Chemical Oxidation Summary Report, March 2010	Location: NE Cape, Alaska
U.S. ARMY CORPS OF ENGINEERS	DATE: April 2010 REVIEWER: Ronald Scrudato PHONE: 845 598 2413 cell	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	SCRUDATO RESPONSE
		regions before reacting with the contaminants of concern. In other words, the sought after reactions occurred near the injection points thereby limiting the radius of influence of the catalyzed .reactions.			
6.	Summary	The use of ISCO within the MOC was ill planned and destined to failure due to the overwhelming presence of natural organic matter including the peat and organic rich soils and sediments which consumed the oxidizing chemicals and the reaction products.		The pilot test did not fail, but rather it provided that ISCO is not likely to be a viable technology for treating the most highly impacted portion of the site. The pilot study was successful in demonstrating that chemical oxidation is not an appropriate remedy for the most highly contaminated area currently identified at the MOC. This is a scenario where the success of the pilot study lies in the fact that it demonstrates a trialed technology is not appropriate for treatment of very high contaminant concentrations in highly organic soils. Unfortunately conditions at the sight suggest that such organic soils are common within the Phase I ISCO area of Interest and likely serve as a significant sink for contaminants at the site serving as an on going	These decisions resulted in expenditures of thousands of dollars to conduct the pilot scale on efforts that were clearly destined to fail based on the presence of the peat deposit within the area selected by the COE and Bristol to conduct the ISCO pilot assessment.

U.S. ARMY CORPS OF ENGINEERS	DATE: April 2010 REVIEWER: Ronald Scrudato PHONE: 845 598 2413 cell	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	SCRUDATO RESPONSE
				source of contamination to groundwater.	
7.	Summary	ISCO remediation would have been far more effective within the southern regions of the MOC as note in the final AECOM report. A range of monitoring wells drilled within the southern regions of the MOC identified groundwater and associated soils/sediments to be contaminated by petroleum, oils and lubricants (POLs). The concentration of organic-rich soils and sediments increases toward the north within the MOC soils and alluvium The northern regions of the MOC impacted by petroleum products remains a viable area to effectively utilize ISCO to effectively degrade the contaminants of concern (COCs) impacting the groundwater. I agree with the conclusions reached by AECOM that the peat/organic rich soils and sediments within the northern regions of the MOC are NOT suitable for the use of advanced oxidation technologies because of the natural organic matter associated with the soils and sediments. I also concur with AECOM's deduction that the peat deposits and organic rich materials within the northern regions of the MOC serve as absorbents of petroleum products and need to be remediated since they will serve as long term sources and therefore continuing impacts to the MOC and the northern regions of the NEC including to serve as a continuous source of contaminants to the Suqi drainage. Natural attenuation is NOT a viable alternative since these contaminants have been concentrated in the peat and organic rich soils for more than fifty years and yet continue to affect down gradient regions of the site including the surface and		Comment acknowledged	

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	SCRUDATO RESPONSE
		groundwater of the northern MOC and systems to the north.			
8.		What is attributed to the reasonable reduction in COCs in select monitoring wells? For instance:MW08-reductions in GRO in 28 days; MW04-Dramatic reduction of naphthalene in 28 days Why the reductions in these areas and little in others??		Groundwater flow dynamics, advection, dispersion, desorption and oxidation.	
9.		This pilot was pre-destined to fail due to the selection of the site to conduct the pilot ISCO assessment.		Comment acknowledged	

REVIEW COMMENTS | **PROJECT: Northeast Cape Main Operations Complex Area**
DOCUMENT: In-Situ Chemical Oxidation (Phase 1) Summary Report (Draft)

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	**DATE:** 25-May-2010 **REVIEWER: Mike Utley** **PHONE: 907-753-2691**	**Action taken on comment by:**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	General	Laboratory analytical data for this report was included with the Landfill report. The data, including ADEC checklists, should be included with this report so that the report is a stand-alone product. Please include all data in Final version.		Updated ADEC checklists will be included in the final report.	OK
2.	Section 3.1	Text indicates water level measured to 1/100 per inch. Forms indicate water level measured to 1/100 per foot. Please revise as necessary.		Texted changed to: Groundwater levels were measured using an electronic water level indicator and measured to the nearest 1/100th of a foot.	OK

REVIEW COMMENTS

PROJECT: Northeast Cape Main Operations Complex Area
DOCUMENT: In-Situ Chemical Oxidation (Phase 1) Summary Report (Draft)

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	**DATE:** 25-May-2010 **REVIEWER: Mike Utley** **PHONE: 907-753-2691**	**Action taken on comment by:**

Item No.	**Drawing Sht. No., Spec. Para.**	**COMMENTS**	**REVIEW CONFERENCE** A - comment accepted W - comment withdrawn (if neither, explain)	**CONTRACTOR RESPONSE**	**USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)**
3.	Section 3.11.1	2nd deviation: Further detail is needed on the justification (i.e. what about the distribution of contaminants allowed deletion of the deeper injection?) Also, the wp text cited groundwater depth as a measuring guide; bulleted text cites depth bgs as a measuring guide – please relate the two so that the reader has a reference of comparison. 3rd deviation: Please include a justification for the change from 10 foot to 5 foot screen. (After reading the entire document, I know you have a good reason; it would be good to include a basic summary here, though, for completeness.)		The following bullet was added to further describe the 2nd deviation: ▪ The observed distribution of contaminants indicated that the primary zone of contamination was more shallow than originally anticipated allowing for deletion of the deeper injection zone. The following bullet was added to further describe the 3rd deviation: ▪ The observed hydraulic conditions at the site indicated the presence of two discrete aquifers in the area of the pilot test. Screening level analysis indicated the shallow aquifer was significantly more impacted than the deeper confined aquifer. Based on these observations and the relatively thin nature of the upper more contaminated aquifer, well screen lengths were adjust to 5 feet from the originally proposed 10 feet lengths.	OK, thanks. Good response.
4.	Section 5.1.2	A few more details are needed here. For example, did you perform a rising or falling head test? What method/software was used to calculate the rates?		The following text was added to section 5.1.2: Rising and falling head tests were conducted. The corresponding water level and elapsed time values were logged using an In-Situ Inc. transducer. AqteSolv 3.5 software was used to solve for hydraulic conductivity values using the Bouwer-Rice method.	OK

REVIEW COMMENTS **PROJECT: Northeast Cape Main Operations Complex Area**
DOCUMENT: In-Situ Chemical Oxidation (Phase 1) Summary Report (Draft)

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 25-May-2010 REVIEWER: Mike Utley PHONE: 907-753-2691	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
5.	Table 5	Data indicates naphthalene was analyzed by method 8270C-SIM, but electronic data indicate that naphthalene was analyzed by SW8260B. Please evaluate and revise as necessary.		Table was incorrect. Changed table to show benzene and naphthalene by 8260.	OK
6.	Table 13	Data flags are not consistent with those presented in Appendix B. See comment regarding SB02 and SB03 below. Please evaluate and revise as necessary.		Added rows to section 2.9 for DRO surrogate recoveries and blank contamination. Flags in section 2.9 now match Table 13.	OK
7.	Table 15	2009 results are presented without including appropriate data flags. Please update data with appropriate flags.		Table 15 has been modified to include flags and explanations. Flags match section 2.9 of the data verification report.	OK
8.	Appendix B				
9.	TOC discussion	Per the hardcopy data, only one of four TOC batches were sent to Sacremento. Please specify relevant SDG/samples that were sent.		Text modified to read: SDG 580-14753 had the TOC analyses of twelve samples subcontracted to TestAmerica-West Sacramento for analyses. All results from this SDG were reported without qualification. All other TOC analyses were performed by TestAmerica Tacoma.	OK
10.	Table 1	Electronic data doesn't indicate that samples in SDG 14753 were subbed to TA Sacremento; neither do the entries in this table document the subbed TOC samples (as detailed in the bullet just above Table 1). Or were not all TOC samples subbed to TA Sacremento?		EDDs updated to reflect analysis by TA West Sac Bullet above Table 1 now reads: • TestAmerica-Tacoma transferred twelve samples from SDG 14753 to TestAmerica in West Sacramento for analyses of the following: Total organic carbon (TOC) by SW-846 9060	OK

REVIEW COMMENTS **PROJECT: Northeast Cape Main Operations Complex Area**
DOCUMENT: In-Situ Chemical Oxidation (Phase 1) Summary Report (Draft)

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 25-May-2010 REVIEWER: Mike Utley PHONE: 907-753-2691	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
11.	Table 2	SB35 has incorrect laboratory sample number. Please correct. GW13 – SAMPID as reported in electronic data is 09NCMOCGW***0***13 (not consistent with this table – please revise as necessary).		Changed SDG # on Table 2 to correct lab #. 09NCMOCSB35 logged in as 580-15434-10. Sample was on hold; never analyzed. Requested the lab to change the field ID for GW13 in the EDDs.	OK
12.	Section 2.1	Last paragraph – Please delete 2.1.1 and 2.1.2 in Matrix and Holding Time Columns		2.1.1 and 2.1.2 removed from columns	OK

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13.	Section 2.2	Electronic data indicates that an MS/MSD was not performed as part of batches 48286, 49247, 50043, and 50785. Please evaluate and revise text as necessary. Holding time qualifications using J/UJ as text indicates is inappropriate.. Please revise flags to QL. Please discuss impact of all anomalies to data usability; merely stating that "data is usable" without stating why is insufficient.		Section 2.2 text modified on 7-7 to say: SDG 14864 had project samples initially analyzed in batch 48207 which included most samples from this SDG. All QC, including a project MS/MSD, were within acceptance criteria. Samples 09NCMOCGW09, -10 and -11 required dilutions and reanalysis and were analyzed in batch 48286.The samples were re-analyzed within holding times. No matrix spike was performed on project samples in batch 48286, which is a deviation from QSM guidelines. However, LCS spike recoveries were within limits and the data is usable for its purpose of establishing initial concentrations of contaminants before treatment. SDG 15053 had project samples initially analyzed in batch 48996, which included most samples from this SDG All QC, including a project MS/MSD, met acceptance criteria. Samples 09NCMOCGW16, -18 and -19 required dilutions and reanalysis and were analyzed in batch 49247.The samples were re-analyzed within holding times. No matrix spike was performed on project samples in batch 49247, which is a deviation from QSM guidelines. However, LCS spike recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants during treatment. SDG 15185 had project samples initially analyzed in batch 49813, which included most samples from this SDG. The MS/MSD was performed on sample 09NCMOCGW33, which had naphthalene concentrations greater than 4 times the spike amount. The MSD failed to acceptance criteria due to the presence of high target analytes, naphthalene. The benzene recoveries for the MS/MSD met acceptance criteria. All other QC were within method acceptance criteria. No qualification was necessary due to the high concentrations of target analyte in the failed MSD. Samples 09NCMOCGW31 and -32 required dilutions and reanalysis and were analyzed in batch 50043.The samples were re-analyzed outside of holding times as noted below. No matrix spike was performed on project samples in batch 50043, which is a deviation from QSM guidelines. However, LCS and LCSD spike recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants during treatment. SDG 15437 had project samples initially analyzed in batch 50620, which included most samples from this SDG, All QC, including a project MS/MSD met acceptance criteria. Samples 09NCMOCGW42, -44, -45, -46, -47 and -48 were re-analyzed in batch 50785 due to required dilutions or sample carryover. No matrix spike was performed on project samples in batch 50785, which is a deviation from QSM guidelines. However, LCS recoveries were within limits and the data is usable for its purpose of determining concentrations of contaminants after treatment. .	Understood – however, please note that the QSM does not allow the use of a non project sample for MS/MSD analysis. MS/MSD must be from a project sample in all cases. This represents a deviation that must be discussed, and the impact to the data evaluated. Also, please note – if a sample is re-extracted for any reason, the corresponding MS/MSD must also be re-extracted. This again is per QSM guidelines.

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14.	Section 2.3	Holding time qualifications using J/UJ as text indicates is inappropriate.. Please revise flags to QL. Please discuss impact of all anomalies to data usability; merely stating that "data is usable" without stating why is insufficient.		Flagging changed to QL. Section 2.3 now reads: Detected results associated with high recoveries were qualified QH to indicate that one or more QC criteria failed, with a high bias. All results associated with low recoveries were qualified QL to indicate that one or more QC criteria failed, with a low bias. Only one sample had a low surrogate recovery with the remainder exceeded surrogate recovery limits. Matrix interference is suspected in both cases. Sample results are usable as estimates for ISCO study purposes though the accuracy of the results is questionable.	OK

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15.	Section 2.4	Table 5 is missing TA Anchorage batch 9070075. Please update. 2nd para – Note that MS/MSD is required in all lab batches. Deficiencies must be noted and usability impacts assessed. Please revise "MS/MSD was included in the majority of batches and the SAP…." accordingly. MS/MSDs were not performed in lab batches 46874, 50480, and TA Alaska batch 9070075. 4th para – pH not less than 2 requires a flag to indicate potential low bias. Please update and revise accordingly. Please specify dilution of surrogates that were diluted out. Method blanks: Please specify that sample results were greater than 10 times that found in the method blanks, and ***that's why qualification is not required.***		Batch 9070075, extracted on 7-26-09 added to table 5. 2nd para now reads: The following items were reviewed and met SAP/method criteria and were within SAP control limits: MS/MSD RPDs. MS/MSDs were not analyzed in batches 9070075, 46874 and 50480 due to insufficient sample quantities or because MS/MSD was not specified on the chain-of-custody. The LCS/LCSD recoveries and RPDs met control limits. 4th para; A QL qualifier was assigned to the DRO result to indicate potential low bias due to insufficient preservation. Text changed to: Insufficient preservation was used for sample 09NCMOCGW09 (one 1-Liter amber). The hydrogen ion concentration was adjusted at the laboratory prior to preparation using hydrochloric acid. A QL qualifier was assigned to the DRO and RRO results to indicate potential low bias. Dilutions were added to section 2.4 in regards to not reporting surrogates. Method blank contamination wording changed to: DRO and RRO concentrations in associated samples were greater than the RL and greater than 10 times the concentration detected in the method blank, thus qualification was not required.	OK

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16.	Section 2.5	Please re-evaluate blank evaluation. Both As and Cr were detected in method blanks; also, results are impacted if associated with a contaminated method blank and less than 10 times the blank concentration ***regardless of RL***. Please revise accordingly.		Revised text in section 2.5 to read: Chromium was detected in the MB at a concentration greater than the MDL, but less than the RL as follows: Batch No. Analyte Units Concentration MDL RL 580-49209 Chromium mg/L 0.0018 0.00037 0.002 580-50906 Arsenic mg/L 0.0013 0.00024 0.002 Associated results were detected at concentrations >RL but less than ten times the concentration in the method blank, sample results were B flagged with a potential high bias. The results were used as a measurement of treatment effectiveness and are usable for that purpose with qualification. The affected samples are listed in Section 2.9.	OK

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17.	Section 2.6	TOC analyzed by Sacremento is not present in COELT EDF. Please revise. MS/MSD was not performed for batch 50865, contrary to text. Please revise accordingly, and indicate impact on data usability. Holding time qualifications using J/UJ as text indicates is inappropriate.. Please revise flags to QL.		Done-revised EDD received for 14753 Text changed to: Required QC for a batch of up to 20 samples includes a MB and a laboratory duplicate. A MB, LCS, and MS/MSD pair were analyzed per batch with the exception of batch 580-50865. The method QC requirement was met for all other batches. Samples submitted under SDG 580-15434 included an MS/MSD pair but they were extracted in two separate batches, 580-50865 and 580-50999 on successive days. The MS/MSD submitted with SDG 580-15434 was analyzed in batch 580-50999. The MS/MSD recoveries for batch 580-50999 are further described below. The LCS in batch 580-50865 met acceptance limits. Batch precision could not be evaluated for project samples in batch 580-50865. Sample results from SDG 580-15434 were used to determine the effectiveness of the ISCO treatment and results are usable for that purpose. Sample 09NCMOCSB31 was M qualified due to out of control recoveries. Soil matrix heterogeneity at the site may have impacted the accuracy and precision of the sample. Holding times, results changed to QL in Tables and Data Verification report.	OK

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18.	Section 2.7	MS/MSD was not performed for batch 49693, contrary to text. Please revise accordingly, and indicate impact on data usability.		Text changed on 7-7 to: Required QC for a batch of up to 20 samples includes a MB and LCS. A MB and LCS/LCSD, and MS/MSD. Samples from SDG 14864 were initially analyzed on 8-14-09 in QC batch 580-48614. Samples 09NCMOCGW04 and -05 exceeded the calibration range and were diluted and re-analyzed on 9-2-09 in QC batch 49693. Sample 09NCMOCGW06, which was also the MS/MSD sample in batch 580-580-48614, was used as the batch duplicate for 49693 and it met acceptance criteria for duplicate precision. All QC met acceptance criteria in both batches.. Sample results are accepted without qualification for QC other than holding times for the out of range samples that required re-analysis at a dilution. The diluted sample results are qualified QL due to low potential bias from holding time exceedences. **Old text removed.**	Note bolded text – were the samples from 49693 re-extracted? If not, no MS/MSD is required (as long as the MS/MSD were reportable from batch 48614.
19.	Section 2.8.1	1st para (RPD not valid when only one result is detected) – statement is not necessarily true. A comparison of a detected value and a detection limit is still useful information. It is noted, though, that criteria may need to be widened for this situation (but this should have been covered in the QAPP). Please revise language.		First para-4th sentence. The statement actually reads: In cases where a target analyte was not detected above the RL in both the field duplicate and parent sample, an RPD would not be valid, and therefore was not calculated. A result above the RL is considered more accurate than a result reported below the RL due to instrument limitations and signal to noise ratio. The lesser degree of accuracy below the RL is why results get J flagged.	OK

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20.	Section 2.8.1.1	Section needs summary text indicating that the ADEC 10% duplicate requirement was not met, and discuss impact to data quality/usability. Merely stating "data is usable" is not sufficient; please provide a justification in text of report.		Section 2.8.1.1 indicates that the 10% frequency was met. Do you have the correct section?	First bullet – 12% Third bullet – 14% Fourth bullet – 13% Fifth bullet – 14% Percentages listed above are all greater than 10%; therefore ADEC mandated 10% duplicate requirement was not met. **Please address comment.**
21.	Table 9	Please delete "2.8.2" in GRO row of first dataset. Why are SB18/SB21 bolded for DRO/RRO? They meet ADEC guidance criteria. (Would help if acceptance criteria [and source] was detailed here).		Deleted. SB18/SB21 %RPD for DRO/RRO will be unbolded in Table 9 The project specific acceptance criteria for field duplicates were set at 20%, same as the LCS/LCSD and MS/MSD precision criteria. Its stated in section 5.2.2.1 of the SAP/QAPP and the 20% value is in Table 5-6 of the QAPP	OK Actually, Section 5.2.2.1 indicates soil duplicate precision is 50%. This criterion is not listed in Table 5-6. Comment still stands (and must be addressed)

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22.	Section 2.8.2	2nd para – MS/MSD are required by the QSM per laboratory batch. Comments were made to this affect during SAP review. Please update text accordingly. The bulleted list should specify those batches where MS/MSD was not included, instead of listing frequency of occurrence.		The failure to include MS/MSDs in all lab batches are documented under the individual analyses. Not all SDGs-CoCs identified samples for MS/MSD. In some instances, samples were re-extracted and re-analyzed without project samples for MS/MSD, such as TOC. They are noted in the data quality summary. Text changed on 7-8 in section 2.8.2 to read: MS and MSD recoveries and RPDs are discussed in Sections 2.2 through 2.7. Some extraction batches did not include project MS/MSD samples, which is a deviation from the QSM. The failure to include the MS/MSD in the batches, including the impact to data quality, is also addressed in sections 2.2 through 2.7 under the individual analyses.	Section 2.8.2 is a summary. The bulleted text indicates that the frequency was met, which it was not. **Please address comment.** If samples from a given batch are re-extracted and re-analyzed, that batch does not count. You can't use it to report MS/MSD if you are not reporting primary data from that batch. It's a field error if MS/MSD is not properly designated on a COC, but fault is not the issue here. The issue is to document data quality issues against a known standard (the QSM). **Please address comment.**

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23.	Section 2.8.3	2nd para – Water samples indicated were collected 8/19/2009; they could not have been shipped 8/12/2009. Also, note that trip blank contamination is a collection/preparation QC sample, not instrumental (and thus is not subject to dilution considerations). Based on that, the only sample requiring qualification is GW26, with a result of 0.0017 mg/L, which is less than 10X the trip blank result of 0.00023 mg/L. Please revise text accordingly. Please specify SDG that trip blanks are associated with. 3rd para - Qualification is not consistent with QSM criteria. Samples GW41 and GW44 are potentially impacted by trip blank contamination (results are less than 10X blank contamination level). Please revise text and data flags accordingly. 4th para – GRO was detected in the trip blank for two SDGs (15084 and 15434). In 15084, the only impacted sample is SB23, with a result of 4.8 mg/kg, TB result of 0.61 mg/kg); In 15434, SB27 and SB32 are the impacted samples (results of 12 mg/kg and 26 mg/kg, respectively, with a TB result of 3 mg/kg.)		Samples were shipped on 8/21, text changed. Samples -GW23 and -GW25 removed from section 2.8.3 and flag table in section 2.9 SDGs added in section 2.8.3 3rd Para (now 4th), added GW41, GW44 and GW47 as impacted samples. Also added to section 2.9 4th para (now 2nd para), Text added to say: GRO was detected in the trip blank at a concentration greater than the MDL but less than half of the RL with soil samples shipped on August 21 in SDG 15084. GRO was reported at less than ten times the trip blank result in sample 09NCMOCSB23. The sample result is B flagged to indicate trip blank contamination. Added to section 2.9 as well. 4th para (now 5th) added -SB32 and also added in section 2.9	OK OK OK OK OK
24.	Section 2.9	Please update flags as indicated in earlier comments.		Added	

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25.	General	ADEC checklists were not provided. Please provide. Per Table 13 in main report, SB02 and SB04 were impacted by high surrogate recovery. However, there is no mention of this in Appendix B (14560-2 or -4 are not listed as flagged samples). Please evaluate and rectify.		ADEC checklists were sent to Utley for review prior to be submitted into the final report Samples are listed in section 2.4 (columns indicating surrogates were diluted out of reporting levels) and section 2.9. The surrogates were not reported due to dilution, as noted in table 13 and sections 2.4 and 2.9. On 7-8-10 the ADEC checklists were emailed to Mike Utley for review prior to sending the final report.	How can ADEC checklists be reviewed if they are provided with the final report? OK

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26.	COELT	NPDL number is incorrectly reported in SDG ASG0063 (should be 09-034, not ASG0063). Please submit corrected data. LocIDs are not consistent (should not be duplicate of SAMPID). Please submit corrected data. SDGs 15053, 15087, and 15185 are reporting the incorrect Extraction Code for AK102/AK103. Please submit corrected data. Note that all samples require a unique identifier: "Trip Blank" is not unique. Please note for future submittals. PVCCODE is incorrect if you prefer the run outside of hold time to the run that exceeded calibration range as indicated in Section 2.2 of the Data Verification Report (SDG 15087, sample GW21 and GW22). Please revise and resubmit. EXPECTED is incorrect for naphthalene in the MS/MSD for SDG 15053; it's reported as 62.1, but it should be 77.1 (57 + 20.1) per the hardcopy. TOC analyzed by Sacramento (batch 9219575) is not present in COELT EDF. Please revise. PVCCODE is incorrect if you prefer the run outside of hold time to the run that exceeded calibration range as indicated in Section 2.7 of the Data Verification Report (SDG 14864, sample GW04 and GW05). Please revise and resubmit.		Updated SEDD and EDF files will be supplied with final report. Corrected files include 14753, 15053, 15185, 14864, 15087. Will include in future SDGs-"Trip blank" including date and -1. If more than one shipmen t then -2,-3 etc PVCCODE was revised in 14864.	OK, backcheck will be required.
27.	SEDD	Please ensure results reported in TA Sacremento batch 9219575 are reported in correct SEDD file.		Updated SEDD and EDF files will be supplied with final report. 14753, 15053, 15185, 14864, 15087 Corrected EDDs sent on 7-8-10 via email to Utley.	OK, backcheck will be required.
28.		■ End –			

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

January 19, 2010

Programs and Project Management Division
Environmental Special Projects

Dr. Ron Scrudato
2790 Teal Court
St. James City, FL 33956

Dear Dr. Scrudato:

Please find enclosed, a CD copy of the *DRAFT* Main Operations Complex Area, Phase I *In Situ* Chemical Oxidation, Technical Memorandum for the Northeast Cape FUDS, St. Lawrence Island, Alaska, dated January 2010. This document is a precursor to the final report. I do not intend to distribute this to the RAB until it is final, but we are certainly interested in any commentary you might have regarding the Draft.

If you have any questions, please contact me at (907) 753-2689, or by e-mail at carey.c.cossaboom@usace.army.mil.

Sincerely,

Carey Cossaboom
Project Manager

Enclosure: CD

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REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

October 6, 2010

CEPOA-PM-ESP-FUDS

«Title» «FirstName» «LastName»
«Company»
«Address1»
«City», «State» «PostalCode»

Dear «Title» «LastName»:

Please find enclosed, a copy of the Final Northeast Cape Phase I In-Situ Chemical Oxidation Summary Report, dated August 2010.

Please place these documents with the others that make up the St. Lawrence Island Information Repository. These copies are not to be checked out, but left at the repository for anyone to read. Thank you very much!

If you have any questions, please contact me at (907) 753-2689, or by e-mail at carey.c.cossaboom@usace.army.mil.

Sincerely,

Carey Cossaboom
Project Manager

Enclosure

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

October 8, 2010

CEPOA-PM-ESP-FUDS

Ms. Vi Waghiyi
Alaska Community Action on Toxics (ACAT)
505 W. Northern Lights Blvd., Ste 205
Anchorage, AK 99503

Dear Ms. Waghiyi:

Please find enclosed, a copy of the Final Northeast Cape Phase I In-Situ Chemical Oxidation Summary Report, dated August 2010. This document describes the pilot study efforts to assess whether chemical oxidation technology would be a viable method for treating the fuel-contaminated soils at the Main Operations Complex. Unfortunately, the abundant peat in the subsurface there makes the method unworkable. We will be using an alternative remediation method in 2011.

If you have any questions, please contact me at (907) 753-2689, or by e-mail at carey.c.cossaboom@usace.army.mil.

Sincerely,

Carey Cossaboom
Project Manager

Enclosure

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

October 6, 2010

CEPOA-PM-ESP-FUDS

Ron Scrudato
R&M Technologies, Inc.
71 Washington Street
Newburyport, MA 01950

Dear Dr. Scrudato:

Please find enclosed, a copy of the Final Northeast Cape Phase I In-Situ Chemical Oxidation Summary Report, dated August 2010. This document describes the pilot study efforts to assess whether chemical oxidation technology would be a viable method for treating the fuel-contaminated soils at the Main Operations Complex. Unfortunately, the abundant peat in the subsurface there makes the method unworkable. We will be using an alternative remediation method in 2011.

If you have any questions, please contact me at (907) 753-2689, or by e-mail at carey.c.cossaboom@usace.army.mil.

Sincerely,

Carey Cossaboom
Project Manager

Enclosure

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STATE OF ALASKA

SEAN PARNELL, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

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File No: 475.38.013

February 16, 2011

Carey Cossaboom, Project Manager
U.S. Army Corps of Engineers Alaska Dist.
CEPOA-PM-C-FUDS
P.O. Box 6898
JBER, AK 99506-6898

Re: ADEC Approval of the Final August 2010 Northeast Cape Summary Report for the Main Operation Complex Area Phase I In-Situ Chemical Oxidation

Dear Mr. Cossaboom:

Thank you for providing The Alaska Department of Environmental Conservation Contaminated Sites Program (ADEC) with a copy of the Final Northeast Cape Summary Report for the Main Operation Complex Area Phase I In-Situ Chemical Oxidation dated August, 2010, which was received by ADEC on September 21, 2010. ADEC submitted comments and revision requests earlier in 2010 which were made and included in the final summary report. ADEC has approved and is filed this report as the final copy on record.

Please contact me at (907) 269-3053 or curtis.dunkin@alaska.gov if you have any questions regarding this letter.

Sincerely,

Curtis Dunkin
Environmental Program Specialist

Cc Molly Welker, Bristol ERS, LLC (via email)

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