UNDERGROUND STORAGE TANK
SITE INVESTIGATION REPORT
FORMER MAKAH AIR FORCE STATION
NEAH BAY, WASHINGTON

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Air Force Civil Engineer Office

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ACRONYMS

ADR	automated data review
AF	United States Air Force
AFS	Air Force Station
ARI	Analytical Resources, Inc.
BaP	benzo(a)pyrene
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CLARC	Cleanup Levels and Risk Calculations
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DoD	Department of Defense
DP	direct push
DRO	Diesel Range Organics
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
EDRO	extended diesel range organics
Eh	reduction potential
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FAA	Federal Aviation Administration
FD	field duplicate
GATR	Ground/Air Transmitter-Receiver Building
GRO	Gasoline Range Organics
HER	Hazard Evaluation Report
IDW	investigation derived waste
KM	Kaplan-Meier
ln	natural log
LOQ	Limit of Quantitation
MEE	methane, ethane, and ethene
mg/kg	milligram per kilogram
µg/kg	microgram per kilogram
µg/L	microgram per liter
MRO	Motor Oil Range Organics
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
MW	monitoring well
N	normal sample
NWTPH-Dx	Northwest Total Petroleum Hydrocarbon method for Semi-Volatile petroleum products
NWTPH-Gx	Northwest Total Petroleum Hydrocarbon method for Volatile petroleum products
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
pE	oxidation reduction potential
ppm	parts per million
PQLG	project quanititation limit goal
QAPP	Quality Assurance Project Plan

QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
ROS	Regression on Order Statistics
SI	Site Investigation
SQL	sample quantitation limits
SVOC	semi-volatile organic compound
TEF	toxicity equivalency factor
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TTEC	total toxic equivalent concentration
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UST	underground storage tank
VOA	Volatile organic analysis
VOC	volatile organic compound
WAC	Washington Administrative Code
WRCC	Western Regional Climate Center

SECTION 1 – INTRODUCTION

1.1 INTRODUCTION & OBJECTIVES

The Air Force (AF) is conducting characterization and environmental restoration activities at the former Makah Air Force Station (AFS) to investigate, remove, and remediate the release of petroleum constituents from underground storage tanks (USTs) at or from the site due to past AF use and activities. The former USTs under investigation at the Site are located in two primary areas: the Cantonment Area (10 USTs) and the Top Camp Area (16 USTs).

The findings presented in this Report are part of an on-going "phased" investigation at the Site. Descriptions of the phases are as follows:

- Phase I. Nine groundwater monitoring wells in the Cantonment Area were sampled in June 2014. Reconnaissance of former USTs in the Top Camp areas was also performed. Investigation findings are presented in the Phase I Technical Memorandum (USACE, 2015a).
- Phase II. Soil and groundwater samples were collected near former USTs located in the Cantonment and Top Camp areas in accordance with the Quality Assurance Project Plan (QAPP) (USACE, 2014) and subsequent revised worksheets presented in Appendix F of the Phase I Technical Memorandum (USACE, 2014; USACE, 2015a). The Phase II investigation occurred in March 2015 and did not include UST G.
- Phase III. Soil samples were collected near former UST G in accordance with the approved Phase III Site Investigation Work Plan. The Phase III investigation occurred in October 2015. The final Phase III site investigation report completion is scheduled for February 2016.

This Site Investigation (SI) Report (Report) describes the Phase II sampling and investigation activities performed within the Cantonment Area and Top Camp Area. The information presented in this Report will be used by the regulators and stakeholders to determine if UST closure requirements have been met and/or to determine the need for subsequent corrective action(s) at specific areas.

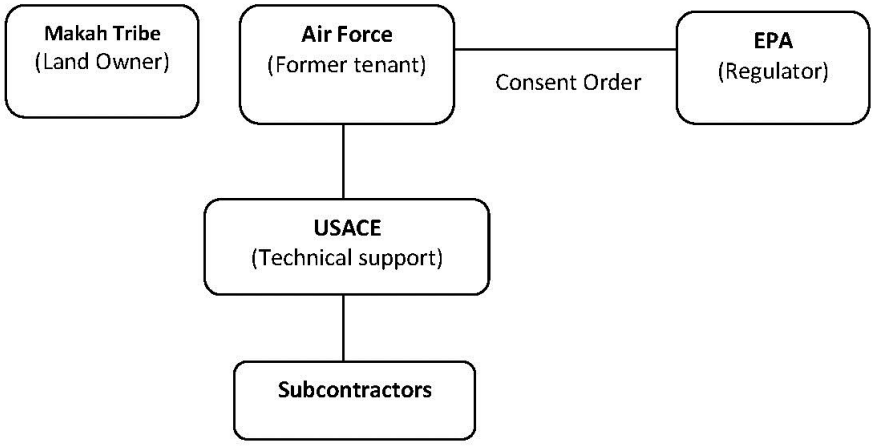
The overall objective of this work is to facilitate successful close-out of 26 USTs that were located in the Cantonment and Top Camp areas of the Site.

1.2 REGULATORY FRAMEWORK

The AF and the United States Environmental Protection Agency (EPA) have entered an Administrative Order on Consent (Consent Order) under the Resource Conservation and Recovery Act (RCRA) UST Program to investigate, remove and remediate the release from USTs of petroleum constituents at or from the Site. Because the Site is located within the Makah Indian Reservation, EPA Region 10 is the implementing agency for the UST program. EPA uses Model Toxics Control Act (MTCA) cleanup levels established by the Washington State Department of Ecology (Ecology) as a guide for determining appropriate cleanup levels for petroleum releases in Indian Country in Washington State. MTCA Method A (Method A) is designed for cleanups that are relatively straight-forward or involve only a few hazardous substances; Method A cleanup levels are considered appropriate for the Site. MTCA regulations and cleanup levels have been promulgated Chapter 173-340 of the Washington Administrative Code (WAC).

1.3 PROJECT TEAM ORGANIZATION

The major stakeholders for the investigation and subsequent corrective actions, if needed, are the Air Force, the Makah Tribe, and the EPA. The United States Army Corps of Engineers (USACE) is providing technical and field support to the AF during this effort.



SECTION 2 – STUDY AREA BACKGROUND

2.1 STUDY AREA LOCATION, DESCRIPTION, AND LAND USE

The former Makah AFS lies within the Makah Indian Reservation (the Reservation), located in the northwest corner of the Olympic Peninsula in the state of Washington (Figure 1). During use, the AF leased approximately 255 acres of land from the Makah Tribe for the AFS. The Reservation, which encompasses approximately 42 square miles, is bordered on the west by the Pacific Ocean and on the north by the Strait of Juan de Fuca. Port Angeles lies approximately 60 miles east of the Reservation. Neah Bay is the only town on the Reservation.

The military facilities at the former AFS were separated into four main areas: cantonment, family housing, Top Camp, and trailer court/family campground. The former USTs under investigation under the Consent Order are located within the Top Camp and Cantonment Areas. Table 1 lists all 26 USTs, installation dates, and other basic information as determined from literature review of available reports. All 26 USTs have either been removed or are no longer used.

According to the Western Regional Climate Center (WRCC), the average annual precipitation at Neah Bay is approximately 100 inches (WRCC, 2015). Three quarters of the annual precipitation occurs during the six-month period from October through March. The Waatch River is the source of domestic water for the town of Neah Bay. Industrial and residential supply wells have been drilled in and around the town. Ridolfi (2005) also reports that at least three public supply wells were drilled for the town by the U.S. Department of Health, but were abandoned due to naturally-occurring inferior water quality and insufficient yield.

2.1.1 CANTONMENT AREA

The Cantonment Area was constructed in the early 1950s to support the former Makah AFS; it is located on Cape Flattery Road near the beaches and estuary where the Waatch River flows into Makah Bay. Buildings and structures in the former Cantonment Area included housing, barracks, maintenance shops, and administration offices.

The Cantonment Area currently contains a mixture of mostly original buildings, paved and unpaved roads, and grassy fields (Figure 2). Current land use of the Cantonment Area is a mixture of commercial and/or industrial. Former dormitories and other structures have been converted into office space used by the local tribal government. Other buildings have retained their original intended uses including mechanical, maintenance, and repair shops. Inactive heavy equipment was observed parked on the southeast portion of the site near the former burn pit. During weekdays, the Cantonment Area is a hub of activity during business hours. There are no known private residences or homes within the Cantonment Area.

Nine groundwater monitoring wells (MW-01 through MW-09) are located in the Cantonment Area in the vicinity and downgradient of the former USTs.

2.1.2 TOP CAMP AREA

The Top Camp is located on Bahokus Peak at an elevation of 1,500 feet above mean sea level. Access is via a steep, single-lane gravel road. The Top Camp Area consists of several small sub-areas which include the Microwave Tower Site (USTs H through O, P, R, S, and W), the Radar Dome Area (USTs T, U, and V), the Ground/Air Transmitter-Receiver (GATR) building (UST X), and former building 102 (UST Q) (Figure 3).

Current land use varies by location. The Federal Aviation Administration (FAA) leases and operates the buildings and radar dome located within a fenced enclosure at the Radar Dome Area. The FAA usually has an on-site caretaker at the facility for a few hours each weekday. However, FAA staff presence at the site was limited during the Phase II investigation. Former USTs T, U, and V are located outside of the fenced enclosure but behind the FAA's gated access road.

The Microwave Tower Site has two fenced areas. Each fenced enclosure contains one tower with associated support structures and facilities. The southern fenced tower and associated facilities are operated by the United States Coast Guard (USCG). The northern fenced area tower and building are marked "Peninsula Telephone," but are currently operated by Century Link.

The GATR and building 102 areas are down the road from the Microwave Tower Site and are no longer used.

2.2 STUDY AREA PHYSICAL SETTING

The two main study areas, Cantonment Area and Top Camp, have distinctly different physical characteristics. Each area is described in more detail in the following sections.

2.2.1 CANTONMENT AREA

The Cantonment Area is relatively flat, approximately 15 feet above mean sea level, and slopes slightly downward towards the southeast. A small creek begins near the northern border of the Cantonment Area and runs southeast through the adjacent wooded area. Near the eastern edge of

the site, the creek flows towards the east, runs beneath the Cape Flattery Road through a culvert, and drains into the Waatch River.

The Cantonment Area was constructed on a sandy floodplain of the Waatch River. The original fine-grained beach sand of the floodplain was covered with a fill layer in the 1950s to level it for construction of the Makah AFS. As such, recent investigations have described Cantonment Area soils as generally consisting of fill material overlying fine silty sand. The fill material, consisting of sandy gravel with occasional cobbles, is mostly continuous over the Site and extends to depths ranging from 2 to 7 feet below ground surface (bgs) (Ridolfi, 2008a; Shannon & Wilson, 1990).

Groundwater has been observed in the Cantonment Area at depths ranging from 2 to 7 feet bgs. Figure 4 shows the Cantonment Area groundwater depths relative to an arbitrary elevation of 100 ft. Groundwater flow has consistently been reported to be to the southeast (from the hillside to the Watch River estuary) (Shannon & Wilson, 1990; Ridolfi, 2005; USACE, 2015a).

2.2.2 TOP CAMP AREA

The Top Camp Area includes the Radar Dome, Microwave Tower site, the GATR, and the former building 102. The Radar Dome Area is at the summit of Bahokus Peak; the Microwave Tower, former building 102, and GATR buildings are located along a ridge within several hundred feet of the summit. The topography of the area is very steep and rocky. The soils are reported to be sandy, and much of the area is underlain by rocks at shallow depths (Radian, 1989; Radian, 1997). This was confirmed during Phase II investigations. Groundwater is not used at the site. During Phase II activities, groundwater was only encountered at one location (Radar Dome Area) in sufficient quantity to allow sample collection (i.e. AQTUV1).

2.3 SITE HISTORY

The former Makah AFS was a radar surveillance station operated by the AF. The station began operations in the 1950s and was closed in 1988. The Cantonment Area served as the Makah AFS administrative headquarters until the station was closed. Buildings and structures used by the AFS at the Cantonment Area included offices, motor equipment garages, medical treatment facilities, various shops, a chapel, a dining hall, a boiler building, a gas station, and dormitories. Recreational facilities included tennis courts, a bowling center, a gymnasium and a weight room (Radian, 1987).

The Top Camp consisted of the radar surveillance transmitting and receiving equipment, control centers, and accompanying support equipment. According to Ridolfi (2013b; original references unavailable), the Department of Defense (DoD) first leased the 10-acre radar dome area from the Makah Tribe in 1941 as part of the Cape Flattery Battery Lease. USACE subsequently constructed an access road from Neah Bay to the top of Bahokus Peak. Between 1945 and 1947, the U.S. Army Air Force (precursor to the U.S. Air Force) operated an aircraft radio relay warning station at the Radar Dome Area. In 1949, the lease expired and the 10-acre parcel was returned to the Makah Tribe. In the 1950s, the same parcel was leased again to the AF for use as part of the Makah AFS. The Radar Dome Area became part of the Bahokus Peak Operation Area or "Top Camp," which included the nearby Microwave Tower, GATR facilities, and former building 102. The Microwave Tower area was the location of the Engineering Plant Building (building 100), which supplied power for the Top Camp. The Top Camp facilities were used as an early warning radar station until the AFS closed in 1988. Gasoline and diesel were stored in various USTS at the site during AFS operation.

After the AFS closed, all of the land leases, except one, were terminated and the property was transferred back to the Makah Tribe. The remaining lease, which contained the Top Camp areas,

was transferred to the FAA in June 1989. The FAA continues to maintain radar operations on Bahokus Peak.

2.4 Summary of Previous Investigations, Cleanup Actions, and Data Gaps

This section summarizes earlier investigation and cleanup actions associated with known USTs. Several site investigations and cleanup activities were previously conducted in the cantonment and Top Camp areas under various DoD contracts and include the following:

- 1987 Hazard Evaluation Report (Radian, 1987)
- 1988 Asbestos and UST survey (TetraTech, 1988)
- 1989 USACE geotechnical survey (USACE, 1989).
- 1989 Pesticide Tank (UST G) investigation (TetraTech, 1989a)
- 1989 Cantonment area soil and groundwater investigation (Shannon & Wilson, 1990)
- 1997 Management Action Plan (Radian, 1997)
- 2004 Cantonment test pit investigation (Ridolfi, 2005)
- 2003-Present. Cantonment groundwater monitoring (Ridolfi, 2003; 2009b;2010; 2013a)
- 2007 Cantonment geoprobe investigation (Ridolfi, 2008a)
- 2007-2008 Microwave Tower investigation(Ridolfi, 2008b)
- 2009 Cantonment Area monitoring well installation (Ridolfi, 2009a)
- 2012 Microwave Tower removal action (Ridolfi, 2012)
- 2012 Bahokus Peak Radar Dome site investigation (Ridolfi, 2013b)
- 2014 Cantonment groundwater monitoring (USACE, 2015a)

Shortly before the former AFS was closed in 1988, a hazard evaluation report (HER) was prepared by Radian Corporation on behalf of the AF that documented the presence of hazardous waste, polychlorinated biphenyls (PCBs), asbestos, and USTs on the Site (Radian, 1987). A total of 24 USTs and one aboveground tank (UST X, which is not actually a UST) were identified on the property, all within the Cantonment and Top Camp areas. Subsequent investigations by Tetra Tech (1988) and Shannon & Wilson (1990) reported UST Y not as one tank, but as three: USTs Y1, Y2, and Y3. Therefore, the total number of USTs at the Site was 26 (16 in the Top Camp Area; 10 in the Cantonment Area).

Various reports issued between 1988 and 1990 indicated that all ten USTs in the Cantonment Area were removed (TetraTech, 1988; 1989b; 1989c; USACE 1989). Radian (1997) stated in the Management Action Plan that all USTs in the support area, also known as the Cantonment Area, were removed. Baker Pacific removed nine USTs and G.L. Construction removed one UST (UST G) from the Cantonment Area. Pease Construction removed "the remainder" (unspecified) from the Top Camp Area (Radian, 1997).

Several of the site investigations and cleanup activities conducted between 1987 and the present confirmed the presence of petroleum constituents in both soil and groundwater associated with the former USTs. Six groundwater monitoring wells (MW-01 through MW-06) were installed in the Cantonment area in the early 1990s (Shannon & Wilson, 1990). Petroleum hydrocarbons were first identified in soil and groundwater in the Cantonment Area around this time.

In December 2004, October 2007, and February 2008, as part of the Native American Lands Environmental Mitigation Program, the Makah's contractor, Ridolfi, Inc., performed further soil investigations at the Site (Ridolfi, 2005; 2008a; 2008b). Analytical data revealed the presence of total petroleum hydrocarbons (TPH) above the MTCA cleanup levels near at least 5 of the 10 former

UST locations in the Cantonment Area and 8 of the 16 former UST locations in the Top Camp Area. Three additional monitoring wells were installed in the Cantonment Area in 2009, bringing the total to nine monitoring wells (Ridolfi, 2009a). Since around 2009, Ridolfi (on behalf of the Tribe) has been conducting semi-annual groundwater monitoring in the Cantonment Area on a varying subset of the nine monitoring wells (Ridolfi, 2009b; 2010; 2011; 2013a).

In June 2009, EPA received seven *Certification of Completed Closure* forms from the AF documenting that 24 USTs were permanently closed at the Site between the years 1988 and 1989. Records describing the closures are not available; therefore, the condition of the USTs when they were removed and the extent of contaminated soil encountered and/or excavated at the time of tank removal are unknown.

2.4.1 CANTONMENT AREA

Ten USTs were identified in the Cantonment Area during the 1987 HER and the subsequent UST survey investigations (Radian, 1987; TetraTech, 1988; TetraTech, 1989a). In January 1990, six groundwater monitoring wells (MW-01 through MW-06) were installed downgradient of USTs in the Cantonment Area; soil analyses were run on soil collected from the respective boreholes (Shannon & Wilson, 1990). In February 1989, USACE dug test holes near nine of the USTs (A, B, C, D, E, F, Y1, Y2, Y3) to perform foundation exploration work prior to their removal (USACE, 1989). Soil samples were collected from the test holes for a limited suite of laboratory analyses including volatile organic analysis (VOA), total recoverable petroleum hydrocarbon (TRPH), resistivity, moisture content, and pH (USACE, 1989).

Nine of the ten Cantonment Area USTs were subsequently removed in early June 1989. The tenth UST (UST G) was also removed around this time, but exact date of its removal is unknown. Shannon and Wilson (1990) reported that all Cantonment USTs were removed during the week of June 4, 1989.

Shannon & Wilson subsequently conducted two rounds of soil and groundwater sampling in 1989. During the first round (June 1989), Shannon & Wilson collected soil samples from the drum storage area near UST G, groundwater samples from the six newly-installed groundwater monitoring wells (MW-01 through MW-06), and one soil sample from the storm water ditch that runs southeast along the northern side of the Cantonment Area (Shannon & Wilson, 1990). During the second sampling event (September 1989), Shannon & Wilson (1990) collected a second round of groundwater samples from the monitoring wells and an additional soil background sample.

No known soil or groundwater investigations related to the USTs occurred from 1991 to 2001.

Starting in 2002, Ridolfi, Inc., on behalf of the Makah Tribe, started performing groundwater monitoring at various subsets of the Cantonment Area monitoring wells (Ridolfi, 2003). Ridolfi installed three new additional downgradient groundwater wells (MW-07, MW-08, and MW-09) in January 2009 (Ridolfi, 2009a). Since 2009, Ridolfi has been conducting groundwater monitoring approximately semi-annually at a subset of the nine wells in the Cantonment Area (Ridolfi, 2009b; 2010; 2011; 2013a).

In 2004, Ridolfi conducted a test pit soil investigation to determine if the former UST G and nearby burn pit may have impacted subsurface soils. In 2007, a geoprobe investigation was conducted in the Cantonment Area to determine potential soil contamination and to verify the removal of USTs from the Cantonment Area.

Investigation findings specific to each UST are discussed in more detail in the following sections. USTs located in close geographic proximity to each other and/or shared similar usage are addressed together.

2.4.1.1 USTs A AND B

Former USTs A and B were 8,000 and 2,000 gallon steel tanks, respectively, located between buildings 2 and 19. UST A, installed in 1951, was situated southeast of UST B, installed in 1979[1]; both USTs stored No. 2 diesel fuel for emergency backup generators (TetraTech, 1989b).

In February 1989, USACE collected a soil sample from a test pit (89-BH-4) located between the two USTs; no detections of petroleum hydrocarbons above 200 parts per million (ppm) were reported (USACE, 1989; Shannon & Wilson, 1990). Both USTs A and B were removed in June 1989 by Baker Pacific.

In 2007, Ridolfi collected nine soil samples from five borings in the vicinity of USTs A and B at depths of 5 to 12 ft bgs. The samples were analyzed for DRO (diesel range organics) and MRO (motor oil range organics) using the Northwest Total Petroleum Hydrocarbon method for semi volatile petroleum products (NWTPH-Dx) (Ridolfi, 2008a). DRO and MRO were detected in 4 of the 9 samples; DRO in one sample located near UST A exceeded the MTCA A soil cleanup level of 2,000 milligram per kilogram (mg/kg). No visual or olfactory evidence of petroleum contamination was noted at any of the five borings.

One monitoring well (MW-04) is located hydraulically downgradient (southeast) of former USTs A and B. In 1989 (when MW-04 was installed), TRPH was not detected in groundwater or soil samples taken from the MW-04 boring (Shannon & Wilson, 1990). Since more regular groundwater monitoring started in 2003, neither DRO nor MRO have been detected in MW-04 (Ridolfi, 2003; 2009b; 2010; 2011; 2013a; USACE, 2015a). Lead was detected once at 25 micrograms per liter (µg/L) (above Method A groundwater cleanup value of 15 µg/L) in 2010; subsequent groundwater lead concentrations in 2013-2014 have been much lower (0.2 to 1.5 µg/L).

Per the approved QAPP, additional soil investigation was conducted near former UST A during this Phase II investigation to confirm the Method A soil DRO exceedance discovered during the previous 2007 soil investigation.

Per the approved QAPP, no further investigation of UST B was conducted during Phase II activities (USACE, 2014, 2015a), and existing information is considered sufficient for an affirmative closure decision.

2.4.1.2 USTs C AND D

Former USTs C and D were 10,000 and 8,000 gallon steel tanks used to store No. 2 diesel fuel for the boilers in the adjacent heating plant (building 14). Former contents also included bunker fuel (No. 5 diesel). USTs C and D were installed[2] in 1979 and 1976, respectively (TetraTech, 1988; 1989b).

[1] Radian (1987) lists the installation date for UST B as 1951. The installation date cited by the newer TetraTech (1989b) UST survey documentation is 1979.
[2] Radian (1987) lists the installation dates for USTs C and D as 1951. The installation dates cited by the newer TetraTech (1989b) UST survey documentation are 1979 and 1976, respectively.

In February 1989, USACE collected test pit sample 89-BH-1 between former USTs C and D prior to their removal; TRPH was reported above 200 ppm.

In June 1989, both USTs C and D were removed by Baker Pacific.

In 2007, Ridolfi collected 19 soil samples from 9 soil borings; fuel-saturated upper soils and strong odors were noted in several of the boring locations. DRO and/or MRO were detected in 18 of 19 soil samples; eight of the 18 detections exceeded Method A soil cleanup levels. Maximum concentrations for DRO and MRO were 20,000 and 2,100 mg/kg, respectively.

Monitoring well MW-05 is located adjacent to and hydraulically downgradient from former USTs C and D. DRO has been consistently detected in groundwater at levels in excess of the Method A cleanup level for groundwater (500 µg/L).

Monitoring well MW-08 is located approximately 150 ft further downgradient (southeast). DRO has been consistently detected in MW-08; with the exception of the October 2012 sample (580 µg/L), all DRO detections since 2009 have been below the Method A groundwater cleanup level (USACE, 2015a).

Lead has been detected occasionally at MW-05, although lead concentrations in groundwater have remained below the Method A groundwater cleanup level of 15 µg/L since October 2012 (USACE, 2015a).

Per the approved QAPP, soil and groundwater samples were collected at USTs C and D during Phase II activities (USACE, 2014; 2015a).

2.4.1.3 UST E

Former UST E was a 2,000 gallon steel tank installed in 1953 and located north east of building 16. UST E stored both unleaded and leaded gasoline for refueling motor vehicles. USACE collected test pit soil sample 89-BH-3 downgradient of UST E in February 1989; TRPH above 200 ppm was reported. Ethylbenzene and total xylenes were also detected, although concentration data is unavailable. UST E was removed in June 1989 by Baker Pacific.

In 2007, eight soil samples were collected from four direct push (DP) borings near UST E. DRO, GRO (gasoline range organics), and benzene, toluene, ethylbenzene, and xylene (BTEX) compounds were detected in 3 of the 8 samples; two samples had GRO detections above the Method A soil cleanup value of 100 mg/kg. Lead was not detected in any soil samples.

Monitoring well MW-06 is located hydraulically downgradient (southeast) of UST E. Elevated concentrations of GRO in groundwater have been detected in MW-06 since 1989. Since 2002, both GRO and DRO have been consistently detected in MW-06 at concentrations in excess of the Method A groundwater cleanup levels. The maximum lead concentration (20 µg/L) was detected in January 2010; subsequently, groundwater lead concentrations have remained consistently below the Method A cleanup value of 15 µg/L.

Arsenic in groundwater has been analyzed occasionally at MW-06 (in 2003 and 2012). In 2012, arsenic was detected at a concentration of 5.1 µg/L, just slightly above the Method A groundwater cleanup level of 5 µg/L. Arsenic is not required for testing at sites with petroleum releases (MTCA 173-340-900 Table 830-1).

Soil and groundwater investigation at UST E was conducted during Phase II activities (USACE, 2014; 2015a).

2.4.1.4 UST F

Former UST F was a 550 gallon steel tank installed in 1954 and located southeast of building 43. UST F stored No. 2 diesel used to refuel motor vehicles. In February 1989, USACE collected a soil sample from test pit (89-BH-2) located adjacent to UST F; no detections of petroleum hydrocarbons above 200 ppm were reported at test pit 89-BH-2 (USACE, 1989; Shannon & Wilson, 1990). UST F was subsequently removed in June 1989 by Baker Pacific.

In 2007, nine soil samples were collected from four direct push borings in the vicinity of UST F at depths ranging from 4 to 12 feet and analyzed for DRO and MRO via NWTPH-Dx (Ridolfi, 2008a). DRO and/or MRO were detected in three of nine samples at maximum concentrations of 65 and 140 mg/kg. No DRO or MRO detections exceeded MTCA A soil cleanup levels of 2,000 mg/kg.

Per the approved QAPP, no further investigation of UST F was conducted during the Phase II activities (USACE, 2014, 2015a) and existing information is considered sufficient for an affirmative closure decision.

2.4.1.5 UST G

Former UST G was a 600 gallon cylindrical concrete tank installed in the mid-1970s that was used to receive pesticide rinse wastes from a sink in the Engineering Maintenance Shop (building 43). UST G is being addressed via the Phase III Site Investigation Work Plan (USACE, 2015b). No investigation was planned at UST G during Phase II activities (USACE, 2014; 2015a).

2.4.1.6 USTs Y1, Y2, AND Y3

Former USTs Y1, Y2, and Y3 consisted of three steel tanks with capacities of 2,000, 2,000, and 3,000 gallons, respectively, located southeast of building 28. Installed in 1962, USTs Y1, Y2, Y3 stored unleaded, super unleaded, and regular leaded gasoline, respectively, for refueling motor vehicles. TRPH was measured above 200 ppm at test pit station 89-BH-5, collected shortly before the tanks were removed in June 1989 by Baker Pacific (USACE, 1989; Shannon & Wilson, 1990).

In 2007, 11 soil samples were collected from six geoprobe borings in the vicinity of USTs Y1, Y2, and Y3 at depths ranging from 6.5 to 12 ft; a subset of samples were analyzed for GRO, BTEX, lead, and DRO/MRO (four samples) (Ridolfi, 2008a). Although petroleum odors were noted during sample collection, DRO, GRO, BTEX, and lead were not detected in any samples. MRO was detected in one sample at a concentration of 16 mg/kg, which does not exceed the MTCA A cleanup level of 2,000 mg/kg.

MW-07, installed in 2009, is the nearest downgradient groundwater monitoring well. Borehole soil samples analyzed during the well's installation in 2009 were also non-detect for GRO, DRO, BTEX, and lead. MRO was detected in only one depth interval (1-5 ft) at 17 mg/kg (Ridolfi, 2009a).

MW-07 has been non-detect for GRO, DRO, and MRO since groundwater monitoring began in 2009.

No further investigation of USTs Y1, Y2, and Y3 was planned during the Phase II investigation (USACE, 2014).

2.4.2 TOP CAMP

The 1987 survey conducted by Radian identified 17 USTs within the Top Camp Area (Radian, 1987). Of these 17 tanks, one tank (tank X) was actually an above ground tank that has been subsequently excluded from the list of USTs being investigated. The remaining 16 USTs range in nomenclature from H through W.

Radian (1987) reported that USTs Q, R, U, V, and W were properly abandoned and filled in place while UST T was still in use. A USACE memorandum dated September 1988 documents the removal of several above- and below-ground tanks as part of alterations and improvements made to the Top Camp facilities (USACE, 1988). In conjunction with the 1987 Radian report and various available as-built drawings, the identity and former locations of several of the removed USTs was confirmed (USACE, 1950; 1961; 1987).

In October 2007 and February 2008, Ridolfi conducted subsurface soil sampling at the Microwave Site and near former building 102 to assess potential soil impacts near former USTs at those locations, and, if possible, to verify the removal of those USTs.

In August/September 2012, a site reconnaissance and soil sampling was conducted in the Radar Dome Area outside the FAA's fenced restricted area to assess potential impacts due to former AFS activities and facilities, including former fuel storage tanks, former transformers, debris, and a septic system (Ridolfi, 2013b).

In October 2012, building and facility debris were excavated from the area where the eight large USTs (H through O) were previously located at the Microwave Tower site (Ridolfi, 2012). After debris removal, the excavation was backfilled with the potentially petroleum-contaminated excavated soil and re-graded with the intent to match natural contours of the area.

2.4.2.1 USTs H THROUGH O

A cluster of eight former USTs (H, I, J, K, L, M, N, and O) was located near the Engineering Plant Building (building 100, also known as the "power plant") at the Microwave Site. With the exception of UST H (7,000 gallons), all USTs were 10,000 gallon capacity steel tanks. All eight USTS were installed in 1960 to store diesel fuel for the power plant. All eight USTs were subsequently removed in 1988 during base closure. At this time, the power plant was also demolished, and the building debris was used as backfill in the excavation from which USTs H through O were removed.

In February 2008, 13 soil samples were collected via test pits from 11 locations at depths of 7 to 12 ft bgs near USTs H through O. Removal of the USTs was confirmed, although the presence of debris in a few locations prevented further advancement of some of the test pits. DRO and MRO were detected in all 13 soil samples. DRO and MRO concentrations each exceeded Method A soil cleanup levels in a separate sample at 8 ft bgs (Ridolfi, 2008b).

In October 2012, the building and facility debris in the area of the former USTs H through O was excavated and removed. The excavation was backfilled with soil stockpiled during the excavation and re-graded; erosion control matting was installed. Suspected petroleum-contaminated soil (PCS) was detected in the excavation but was not removed. Collection of confirmation soil samples was planned, but not performed (Ridolfi, 2012).

Per the approved QAPP, soil and groundwater samples were conducted at USTs H through O during Phase II activities.

2.4.2.2 UST P

Former UST P was a 550 gallon steel tank installed south of the Engineering Plant Building (building 100) in 1960 that contained waste oil (Radian, 1987). UST P was removed in 1988 by Pease Construction as part of alterations and improvements to the Top Camp Area (USACE, 1988a).

In 2008, five soil samples were collected from four test pit locations at depths of 3 to 6 ft bgs and analyzed for petroleum hydrocarbons and lead. DRO and MRO were detected in all samples with maximum concentrations of 71 and 31 mg/kg, respectively. Lead was detected in one sample at 6 mg/kg. No DRO, MRO, or lead detections exceeded the Method A soil cleanup levels (Ridolfi, 2008b).

The 2008 investigation did not conduct analyses for PCBs or carcinogenic polycyclic aromatic hydrocarbons (cPAHs). MTCA requires testing for both of these analyte groups when the former tank contents include waste oil and unknown oil. Per the approved QAPP, soil and groundwater sampling was conducted during Phase II activities at UST P to assess potential PCB and cPAH contamination.

2.4.2.3 UST Q

Former UST Q was a 550 gallon steel tank located near former building 102. Radian (1987) states that UST Q was installed in 1951, stored diesel fuel, and was reported abandoned in place. No additional documentation of the tank's removal is available.

In 2007, one soil sample was collected from a test pit at a depth of 4 ft bgs in the vicinity of the former building 102. The exact location of former UST was unknown; according to communications with Ridolfi personnel, the sample was located adjacent to the foundation on the north side of former building 102. No petroleum hydrocarbons were detected in the soil sample.

Per the approved QAPP, no further investigation was conducted at UST Q during Phase II activities.

2.4.2.4 USTs R AND S

Former UST R was a 500 gallon steel tank located near former building 103. Radian (1987) listed the installation date as 1951 and reported the tank as abandoned in place (emptied and filled with sand). UST R stored diesel fuel.

Former UST S was a 200 gallon steel tank also located near former building 103. Radian (1987) listed UST S as Navy property; the tank contents were gasoline.

USACE (1988) states that two tanks (one above ground and one underground) were removed at building 103. Further identifying information is not provided, although it appears likely that UST R, UST S, or both were removed.

In 2007, Ridolfi attempted to collect soil samples near USTs R and S, but samples could not be collected due to the presence of newer facilities in the presumed location of former USTs R and S.

The exact former locations of USTs R and S are unknown.

Per the approved QAPP, soil and groundwater investigation was conducted for USTs R and S during Phase II activities.

2.4.2.5 USTs T, U, AND V

Former USTs T, U, and V consisted of a 6,000, 550, and 550 gallon steel tanks, respectively, and were located at the northwest end of the Radar Dome Area. USTs T, U, and V were installed in 1953, 1962, and 1953, respectively. All three tanks stored diesel fuel.

USTs T, U, and V were removed in 1988. Their removal is documented in a USACE (1988) memo that references the removal of "Tank Nos. 2, 3, and 4" near former building 108. The building number and tank numbers correspond with the Top Camp improvement and demolition 1988 as-builts (USACE, 1988b). A septic tank, labeled as Tank No. 1 on the as-built, was left in place.

In 2012, surface soil grab samples were collected downhill from the suspected locations of the USTs. Debris and other man-made items were found in many sampling areas and may have contributed to the scattered DRO and MRO soil exceedances observed (Ridolfi, 2013b).

Per the approved QAPP, soil and groundwater investigation was conducted for USTs T, U, and V during Phase II activities.

2.4.2.6 UST W

Former UST W was a 2,000 gallon steel tank located near building 117 at the Microwave Tower site. UST W was installed in 1959 and stored diesel fuel (Radian, 1987). UST W was reported as properly abandoned (emptied and filled with sand) by Radian (1987).

In 2007, two soil samples were collected at depths of 2 to 3 ft bgs from two locations in the vicinity of former UST W near former building 117 (Ridolfi, 2008b). The sampling locations were selected based on accessibility and institutional knowledge of the tanks by a former AF employee. DRO and MRO were detected in both samples at concentrations below Method A soil cleanup levels. UST W was not encountered nor was its removal confirmed during the 2007 investigation.

Per the approved QAPP, no further investigation of UST W was conducted during the Phase II activities (USACE, 2014, 2015a) and existing information is considered sufficient for an affirmative closure decision.

SECTION 3 – SITE INVESTIGATION ACTIVITIES

This section presents a brief description of field work activities performed, notes any deviations from the QAPP, and summarizes the quality control activities and findings.

All field preparation and sampling activities were performed by USACE Seattle District personnel. Geoprobe drilling services were provided by Holt Services, Incorporated, under contract to USACE. Geoprobe drilling and soil sampling was limited to weekdays only.

The sequence of the Phase II field work activities completed was as follows:

- February 23-27. Utility locate and brush clearing occurred.
- March 2. Drillers and field samplers mobilized to site.
- March 3-5. Cantonment area planned borings completed.
- March 6. Top camp area planned borings started (USTs P and H through O).
- March 8. Cantonment groundwater monitoring wells sampled by USACE personnel.
- March 9-10. Top camp planned borings continued (USTs H through O, R, and S).

- March 10-13. Cantonment area step-out borings.
- March 16. Cantonment step-out borings completed. Drilling moved back to Top Camp (USTs T, U, V).
- March 16-18. Planned and step-out borings completed at USTs T, U, and V. Last boring at USTs R and S completed. Investigation derived waste (IDW) sampled. Cantonment groundwater elevations measured.
- March 19. Field work completed. Personnel demobilized from site.

Each of the major activity steps is further detailed below. Appendix B presents site photos taken during the field sampling activities.

3.1 Utility Locate and Brush Clearing

During the week of February 23, USACE personnel mobilized to the site to conduct underground utility surveys and oversee clearing and brushing activities.

Clearing and brushing was conducted primarily at the Radar Dome and Microwave Site to facilitate drill rig access. Clearing and brushing was also completed in the vicinity of UST G in anticipation of future Phase III field work.

3.2 Groundwater Well Sampling

Groundwater samples were collected on March 8, 2015 from four wells in the Cantonment Area (MW-05, MW-06, MW-08, and MW-09). Groundwater samples were collected using a peristaltic pump and approved low-flow sampling techniques. Five samples (including one field duplicate) were collected. Field parameters for dissolved oxygen, pH, oxidation reduction potential (ORP), turbidity, specific conductance, and ferrous iron were measured at all wells except MW-08, where ferrous iron was not sampled due to sampler error.

3.3 Soil and Groundwater Grab Sampling

Soil samples were collected March 3-18, 2015. Sampling location and order depended on a variety of factors including site access and availability of preliminary petroleum hydrocarbon laboratory data. Due to the extended nature of the field mobilization, receipt and evaluation of preliminary laboratory petroleum hydrocarbon data was possible. The sampling team used preliminary lab results to confirm exceedances of step-out decision-making criteria measured via the field petroleum hydrocarbon test kit.

Depth-dependent sampling decisions, as well as step-out boring locations, were made in real-time using the field test kit and the decision-making criteria outlined in the QAPP.

Soil sampling details specific to each investigation area are detailed in the following subsections. Soil and groundwater grab laboratory analyses for each area are listed in Tables 2 and 5.

3.3.1 UST A

A total of seven direct push borings for soil samples were placed near UST A (Figure 5). Four planned direct push borings (GP-11-A4 through -A7) were drilled at UST A during the week of March 3. Three step-out borings (GP-11-A8, GP-11-A9, and GP-11-A10) were placed radially outward from GP-11-A6 during the week of March 10 following receipt of preliminary laboratory DRO results. Fourteen soil samples for laboratory analysis were collected at depths ranging from 0

to 15 ft bgs. Soil samples were analyzed for DRO and volatile organic compounds (VOCs) as shown in Table 2.

One groundwater grab sample (AQA1) was collected from direct push boring AQA1 placed near GP-11-A6 on March 13. The temporary groundwater well was purged in accordance with the QAPP for approximately 2 minutes before sample collection. The groundwater grab sample was analyzed for DRO, VOCs, anions, dissolved manganese, and methane, ethane, and ethene (MEE) as shown in Table 5.

3.3.2 USTs C AND D

A total of 20 direct push borings for soil samples were placed near USTs C and D (Figure 6). Nine planned DP borings (GP-11-CD1 through -CD9) were drilled during the week of March 3. Eleven step-out DP borings (GP-11-CD10 through GP-11-CD20) were placed during the week of March 10 following receipt of preliminary laboratory DRO results. Forty-eight soil samples for laboratory analysis were collected at depths ranging from 0 to 20 ft bgs. Soil samples were analyzed for DRO, VOCs, and semi-volatile organic compounds (SVOCs) as shown in Table 2.

On March 12, two direct push borings were placed near soil borings GP-11-CD6 and GP-11-CD5, respectively, to collect groundwater grab samples AQCD1 and AQCD2. A field duplicate (AQCD7) was collected at location AQCD1. Groundwater grab samples were analyzed for DRO, VOCs, anions, dissolved manganese, and methane, ethane, and ethene (MEE) as shown in Table 5.

3.3.3 UST E

A total of 10 direct push borings for soil samples were placed near UST E (Figure 7). Seven planned DP borings (GP-11-E5 through -E11) were drilled during the week of March 3. Three step-out DP borings (GP-11-E12 through -E14) were placed during the week of March 10 following receipt of preliminary laboratory GRO and DRO results.

At location GP-11-E11, the field test kit GRO results exceeded the step-out criteria of 10 mg/kg; laboratory GRO data was even higher. According to the decision criteria, a step-out boring was required radially outward from GP-11-E11. However, due to the presence of building 16, a step-out boring to the south or southwest was not possible. Step-out boring GP-11-E12 was therefore placed in the next most accessible but reasonable location to the northwest, which was also closer to the former dispenser island.

Results from locations GP-11-E7 through -E9 and results from sampling performed by Ridolfi in 2007 showed no soil detections of GRO or DRO southeast of the former location of Tank E; however there have been detections of petroleum in groundwater in MW-06. To determine if another potential source of contamination in MW-06 exists two direct push borings (GP-11-E13 and GP-11-E14) were placed downgradient of MW-06. DP boring GP-11-E13 contained a strong gasoline odor and wood chips at approximately 4.5-5.5 ft bgs. The wood chips also had a strong odor. Despite the strong odor, there were no detections of GRO in the field test kit at location GP-11-E13. To determine if the wood chips were localized to GP-11-E13, an additional boring was placed 15 ft downgradient. Similar results were found in GP-11-E14.

Twenty-one soil samples for laboratory analysis were collected at depths ranging from 0 to 15 ft bgs. Soil samples were analyzed for GRO, DRO, and VOCs as shown in Table 2.

Three DP borings (AQE1, AQE2, and AQE3) were placed to collect groundwater grab samples. AQE1 was placed near boring GP-11-E11 which recorded both the highest field test kit and laboratory GRO results. AQE2 was placed halfway between MW-06 and MW-09 in accordance with the decision criteria. AQE3 was placed near the southern corner of building 16 in the downgradient path of potential contaminant migration from GP-11-E11.

Three groundwater grab samples were collected (one each from AQE1, AQE2, and AQE3). Groundwater samples were analyzed for GRO, DRO, VOCs, anions, dissolved manganese, and MEE as shown in Table 5.

3.3.4 USTs H THROUGH O

A total of nine direct push borings for soil samples were placed near USTs H through O (Figure 8). Six planned boring locations (GP-06-H1 through –H6) were drilled during the week March 2 and March 9. The three step-out boring locations (GP-06-H7 through -H9) were placed radially outward from location GP-06-H3 during the week of March 16th following receipt of preliminary laboratory DRO results. The test kit DRO result of 1,920 mg/kg at GP-06-H3 for the 10-12 ft depth interval easily exceeded the step-out criteria; the corresponding laboratory data result of 3,000 mg/kg received a few days later confirmed that an exceedance of the soil cleanup level was present at this location.

During step-out sampling, DRO was again detected above the 500 mg/kg step-out decision criteria at locations -H7 to the east and -H8 to the west. Due to the steepening slope and vegetation present, an additional step-out boring to the west could not be obtained. Location -H7 was similarly bounded by the steep slope to the north and boring -H4 to the east.

Eighteen soil samples for laboratory analysis were collected at depths ranging from 5-13 ft bgs. Soil samples were analyzed for DRO and VOCs as shown in Table 2.

One DP boring for groundwater collection was attempted midway between -H1, -H2, and -H3. No groundwater sample was collected due to insufficient yield.

3.3.5 UST P

A total of two DP borings for soil samples were placed near UST P during the week of March 6 to depths up to 15 ft bgs (Figure 9). No step-out borings were planned or needed. The maximum measured DRO via field test kit was 23 mg/kg, well below step-out criteria. Four soil samples for laboratory analysis were collected at depths ranging from 0 to 14 ft bgs. Soil samples were analyzed for PCB Aroclors and SVOCs as shown in Table 2.

Saturated soils were encountered in location GP-06-P1 below about 10 ft bgs. One DP boring for groundwater sampling was attempted adjacent to GP-06-P1, but a groundwater sample could not be collected due to a combination of high turbidity and insufficient yield.

3.3.6 USTs R AND S

A total of eight DP borings for soil samples were advanced in the vicinity of USTs R and S (Figure 10). Seven of the eight locations were drilled March 9-10, 2015. Soil boring GP-06-RS4, located within the fenced enclosure, was drilled on March 17 following receipt of an access key from the USCG.

All borings at this location hit shallow refusal at 5 ft bgs or less despite repeated attempts to find locations with deeper available soils.

Step-out borings were neither planned nor needed. The maximum measured DRO field test kit measurement was 100 mg/kg, well below the step-out decision criteria of 500 mg/kg.

Nine soil samples for laboratory analysis were collected at depths ranging from 0 to 5 ft bgs. Soil samples were analyzed for GRO, DRO, VOCs, and lead (Table 2).

Saturated soils were not encountered. A DP boring for a groundwater grab sample was not attempted.

3.3.7 USTs T, U, AND V

A total of 13 DP borings for soil samples were advanced in the vicinity of USTs T, U, and V (Figure 11). Nine planned DP borings (GP-05-T1 through T3, GP-05-U1 through U3 and GP-05-V1 though V3) were drilled during the week of March 16. Three step-out DP borings (GP-05-TUV1 through TUV4) were placed the same week. Unlike the other USTs, step-out decision-making at USTs T, U, and V relied solely on UVF-3100 test kit data, because preliminary laboratory data was not available within the timeframe of the field mobilization. Step-out locations were placed radially outward from GP-05-T1 and GP-05-T2. Although test kit DRO results were above the decision criteria of 500 mg/kg at locations GP-05-V1 and GP-05-V3, step-out borings to the west and north were not possible at these locations due to the presence of the active septic tank to the west and the steep slope drop-off to the north.

Twenty-eight soil samples for laboratory analysis were collected at depths ranging from 0 to 12 ft bgs. Soil samples were analyzed for DRO and VOCs as shown in Table 2.

One groundwater grab sample (AQTUV1) was collected near soil boring location GP-05-T3, which had the highest soil test kit screening result. The groundwater sample was analyzed for DRO, VOCs, anions, dissolved manganese, and MEE as shown in Table 5.

3.4 UVF-3100A FIELD TESTS

Soil samples from every depth interval were analyzed using SiteLab's portable UVF Analytical Test Kit UVF-3100A (UVF-3100A). The UVF tests were conducted in the field for either the gasoline range organics (GRO) or extended diesel range organics (EDRO). Due to instrument's inability to store more than one calibration (GRO or EDRO, but not both), the most appropriate analyte was selected for each UST based on prior knowledge of the USTs former contents. The UVF field test results for all soil locations and all depths are tabulated in Table 6. For comparison, Table 6 also includes the respective laboratory results for NWTPH-Dx and Northwest Total Petroleum Hydrocarbon method for volatile petroleum products (NWTPH-Gx).

A plot of laboratory data versus field test kit DRO measurements was created to evaluate the performance of the field test kit data relative to the laboratory data and to determine if the step-out criteria of 500 mg/kg (via field test kit) was appropriate (Figure 14). Lines representing the Method A cleanup level (2,000 mg/kg; red line) and the field test kit step-out decision criteria (500 mg/kg; green line) have been added for clarity.

For statistical comparison of the UVF-3100A and laboratory data, a linear regression of the natural log (ln) of the diesel-range results was completed (Figure 14). The best-fit line has a square of the

correlation coefficient r (R^2) of 0.72. While the field test DRO results were in general agreement with the lab results, the field test kit results did not typically provide an exact match to the laboratory DRO results. Contributing factors for this discrepancy include one or more of the following scenarios:

- Sample homogeneity. Because the UVF field test is performed on a different sample volume than that for the laboratory analyses, measuring concentrations of GRO and EDRO is dependent on the homogeneity of the sample matrix.
- Sampling techniques. The samples analyzed by the laboratory were taken through a more rigorous extraction process than the UVF-3100A samples, which were simply shaken in methanol for ~5 minutes.
- Methodological differences. The UVF field test kit and the laboratory NWTPH-Dx method measure different ranges of carbon-containing compounds. The UVF-3100A field kit is calibrated to measure an extended range of hydrocarbons (C10 to C36) that includes both diesel and oil range hydrocarbons whereas NWTPH-Dx only measures up to about C30. Furthermore, the NWTPH-Dx method reports DRO and MRO as separate measured concentrations.
- Errors due to dilution. Due to its fairly narrow measurement range, samples with high concentrations of petroleum hydrocarbons for the UVF field test kit sometimes required multiple dilutions. Field dilutions were not performed using the more exact volumetric glassware available in a lab setting, thus introducing more potential error in the field test kit results.
- Dilution range exceedances. For samples with very high concentrations of petroleum hydrocarbons, the extra dilutions to allow sample measurement were occasionally not performed when the sample concentration was already clearly over the decision-making criteria. Thus, the reported field test kit concentration may have been truncated at the upper calibration standard available for the greatest dilution performed.

Figure 14 further illustrates that there were no samples with field test kit data less than 500 mg/kg for which the laboratory data was also greater than 2,000 mg/kg. This information indicates that the step-out decision criteria of 500 mg/kg was an effective field threshold for delineating soil DRO contamination in excess of the Method A clean-up level.

Of the UVF-3100A test results for GRO, none of the samples had concentrations greater than the corresponding laboratory GRO results. GRO is volatile and losses can occur when exposed to air. The 5-gram aliquot for the UVF-3100A analysis was weighed on an open-air balance. The 5-gram aliquot for the laboratory analysis was collected by EPA Method 5035, which uses a syringe to transfer soil from in situ directly into a 40-mL vial with methanol preservative. Sample aliquots for the laboratory analyses were immersed in the extraction fluid for 2-3 days because of the time required for delivery to the lab and log-in procedures before analysis, while sample aliquots for the UVF-3100A analyses were performed in the field within 15 minutes of collection. A longer extraction period can extract more GRO over time when concentrations are higher.

The UVF-3100A results were used for screening purposes only. Within each boring, the UVF results helped guide the selection of the sample depth intervals for laboratory analyses. The UVF results were also used to guide the step-out decision making criteria when preliminary laboratory data was not available. In these situations, the decision-making criteria in the QAPP Figures 13 and 14 were followed for the depth-dependent sample selection and the step-out locations. In addition, UVF results were also used to notify the lab when higher concentrations were expected.

3.5 LABORATORY ANALYSES

Phase II soil and groundwater samples were shipped or delivered to Analytical Resources, Inc., (ARI) in Tukwila, Washington for laboratory analysis. ARI is a DoD Environmental Laboratory Accreditation Program (ELAP) certified laboratory. The exact suite of analyses for each UST or UST grouping varied based on the former UST contents and prior groundwater data in accordance with the approved QAPP and Tech Memo (USACE, 2014; 2015a).

Soil analyses included the following:

- NWTPH-Dx for Diesel-range and oil-range petroleum hydrocarbons
- NWTPH-Gx for Gasoline-range petroleum hydrocarbons
- EPA Method 8260C for VOCs
- EPA Method 8270D Selective Ion Monitoring (SIM) for SVOCs
- EPA Method 8082 for PCB Aroclors
- EPA Method 6020 for total lead

Groundwater analyses included the following:

- NWTPH-Dx for Diesel-range and oil-range petroleum hydrocarbons
- NWTPH-Gx for Gasoline-range petroleum hydrocarbons
- EPA Method 8260C for VOCs
- EPA Method 6020 for dissolved manganese (Mn)
- EPA Method 300.0 for nitrate and sulfate
- RSK-175 for methane, ethane, and ethane

Tables 2 and 5 list all soil and groundwater samples collected and their respective laboratory analyses. For Methods 8260 and 8270, the target analyte lists were limited to petroleum-related analytes in accordance with the QAPP and revised QAPP worksheets (USACE, 2014; 2015).

3.6 DATA QUALITY AND USABILITY

This section provides a summary of overall data quality and usability. A detailed data usability and assessment review is presented in Appendix E. Data validation reports are presented in Appendix F.

Field QC samples such as matrix spike (MS)/matrix spike duplicates (MSDs), field duplicates, rinsate blanks, and trip blanks were collected to determine the quality of the field data. Laboratory QC samples included method blanks, surrogate spikes, laboratory control samples (LCSs), and MS/MSDs.

Stage 2a data validation was performed on all laboratory analytical data. A summary and details of the data validation findings are provided in Appendices E and F, respectively. The data validation narratives indicate that the sample analyses generally met the QC criteria set forth in the QAPP (USACE, 2014). Results associated with QC outliers were appropriately qualified by data validators. No data were rejected.

Field measurements were collected from groundwater wells and soil borings. All measurements were made following standardized procedures by personnel familiar and knowledgeable with the instrument(s).

3.6.1 Elevated Detection Limits

Each analytical method used during the investigation was chosen because it has a Limit of Quantitation (LOQ) at or below the level of concern. For each analyte, the QAPP provided a Project Quantitation Limit Goal (PQLG) as the goal that the laboratory was to achieve to provide analytical results at or below regulatory comparison criteria (USACE, 2014).

In practice, actual reported sample quantitation limits (SQLs) may be elevated in some samples due to matrix interference or the presence of high concentrations of other target analytes.

Note that the laboratory LOQ for ethylene dibromide (0.2 µg/L; EDB) via Method 8260 in groundwater exceeded the Method A groundwater cleanup level of 0.01 µg/L. EDB was not detected in any wells above the cleanup level during the June 2014 (Phase I) investigation via low-level analysis (8260 SIM); therefore, EDB via low-level analysis was removed from the Phase II groundwater analyses (USACE, 2015a). However, the laboratory data for groundwater via Method 8260 still reported EDB even though the LOQ for EDB via the standard Method 8260 was known to exceed the cleanup level. As such and per the approved QAPP, Phase II EDB groundwater data via the standard Method 8260 are not to be used to make comparisons to the groundwater cleanup levels in this SI report.

Except for EDB, elevated non-detect SQLs that exceed regulatory cleanup criteria are highlighted in the data tables and are listed below. The impact of the elevated SQLs on usability is discussed in Section 4.3.

UST A/B soil samples:

- The SQL for benzene exceeded cleanup levels in one sample.

UST C/D soil samples:

- The SQL for benzene exceeded cleanup levels in 9 samples.
- The SQL for methyl tert-butyl ether (MTBE) exceeded the cleanup level in one sample.

UST E soil samples:

- The SQL for benzene exceeded the cleanup level in two samples.

USTs H through O soil samples:

- The SQL for benzene exceeded the cleanup levels in three samples.

UST P

- No SQLs exceeded cleanup levels.

USTs R and S

- No SQLs exceeded cleanup levels.

USTs T, U, and V

- No SQLs exceeded cleanup levels.

3.7 Deviations from QAPP

The following deviations from the QAPP are noted:

- Ferrous iron (a field measurement) was not measured during groundwater sampling at MW-08 due to inadvertent omission.
- A step-out soil boring sample could not be placed south of GP-11-E11 due to the presence of building 16. The step-out boring –E12 was placed radially outward to the northwest.
- NWTPH-Gx analysis was planned for all UST E grab samples; however, the field crew neglected to fill a sample bottle for GRO for grab sample AQE1. All other analyses (DRO, VOCs, metals, etc) were collected and measured at AQE1. Once the omission was discovered approximately 6 weeks after recommended holding time (8 weeks after sampling), extra saved sample volume from AQE1 was immediately analyzed for GRO.

SECTION 4 – NATURE AND EXTENT OF CONTAMINATION

4.1 BACKGROUND AND REFERENCE CRITERIA

Reference soil samples were not collected. Ecology has published regional 90th percentile value background levels for the Puget Sound Basin region for several inorganic constituents including lead (Ecology, 1994). Only lead concentrations are of interest because contamination under investigation is constrained to petroleum-related compounds. Lead analysis was only conducted at USTs R and S in accordance with the QAPP and revised QAPP worksheets (USACE, 2014; 2015a). The published Puget Sound regional 90th percentile value for lead is 24 mg/kg.

State or regional background values for groundwater do not exist. Cantonment monitoring well (MW-01) is located upgradient of all Cantonment Area USTs and contaminated sites and therefore represents a background sample. MW-01 was analyzed in Phase I (June 2014) for GRO, DRO, VOCs, lead, dissolved manganese, anions, and MEE (USACE, 2014).

4.2 COMPARISON CRITERIA

In accordance with the Consent Order and approved QAPP, MTCA cleanup levels are used to evaluate analytical data generated during this sampling effort. Method A is designed for cleanups that are relatively straight-forward or involve only a few hazardous substances. On this basis, the approved QAPP (USACE, 2014; 2015a) uses Method A Soil Cleanup Levels for Unrestricted Land Uses (WAC 173-340-900, Table 740-1) as the primary criteria for comparison for the Makah AFS UST investigation.

4.3 CHEMICAL SPECIFIC CALCULATIONS

The presence of non-detects in chemical datasets can present a challenge when calculating cPAH Total Toxic Equivalent Concentrations (TTECs), total PCBs, or total naphthalenes. Various methodologies have historically been used that range from substituting zero to the sample quantitation limit for non-detects. The common procedure of substituting one-half of each sample quantitation limit for non-detects can cause the least precise measurements (non-detects with high SQLs) to heavily influence the resulting TTEC or PCB total.

To address this problem, Helsel (2012) recommends using the nonparametric Kaplan-Meier (KM) statistical method to estimate the mean of a data set; the total is then computed by multiplying the mean by the number of target analytes. For datasets with more than 50% non-detects, the KM procedure is not recommended due to the unacceptable increase in estimation errors. For datasets with 50-80% non-detects and small sample sizes (less than 50 observations), Helsel (2012) recommends robust Regression on Order Statistics (ROS) for computing descriptive statistics with

data containing non-detects. ROS is suitable for small and large data sample sizes for which the proportion of non-detects does not exceed 80%.

4.3.1 cPAHs Total Toxic Equivalent Calculations

Method A cleanup levels for cPAHs in soil are presented as benzo(a)pyrene (BaP) equivalents, also known as a Total Toxic Equivalent Concentration (TTEC). MTCA uses the toxicity equivalent factor (TEF) methodology to evaluate toxicity and assess the risks for carcinogenic polycyclic aromatic hydrocarbons (cPAHs). WAC 173-340-900 Table 708-2 provides TEFs for the following cPAHs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Using TEF methodology, TTECs are calculated for each sample in which cPAHs were analyzed using four methods:

- Substitution of zero for non-detects;
- Substitution of one-half the sample quantitation limit for non-detects;
- Kaplan-Meier estimation using EPA's ProUCL software; and
- Robust ROS using EPA's ProUCL software.

When one or more results from the above four method differ, the discrepancy is discussed in further detail relative to the most appropriate method for that particular sample.

The analytical laboratory did not report benzo(b)fluoranthene and benzo(k)fluoranthene individually. Instead, the lab reported "Total benzofluoranthenes" which includes the (b), (k), and (j) isomers, and therefore represents a conservative estimate of the (b) and (k) isomers due to the unknown contribution of the (j) isomer. The (b) and (k) isomers share the same TEF of 0.1, whereas the (j) isomer does not have a TEF (WAC 173-340-900 Table 708-2). Total benzofluoranthenes were therefore assigned a TEF of 0.1 for the cPAH TTEC calculation.

4.3.2 Total PCBs

The Method A soil cleanup level of 1 mg/kg for PCBs represents a total value for all PCBs. PCBs were only analyzed in soil at UST P. Because all PCB data were non-detect, calculation of PCB totals using Kaplan-Meier or robust ROS techniques is not appropriate. The PCB totals were set equal to the highest individual sample quantitation limit.

4.3.3 Total Naphthalenes

The Method A soil cleanup level of 5,000 mg/kg for naphthalanes represents a total value for napthalane, 1-methylnaphthalene, and 2-methylnaphthalene. These chemicals were analyzed in soil at USTs C/D and P. Total naphthalenes were calculated by substituting either zero or one-half the SQL for non-detects. Kaplan-Meier estimation and robust ROS are not appropriate for the small number (3) of target analytes.

4.4 Discussion of Analytical Results

The discussion of laboratory analytical results that follows is based on those chemicals that were reported at concentrations or non-detect concentration greater than their cleanup level in one or more samples in one or more media.

4.4.1 UST A

This section summarizes the analytical results of chemicals detected in soil and groundwater near UST A.

4.4.1.1 SOIL

All soil samples were analyzed for DRO and petroleum-related VOCs.

As shown in Table 8, DRO was reported in 12 of 14 soil samples, with a maximum concentration of 4,000 mg/kg at location GP-11-A6-8. DRO concentrations exceeded the Method A soil cleanup level of 2,000 mg/kg in 2 of 12 soil samples. MRO was reported in 6 of 14 soil samples, with a maximum concentration of 160 mg/kg at GP-11-A6-8. No MRO detections exceeded the Method A soil cleanup level of 2,000 mg/kg.

One VOC (toluene) was reported in 9 of 14 soil samples, with a maximum concentration of 2.40 µg/kg at location GP-11-A4-8. Benzene was reported as non-detect at an elevated SQL of 90 µg/kg at location GP-11-A4-12; which exceeds the Method A soil cleanup value of 30 µg/kg. Although benzene is required for analysis for DRO releases, it is more commonly associated with gasoline. Heavier fuels such as diesel fuel typically have much less benzene present. Given that UST A only stored diesel fuel and benzene was non-detect in all other soil samples with SQLs below the Method A cleanup level of 30 µg/kg, the presence of benzene in soil above the cleanup level is unlikely.

4.4.1.2 GROUNDWATER

The groundwater grab sample AQA1 was analyzed for DRO, VOCs, anions, dissolved manganese, and MEE. DRO was detected at 730 µg/L (estimated) and exceeded the Method A groundwater cleanup level of 500 µg/L. MRO was detected at 170 (estimated) µg/L and did not exceed the Method A groundwater cleanup level of 500 µg/L. All VOCs were non-detect.

Among the non-regulated parameters, dissolved manganese, nitrate, sulfate, and methane gas were detected.

4.4.2 USTs C AND D

This section summarizes the analytical results of chemicals detected soil and groundwater near USTs C and D.

4.4.2.1 SOIL

All soil samples were analyzed for DRO, VOCs, and SVOCs.

As shown in Table 9, DRO was reported in 43 of the 48 soil samples, with a maximum estimated concentration of 34,000 mg/kg at location GP-11-CD6-5. DRO concentrations exceeded the Method A soil cleanup level of 2,000 mg/kg in 15 of 48 soil samples. MRO was reported in 27 of 48 soil samples, with a maximum concentration of 1,400 mg/kg at location GP-11-CD2-10. No MRO detections exceeded the Method A soil cleanup level of 2,000 mg/kg.

Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene were reported in all but a few samples, with a calculated maximum total naphthalenes concentration of 205 mg/kg at location GP-11-CD5-5. Total naphthalenes exceeded the soil cleanup level of 5 mg/kg in 11 samples.

Six VOCs (benzene, ethylbenzene, m,p-xylenes, naphthalene, o-xylene, and toluene) were reported in one or more samples. Toluene was detected in the largest number of samples (28), with a maximum concentration of 4.6 µg/kg. Naphthalene and total naphthalenes exceeded the soil cleanup level in three samples (GP-11-CD5-10, GP-11-CD6-5, and GP-11-CD6-10). Benzene was non-detect in 8 samples with an SQL greater than the soil cleanup level of 30 mg/kg. MTBE was non-detect in one sample with an SQL greater than the soil cleanup level of 100 mg/kg.

Polycyclic aromatic hydrocarbons (PAHs) were reported in 43 of 48 samples, with an individual maximum concentration of 4,600 µg/kg (total benzofluoranthenes) at location GP-11-CD2-10. Benzo(a)pyrene concentrations exceeded the soil cleanup level of 100 µg/kg in five samples; the maximum benzo(a)pyrene concentration was 2,400 µg/kg. Benzo(a)pyrene was reported as non-detect at 450 µg/kg in sample GP-11-CD5-5, which exceeded the soil cleanup level of 100 µg/kg. All non-detect PAHs in this sample had similarly elevated SQLs. The elevated DRO concentration (24,000 mg/kg) in sample GP-11-CD5-5 required sample dilution which contributed to the elevated SQLs.

Benzo(a)pyrene TTECs (all calculation methods) exceeded the soil cleanup level in six samples. Due to elevated non-detect SQLs, the benzo(a)pyrene TTEC calculated with non-detects set equal to one-half the SQL also exceeded the soil cleanup level in sample GP-11-CD5-5. Only one of the PAHs used in the TTEC calculation (chrysene) was estimated (300 µg/kg). Given that non-detects represent greater than 80% of the input data, the KM and robust ROS methods for calculating TTEC are not recommended. Given that the non detect SQL for benzo(a)pyrene in sample GP-11-CD5-5 also exceeded the cleanup level, a statement that this sample is clean with respect to the benzo(a)pyrene cleanup level cannot be made.

4.4.2.2 GROUNDWATER

The groundwater grab samples AQCD1, AQCD2, and field duplicate AQCD7 were analyzed for DRO, VOCs, anions, dissolved manganese, and MEE (Table 7). The maximum DRO and MRO concentrations (10,000 and 490 µg/L, respectively) were detected at AQCD2. DRO was detected above the Method A groundwater cleanup level in all samples.

VOCs (benzene, ethylbenzene, and naphthalene) were detected in one or more samples. Toluene was only detected at AQCD2. Napthalene (210 ug/l) was the only VOC detected above its corresponding Method A cleanup level (i.e. 160 ug/l)..

Monitoring wells MW-05 and MW-08 were analyzed for GRO, DRO, VOCs, anions, dissolved manganese, and MEE. DRO was detected at both MW-05 and MW-08 (2,200 and 280 µg/L, respectively). MRO was only detected at MW-05. No VOCS were detected.

Among the non-regulated parameters, dissolved manganese, nitrate, sulfate, and methane gas were detected.

4.4.3 UST E

This section summarizes the analytical results of chemical detected soil and groundwater near UST E.

4.4.3.1 SOIL

All soil samples were analyzed for DRO, GRO, and VOCs.

As shown in Table 10, GRO was detected in 3 of the 21 soil samples, with a maximum concentration of 1,900 mg/kg at location GP-11-E11-10. All GRO detections exceeded the MTCA A cleanup level of 100 mg/kg. DRO was reported in 10 of 21 soil samples, with a maximum concentration of 69 mg/kg at location GP-11-E6-10. MRO was reported in 6 of 21 soil samples, with a maximum concentration of 340 mg/kg at location GP-11-E13-10. No DRO or MRO detections exceeded their cleanup levels of 2,000 mg/kg.

VOCs (benzene, ethylbenzene, m,p-xylenes, naphthalene, o-xylene, and toluene) were detected in 13 of 21 soil samples. The highest VOC concentrations were detected at locations GP-11-E6-10 and GP-11-E11-10. Toluene was detected in the largest number of samples (9), with a maximum concentration of 130 µg/kg at GP-11-E6-10.

Benzene was detected in one sample (GP-11-E6-10) at a concentration of 41 µg/kg (estimated) that exceeded its cleanup level of 30 µg/kg. No other VOCs were detected above their cleanup levels.

In all three samples (GP-11-E6-10, GP-11-E11-10, GP-11-E11-15) GRO was also present at a concentration that exceeded its soil cleanup level. Benzene was also reported as a non-detect with an SQL greater than the cleanup level of 30 µg/kg in two samples (GP-11-E11-10 and GP-11-E11-15).

4.4.3.2 GROUNDWATER

The groundwater grab samples AQE1, AQE2, and AQE3 were analyzed for GRO, DRO, VOCs, anions, dissolved manganese, and MEE. GRO was detected in AQE1 and AQE2, with a maximum concentration of 27,000 (estimated) µg/L at AQE1, located adjacent to soil boring GP-11-E11. DRO was detected in AQE1 and AQE2, with a maximum concentration of 730 µg/L at AQE1. MRO was not detected in any samples. GRO and DRO detections exceeded the Method A groundwater cleanup level at AQE1.

VOCs (benzene, ethylbenzene, m,p-xylene,naphthalene, o-xylene, and toluene) were detected in one or more samples, with the maximum concentrations generally reported at AQE1.

Among the non-regulated parameters, dissolved manganese, nitrate, sulfate, and methane gas were detected.

4.4.4 USTs H THROUGH O

This section summarizes the analytical results of chemicals detected in soil near USTs H through O. All soil samples were analyzed for DRO and VOCs.

As shown in Table 11, DRO was detected in all 18 soil samples with a maximum concentration of 3,000 mg/kg at location GP-06-H3-12. DRO concentrations exceeded the Method A soil cleanup level of 2,000 mg/kg in 1 of 18 soil samples. MRO was detected in 17 of 18 soil samples with a maximum concentration of 1,500 mg/kg at location GP-06-H1-5. No MRO detections exceeded the Method A soil cleanup level of 2,000 mg/kg.

VOCs (benzene, ethylbenzene, m,p-xylenes, napththalene, o-xylene, and toluene) were detected at one or more locations. No VOC detections exceeded soil cleanup levels.

Benzene had non-detect SQL that exceeded the soil cleanup level in two samples (GP-06-H3-10 and GP-06-H3-12). Although benzene is required for analysis for DRO releases, it is more commonly associated with gasoline. Heavier fuels such as diesel fuel typically have much less benzene present. Given that USTs H through O only stored diesel fuel for fueling the power house, and all other benzene detections at the site are well below the Method A cleanup level of 5 mg/kg, the presence of benzene in soil above the cleanup level at USTs H-O is unlikely.

4.4.5 UST P

This section summarizes the analytical results of chemicals detected in soil near UST P. All soil samples were analyzed for SVOCs and PCB Aroclors.

As shown in Table 12, one or more cPAHs were reported in 3 of 4 soil samples, with a maximum concentration of 17 µg/kg for total benzofluoranthenes at location GP-06-P2-10. TTEC of cPAHs via all four calculation methods are below the benzo(a)pyrene soil cleanup level of 100 µg/kg. PCB Aroclors were non-detect in all samples.

No chemicals were detected at concentrations in excess of soil cleanup levels.

4.4.6 USTs R AND S

This section summarizes the analytical results of chemicals detected in soil near USTs R and S. All soil samples were analyzed for GRO, DRO, VOCs, and lead.

As shown in Table 13, GRO was non-detect in all samples. DRO and MRO were detected in all nine samples, with maximum concentrations of 110 and 390 mg/kg, respectively, at location GP-06-RS8-2. No DRO or MRO detections exceeded the Method A soil cleanup level of 2,000 mg/kg.

Toluene was detected in 8 of 9 soil samples, with a maximum concentration of 1.2 (estimated) µg/kg. Naphthalene was detected in one soil sample with a concentration of 2.70 (estimated) µg/kg at location GP-06-RS4-3. No VOC detections exceeded soil cleanup levels.

Lead was detected in all nine soil samples, with a maximum concentration of 20.6 mg/kg at location GP-06-RS7-3. No lead detections exceeded the soil cleanup level of 250 mg/kg.

4.4.7 USTs T, U, AND V

This section summarizes the analytical results of chemicals detected soil and groundwater near USTs T, U, and V.

4.4.7.1 SOIL

All soil samples were analyzed for DRO and VOCs.

As shown in Table 14, DRO was detected in 27 of 28 samples with a maximum concentration of 2,100 mg/kg at location GP-05-T3-12. DRO concentrations exceeded the Method A soil cleanup level of 2,000 mg/kg in 1 of 28 soil samples. MRO was detected in 27 of 28 samples with a maximum concentration of 1,600 mg/kg at location GP-05-TUV4-3. No MRO detections exceeded the Method A soil cleanup level of 2,000 mg/kg.

VOCs (benzene, ethyl benzene, m,p-xylenes, naphthalene, o-xylene, and toluene) were detected in one or more of the soil samples. No VOC concentrations exceeded soil cleanup levels.

4.4.7.2 GROUNDWATER

The groundwater grab sample AQTUV1 was analyzed for DRO, VOCs, anions, dissolved manganese, and MEE. DRO was detected at 900 µg/L which exceeds the groundwater cleanup level of 500 µg/L. MRO was detected at 250 µg/L.

All VOCs were non-detect.

Among the non-regulated parameters, dissolved manganese, nitrate, and sulfate were detected.

4.4.8 MONITORING WELLS

This section discusses long-term trends for all wells. Plots showing available long-term DRO and GRO concentrations (since 2003) in groundwater are shown in Figures 12 and 13. Only wells with at least one detection are included. Non-detects are plotted at their SQL.

DRO in groundwater has been detected in at least five Cantonment Area wells since 2003 (MW-03, MW-05, MW-06, MW-07, and MW-08). Figure 12 shows that DRO concentrations in MW-05 and MW-06 have been variable, but frequently exceed the groundwater cleanup level of 500 µg/L. With the exception of one data point in 2012, DRO concentrations in MW-03, MW-07, and MW-08 have remained consistently below the groundwater cleanup level of 500 µg/L.

GRO in groundwater has only been detected in the cantonment wells at MW-06. Figure 13 shows a decreasing trend in concentration over time, with the most recent concentrations at approximately 5,000 µg/L which exceeds the cleanup level of 1,000 µg/L.

Figure 15 shows DRO and GRO concentrations and groundwater elevations (since 2010) for MW-06. In general, there is an inverse relationship in which DRO and GRO concentrations decrease as groundwater elevations increase.

SECTION 5 – RESULTS AND CONCLUSIONS

This section summarizes the results of the investigation for each UST or UST grouping and presents conclusions for use in subsequent corrective action and potential closure decision-making for individual UST sites. Table 15 summarizes the findings by UST.

5.1 UST A

Fourteen soil and one groundwater sample(s) were collected and analyzed for compounds associated with petroleum hydrocarbon contamination. DRO exceeded the soil cleanup level in two samples (GP-11-A4-12 and GP-11-A6-8) ranging from 4-12 ft bgs. Both samples are centrally located between the adjacent buildings. No soil exceedances were observed in samples immediately adjacent to the existing buildings. Benzene was non-detect in all samples; however, the SQL exceeded the soil cleanup levels in one of the two samples with DRO exceedances. Benzene is more commonly associated with gasoline; thus the actual presence above soil cleanup levels is unlikely. All historical documentation indicates that UST A stored diesel fuel.

DRO in groundwater exceeded the cleanup level in AQA1. The downgradient monitoring well, MW-04, was not sampled during the Phase II investigation; however, in past sampling DRO has been non-detect. This suggests that the contamination in groundwater near AQA1 has not migrated downgradient to MW-04.

5.2 USTS C AND D

Forty-eight soil, three groundwater (grab), and two groundwater monitoring well samples were collected and analyzed for compounds associated with petroleum hydrocarbon contamination.

DRO exceeded the soil cleanup level during the planned and step-out stages of sample collection. However, all perimeter sample locations at UST C and D were non-detect or below the soil cleanup levels, indicating that the soil investigation successfully delineated the extent of the soil

contamination. Soil under buildings 14 and 18 was inaccessible during the Phase II investigation. Further sampling may be necessary to determine if there is contamination above cleanup levels under both buildings. The highest DRO detections were located immediately adjacent to UST D (i.e. -CD1, -CD2, and –CD3) and downgradient in the middle of the street (i.e. -CD5, -CD6, -CD16). The highest concentrations ranged in depth from 0 to 10 ft bgs but did not exceed the soil cleanup level below 10 ft bgs at any location.

Total naphthalenes and cPAHs as TTECs in excess of soil cleanup levels were also observed at several locations, generally in association with elevated soil DRO. The most notable exception occurred at location GP-11-CD13, where cPAH as TTECs exceeded the soil cleanup level significantly in the 0 to 5 ft bgs depth interval and DRO was very low or non-detect for 0 to 5 and 5 to 10 ft bgs intervals, respectively. Carcinogenic PAHs as TTEC were well below the soil cleanup level for all depth intervals at the two upgradient soil sampling locations (-CD12 and –CD18), which suggests that the cPAH exceedance at CD13 may be an isolated occurrence not associated with the UST C and D petroleum release.

Naphthalene in groundwater exceeded the cleanup level in groundwater grab sample AQCD2. DRO in groundwater exceeded cleanup levels in both groundwater grab sample locations AQCD1 and AQCD2 and downgradient well MW-05. DRO concentrations at the AQCD1 and AQCD2 locations were higher than the DRO concentration in MW-05, suggesting that the groundwater plume is steadily progressing downgradient. However, concentrations at MW-05 have also been slightly increasing since 2013 which could mean there is a continuing source of contamination contributing to the groundwater plume. DRO was detected at concentrations below the cleanup level in MW-08, which is located downgradient of MW-05. Further groundwater sampling downgradient of AQCD1 may be necessary to further delineate the extent of contamination. Although downgradient monitoring wells MW-07 and MW-02 are historically non-detect, results from the Phase II investigation indicate the soils beneath the road may be acting as a conduit for contamination.

5.3 UST E

Twenty-one soil, three groundwater grab, and two groundwater monitoring well samples were collected and analyzed for compounds associated with petroleum hydrocarbon contamination. GRO and benzene were detected above their respective soil cleanup levels in one or more samples ranging from 5-15 ft bgs. Benzene was non-detect with SQL exceeding the cleanup level in 2 or more samples. All non-detect SQL exceedances occurred in samples that had GRO concentrations in exceedance of cleanup levels.

The greatest GRO detections occurred near the approximate center of the former UST (GP-11-E6) and to the west (GP-11-E11) adjacent to building 16. The extent of contamination to the west could not be determined due to the presence of building 16. There were no detections of GRO in samples down gradient of GP-11-E11 at GP-11-E7 and –E8 indicating the contamination at –E11 was localized to the release area.

GRO and DRO exceeded the groundwater cleanup levels in the grab sample AQE1 located near GP-11-E11 but were estimated below their corresponding LOQs at AQE2. The source of the DRO is unknown; all historical documents indicate that UST E contained gasoline.

GRO also exceeded the groundwater cleanup level and DRO was detected just below the groundwater cleanup level in downgradient well MW-06. Soil samples collected nearest to MW-06 (i.e. -E13, -E14) produced samples with a petroleum odor, but analytical results were non-detect for GRO with low concentrations of DRO and MRO. GRO was not detected in soil samples GP-11-E7, -E8

and -E9 located immediately downgradient from GP-11-E11 and between UST E and MW-06. This supports the theory that the contamination detected in GP-11-E11 and –E6 is localized and the contamination found in MW-06 is from an alternate source. Another theory is that contamination originated from UST E and migrated to MW-06 in the groundwater but did not impact the surrounding soil (i.e., GP-11-E7, -E8 and -E9).

Furthermore, recent groundwater flow direction data indicates contamination at GP-11-E-11 would flow more likely under building 16 and not towards MW-06. To further delineate contamination that may have originated from UST E; soil and groundwater samples should be collected from under building 16, between UST E and MW-06 and between MW-06 and AQE3.

5.4 UST P

Four soil samples were collected and analyzed for compounds associated with petroleum hydrocarbon contamination. No target analytes exceeded soil cleanup levels.

5.5 USTs R AND S

Nine soil samples were collected and analyzed for compounds associated with petroleum hydrocarbon contamination. No target analytes exceeded soil cleanup levels. Although the status of the tanks is unconfirmed, no tanks were encountered during this investigation.

5.6 USTs T, U, AND V

Twenty-eight soil and one groundwater grab sample(s) were collected and analyzed for compounds associated with petroleum hydrocarbon contamination. DRO exceeded the soil cleanup level in one sample (GP-05-T3-12) located near former UST T at a depth of 10-12 ft bgs. The sample was located underneath the existing paved access road leading to the FAA facilities. One or more samples collected near UST T had detected concentrations of DRO and MRO. DRO also exceeded the groundwater cleanup level in the groundwater grab sample AQTUV1 taken adjacent to GP-05-T3.

5.7 CONCLUSIONS

USTs, B, F, W, Y1, Y2, and Y3 were not investigated as part of the SI because existing information, as detailed in the QAPP (USACE, 2014), is considered sufficient for affirmative closure decisions at these sites. SI results for UST P and USTs R and S did not exceed any threshold screening criteria established in the QAPP (USACE, 2014, 2015a) that would indicate a potential need for corrective action at these sites. For those UST sites (i.e. USTs A, C&D, E, H and T…) where results exceeded applicable MTCA A cleanup levels, remedial options will be addressed in the corrective action plan as required by the Consent Order. Possible future actions for each of the UST sites may include active remediation to meet MTCA A cleanup levels, thereby supporting a No Further Action (clean closure) determination by EPA or a risk-based closure which may include institutional controls or similar restrictions. Future corrective action/closure decisions for each UST site will be made in accordance with the terms of the Consent Order in consultation with the Makah Tribe and will be based on the site history, previous response actions, SI data and results, and comparisons to chemical and risk-based regulatory criteria that are identified in this SI Report.

SECTION 6 – REFERENCES

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TABLES

Table 1. Cantonment and Top Camp USTs

UST	Former Contents	Former Use (if known)	Capacity in gallons	Year Installed	Pre-Phase II known MTCA A soil exceedances	Tank Status	Phase II Investigation
Cantonment Area							
A	No. 2 diesel	fuel for emergency backup generators	8,000	1951	DRO	Tank removed in 1989.	Yes
B	No. 2 diesel	fuel for emergency backup generators	2,000	1979	None	Tank removed in 1989.	No
C	No. 2 diesel (previously bunker fuel, #4 diesel)	fueling boilers operating 24 hrs/day	10,000	1979	DRO, MRO	Tank removed in 1989.	Yes
D	No. 2 diesel (previously bunker fuel, #4 diesel)	fueling boilers operating 24 hrs/day	8,000	1976	DRO, MRO	Tank removed in 1989.	Yes
E	Unleaded (previously leaded) gasoline	motor vehicle refueling	2,050	1953	GRO	Tank removed in 1989.	Yes
F	No. 2 diesel	motor vehicle refueling	550	1954	None	Tank removed in 1989.	No
G	Waste chemicals pesticide rinse	Received pesticide rinse wastes from building 43	1,000	Est. 1975	Drainfield: Benzo(a)pyrene, chromium	Tank removed in 1989.	No
Y1	Gasoline (unleaded)	motor vehicle refueling	2,000	1962	None	Tank removed in 1989.	No
Y2	Gasoline (super unleaded)	motor vehicle refueling	2,000	1962	None	Tank removed in 1989.	No
Y3	Gasoline (regular leaded)	motor vehicle refueling	3,023	1962	None	Tank removed in 1989.	No
Microwave Tower Site							
H	Diesel Fuel	Fuel for Engineering Plant building	7,000	1960	DRO, MRO	Tanks removed in 1988.	Yes
I			10,000	1960			
J			10,000	1960			
K			10,000	1960			
L			10,000	1960			
M			10,000	1960			
N			10,000	1960			
O			10,000	1960			
P	Waste oil	Stored waste oil	550	1960	None	Tank removed in 1988.	Yes
R	Diesel fuel		550	1951	No data.	Status unconfirmed: Tank reported abandoned in place (Radian 1987). Memo dated 28 September 1988 indicates that one above ground and one below ground tanks were removed at building 103. Either or both Tanks R and S may have been the subject tanks removed. Tank not encountered during Phase II investigation.	Yes
S	Gasoline (unleaded, leaded, and super unleaded)		200	Unknown	No data.	Status unconfirmed: Tank belonged to Navy and was listed as operational in Radian 1987 HER. Memo dated 28 September 1988 indicates that one above ground and one below ground tanks were removed at building 103. Either or both Tanks R and S may have been the subject tanks removed. Tank not encountered during Phase II investigation.	Yes
W	Diesel Fuel		2,000	1959	None	Status unconfirmed: Reported abandoned in place (Radian 1987). Memo data 28 September 1988 indicates that on above ground and one below ground tanks were removed at building 103. UST W was listed by Radian as being adjacent to Building 117, so memo listing may not be referring to UST W.	No
Radar Dome Area							
T	Diesel Fuel		6,000	1953	No data.	Tank removed in 1988. Tank was not encountered during Phase II investigation.	Yes
U	Diesel Fuel (#4)		550	1962	No data	Tank removed in 1988. Tank was not encountered during Phase II investigation.	Yes
V	Diesel Fuel		550	1953	No data	Tank removed in 1988. Tank was not encountered during Phase II investigation.	Yes
Former Building 102							
Q	Diesel Fuel		550	1951	None	Status unconfirmed: Tank reported abandoned in place (Radian 1987). Tank not encountered during 2007/2008 soil investigation (Ridolfi 2008).	No

Table 2. Soil Analyses by UST

Sample ID	Location	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Collection Date & Time	Sample Type	Analyses					
						Total Lead (6020)	PCB Aroclors (8082)	VOCs (8260C)	SVOCs (8270D SIM)	Diesel-range and Oil-range Petroleum Hydrocarbons (NWTPH-Dx)	Gasoline-range Petroleum Hydrocarbons (NWTPH-Gx)
UST A											
GP-11-A4-8	GP11A4	4	8	3/3/15 9:18	N			1		1	
GP-11-A4-12	GP11A4	8	12	3/3/15 9:18	N			1		1	
GP-11-A5-10	GP11A5	5	10	3/3/15 10:45	N			1		1	
GP-11-A5-15	GP11A5	10	15	3/3/15 10:45	N			1		1	
GP-11-A6-8	GP11A6	4	8	3/3/15 8:45	N			1		1	
GP-11-A6-13	GP11A6	8	13	3/3/15 8:45	N			1		1	
GP-11-A7-8	GP11A7	4	8	3/3/15 9:53	N			1		1	
GP-11-A7-13	GP11A7	8	13	3/3/15 9:53	N			1		1	
GP-11-A8-10	GP11A8	5	10	3/10/15 14:35	N			1		1	
GP-11-A8-15	GP11A8	10	15	3/10/15 14:35	N			1		1	
GP-11-A9-5	GP11A9	0	5	3/10/15 13:45	N			1		1	
GP-11-A9-10	GP11A9	5	10	3/10/15 13:45	N			1		1	
GP-11-A10-10	GP11A10	5	10	3/10/15 15:05	N			1		1	
GP-11-A10-15	GP11A10	10	15	3/10/15 15:05	N			1		1	
USTs C, D											
GP-11-CD1-5	GP11CD1	0	5	3/4/15 10:30	N			1	1	1	
GP-11-CD1-10	GP11CD1	5	10	3/4/15 10:30	N			1	1	1	
GP-11-CD2-10	GP11CD2	5	10	3/4/15 7:55	N			1	1	1	
GP-11-CD2-11	GP11CD2	10	11	3/4/15 7:55	N			1	1	1	
GP-11-CD20-10	GP11CD20	5	10	3/11/15 13:25	N			1	1	1	
GP-11-CD20-15	GP11CD20	10	15	3/11/15 13:25	N			1	1	1	
GP-11-CD3-10	GP11CD3	5	10	3/4/15 9:00	N			1	1	1	
GP-11-CD31-10	GP11CD3	5	10	3/4/15 9:10	FD			1	1	1	
GP-11-CD3-15	GP11CD3	10	15	3/4/15 9:00	N			1	1	1	
GP-11-CD4-5	GP11CD4	0	5	3/4/15 11:10	N			1	1	1	
GP-11-CD4-10	GP11CD4	5	10	3/4/15 11:10	N			1	1	1	
GP-11-CD5-5	GP11CD5	0	5	3/4/15 14:00	N			1	1	1	
GP-11-CD5-10	GP11CD5	5	10	3/4/15 14:00	N			1	1	1	
GP-11-CD5-18	GP11CD5	15	18	3/4/15 14:00	N			1	1	1	
GP-11-CD6-5	GP11CD6	0	5	3/4/15 14:40	N			1	1	1	
GP-11-CD6-10	GP11CD6	5	10	3/4/15 14:40	N			1	1	1	
GP-11-CD6-20	GP11CD6	15	20	3/4/15 14:40	N			1	1	1	
GP-11-CD7-5	GP11CD7	0	5	3/4/15 12:50	N			1	1	1	
GP-11-CD7-10	GP11CD7	5	10	3/4/15 12:50	N			1	1	1	
GP-11-CD8-6	GP11CD8	0	6	3/3/15 14:02	N			1	1	1	
GP-11-CD8-10	GP11CD8	6	10	3/3/15 14:02	N			1	1	1	
GP-11-CD9-10	GP11CD9	5	10	3/3/15 13:10	N			1	1	1	
GP-11-CD91-15	GP11CD9	10	15	3/3/15 13:40	FD			1	1	1	
GP-11-CD9-15	GP11CD9	10	15	3/3/15 13:10	N			1	1	1	
GP-11-CD10-5	GP11CD10	0	5	3/12/15 13:25	N			1	1	1	
GP-11-CD10-10	GP11CD10	5	10	3/12/15 13:25	N			1	1	1	
GP-11-CD11-5	GP11CD11	0	5	3/12/15 14:10	N			1	1	1	
GP-11-CD11-10	GP11CD11	5	10	3/12/15 14:10	N			1	1	1	
GP-11-CD12-5	GP11CD12	0	5	3/12/15 12:25	N			1	1	1	
GP-11-CD12-10	GP11CD12	5	10	3/12/15 12:25	N			1	1	1	
GP-11-CD13-5	GP11CD13	0	5	3/12/15 11:20	N			1	1	1	
GP-11-CD13-10	GP11CD13	5	10	3/12/15 11:20	N			1	1	1	
GP-11-CD14-5	GP11CD14	0	5	3/12/15 8:55	N			1	1	1	
GP-11-CD14-10	GP11CD14	5	10	3/12/15 8:55	N			1	1	1	
GP-11-CD15-5	GP11CD15	0	5	3/10/15 10:35	N			1	1	1	
GP-11-CD15-10	GP11CD15	5	10	3/10/15 10:35	N			1	1	1	
GP-11-CD151-10	GP11CD15	5	10	3/10/15 10:45	FD			1	1	1	
GP-11-CD16-5	GP11CD16	0	5	3/11/15 12:05	N			1	1	1	
GP-11-CD16-10	GP11CD16	5	10	3/11/15 12:05	N			1	1	1	
GP-11-CD16-15	GP11CD16	10	15	3/11/15 12:05	N			1	1	1	
GP-11-CD17-5	GP11CD17	0	5	3/11/15 15:10	N			1	1	1	
GP-11-CD17-10	GP11CD17	5	10	3/11/15 15:10	N			1	1	1	
GP-11-CD18-10	GP11CD18	5	10	3/12/15 10:20	N			1	1	1	
GP-11-CD181-10	GP11CD18	5	10	3/12/15 10:50	FD			1	1	1	
GP-11-CD18-15	GP11CD18	10	15	3/12/15 10:20	N			1	1	1	
GP-11-CD19-5	GP11CD19	0	5	3/11/15 14:20	N			1	1	1	
GP-11-CD19-10	GP11CD19	5	10	3/11/15 14:20	N			1	1	1	
GP-11-CD191-10	GP11CD19	5	10	3/11/15 14:40	FD			1	1	1	
UST E											
GP-11-E5-10	GP11E5	5	10	3/5/15 8:10	N			1		1	1
GP-11-E51-15	GP11E5	10	15	3/5/15 8:30	FD			1		1	1
GP-11-E5-15	GP11E5	10	15	3/5/15 8:10	N			1		1	1
GP-11-E6-10	GP11E6	5	10	3/5/15 10:35	N			1		1	1
GP-11-E6-15	GP11E6	10	15	3/5/15 10:35	N			1		1	1
GP-11-E7-10	GP11E7	5	10	3/5/15 13:15	N			1		1	1
GP-11-E7-15	GP11E7	10	15	3/5/15 13:15	N			1		1	1
GP-11-E8-5	GP11E8	0	5	3/5/15 14:00	N			1		1	1
GP-11-E8-10	GP11E8	5	10	3/5/15 14:00	N			1		1	1
GP-11-E9-5	GP11E9	0	5	3/5/15 9:50	N			1		1	1
GP-11-E9-10	GP11E9	5	10	3/5/15 9:50	N			1		1	1
GP-11-E10-10	GP11E10	5	10	3/5/15 9:05	N			1		1	1
GP-11-E10-15	GP11E10	10	15	3/5/15 9:05	N			1		1	1
GP-11-E11-10	GP11E11	5	10	3/5/15 11:10	N			1		1	1
GP-11-E11-15	GP11E11	10	15	3/5/15 11:10	N			1		1	1
GP-11-E12-10	GP11E12	5	10	3/13/15 9:40	N			1		1	1
GP-11-E12-15	GP11E12	10	15	3/13/15 9:40	N			1		1	1
GP-11-E13-5	GP11E13	0	5	3/13/15 11:15	N			1		1	1
GP-11-E13-10	GP11E13	5	10	3/13/15 11:15	N			1		1	1
GP-11-E14-5	GP11E14	0	5	3/13/15 12:15	N			1		1	1

Sample ID	Location	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Collection Date & Time	Sample Type	Analyses					
						Total Lead (6020)	PCB Aroclors (8082)	VOCs (8260C)	SVOCs (8270D SIM)	Diesel-range and Oil-range Petroleum Hydrocarbons (NWTPH-Dx)	Gasoline-range Petroleum Hydrocarbons (NWTPH-Gx)
GP-11-E14-10	GP11E14	5	10	3/13/15 12:15	N			1		1	1
USTs H - O											
GP-06-H1-5	GP06H1	0	5	3/9/15 9:20	N			1		1	
GP-06-H1-8	GP06H1	5	8	3/9/15 9:20	N			1		1	
GP-06-H2-10	GP06H2	5	10	3/9/15 10:05	N			1		1	
GP-06-H2-11	GP06H2	10	11	3/9/15 10:05	N			1		1	
GP-06-H3-10	GP06H3	5	10	3/6/15 9:55	N			1		1	
GP-06-H3-12	GP06H3	10	12	3/6/15 9:55	N			1		1	
GP-06-H4-5	GP06H4	0	5	3/6/15 10:30	N			1		1	
GP-06-H4-9	GP06H4	5	9	3/6/15 10:30	N			1		1	
GP-06-H5-5	GP06H5	0	5	3/6/15 10:55	N			1		1	
GP-06-H5-10	GP06H5	5	10	3/6/15 10:55	N			1		1	
GP-06-H6-5	GP06H6	0	5	3/9/15 8:50	N			1		1	
GP-06-H7-5	GP06H7	0	5	3/17/15 8:55	N			1		1	
GP-06-H7-7	GP06H7	5	7	3/17/15 8:55	N			1		1	
GP-06-H8-10	GP06H8	5	10	3/17/15 10:15	N			1		1	
GP-06-H8-12	GP06H8	10	12	3/17/15 10:15	N			1		1	
GP-06-H9-10	GP06H9	5	10	3/17/15 9:35	N			1		1	
GP-06-H91-13	GP06H9	10	13	3/17/15 9:55	FD			1		1	
GP-06-H9-13	GP06H9	10	13	3/17/15 9:35	N			1		1	
UST P											
GP-06-P1-10	GP06P1	5	10	3/6/15 8:15	N		1		1		
GP-06-P1-14	GP06P1	10	14	3/6/15 8:15	N		1		1		
GP-06-P2-5	GP06P2	0	5	3/6/15 9:15	N		1		1		
GP-06-P2-10	GP06P2	5	10	3/6/15 9:15	N		1		1		
USTs R, S											
GP-06-RS1-5	GP06RS1	0	5	3/9/15 11:15	N	1		1		1	1
GP-06-RS2-4	GP06RS2	0	4	3/9/15 12:45	N	1		1		1	1
GP-06-RS3-3	GP06RS3	0	3	3/9/15 13:15	N	1		1		1	1
GP-06-RS4-3	GP06RS4	0	3	3/17/15 7:55	N	1		1		1	1
GP-06-RS5-3	GP06RS5	0	3	3/10/15 8:45	N	1		1		1	1
GP-06-RS61-5	GP06RS6	0	5	3/9/15 14:25	FD	1		1		1	1
GP-06-RS6-5	GP06RS6	0	5	3/9/15 14:15	N	1		1		1	1
GP-06-RS7-3	GP06RS7	0	3	3/10/15 9:45	N	1		1		1	1
GP-06-RS8-2	GP06RS8	0	2	3/10/15 9:10	N	1		1		1	1
USTs T, U, V											
GP-05-T1-5	GP05T1	0	5	3/16/15 14:55	N			1		1	
GP-05-T1-8	GP05T1	5	8	3/16/15 14:55	N			1		1	
GP-05-T2-10	GP05T2	5	10	3/16/15 12:15	N			1		1	
GP-05-T2-12	GP05T2	10	12	3/16/15 12:15	N			1		1	
GP-05-T3-5	GP05T3	0	5	3/16/15 13:00	N			1		1	
GP-05-T3-10	GP05T3	5	10	3/16/15 13:00	N			1		1	
GP-05-T3-12	GP05T3	10	12	3/16/15 13:00	N			1		1	
GP-05-TUV1-5	GP05TUV1	0	5	3/18/15 10:50	N			1		1	
GP-05-TUV1-8	GP05TUV1	5	8	3/18/15 10:50	N			1		1	
GP-05-TUV2-5	GP05TUV2	0	5	3/18/15 11:30	N			1		1	
GP-05-TUV2-10	GP05TUV2	5	10	3/18/15 11:30	N			1		1	
GP-05-TUV3-5	GP05TUV3	0	5	3/18/15 12:10	N			1		1	
GP-05-TUV3-6	GP05TUV3	5	6	3/18/15 12:10	N			1		1	
GP-05-TUV41-3	GP05TUV4	0	3	3/18/15 12:50	FD			1		1	
GP-05-TUV4-3	GP05TUV4	0	3	3/18/15 12:30	N			1		1	
GP-05-U1-5	GP05U1	0	5	3/17/15 12:05	N			1		1	
GP-05-U1-10	GP05U1	5	10	3/17/15 12:05	N			1		1	
GP-05-U2-5	GP05U2	0	5	3/17/15 12:45	N			1		1	
GP-05-U2-10	GP05U2	5	10	3/17/15 12:45	N			1		1	
GP-05-U2-12	GP05U2	10	12	3/17/15 12:45	N			1		1	
GP-05-U3-5	GP05U3	0	5	3/18/15 10:20	N			1		1	
GP-05-U3-9	GP05U3	5	9	3/18/15 10:20	N			1		1	
GP-05-V1-5	GP05V1	0	5	3/16/15 13:50	N			1		1	
GP-05-V1-7	GP05V1	5	7	3/16/15 13:50	N			1		1	
GP-05-V2-5	GP05V2	0	5	3/17/15 11:25	N			1		1	
GP-05-V2-8	GP05V2	5	8	3/17/15 11:25	N			1		1	
GP-05-V3-5	GP05V3	0	5	3/16/15 14:35	N			1		1	
GP-05-V3-8	GP05V3	5	8	3/16/15 14:35	N			1		1	
Totals						9	4	138	52	138	30

Table 3. Cantonment Monitoring Well Construction Details and Phase II Groundwater Elevation Measurements

	Information from Boring Logs						June 2014	June 2014		March 2015	
Location	Installation Date	Completion	Inner well diameter (in)	Top of well PVC pipe (ft bgs)	Screen Depth (ft bgs)	Top of Casing relative elevation (ft)	Measured well depth (ft)	Depth to Groundwater (ft)	Relative water elevation (ft)	Depth to Groundwater from top of PVC pipe (ft)	Relative water elevation (ft)
MW-01	1989	flush-mount	2	0.1 ft	5.3-10.7	106.51	10.5	4.73	101.78	3.65	102.86
MW-02	1989	flush-mount	2	0.5 ft	6.6-12.0	97.62	11.3	3.73	93.89	2.55	95.07
MW-03	1989	flush-mount	2	0.3 ft	6.4-11.8	98.49	11.83	4.62	93.87	3.73	94.76
MW-04	1989	flush-mount	2	0.9 ft	3.1-13.5	105.19	12.5	5.33	99.86	3.72	101.47
MW-05	1989	flush-mount	2	0.9 ft	3.1-13.5	102	13	6.07	95.93	4.74	97.26
MW-06	1989	flush-mount	2	0.5 ft	3.6-14.0	102.89	11.75	5.35	97.54	4.24	98.65
MW-07	2009	flush-mount	~1? (<2)	0.26	5.0-15.0	97.63	11.5	3.14	94.49	1.85	95.78
MW-08	2009	flush-mount	~1? (<2)	0.36	5.0-15.0	100.46	9	5.65	94.81	4.34	96.12
MW-09	2009	flush-mount	~1? (<2)	0.37	5.0-15.0	100.7	Not recorded	5.37	95.33	4.17	96.53

Notes:

1 - The monument elevations reference a common control point assigned an arbitrary elevation of 100 ft. Source: Ridolfi MW Installation Report, March 2009, Appendix.

2 - Relative groundwater elevations are approximate. Relative groundwater elevations were calculated by subtracting the measured depth to groundwater from the monument relative elevations.

Table 4. Sampling Locations

Location	X-coordinate	Y-coordinate
Cantonment Monitoring Wells		
MW-01	708511.441	515373.408
MW-02	708722.733	514720.428
MW-03	708903.778	514843.419
MW-04	708528.569	515192.797
MW-05	708494.617	514837.326
MW-06	708574.350	515017.417
MW-07	708607.916	514591.890
MW-08	708522.712	514729.444
MW-09	708653.435	514864.566
UST A		
GP11A4	708486.297	515225.792
GP11A5	708491.383	515212.289
GP11A6	708496.384	515224.157
GP11A7	708480.014	515222.818
GP11A8	708508.066	515217.360
GP11A9	708490.365	515233.560
GP11A10	708499.646	515202.024
AQA1	708495.967	515221.420
USTs C, D		
GP11CD1	708475.442	514854.433
GP11CD2	708479.887	514864.438
GP11CD3	708467.505	514860.953
GP11CD4	708454.154	514853.992
GP11CD5	708490.957	514810.120
GP11CD6	708514.313	514770.339
GP11CD7	708457.756	514834.645
GP11CD8	708495.770	514883.264
GP11CD9	708473.827	514900.850
GP11CD10	708514.622	514906.317
GP11CD11	708428.490	514852.935
GP11CD12	708521.366	514858.965
GP11CD13	708529.791	514810.084
GP11CD14	708493.311	514784.986
GP11CD15	708508.313	514737.363
GP11CD16	708537.076	514752.822
GP11CD17	708520.153	514791.978
GP11CD18	708508.692	514823.885
GP11CD19	708544.918	514776.180
GP11CD20	708561.379	514735.963
AQCD1	708518.330	514767.763
AQCD2	708494.600	514806.875

Location	X-coordinate	Y-coordinate
UST E		
GP11E5	708541.839	515048.885
GP11E6	708548.220	515040.617
GP11E7	708545.693	515032.291
GP11E8	708550.424	515024.909
GP11E9	708560.510	515043.734
GP11E10	708549.758	515055.110
GP11E11	708532.168	515041.357
GP11E12	708515.954	515050.201
GP11E13	708586.004	515014.596
GP11E14	708594.773	515009.466
AQE1	708532.168	515041.357
AQE2	708608.336	514955.807
AQE3	708535.969	514993.842
UST H-O		
GP06H1	707435.366	523418.775
GP06H2	707417.095	523426.158
GP06H3	707424.816	523448.339
GP06H4	707454.517	523447.854
GP06H5	707480.013	523440.403
GP06H6	707472.267	523410.259
GP06H7	707443.181	523441.269
GP06H8	707415.429	523450.404
GP06H9	707430.772	523458.002
UST P		
GP06P1	707357.440	523324.163
GP06P2	707353.258	523330.542
UST R,S		
GP06RS1	707583.155	523241.245
GP06RS2	707597.675	523269.826
GP06RS3	707606.462	523280.162
GP06RS4	707566.977	523271.792
GP06RS5	707563.203	523296.662
GP06RS6	707586.003	523292.698
GP06RS7	707533.309	523301.756
GP06RS8	707519.994	523284.466

Location	X-coordinate	Y-coordinate
USTs T, U, V		
GP05T1	706741.497	523864.229
GP05T2	706746.015	523855.600
GP05T3	706737.593	523853.752
GP05TUV1	706757.140	523865.259
GP05TUV2	706759.001	523849.352
GP05TUV3	706723.232	523851.363
GP05TUV4	706738.631	523840.489
GP05U1	706684.444	523844.102
GP05U2	706695.015	523839.137
GP05U3	706686.449	523833.457
GP05V1	706726.809	523873.215
GP05V2	706738.383	523873.828
GP05V3	706735.076	523868.789
AQTUV1	706737.593	523853.752

Notes:
Coordinate system is NAD 1983 StatePlane Washington North FIPS 4601 (US Feet)

Table 5. Groundwater Analyses

Sample ID	Location	Sample Collection Date and Time	Sample Type	Analyses						
				Nitrate, Sulfate (300.0)	Dissolved Mn (6020)	VOCs (8260C)	Low-Level VOCs (8260C SIM)	Diesel-range and Oil-range Petroleum Hydrocarbons (NWTPH-Dx)	Gasoline-range Petroleum Hydrocarbons (NWTPH-Gx)	Methane, Ethane, Ethene (RSK-175)
Phase I Monitoring Wells										
20140609-MW05	MW-05	6/9/14 15:55	N	1	1	1		1	1	1
20140609-MW07	MW-07	6/9/14 13:45	N	1	1	1		1	1	1
20140609-MW08	MW-08	6/9/14 11:09	N	1	1	1		1	1	1
20140609-MW09	MW-09	6/9/14 12:45	N	1	1	1		1	1	1
20140610-MW01	MW-01	6/10/14 13:52	N	1	1	1		1	1	1
20140610-MW02	MW-02	6/10/14 15:09	N	1	1	1		1	1	1
20140610-MW03	MW-03	6/10/14 16:22	N	1	1	1		1	1	1
20140610-MW04	MW-04	6/10/14 11:57	N	1	1	1		1	1	1
20140610-MW06	MW-06	6/10/14 8:22	N	1	1	1	1	1	1	1
20140610-MW10	MW-06	6/10/14 8:41	FD	1	1	1	1	1	1	1
Phase II Monitoring Wells										
AQMW05	MW-05	3/8/15 12:23	N	1	1	1		1		1
AQMW06	MW-06	3/8/15 9:00	N	1	1	1		1	1	1
AQMW08	MW-08	3/8/15 13:10	N	1	1	1		1		1
AQMW09	MW-09	3/8/15 11:25	N	1	1	1		1	1	1
AQMW10	MW-06	3/8/15 9:15	FD	1	1	1		1	1	1
Phase II Groundwater Grab Samples										
AQA1	AQA1	3/13/15 8:25	N	1	1	1		1		1
AQCD1	AQCD1	3/12/15 15:15	N	1	1	1		1		1
AQCD2	AQCD2	3/12/15 15:49	N	1	1	1		1		1
AQCD7	AQCD1	3/12/15 15:40	FD	1	1	1		1		1
AQE1	AQE1	3/13/15 10:10	N	1	1	1		1	1	1
AQE2	AQE2	3/16/15 9:10	N	1	1	1		1	1	1
AQE3	AQE3	3/16/15 9:10	N	1	1	1		1	1	1
AQTUV1	AQTUV1	3/18/15 8:45	N	1	1	1		1		1
Totals				23	23	23	2	23	16	23

Table 6. Lab vs UVF 3100A Comparison

Sample Location	Sample ID	Parameter	Start Depth (ft)	End Depth (ft)	Lab Result (mg/kg)	UVF-3100 Result (ppm)
USTs A,B						
GP11A4	GP-11-A4-4	Diesel-Range Organics	0	4		10 U
GP11A4	GP-11-A4-8	Diesel-Range Organics	4	8	1800	582.2
GP11A4	GP-11-A4-12	Diesel-Range Organics	8	12	2500	1200
GP11A5	GP-11-A5-5	Diesel-Range Organics	0	5		10 U
GP11A5	GP-11-A5-10	Diesel-Range Organics	5	10	6 U	10 U
GP11A5	GP-11-A5-15	Diesel-Range Organics	10	15	6.2 U	10 U
GP11A6	GP-11-A6-4	Diesel-Range Organics	0	4		10 U
GP11A6	GP-11-A6-8	Diesel-Range Organics	4	8	4000 J	122
GP11A6	GP-11-A6-13	Diesel-Range Organics	8	13	210	598
GP11A7	GP-11-A7-4	Diesel-Range Organics	0	4		10 U
GP11A7	GP-11-A7-8	Diesel-Range Organics	4	8	6.8	101.5
GP11A7	GP-11-A7-13	Diesel-Range Organics	8	13	9.8	10 U
GP11A8	GP-11-A8-5	Diesel-Range Organics	0	5		10 U
GP11A8	GP-11-A8-10	Diesel-Range Organics	5	10	50	10 U
GP11A8	GP-11-A8-15	Diesel-Range Organics	10	15	6.4	10 U
GP11A9	GP-11-A9-5	Diesel-Range Organics	0	5	28	10 U
GP11A9	GP-11-A9-10	Diesel-Range Organics	5	10	50	10 U
GP11A9	GP-11-A9-15	Diesel-Range Organics	10	15		10 U
GP11A10	GP-11-A10-5	Diesel-Range Organics	0	5		10 U
GP11A10	GP-11-A10-10	Diesel-Range Organics	5	10	7.7	10 U
GP11A10	GP-11-A10-15	Diesel-Range Organics	10	15	3.9 J	10 U
USTs C, D						
GP11CD1	GP-11-CD1-5	Diesel-Range Organics	0	5	11000	5000
GP11CD1	GP-11-CD1-10	Diesel-Range Organics	5	10	4800 J	1310
GP11CD1	GP-11-CD1-15	Diesel-Range Organics	10	15		36
GP11CD2	GP-11-CD2-5	Diesel-Range Organics	0	5		102.6
GP11CD2	GP-11-CD2-10	Diesel-Range Organics	5	10	11000 J-	5000
GP11CD2	GP-11-CD2-11	Diesel-Range Organics	10	11	74	175.1
GP11CD3	GP-11-CD3-5	Diesel-Range Organics	0	5		60.8
GP11CD3	GP-11-CD3-10	Diesel-Range Organics	5	10	5300 J	791
GP11CD3	GP-11-CD3-15	Diesel-Range Organics	10	15	890	1495
GP11CD3	GP-11-CD3-20	Diesel-Range Organics	15	20		10 U
GP11CD4	GP-11-CD4-5	Diesel-Range Organics	0	5	67	62.3
GP11CD4	GP-11-CD4-10	Diesel-Range Organics	5	10	1400	285.4
GP11CD4	GP-11-CD4-15	Diesel-Range Organics	10	15		10 U
GP11CD5	GP-11-CD5-5	Diesel-Range Organics	0	5	24000 J	5000
GP11CD5	GP-11-CD5-10	Diesel-Range Organics	5	10	10000 J	1998
GP11CD5	GP-11-CD5-15	Diesel-Range Organics	10	15		106.1
GP11CD5	GP-11-CD5-18	Diesel-Range Organics	15	18	65	611
GP11CD5	GP-11-CD5-20	Diesel-Range Organics	18	20		62
GP11CD5	GP-11-CD5-25	Diesel-Range Organics	20	25		13
GP11CD6	GP-11-CD6-5	Diesel-Range Organics	0	5	34000 J	5000
GP11CD6	GP-11-CD6-10	Diesel-Range Organics	5	10	10000	3805
GP11CD6	GP-11-CD6-15	Diesel-Range Organics	10	15		48.6
GP11CD6	GP-11-CD6-20	Diesel-Range Organics	15	20	43	70.8
GP11CD6	GP-11-CD6-25	Diesel-Range Organics	20	25		22.1
GP11CD7	GP-11-CD7-5	Diesel-Range Organics	0	5	47	111
GP11CD7	GP-11-CD7-10	Diesel-Range Organics	5	10	19	22.6
GP11CD7	GP-11-CD7-15	Diesel-Range Organics	10	15		10 U
GP11CD8	GP-11-CD8-6	Diesel-Range Organics	0	6	3900	2351
GP11CD8	GP-11-CD8-10	Diesel-Range Organics	6	10	5000 J-	857
GP11CD8	GP-11-CD8-15	Diesel-Range Organics	10	15		10 U
GP11CD8	GP-11-CD8-20	Diesel-Range Organics	15	20		15.8
GP11CD9	GP-11-CD9-5	Diesel-Range Organics	0	5		10 U
GP11CD9	GP-11-CD9-10	Diesel-Range Organics	5	10	5.9 U	10 U
GP11CD9	GP-11-CD9-15	Diesel-Range Organics	10	15	6.1 U	10 U
GP11CD10	GP-11-CD10-5	Diesel-Range Organics	0	5	21	10 U
GP11CD10	GP-11-CD10-10	Diesel-Range Organics	5	10	5.2 U	10 U
GP11CD10	GP-11-CD10-15	Diesel-Range Organics	10	15		10 U
GP11CD11	GP-11-CD11-5	Diesel-Range Organics	0	5	93	59
GP11CD11	GP-11-CD11-10	Diesel-Range Organics	5	10	33	16
GP11CD11	GP-11-CD11-15	Diesel-Range Organics	10	15		10 U
GP11CD12	GP-11-CD12-5	Diesel-Range Organics	0	5	4.8 J	10 U
GP11CD12	GP-11-CD12-10	Diesel-Range Organics	5	10	3.3 J	10 U
GP11CD12	GP-11-CD12-15	Diesel-Range Organics	10	15		10 U
GP11CD13	GP-11-CD13-5	Diesel-Range Organics	0	5	33	60
GP11CD13	GP-11-CD13-10	Diesel-Range Organics	5	10	5.8 U	10 U
GP11CD13	GP-11-CD13-15	Diesel-Range Organics	10	15		10 U
GP11CD14	GP-11-CD14-5	Diesel-Range Organics	0	5	150	10 U
GP11CD14	GP-11-CD14-10	Diesel-Range Organics	5	10	32	26.8
GP11CD14	GP-11-CD14-15	Diesel-Range Organics	10	15		10 U
GP11CD15	GP-11-CD15-5	Diesel-Range Organics	0	5	14	50 U
GP11CD15	GP-11-CD15-10	Diesel-Range Organics	5	10	4.2 J	50 U
GP11CD15	GP-11-CD15-15	Diesel-Range Organics	10	15		10 U
GP11CD16	GP-11-CD16-5	Diesel-Range Organics	0	5	5000	2504
GP11CD16	GP-11-CD16-10	Diesel-Range Organics	5	10	12000 J	4166
GP11CD16	GP-11-CD16-15	Diesel-Range Organics	10	15	490	268
GP11CD17	GP-11-CD17-5	Diesel-Range Organics	0	5	220	10 U
GP11CD17	GP-11-CD17-10	Diesel-Range Organics	5	10	22	57.7
GP11CD17	GP-11-CD17-15	Diesel-Range Organics	10	15		10 U
GP11CD18	GP-11-CD18-5	Diesel-Range Organics	0	5		16
GP11CD18	GP-11-CD18-10	Diesel-Range Organics	5	10	3600 J-	2177
GP11CD18	GP-11-CD18-15	Diesel-Range Organics	10	15	780	645
GP11CD18	GP-11-CD18-18	Diesel-Range Organics	15	18		50 U
GP11CD18	GP-11-CD18-20	Diesel-Range Organics	15	20		50 U
GP11CD19	GP-11-CD19-5	Diesel-Range Organics	0	5	29	22.1
GP11CD19	GP-11-CD19-10	Diesel-Range Organics	5	10	22	10 U
GP11CD19	GP-11-CD19-15	Diesel-Range Organics	10	15		10 U

Table 6. Lab vs UVF 3100A Comparison

Sample Location	Sample ID	Parameter	Start Depth (ft)	End Depth (ft)	Lab Result (mg/kg)	UVF-3100 Result (ppm)
GP11CD20	GP-11-CD20-5	Diesel-Range Organics	0	5		10 U
GP11CD20	GP-11-CD20-10	Diesel-Range Organics	5	10	12	10 U
GP11CD20	GP-11-CD20-15	Diesel-Range Organics	10	15	32	122.2
UST E						
GP11E5	GP-11-E5-5	Gasoline-Range Organics	0	5		10 U
GP11E5	GP-11-E5-10	Gasoline-Range Organics	5	10	7 U	10 U
GP11E5	GP-11-E5-15	Gasoline-Range Organics	10	15	7.1 U	10 U
GP11E6	GP-11-E6-5	Gasoline-Range Organics	0	5		10 U
GP11E6	GP-11-E6-10	Gasoline-Range Organics	5	10	130	77.4
GP11E6	GP-11-E6-15	Gasoline-Range Organics	10	15	7 U	10 U
GP11E7	GP-11-E7-5	Gasoline-Range Organics	0	5		10 U
GP11E7	GP-11-E7-10	Gasoline-Range Organics	5	10	6.9 U	5 U
GP11E7	GP-11-E7-15	Gasoline-Range Organics	10	15	6.9 U	5 U
GP11E8	GP-11-E8-5	Gasoline-Range Organics	0	5	6.6 U	10 U
GP11E8	GP-11-E8-10	Gasoline-Range Organics	5	10	7 U	5 U
GP11E8	GP-11-E8-15	Gasoline-Range Organics	10	15		5 U
GP11E9	GP-11-E9-5	Gasoline-Range Organics	0	5	6.2 U	5 U
GP11E9	GP-11-E9-10	Gasoline-Range Organics	5	10	6.7 U	5 U
GP11E9	GP-11-E9-15	Gasoline-Range Organics	10	15		5 U
GP11E10	GP-11-E10-5	Gasoline-Range Organics	0	5		10 U
GP11E10	GP-11-E10-10	Gasoline-Range Organics	5	10	6.8 U	10 U
GP11E10	GP-11-E10-15	Gasoline-Range Organics	10	15	7.3 U	10 U
GP11E11	GP-11-E11-5	Gasoline-Range Organics	0	5		5 U
GP11E11	GP-11-E11-10	Gasoline-Range Organics	5	10	1900	32.6
GP11E11	GP-11-E11-15	Gasoline-Range Organics	10	15	420	131.2
GP11E11	GP-11-E11-20	Gasoline-Range Organics	15	20		5 U
GP11E12	GP-11-E12-5	Gasoline-Range Organics	0	5		10 U
GP11E12	GP-11-E12-10	Gasoline-Range Organics	5	10	7.1 U	10 U
GP11E12	GP-11-E12-15	Gasoline-Range Organics	10	15	11 U	10 U
GP11E13	GP-11-E13-5	Gasoline-Range Organics	0	5	7.9 U	10 U
GP11E13	GP-11-E13-10	Gasoline-Range Organics	5	10	6.8 U	10 U
GP11E13	GP-11-E13-15	Gasoline-Range Organics	10	15		10 U
GP11E14	GP-11-E14-5	Gasoline-Range Organics	0	5	9.6 U	10 U
GP11E14	GP-11-E14-10	Gasoline-Range Organics	5	10	9 U	10 U
GP11E14	GP-11-E14-15	Gasoline-Range Organics	10	15		10 U
USTs H - O						
GP06H1	GP-06-H1-5	Diesel-Range Organics	0	5	1200	69.5
GP06H1	GP-06-H1-8	Diesel-Range Organics	5	8	250	16.2
GP06H2	GP-06-H2-5	Diesel-Range Organics	0	5		20.9
GP06H2	GP-06-H2-10	Diesel-Range Organics	5	10	270	48.9
GP06H2	GP-06-H2-11	Diesel-Range Organics	10	11	350	75.5
GP06H3	GP-06-H3-5	Diesel-Range Organics	0	5		50.8
GP06H3	GP-06-H3-10	Diesel-Range Organics	5	10	680	327.3
GP06H3	GP-06-H3-12	Diesel-Range Organics	10	12	3000	1920
GP06H4	GP-06-H4-5	Diesel-Range Organics	0	5	120	133
GP06H4	GP-06-H4-9	Diesel-Range Organics	5	9	210	102
GP06H5	GP-06-H5-5	Diesel-Range Organics	0	5	160	18.7
GP06H5	GP-06-H5-10	Diesel-Range Organics	5	10	380	105.7
GP06H6	GP-06-H6-5	Diesel-Range Organics	0	5	300	36.2
GP06H7	GP-06-H7-5	Diesel-Range Organics	0	5	240	461
GP06H7	GP-06-H7-7	Diesel-Range Organics	5	7	1000	1490
GP06H8	GP-06-H8-5	Diesel-Range Organics	0	5		68
GP06H8	GP-06-H8-10	Diesel-Range Organics	5	10	250	252
GP06H8	GP-06-H8-12	Diesel-Range Organics	10	12	950	1930
GP06H9	GP-06-H9-5	Diesel-Range Organics	0	5		20 U
GP06H9	GP-06-H9-10	Diesel-Range Organics	5	10	250	77
GP06H9	GP-06-H9-13	Diesel-Range Organics	10	13	590	510
UST P						
GP06P1	GP-06-P1-5	Diesel-Range Organics	0	5		10 U
GP06P1	GP-06-P1-10	Diesel-Range Organics	5	10		10 U
GP06P1	GP-06-P1-15	Diesel-Range Organics	14	15		23.4
GP06P2	GP-06-P2-5	Diesel-Range Organics	0	5		22.8
GP06P2	GP-06-P2-10	Diesel-Range Organics	5	10		20.7
GP06P2	GP-06-P2-15	Diesel-Range Organics	10	15		10 U
USTs R, S						
GP06RS1	GP-06-RS1-5	Diesel-Range Organics	0	5	62	10 U
GP06RS2	GP-06-RS2-4	Diesel-Range Organics	0	4	5.8	10 U
GP06RS3	GP-06-RS3-3	Diesel-Range Organics	0	3	18	10 U
GP06RS4	GP-06-RS4-3	Diesel-Range Organics	0	3	32	26.4
GP06RS5	GP-06-RS5-3	Diesel-Range Organics	0	3	9.8	10 U
GP06RS6	GP-06-RS6-5	Diesel-Range Organics	0	5	5.2 J	10 U
GP06RS7	GP-06-RS7-3	Diesel-Range Organics	0	3	34	99.9
GP06RS8	GP-06-RS8-2	Diesel-Range Organics	0	2	110	64.4
USTs T, U, V						
GP05T1	GP-05-T1-5	Diesel-Range Organics	0	5	200	488
GP05T1	GP-05-T1-8	Diesel-Range Organics	5	8	83	93.8
GP05T2	GP-05-T2-5	Diesel-Range Organics	0	5		135
GP05T2	GP-05-T2-10	Diesel-Range Organics	5	10	510	748
GP05T2	GP-05-T2-12	Diesel-Range Organics	10	12	860	1117
GP05T3	GP-05-T3-5	Diesel-Range Organics	0	5	160	801
GP05T3	GP-05-T3-10	Diesel-Range Organics	5	10	500	558
GP05T3	GP-05-T3-12	Diesel-Range Organics	10	12	2100	3765
GP05U1	GP-05-U1-5	Diesel-Range Organics	0	5	68	302
GP05U1	GP-05-U1-10	Diesel-Range Organics	5	10	30	117
GP05U1	GP-05-U1-14	Diesel-Range Organics	10	14		55
GP05U2	GP-05-U2-5	Diesel-Range Organics	0	5	64	313
GP05U2	GP-05-U2-10	Diesel-Range Organics	5	10	120	48
GP05U2	GP-05-U2-12	Diesel-Range Organics	10	12	24	428
GP05U3	GP-05-U3-5	Diesel-Range Organics	0	5	140	160

Table 6. Lab vs UVF 3100A Comparison

Sample Location	Sample ID	Parameter	Start Depth (ft)	End Depth (ft)	Lab Result (mg/kg)	UVF-3100 Result (ppm)
GP05U3	GP-05-U3-9	Diesel-Range Organics	5	9	97	88
GP05V1	GP-05-V1-5	Diesel-Range Organics	0	5	500	1340
GP05V1	GP-05-V1-7	Diesel-Range Organics	5	7	1200 J-	1345
GP05V2	GP-05-V2-5	Diesel-Range Organics	0	5	96	58
GP05V2	GP-05-V2-8	Diesel-Range Organics	5	8	44	10 U
GP05V3	GP-05-V3-5	Diesel-Range Organics	0	5	160	360
GP05V3	GP-05-V3-8	Diesel-Range Organics	5	8	1400	2238
GP05TUV1	GP-05-TUV1-5	Diesel-Range Organics	0	5	62	38
GP05TUV1	GP-05-TUV1-8	Diesel-Range Organics	5	8	5.7 U	20 U
GP05TUV2	GP-05-TUV2-5	Diesel-Range Organics	0	5	25	92
GP05TUV2	GP-05-TUV2-10	Diesel-Range Organics	5	10	8.6	20 U
GP05TUV3	GP-05-TUV3-5	Diesel-Range Organics	0	5	57	152
GP05TUV3	GP-05-TUV3-6	Diesel-Range Organics	5	6	67	74
GP05TUV4	GP-05-TUV4-3	Diesel-Range Organics	0	3	1100	423

Table 7. Groundwater Analytical Results and Field Measurements

					Location	MW-05	MW-06	MW-06	MW-08	MW-09	AQA1	AQCD1	AQCD1	AQCD2	AQE1	AQE2	AQE3	AQTUV1
					Sample ID	AQMW05	AQMW06	AQMW10	AQMW08	AQMW09	AQA1	AQCD1	AQCD7	AQCD2	AQE1	AQE2	AQE3	AQTUV1
					Sample Type	N	N	FD	N	N	N	N	FD	N	N	N	N	N
					Sample Date	3/8/2015	3/8/2015	3/8/2015	3/8/2015	3/8/2015	3/13/2015	3/12/2015	3/12/2015	3/12/2015	3/13/2015	3/16/2015	3/16/2015	3/18/2015
Chemical	Method	Method A Groundwater	Alternate AL	AL Note	Unit													
Petroleum Hydrocarbons																		
Gasoline Range Organics	NWTPH-GX	1000	800	If Benzene present	ug/l		**3700**	**3500**		250 U					**27000 J-**	**200 J**	250 U	
Diesel Range Organics	NWTPH-DX	500			ug/l	**2200**	**390**	**420**	**280**	100 U	**730 J-**	**8500**	**6200**	**10000**	**730**	**60 J**	100 U	**900**
Motor Oils	NWTPH-DX	500			ug/l	**280**	200 U	200 U	200 U	200 U	**170 J**	**440 J-**	**280**	**490**	200 U	200 U	200 U	**250**
Volatile Organic Compounds																		
1,2-Dibromoethane (ethylene dibromide) (see note)	8260C	0.01			ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1 U	1 U	1 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-DICHLOROETHANE	8260C	5			ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1 U	1 U	1 U	0.20 U	0.20 U	0.20 U	0.20 U
BENZENE	8260C	5			ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	**0.70 J**	**0.65 J**	**2**	**0.26 J+**	**0.64**	0.20 U	0.20 U
ETHYLBENZENE	8260C	700			ug/l	0.20 U	**0.68**	**0.61**	0.20 U	0.20 U	0.20 U	**0.70 J**	**0.70 J**	**16**	**17 J+**	**1.10**	0.20 U	0.20 U
M,P-XYLENE	8260C				ug/l	0.40 U	**3**	**2.50**	0.40 U	0.40 U	0.40 U	2 U	2 U	2 U	**94 J+**	**0.85**	**0.10 J**	0.40 U
Methyl Tert-Butyl Ether (MTBE)	8260C	20			ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	2.50 U	2.50 U	2.50 U	0.50 U	0.50 U	0.50 U	0.50 U
NAPHTHALENE	8260C	160			ug/l	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	**130 J-**	**130 J-**	**210 J-**	**10 J**	0.50 UJ	0.50 UJ	0.50 U
O-XYLENE	8260C				ug/l	0.20 U	**0.38**	**0.34**	0.20 U	0.20 U	0.20 U	1 U	1 U	1 U	**8.20 J+**	**0.12 J**	0.20 U	0.20 U
Toluene	8260C				ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1 U	1 U	**0.65 J**	**1 J+**	**0.49**	**0.16 J**	0.20 U
Metals																		
Manganese	6020				ug/l	**320**	**44.40**	**46**	**282**	**166**	**258**	**1410**	**1400**	**1360**	**297**	**290**	**74.90**	**74**
Anions																		
Nitrate	300.0				mg/l	0.10 U	0.10 U	0.10 U	**0.40**	0.10 U	**0.10**	0.10 U	**0.10**	0.10 U	**0.10**	**0.10**	**0.30**	**0.20**
Sulfate as SO4	300.0				mg/l	**5.80**	**2.70**	**4**	**4.10**	**4.90**	**5.50**	**0.50**	**1.80**	**0.40**	**5.60**	**1.80**	**4.70**	**13.20**
Dissolved Gases																		
Ethane	RSK-175				ug/l	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U
Ethene	RSK-175				ug/l	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U
Methane	RSK-175				ug/l	**962**	**32.70**	**41.70**	**71.70**	**318**	**48.30**	**1840**	**1780**	**1210**	**51.80**	**932**	**32**	0.70 U
Field Measurements																		
Dissolved oxygen	FIELD MEASURE				mg/l	0.27	0.27		0.33	0.51								
Ferrous iron	FIELD MEASURE				mg/l	5.30	7			2								
OXIDATION-REDUCTION POTENTIAL	FIELD MEASURE				mv	-182	-203		-94	-104								
PH	FIELD MEASURE				PH	6.42	5.80		6.27	6.21								
Specific Conductivity	FIELD MEASURE				ms/cm	0.35	0.15		0.24	0.22								
Temperature	FIELD MEASURE				C	11.30	10.10		11.40	11.40								
Turbidity	FIELD MEASURE				NTU	16.50	13.80		15.40	12.60								

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

AL = Action Level

C = Celsius

mS/cm = milliSiemens per centimeter

NTU = nephelometric turbidity units

U =nondetect

J = estimated

UJ = estimated non detect

Per the January 2015 Tech Memo, low-level EDB was not required for Phase II groundwater analyses because it was non detect in all cantonment wells during the June 2014 (Phase I) groundwater sampling event. EDB via standard 8260 was still reported by the lab; however, it is not used to make comparisons to the groundwater cleanup levels.

Table 8. Soil Analytical Results at UST A

	Sample ID	GP-11-A4-8	GP-11-A4-12	GP-11-A5-10	GP-11-A5-15	GP-11-A6-8	GP-11-A6-13	GP-11-A7-8	GP-11-A7-13	GP-11-A8-10	GP-11-A8-15	GP-11-A9-5	GP-11-A9-10	GP-11-A10-10	GP-11-A10-15
	Location	GP11A4	GP11A4	GP11A5	GP11A5	GP11A6	GP11A6	GP11A7	GP11A7	GP11A8	GP11A8	GP11A9	GP11A9	GP11A10	GP11A10
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Sample Date	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/10/2015	3/10/2015	3/10/2015	3/10/2015	3/10/2015	3/10/2015
	Start Depth (ft)	4	8	5	10	4	8	4	8	5	10	0	5	5	10
	End Depth (ft)	8	12	10	15	8	13	8	13	10	15	5	10	10	15
Analyte	MTCA A Unrestricted														
Diesel Range Organics by Method NWTPH-Dx (mg/kg)															
Diesel Range Organics	2000	**1800**	**2500**	6 U	6.20 U	**4000 J**	**210**	**6.8**	**9.8**	**50**	**6.4**	**28**	**50**	**7.7**	**3.90 J**
Motor Oil Range Organics	2000	120 U	120 U	12 U	12 U	**160 J**	120 U	12 U	12 U	**30**	**7.40 J**	**25**	**130**	**10 J**	12 U
VOCs by Method 8260 (ug/kg)															
1,2-Dibromoethane (Ethylene dibromide)	5	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
Benzene	30	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
Ethylbenzene	6000	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
m,p-Xylenes	9000	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
Methyl Tert-Butyl Ether	100	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
Naphthalene	5000	6.50 U	450 U	5.80 U	5.60 U	4.80 U	5.60 U	5.40 U	6.40 U	5.80 U	6 U	5.80 U	5.20 U	5.10 U	5.30 U
o-Xylene	9000	1.30 U	90 U	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1.30 U	1.20 U	1.20 U	1.20 U	1 U	1 U	1.10 U
Toluene	7000	**2.4**	90 U	1.20 U	1.10 U	**1.7**	**1.3**	**1.2**	**1.3**	**0.90 J**	1.20 U	**0.60 J**	**0.70 J**	**0.60 J**	1.10 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Cleanup level for Xylenes is for total xylenes (m,p, and o)

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 9. Soil Analytical Results at USTs C and D

Sample ID		GP-11-CD1-5	GP-11-CD1-10	GP-11-CD2-10	GP-11-CD2-11	GP-11-CD3-10	GP-11-CD31-10	GP-11-CD3-15	GP-11-CD4-5	GP-11-CD4-10	GP-11-CD5-5	GP-11-CD5-10	GP-11-CD5-18	GP-11-CD6-5	GP-11-CD6-10	GP-11-CD6-20	GP-11-CD7-5	GP-11-CD7-10
Location		GP11CD1	GP11CD1	GP11CD2	GP11CD2	GP11CD3	GP11CD3	GP11CD3	GP11CD4	GP11CD4	GP11CD5	GP11CD5	GP11CD5	GP11CD6	GP11CD6	GP11CD6	GP11CD7	GP11CD7
Sample Type		N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N
Sample Date		3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015	3/4/2015
Start Depth (ft)		0	5	5	10	5	5	10	0	5	0	5	15	0	5	15	0	5
End Depth (ft)		5	10	10	11	10	10	15	5	10	5	10	18	5	10	20	5	10
Analyte	MTCA A Unrestricted																	
Diesel Range Organics by Method NWTPH-Dx (mg/kg)																		
Diesel Range Organics	2000	**11,000**	**4800 J**	**11,000 J-**	**74**	**5300 J**	**5100 J**	**890**	**67**	**1400**	**24,000 J**	**10,000 J**	**65**	**34,000 J**	**10,000**	**43**	**47**	**19**
Motor Oil Range Organics	2000	**400**	1200 UJ	**1400**	**24**	1200 UJ	1200 UJ	120 U	**82**	120 U	**210 J**	1200 UJ	**34**	**380 J**	120 U	12 U	**210**	**44**
SVOCs by Method 8270D-SIM (ug/kg)																		
Naphthalene		**2800**	**1000**	**480 J+**	**74**	**220**	**180**	**31**	**38**	**57**	**1000**	**1800**	**60**	**2000**	**2900**	**34**	**7.9**	**8.9**
1-Methylnaphthalene		**35000**	**13000**	**20000 J-**	**170**	**10000**	**11000**	**2300**	**42**	**330**	**84000**	**25000**	**190**	**56000**	**18000**	**92**	**30**	**54**
2-Methylnaphthalene		**35000**	**13000**	**890**	**110**	**2200**	**2500**	**340**	**46**	**140**	**120000**	**38000**	**250**	**55000**	**22000**	**120**	**43**	**66**
Total Naphthalenes(ND = 0)	5000	*72800*	*27000*	*21370*	*354*	*12420*	*13680*	*2671*	*126*	*527*	*205000*	*64800*	*500*	*113000*	*42900*	*246*	*80.9*	*128.9*
Total Naphthalenes(ND = SQL/2)	5000	*72800*	*27000*	*21370*	*354*	*12420*	*13680*	*2671*	*126*	*527*	*205000*	*64800*	*500*	*113000*	*42900*	*246*	*80.9*	*128.9*
Benzo(a)anthracene		**440**	**76**	**3400**	**110**	**64**	**55**	**10**	**3.70 J**	46 U	450 U	**37 J**	**4.30 J**	**90**	**23 J**	**3 J**	**3.20 J**	4.60 U
Benzo(a)pyrene	100	**320**	**51**	**2400**	**36**	**51**	**44 J**	**5**	**5.2**	46 U	450 U	49 U	**2.50 J**	**36 J**	45 U	4.50 U	4.90 U	4.60 U
Chrysene		**570**	**120**	**3600**	**97**	**85**	**93**	**16**	**7.6**	**30 J**	**300 J**	**80**	**14**	**210**	**53**	**9.1**	**8.4**	**3.20 J**
Dibenz(a,h)anthracene		**34 J**	44 U	**320**	**4.30 J**	46 U	45 U	4.60 U	**2.70 J**	46 U	450 U	49 U	4.70 U	49 U	45 U	4.50 U	4.90 U	4.60 U
Indeno(1,2,3-cd)pyrene		**120**	44 U	**1000**	**13**	46 U	**31 J**	4.60 U	**8.9**	46 U	450 U	49 U	4.70 U	49 U	45 U	4.50 U	4.90 U	4.60 U
Total Benzofluoranthenes		**570**	**110**	**4600**	**72**	**81**	**82**	**11**	**11**	46 U	450 U	49 U	**6.3**	**76**	**45 U**	**5.2**	**4.70 J**	4.60 U
Benzo(a)pyrene TTEC (ND = 0)	*100*	*442.1*	*70.8*	*3368*	*56.9*	*66.4*	*61.7*	*7.3*	*7.9*	*0.3*	*3*	*4.5*	*3.7*	*54.7*	*2.8*	*0.9*	*0.9*	*0.03*
Benzo(a)pyrene TTEC (ND = SQL/2)	*100*	*442.1*	*75.2*	*3368*	*56.9*	*71.0*	*64.0*	*7.7*	*7.9*	*32.4*	*519.8*	*36.4*	*8.0*	*59.6*	*32.1*	*3.6*	*3.8*	*3.25*
Benzo(a)pyrene TTEC (Kaplan-Meier)	*100*	*442.1*	*73.2*	*3368*	*56.9*	*68.0*	*63.7*	*7.6*	*7.9*	*1.8*	*18*	*13.5*	*4.3*	*68.2*	*8.5*	*1.6*	*1.7*	*0.19*
Benzo(a)pyrene TTEC (robust ROS)	*100*	*442.1*	*73.2*	*3368*	*56.9*	*68.0*	*63.2*	*7.6*	*7.9*	*0.3*	*3.0*	*14.2*	*4.2*	*62.9*	*8.9*	*1.4*	*1.6*	*0.0*
VOCs by Method 8260 (ug/kg)																		
1,2-Dibromoethane (Ethylene dibromide)	5	68 U	76 U	72 U	1.20 U	1.10 U	70 U	1.10 U	0.90 U	1.10 U	250 U	66 U	1.30 U	110 U	68 U	1.20 U	1.20 U	1.40 U
Benzene	30	68 U	76 U	72 U	1.20 U	1.10 U	70 U	1.10 U	0.90 U	1.10 U	250 U	66 U	**0.80 J**	110 U	68 U	**1.10 J**	1.20 U	1.40 U
Ethylbenzene	6000	**100 J+**	**110 J+**	**140 J+**	**0.80 J**	**0.70 J**	**36 J**	1.10 U	0.90 U	1.10 U	**3200 J+**	**250 J+**	**1.40 J+**	**150 J+**	**41 J**	1.20 U	1.20 U	1.40 U
m,p-Xylenes	9000	68 U	76 U	72 U	1.20 U	**1 J**	**56 J**	1.10 U	0.90 U	1.10 U	250 U	66 U	1.30 U	110 U	68 U	**0.60 J**	1.20 U	1.40 U
Methyl Tert-Butyl Ether	100	68 U	76 U	72 U	1.20 U	1.10 U	70 U	1.10 U	0.90 U	1.10 U	250 U	66 U	1.30 U	110 U	68 U	1.20 U	1.20 U	1.40 U
Naphthalene	5000	**3300**	**2100**	**2300**	**6.80**	**21**	**580**	**4.40 J**	**1.10 J**	5.50 U	**2900**	**11000**	**32**	**5300**	**11000**	**46**	5.80 U	**4.80 J**
o-Xylene	9000	68 U	76 U	72 U	1.20 U	**0.90 J**	70 U	1.10 U	0.90 U	1.10 U	250 U	66 U	1.30 U	110 U	68 U	1.20 U	1.20 U	1.40 U
Toluene	7000	68 U	76 U	72 U	**4.60**	**3.10**	70 U	**1.50**	**0.90**	**3.20**	250 U	66 U	1.30 U	110 U	68 U	**1.60**	1.20 U	**2.90**

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Total benzofluoranthenes includes Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(j)fluoranthene.
MTCA A for Xylenes is for total xylenes (m,p, and o).

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 9. Soil Analytical Results at USTs C and D

	Sample ID	GP-11-CD8-6	GP-11-CD8-10	GP-11-CD9-10	GP-11-CD9-15	GP-11-CD91-15	GP-11-CD10-5	GP-11-CD10-10	GP-11-CD11-5	GP-11-CD11-10	GP-11-CD12-5	GP-11-CD12-10	GP-11-CD13-5	GP-11-CD13-10	GP-11-CD14-5	GP-11-CD14-10	GP-11-CD15-5	GP-11-CD15-10
	Location	GP11CD8	GP11CD8	GP11CD9	GP11CD9	GP11CD9	GP11CD10	GP11CD10	GP11CD11	GP11CD11	GP11CD12	GP11CD12	GP11CD13	GP11CD13	GP11CD14	GP11CD14	GP11CD15	GP11CD15
	Sample Type	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N
	Sample Date	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/3/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/12/2015	3/10/2015	3/10/2015
	Start Depth (ft)	0	6	5	10	10	0	5	0	5	0	5	0	5	0	5	0	5
	End Depth (ft)	6	10	10	15	15	5	10	5	10	5	10	5	10	5	10	5	10
Analyte	MTCA A Unrestricted																	
Diesel Range Organics by Method NWTPH-Dx (mg/kg)																		
Diesel Range Organics	2000	**3900**	**5000 J-**	5.90 U	6.10 U	6 U	**21**	5.20 U	**93**	**33**	**4.80 J**	**3.30 J**	**33**	5.80 U	**150**	**32**	**14**	**4.20 J**
Motor Oil Range Organics	2000	**170**	120 U	12 U	12 U	12 U	12 U	10 U	**240**	**25**	**20**	12 U	**76**	12 U	450	140	120	12 U
SVOCs by Method 8270D-SIM (ug/kg)																		
Naphthalene		**140**	**46**	4.70 U	**4.60 J**	**4.20 J**	**3.60 J**	**2.90 J**	**10 J**	**10**	**7.2**	**3.50 J**	**6.9**	**3.50 J**	**120**	**68 J-**	**5.6**	**11**
1-Methylnaphthalene		**2900**	**420 J**	**4.50 J**	**6.30**	**6.50**	**4.50 J**	4.70 U	**20**	**14**	**8.4**	**4.20 J**	**9.4**	**4.20 J**	**260**	**200 J-**	**6.3**	**18**
2-Methylnaphthalene		**330**	20 U	**5.70**	**8.40**	**9.10**	**5.90**	**4.80**	**33**	**26**	**12**	**6.30**	**11**	**5.20 J**	**330**	**270 J-**	**8.2**	**24**
Total Naphthalenes(ND = 0)	5000	*3370*	*466*	*10.2*	*19.3*	*19.8*	*14*	*7.7*	*63*	*50*	*27.6*	*14*	*27.3*	*12.9*	*710*	*538*	*20.1*	*53*
Total Naphthalenes(ND = SQL/2)	5000	*3370*	*476*	*12.55*	*19.3*	*19.8*	*14*	*10.05*	*63*	*50*	*27.6*	*14*	*27.3*	*12.9*	*710*	*538*	*20.1*	*53*
Benzo(a)anthracene		**210**	**180**	4.70 U	4.80 U	4.80 U	4.70 U	4.70 U	15 U	4.70 U	4.70 U	4.60 U	**2200**	**100**	**3.90 J**	**7.60 J**	4.90 U	4.60 U
Benzo(a)pyrene	100	**150**	**120**	4.70 U	4.80 U	4.80 U	4.70 U	4.70 U	15 U	4.70 U	4.70 U	4.60 U	**1700**	**77**	**3 J**	15 U	4.90 U	4.60 U
Chrysene		**230**	**180**	4.70 U	**2.90 J**	**2.50 J**	4.70 U	4.70 U	**12 J**	**3.30 J**	**7.6**	4.60 U	**2200**	**100**	**9.8**	**31 J-**	4.90 U	**3.30 J**
Dibenz(a,h)anthracene		**23 J**	**18 J**	4.70 U	4.80 U	4.80 U	4.70 U	4.70 U	15 U	4.70 U	4.70 U	4.60 U	**320**	**17**	4.90 U	15 U	4.90 U	4.60 U
Indeno(1,2,3-cd)pyrene		**73**	**44**	4.70 U	4.80 U	4.80 U	4.70 U	4.70 U	15 U	4.70 U	4.70 U	4.60 U	**800**	**36**	4.90 U	15 U	4.90 U	4.60 U
Total Benzofluoranthenes		**290**	**220**	4.70 U	4.80 U	4.80 U	4.70 U	4.70 U	15 U	**2.50 J**	**4 J**	4.60 U	**3200**	**140**	**4.70 J**	**15**	**2.60 J**	4.60 U
Benzo(a)pyrene TTEC (ND = 0)	*100*	*212*	*168*	*0*	*0.03*	*0.03*	*0*	*0*	*0.12*	*0.28*	*0.48*	*0*	*2374*	*107*	*4.0*	*2.6*	*0.26*	*0.03*
Benzo(a)pyrene TTEC (ND = SQL/2)	*100*	*212*	*168*	*3.3*	*3.4*	*3.4*	*3.3*	*3.3*	*10.6*	*3.3*	*3.5*	*3.2*	*2374*	*107*	*4.2*	*11.6*	*3.5*	*3.3*
Benzo(a)pyrene TTEC (Kaplan-Meier)	*100*	*212*	*168*	*NA*	*0.2*	*0.15*	*NA*	*NA*	*0.72*	*0.85*	*1.4*	*NA*	*2374*	*107*	*5.7*	*8.3*	*0.93*	*0.20*
Benzo(a)pyrene TTEC (robust ROS)	*100*	*212*	*168*	*NA*	*0.0*	*0.0*	*NA*	*NA*	*0.1*	*0.9*	*1.5*	*NA*	*2374*	*107*	*5.7*	*7.9*	*0.3*	*0.0*
VOCs by Method 8260 (ug/kg)																		
1,2-Dibromoethane (Ethylene dibromide)	5	1.40 U	1.10 U	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	1.10 U	1.20 U	1.10 U	1.10 U
Benzene	30	1.40 U	1.10 U	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	**0.70 J**	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	**2.10**	1.20 U	1.10 U	1.10 U
Ethylbenzene	6000	**0.90 J**	1.10 UJ	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	1.10 U	1.20 U	1.10 U	1.10 U
m,p-Xylenes	9000	**0.80 J**	**0.60 J**	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	1.10 U	1.20 U	1.10 U	1.10 U
Methyl Tert-Butyl Ether	100	1.40 U	1.10 U	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	1.10 U	1.20 U	1.10 U	1.10 U
Naphthalene	5000	**3600**	5.60 U	6.40 U	5.70 U	5.60 U	5.50 U	5.40 U	5.70 U	5.70 U	6 U	5.70 U	7 U	5.50 U	**7.10**	5.90 U	5.70 U	5.40 U
o-Xylene	9000	1.40 U	1.10 UJ	1.30 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.10 U	1.20 U	1.10 U	1.40 U	1.10 U	1.10 U	1.20 U	1.10 U	1.10 U
Toluene	7000	**0.80 J**	**2.50 J-**	**0.80 J**	1.10 U	1.10 U	1.10 U	**0.60 J**	**0.60 J**	**0.60 J**	**0.70 J**	**0.80 J**	1.40 U	1.10 U	1.10 U	1.20 U	**0.60 J**	**1.30**

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Total benzofluoranthenes includes Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(j)fluoranthene.
MTCA A for Xylenes is for total xylenes (m,p, and o).

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 9. Soil Analytical Results at USTs C and D

	Sample ID	GP-11-CD151-10	GP-11-CD16-5	GP-11-CD16-10	GP-11-CD16-15	GP-11-CD17-5	GP-11-CD17-10	GP-11-CD18-10	GP-11-CD181-10	GP-11-CD18-15	GP-11-CD19-5	GP-11-CD19-10	GP-11-CD191-10	GP-11-CD20-10	GP-11-CD20-15
	Location	GP11CD15	GP11CD16	GP11CD16	GP11CD16	GP11CD17	GP11CD17	GP11CD18	GP11CD18	GP11CD18	GP11CD19	GP11CD19	GP11CD19	GP11CD20	GP11CD20
	Sample Type	FD	N	N	N	N	N	N	FD	N	N	N	FD	N	N
	Sample Date	3/10/2015	3/11/2015	3/11/2015	3/11/2015	3/11/2015	3/11/2015	3/12/2015	3/12/2015	3/12/2015	3/11/2015	3/11/2015	3/11/2015	3/11/2015	3/11/2015
	Start Depth (ft)	5	0	5	10	0	5	5	5	10	0	5	5	5	10
	End Depth (ft)	10	5	10	15	5	10	10	10	15	5	10	10	10	15
Analyte	MTCA A Unrestricted														
Diesel Range Organics by Method NWTPH-Dx (mg/kg)															
Diesel Range Organics	2000	**4.90 J**	**5000**	**12000 J**	**490**	**220**	**22**	**3600 J-**	**3700 J-**	**780**	**29**	**22**	**16**	**12**	**32**
Motor Oil Range Organics	2000	**8.80 J**	110 U	**1100**	120 U	**1100**	**56**	100 J-	110 UJ	**14**	**130**	**120**	**92**	**37**	**190**
SVOCs by Method 8270D-SIM (ug/kg)															
Naphthalene		**5**	**40**	44 U	**47**	**31**	**28**	**110**	**89**	**120**	**3.80 J**	**5.3**	**11 J**	**10**	**14**
1-Methylnaphthalene		**7.4**	**2700**	**9100 J-**	**390**	**90**	**31**	**2800**	**1800**	**650**	**5**	**8.7**	**14**	**16**	**21**
2-Methylnaphthalene		**10**	**2400**	**9500 J**	**430**	**74**	**53**	**1300**	**770**	**620**	**6.50**	**13**	**21**	**25**	**25**
Total Naphthalenes(ND = 0)	5000	*22.4*	*5140*	*18600*	*867*	*195*	*112*	*4210*	*2659*	*1390*	*15.3*	*27*	*46*	*51*	***60***
Total Naphthalenes(ND = SQL/2)	5000	*22.4*	*5140*	*18622*	*867*	*195*	*112*	*4210*	*2659*	*1390*	*15.3*	*27*	*46*	*51*	*60*
Benzo(a)anthracene		5 U	**17**	**30 J**	6.70 U	**9.60 J**	4.90 U	**38**	**33**	**9.60 J**	5 U	4.60 U	14 U	4.60 U	**3 J**
Benzo(a)pyrene	100	5 U	16 U	44 U	6.70 U	**18**	4.90 U	**27**	**24**	**6.10 J**	5 U	4.60 U	14 U	4.60 U	4.60 U
Chrysene		5 U	**48**	**71**	**8.5**	**37**	**4.20 J**	**50**	**49**	**16**	**3 J**	**8.8**	**21**	**4.7**	**7.2**
Dibenz(a,h)anthracene		5 U	16 U	44 U	6.70 U	**8 J**	4.90 U	**3.30 J**	20 U	12 U	5 U	4.60 U	14 U	4.60 U	4.60 U
Indeno(1,2,3-cd)pyrene		5 U	16 U	44 U	6.70 U	**10 J**	4.90 U	**11**	20 U	12 U	5 U	4.60 U	14 U	4.60 U	4.60 U
Total Benzofluoranthenes		5 U	**10 J**	44 U	**3.10 J**	**34**	4.90 U	**50**	**51**	**6.70 J**	**2.40 J**	4.60 U	14 U	4.60 U	**2.60 J**
Benzo(a)pyrene TTEC (ND = 0)	*100*	*0*	*3.2*	*3.8*	*0.40*	*24.5*	*0.04*	*37.7*	*32.9*	*7.9*	*0.27*	*0.088*	*0.21*	*0.047*	*0.63*
Benzo(a)pyrene TTEC (ND = SQL/2)	*100*	*3.5*	*12.8*	*32.3*	*4.8*	*24.5*	*3.5*	*37.7*	*34.9*	*9.1*	*3.5*	*3.3*	*10*	*3.3*	*3.4*
Benzo(a)pyrene TTEC (Kaplan-Meier)	*100*	*NA*	*5.6*	*58.6*	*1.2*	*24.5*	*0.25*	*37.7*	*33.9*	*11*	*0.81*	*0.53*	*1.3*	*0.28*	*1.3*
Benzo(a)pyrene TTEC (robust ROS)	*100*	*NA*	*5.4*	*58.6*	*1.2*	*24.5*	*0.0*	*37.7*	*33.9*	*10.9*	*0.9*	*0.1*	*0.2*	*0.0*	*1.2*
VOCs by Method 8260 (ug/kg)															
1,2-Dibromoethane (Ethylene dibromide)	5	1.20 U	70 U	69 U	1.20 U	1.20 U	1.40 U	1.10 U	1.40 U	1.10 U	1.10 U	1.30 U	1.40 U	1.40 U	1.10 U
Benzene	30	1.20 U	70 U	69 U	1.20 U	**1 J**	1.40 U	1.10 U	1.40 U	**0.60 J**	1.10 U	**0.70 J**	1.40 U	1.40 U	1.10 U
Ethylbenzene	6000	1.20 U	70 U	69 U	1.20 U	1.20 U	1.40 U	**6**	**10**	**3.40**	1.10 U	1.30 U	1.40 U	1.40 U	1.10 U
m,p-Xylenes	9000	1.20 U	70 U	69 U	1.20 U	1.20 U	1.40 U	1.10 U	1.40 U	**0.60 J**	1.10 U	1.30 U	1.40 U	1.40 U	1.10 U
Methyl Tert-Butyl Ether	100	1.20 U	70 U	69 U	1.20 U	1.20 U	1.40 U	1.10 U	1.40 U	1.10 U	1.10 U	1.30 U	1.40 U	1.40 U	1.10 U
Naphthalene	5000	6.20 U	350 U	350 U	6.20 U	5.90 U	**21**	**33**	**39**	**140**	5.30 U	6.30 U	6.90 U	7.20 U	5.60 U
o-Xylene	9000	1.20 U	70 U	69 U	1.20 U	1.20 U	1.40 U	1.10 U	1.40 U	1.10 U	1.10 U	1.30 U	1.40 U	1.40 U	1.10 U
Toluene	7000	**0.60 J**	70 U	69 U	**0.90 J**	**1.40**	**1.30 J**	**1.40**	**1.90**	**1.40**	1.10 U	**1.20 J**	**1.20 J**	**1.60**	**2.20**

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Total benzofluoranthenes includes Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(j)fluoranthene.
MTCA A for Xylenes is for total xylenes (m,p, and o).

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 10. Soil Analytical Results at UST E

	Sample ID	GP-11-E5-10	GP-11-E5-15	GP-11-E51-15	GP-11-E6-10	GP-11-E6-15	GP-11-E7-10	GP-11-E7-15	GP-11-E8-5	GP-11-E8-10	GP-11-E9-5	GP-11-E9-10	GP-11-E10-10	GP-11-E10-15	GP-11-E11-10	GP-11-E11-15	GP-11-E12-10	GP-11-E12-15	GP-11-E13-5	GP-11-E13-10	GP-11-E14-5	GP-11-E14-10
	Location	GP11E5	GP11E5	GP11E5	GP11E6	GP11E6	GP11E7	GP11E7	GP11E8	GP11E8	GP11E9	GP11E9	GP11E10	GP11E10	GP11E11	GP11E11	GP11E12	GP11E12	GP11E13	GP11E13	GP11E14	GP11E14
	Sample Type	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Sample Date	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/5/2015	3/13/2015	3/13/2015	3/13/2015	3/13/2015	3/13/2015	3/13/2015
	Start Depth (ft)	5	10	10	5	10	5	10	0	5	0	5	5	10	5	10	5	10	0	5	0	5
	End Depth (ft)	10	15	15	10	15	10	15	5	10	5	10	10	15	10	15	10	15	5	10	5	10
Analyte	MTCA A Unrestricted																					
Gasoline Range Organics by Method NWTPH-Gx (mg/kg)																						
Gasoline Range Organics	100	7 U	7.10 U	7.20 U	**130**	7 U	6.90 U	6.90 U	6.60 U	7 U	6.20 U	6.70 U	6.80 U	7.30 U	**1900**	**420**	7.10 U	11 U	7.90 U	6.80 U	9.60 U	9 U
Diesel Range Organics by Method NWTPH-Dx (mg/kg)																						
Diesel Range Organics	2000	**8.4**	6.10 U	6.10 U	**69**	6 U	6.10 U	6.30 U	**20**	**6.9**	5.70 U	6.10 U	6.20 U	6 U	**15**	**15**	5.90 U	6.10 U	**41**	**65**	**32**	**50**
Motor Oil Range Organics	2000	12 U	12 U	12 U	**14**	12 U	12 U	12 U	**35**	12 U	11 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	**110**	**340**	**100**	**260**
VOCs by Method 8260 (ug/kg)																						
1,2-Dibromoethane (Ethylene dibromide)	5	1.10 U	1 U	1.10 U	59 U	1.10 U	1.10 U	1.20 U	1.10 U	1.20 U	1.20 U	1.10 U	1 U	1 U	63 U	66 U	1 U	1.20 U	1.10 U	1.10 U	1.10 U	1.10 U
Benzene	30	1.1	1 U	1.10 U	**41 J**	**0.90 J**	**1.8**	1.20 U	**4.4**	**0.90 J**	1.20 U	1.10 U	1 U	1 U	63 U	66 U	1 U	1.20 U	1.10 U	**0.50 J**	1.10 U	1.10 U
Ethylbenzene	6000	**0.60 J**	1 U	1.10 U	**270**	1.10 U	1.10 U	1.20 U	**2.8**	1.20 U	1.20 U	1.10 U	1 U	1 U	**160**	**91**	1 U	1.20 U	1.10 U	**0.60 J**	1.10 U	1.10 U
m,p-Xylenes	9000	**2.3**	1 U	1.10 U	**220**	**1.2**	**2.8**	1.20 U	**20**	**1.8**	**1.10 J**	1.10 U	1 U	1 U	**970**	**510**	1 U	1.20 U	**0.80 J**	**2**	1.10 U	**0.80 J**
Methyl Tert-Butyl Ether	100	1.10 U	1 U	1.10 U	59 U	1.10 U	1.10 U	1.20 U	1.10 U	1.20 U	1.20 U	1.10 U	1 U	1 U	63 U	66 U	1 U	1.20 U	1.10 U	1.10 U	1.10 U	1.10 U
Naphthalene	5000	**5 J**	5.10 U	5.30 U	**2900**	5.50 U	5.50 U	5.80 U	**3.80 J**	5.80 U	5.90 U	5.40 U	5.20 U	4.80 U	**1500**	**510**	5.20 U	5.90 U	5.30 U	5.40 U	5.40 U	5.50 U
o-Xylene	9000	**0.70 J**	1 U	1.10 U	59 U	1.10 U	**1.3**	1.20 U	**8.3**	**0.60 J**	1.20 U	1.10 U	1 U	1 U	**62 J**	**49 J**	1 U	1.20 U	1.10 U	1.10 U	1.10 U	1.10 U
Toluene	7000	**2.2**	1 U	1.10 U	**130**	**1.9**	**3.7**	1.20 U	**14**	**1.8**	**1.10 J**	**0.90 J**	1 U	1 U	63 U	66 U	1.2	1.20 U	1.10 U	**0.60 J**	1.10 U	1.10 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 11. Soil Analytical Results at USTs H thru O

	Sample ID	GP-06-H1-5	GP-06-H1-8	GP-06-H2-10	GP-06-H2-11	GP-06-H3-10	GP-06-H3-12	GP-06-H4-5	GP-06-H4-9	GP-06-H5-5	GP-06-H5-10
	Location	GP06H1	GP06H1	GP06H2	GP06H2	GP06H3	GP06H3	GP06H4	GP06H4	GP06H5	GP06H5
	Sample Type	N	N	N	N	N	N	N	N	N	N
	Sample Date	3/9/2015	3/9/2015	3/9/2015	3/9/2015	3/6/2015	3/6/2015	3/6/2015	3/6/2015	3/6/2015	3/6/2015
	Start Depth (ft)	0	5	5	10	5	10	0	5	0	5
	End Depth (ft)	5	8	10	11	10	12	5	9	5	10
Analyte	MTCA A Unrestricted										
Diesel Range Organics by Method NWTPH-Dx (mg/kg)											
Diesel Range Organics	2000	**1200**	**250**	**270**	**350**	**680**	**3000**	**120**	**210**	**160**	**380**
Motor Oil Range Organics	2000	**1500**	**140**	**110**	**120**	**120**	**260**	**240**	**160**	**130**	**79**
VOCs by Method 8260 (ug/kg)											
1,2-Dibromoethane (Ethylene dibromide)	5	1.30 U	1 U	1.10 U	1 U	58 U	76 U	0.90 U	0.90 U	1 U	62 U
Benzene	30	1.30 U	1 U	1.10 U	1 U	58 U	76 U	0.90 U	**0.50 J**	1 U	62 U
Ethylbenzene	6000	1.30 U	1 U	1.10 UJ	1 U	40 J	**250**	0.90 U	0.90 U	1 U	62 U
m,p-Xylenes	9000	1.30 U	**0.60 J**	1.10 UJ	1 U	49 J	**93**	0.90 U	**0.50 J**	1 U	62 U
Methyl Tert-Butyl Ether	100	1.30 U	1 U	1.10 U	1 U	58 U	76 U	0.90 U	0.90 U	1 U	62 U
Naphthalene	5000	6.40 U	5.20 U	5.70 UJ	4.90 U	**350**	**1700**	4.60 U	**3.50 J**	5 U	**100 J**
o-Xylene	9000	1.30 U	1 U	1.10 UJ	1 U	58 U	76 U	0.90 U	0.90 U	1 U	62 U
Toluene	7000	1.30 U	1 U	**1.10 J-**	**1.2**	58 U	76 U	0.90 U	**0.50 J**	**0.70 J**	62 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

MTCA A for Xylenes is for total xylenes (m,p, and o)

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 11. Soil Analytical Results at USTs H thru O

	Sample ID	GP-06-H6-5	GP-06-H7-5	GP-06-H7-7	GP-06-H8-10	GP-06-H8-12	GP-06-H9-10	GP-06-H9-13	GP-06-H91-13
	Location	GP06H6	GP06H7	GP06H7	GP06H8	GP06H8	GP06H9	GP06H9	GP06H9
	Sample Type	N	N	N	N	N	N	N	FD
	Sample Date	3/9/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015
	Start Depth (ft)	0	0	5	5	10	5	10	10
	End Depth (ft)	5	5	7	10	12	10	13	13
Analyte	MTCA A Unrestricted								
Diesel Range Organics by Method NWTPH-Dx (mg/kg)									
Diesel Range Organics	2000	**300**	**240**	**1000**	**250**	**950**	**250**	**590**	**550**
Motor Oil Range Organics	2000	**120**	**670**	**640**	**86**	120 U	**96**	**150**	**160**
VOCs by Method 8260 (ug/kg)									
1,2-Dibromoethane (Ethylene dibromide)	5	1.30 U	1.10 U	1 U	1.10 U	0.90 U	1 U	1.20 U	1.20 U
Benzene	30	1.30 U	1.10 U	**1.1**	1.10 U	0.90 U	**0.60 J**	**1.7**	**1.2**
Ethylbenzene	6000	1.30 U	1.10 U	**2**	1.10 U	**0.50 J**	**2.5**	**7.3**	**1.7**
m,p-Xylenes	9000	1.30 U	1.10 U	**3**	1.10 U	0.90 UJ	**7.6**	**3.3**	**0.80 J**
Methyl Tert-Butyl Ether	100	1.30 U	1.10 U	1 U	1.10 U	0.90 U	1 U	1.20 U	1.20 U
Naphthalene	5000	6.50 U	5.30 U	**13**	5.70 U	4.60 U	**39**	**18**	5.80 U
o-Xylene	9000	1.30 U	1.10 U	1 U	1.10 U	0.90 UJ	**0.70 J**	**1.2**	1.20 U
Toluene	7000	**1 J**	1.10 U	**0.60 J**	1.10 U	0.90 UJ	**1.3**	**1.7**	**0.70 J**

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

MTCA A for Xylenes is for total xylenes (m,p, and o)

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 12. Soil Analytical Results at UST P

		Sample ID	GP-06-P1-10	GP-06-P1-14	GP-06-P2-5	GP-06-P2-10
		Location	GP06P1	GP06P1	GP06P2	GP06P2
		Sample Type	N	N	N	N
		Sample Date	3/6/2015	3/6/2015	3/6/2015	3/6/2015
		Start Depth (ft)	5	10	0	5
		End Depth (ft)	10	14	5	10
Analyte	MTCA A Unrestricted					
SVOCs by Method 8270D-SIM (ug/kg)						
Naphthalene		**6.2**	**9.8**	**17**	**7.2**
1-Methylnaphthalene		**10**	**14**	**18**	**8.6**
2-Methylnaphthalene		**13**	**21**	**53**	**16**
Total Naphthalenes (ND = 0)	5000	*29.2*	*44.8*	*88*	*31.8*
Total Naphthalenes(ND = SQL/2)	5000	*29.2*	*44.8*	*88*	*31.8*
Benzo(a)anthracene		4.70 U	4.80 U	**7.50**	**11**
Benzo(a)pyrene	100	4.70 U	4.80 U	**7.40**	**9**
Chrysene		4.70 U	4.80 U	**9**	**13**
Dibenz(a,h)anthracene		4.70 U	**3.30 J**	5 U	**3.30 J**
Indeno(1,2,3-cd)pyrene		4.70 U	4.80 U	**5**	**5.80**
Total Benzofluoranthenes		4.70 U	**2.40 J**	**15**	**17**
Benzo(a)pyrene TTEC (ND = 0)	100	*0*	*0.6*	*10.2*	*12.8*
Benzo(a)pyrene TTEC (ND = 1/2 LOQ)	100	*3.3*	*3.5*	*10.5*	*12.8*
Benzo(ap)pyrene TTEC (K-M)	100	NA	*1.2*	*10.3*	*12.8*
Benzo(a)pyrene TTEC (robust ROS)	100	NA	*1.4*	*10.3*	*12.8*
PCBs by Method 8082 (ug/kg)					
Aroclor 1016		19 U	18 U	18 U	19 U
Aroclor 1221		19 U	18 U	18 U	19 U
Aroclor 1232		19 U	18 U	18 U	19 U
Aroclor 1242		19 U	18 U	18 U	19 U
Aroclor 1248		19 U	18 U	18 U	19 U
Aroclor 1254		19 U	18 U	18 U	19 U
Aroclor 1260		19 U	18 U	18 U	19 U
Total PCBs	1000	19 U	18 U	18 U	19 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

Method A soil cleanup value for Naphthalenes includes naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Total benzofluoranthenes includes Benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(j)fluoranthene.

Table 13. Soil Analytical Results at USTs R and S

	Sample ID	GP-06-RS1-5	GP-06-RS2-4	GP-06-RS3-3	GP-06-RS4-3	GP-06-RS5-3	GP-06-RS6-5	GP-06-RS61-5	GP-06-RS7-3	GP-06-RS8-2
	Location	GP06RS1	GP06RS2	GP06RS3	GP06RS4	GP06RS5	GP06RS6	GP06RS6	GP06RS7	GP06RS8
	Sample Type	N	N	N	N	N	N	FD	N	N
	Sample Date	3/9/2015	3/9/2015	3/9/2015	3/17/2015	3/10/2015	3/9/2015	3/9/2015	3/10/2015	3/10/2015
	Start Depth (ft)	0	0	0	0	0	0	0	0	0
	End Depth (ft)	5	4	3	3	3	5	5	3	2
Analyte	MTCA A Unrestricted									
Gasoline Range Organics by Method NWTPH-Gx (mg/kg)										
Gasoline Range Organics	100	9.30 U	5.20 U	6 U	5.30 U	5.50 U	8.10 U	7.20 U	5.10 U	6.10 U
Diesel Range Organics by Method NWTPH-Dx (mg/kg)										
Diesel Range Organics	2000	**62**	**5.8**	**18**	**32**	**9.8**	**5.20 J**	**9.8**	**34**	**110**
Motor Oil Range Organics	2000	**150**	**17**	**34**	**84**	**37**	**23**	**45**	**180**	**390**
VOCs by Method 8260 (ug/kg)										
1,2-Dibromoethane (Ethylene dibromide)	5	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
Benzene	30	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
Ethylbenzene	6000	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
m,p-Xylenes	9000	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
Methyl Tert-Butyl Ether	100	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
Naphthalene	5000	5.40 U	4.90 U	5.50 U	**2.70 J**	5.40 U	5.60 U	7.30 U	6 U	4.80 U
o-Xylene	9000	1.10 U	1 U	1.10 U	0.90 U	1.10 U	1.10 U	1.50 U	1.20 U	1 U
Toluene	7000	**1 J**	**1.1**	**0.80 J**	**0.50 J**	1.10 U	**0.60 J**	**1.20 J**	**0.60 J**	**0.80 J**
Metals by Method 6020 (mg/kg)										
Lead	250	**5.80 J**	**4.6**	**7.6**	**7 J**	**6.1**	**5.1**	**5.3**	**20.6**	**14.7**

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

MTCA A for Xylenes is for total xylenes (m,p, and o)

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 14. Soil Analytical Results at USTs T, U, and V

	Sample ID	GP-05-T1-5	GP-05-T1-8	GP-05-T2-10	GP-05-T2-12	GP-05-T3-10	GP-05-T3-12	GP-05-T3-5	GP-05-U1-5	GP-05-U1-10	GP-05-U2-5	GP-05-U2-10	GP-05-U2-12	GP-05-U3-5	GP-05-U3-9	GP-05-V1-5	GP-05-V1-7	GP-05-V2-5	GP-05-V2-8	GP-05-V3-5
	Location	GP05T1	GP05T1	GP05T2	GP05T2	GP05T3	GP05T3	GP05T3	GP05U1	GP05U1	GP05U2	GP05U2	GP05U2	GP05U3	GP05U3	GP05V1	GP05V1	GP05V2	GP05V2	GP05V3
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Sample Date	3/16/2015	3/16/2015	3/16/2015	3/16/2015	3/16/2015	3/16/2015	3/16/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015	3/17/2015	3/18/2015	3/18/2015	3/16/2015	3/16/2015	3/17/2015	3/17/2015	3/16/2015
	Start Depth (ft)	0	5	5	10	5	10	0	0	5	0	5	10	0	5	0	5	0	5	0
	End Depth (ft)	5	8	10	12	10	12	5	5	10	5	10	12	5	9	5	7	5	8	5
Analyte	MTCA A Unrestricted																			
Diesel Range Organics by Method NWTPH-Dx (mg/kg)																				
Diesel Range Organics	2000	**200**	**83**	**510**	**860**	**500**	**2100**	**160**	**68**	**30**	**64**	**120**	**24**	**140**	**97**	**500**	**1200 J-**	**96**	**44**	**160**
Motor Oil Range Organics	2000	**300**	110 U	**220**	**260**	**240**	**440**	**310**	**360**	**110**	**150**	**140**	**120**	**170**	**110**	**900**	**340**	**130**	**100**	**240**
VOCs by Method 8260 (ug/kg)																				
1,2-Dibromoethane (Ethylene dibromide)	5	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1 U	0.90 U	0.90 U	1 U	1.20 U	1 U	1 U	1 U	1 U	1.10 U	1.20 UJ	1.10 U	1.30 U	1 U
Benzene	30	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1 U	0.90 U	0.90 U	1 U	1.20 U	1 U	1 U	1 U	1 U	1.10 U	**0.80 J**	1.10 U	1.30 U	1 U
Ethylbenzene	6000	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1 U	0.90 U	0.90 U	1 U	1.20 U	1 U	1 U	1 U	**1.4**	1.10 U	**10 J-**	1.10 U	1.30 U	1 U
m,p-Xylenes	9000	1.20 U	**1 J**	**1.5**	**0.80 J**	1.10 U	1 U	0.90 U	0.90 U	**1.4**	1.20 U	**0.50 J**	1 U	1 U	**1**	1.10 U	**6.30 J-**	1.10 U	1.30 U	1 U
Methyl Tert-Butyl Ether	100	1.20 U	1.10 U	1 U	1.10 U	1.10 U	1 U	0.90 U	0.90 U	1 U	1.20 U	1 U	1 U	1 U	1 U	1.10 U	1.20 U	1.10 U	1.30 U	1 U
Naphthalene	5000	5.80 U	5.50 U	4.90 U	5.30 U	5.40 U	5.20 U	4.30 U	4.40 U	4.90 U	5.80 U	5.20 U	4.90 U	4.90 U	4.80 U	5.60 U	**40**	5.70 U	6.60 U	5.10 U
o-Xylene	9000	1.20 U	**1.1**	**0.80 J**	1.10 U	1.10 U	1 U	0.90 U	0.90 U	**0.70 J**	1.20 U	1 U	1 U	1 U	**1.2**	1.10 U	**3.10 J-**	1.10 U	1.30 U	1 U
Toluene	7000	**0.60 J**	**0.80 J**	**1.7**	**1.3**	1.10 U	**0.50 J**	0.90 U	0.90 U	**1.7**	1.20 U	**1.1**	**1.2**	1 U	**3.3**	1.10 U	**1.60 J-**	**0.80 J**	**0.90 J**	1 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

MTCA A for Xylenes is for total xylenes (m,p, and o)

Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 14. Soil Analytical Results at USTs T, U, and V

		Sample ID	GP-05-V3-8	GP-05-TUV1-5	GP-05-TUV1-8	GP-05-TUV2-5	GP-05-TUV2-10	GP-05-TUV3-5	GP-05-TUV3-6	GP-05-TUV4-3	GP-05-TUV41-3
		Location	GP05V3	GP05TUV1	GP05TUV1	GP05TUV2	GP05TUV2	GP05TUV3	GP05TUV3	GP05TUV4	GP05TUV4
		Sample Type	N	N	N	N	N	N	N	N	FD
		Sample Date	3/16/2015	3/18/2015	3/18/2015	3/18/2015	3/18/2015	3/18/2015	3/18/2015	3/18/2015	3/18/2015
		Start Depth (ft)	5	0	5	0	5	0	5	0	0
		End Depth (ft)	8	5	8	5	10	5	6	3	3
Analyte	MTCA A Unrestricted										
Diesel Range Organics by Method NWTPH-Dx (mg/kg)											
Diesel Range Organics	2000	**1400**	**62**	5.70 U	**25**	**8.6**	**57**	**67**	**1100**	**99**
Motor Oil Range Organics	2000	**190**	**70**	**9.20 J**	**64**	**43**	**110**	**310**	**1600**	**120**
VOCs by Method 8260 (ug/kg)											
1,2-Dibromoethane (Ethylene dibromide)	5	1.20 U	1 U	0.90 U	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
Benzene	30	1.20 U	1 U	0.90 U	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
Ethylbenzene	6000	**6.2**	1 U	0.90 U	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
m,p-Xylenes	9000	**14**	1 U	0.90 UJ	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
Methyl Tert-Butyl Ether	100	1.20 U	1 U	0.90 U	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
Naphthalene	5000	**84**	4.90 U	4.50 UJ	4.70 U	5.40 U	5.40 U	5.60 U	4.80 U	5.20 U
o-Xylene	9000	**5.1**	1 U	0.90 U	0.90 U	1.10 U	1.10 U	1.10 U	1 U	1 U
Toluene	7000	**1 J**	**0.80 J**	**1**	0.90 U	1.10 U	**2.1**	**1.7**	1 U	1 U

Notes:

Detections shown in **bold.**

Exceeds cleanup level.

Calculated value (e.g. summation).

U =nondetect

J = estimated

UJ = estimated non detect

MTCA A for Xylenes is for total xylenes (m,p, and o)

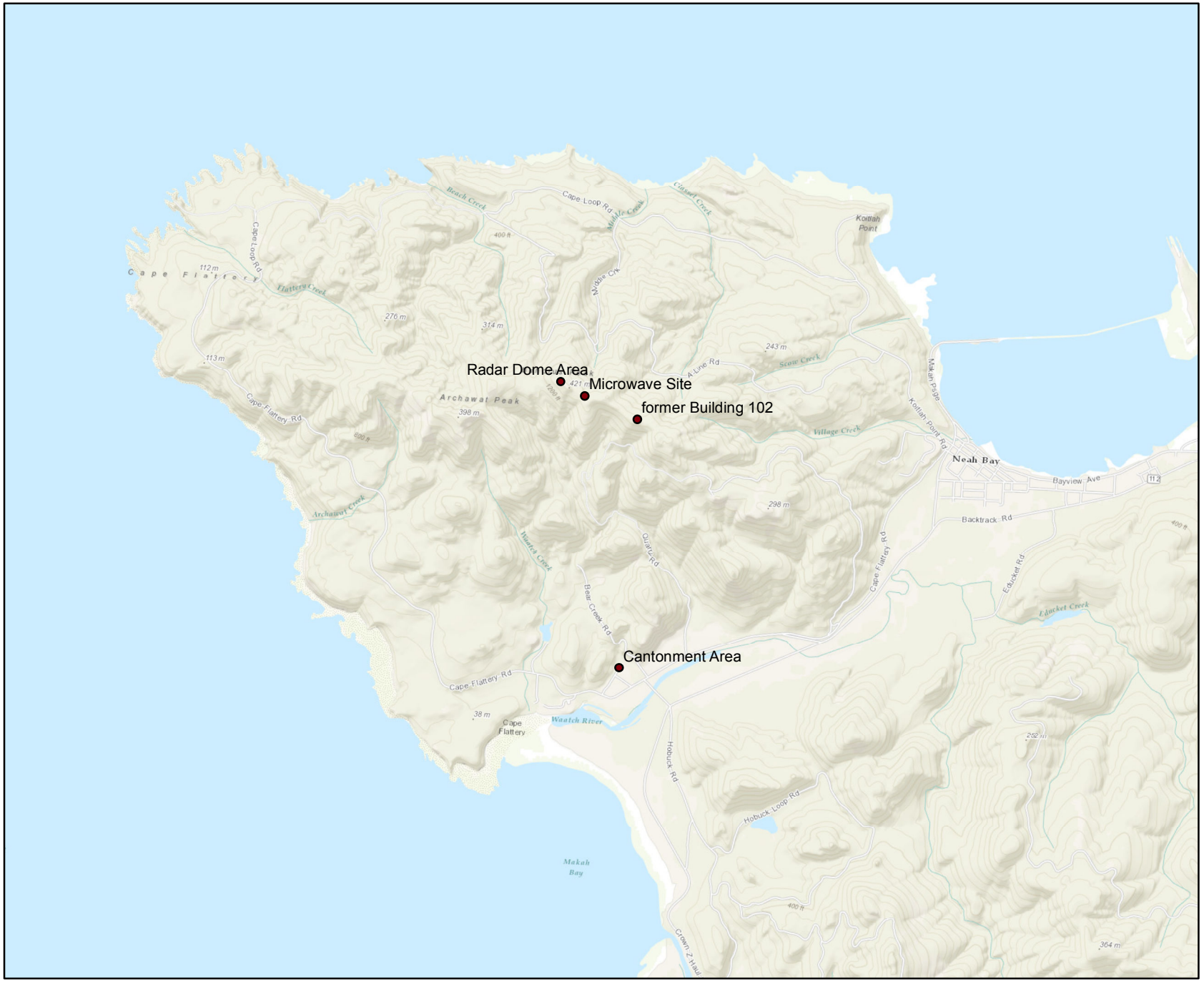
Method A soil cleanup value for Naphthalenes is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

Table 15. Summary of UST Site Findings

UST	Former Contents	# of Soil Samples	Soil Analytes Above Cleanup Levels	Comments
Cantonment Area				
A	No. 2 diesel	14	DRO, EDB, benzene	EDB and benzene were non detect with SQLs > soil cleanup levels in one sample. EDB was a gasoline additive and is not a required analyte for diesel petroleum releases. EDB and benzene are more commonly associated with gasoline.
B	No. 2 diesel	NA (Not investigated)		
C	No. 2 diesel (previously bunker fuel, #4 diesel)	48	DRO, (total) naphthalenes, cPAHs, EDB, benzene, m,p-xylenes,	EDB, benzene, and/or m,p-xylene exceedances were non detect with elevated SQLs in up to 10 samples.
D	No. 2 diesel (previously bunker fuel, #4 diesel)			
E	Unleaded (previously leaded) gasoline	21	GRO, EDB, benzene	EDB was non detect with elevated SQL > soil cleanup level in three samples. Maximum benzene exceedance was also ND with elevated SQL > soil cleanup level in two samples; benzene was detected above soil cleanup level in one sample.
F	No. 2 diesel	NA (Not investigated)		
G	Waste chemicals pesticide rinse	NA (Not investigated)		UST G will be investigated during Phase III.
Y1	Gasoline (unleaded)	NA (Not investigated)		
Y2	Gasoline (super unleaded)			
Y3	Gasoline (regular leaded)			
Microwave Tower Site				
H	Diesel Fuel	18	DRO, EDB, benzene	EDB and benzene were non detect with SQLs > soil cleanup levels in two samples. EDB was a gasoline additive and is not a required analyte for diesel petroleum releases. EDB and benzene are more commonly associated with gasoline.
I				
J				
K				
L				
M				
N				
O				
P	Waste oil	4	None	
R	Diesel fuel	9	None	
S	Gasoline (unleaded, leaded, and super unleaded)			
W	Diesel Fuel	NA (Not investigated)		
Radar Dome Area				
T	Diesel Fuel	28	DRO	
U	Diesel Fuel (#4)			
V	Diesel Fuel			
Former Building 102				
Q	Diesel Fuel	NA (Not investigated)		

FIGURES

Figure 1. Study Area



Legend

- Sites

Former Makah AFS
UST Site Investigation

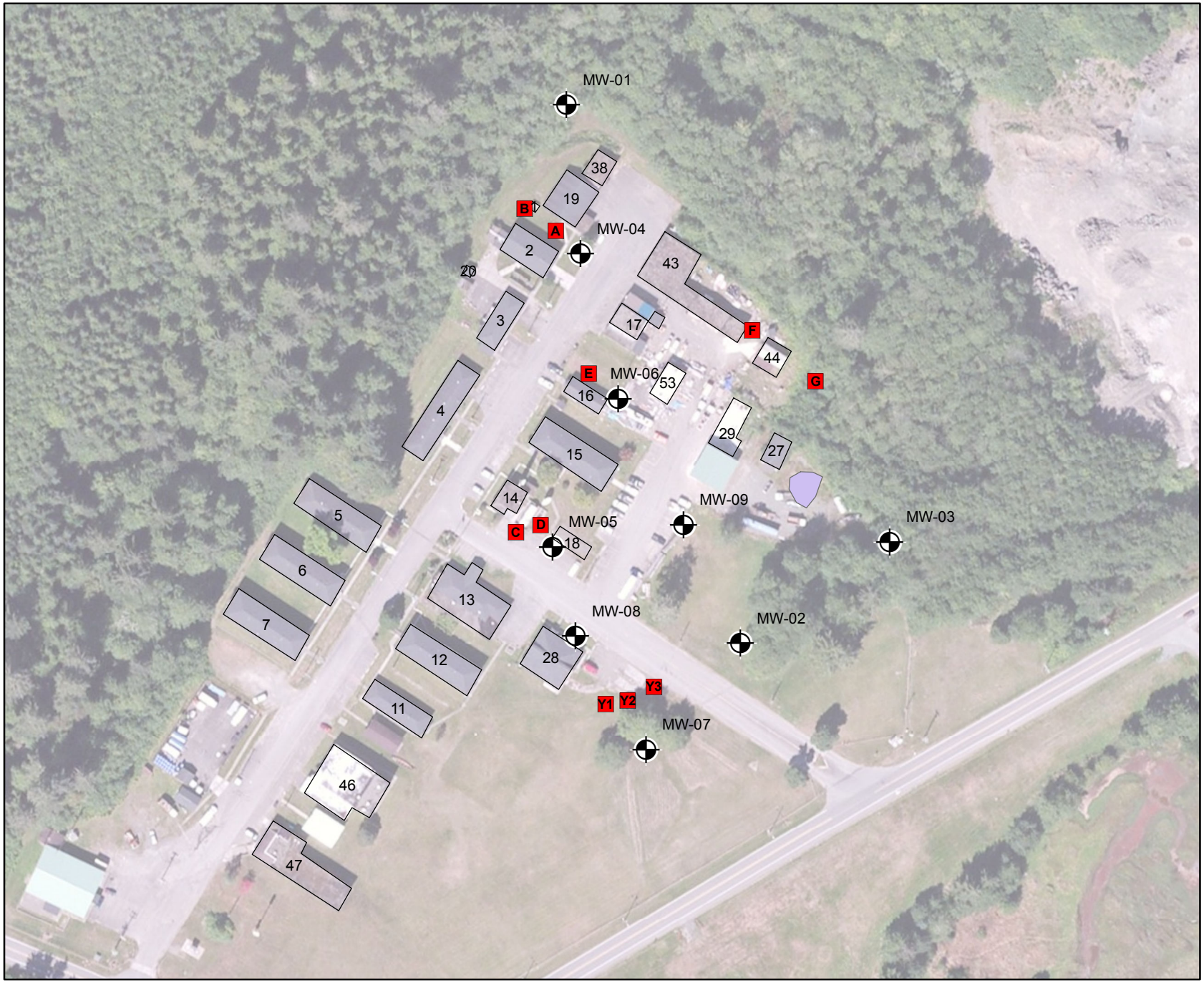
Location Map

N W E S

0 0.35 0.7

Miles

Figure 2. Cantonment Area USTs and Monitoring Wells



Legend

- Underground Storage Tank
- Building
- Monitoring well
- Burnpit

N

Former Makah AFS
UST Site Investigation

Location Map

0 70 140
Feet

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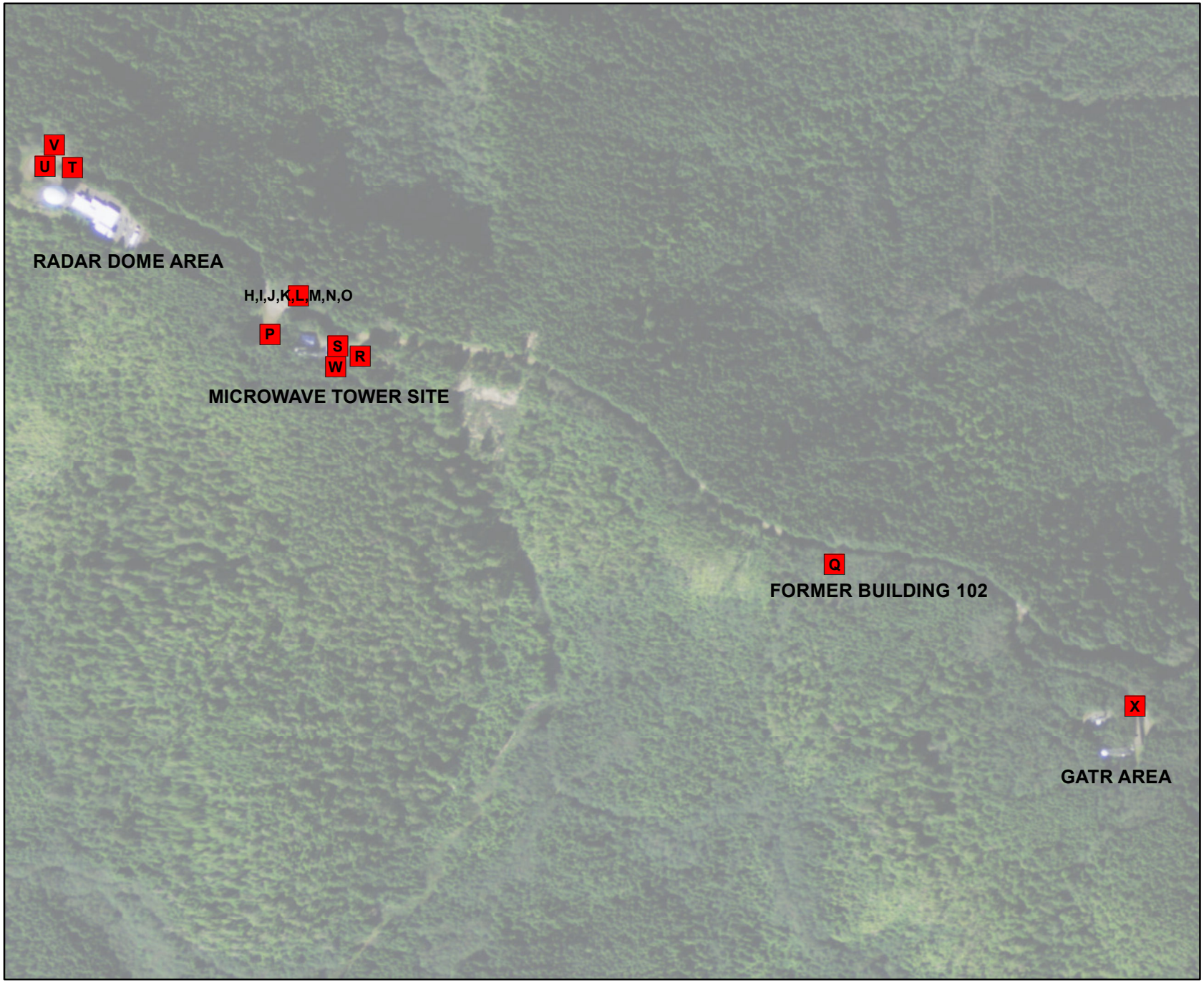
Figure 3. Top Camp Overview



Legend

Underground Storage Tank (approximate)

N

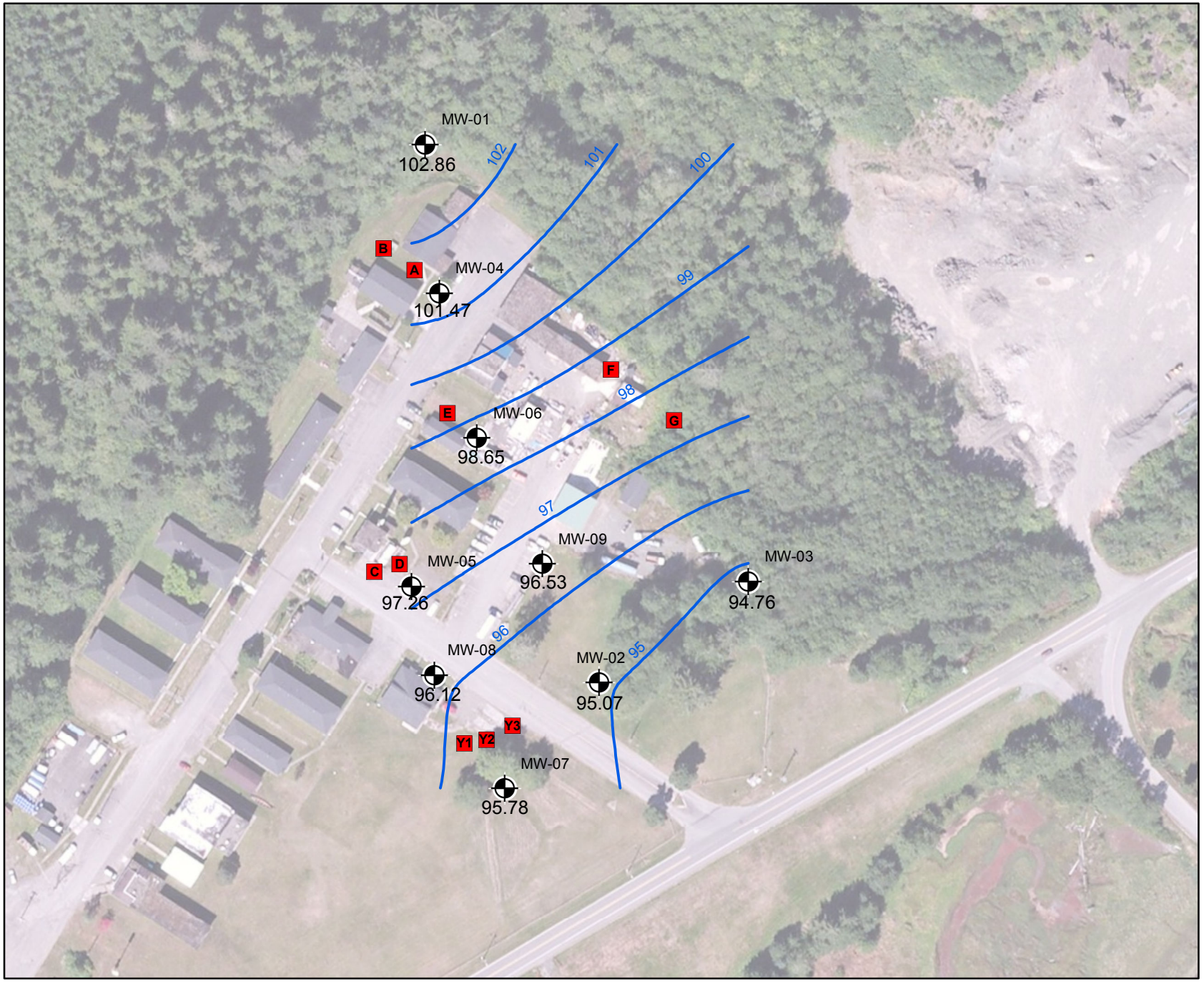
0 200 400

Feet

Former Makah AFS
UST Site Investigation

Location Map

Figure 4. March 2015 Cantonment Area Groundwater Elevations



Legend

- Underground Storage Tank
- Monitoring well
- Water Level Contour (relative ft)

N

Elevations reference a common control point assigned an arbitrary elevation of 100 ft.

Former Makah AFS UST Site Investigation

Location Map

0 70 140
Feet

Figure 5. USTs A and B Sampling Locations

Legend

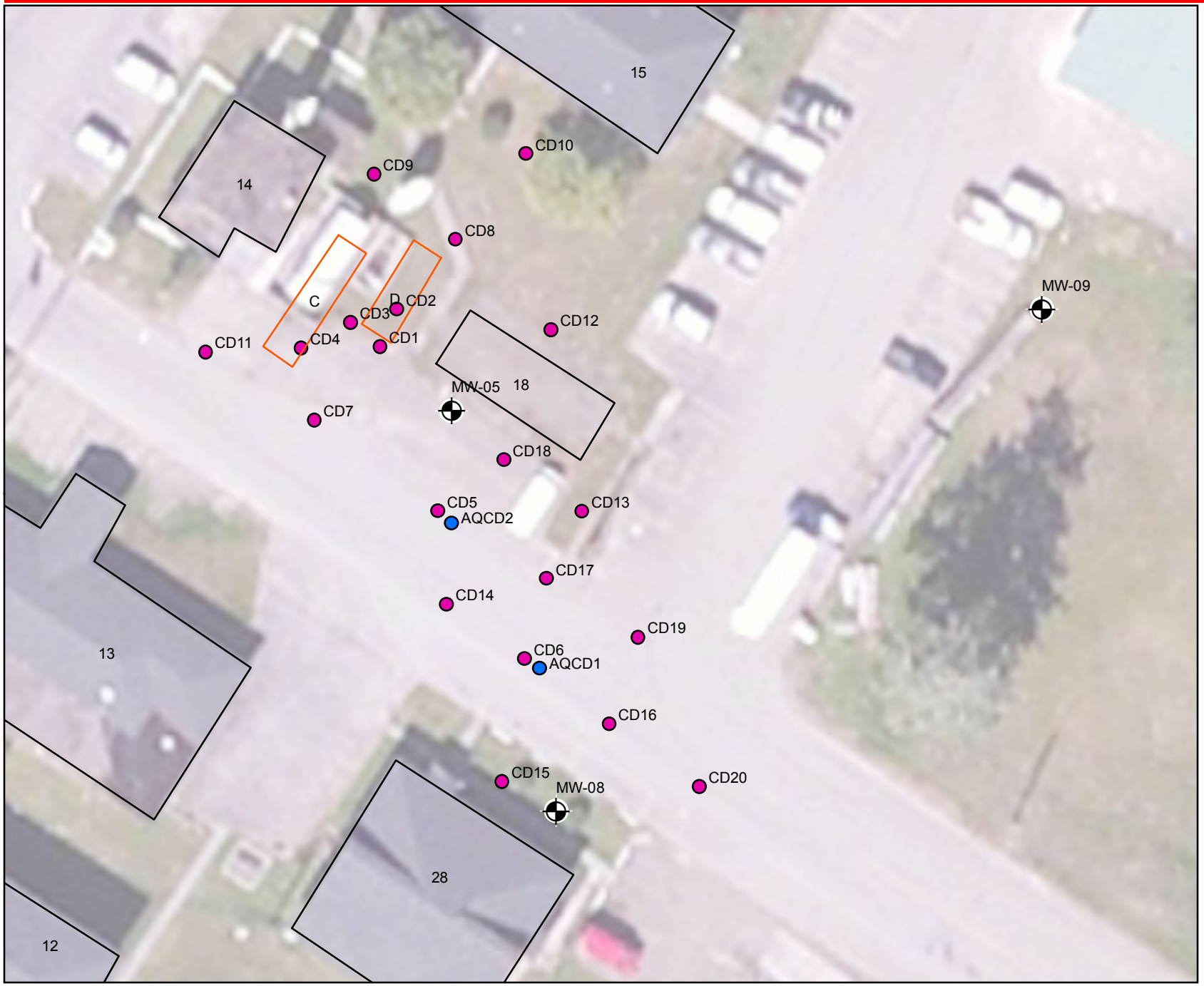
- Building
- Underground StorageTank
- PhII Direct Push Soil Sample
- Groundwater Grab Sample
- Monitoring Well

N

0 7.5 15 22.5
Feet

Location Map

Figure 6. USTs C and D Sampling Locations



Legend

- Building
- Underground Storage Tank
- PhII Direct Push Soil Sample
- Groundwater Grab Sample
- Monitoring Well

N

0 10 20 30

Feet

Location Map

Figure 7. UST E Sampling Locations

Legend

- Building
- Underground Storage Tank
- PhII Direct Push Soil Sample
- Groundwater Grab Sample
- Monitoring Well

N

0 10 20 30

Feet

Location Map

DISCLAIMER - While the United States Army Corps of Engineers, (hereinafter referred to USACE) has made a reasonable effort to insure the accuracy of the maps and associated data, its should be explicitly noted that USACE makes no warranty, representation or guaranty, either express or implied, as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The USACE, its officers, agents, employees, or servants shall assume no liability of any nature for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The USACE, its officers, agents, employees or servants shall assume no liability for any decisions made or actions taken or not taken by the user of the maps and associated data in reliance upon any information or data furnished here. By using these maps and associated data the user does so entirely at their own risk and explicitly acknowledges that he/she is aware of and agrees to be bound by this disclaimer and agrees not to present any claim or demand of any nature against the USACE, its officers, agents, employees or servants in any forum whatsoever for any damages of any nature whatsoever that may result from or may be caused in any way by the use of the maps and associated data.

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Figure 8. USTs H through O Sampling Locations

Legend

- PhII Direct Push Soil Sample
- Monitoring Well

N

0 7 14 21

Feet

Location Map

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Figure 9. UST P Sampling Locations

Legend

- Underground Storage Tank (approx.)
- PhII Direct Push Soil Sample
- Groundwater Grab Sample

N

0 9 18 27

Feet

Location Map

Figure 10. USTs R and S Sampling Locations

Legend

- Building
- Underground Storage Tank (Approx.)
- Direct Push Soil Sample

N

0 8.5 17 25.5

Feet

Location Map

Figure 11. USTs T, U, and V Sampling Locations

Legend

- Underground Storage Tank (approx.)
- PhII Direct Push Soil Sample
- Groundwater Grab Sample

N

0 9 18 27

Feet

Location Map

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APPENDIX A BORING LOGS

Hole No. GP-11-04

DRILLING LOG

DIVISION: Seattle

INSTALLATION: N/A

SHEET: 1 OF 1

1. PROJECT: Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah Contonment Area
3. DRILLING AGENCY: Holt Agency
4. HOLE NO. (As shown on drawing title and file number): GP-11-04
5. NAME OF DRILLER: Louie Fehmer
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 11.5'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 11.5'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~9' bgs
16. DATE HOLE: STARTED 3/3/2015; COMPLETED 3/3/2015
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 70%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Top 4" - clayey silt with organics (TOPSOIL)	Run1		(TOPSOIL)
			silty sand w/ occ gravel (fn, rnd) (SM)			dry
			sand w/ silt and occ gravel (fn, rnd) (SP-SM)	3/5		dry No PID hits
	2					
			- hit a rubble - shale - broken			
			core loss			
	4					
			- broken shale			
			silty sand w/ occ gravel (SM)	Run2		moist
	6					
				4.5/5		
	8				(1)	
			sandy silt w/ occ gravel and wood chunks (ML)			- saturated oily sheen, diesel odor
	10			Run3		
				1.5/1.5		
	11.5		refusal on rock BOH 11.5' 03 Mar 2015		(2)	

ENG FORM 1836e

PROJECT

HOLE NO. GP-11-04

Hole No. GP-11-A5

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt Drilling
4. HOLE NO. (As shown on drawing title and file number)	GP-11-A5
5. NAME OF DRILLER	Logie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	10' bgs
16. DATE HOLE	STARTED 3/3/2015 COMPLETED 3/3/2015
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	90%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			Top 5" - clayey silt w/ organics and gravel	Run 1		(TOPSOIL) Start 1030
			silty sand w/ some gravel (SM)			dry
			- pulverized cobble	3.5/5		No PID hits
	2					
			sand w/ silt and gravel (SP-SM) brown			S - 70% M - 10% G - 20%
	4		- becomes moist			
				Run 2		
	6					No odor noted
				5/5		
	8					
			- saturated		(1)	saturated
	10		sand becomes black, less silt (SP)	Run 3		- S - 80% M - 5% G - 15%
				5/5		
	12					
	14					
	15		BOH at 15'. Meet criteria to stop drilling. 03 Mar 2015			

ENG FORM 1836e | PROJECT (2) | HOLE NO. GP-11-A7

Hole No. GP-11-A6

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-A6
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 12'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 12'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~7' bgs
16. DATE HOLE: STARTED 3/3/2015; COMPLETED 3/3/2015
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 75%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL: clayey silt with organics in first 4 inches, occ gravel	3/5 Run1		sl moist
	2		sand w/ occ gravel (SP) (fn, rnd)			dry No PID hits
			silty sand w/ occ gravel (SM) (fn, rnd) moist			
	4		core loss			
			silty sand w/ occ gravel (SM)	Run2		
	6		sand w/ silt and occ gravel (fn, rnd) saturated (SP-SM)	4/5		-saturated @ 7'
	8				①	
			core loss			
	10		sand w/ silt and occ gravel (fn, rnd) saturated (SP-SM)	Run3 2/2		oily sheen present
	12		refusal on rock. Bolt 12.0' bgs 03 Mar 15		②	

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-A6

Hole No. GP-11-A7

DRILLING LOG

DIVISION: Seattle

INSTALLATION: N/A

SHEET: 1 OF 1

1. PROJECT: Makah Former AFS MGT Ph II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt Drilling
4. HOLE NO. (As shown on drawing title and file number): GP-11-A7
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 13'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 13'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~9.5' bgs
16. DATE HOLE: STARTED 3/3/2015; COMPLETED 3/3/2015
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 92%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Top 6" - clayey silt w/ organics + f gravel	Run 1		-(TOPSOIL) dry
			sand w/ silt and gravel (fn, rnd and brkn) (SP-SM)			No PID hits
	2			4/5		
	4		core loss			
			sand w/ silt and gravel (SP-SM) (fn, rnd to brkn)	Run 2		S-70% m-10% g-20%
	6		} saturated zone			-saturated
	8			4/4	①	
			grades to less silt (SP)			s-80% m-5% g-15%
	10		} saturated moist ↓	Run 3		
	12			4/4		
	13		refusal on rock BOH 13.0' 03 Mar 2015		②	

ENG FORM 1836e

PROJECT

HOLE NO. GP-11-A7

Hole No. GP-11-A8

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-A8
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES: NA
15. ELEVATION GROUND WATER: 15.5'
16. DATE HOLE: STARTED 10 Mar 15; COMPLETED 10 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 87%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			topsoil	Run 1		start 1414
			Sand w/ gravel (SP) S-60%, fm, brown G-20%, fm-cr	4/5		No PID No odor or sheen noted
				Run 2		- saturated
			- becomes gray	4/5		
			3 ore wood chunks	Run 3	①	
				5/5		

ENG FORM 1836e — PROJECT ⑦ — HOLE NO. GP-11-A8

Bott 15' 10 Mar 15 — Stopped 1429

Hole No. GP-11-A9

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-A9
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	11'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	6.5'
16. DATE HOLE	STARTED 10Mar15 / COMPLETED 10 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	82%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			TOPSOIL	Run 1		start 1315
			gravelly sand w/ silt (SP-SM)			No PID
	2		sand (SW) clean, fine-med	4/5		No odor
	4		gravelly silty sand (SW-SM) S-70%, fn-crs,		①	
				Run 2		
	6			4/5		- saturated
			-3" wood chunk			
	8		sand (SW) clean, fine-med			
	10				②	
				Run 3 1/1		
	11		BOH 11', refusal on rock, 10mar15			

Hole No. GP-11-A10

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-A10
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	5.15'
16. DATE HOLE	STARTED 10Mar15 / COMPLETED 10 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	80%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Topsoil	Run 1		start 1445
			Sand w/ gravel (SW)			No PID
			S - 85%, fn - med, brown			No odor
	2		g - 15%, fn, rnd - subrnd	4/5		
	4					
				Run 2		- saturated
	6		- wood chunk			
			- becomes gray	4/5		
	8					
	10				①	
				Run 3		
	12			4/5		
	14					
	15				②	

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-A10

BOH 15' 10Mar15 Stop 1501

Hole No. GP-11-CD1

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	Seattle	N/A	1 OF 2

1. PROJECT	Makah Former AFS UST Ph II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah cantonment Area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	Holt Drilling	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD1	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER	~5.5'
		16. DATE HOLE	STARTED 4 Mar 15 / COMPLETED 4 Mar 15
7. THICKNESS OF OVERBURDEN	15'	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	NA	18. TOTAL CORE RECOVERY FOR BORING	87%
9. TOTAL DEPTH OF HOLE	15'	19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			3" ASPHALT	RUN 1		started 0955
			FILL - silty gravelly sand (SP-SM)			
	2			3/5		
	4		- silty sand w/ gravel (SP-SM)			- diesel odor noted
			S - 70%, fn, poorly sorted			
			M - ~15%			
			G - ~15% fn, rnd to subrnd	RUN 2	①	- saturated
	6					- PID 67.9 ppm
						- PID - 34.0 ppm
				5/5		
	8		- sand w/ silt (SP)			
			S - 90%, fn			- PID - 19.2 ppm
	10			RUN 3	②	
						- PID - 15.0 ppm
	12			5/5		
						- PID - 1.0
	14					

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		Sand (as above)			
	15		EOH 15' 04mar2015			1030 stop

Hole No. GP-11-CD2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Grp II
2. LOCATION (Coordinates or Station)	Makah containment area
3. DRILLING AGENCY	Holt Drilling
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD2
5. NAME OF DRILLER	Lonie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	11.0'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~8' bgs
16. DATE HOLE	STARTED 4 Mar 15 / COMPLETED 4 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	73%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			TOPSOIL	Run 1		Drilling started @ 0755
	2		FILL - silty gravelly sand with organic material (SM).	3/5		
	4		sand w/ silt and gravel S=75%, fn, poorly sorted g=10-15%, fn, rnd (SP-SM)			PID - no readings throughout
				Run 2		No odor noted
	6			4/5		
	8		oily sheen and strong diesel odor noted			- saturated
	10			Run 3 1/1	①	2FT slough in Run 3
	11		BOH 11.0' in rock 04 Mar 2015	BOH	②	Refusal at 11FT stopped 0815

ENG FORM 1836e | PROJECT | HOLE NO.

Hole No. GP-11-CD3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 2

1. PROJECT	Makah Former AFS UST Ph II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah cantonment area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	Holt Drilling	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER	~6' bgs
		16. DATE HOLE	STARTED 4 Mar 15 / COMPLETED 4 Mar 15
7. THICKNESS OF OVERBURDEN	20'	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	NA	18. TOTAL CORE RECOVERY FOR BORING	88%
9. TOTAL DEPTH OF HOLE	20'	19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		started 0848
			FILL - silty gravelly sand (SP-SM)			
	2		sand w/ silt + gravel (SP)	3/5		
			S - 75%, fn, poorly sorted			
			g - 10-15%, fn, subrnd			
	4		m - 10-15%			
			- cobble - pulverized shale	Run 2		
	6		Sand w/ silt, trace gravel (SP)			- saturated
			S - 85-90%, fn, poorly sorted	4.5/5		diesel odor noted from here to BOH
	8					
	10			Run 3	(1)	
						- PID - 1.5 ppm
	12					no PID hits anywhere else
				5/5		
	14					

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		(SP) (as above)			
				RUN 4	(2)	
	16					
				5/5		
	18					
	20		BOH 20' 04mar2015			stopped 0915

Hole No. GP-11-CD4

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Former Makah AFS UST PH II
2. LOCATION (Coordinates or Station): Makah cantonment area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CD4
5. NAME OF DRILLER: Lonie Fehner
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ≈ 6"
16. DATE HOLE: STARTED 4 Mar 15; COMPLETED 4 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 83%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	RUN 1		started 1053
	2		FILL - gravelly sand (SW) S- ~55% fn-crs S- ~45%, mostly fn	2.5/5		
	4				①	
				RUN 2		
	6		Sand w/ silt and trace gravel S - 85-90%, fn (SP)			- saturated
				5/5		No PID hits
	8					slight diesel odor noted
	10				②	
				RUN 3		
	12			5/5		
	14					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD4

15

BOH 15' 04 Mar 2015

stopped 1110

Hole No. GP-11-CDS

DRILLING LOG

DIVISION: Seattle
INSTALLATION: NA
SHEET: 1 OF 2

1. PROJECT: Makah Former AFS List PH II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CDS
5. NAME OF DRILLER: Louie Fehmer
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 25'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 25'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: 6'
16. DATE HOLE: STARTED 4 Mar 15; COMPLETED 4 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 94%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			ASPHALT	RUN 1		started 1310
	2		FILL - silty gravelly sand (SP-SM) S - 50% g - 40% m - 10%	3.5/5		
	4		- organic zone			- diesel odor here to 15' bgs no PID hits
			sand w/ silt and occ gravel (SP) S - 80-90%, fn m - 5-10% g - 5-10%, fn - crs	RUN 2	①	- saturated
	8		- no gravel, becomes 90% fn sand	5/5		
	10			RUN 3	②	
	12			5/5		no PID hits
	14					

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		(SP) (as above)			
				RUN 4		
	16					
			} silty zone with visible product and odor	5/5		
	18				(3)	— no odor beyond 18'
	20			RUN 5		
	22			5/5		
	24					
	25		— BOH 25' 04Mar15			stopped 1358

Hole No. GP-11-CD6

DRILLING LOG

DIVISION: Seattle

INSTALLATION: N/A

SHEET: 1 OF 2

1. PROJECT: Makah Former AFS UST PH II

2. LOCATION (Coordinates or Station): Makah Containment Area

3. DRILLING AGENCY: Holt

4. HOLE NO. (As shown on drawing title and file number): GP-11-CD6

5. NAME OF DRILLER: Louie Fehmer

6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN: 25'

8. DEPTH DRILLED INTO ROCK: N/A

9. TOTAL DEPTH OF HOLE: 25'

10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT

11. DATUM FOR ELEVATION SHOWN (TBM or MSL):

12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED -

14. TOTAL NUMBER OF CORE BOXES: N/A

15. ELEVATION GROUND WATER: 4.5'

16. DATE HOLE: STARTED 4 Mar 15; COMPLETED 4 Mar 15

17. ELEVATION TOP OF HOLE:

18. TOTAL CORE RECOVERY FOR BORING: 96%

19. SIGNATURE OF INSPECTOR:

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			ASPHALT	RUN 1		started 1428
			FILL - silty gravelly sand (SP-SM)	4/5		
	2					
			- organic / woody zone			
	4		sand w/ silt and gravel (SP) S - 80-90% m - 5-10% g - 5-10%			- strong diesel odor. - Saturated
				RUN 2	(1)	
			- organic / woody zone - gravel zone			
	6					- strong diesel odor
			sand w/ silt and occ gravel (SP) S - 85-90% m - 5-10% g - 0-5%	5/5		
	8					diesel odor ↓
						no PID hits
	10			RUN 3	(2)	
				5/5		
	12					
	14					

ENG FORM 1836e

PROJECT

HOLE NO. GP-11-CD6

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		(SP) (as above)			diesel odor ↓
				RUN 4		
	16		-sand coarsens, fine - med.	5/5		No PID hits
	18					
	20		-2" silty lens	RUN 5	(3)	
	22			5/5		
	24					
	25		~~BOH~~ 25' bgs 04mar15			stopped 1500

Hole No. GP-11-CD7

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST PH II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD7
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	NA
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	6'
16. DATE HOLE	STARTED 4Mar15 / COMPLETED 4 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	RUN 1		started 1225
			FILL - silty gravelly sand (SP-SM)			
	2			4/5		
	4		- woody debris			
			sand w/ silt + gravel (SP)		①	
			- organic/woody lense 2" thick	RUN 2		
	6		- gravel lense 3" thick			- saturated
			sand w/ silt and trace gravel			
			S - 85-90%, fn (SP)			
				5/5		No PID hits
	8					no odor noted
	10				②	
				RUN 3		
	12			5/5		
	14					
	15		BOH 15' 04Mar15			

ENG FORM 1836e — PROJECT — HOLE NO. GP-11-CD7

Hole No. GP-11-CDB

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 2

1. PROJECT Makah Former AFS UST Ph II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah cantonment Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt Drilling		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-11-CDB		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED
5. NAME OF DRILLER Louie Fehner		14. TOTAL NUMBER OF CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER ~6' bgs	
7. THICKNESS OF OVERBURDEN 20'		16. DATE HOLE STARTED 3/3/2015	COMPLETED 3/3/15
8. DEPTH DRILLED INTO ROCK N/A		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 20'		18. TOTAL CORE RECOVERY FOR BORING 93%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			TOPSOIL	Run 1		Start 1342
			Fill - clayey silty sand and gravel (SM)			No PID hits
	2			3, 5/5		
			- dark brown at top w/organic	debris		diesel odor from this depth to 18'
	4		Sand w/silt and gravel - becomes gray (SP-SM)			S-85% m-10% g-5%
				Run 2		
	6				①	- saturated
				5/5		
	8					
			- becomes brown			
	10		- become gray	Run 3	②	
			- brown			
	12			5/5		
	14		- gray			

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CDB

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		(SP-SM)(as above)			
			- brown			
				Run 4		
	16		- gray			
				5/5		
	18					- diesel odor dissappears
	20		- BOH 20.0' 03mar2015			- 1402

Hole No. GP-11-CD9

DRILLING LOG	DIVISION Seattle	INSTALLATION MA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt Drilling
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD9
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~8' bgs
16. DATE HOLE	STARTED 3/3/2015 COMPLETED 3/3/2015
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Topsoil + organics	Run 1		start 1210
			Fill - silty gravelly sand (SM)	4/5		
	2					
			Sand w/ silt and gravel brown grades red (SP-SM)			S - 85% m ~ 10% g ~ 5-10%
	4					No PID hits
				5/5 Run 2		No odor noted
	6					
	8					- saturated
	10				(1)	
				Run 3		
	12		- sand becomes black	5/5		
	14					stopped 1310
	15		BOH, Terminated on decision criteria (2) 03 Mar 2015			

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD9

Hole No. GP-11-CD10

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF

1. PROJECT: Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah cantonment area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CD10
5. NAME OF DRILLER: Lonie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: 6.0'
16. DATE HOLE: STARTED 12 Mar 15; COMPLETED 12 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 93%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 1305
			FILL Sandy silty gravel (GW-GM)			No PID
	2			4/5		
			Sand w/ occ organics and S-90%, fn-med, gravel (SW) brown			No odor No sheen
	4					
					①	
				Run 2		
	6		- gravelly lens + silty saturated - becomes lt gray			- saturated
				5/5		
	8					
	10				②	
				Run 3		visible water in core
				5/5		
	12					
			- 1 cm gravel chunk			
	14					
	15					

ENG FORM 1836e — PROJECT — HOLE NO. GP-11-CD10

Step 1318

Both 15' bgs 12 Mar 15

Hole No. GP-11-CD11

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Contaminant Area
3. DRILLING AGENCY	HolH
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD11
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	6'
16. DATE HOLE	STARTED 12Mar15 / COMPLETED 12Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		Start 1354
			FILL			
			gravelly sand w/ silt (SW-SM)			No PID
	2		S-55%, fine-med, brown	4/5		
			g-30%, fn, rounded			No odor
			m-15%			No sheen
	4					
				Run 2	①	
	6		- gravelly silty zone saturated			- saturated
				5/5		
	8					visible water in core
	10				②	
				Run 3		
	12			5/5		
			- becomes gray			
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD11

stop 1405

BOH 15.0' bgs 12mar15

Hole No. GP-11-CD12

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah Cantonment Area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	H&H	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2 / UNDISTURBED	
5. NAME OF DRILLER	Louie Fehmer	14. TOTAL NUMBER OF CORE BOXES	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER	6'
7. THICKNESS OF OVERBURDEN	15'	16. DATE HOLE: STARTED 12 Mar 15 / COMPLETED	12 Mar 15
8. DEPTH DRILLED INTO ROCK	0'	17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE	15'	18. TOTAL CORE RECOVERY FOR BORING	93%
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			TOPSOIL	Run 1		start 1200
			FILL sand, gravel, silt, rocky debris			No PID
	2		Pulverized rock, poss cobble	1/5		
			wood debris mixed w/ sand + gravel			
			Sand w/ occ gravel (SW) S=90%, fine-med, brown			
	4					
					①	
			- organic lens	Run 2		
	6		- gravelly lens saturated			- saturated
				5/5		
	8					
	10				②	water visible in core
				Run 3		
	12			5/5		
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD12

Bott 15.0' bss 12 Mar 15

Stop 1215

Hole No. GP-11-CB13

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Containment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CB13
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	6.5'
16. DATE HOLE	STARTED 12 Mar 15 / COMPLETED 12 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL	Run 1		start 1104
			FILL - sand, gravel, silt rocky debris			
	2			4/5		No PID
			Sand w/ occ fn gravel (SW) S-90%, fn-med, lt brown			
	4					No odor or sheen noted
					①	
	6			Run 2		
			- silty gravelly lens - saturated - sand becomes dk brown			- saturated
	8			5/5		
					②	- visible water in core
	10			Run 3		
				5/5		
	12					
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CB13

Stop 1112

BOH 15.0' bgs 12 Mar 15

Hole No. GP-11-CD14

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD14
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	6.5'
16. DATE HOLE	STARTED 12 Mar 15 / COMPLETED 12 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		start 0840
			Compacted road fill	4/5		No PID
	2					Slight diesel odor at 3' and 6'
			Sand w/ occ gravel (SW) 5-90%, fine-med, brown			No sheen
	4				①	
				Run 2		
	6		- gravel lens, 2" thick - sand becomes gray	5/5		- saturated
	8					
	10				②	
				Run 3		
	12			5/5		
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO.

Stop 0850 GP-11-CD14

BOH 15' 12 Mar 15

Hole No. GP-11-CD15

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF

1. PROJECT: Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CD15
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: NA
15. ELEVATION GROUND WATER: 6.5'
16. DATE HOLE: STARTED 11Mar15; COMPLETED 11Mar15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 93%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	0		TOPSOIL	Run 1		Start 1005
			FILL silty sandy gravel	4/5		NO PID
	2					No odor or sheen noted
	4		Sand w/ gravel (SP) S-80%, fn, brown G-10%, fn		(1)	
				Run 2		
	6		- 4" gravelly lens	5/5		- saturated
	8		- gray			
	10			Run 3	(2)	
				5/5		
	12					
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD15

BOH 15' 11Mar15 stop 1025

Hole No. GP-11-CD16

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1
1. PROJECT Makah former AFS UST Phase II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah Containment Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-11-CD16		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3	UNDISTURBED /
5. NAME OF DRILLER Louie Fehner		14. TOTAL NUMBER OF CORE BOXES NA	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER 5.5'	
		16. DATE HOLE STARTED 11 Mar 15	COMPLETED 11 Mar 15
7. THICKNESS OF OVERBURDEN 15'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING	
9. TOTAL DEPTH OF HOLE 15'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ASPHALT	Run 1		Start 1130
			Compacted crushed fill			No PID
	2			3.5/5		
			silty sandy Gravel (GW-GM)			diesel odor detected from here to bottom of hole
	4		G - 50% - Fine - Coarse			
			S - 30% - Fine-med			
			M - 20%			
			Sand w/ occ gravel (SW)	Run 2	①	- saturated
	6		S - 90% Fine-med			
			G - 10% - Fine			
	8			5/5		
	10			Run 3	②	
	12			5/5		
	14					
	15				③	stop 1145

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD16

BOH 15' 11Mar15

Hole No. GP-11-CD17

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CD17
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822-DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: NA
15. ELEVATION GROUND WATER: 6'
16. DATE HOLE: STARTED 11 Mar 15; COMPLETED 11 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 93%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ASPHALT	Run 1		Start 1450
			Compacted road fill	4/5		No PID
	2					
	4		Sand w/ trace gravel and wood chunks (SP) 5-90-95%, mostly fn			slight diesel odor 5'-5'
				Run 2	①	
	6					- saturated
				5/5		
	8					slight diesel odor 8'-10'
	10			Run 3	②	
	12			5/5		
	14					
	15		EOH 15' 11 Mar 15			

ENG FORM 1836e | PROJECT | HOLE NO. Stop 1504 GP-11-CD17

Hole No. GP-11-CD18

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 2

1. PROJECT Makah Former AFS UST ph II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah cantonment Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-11-CD18		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
5. NAME OF DRILLER Louie Fehner		14. TOTAL NUMBER OF CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER 6'	
7. THICKNESS OF OVERBURDEN 20'		16. DATE HOLE	STARTED 12 Mar 15 / COMPLETED 12 Mar 15
8. DEPTH DRILLED INTO ROCK 0'		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 20'		18. TOTAL CORE RECOVERY FOR BORING 95%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		start 0935
			compacted AGG			No PID
	2		3 pulverized rock	4/5		
			sand w/ ore gravel (SW)			
			5-90% fine sand, brown			
	4					
	6			Run 2		- saturated
			gravel lens <2" thick			
			sand becomes gray	3/5		
	8					
	10				(1)	strong diesel odor 6'-15'
				Run 3		
				5/5		
	12					slight stream 12'-14'
	14					

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	14'		(SW) as above			strong sheen and diesel odor 15-17.5'.
				Run 4	②	
	16			5/5		
			~3" silty lens			
	18					
	20		BOH 20.0' bgs [illegible]			stop 1010

ENG FORM 1836e

PROJECT

HOLE NO. GP-11-C018

Hole No. GP-11-CD19

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-CD19
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: NA
15. ELEVATION GROUND WATER: 6'
16. DATE HOLE: STARTED 11Mar15; COMPLETED 11Mar15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 93%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ASPHALT	Run 1		Start 1353
			compacted road fill			No PID
	2			4/5		
						No odor or sheen noted
	4		Sand w/ occ gravel + silt (SP)			
			S - ~90%, mostly fn		①	
			g - ~5%, mostly fn	Run 2		
	6		m - ~5%	5/5		- saturated
			- gravel lens			
	8					
			- silty lens			
	10			Run 3	②	
	12			5/5		
	14					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-CD19

15

Bott 15' 11Mar15

stop 1408

Hole No. GP-11-CD20

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-CD20
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	6'
16. DATE HOLE	STARTED 11Mar15 / COMPLETED 11Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ASPHALT	Run 1		Start 1300
			Compacted road fill sandy silty gravel	4/5		No PID
	4		Sand, 95% f-m, (SW)			
			trace gravel wood chunk 2" long - 3" peat lens - 2" gravel lens	Run 2		diesel odor at 5' only - saturated
	6			5/5		
	8					
	10		- 4" of clay/silt	Run 3		
	12			5/5		
	14					
	15		BOH 15' 11Mar15			

ENG FORM 1836e | PROJECT | Stip 1320 | HOLE NO. GP-11-CD20

Hole No. GP-11-E5

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST PW II
2. LOCATION (Coordinates or Station)	Makah cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-E5
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~7'6.5
16. DATE HOLE	STARTED 5/Mar/15 COMPLETED 5 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	83%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		started 0745
			silty sand w/ occ gravel (SM) S - 80% m - 15-20% g - 0-5%	3.5/5		No PID hits
			3 gravelly zone	Run 2		
				4/5		- saturated
			Sand - (SP) S - 90%, fn, gray	Run 3	(1)	
				5/5		

ENG FORM 1836e | PROJECT (2) | HOLE NO. GP-11-E5

BOH 15' 05Mar15 | Stopped 0805

Hole No. GP-11-E6

DRILLING LOG	DIVISION: Seattle	INSTALLATION: N/A	SHEET: 1 OF 1

1. PROJECT	Makah Former AFS UST PH II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-E6
5. NAME OF DRILLER	Louie Fehnen
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 2 / UNDISTURBED: 2
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~ 7' bgs
16. DATE HOLE	STARTED: 5 Mar 15 / COMPLETED: 5 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	82%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 1015
			sand w/ silt and occ gravel (SP-SM)			No PID
			S - 80%			
			M - 10-15%			
			G - 5-10%			
	2			3.5/5		
			- silty lens			
	4		- silty lens			
				Run 2		No odor noted
	6		- gravelly lens			
				3.7/5		- saturated
	8					
	10			Run 3	(1)	
	12			5/5		
	14					
	15		BOH 15' 05Mar15			stopped 1030

ENG FORM 1836e — PROJECT (2) — HOLE NO. GP-11-E6

Hole No. GP-11-E7

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST PH II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-E7
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~ 6' bgs
16. DATE HOLE: STARTED 5Mar15; COMPLETED 5Mar15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 87%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 1250
			sand w/ silt and occ gravel (SP) S - 85%, fn m - 10-15% g - 0-5%, fn, subrnd	3/5		No PID
	2					
	4					No odor noted
			-2" silty - clayey (?) lens			
				Run 2		
	6					- saturated
				5/5		
	8		-3" gravelly lens			
			- grades sandier (still SP) S - 90%			
	10				①	
				Run 2		
	12			5/5		
			} gravel - fn			
	14					
	15					

ENG FORM 1836e — PROJECT ② — HOLE NO. GP-11-E7

BOH 15' 05mar2015 — stopped 1310

Hole No. GP-11-E8

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-E8
5. NAME OF DRILLER: Lonze Fehmer
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 2
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~6' bgs
16. DATE HOLE: STARTED 5 Mar 15; COMPLETED 5 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 87%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Topsoil	Run 1		start 1340
			sand w/ silt and occ gravel (SP) S-85%, fn, M-10-15% G-0-5%, fn, subrnd	3/5		No PID
	2					
	4					No odor
			- gravelly lens - ~2"	Run 2	①	
	6					- saturated
			- 3" silty lens	5/5		
	8					
			- grades sandier (still SP) S-90-95%			
	10			Run 3	②	
				3/5		
	12					
	14					
	15					

BOH 15' 05Mar2015 stop 1355

Hole No. GP-11-E9

DRILLING LOG

DIVISION: Seattle

INSTALLATION: NA

SHEET: 1 OF 1

1. PROJECT: Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah Cantonment Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-11-E9
5. NAME OF DRILLER: Lonie Fehmer
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 7
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~8' bgs
16. DATE HOLE: STARTED 5 Mar 15; COMPLETED 5 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 85%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL	Run 1		start 0920
			sand w/ silt and fine gravel (SP-SM)			NO PID
			S - 80%			
			M - 10-15%			
			G - 5-10%			
	2			3/5		
	4				①	
				Run 2		No odor noted
			- silty lens			
	6					
				5/5		
	8					- saturated
					②	
	10			Run 3		
			- silty lens			
	12			5/5		
	14					
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-E9

BOH 15' 05Mar15 Stop 0940

Hole No. GP-11-E10

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST PH II
2. LOCATION (Coordinates or Station)	Makah cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-E10
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~7' bgs
16. DATE HOLE	STARTED 5 Mar 15 / COMPLETED 5 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	85%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			Topsoil	Run 1		Start 0830
	2		Sand w/ silt and occ gravel (SP-SM) S- 80% M- 10-15% G- 0-5%	3/5		
	4					No PID No odor noted
	6			Run 2		
	8		Sand (SP) S- 90%, gray	5/5		- saturated
	10			Run 3	(1)	
	12			5/5		
	14					
	15				(2)	

BOH 15' 05Mar15

Stop 0845

Hole No. GP-11-E11

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 2

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-E11
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	20'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	20'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	~7' bgs
16. DATE HOLE	STARTED 5Mar15 / COMPLETED 5Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	90%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	0		TOPSOIL	Run 1		Start 1055
			silty Sand w/gravel (SM)			No PID
			S - 75%, fn			
			m - 15%			
			g - 10%, fn, rnd - sub rnd			
	2			3.5/5		
	4		3 gravelly zone			
				Run 2		
	6					mild gasoline odor
						- saturated
			Sand w/ silt and gravel (SP)	4.5/5		
	8		S - 80-85%, fn			
	10		- gravelly		(1)	moderate gas odor
				Run 3		oily sheen + strong gasoline odor
	12			5/5		
			- gravelly			
	14					

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	14		(SP) (as above)			
	15			RUN 4	(2)	
	16					
				5/5		
	18		} silty zone m - 25%			
	20					
			BOH 20' 05Mar2015			stop 1125

ENG FORM 1836e

PROJECT

HOLE NO.

GP-11-Fe11

Hole No. GP-11-E12

DRILLING LOG	DIVISION Seattle	INSTALLATION W/A	SHEET 1 OF 1

1. PROJECT Makalu Former AFS UST Ph II	10. SIZE AND TYPE OF BIT Geoprobe 7822 DT
2. LOCATION (Coordinates or Station) Makalu Cantonment Area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY Holt	12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
4. HOLE NO. (As shown on drawing title and file number) GP-11-E12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED —
5. NAME OF DRILLER Louie Fehner	14. TOTAL NUMBER OF CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 6'
7. THICKNESS OF OVERBURDEN 15'	16. DATE HOLE STARTED 13 Mar 15; COMPLETED 13 Mar 15
8. DEPTH DRILLED INTO ROCK 0'	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 15'	18. TOTAL CORE RECOVERY FOR BORING 93%
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL	Run 1		Start 0907
			Sand - 90% fine, gray to brown w/ gravel (SW)			No PID
	2			4/5		
			- 3" silty lens			
	4					
					①	
				Run 2		
	6		- becomes wet			- saturated
				5/5		No odor noted
	8					
			- 4" coarse gravel lens			
	10				②	
				Run 3		
			- fn gravelly lens, about 4" thick	5/5		
	12		- becomes dk gray			
	14					
	15					

BOH 15' 13Mar15

ENG FORM 1836e | PROJECT | site 0921 | HOLE NO. GP-11-E12

Hole No. GP-11-B13

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1
1. PROJECT Makah Former AFS UST PH II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah Contaminant Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-11-B13		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3	UNDISTURBED 1
5. NAME OF DRILLER Louie Fehner		14. TOTAL NUMBER OF CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER 6'	
7. THICKNESS OF OVERBURDEN 15'		16. DATE HOLE STARTED 13 Mar 15	COMPLETED 13 Mar 15
8. DEPTH DRILLED INTO ROCK 0'		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 15'		18. TOTAL CORE RECOVERY FOR BORING 93%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		stood 1053
	2		Gravel w/ sand - HLL (GW) g - 70-80%, fine-crs, subrnd s - 20-30%, fine-med	4/5		
	4					
			gravelly sand - (SP) s - 80% g - 20%	Run 2	(1) (B)	- strong gasoline-like odor 4.5' - 5.5' B1 - wood, charred
	6		- gravelly lens			- saturated
			Sand w/ occ gravel (SP) S - 90%, fine-med, gray	5/5		
	8					
	10		- silty lens	Run 3	(2)	
				5/5		
	12					
	14					
	15					

ENG FORM 1836e | PROJECT Stop 1106 | HOLE NO. GP-11-B13

Both 15' 13 Mar 15

Hole No. GP-11-E14

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Cantonment Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-11-E14
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	
15. ELEVATION GROUND WATER	6.5'
16. DATE HOLE	STARTED 13/Mar 15 COMPLETED 13 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	93%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
	0		ASPHALT	Run 1		start 1150
			Gravel w/ sand - FILL (GW) 5 - 70%, fine to coarse, subrnd - sub-angular G - 30%, fine med	4/5		No PID
	4		many wood chunks with strong gas odor 4.5'-5'			- loss gravel 4.5'-5.0'
				Run 2	①	strong gas-like odor 4.5'-6.5'
	6		sand w/ gravel (SP) - black, S-70% G-30%			- saturated
			Sand w/ occ gravel (SP) S - 90%, fine med, gray	5/5		
	8					
	10			Run 3	②	
	12			5/5		
	14					
	15		BOH 15' 13 Mar 15			stop 1220

ENG FORM 1836e | PROJECT | HOLE NO. GP-11-E14

Hole No. GP-06-H1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Ph. II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-06-H1
5. NAME OF DRILLER: Louie Fehrner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 8.5'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 8.5'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: ~N/A
16. DATE HOLE: STARTED 9 Mar 15; COMPLETED 9 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 72%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	2 in /		start 0905
			silty, gravelly, sand (SW-SM) s - 60%, fines m - 10% g - 30%, fines	3.5/5		
	2					
	4				(1)	
			- crushed gravel			
	6			3/3.5		
			silty zone			
	8				(2)	
	8.5		BOH 8.5' on rock 09Mar15			stopped 0915

ENG FORM 1836e

PROJECT

HOLE NO. GP

Hole No. GP-06-H2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF

1. PROJECT	Makah Former AFS UST Ph. II
2. LOCATION (Coordinates or Station)	Makah
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H2
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	10.5'
8. DEPTH DRILLED INTO ROCK	0.5'
9. TOTAL DEPTH OF HOLE	11'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 9 Mar 15 / COMPLETED 9 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	68%.
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 0940
			silty, gravelly, sand (FILL?) (SP-SM) S-fn-crs, ~65%	3.5/5		No PID No water No odor or sheen
	2					
	4					
				Run 2		
	6			3/5		
	8					
			sand, fine, (SP)			
	10			Run 3	①	
			Rock	1/1	②	
	11		Bottom of hole at 11' 09 Mar 15			stop 1000

Hole No. GP-06-H3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah Top Camp Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H3
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	12.5'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	12.5'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED 2
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 6 Mar 15 / COMPLETED 6 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	60%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 0930
			sandy gravel (GW) g=50%, fn-crs, subrnd-s=50%, fn-med sub ang-	3/5		No PID
	2					
	4			Run 2		
	6			3.5/5		No water
			sand, fn (SP)			
	8		sandy gravel w/ silt and organics (GW-GM)			- woody chunks
	10		- woody chunk	Run 3	(1)	
			- sand lens - wood chunk	2.5/2.5		diesel odor noted
	12		} clay - plastic		(2)	
			BOH, Refusal on rock 12.5', 06Mar15			

Hole No. GP-06-H4

DRILLING LOG	DIVISION Seattle	INSTALLATION NA	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah Top Camp Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H4
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	9.5'
8. DEPTH DRILLED INTO ROCK	0.5'
9. TOTAL DEPTH OF HOLE	10'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	NA
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 6 Mar 15 / COMPLETED 6 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	55%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOP SOIL	Run 1		start 1015
			FILL silty gravelly sand (SP-SM)			No PID
	2			2.5/5		
						No odors
	4					
				Run 2	①	
	6					no water
				3/5		
	8		- Sand lens			
					②	
			Rock			
	10		BOH - refusal on rock 10' 06mar15			Stopped 1025

Hole No. GP-06-H5

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1
1. PROJECT: Makah Former AFS UST Ph. II		10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station): Makah Top Camp Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY: Holt		12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe	
4. HOLE NO. (As shown on drawing title and file number): GP-06-H5		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2	UNDISTURBED
5. NAME OF DRILLER: Louie Fehner		14. TOTAL NUMBER OF CORE BOXES: N/A	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: N/A	
7. THICKNESS OF OVERBURDEN: 10'		16. DATE HOLE: STARTED 6 Mar 15	COMPLETED 6 Mar 14
8. DEPTH DRILLED INTO ROCK: N/A		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE: 10'		18. TOTAL CORE RECOVERY FOR BORING: 60%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		Start 1035
			Fill - silty gravelly sand S - 50%, fn, brown (SP-SM) M - 15-20% G - 30-35% fn-crs	2.5/5		No PID
	2					
	4					No odor
					(1)	
	6			Run 2		No water
			- silty lens	3.5/5		
	8					
			- wood chunk			
	10				(2)	
			BOH, Refusal on rock 10', 06 mar 15			
						stopped 1050

Hole No. GP-06-H6

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST PH.II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah Top Camp Area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	Holt	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H6	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1 / UNDISTURBED	
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER	N/A
7. THICKNESS OF OVERBURDEN	4'	16. DATE HOLE: STARTED 9 Mar 15 / COMPLETED 9 Mar 15	
8. DEPTH DRILLED INTO ROCK	1'	17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE	5'	18. TOTAL CORE RECOVERY FOR BORING	60%
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 0825
			silty gravelly sand (SGW-SM)			No PID
	2		S - 50%, fines	3/5		No odor
			m - 15%			no water
			g - 35% - 1in			
	4		weathered rock			
	5		BOH 09mar15 5.0' bgs		①	stopped 0845

ENG FORM 1836e | PROJECT | HOLE NO.

GP-06-H6

Hole No. GP-06-H7

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Tyee Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H7
5. NAME OF DRILLER	Lonnie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	7'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	7'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	5.5'
16. DATE HOLE	STARTED 17 Mar 15 / COMPLETED 17 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	79%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		Start 0830
			sandy gravel (GW)			poor recovery, moved 2', re-drilled
			g-60-70%, fine-coarse, subround-subang)			
	2		s-30-40% fine-coarse, brown	3.5/5		No PID
	4		- organic burned lens, 2" thick black			
				Run 2	①	saturated @ 5.5' diesel odor, 5-7' screen at 5.5' from 5-7'
	6		- black,	2/2		
	7		BOH 7' on rock, 17 Mar 15		②	

ENG FORM 1836e | PROJECT | HOLE NO.

Hole No. GP-06-H8

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Tap Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H8
5. NAME OF DRILLER	Lonnie Fehmer
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	12'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	12'
10. SIZE AND TYPE OF BIT	Response 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Response
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED — / UNDISTURBED 2
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 17Mar15 COMPLETED 17Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	79%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		Amt 1003
			gravelly, sand (SW) S-70%, fn-med, brown g-30%, fn subrnd	3.5/5		No PID
	2					
	4					No water
						No odor or sheen
	6			Run 2		
			sandy mostly med, gray, (SP) occ crs gravel	4/5		
	8					
			- pulverized rock, possible			
	10		- 2" silty gravel cobble lens	Run 3	①	
			Sand (SP) 95% med, gray	2/2		
			- silty lens			
	12		wood		②	
			Bott on hard wood, 12' 17Mar15			

Hole No. GP-06-H9

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Top Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-H9
5. NAME OF DRILLER	Louie Fitzner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	13'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	13'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 17 Mar. 15 / COMPLETED 17 Mar. 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	84%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 0916
			gravelly sand (SW)			
			5-60% fine sand			
			9-40% fn			No PID
	2		occ gravelly lenses 1-2" thick	3.5/5		
	4					
				Run 2		
	6					- wet
			- silty lens	4.5/5		
	8		- gravel coarsens from here to BOH			moist between
			- rock, possible cobble, drilled through, pulverized			
	10		- silty lens	Run 3	①	
			- silty lens	3/3		diesel odor 11-13'
	12		- gravelly lens			- wet
			- silty lens			
	13				②	
			BOH 13' on rock. 17 Mar 15			

Hole No. GP-06-P1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station): Makah Top Camp Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-06-P1
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: 10.5'-12' bgs
16. DATE HOLE: STARTED 6 Mar 15; COMPLETED 6 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 69%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL	Run 1		start 0745
			FILL - silty sandy Gravel (GM) g - 50-60%, fn-crs, s - fn-crs, subrnd-subang	3/5		No PID
	4					
				Run 2		
	6			3.5/5		
	8					No odor noted
	10		? - sandy zone 10.3'-12' water bearing zone	Run 3	①	- saturated
	12		silty clay w/ sand and gravel (CL) - wood chunks ? OCC organics	4/5		- dry c-40% m-20% s-20% g-20%
	14				②	
	15					

ENG FORM 1836e | PROJECT | HOLE NO. GP-06-P1

Bgn 15' 06mar15 Stopped 0805

Hole No. GP-06-P2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Phase II
2. LOCATION (Coordinates or Station)	Makah Top Camp Area
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-06-P2
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15'
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	15'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 6 Mar 15 / COMPLETED 6 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	66%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		TOPSOIL	Run 1		Start 0840
			FILL - silty sandy gravel 0-30-60% (GW-GM)			
						No PID
	2		occ 1"-2" silty and sandy lenses from 3' to BOH	3/5		
	4					
					(1)	
				Run 2		
	6					
				3/5		No water
	8					
						No odor
	10				(2)	
				Run 3		
				4/5		
	12					
	14					
	15		BOH 15', 06 Mar 15			Stopped 0851

ENG FORM 1836e | PROJECT | HOLE NO. GP-06-P2

Hole No. GP-06-RS1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF

1. PROJECT: Makah Former AFS UST Ph. II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-06-RS1
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 5.5'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 9 Mar 15; COMPLETED 9 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 82%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if singificant) g
			FILL sand, silt, gravel, roots throughout	Run 1 4/5		start 1100 No PID No odor No sheen No water
	2					
	4					
	5		Rock	.5/.5	①	
	5.5		BOH 5.5' on rock 09Mar15			stop 1110

Hole No. GP-06-RS2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah Former AFS UST Ph. II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah Top Camp Area	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	Holt	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-06-RS2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED / UNDISTURBED	1 /
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED DEG. FROM VERT.	15. ELEVATION GROUND WATER	N/A
7. THICKNESS OF OVERBURDEN	4.5'	16. DATE HOLE — STARTED / COMPLETED	9Mar15 / 9Mar15
8. DEPTH DRILLED INTO ROCK	N/A	17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE	4.5'	18. TOTAL CORE RECOVERY FOR BORING	90%
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		FILL sand, gravel, silt, organics, cobbles(?)	Run 1 4/4.5		start 1230 No PID No water No odor or sheen
	4 4.5		BOH, refusal on rock at 4.5' 09Mar15			Stop 1240 (re-attempted, but met refusal at 4')

ENG FORM 1836e | PROJECT | HOLE NO. GP-06-RS2

Hole No. GP-06-RS3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST Ph II.
2. LOCATION (Coordinates or Station): Makah Top Camp Area
3. DRILLING AGENCY: HDR
4. HOLE NO. (As shown on drawing title and file number): GP-06-RS3
5. NAME OF DRILLER: Louie Fehmer
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 3'
8. DEPTH DRILLED INTO ROCK: 2'
9. TOTAL DEPTH OF HOLE: 5'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9Mar15; COMPLETED 9Mar15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 100%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		FILL silty sandy gravel G - 50%, fine S - 30%, fine-med M - 20%	Run 1 5/5		start BGS No PID No water
	4		weathered Rock		①	No odor or Sheen
	5		Refusal in rock - BOH 5' 09Mar15			stop 1310

ENG FORM 1836e

PROJECT

HOLE NO. GP-06-RS3

Hole No. GP-06-RS4

DRILLING LOG	DIVISION: Seattle	INSTALLATION: N/A	SHEET 1 OF 1

1. PROJECT: Makah AFS UST PL II	10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
2. LOCATION *(Coordinates or Station)*: Makah Top Camp	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: Holt	12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
4. HOLE NO. *(As shown on drawing title and file number)*: GP-06-RS4	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: 1 — UNDISTURBED: /
5. NAME OF DRILLER: Lonnie Fehmer	14. TOTAL NUMBER OF CORE BOXES: N/A
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
	16. DATE HOLE — STARTED: 17 Mar 15 — COMPLETED: 17 Mar 15
7. THICKNESS OF OVERBURDEN: 3'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK: 0'	18. TOTAL CORE RECOVERY FOR BORING: 100%
9. TOTAL DEPTH OF HOLE: 3'	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS *(Description)* d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth of weathering, etc., if significant)* g
			Compacted fill sandy gravel w/ occ organics	Run 1 3/3		start 0745 wait 3', refusal on rock. moved 3' N. start 0756 moved again. stopped 0820
	2				1	
			BOH 3' on rock. 17 Mar 15			
	4					
	6					

ENG FORM 1836e | PROJECT | HOLE NO. GP-06-RS4

Hole No. GP-06-RS5

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF
1. PROJECT Makah Former AFS LIST Ph. II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah Top Camp Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-06-RS5		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1	UNDISTURBED /
5. NAME OF DRILLER Louie Fehner		14. TOTAL NUMBER OF CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN 4'		16. DATE HOLE STARTED 10 Mar 15	COMPLETED 10 Mar 15
8. DEPTH DRILLED INTO ROCK 1'		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 5'		18. TOTAL CORE RECOVERY FOR BORING 80%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		FILL silty gravelly sand S- 40% G- 35% M- 25%	Run 1 4/5	①	start 0833 No PID No odor no water
	4		weathered rock			
	5		BOH 5' in rock 10Mar15			stop 0840

ENG FORM 1836e

PROJECT

HOLE NO. GP-06-RS5

Hole No. GP-06-RSG

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah Former AFS UST PH. II
2. LOCATION (Coordinates or Station): Makah Top Camp Area
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-06-RSG
5. NAME OF DRILLER: Louie Fenner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 4.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 5'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9 Mar 15 / COMPLETED 9 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 80%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		Fill silty gravelly sand S - 50% g - 30% m - 20%	Run 1 4/5		start 1403 No PID No water No odor or sheen
	4					
	5		weathered rock BOH 5' in rock 09 Mar 15		@	stop 1410 (2 previous attempts to drill this hole met refusal at 4' and 3')

Hole No. GP-06-RS7

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah AFS UST Ph. II
2. LOCATION (Coordinates or Station): Makah
3. DRILLING AGENCY: Holt
4. HOLE NO. (As shown on drawing title and file number): GP-06-RS7
5. NAME OF DRILLER: Louie Fehner
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 2.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 3'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 10 Mar 15; COMPLETED 10 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 100%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		FILL silty gravelly sand	Run 1 3/3		Start 0920 No PID No odor No water
	3		weathered rock		01	
			BOH 3' bgs 10 Mar 15 refusal on rock			Stop 0930 (2 attempts met refusal at 1.5' each)

ENG FORM 1836e

PROJECT

HOLE NO. GP-06-RS7

Hole No. GP-06-RS8

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1
1. PROJECT Makah Former AFS UST ph II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah Top Camp Area		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Holt		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number)	GP-06-RS8	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED
5. NAME OF DRILLER Louie Fenner		14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER	N/A
7. THICKNESS OF OVERBURDEN	2'	16. DATE HOLE STARTED	10 Mar 15
8. DEPTH DRILLED INTO ROCK	0.5'	COMPLETED	10 Mar 15
9. TOTAL DEPTH OF HOLE	2.5'	17. ELEVATION TOP OF HOLE	
		18. TOTAL CORE RECOVERY FOR BORING	80%
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			FILL silty sand, gravel g-60% s-20% m-20%	2/2.5		start 0900 no PID no odor no water
	2		weathered rock		①	
	2.5		BOH 2.5' on rock 10 mar 15			stop 0905

ENG FORM 1836e | PROJECT | HOLE NO.

GP-06-RS8

Hole No. GP-05-T1

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	Seattle	N/A	1 OF 1

1. PROJECT	Makah AFS UST PH II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION *(Coordinates or Station)*	Makah Top Camp	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	
3. DRILLING AGENCY	Holt	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. *(As shown on drawing title and file number)*	GP-05-T1	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED	2
		UNDISTURBED	/
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER	N/A
		16. DATE HOLE STARTED	16 Mar 15
		COMPLETED	16 Mar 15
7. THICKNESS OF OVERBURDEN	6'	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	2'	18. TOTAL CORE RECOVERY FOR BORING	81%
9. TOTAL DEPTH OF HOLE	8'	19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 1441
			gravelly sand (SW) 5~70% fn-crs, brown-gray 9~30% fn-crs			No PID
	2					No water
				4/5		
	4				①	
				Run 2		
	6		Rock, pulverized by drilling, mixed w/ sand	2.5/3		slight diesel odor 6-8'
			Rock - poss sandstone, or shale,		②	
	8		Bolt 8' on rock, 16mar15			Stop 1449

ENG FORM 1836e

PROJECT

HOLE NO. GP-05-T1

Hole No. GP-05-T2

DRILLING LOG

DIVISION: Seattle

INSTALLATION: N/A

SHEET: 1 OF 1

1. PROJECT: Makah AFS UST Ph II
2. LOCATION (Coordinates or Station): Makah Top Camp
3. DRILLING AGENCY: Hart
4. HOLE NO. (As shown on drawing title and file number): GP-05-T2
5. NAME OF DRILLER: Louie Fehimer
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 12'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 12'
10. SIZE AND TYPE OF BIT: Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES: N/A
15. ELEVATION GROUND WATER: 8'
16. DATE HOLE: STARTED 16 Mar 15; COMPLETED 16 Mar 15
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 88%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		start 1141
	2		Compacted road fill sand, gravel, occ brick, occ debris	5/5		No PID
	4		Gravel w/ sand+silt (GW-GM) g - 60-70%, fn-crs, subr-subang s - 20-30%, fn-med m - 0-10%			
	6			Run 2		Diesel odor 5'-12'
			gravelly sand (SW) s - 70%, fn-med+crs g - 30%, fn, subr-subang	3.5/5		
	8					- saturated
	10		- s - med-crs, less fn	Run 3	(1)	
				2/2		- light sheen
	12		BOH 12.0' bgs 16 Mar 15		(2)	

ENG FORM 1836e

PROJECT: Stop 1133

HOLE NO.: GP-05-T2

Hole No. GP-05-T3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT: Makah AFS UST Ph II	10. SIZE AND TYPE OF BIT: Geoprobe 7822DT
2. LOCATION *(Coordinates or Station)*: Makah Dp Camp	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: Holt	12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
4. HOLE NO. *(As shown on drawing title and file number)*: GP-05-T3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: 3; UNDISTURBED: /
5. NAME OF DRILLER: Louie Fehner	14. TOTAL NUMBER OF CORE BOXES: N/A
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER: 10'
7. THICKNESS OF OVERBURDEN: 12'	16. DATE HOLE — STARTED: 16 mar 15; COMPLETED: 16 Mar 15
8. DEPTH DRILLED INTO ROCK: 0'	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 12'	18. TOTAL CORE RECOVERY FOR BORING: 79%
	19. SIGNATURE OF INSPECTOR

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	0		ASPHALT	Run 1		start 1237
			compacted road fill — sand, gravel, occ debris			0.0 PID
	2			4/5		
			sandy gravel (GW) — g ~70%, f-c; s ~30%, f-c			
	4					
	5		coarse gravel lens — all coarse, broken, 4" thick, 2" dia (largest)	Run 2	(1)	
	6					
	7			3.5/5		
	8					
	10		- coarser gravel - 2" thick, 2" dia. (largest)	Run 3	(2)	- saturated, Diesel odor 10'-12'
	11			2/2		
	12				(3)	
			BOH 12.0 bgs 16 mar 15			stop 1250

ENG FORM 1836e | PROJECT | HOLE NO. GP-05-T3

Hole No. GP-05-TUV1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Top Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-TUV1
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	8'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	8'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 18 Mar 15 / COMPLETED 18 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	94%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Topsoil	Run 1		start 1042
			loose Fill - gravel, sand, occ cobble			No PID
	2					No water
				4.5/5		no odor or sheen
	4					
			- 3" pulverized cobble			
			gravelly sand (SW)		①	
			5-55%, fn-med, brown	Run 2		
	6		9-45%, fn, subrnd-subang	3/3		
	8				②	
			BOH 8' on rock, 18 Mar 15			stop 1048

ENG FORM 1836e

PROJECT

HOLE NO. GP-05-TUV1

Hole No. GP-05-THV2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST PH II
2. LOCATION (Coordinates or Station)	Makah Tup Camp A
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-THV2
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	10'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	10'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 18 Mar 15 / COMPLETED 18 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	95%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		start 1110
			compacted fill - gravel, sand, silt.			No PID
	2			4.5/5		No water
						No diesel odor or sheen
			sandy gravel (GW) 9-60%, fines, subr- 5-40%, fn-med sndbang			
	4					
				Run 2	①	
			-3" coarse sand lens			
	6					
				5/5		
	8		-silty lens, ~3" thick			
	10				②	
			BOH 10' in rock. 18 Mar 15			stop 1120

Hole No. GP-05-TMW3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Tug Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-TMW3
5. NAME OF DRILLER	Lonie Fehmer
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	6'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 18Mar15 / COMPLETED 18Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	92%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		start 1142
			FILL - sand, gravel, occ cobbles, brick, debris, woody debris			No PID
	2			4.5/5		No gw
						No diesel odor or sheen
	4		- brick, brkn		①	
				Run 2 1/1		
	6				②	wet - organic odor - 6' strip - 1201
			BOH 6' on rock. 18Mar15			in shoe

ENG FORM 1836e

PROJECT

HOLE NO. GP-05-TMW3

Hole No. GP-05-U1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST PH II
2. LOCATION (Coordinates or Station)	Makah Top Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-U1
5. NAME OF DRILLER	Louie Fehmer
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	14'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	14'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED /
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 17Mar15 / COMPLETED 17Mar15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	79%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run 1		Start 1143
	2		Compacted FILL - gravel, sand, wood chunks/debris	4/5		No PID
	4					No water
						No diesel odor or sheen
	6		sandy gravel (GW) g-60% fine-coarse, subr to subang s-40% fine-crs, brown	Run 2 3/5	①	
	8					
	10		- wood + black organics, 3" thick	Run 3	②	
	12		-4" wood chunk	4/4		organic odor 12-14'
	14		silty sand w/ gravel (SP-SM) s-fn, dk brown, 50% m-25% g-25% fine-crs			- moist 13-14'

EOH 14' on rock. 17Mar15

PROJECT stvp 1156

HOLE NO. GP-05-U1

Hole No. GP-05-U2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST PL II
2. LOCATION (Coordinates or Station)	Makah Tnp Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-U2
5. NAME OF DRILLER	Louie Fehmer
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	12'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	12'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 3 / UNDISTURBED ✓
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 17 Mar 15 / COMPLETED 17 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	88%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ASPHALT	Run 1		start 1225
	2		Compacted road fill - sand, gravel, wood debris, brick (broken)	4/5		No PID
	4		sandy gravel w/ occ wood (GW) G-60% fines, sub-subang S-40%			No water
	6			Run 2	(1)	No diesel odor or sheen
	8		- 3" pulverized rock lens, possible cobble	4.5/5		
	10		- woody debris and roots	Run 3 2/2	(2)	
	12		BOH 12' on rock. 17 Mar 15		(3)	Stop 1236.

Hole No. GP-05-U3

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT	Makah AFS UST Ph II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION *(Coordinates or Station)*	Makah Top Camp	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	
3. DRILLING AGENCY	Holt	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. *(As shown on drawing title and file number)*	GP-05-U3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED	2
		UNDISTURBED	✓
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER	N/A
		16. DATE HOLE — STARTED	18 Mar 15
		COMPLETED	18 Mar 15
7. THICKNESS OF OVERBURDEN	9'	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	0'	18. TOTAL CORE RECOVERY FOR BORING	94%
9. TOTAL DEPTH OF HOLE	9'	19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ASPHALT	Run1		Start 0958
			Compacted Fill - gravel, sand, wood, occ cobble, occ silt, occ brick			No PID
	2			4.5/5		No water
			- brick			No diesel odor or sheen.
			- cobble pulverized by drilling, 4" thick			
	4				①	
				Run2		
	6					
				4/4		
	8		- silty woody lens, 5" thick			
	9				②	
			Bott 9' on rock. 18 Mar 15			Stop 1010

Hole No. GP-05-V1

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF 1

1. PROJECT Makah AFS UST Ph II		10. SIZE AND TYPE OF BIT Geoprobe 7822 DT	
2. LOCATION (Coordinates or Station) Makah TDP Camp		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Hart		12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe	
4. HOLE NO. (As shown on drawing title and file number) GP-05-V1		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
5. NAME OF DRILLER Louie Fehmer		14. TOTAL NUMBER OF CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN 7'		16. DATE HOLE STARTED 16 Mar 15 / COMPLETED 16 Mar 15	
8. DEPTH DRILLED INTO ROCK 0		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 7.0		18. TOTAL CORE RECOVERY FOR BORING 79%	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		Start 1330
			gravelly sand (SW) 5-60-70%, fine-med G-30-40%, fines, subr-subang	3.5/5		No PID No odor
	2					
	4					
	6		- occ woody debris 3" silt lens w/ organics (pine needles)	Run 2 2/2	①	- wet - moist light sheen above silt lens
	7		BOH on rock 7.0' bgs 16mar15	—	②	stop 1338

Hole No. GP-06-V2

DRILLING LOG	DIVISION Seattle	INSTALLATION N/A	SHEET 1 OF

1. PROJECT	Makah AFS UST Ph II	10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
2. LOCATION (Coordinates or Station)	Makah Top Camp	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	Holt	12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
4. HOLE NO. (As shown on drawing title and file number)	GP-06-V2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED	2
		UNDISTURBED	/
5. NAME OF DRILLER	Louie Fehner	14. TOTAL NUMBER OF CORE BOXES	N/A
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	15. ELEVATION GROUND WATER	N/A
		16. DATE HOLE — STARTED	17 Mar 15
		COMPLETED	17 Mar 15
7. THICKNESS OF OVERBURDEN	7.5	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	0	18. TOTAL CORE RECOVERY FOR BORING	80%
9. TOTAL DEPTH OF HOLE	7.5	19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TOPSOIL	Run 1		start 1110
			Fill - sand, gravel, silt, wood, debris			No PID
	2			2.5/5		No water
	4					No diesel odor or sheen
					①	
				Run 2		
	6			2.5/2.5		
	7.5				②	
			BOH 7.5' on rock. 17Mar15			stop 1120

Hole No. GP-05-V3

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	Seattle	N/A	1 OF 1

1. PROJECT	Makah AFS UST Ph II
2. LOCATION (Coordinates or Station)	Makah Tip Camp
3. DRILLING AGENCY	Holt
4. HOLE NO. (As shown on drawing title and file number)	GP-05-V3
5. NAME OF DRILLER	Louie Fehner
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	8'
8. DEPTH DRILLED INTO ROCK	0'
9. TOTAL DEPTH OF HOLE	8'
10. SIZE AND TYPE OF BIT	Geoprobe 7822 DT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED —
14. TOTAL NUMBER OF CORE BOXES	N/A
15. ELEVATION GROUND WATER	N/A
16. DATE HOLE	STARTED 16 Mar 15 / COMPLETED 16 Mar 15
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	88%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			topsoil	Run1		start 1410
			gravelly sand (SW) s-fm-crs, 70%, g-fm-crs, 30%			No PID
	2			4/5		No water
	4					
				Run2	①	- strong diesel odor 5-8'
	6		- black, moist, strong diesel odor w/ woody debris	3/3		
						- pulverized rock mixed with black soil
	8				②	- strong diesel odor at bottom, in rock/gravel
			BOH 8' on rock, 16mar15			stopped 1419

APPENDIX B SITE PHOTOGRAPHS

PHOTO LOG

Photo 1. Setting up at UST A (GP-11-A6)

Photo 2. GP-11-A4 12.5-15.5 ft bgs with visible sheen

Photo 3. PID use for GP-11-A5 0-5ft bgs

Photo 4. GP-11-CD2 table setup

Photo 5. Drilling at USTs C/D (GP-11-CD3)

Photo 6. UST C/D sampling (GP-11-CD7)

Photo 7. GP-11-CD5 0-25 ft bgs (Top)

Photo 8. GP-11-CD5 0-25 ft bgs (Bottom)

Photo 9. UVF-3100A Field Test Kit station

Photo 10. UST C/D drilling (GP-11-CD5)

Photo 11. UST C/D drilling (GP-11-CD6)

Photo 12. GP-11-E5 0-15 ft bgs (Bottom)

Photo 13. GP-11-E5 0-15 ft bgs (Top)

Photo 14. UST E drilling (GP-11-E10)

Photo 15. GP-11-E11 0-20 ft bgs (Bottom)

Photo 16. GP-11-E11 0-20 ft bgs (Top)

Photo 17. UST E drilling (GP-11-E11)

Photo 18. UST E drilling (GP-11-E7)

Photo 19. UST E drilling (GP-11-E8)

Photo 20. View looking south at UST P site (GP-06-P1)

Photo 21. GP-06-P2 0-15 ft bgs (bottom)

Photo 22. GP-06-P2 0-15 ft bgs (top)

Photo 23. USTs H-O drilling (GP-06-H3)

Photo 24. GP-06-H3 0-15 ft bgs (bottom)

Photo 25. GP-06-H3 0-15 ft bgs (Top)

Photo 26. Monitoring well MW-6 with visible sheen in water within casing

Photo 27. Sampling setup at MW-6

Photo 28. Purging water out of well casing at MW-5

Photo 29. Suspected damage to riser in MW-5

Photo 30. Purging setup at MW-8

Photo 31. GP-06-H6 0-8 ft bgs

Photo 32. GP-06-RS7 0-5 ft bgs

Photo 33. UST A step-out drilling (GP-11-A9)

Photo 34. Groundwater push point

Photo 35. GP-11-A10 0-15 ft bgs

Photo 36. USTs C/D step-out sampling (GP-11-CD15)

Photo 37. USTs C/D step-out sampling (GP-11-CD16)

Photo 38. USTs C/D step-out sampling (GP-11-CD19

Photo 39. USTs C/D step-out sampling (GP-11-CD14)

Photo 40. USTs C/D step-out sampling (GP-11-CD14)

Photo 41. USTs C/D step-out sampling (GP-11-CD18)

Photo 42. GP-11-CD18 0-15 ft bgs (top) with visible sheen through 10-15ft bgs interval

Photo 43. USTs C/D step-out sampling (GP-11-CD13)

Photo 44. USTs C/D step-out sampling (GP-11-CD12)

Photo 45. USTs C/D step-out sampling (GP-11-CD10)

Photo 46. USTs C/D Groundwater grab sampling (AQCD2)

Photo 47. AQCD2 purge water with sheen

Photo 48. UST A groundwater grab sampling (AQA1)

Photo 49. UST E Groundwater grab sampling (AQE1)

Photo 50. UST E step-out sampling (GP-11-E12)

Photo 51. UST E step-out sampling (GP-11-E13)

Photo 52. Wood chunks found in GP-11-E13 at approximately 4-5 ft bgs

PHOTO LOG

Photo 53. More wood chunks found in GP-11-E13 at approximately 4-5 ft bgs

Photo 54. UST E Groundwater grab sampling (AQE3)

Photo 55. USTs T, U, V sampling (GP-05-T2)

Photo 56. GP-05-T3 0-10 ft bgs

Photo 57. USTs T, U, V Sampling (GP-05-T3)

Photo 58. USTs T, U, V sampling (GP-05-V2)

Photo 59. GP-05-V2 0-10 ft bgs

Photo 60. USTs T, U, V sampling (GP-05-U3)

Photo 61. Investigaton derived waste (IDW) drums storage area in cantonment area.

PHOTO LOG

Photo 1. Setting up at UST A (GP-11-A6)

Photo 2. GP-11-A4 12.5-15.5 ft bgs with visible sheen

Photo 3. PID use for GP-11-A5 0-5ft bgs

Photo 4. GP-11-CD2 table setup

PHOTO LOG

Photo 5. Drilling at USTs C/D (GP-11-CD3)

Photo 6. UST C/D sampling (GP-11-CD7)

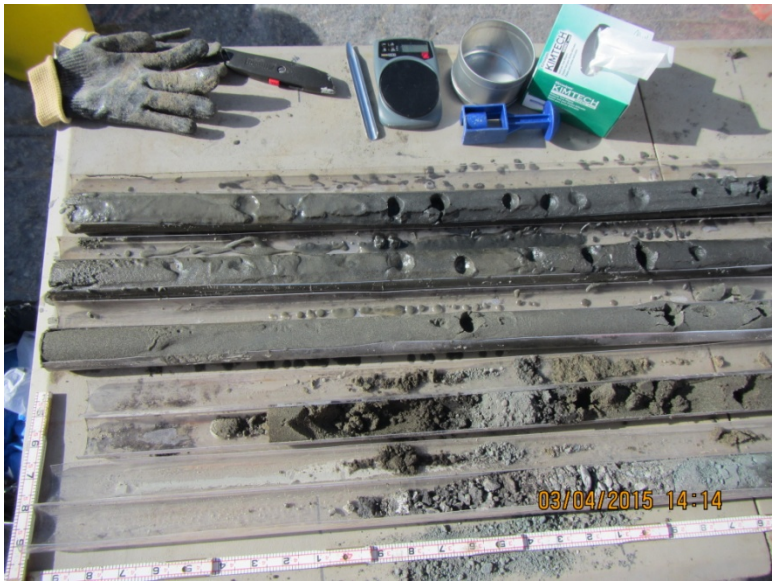

Photo 7. GP-11-CD5 0-25 ft bgs (Top)

Photo 8. GP-11-CD5 0-25 ft bgs (Bottom)

PHOTO LOG

Photo 9. UVF-3100A Field Test Kit station

Photo 10. UST C/D drilling (GP-11-CD5)

Photo 11. UST C/D drilling (GP-11-CD6)

Photo 12. GP-11-E5 0-15 ft bgs (Bottom)

PHOTO LOG

Photo 13. GP-11-E5 0-15 ft bgs (Top)

Photo 14. UST E drilling (GP-11-E10)

Photo 15. GP-11-E11 0-20 ft bgs (Bottom)

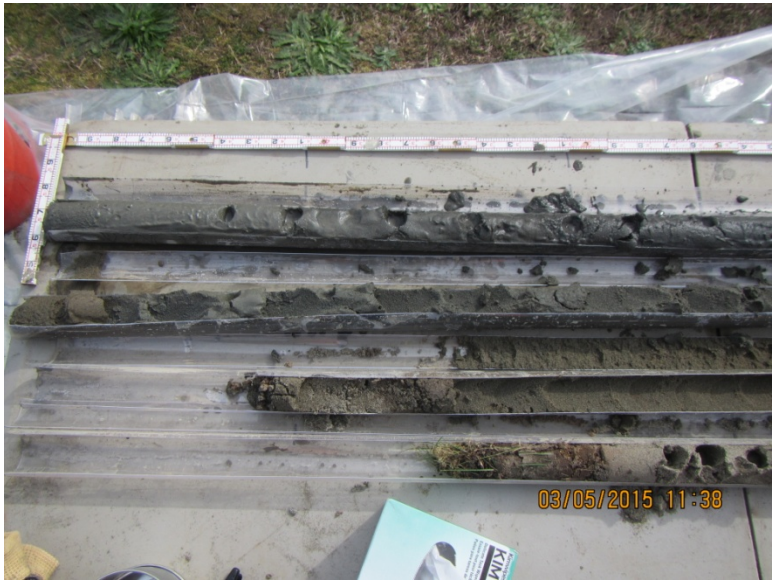

Photo 16. GP-11-E11 0-20 ft bgs (Top)

PHOTO LOG

Photo 17. UST E drilling (GP-11-E11)

Photo 18. UST E drilling (GP-11-E7)

Photo 19. UST E drilling (GP-11-E8)

Photo 20. View looking south at UST P site (GP-06-P1)

PHOTO LOG

Photo 21. GP-06-P2 0-15 ft bgs (bottom)

Photo 22. GP-06-P2 0-15 ft bgs (top)

Photo 23. USTs H-O drilling (GP-06-H3)

Photo 24. GP-06-H3 0-15 ft bgs (bottom)

PHOTO LOG

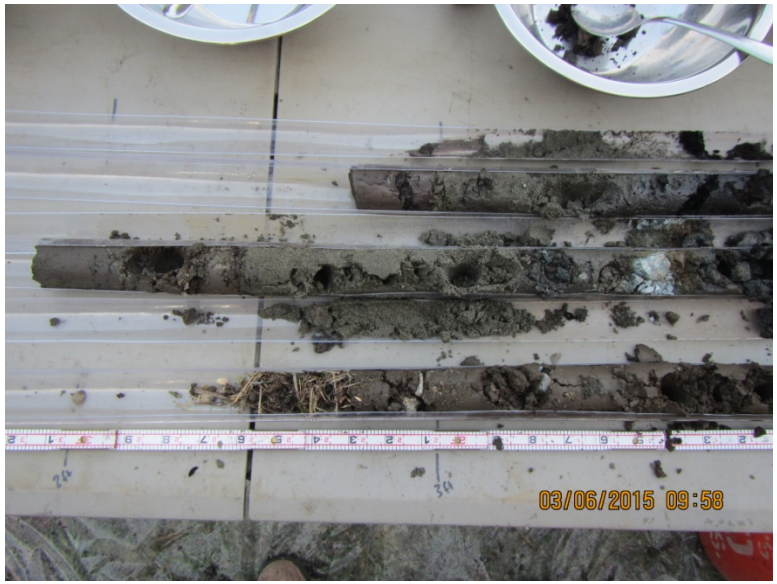

Photo 25. GP-06-H3 0-15 ft bgs (Top)

Photo 26. Monitoring well MW-6 with visible sheen in water within casing

Photo 27. Sampling setup at MW-6

Photo 28. Purging water out of well casing at MW-5

PHOTO LOG

Photo 29. Suspected damage to riser in MW-5

Photo 30. Purging setup at MW-8

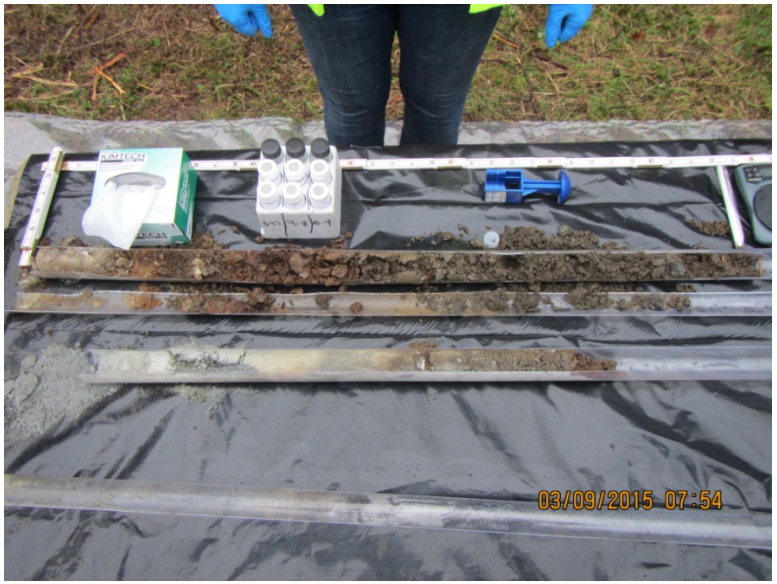

Photo 31. GP-06-H6 0-8 ft bgs

Photo 32. GP-06-RS7 0-5 ft bgs

PHOTO LOG

Photo 33. UST A step-out drilling (GP-11-A9)

Photo 34. Groundwater push point

Photo 35. GP-11-A10 0-15 ft bgs

Photo 36. USTs C/D step-out sampling (GP-11-CD15)

PHOTO LOG

Photo 37. USTs C/D step-out sampling (GP-11-CD16)

Photo 38. USTs C/D step-out sampling (GP-11-CD19

Photo 39. USTs C/D step-out sampling (GP-11-CD14)

Photo 40. USTs C/D step-out sampling (GP-11-CD14)

PHOTO LOG

Photo 41. USTs C/D step-out sampling (GP-11-CD18)

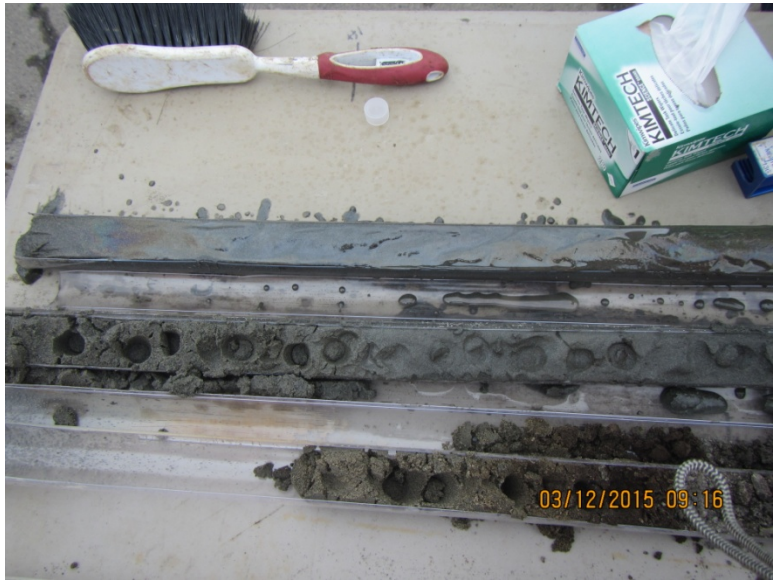

Photo 42. GP-11-CD18 0-15 ft bgs (top) with visible sheen through 10-15ft bgs interval

Photo 43. USTs C/D step-out sampling (GP-11-CD13)

Photo 44. USTs C/D step-out sampling (GP-11-CD12)

PHOTO LOG

Photo 45. USTs C/D step-out sampling (GP-11-CD10)

Photo 46. USTs C/D Groundwater grab sampling (AQCD2)

Photo 47. AQCD2 purge water with sheen

Photo 48. UST A groundwater grab sampling (AQA1)

PHOTO LOG

Photo 49. UST E Groundwater grab sampling (AQE1)

Photo 50. UST E step-out sampling (GP-11-E12)

Photo 51. UST E step-out sampling (GP-11-E13)

Photo 52. Wood chunks found in GP-11-E13 at approximately 4-5 ft bgs

PHOTO LOG

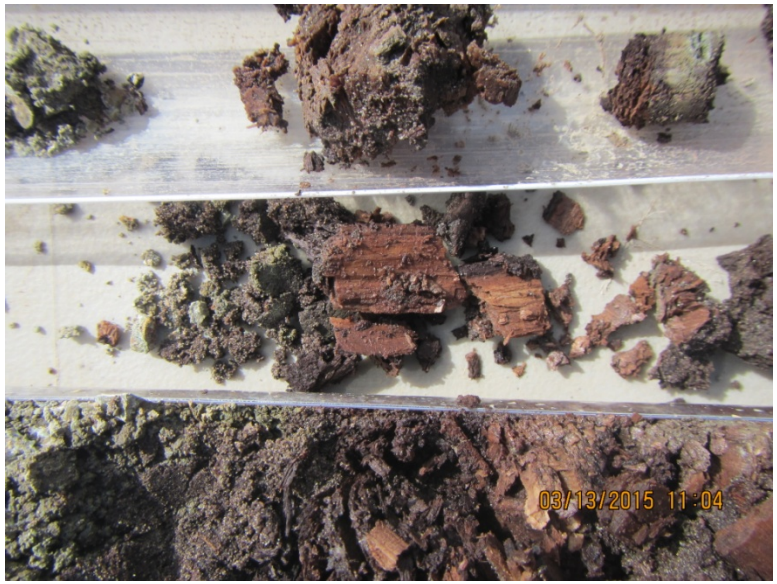

Photo 53. More wood chunks found in GP-11-E13 at approximately 4-5 ft bgs

Photo 54. UST E Groundwater grab sampling (AQE3)

Photo 55. USTs T, U, V sampling (GP-05-T2)

Photo 56. GP-05-T3 0-10 ft bgs

PHOTO LOG

Photo 57. USTs T, U, V Sampling (GP-05-T3)

Photo 58. USTs T, U, V sampling (GP-05-V2)

Photo 59. GP-05-V2 0-10 ft bgs

Photo 60. USTs T, U, V sampling (GP-05-U3)

PHOTO LOG

Photo 61. Investigaton derived waste (IDW) drums storage area in cantonment area.

APPENDIX C FIELD NOTES AND FIELD FORMS

Sample Field Book
Monitoring Well Purge Logs
UVF-3100 Field Sample Notes
UVF-3100 Sample Log Sheets
Drum Log

Makah Former AFS UST Investigation Phase II

Sampling Table - GW

Sample ID	Well/Loc	(2015) DATE	TIME	Sample Type	DRO	GRO	VOCs	VOCs SIM	Diss Met	Anions	MEE	Fe^{2+}	NOTES
-AQMW05	MW-05/cantonment	08 Mar	1223	Primary	✓	–	✓	–	✓	✓	✓	✓	
-AQMW06	MW-06/ "	08 Mar	0900	P, ms, msd	✓	✓	✓	–	✓	✓	✓	✓	
-AQMW10	MW-06/ "	08 Mar	0915	Field dup	✓	✓	✓	–	✓	✓	✓	–	
-AQMW08	MW-08/ "	08 Mar	1310		✓	–	✓	–	✓	✓	✓	✓	
-AQMW09	MW-09/ "	08 Mar	1125		✓	✓	✓	–	✓	✓	✓	✓	

FedEx (Express)
1-800-463-3339
Ask for p/up @ 201 Resort Drive. Be ready by noon. P/up is anytime from 1130-1400

Makah Former AFS UST Investigation Phase II

Sampling Table – Soils

SAMPLE ID	LOC	DATE (2015)	TIME	Dx	Gx	VOCs 8260	ANALYSIS Total Solids Gx + 8260	SVOCs SIM 8270	Metals (Pb) (6020)	PCB Aroclors (8082)	NOTES
GP-11-A6-~~18~~ 13	UST A	3/3	0845	✓		✓	✓				Put labels on VOCs this sample only
~~GP-11-A6-12~~ A4-8 GP-11-A6-8	UST A	3/3	~~0918~~ ~~0845~~ 0845	✓		✓	✓				
GP-11-A4-12	UST A	3/3	0918	✓		✓	✓				
GP-11-A4-8	UST A	3/3	0918	✓		✓	✓				
GP-11-A7-8	UST A	3/3	0933	✓		✓	✓				
GP-11-A7-13	UST A	3/3	0953	✓		✓	✓				
AQTB1	UST A	3/3	N/A			✓					Trip Blank
GP-11-CD9-15	UST C+D	3/3	1310	✓		✓	✓	✓			
GP-11-CD91-15	UST C+D	3/3	1340	✓		✓	✓	✓			Field Dupe
GP-11-CD9-10	UST C+D	3/3	1310	✓		✓	✓	✓			
GP-11-A5-15	UST A	3/3	1045	✓		✓	✓				
GP-11-A5-10	UST A	3/3	1045	✓		✓	✓				
GP-11-CD8-6	UST C+D	3/3	1402	✓		✓	✓	✓			
GP-11-CD8-10	UST C+D	3/3	1402	✓		✓	✓	✓			extra vol for ms/msd
GP-11-CD2-10	UST C+D	3/4	0755	✓		✓	✓	✓			extra vol for ms/msd
GP-11-CD2-11	UST C+D	3/4	0755	✓		✓	✓	✓			
GP-11-CD3-10	UST C+D	3/4	0900	✓		✓	✓	✓			
GP-11-CD31-10	UST C+D	3/4	0910	✓		✓	✓	✓			Field Dupe
GP-11-CD3-15	UST C+D	3/4	0900	✓		✓	✓	✓			
~~GP-11-CD1-~~											
AQRB1	Rinsate blank on shoe	3/4	0950			✓					
GP-11-CD1-5	UST C+D	3/4	1030	✓		✓	✓	✓			
GP-11-CD1-10	UST C+D	3/4	1030	✓		✓	✓	✓			
GP-11-CD4-5	UST C+D	3/4	1110	✓		✓	✓	✓			
GP-11-CD4-10	UST C+D	3/4	1110	✓		✓	✓	✓			
GP-11-CD7-5	UST C+D	3/4	1250	✓		✓	✓	✓			
GP-11-CD7-10	UST C+D	3/4	1250	✓		✓	✓	✓			
GP-11-CD5-5	UST C+D	3/4	1400	✓		✓	✓	✓			
GP-11-CD5-10	UST C+D	3/4	1400	✓		✓	✓	✓			
GP-11-CD5-18	UST C+D	3/4	1400	✓		✓	✓	✓			
GP-11-CD6-5	UST C+D	3/4	1440	✓		✓	✓	✓			
GP-11-CD6-10	UST C+D	3/4	1440	✓		✓	✓	✓			
GP-11-CD6-20	UST C+D	3/4	1440	✓		✓	✓	✓			
GP-11-E5-15	UST E	3/5	0810	✓	✓	✓	✓				
GP-11-E5-10	UST E	3/5	0810	✓	✓	✓	✓				
GP-11-E51-15	UST E	3/5	0830	✓	✓	✓	✓				Field dupe

Makah Former AFS UST Investigation – Phase II

Sampling Table - SOILS

SAMPLE ID	LOC	DATE (2015)	TIME	ANALYSIS: DX	GX	VOCs 8260	Total Solids	SVOC SIM 8270	Metals, Pb	PCB 8082	NOTES
GP-11-E10-10	UST E	3/5	0905	✓	✓	✓	✓				
GP-11-E10-15	UST E	3/5	0905	✓	✓	✓	✓				
GP-11-E9-5	UST E	3/5	0950	✓	✓	✓	✓				
GP-11-E9-10	UST E	3/5	0950	✓	✓	✓	✓				
AQTB 2	UST E	3/5	N/A		✓	✓					Trip Blank (2 for GX, 2 for 8260)
GP-11-E6-15	UST E	3/5	1035	✓	✓	✓	✓				
GP-11-E6-10	UST E	3/5	1035	✓	✓	✓	✓				Extra vol for ms/msd
GP-11-E11-10	UST E	3/5	1110	✓	✓	✓	✓				
GP-11-E11-15	UST E	3/5	1110	✓	✓	✓	✓				
GP-11-E7-10	UST E	3/5	1315	✓	✓	✓	✓				
GP-11-E7-15	UST E	3/5	1315	✓	✓	✓	✓				
AQRB 2	Rinsate blank on shoe	3/5	1325		✓	✓					(2 GX, 2 8260)
GP-11-E8-5	UST E	3/5	1400	✓	✓	✓	✓				
GP-11-E8-10	UST E	3/5	1400	✓	✓	✓	✓				
GP-06-P1-10	UST P	3/6	0815					✓		✓	Sample may contain organics
GP-06-P1-14	UST P	3/6	0815					✓		✓	Sample may contain organics
GP-06-P2-5	UST P	3/6	0915					✓		✓	
GP-06-P2-10	UST P	3/6	0915					✓		✓	
~~AQ RB3~~	Rinsate blank on shoe	3/6	0920								
GP-06-H3-10	UST H-O	3/6	0955	✓		✓	✓				Extra vol for ms/msd
GP-06-H3-12	UST H-O	3/6	0955	✓		✓	✓				
GP-06-H4-5	UST H-O	3/6	1030	✓		✓	✓				
GP-06-H4-9	UST H-O	3/6	1030	✓		✓	✓				
GP-06-H5-5	UST H-O	3/6	1055	✓		✓	✓				
GP-06-H5-10	UST H-O	3/6	1055	✓		✓	✓				
AQTB 3	MW	3/8	N/A		✓	✓					(2 GX, 2 8260)
GP-06-H6-5	UST H-O	3/9	0850	✓		✓	✓				
GP-06-H1-5	UST H-O	3/9	0920	✓		✓	✓				
GP-06-H1-8	UST H-O	3/9	0920	✓		✓	✓				
GP-06-H2-10	UST H-O	3/9	1005	✓		✓	✓				
GP-06-H2-11	UST H-O	3/9	1005	✓		✓	✓				Extra vol for ms/msd
GP-06-RS1-5	UST R/S	3/9	1115	✓	✓	✓	✓		✓		
GP-06-RS2-4	UST R/S	3/9	1245	✓	✓	✓	✓		✓		(1245)
GP-06-RS3-3	UST R/S	3/9	1315	✓	✓	✓	✓		✓		
GP-06-RS6-5	UST R/S	3/9	1415	✓	✓	✓	✓		✓		
GP-06-RSB1-5	UST R/S	3/9	1425	✓	✓	✓	✓		✓		

Makah Former AFS UST Investigation PH II

Sampling Table ~~Soil~~

SAMPLE ID	LOC	DATE (2015)	TIME	DX	GX	VOC 8260	Total Solids	SVOC SIM 8270	6020 Pb	PCB 8082		NOTES
GP-06-RS5-3	UST R/S	10 Mar	0845	✓	✓	✓	✓		✓			
GP-06-RS7	UST R/S	10 Mar	—									Not taken, only rock.
GP-06-RS8-2	UST R/S	10 Mar	0910	✓	✓	✓	✓		✓			
GP-06-~~RS7~~ RS7-3	UST R/S	10 Mar	0945	✓	✓	✓	✓		✓			RS7 take 4!
GP-11-A9-5	UST A	10 Mar	1345	✓		✓	✓					
GP-11-A9-10	UST A	10 Mar	1345	✓		✓	✓					
GP-11-A8-10	UST A	10 Mar	1435	✓		✓	✓					
GP-11-A8-15	UST A	10 Mar	1435	✓		✓	✓					
GP-11-A10-10	UST A	10 Mar	1505	✓		✓	✓					
GP-11-A10-15	UST A	10 Mar	1505	✓		✓	✓					
AQTB 4	N/A	10 Mar	N/A			✓						
GP-06-CD15-5	UST C/D	11 Mar	1035	✓		✓	✓	✓				6
GP-06-CD15-10	UST C/D	11 Mar	1035	✓		✓	✓	✓				
GP-06-CD151-10	UST C/D	11 Mar	1045	✓		✓	✓	✓			Field dup	
GP-~~06~~ 11-CD16-5	UST C/D	11 Mar	1205	✓		✓	✓	✓				
GP-~~06~~ 11-CD16-10	UST C/D	11 Mar	1205	✓		✓	✓	✓			extra vol for	ms/msd
GP-~~06~~ 11-CD16-15	UST C/D	11 Mar	1205	✓		✓	✓	✓				
GP-11-CD20-10	UST C/D	11 Mar	1325	✓		✓	✓	✓				
GP-11-CD20-15	UST C/D	11 Mar	1325	✓		✓	✓	✓				
GP-11-CD19-5	UST C/D	11 Mar	1420	✓		✓	✓	✓				
GP-11-CD19-10	UST C/D	11 Mar	1420	✓		✓	✓	✓				
GP-11-CD191-10	UST C/D	11 Mar	1440	✓		✓	✓	✓			Field dup	
GP-11-CD17-5	UST C/D	11 Mar	1510	✓		✓	✓	✓				
GP-11-CD17-10	UST C/D	11 Mar	1510	✓		✓	✓	✓				
GP-11-CD14-5	UST C/D	12 Mar	0855	✓		✓	✓	✓				
GP-11-CD14-10	UST C/D	12 Mar	0855	✓		✓	✓	✓			extra vol for	ms/msd
GP-11-CD18-10	UST C/D	12 Mar	1020	✓		✓	✓	✓				
GP-11-CD18-15	UST C/D	12 Mar	1020	✓		✓	✓	✓				
GP-11-CD181-10	UST C/D	12 Mar	1050	✓		✓	✓	✓			field dup	
AQRB3	Rinsate blank	12 Mar	1105			✓					taken from	drive shoe
GP-11-CD13-5	UST C/D	12 Mar	1120	✓		✓	✓	✓				
GP-11-CD13-10	UST C/D	12 Mar	1120	✓		✓	✓	✓				
GP-11-CD12-5	UST C/D	12 Mar	1225	✓		✓	✓	✓				
GP-11-CD12-10	UST C/D	12 Mar	1225	✓		✓	✓	✓				
GP-11-CD10-5	UST C/D	12 Mar	1325	✓		✓	✓	✓				

Makah Former AFS UST Investigation Phase II
Sampling Table

SAMPLE ID	LOC	DATE (2015)	TIME	Dx	Gx	VOC 8260	Total Solids	SVOC SIM 8270	6020 Pb	PCB 8082	Dissolved Metals (Mn)	Anions	MEE	NOTES	
~~GP-11-CD10-~~	~~UST C/D~~														
GP-11-CD10-10	UST C/D	12Mar	1325	✓		✓	✓	✓							
GP-11-CD11-5	UST C/D	12Mar	1416	✓		✓	✓	✓							
GP-11-CD11-10	UST C/D	12Mar	1410	✓		✓	✓	✓							
AQCD1	UST C/D	12Mar	1515	✓		✓					✓	✓	✓		9
AQCD7	UST C/D	12Mar	1540	✓		✓					✓	✓	✓	Field dup (AQCD1)	
AQCD2	UST C/D	12Mar	1549	✓		✓					✓	✓	✓		
AQA1	UST A	13Mar	0825	✓	~~✓~~	✓					✓	✓	✓	Extra vol for ms/msd	23 ~~18~~
GP-11-E12-10	UST E	13Mar	0940	✓	✓	✓	✓								7 ~~6~~
GP-11-E12-15	UST E	13Mar	0940	✓	✓	✓	✓								
AQE1	UST E	13Mar	1010 ~~1005~~	✓	✓	✓					✓	✓	✓	H	12 ~~10~~
GP-11-E13-5	UST E	13Mar	1115	✓	✓	✓	✓								
GP-11-E13-10	UST E	13Mar	1115	✓	✓	✓	✓								
GP-11-E14-5	UST E	13Mar	1215	✓	✓	✓	✓								
GP-11-E14-10	UST E	13Mar	1215	✓	✓	✓	✓								
AQTB5	N/A	16Mar	N/A		✓	✓									4
AQE2	UST E	16Mar	0910	✓	✓	✓					✓	✓	✓	Extra vol for ms/msd	29
AQE3	UST E	16Mar	1000	✓	✓	✓					✓	✓	✓		11
GP-05-T2-10	UST T-V	16Mar	1215	✓		✓	✓								5
GP-05-T3-5	UST-T-V	16Mar	1300	✓		✓	✓								
GP-05-V1-5	UST ~~T~~-V	16Mar	1350	✓		✓	✓							~~extra vol for ms/msd~~	16
GP-05-V3-5	UST T-V	16Mar	1435	✓		✓	✓								5
GP-05-T1-5	UST T-V	16Mar	1455	✓		✓	✓								
GP-05-T2-12		16 Mar	1215	✓		✓	✓								
GP-05-T3-10		↓		✓		✓	✓							extra vol for MS/MSD	
GP-05-T3-12		↓		✓		✓	✓								
GP-05-V1-8		↓		✓		✓	✓								
GP-05-V3-8		↓		✓		✓	✓								
GP-05-T1-8		↓		✓		✓	✓								

Makah Former AFS UST Investigation Phase II

Sampling Table

Sample ID	Loc	Date (2015)	Time	Dx	Gx	8260	PAH SIM	SIM 8270	6020 Pb	PCB 8082	Mn	Anions	MNA	RCRA metals	Notes	
GP-06-RS4-3	UST R/S	17 Mar	0755	✓	✓	✓	✓		✓							8
GP-06-H7-5	UST H-O	17 Mar	0855	✓		✓	✓									5
GP-06-H7-7	UST H-O	17 Mar	0855	✓		✓	✓									
GP-06-H9-10	UST H-O	17 Mar	0935	✓		✓	✓									
GP-06-H9-13	UST H-O	17 Mar	0935	✓		✓	✓									
GP-06-H91-13	UST H-O	17 Mar	0955	✓		✓	✓								Field dup	
GP-06-H8-10	UST H-O	17 Mar	1015	✓		✓	✓									
GP-06-H8-12	UST H-O	17 Mar	1015	✓		✓	✓								extra vol for ms/msd	11
GP-05-V2-5	UST T-V	17 Mar	1125	✓		✓	✓									
GP-05-V2-8	UST T-V	17 Mar	1125	✓		✓	✓									
GP-05-U1-5	UST T-V	17 Mar	1205	✓		✓	✓									
GP-05-U1-10	UST T-V	17 Mar	1205	✓		✓	✓									
GP-05-U2-5	UST T-V	17 Mar	1245	✓		✓	✓									
GP-05-U2-10	UST T-V	17 Mar	1245	✓		✓	✓									
GP-05-U2-12	UST T-V	17 Mar	1245	✓		✓	✓									
AQRB4	~~N/A~~ UST T-V	17 Mar	1310			✓										
AQTUV1	GP-05-T3 TUV	18 Mar	0845	6 ✓		9 ✓					1 ✓	1 ✓	1 ✓		extra vol for ms/msd; Fe^{2+} by HACH - 0.5 mg/l	23
~~AQP1~~	~~UST P~~	~~18 Mar~~						✓	✗		✓	✓	✓		Fe^{2+}	
GP-05-U3-5	UST T-V	18 Mar	1020	✓		✓	✓									5
GP-05-U3-9	UST T-V	18 Mar	1020	✓		✓	✓									5
GP-05-TUV1-5	UST T-V	18 Mar	1050	✓		✓	✓									5
GP-05-TUV1-8	UST T-V	18 Mar	1050	✓		✓	✓								extra vol for ms/msd	11
AQTB6	UST T-V	18 Mar				✓										2
GP-05-TUV2-5	UST T-V	18 Mar	1130	✓		✓	✓									5
GP-05-TUV2-10	UST T-V	18 Mar	1130	✓		✓	✓									5
GP-05-TUV3-5	UST T-V	18 Mar	1210	✓		✓	✓									5
GP-05-TUV3-6	UST T-V	18 Mar	1210	✓		✓	✓									5
GP-05-TUV4-3	UST T-V	18 Mar	1230	✓		✓	✓									5
GP-05-TUV41-3	UST T-V	18 Mar	1250	✓		✓	✓								Field dup	5
Drum 1	IDW	18 Mar	1430												TCLP SVOCs, TCLP metals, TCLP volatiles	3
Drum 2	↓	↓	1450			✓		✓							✓	
Drum 3			1440			✓		✓							✓	
Drum 4			1430												TCLP SVOCs, TCLP metals, TCLP volatiles	3
Drum 5			1500			✓		✓							✓	

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Field Notes

02
03 March 2015

1230 Arr at Containment Area - Sullivan, Fowie, Haskins, Brookshier
Met Tom Bowden, Ridolfi Eng.
1330 Drillers from Holt arrived -
Met with Steve Pendleton, went to boring locations,
lay down area, drum storage, and Top Camp locations.
1550 Organized supplies in vehicles
Prepped for next day work
1700 Dinner break
1730 Prepped paperwork, maps, etc.
1900 End of day

Makah Former UST Investigation Phase II
Field Notes

~~03~~ 04 Mar 15

0700	Arr onsite. UST A. GP-11-A6. Conducted safety brief with USACE personnel and Tom Bowden. Conducted safety brief with drillers.
0807	Commenced drilling with Geoprobe; Hult Drilling; Louie Fehner Jr driller.
0827	BOH at 12', refusal on rock. Oily sheen + diesel odor ~9' to bottom
0906	Drilling on GP-11-A4.
0917	BOH at 11.5', refusal on rock. Oily sheen + diesel odor ~9.5' to bottom. Sample time 0918
0940	Drilling GP-11-A7.
0955	BOH at 13', refusal. No sheen noted. Sample time 0953.
1030	Drilling GP-11-A5.
1045	BOH at 15', met decision criteria to stop. No sheen noted. Sample time 1041
1120	Went to get ice, took lunch
1210	Drilling GP-11-CD9. Stopped to prep bottles.
1310	BOH at 15', met decision criteria to stop. No sheen noted. Sample time 1310.
1340	Sample time Field dupe
1341	Drilling GP-11-CD8
1402	BOH at 20' per contract maximum depth.
1505	Completed drilling + sample collection for day
	Updated maps, paperwork
	Bought ice
	Prepped coolers for shipping
1730	End of day

Makah Former AFS UST Investigation Phase II
Field Notes

04 Mar 15

0700 Arr onsite. Setting up.
0755 Drilling GP-11-CD2.
0815 Bott at 11.5', refusal on rock. Sample time 0755. Sheen and diesel odor noted.
0848 Drilling GP-11-CD3. Diesel odor noted at saturated zone. Sample time 0900. Field dup time 0910.
0915 Bott at 20' bgs.
0950 Took rinsate sample on drive shoe.
0955 Drilling GP-11-CD1. Diesel odor noted. PID hits noted on Boring log. VOAs & field test kit collected late.
1030 Sample time.
1053 Drilling GP-11-CD4. slight diesel odor noted.
1110 Sample time. Bott at 15' bgs.
1140 Went to buy ice, took lunch
1220 Set up on GP-11-CD7.
1225 Drilling GP-11-CD7. slight diesel odor noted.
1250 Sample time.
Bott 15' bgs
1310 Drilling GP-11-CD5. slight diesel odor noted.
At 18' bgs, noted visible product, no odor or product below 18'.
1358 Bott 25' bgs
1400 Sample time.
1428 Drilling GP-11-CD6. Strong diesel odors noted.
1440 Sample time.
1506 Bott 25' bgs. Shipped 4 coolers via FedEx.
1545 Cleaned up site. Updated maps. Bought ice.
Prepped coolers for shipping.
Completed paperwork for day
1845 End of day

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Field Notes

05 Mar 15	
0700	Arr on site, warming up field test kit and drill rig.
0745	Drilling GP-11-E5. Slight diesel/gas odor detected
	Calibrated PID last nite, but seems to malfunction. Has not had a reading since yesterday noon. Slight diesel/gas odor
0805	BOH 15'.
0810	Sample time. Field dup sample time 0830
0825	Moved to GP-11-E10
0830	Drilling GP-11-E10. No odor noted
0845	BOH 15'.
0905	Sample time.
0920	Drilling GP-11-E9. No odor noted.
0940	BOH 15'.
0950	Sample time.
1015	Drilling GP-11-E6. Gasoline odor detected.
1030	BOH 15'.
1035	Sample time.
1055	Drilling GP-11-E11. Gasoline odor noted.
1105	BOH 15'.
1110	Sample time.
1120	Drilling deeper in GP-11-E11 based on test kit results - high Ax.
1125	BOH 20'.
1140	Bought ice, took lunch
1230	Set-up on GP-11-E7.
	Discussed logistics for drilling, at Top Camp with drillers
1250	Drilling GP-11-E7. No odor noted
1310	BOH 15'. Shipped 4 coolers via FedEx
1315	Sample time.
1340	Drilling GP-11-E8. No odors noted.
1355	BOH 15'.
1400	Sample time.
1435	Bought ice. Updated maps and spreadsheets. GPS'd boring locations.
	Prepped coolers for shipping. Prepped paperwork for next day
1800	End of day

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Field Notes

06 Mar 15

0700 Arr onsite. Warming up field test kit and drill rig, organizing gear and supplies

0740 Set-up on GP-06-P1. Discussed rocky subsurface and shallow bedrock conditions with driller.

0745 Drilling GP-06-P1. No odor noted.

0805 BOH 15'.

0815 Sample time. Samples likely contain organics

0840 Drilling GP-06-P2. No odor noted.

0851 BOH 15'.

0915 Sample time.

0930 Drilling GP-06-H3. Diesel odor noted in 10-11.5' zone.

0940 BOH 12.5', refusal on rock.

0955 Sample time

1015 Drilling GP-06-H4. No odor noted.

1025 BOH 10', refusal on rock. Sample time 1030.

1035 Start Drilling GP-06-H5. No odor noted

1050 BOH 10'. Refusal on rock

1055 Sample time.

1105 Drillers packing up to leave.

Finishing cleaning up site, storing gear and supplies.

Shipped 4 coolers via FedEx

Bought ice.

Prepped coolers for shipping

Prepped paperwork, updated spreadsheets. GPS'd boring locs.

1600 End of day.

Makah Former AFS UST Investigation Phase II

Field Notes

08 Mar 15

0730 Calibrated Flow cell. Ph 7 would not calibrate. All other standards calibrated without problem

0810 Arrived MW-06. Opened well. Sheen noted on standing water in casing. Pumped out.

0830 Purging, then microprge to stabilization. Gasoline odor noted.

0900 Sample time. 0915 = Sample time for field dup. Fe^{2+} = 2.0 by Hach

1005 Sampling complete. Closed and secured well.

1010 Went to town for supplies.

1055 Mob to MW-09. opened well. SI sheen noted in standing water in casing. Distance for riser to top of casing - 0.39'. Pumped out water.

1110 Purging, then microprge to stabilization.

1122 Stable

1125 Sample time

1146 Sampling complete. Closed and secured well.

1158 Mob to MW-05. opened well. NS sheen noted in water in casing. Pumped out water.

1209 Purging, then microprge to stabilization.

1219 Stable

1223 Sample time.

1242 Sampling complete. Closed and secured well.

1248 Mob to MW-08. opened well. NS water in riser. Distance from riser to top of casing 0.40'.

1255 Purging, then microprge to stabilization

1306 Stable

1310 Sample time.

1324 Sampling complete. Closed and secured well.

Prepped coolers.

Went for ice.

Prepped supplies for next day.

Finished day's paperwork, prepped for next day.

1715 End of day.

Makah Former AFS UST Investigation Phase II CLMA154

Field Notes

09Mar-15

0700	Met drillers, discussed plan for today.
0730	Mob to Top Camp, H-O USTs. Onsite: David Sullivan, Karah Haskins, Jo Mien, David Clark.
0745	Went back for plastic sheeting
0825	Drilling GP-06-H6. No odor noted, no sheen
0845	BOH 5', refusal on rock.
0850	Sample time
0900	Moved to GP-06-H1.
0905	Drilling GP-06-H1. No odor or sheen noted.
0915	BOH 8.5', refusal on rock.
~~Sample~~ 0920	Sample time.
0940	Drilling GP-06-H2. No odor or sheen noted.
1000	BOH 11', refusal on rock
1005	Sample time.
1050	Moved to UST R/S
	Set up on GP-06-RS1
1100	Drilling GP-06-RS1
1110	BOH 5.5' refusal on rock No odor or sheen noted.
1115	Sample time.
1140	Shipped 5 coolers via FedEx.
1150	Lunch
1230	Drilling GP-06-RS2
1240	BOH 4.5', refusal on rock. Moved 2 feet, refusal at 4'.
1245	Sample time.
1305	Drilling GP-06-RS3
1310	BOH 5', refusal on rock, moved 2 feet, same
1315	Sample time
1335	Moved to GP-06-RS6. Refusal at 4', rock at 3'. Moving RS6 over to between RS1 and RS2, and about 4' North.
	Still not enough soil to sample. Moving back to original RS6 location, and then 2' north of original.
1403	Drilling GP-06-RS6 take 3.
1410	BOH 5', 6" into rock.
1415	Sample time.
1425	Sample time Field dup.
1440	Packed gear to depart. Got ice. Prepped coolers for shipping, updated data, went over plans for week.
1750	End of day

Makalu Former AFS UST Investigation Phase II
Field Notes

~~10 March~~ 15 - foggy, breezy, 48°F

0710	Departed for meeting site	
0740	At meeting site. Setting up, warming up tool kit, warming up drill rig.	
0834	Drilling GP-06-RS5. No odor or sheen detected.	David Domingo (ICPA) onsite
0840	BOH 5'. Rock at 4'.	
0845	Sample time.	
0850	Drilling GP-06-RS7, 2 holes reached 15' before meeting refusal or rock.	
0900	Drilling GP-06-RS8.	
0905	BOH 2.5', rock at 2'. No odors or sheen detected	
0910	Sample time	
0920	Drilling GP-06-RS7-	
0930	BOH 5', rock at 2.5'. No odors or sheen detected.	
0945	Sample time.	
1020	placed screen for groundwater at P-1 (AQP1)	
	Lunch while waiting for Coast Guard. CG stuck in truck accident, not coming out today	
1245	Re-mob to MST A for 3 step-outs	
1315	Drilling GP-11-A9 (step-out)	Karl Kumm onsite.
1328	BOH 11', refusal on rock.	
1414	Drilling GP-11-A8 (step-out). No odor or sheen.	
1429	BOH @ 15'.	
1445	Drilling GP-11-A10 (step-out). No odor or sheen.	
1501	BOH 15'.	
1505	Pushed groundwater sampling point to 11' bgs next to GP-11-~~A5~~ AC (AQA1)	
1525	WL 4.8' at AQA1	
	Packed gear + equipment, cleaned up site.	
	Went for ice. Bagged ice, prepped coolers for shipping. Updated spreadsheets, maps, paperwork.	
1745	End of day.	

Makah Former AFS UST Investigation Phase II

Field Notes

11 Mar 15 - rainy, breezy, 50°F

0730 Mob to UST C/D area
Discussed plan w/ David Domingo (on-site) and Karl Kunnas by phone
marked new utility locate areas.
Steve Pendleton and David Lucas (tribal utilities rep) cleared the step-out borings locations
Drove to Microwave site at Top Camp, met TETC Feingold, USCG, who ok'd the boring location inside the fence line.
Checked gw level in AOPL. 12.3' bgs, so 1.7' of water.

1005 Drilling GP-~~06~~-11-CD15

1025 BOH 15'. No odor or sheen noted.

1035 Sample time

1045 Field dup time.

1130 Drilling GP-~~06~~-11-CD16

1145 BOH 15'. odor (diesel) detected throughout core from 3'-15'.

1205 Sample time. ms/msd

1225 Lunch

1300 Drilling GP-~~06~~-11-CD20

1320 BOH 15'. Diesel odor noted only at 5'.

1325 Sample time.

1353 Drilling GP-11-CD19

1408 BOH 15'. No odor detected.

1420 Sample time. 1440 Sample time field dup

1450 Drilling GP-11-CD17

1504 BOH 15'. Slight diesel odor noted at 4' and 9'.

1530 Sampling complete.
Packed gear and equipment, cleaned site.
Went for ice. Bagged ice, prepped coolers for shipping. Updated data, maps, paperwork. (COCs, airbills, boring logs, etc.)

1800 End of day

Makah Former AFS UST Investigation Phase II

Field Notes

12 Mar 15	cloudy, breezy, 50°F
0730	Mob to GP-11-CD14. Setting up gear and equipment, warming up clay and calibrating test kit.
0840	Drilling GP-11-CD14. slight diesel odor at 3' and 6'.
0850	BOH 15'. No sheen
0855	Sample time
0935	Drilling GP-11-CD18.
0945	BOH 15'. Strong diesel odor from 6' down. ~~No~~ Sheen noted 12-14'
1010	Drilled down another 5'. BOH now 20'. Sheen from 15-17.5'.
1020	Sample time, 1050 sample time field dup.
1104	Drilling GP-11-CD13.
1112	BOH 15'. No odor or sheen noted.
1120	Sample time.
1200	Drilling GP-11-CD12.
1215	BOH 15'. No odor or sheen noted.
1225	Sample time.
1235	Lunch
1305	Drilling GP-11-CD10.
1318	BOH 15'. No odor or sheen noted.
1325	Sample time.
1354	Drilling GP-11-CD11
1405	BOH 15'. No odor or sheen noted. Shipped 3 coolers via FedEx
1410	Sample time
1435	Punching hole for gw grab sample AQCD1
1445	Punched hole for gw grab sample AQCD2
1502	Pumping AQCD1, low flow. WL 5.73'. Sampling commenced, 200 ml/min.
1541	Sampling complete AQCD1. Sample time 1515. Field dup sample time 1540
1543	Moved to AQCD2. WL 5.70'. Sheen noted in bucket
1549	Sample time AQCD2.
1601	Sampling complete AQCD2.
	Packed gear and equipment, cleaned up site.
	Went for ice, Bagged ice. Prepped coolers for shipping.
	Updated data, maps, paperwork
1800	End of day

Makah Former AFS UST Investigation Phase II

Field Notes

8 Mar 15 mostly cloudy, windy, 50°F

0700 Mob to Containment Area. Setting up gear and equipment, warming up rig and calibrating test kit.

0745 Pushing gw grab screen for new AQA1.

0808 Pushed gw grab screen for AQE1

0820 WL at AQA1 - 4.8' bgs. Drew samples, low flow, 200 ml/min.

0825 Sample time. Fe^{2+} by HACH = 1.7 mg/l

0900 Sampling complete AQA1

0907 Drilling GP-11-E12

0919 BOH 15'. No odor or sheen noted

0940 Sample time.

1005 WL at AQE1 - 5.7' bgs. Drew samples, low flow, 200 ml/min.

1010 Sample time. Fe^{2+} by HACH = 4.0 mg/l. Gasoline odor detected

1045 Moved to GP-11-E13. Tried 2 locations, met refusal. Third location worked.

1053 Drilling GP-11-E13. Strong gasoline odor at 4.5'-5.5'; wood chunks also smell. (sample)

1106 BOH 15'.

1115 Sample time.

1150 Drilling GP-11-E14. Strong gas odor 4.5'-6.5'; wood chunks 4.5'-5.5'; gas smell.

1201 BOH 15'.

1215 Sample time.

1225 Driller de-mobing for weekend

Packed gear and equipment, cleaned up site.

Went for ice. Bagged ice, prepped coolers for shipping.

Updated data, maps, paperwork.

1530 End of day

Rite in the Rain

Makah Former AFS UST Investigation Phase II

Field Notes

16 Mar 15 - partly cloudy, calm, 45°F

0650 Packed up gear into trucks.

0705 Met w/ drillers, looked at locations & gw grabs. Warmed up drill rig

0755 Installed screen for AQE3.

0815 Installed screen for AQE2.

0852 WL in AQE2. 4.45' bgs

WL AQE3 4.89' bgs

0855 Extracting water AQE2. ~~S~~ Fe^{2+} by HACH - 360 mg/l

0910 Sampling time AQE2.

0955 Extracting water AQE3. Fe^{2+} by HACH - 2.0 mg/l

1000 Sample time AQE3.

1022 Sampling complete. Cleaned up area

Mob to Top Camp.

1100 Met FAA rep Pat Weidenhold at lower FAA gate.

1120 Set-up on ~~GP-06~~ GP-05-T2

1138 Drilling ~~#38~~ GP-05-T2. Diesel odor detected at 5-12', sheen 10-11'

1153 BOH 12' on rock

1215 Sample time

1237 Drilling GP-05-T3. Diesel odor 10-12', sheen 11-12'.

1250 BOH 12' on rock.

1300 Sample time

1330 Drilling GP-05-V1. No odor noted. Light sheen at 6'.

1338 BOH 7' on rock.

1350 Sample time.

1410 Drilling GP-05-V3. Strong diesel odor 6-8'

1427 BOH 8' on rock.

1435 Sample time.

1441 Drilling GP-05-T1.

1449 BOH 8' on rock. Drilled 2' into rock

1455 Sample time.

1520 Sampling complete.

Packed gear and equipments. Cleaned up site.

Bought ice. Bagged ice, prepped coolers for shipping.

Updated data, ~~spmgs~~, paperwork

1830 End of day

Makah Former AFS UST Investigation Phase II

Field Notes

17 Mar 15 - mostly cloudy, breezy, 42°F

0700 Departed for microwave site.
warming up equipment

0745 Drilled GP-06-RS4. Outside microwave fence. Met refusal @ 3'. Moved, tried again. Refusal at 1.5'. No odor, no sheen

0751 BOH 3'.

0755 Sample time.

0830 Drilled GP-06-H7. Met refusal at 7', poor recovery. Moved 2' and tried again.

0845 BOH 7' on rock. Diesel odor and sheen 5-7'

0855 Sample time.

0916 Drilled GP-06-H9.

0929 BOH 13' on rock. Diesel odor 11-13'

0935 Sample time. 0955 Field dup sample-Aimo.

1003 Drilled GP-06-H8.

~~1016~~ 1013 BOH 12' on thick cedar root.

1015 Sample time

1110 Moved to FAA radar site. Drilled GP-05-V2.

1120 BOH 7.5' on rock. No odor or sheen noted.

1125 Sample time.

1143 Drilled GP-05-H1.

1156 BOH 14' on rock. No odor or sheen noted.

1205 Sample time.

1225 Drilled GP-05-H2.

1236 BOH 12' on rock. No odor or sheen noted.

1245 Sample time.

1310 Sample time AQRB4

1311 Set screen for AQT2

1335 Sampling complete.

Packed gear and equipment. Cleaned up site.

Bought ice. Bagged ice, prepped coolers for shipping

Took GPS points of borings

Updated data, maps, paperwork.

1630 End of day

Rite in the Rain

Makah Former AFS UST Investigation Phase II

Field Notes

18 March	15 - mostly cloudy, sl breeze, 46°F
0730	Departed for Top Camp.
0810	Arr FAA site. Set-up on AQTUV1. W.L. 8.07' bgs. Screen at 12'. Set ~~pipe~~ hose at 10'. No water. Dropped hose to 11'.
0822	Pumping at ~200 ml/min. Sheen noted in water, diesel odor.
0825	Commenced sampling. WL: 8.15'.
0845	Sample time. AQTUV1 Fe+2: 0.5 mg/l by HACH
0910	Sampling complete
0916	Moved to AQP1
0920	Pumping at 250 ml/min. Very turbid. Reduced pumping rate. Still have drawdown
0924	Pumped ~~dry~~ screen empty. Very slow recovery. No sample.
0930	Packed up gear. Waiting for FAA to open gate so vehicles can return to USTs T-V
0958	Drilled GP-05-U3.
1010	BOH 9' on rock. No odor or sheen noted.
1020	Sample time.
1042	Drilled GP-05-TUV2.
1048	BOH 8' on rock. No odor or sheen noted.
1050	Sample time.
1110	Drilled GP-05-TUV2.
1120	BOH 10' on rock. No odor or sheen noted.
1130	Sample time.
1140	Tried 3 times drilling GP-05-TUV3. Gave up, moved several feet, drilled again
1201	Drilling GP-05-TUV3 complete. BOH 6' on rock. No odor or sheen.
1210	Sample time
1216	Drilled GP-05-TUV4.
1219	BOH 3.5' on rock. No odor or sheen noted.
1230	Sample time. 1250 Field dup sample time.
1255	Sampling complete.
1315	Went to meet FedEx, shipped 3 coolers.
1330	Drilled hole & set screen for AQH1.
1400	8" water in AQH1, pumped dry in less than one minute.
1425	Returned to containment area, to IDW drum site, to take samples. Drum 1 - 1430, Drum 4 - 1430. Drum 3 - 1440. Drum 2 - 1450, Drum 5 - 1500 - Sample times

18 Mar (cont.)

1515 Taking gw levels in monitoring wells.
On 8 Mar ~~manual~~ measured MW 05, 06, 08, 09
MW 07 - 1.85' riser to TOC .26'
MW 08 - 4.34' riser to TOC .36'
MW 05 - 4.74' -
MW 09 - 4.17' riser to TOC .37'
MW 02 - 2.55' -
MW 03 - 3.73' -
MW 06 - 4.24' -
MW 01 - 3.65' -
MW 04 - 3.72' -

1630 Bagged ice, prepped coolers, took GPS points
updated data maps, paperwork

Sheet _1_ of _1_

MICROPURGE/LOW-FLOW SAMPLING LOG

US Army Corps of Engineers ®
Seattle District

PROJECT: Makah UST Ph II
Sample Round:
Task:
Date: 8 Mar 15
Weather: clear, 53°F, ~1 breeze
Samplers: Sullivan, Haskins

Purge Method: Micropurge
Sample Collection Method: Low Flow
Sampling Device: Peristaltic Pump or portable bladder pump
Tubing: Bonded TLPE **Pump Intake Depth:**
Total Recovered Purge Water This Well: ~2 gal

WELL ID: MW-09
flush mount (Y) N
Well Condition: fair
Well Riser Dia. (ID): 1"
Screened Interval:
S.W.L. Measuring Pnt: top of well riser

distance riser to top of casing: 0.39'
Well Bottom Depth:
STATIC WATER LEVEL: 4.64, 4.56'
Initial Purge Volume: ~1 gal
Approximate Pump Throttle Setting:

Groundwater Sample Data:

Sample ID	Analysis	Primary	QC	MS/MSD	Blank					

Instrumentation/Equipment Data:	**Calibration Date:** (Temperature is factory calibrated)
MP 20 Water Analyzer - probes for Temp., pH, Cond., ORP, D.O.,	8 Mar 15
and Turbidity.	Ph 7 did not calibrate

Field Test Results:

Pump Flow Rate: 280 ml/min

Ferrous Iron by HACH

Fe^{2+}	2.0				

Comments:
Observations: Clarity: clear Odor: none Floating Product: none Sheen: none

PURGE WATER DATA TABLES

Stabilization Parameters	Units	0 Minutes	2 Minutes	4 Minutes	6 Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C	11.49	11.59	11.70	11.43				
Sp. Cond.	ms/cm	0.21	0.21	0.22	0.22				
D.O.	ppm	0.82	0.70	0.54	0.51				
pH		6.53	6.38	6.25	6.21				
ORP (Eh)	mV	-120	-117	-110	-104				
Turbidity	NTU	13.6	12.6	12.2	12.6				
Clock Time		1116	1118	1120	1122				
Static W.L.		4.60	–	–	4.90				
Flow Rate		280	–	–	–				

Stabilization Parameters	Units	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C								
Sp. Cond.	ms/cm								
D.O.	ppm								
pH									
ORP (Eh)	mV								
Turbidity	NTU								
Clock Time									
Static W.L.									
Flow Rate									

US Army Corps of Engineers Environmental Sampling Team

Sheet _1__ of __1_

MICROPURGE/LOW-FLOW SAMPLING LOG

US Army Corps of Engineers ®
Seattle District

PROJECT: Makah UST Pl. II
Sample Round:
Task:
Date: 8 Mar 15
Weather: clear, 55°F, sl breeze
Samplers: Sullivan, Hadeins

WELL ID: MW-05
flush mount (Y) N
Well Condition: fair
Well Riser Dia. (ID): 2"
Screened Interval:
S.W.L. Measuring Pnt: top of well riser

Purge Method: Micropurge
Sample Collection Method: Low Flow
Sampling Device: Peristaltic Pump or portable bladder pump
Tubing: Bonded TLPE **Pump Intake Depth:**
Total Recovered Purge Water This Well: ~2.5 gal

Well Bottom Depth:
STATIC WATER LEVEL: 5.19
Initial Purge Volume: ~1 gal
Approximate Pump Throttle Setting:

Groundwater Sample Data:

Sample ID	Analysis	Primary	QC	MS/MSD	Blank					

Instrumentation/Equipment Data:	**Calibration Date:** (Temperature is factory calibrated)
MP 20 Water Analyzer - probes for Temp., pH, Cond., ORP, D.O.,	8 mar 15
and Turbidity.	Ph 7 did not calibrate

Field Test Results:

Pump Flow Rate: 300 ml/min

Ferrous Iron by HACH:

Fe^{2+}	5.3				

Comments:
Observations: Clarity: clear Odor: none Floating Product: none Sheen: none

PURGE WATER DATA TABLES

Stabilization Parameters	Units	0 Minutes	2 Minutes	4 Minutes	6 Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C	11.36	11.33	11.34	11.31				
Sp. Cond.	ms/cm	0.34	0.36	0.36	0.35	Stable			
D.O.	ppm	0.49	0.35	0.31	0.27				
pH		6.70	6.57	6.51	6.42				
ORP (Eh)	mV	-160	-167	-174	-182				
Turbidity	NTU	15.9	16.6	16.3	16.5				
Clock Time		1213	1215	1217	1219				
Static W.L.		5.21	"	"	"				
Flow Rate		300	"	"	"				

Stabilization Parameters	Units	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C								
Sp. Cond.	ms/cm								
D.O.	ppm								
pH									
ORP (Eh)	mV								
Turbidity	NTU								
Clock Time									
Static W.L.									
Flow Rate									

US Army Corps of Engineers Environmental Sampling Team

MICROPURGE/LOW-FLOW SAMPLING LOG

US Army Corps of Engineers Seattle District

PROJECT: Makah UST PH II
Sample Round:
Task:
Date: 8 Mar 15
Weather: clear to foggy, 55°F, sl breeze
Samplers: Sullivan, Haskins

Purge Method: Micropurge
Sample Collection Method: Low Flow
Sampling Device: Peristaltic Pump or portable bladder pump
Tubing: Bonded TLPE **Pump Intake Depth:**
Total Recovered Purge Water This Well: ~3 gal

WELL ID: MW-08
flush mount (Y) N
Well Condition: fair
Well Riser Dia. (ID): 1"
Screened Interval:
S.W.L. Measuring Pnt: top of well riser
distance from riser to top of casing = 0.40"
Well Bottom Depth:
STATIC WATER LEVEL: 4.75
Initial Purge Volume: ~1 gal
Approximate Pump Throttle Setting:

Groundwater Sample Data:

Sample ID	Analysis	Primary	QC	MS/MSD	Blank					

Instrumentation/Equipment Data:	**Calibration Date:** (Temperature is factory calibrated)
MP 20 Water Analyzer - probes for Temp., pH, Cond., ORP, D.O.,	8 Mar 15
and Turbidity.	Ph 7 did not calibrate

Field Test Results:

Pump Flow Rate: 300 ml/min

Ferrous Iron by HACH

Fe^{2+}	(Not taken)				

Comments:
Observations: Clarity: clear Odor: sl diesel Floating Product: none Sheen: none

PURGE WATER DATA TABLES

Stabilization Parameters	Units	0 Minutes	2 Minutes	4 Minutes	6 Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C	11.45	11.43	11.42	11.41				
Sp. Cond.	ms/cm	0.26	0.25	0.25	0.24	S			
D.O.	ppm	0.61	0.47	0.38	0.33	t			
pH		6.48	6.38	6.31	6.27	a			
ORP (Eh)	mV	-110	-104	-98	-94	b			
Turbidity	NTU	16.5	16.4	16.1	15.4	l			
Clock Time		1300	1302	1304	1306	e			
Static W.L.		4.83	–	4.87	–				
Flow Rate		300	–	–	–				

Stabilization Parameters	Units	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C								
Sp. Cond.	ms/cm								
D.O.	ppm								
pH									
ORP (Eh)	mV								
Turbidity	NTU								
Clock Time									
Static W.L.									
Flow Rate									

Sheet _1__ of __1_

MICROPURGE/LOW-FLOW SAMPLING LOG

PROJECT: Makah UST Ph II
Sample Round:
Task:
Date: 08 Mar 15
Weather: fog, p. cloudy, 48°F, calm
Samplers: Sullivan, Haskins

Purge Method: Micropurge
Sample Collection Method: Low Flow
Sampling Device: Peristaltic Pump or portable bladder pump
Tubing: Bonded TLPE **Pump Intake Depth:**
Total Recovered Purge Water This Well: 23.5 gal

WELL ID: MW-06
flush mount (Y) N
Well Condition: Fair
Well Riser Dia. (ID): 2"
Screened Interval:
S.W.L. Measuring Pnt: top of well riser

Well Bottom Depth:
STATIC WATER LEVEL: 4.50'
Initial Purge Volume: ~ 1.0 gal
Approximate Pump Throttle Setting:

US Army Corps of Engineers®
Seattle District

Groundwater Sample Data:

Sample ID	Analysis	Primary	QC	MS/MSD	Blank					

Instrumentation/Equipment Data:	**Calibration Date:** (Temperature is factory calibrated)
MP 20 Water Analyzer - probes for Temp., pH, Cond., ORP, D.O.,	08 Mar 15
and Turbidity.	Ph 7 not calibrated

Field Test Results:

Pump Flow Rate: 280 ml/min

Ferrous Ion by Hach: 7.0

Comments:
Observations: Clarity: clear Odor: strong gasoline Floating Product: none Sheen: yes

PURGE WATER DATA TABLES

Stabilization Parameters	Units	0 Minutes	2 Minutes	4 Minutes	6 Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C	10.08	10.07	10.04	10.09				
Sp. Cond.	ms/cm	0.15	0.15	0.15	0.15	S			
D.O.	ppm	0.37	0.34	0.30	0.27	7			
pH		5.93	5.87	5.81	5.80	A			
ORP (Eh)	mV	-186	-194	-199	-203	b			
Turbidity	NTU	14.9	14.3	13.7	13.8	4			
Clock Time		0848	0850	0852	0854				
Static W.L.		4.60	–		4.71	e			
Flow Rate		280	–	–	–				

Stabilization Parameters	Units	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes	___ Minutes
Temperature	C								
Sp. Cond.	ms/cm								
D.O.	ppm								
pH									
ORP (Eh)	mV								
Turbidity	NTU								
Clock Time									
Static W.L.									
Flow Rate									

US Army Corps of Engineers Environmental Sampling Team

2/20/2015 Test kit and sample kits arrived.
CRO calibrated 2/17/2015

2/24/2015 Picked up methanol solvent from ART

2/25/15 Set up instrument.
Checked lamp ✓
Methanol blank #1 Rds -0.24 ppm (mg/kg)
blank #2 -0.30 ppm

Std check: 5ppm Rdng 5.06 ppm

2/26/15 Std check Rdng
3 ppm std 3.03 ppm
Looks good!

Date 2/27

Methanol Blank -0.14
Sens: 36% Flow. -11.64
Cali

- Ran DRO Calibration ✱ 2/27
- Calibration Check

Std	Rdg (ppm)
5	5.197
5	5.126

3/3/2015

First day of sampling
Cal. Check:

	Std	Rdg
	5	4.57
	Blank	-0.034
	5	4.64
	1	0.92
10:52	Blank	-0.38
	3	2.94
	0.5	0.499
1430	0.1	0.99

3/4/15 calibrated
cal check sen 20

Std	Rdg
3	3.042
5	5.99

calibrated 11:30

Std	
3	3.01

Std	1500 end of day
0.5	0.501

3/5/15 calibrate for GRO
sens 36

Std	rdg
5	4.85
10	9.75
3	2.82

lunch calibrate 5 5.22
after lunch 0.5 0.55

Rite in the Rain

3/16/15 calibrate

test calibrate

std	Rdg
3	3.02
after 1	1.11
5	5.496

3/9/15 test calibrate

DRO std	Rdg
5	5.064
0.5	0.515
After noon 3	3.04

3/10/15 test Calibrate

DRO std	Rdg	
~~5~~	5.134	✓
0.5	0.517	✓
after 1	0.987	✓
noon 3	3.117	✓

3/11/15 calibrated

std	Rdg
3.0	2.73
with new std 5.0	5.377

3/12/15 calibrated w/ new stds.

3	3.005
lunch 5	5.298
0.1	0.109

calibrated for GRO

std	Rdg
5	4.86
0.5	0.54

3/16/15 Calibrate for EDRO Check

Std	Rdg
1.0	1.001
3.0	2.996
ad std 5.0	5.125
ad std 0.5	0.621

3/17/15 1330 Calibrate for EDRO Check

std	Rdg
0.5	~~0.47~~ 0.500
3.0	3.05

siteLAB Petroleum Hydrocarbon Solutions — Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/3/15

Project Name/Job No: Makah UST A/B

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name:

Test Parameter: EDRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: 2/27/2015

Calibration Points ____ R^2 Slope of Curve ____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: A

Calibration Sensitivity or "Sens" value: 20

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
DRO 5.0	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
1	A-6-4	11.89	0.052	x	1000	=	52
2	A6-8	188.33	1.220	x	1000	=	1220
3	A6-12	1020 ~~1005~~	OVER	x	1000	=	>5000
4	A6-12	94.53	0.598	x	10000	=	5,980
5	A4-4	8.16	0.036	x	1000	=	36
6	A4-8	812.22	5.822	x	1000	=	5822
7	A4-12	1670.5	Over	x	1000	=	>5000
8	A4-12	183.80	1.2	x	10,000	=	12,000
9	A7-4	-5.21	-0.023	x	1000	=	ND
10	A7-8	157.24	1.015	x	1000	=	1015
11	A7-~~#~~13	-5.73	-0.025	x	1000	=	ND
12	A5-4	-6.20	-0.027	x	1000	=	ND
13	A5-8	-7.00	-0.031	x	1000	=	ND
14	A5-12	-5.55	-0.024	x	1000	=	ND
15	CD9-4	-8.04	-0.035	x	1000	=	ND
16	CD9-8	-8.35	-0.037	x	1000	=	ND
17	CD9-12	-8.11	-0.035	x	1000	=	ND
18	CD8-4	2393	Over	x	1000	=	75000
19	CD8-4	348.93	2.351	x	10,000	=	20,351
20	CD8-8	1528.	Over	x	1000	=	>5,000

 Need Help? Call Toll Free 877-SITELAB or (978) 363-2299 See us at: www.site

ND = Negative value

siteLAB® Petroleum Hydrocarbon Solutions

Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/3/15

Project Name/Job No: Makah CD

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: Haskins

Test Parameter: EDRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: 2/27/15

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: A

Calibration Sensitivity or "Sens" value: 20
Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
21	CD8-8	133.15	0.857	x	10,000	=	8,570
22	CD8-12	-2.78	-0.012	x	1000	=	ND
23	CD8-16	31.11	0.158	x	1000	=	158
24	CD8-12 resamp.	2.54	0.011	x	1000	=	10
1	CD2-5	161.79	1.026	x	1000	=	1026
2	CD2-10	2163.40	over	x	1000	=	over
3	CD2-10	1087	over	x	10,000	=	over
4	CD2-11	254.08	1.751	x	1000	=	1751
5	CD3-5	101.03	0.608	x	1000	=	608
6	CD3-10		over	x	1000	=	over
7	CD3-10	127.	0.791	x	10000	=	7,910
8	CD3-15	1935	over	x	1000	=	over
9	CD3-15	221.54	1.495	x	10,000	=	10,495
10	CD3-20	21.04	0.070	x	1000	=	70 U
11	CD1-5	2256.73	over	x	1000	=	over
12	CD1-5	1318.38	over	x	10,000	=	over
13	CD1-10	1558.78	over	x	10000	=	over
14	CD1-10	197.7	1.310	x	10,000	=	13,100
15	CD1-15	65.78	0.360	x	1000	=	360
				x		=	

3/4/15

siteLAB Petroleum Hydrocarbon Solutions

Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/4/15

Project Name/Job No: Makah C/D

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: Haskins

Test Parameter: EDRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: March 4, 2015

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: A

Calibration Sensitivity or "Sens" value: 20

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
16	CD4-5	103.26	0.623	x	1000	=	623
17	CD4-10	396.34	2.854	x	1000	=	2,854
18	CD4-15	4.56	0.015	x	1000	=	15
19	CD7-5	184.67	1.11	x	1000	=	1,110
20	CD7-10	52.41	0.226	x	1000	=	226
21	CD7-15	3.28	0.010	x	1000	=	10
22	CD5-5	2365	over	x	1000	=	over
23	CD5-5	1890	over	x	10,000	=	over
24	CD5-10	2367.	over	x	1000	=	over
25	CD5-10	313.16	1.918	x	10,000	=	20,000
26	CD5-15	175.76	1.061	x	1000	=	1061
27	CD5-18	1009.27	over	x	1000	=	
28	CD5-18	110.13	0.611	x	10,000	=	6,130
29	CD5-20	110.32	0.62	x	1000	=	620
30	CD5-25	38.74	0.130	x	1000	=	130
31	CD6-5	2389.12	over	x	1000	=	over
32	CD6-5	1326	over	x	10,000	=	over
33	CD6-10	2390	over	x	1000	=	over
34	CD6-10	576.7	3.805	x	10,000	=	30,805
35	CD6-15	90.28	0.486	x	1000	=	486

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/4/15 - 3/5/15

Project Name/Job No: C/D - E

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: Hashim

Test Parameter: EDRO - GRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above):* 3/4/15

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D):* A

Calibration Sensitivity or "Sens" value: 20
Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
36	CD6-20	125.20	0.708	x	1000	=	708
37	CD6-25	51.83	0.221	x	1000	=	221
1	E5-5		-0.03	x	20	=	ND
2	E5-10	26.89	0.27	x	20	=	5.4
3	E5-15	1.34	0.01	x	20	=	0.2
4	E10-5	5.79	0.06	x	20	=	1.2
5	E10-10	6.82	0.07	x	20	=	1.4
6	E10-15	6.07	0.06	x	20	=	1.2
7	E9-5	11.37	0.11	x	10	=	1.1
8	E9-10	14.15	0.14	x	10	=	1.4
9	E9-15	8.82	0.09	x	10	=	0.9
10	E6-5	6.96	0.07	x	20	=	1.4
11	E6-10	283.44	3.87	x	20	=	77.4
12	E6-15	10.06	0.1	x	20	=	2.0
13	E11-5	9.21	0.09	x	20	=	1.8
14	E11-10	134.90	1.63	x	20	=	32.6
15	E11-15	524.32	6.56	x	20	=	131.8
16	E11-5	7.76	0.07	x	10	=	0.7
17	E11-20	25.34	0.25	x	20	=	5.2
18	E11-20	42.15	0.42	x	10	=	4.2

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/5/15 / 3/6/15

Project Name/Job No: E / P

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: Harkins

Test Parameter: GRO / DRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above):* _____

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D):* B / A

Calibration Sensitivity or "Sens" value: 36 / 120

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
19	E7-5	0.61	0.0	x	20	=	0.
20	E7-10	1.23	0.01	x	10	=	0.1
21	E7-15	1.88	0.02	x	10	=	0.2
22	E8-5	10.32	0.03	x	10	=	0.6
23	E8-10	8.21	0.05	x	10	=	0.5
24	E8-15	6.59	0.02	x	10	=	0.2
1	P1-10	22.60	0.072	x	100	=	7.2
2	P1-15	49.12	0.234	x	100	=	23.4
3	P1-5	25.30	0.081	x	100	=	8.1
4	P2-5	48.37	0.228	x	100	=	22.8
5	P2-10	45.57	0.207	x	100	=	20.7
6	P2-15	16.3	0.051	x	100	=	5.1
7	H3-5	85.84	0.508	x	100	=	50.8
8	H3-10	452.65	3.273	x	100	=	327
9	H3-12	2023.08	over	x	100	=	
10	H3-12	274.03	1.920	x	1000	=	1092
11	H4-5	196.44	1.33	x	100	=	133
12	H4-9	155.25	1.02	x	100	=	102
13	H5-5	42.82	0.187	x	100	=	18.7
	H5-10	159.81	1.059	x	100	=	106

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/9/15 , 3/10/15

Project Name/Job No: Makah H

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: _____

Test Parameter: EDR
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: 3/6/15

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: A

Calibration Sensitivity or "Sens" value: 20

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
5	5.03 vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
1	H6-5	166.19	0.362	x	100	=	36.2
2	H7-5	110.81	0.695	x	100	=	69.6
3	H7-6	39.43	0.162	x	100	=	16.2
4	H2-5	45.78	0.209	x	100	=	20.9
5	H2-10	83.18	0.489	x	100	=	48.9
6	H2-11	118.92	0.755	x	100	=	75.5
7	RS1-5	29.20	0.093	x	100	=	9.3
8	RS2-5	5.95	0.019	x	100	=	1.9
9	RS3-3	24.65	0.079	x	100	=	7.9
10	RS6-5	18.05	0.058	x	100	=	5.8
3/10/15	RS5-3	15.30	0.049	x	100	=	4.9
12	RS8-2	103.98	0.644	x	100	=	64.4
13	RS7-3	152.68	0.999	x	100	=	99.9
14	A9-5	29.62	0.095	x	100	=	9.5
15	A9-10	29.72	0.095	x	100	=	9.5
14	A9-15	9.15	0.029	x	100	=	2.9
17	A8-5	13.87	0.045	x	100	=	4.5
18	A8-10	7.45	0.024	x	100	=	2.4
	A8-15		0.016	x	100	=	1.60
20	A10-5	3.78	0.012	x	100	=	1.2

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: _____

Project Name/Job No: _____

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: _____

Test Parameter: _____
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: _____

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: _____

Calibration Sensitivity or "Sens" value: _____
Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
21	A10-10	3.701	0.012	x	100	=	1.2
22	A10-15	2.36	0.008	x	100	=	0.8
1	CD15-5	1.65	0.005	x	500	=	2.5
2	CD15-10	0.87	0.001	x	500	=	0.5
3	CD15-15		0.010	x	100	=	1.0
4	CD16-5		Over	x	100	=	Over
5	CD16-5	375.95	2.504	x	1000	=	2504
6	CD16-10	1178	Over	x	500	=	Over
7	CD16-10	601.63	4.166	x	1000	=	4766
8	CD16-15	57.02	0.268	x	1000	=	268
9	CD20-5	6.01	0.017	x	500	=	8.5
10	CD20-10	1.26	0.004	x	500	=	
11	CD20-10		0.014	x	100	=	1.4
12	CD20-15	195.9	1.222	x	100	=	1.22
13	CD20-5	28.52	0.082	x	100	=	8.2
14	CD19-5	50.88	0.221	x	100	=	22
15	CD19-10	1.41	0.004	x	100	=	0.4
16	CD19-15	3.34	0.010	x	100	=	1.0
17	CD17-5	18.62	0.054	x	100	=	5.4
18	CD17-10	100.49	0.579	x	100	=	58

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: _____

Project Name/Job No: _____

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: _____

Test Parameter: _____
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: _____

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: _____

Calibration Sensitivity or "Sens" value: _____

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
19	CD17-15	11.72	0.032	x	100	=	3.2
1	CD14-5	15.21	0.095	x	100	=	9.0
2	CD14-10	40.99	0.268	x	100	=	26.8
3	CD14-15	4.87	0.030	x	100	=	3.0
4	CD18-5	25.47	0.163	x	100	=	16.3
5	CD18-10	598	4.354	x	500	=	2177
6	CD18-15	169.34	1.291	x	500	=	6455
7	CD18-20 bottom	3.86	0.023	x	500	=	ND
8	CD18-20 top	2.62	0.017	x	500	=	ND
9	CD13-5	88.09	0.603	x	100	=	60.3
10	CD13-10	0.89	0.006	x	100	=	0.6
11	CD13-15	2.35	0.015	x	100	=	1.5
12	CD12-5	9.30	0.058	x	100	=	5.8
13	CD12-10	0.78	0.005	x	100	=	0.5
14	CD12-15	1.07	0.007	x	100	=	0.7
15	CD10-5	2.04	0.013	x	100	=	1.3
16	CD10-10	0.67	0.004	x	100	=	0.4
17	CD10-15	1.39	0.007	x	100	=	0.7
18	CD11-5	86.82	0.591	x	100	=	59.1
19	CD11-10	25.04	0.160	x	100	=	16.0

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: _____ Project Name/Job No: _____

Report Concentrations in ppm *(mg/Kg soil or mg/L water)* Operator's Name: _____

Test Parameter: GRO **Check the Calibration Curve for QA/QC:**
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Date of Calibration: *(If different from above):* 3/13/15 Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D):* B

Calibration Sensitivity or "Sens" value: 37
Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
20	CD11-15	1.30	0.008	x	100	=	0.8
21	CD6 GW		0.087	x	100	=	8.7
22	CD5 GW	17.89	0.179	x	100	=	18.0
1	E12-5	-7.95	-0.07	x	20	=	ND
2	E12-10	2.15	0.02	x	20	=	0.4
3	E12-15	2.71	0.03	x	20	=	0.6
4	E13-5 bias	4.40	0.04	x	20	=	0.8
5	E13-10	6.94	0.06	x	20	=	1.2
6	E13-15	3.63	0.03	x	20	=	0.6
7	E14-5 bias	18.61	0.17	x	20	=	3.4
8	E14-10		0.00	x	20	=	
9	E14-15	13.83	0.13	x	20	=	2.6
				x		=	
				x		=	
				x		=	
				x		=	
				x		=	
				x		=	
				x		=	
				x		=	

Test Result Record

For use with Sitelab UVF-3100 analyzers

Petroleum Hydrocarbon Solutions

Date & Time: 3/16/2015

Project Name/Job No: Makah

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: Heather Fournie

Test Parameter: EDRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: 3/16/2015

Calibration Points ____ R^2 Slope of Curve ____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: B

Calibration Sensitivity or "Sens" value: 19

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
1	Methanol Blank	37	-0.42	x	ø	=	ND
2	T2-5	174	1.348	x	100	=	135
3	T2-10	103.35	0.748	x	1000	=	748
4	T2-12	144	1.117	x	1000	=	1116
5	T3-5	206.34	1.602	x	500	=	800
6	T3-10	144	1.115	x	500	=	558
7	T3-12	500	3.765	x	1000	=	3763
8	Blank	-0.16	0.000	x	ø	=	0 ND
9	V1-5	343.68	2.679	x	500	=	1340
10	V1-7	344	2.69	x	500	=	1345
11	V3-5	56.86	0.360	x	1000	=	360
12	V3-8	608	4.476	x	500	=	2235
13	3.0 ppm std	379	2.957	x	ø	=	2.957
14	T1-5	314	2.44	x	200	=	488
15	T1-8	72.4	0.469	x	200	=	93.8
16	Blank	-0.93	-0.005	x	ø	=	ND
				x		=	
1	Blank	-0.93	-0.00	x	1	=	ND
2	0.5 ppm	72.3	0.467	x	1	=	0.467
3	RS4-3	40	0.264	x	100	=	26.4

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Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/17/2015

Project Name/Job No: _____

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: _____

Test Parameter: _____
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: _____

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: _____

Calibration Sensitivity or "Sens" value: _____

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
4	H7-5	121	0.921	x	500	=	460
5	H7-7	380	2.98	x	500	=	1490
6	H9-5	15	0.079	x	200	=	16
7	H9-10	59	0.384	x	200	=	192
8	H9-13	327	2.55	x	200	=	510
9	3.0 ppm std	378	2.95	x	1	=	2.95 ✓
10	1.0 ppm std (3/17/15	147	1.14	x	1	=	1.14
11	3.0 ppm std (3/17/15)	428	3.29	x	~~200~~	=	
12	H8-5	54	0.338	x	200	=	68
13	H8-10	162	1.257	x	200	=	251
14	H8-12 (reddish extract)		over	x	200	=	7100
15	H8-12	247	1.927	x	1000	=	1927
16	V2-5	86	0.58	x	100	=	58
17	V2-8	12	0.06	x	100	=	6 = 16 4
18	Blank	-0.9	-0.005	x	1	=	ND
19	U1-5	387	3.02	x	100	=	300
20	U1-10	86	0.586	x	200	=	117
21	U1-14		0.273	x	200	=	55
22	U2-5		3.13	x	100	=	313
23	U2-10	38	0.238	x	200x	=	47

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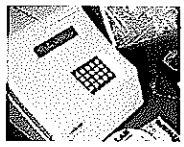

Test Result Record

For use with Sitelab UVF-3100 analyzers

Date & Time: 3/17/2015

Project Name/Job No: _____

Report Concentrations in ppm *(mg/Kg soil or mg/L water)*

Operator's Name: _____

Test Parameter: DRO
Enter GRO, EDRO, TPH-Oil, Total PAHs, Target PAHs or other

Check the Calibration Curve for QA/QC:

Date of Calibration: *(If different from above)*: 3/17/205

Calibration Points _____ R^2 Slope of Curve _____
Enter 1, 2, 3, 4 or 5 point *To view, download curve to computer*

Optical Filters used: *(Enter Slot A, B, C or D)*: A

Calibration Sensitivity or "Sens" value: 20

Press the "8" Key to view. Optimum UVF-3100 sensitivity range = 24 to 40 for GRO and 13 to 22 for EDRO, TPH-Oil, Total PAHs or Target PAHs. See calibration kit certificate of analysis sheet and operating manual for more details.

Standard ID	Result	Concentration	Remarks
	vs.		
	vs.		
	vs.		
	vs.		
	vs.		
Solvent Blank	vs.	0.00	

Test Run #	Sample ID:	Fluorescence *To see FSU, Press the "8" Key. Press "H" or "HOME" Key to Return*	Sample Concentration:		Dilution Factor:		**TEST RESULT:**
24	12-12	578	4.28	x	100	=	428
				x		=	
1	~~US~~ Blank	0.22	0.001	x	1	=	ND
2	1.0 std	148	0.98	x	1	=	0.98
3	U3-5	233	1.606	x	100	=	160
4	U3-9	132	0.876	x	100	=	88
5	TUV1-5	29	0.193	x	200	=	38.
6	TUV1-8	6.3	0.039	x	200	=	7.8 = 204
7	TUV2-5	70	0.46	x	200	=	92
8	TUV2-10	12.8	0.08	x	200	=	16 204
9	TUV3-5	222	1.52	x	100	=	152
10	TUV3-6	111	0.74	x	100	=	74
11	Blank	0.03	-0.000	x	1	=	0 = 0.14
12	3.0 ppm std		3.04	x	1	=	3.04
13	TUV4-3	613	4.23	x	100	=	423
				x		=	
				x		=	
				x		=	
				x		=	
				x		=	

Drum #	Media	Cmts
1	Soil	soil cutting USTs A,C,D,E
~~2~~	~~AQ~~	P, and H-O
2	AQ	Decon + Rinse H_2O from A,C,D,E
3	AQ	Decon + ~~rinse H_2O from~~ + purge H_2O
4	Soil	contam + equipment
5	AQ	Decon + rinse H_2O Purge H_2O

APPENDIX D QUALITY CONTROL SUMMARY REPORT

QUALITY CONTROL SUMMARY REPORT
UNDERGROUND STORAGE TANK
SITE INVESTIGATION REPORT
FORMER MAKAH AIR FORCE STATION
NEAH BAY, WASHINGTON

Prepared for:
Air Force Civil Engineer Office

Prepared By:
U.S. Army Corps of Engineers
Seattle District

May 10, 2015

TABLE OF CONTENTS

ACRONYMS

ADR	automated data review
AF	United States Air Force
AFS	Air Force Station
ARI	Analytical Resources, Inc.
BaP	benzo(a)pyrene
bgs	below ground surface
CLARC	Cleanup Levels and Risk Calculations
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DoD	Department of Defense
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FD	field duplicate
IDW	investigation derived waste
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
MW	monitoring well
N	normal sample
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
SVOC	semi-volatile organic compound
USACE	United States Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound

SECTION 1 – USABILITY SUMMARY

1.1 INTRODUCTION & OBJECTIVES

The purpose of this Quality Control Summary Report is to evaluate the Phase II data collected and determine whether they meet the data quality objectives (DQOs) outlined in the Quality Assurance Project Plan (QAPP), Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Data collected during Phase I was evaluated in the Phase I Technical Memorandum.

Soil and groundwater samples were collected and analyzed for field and analytical analyses in accordance with the QAPP, with exception of minor and infrequent field deviations enacted during the investigation. Deviations are discussed in Section 3.7 of the Site Investigation Report. These deviations did not have an adverse impact on the site investigation objectives.

This report briefly assesses the two main types of data collected, field and analytical, and discusses the intended usability of each data type.

SECTION 2 – FIELD MEASUREMENTS

The following types of field measurements were collected during Phase II sampling activities:

- Temperature
- Dissolved oxygen
- pH
- Oxidation Reduction Potential (ORP)
- Specific Conductivity
- Ferrous Iron
- Gasoline Range Organics (GRO) and Extended Diesel Range Organics (EDRO) via a field portable UVF3100 test kit.

Field measurements were collected using the approved procedures in the QAPP. Calibration and quality control procedures were performed per the QAPP or the manufacturer's instructions when specific directions were not included in the QAPP.

The field notes from March 11, 2015 groundwater well sampling state that the pH 7 standard would not calibrate on the flow-cell. Acidity readings from the groundwater monitoring should be considered estimated.

For the UVF3100, calibration was performed daily or whenever the target analyte (GRO or EDRO) was changed. Blanks and continuing calibration standards were run at regular intervals to ensure the calibration remained valid.

Uncertainty can arise when different individuals prepare and run the field tests. User-induced variation was minimized by limiting the number of users performing the field tests and ensuring that new users operated under the guidance of more experienced users until mastery was achieved.

The field measurements are generally intended for screening, field decision-making purposes, and as supplemental investigative information. This data is not intended for making site closure determinations.

SECTION 3 – ANALYTICAL DATA

USACE completed Phase II analytical sampling activities in accordance with the approved QAPP (USACE, 2014). The following laboratory samples were collected during the Phase II investigation: 25 aqueous samples (including equipment blanks) and 145 soil samples. Samples were collected and shipped to Analytical Resources, Incorporated (ARI) in Tukwila, WA. Table 1 lists all samples and their respective sample data group (SDG) assignments.

The analytical data collected during the SI is usable as reported with the data validation qualifiers added. Samples results that were rejected by the data validation are not usable. As discussed in the following sections, the data generated from the sampling and analyses program are of sufficient quality and quantity to support the objectives for the investigation.

3.1 DEVIATIONS FROM FIELD PROCEDURES

Due to conditions encountered in the field, some deviations were made from QAPP during the fieldwork portion of Phase II. Specific field deviations are detailed in Section 3 of the SI report.

3.2 FIELD QUALITY CONTROL

Field QC samples, such as matrix spike/matrix spike duplicates (MS/MSDs), field duplicates, rinsate blanks, and trip blanks, were collected to determine the quality of the field data. Six trip blanks, four rinsate blanks, 11 MS/MSD samples, and 11 field duplicate samples were collected. Equipment rinsate samples were collected every few days during soil sample collection. A trip blank was included every few days with shipments that included samples for VOC analyses.

3.3 LABORATORY METHODS

Samples were analyzed using the following methods:

- NWTPH-Dx for Diesel Range Organics (DRO) and motor oils;
- NWTPH-Gx for Gasoline Range Organics (GRO);
- EPA Method 8260 for volatile organic compounds (VOCs);
- EPA Method 8260-Selected Ion Monitoring (SIM) for low-level VOCs;
- EPA Method 6020 - lead and manganese;
- EPA Method 300.0 - Nitrate, sulfate;
- RSK-175 - Methane, ethane, ethene.

3.4 DATA VALIDATION PROCEDURES

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review.

The data validation narratives indicate that the sample analyses generally met the QC criteria cited in the QSM and appropriate validation guidance documents. Results associated with QC outliers were appropriately qualified during the data validation process.

3.5 DATA QUALITY INDICATORS

This section summarizes the validation performed and the overall quality of the analytical data based on the PARCCS parameters defined in Worksheet #37 of the QAPP. Individual data validation reports with specific sample details are provided in Appendix E. The PARCCS parameters are defined in the following sections.

3.5.1 PRECISION

Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. Precision is expressed in terms of relative percent difference (RPD) between duplicate determinations.

Some RPDs were outside criteria. The data validation qualified the data as discussed below.

- Some MS/MSD RPD results were outside of criteria resulting in some data being qualified as estimated (J/UJ); no results were rejected due to this criterion.
- Some LCS/LCS duplicate RPD results were outside of criteria resulting some data being qualified as estimated (J/UJ); no results were rejected due to this criterion.
- Some laboratory duplicate RPD results were outside of criteria resulting in some metals data being qualified as estimated (J/UJ); no results were rejected due to this criterion.
- Some field duplicate RPD results were outside of criteria for soil samples. Results associated with field duplicate precision outliers were noted in the DVRs but not qualified.

There is no discernible pattern of reason for the exceedances. Soil data is inherently more heterogeneous in nature than water samples that may be a variable contributing to the lower sampling precision.

3.5.2 ACCURACY

Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Below is a summary of the findings that affect the usability of the data:

- Surrogate recoveries were above or below criteria for several compounds, resulting in some data being qualified as estimated (J/UJ) based on surrogate recoveries.
- MS/MSD recoveries were outside of criteria for several compounds. These compounds were qualified estimated (J/UJ) in the associated parent samples.
- LCS/LCSD recoveries were outside of criteria for a few compounds, resulting in some data being qualified as estimated based on LCS recoveries.

3.5.3 REPRESENTATIVENESS

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, contaminants were not detected in method blanks, equipment blanks, or trip blanks, and that holding times were met. In general, holding times were met for all analyses with a few exceptions. Most notably, groundwater sample AQE1 was run for NWTPH-Gx nearly 6 weeks past hold time. This was due to sampler error that neglected to collect sample volume for NWTPH-Gx. As a result of not receiving sample bottles labeled for NWTPH-Gx, the laboratory did not know that this analysis was desired. Subsequent data review revealed the missing sample; in lieu of no data, NWTPH-Gx was analyzed on extra saved sample volume from AQE1 that was being held at the laboratory. A decline in concentration is expected after 6 weeks past the holding time due to volatilization and biological degradation; however, the degree of decline is unknown. It is likely the result would be higher if the holding time was not exceeded.

In addition, a few aqueous samples for nitrate analysis were slightly out of hold time owing to the remote location of the sampling location and the shipping time required to transport the samples to the lab. The samplers were aware of this hurdle and made a best effort to ensure samples would

arrive at the laboratory within holding times. Sample results out of holding time criteria were qualified as estimated (J/UJ).

Contaminants were not detected in the trip blanks, although low levels of contaminants were occasionally detected in the equipment rinsate blanks and laboratory method blanks. Equipment rinsate blanks were collected during soil sampling and were generated by rinsing the drilling shoe after decontamination with de-ionized water.

3.5.4 COMPARABILITY

To ensure comparability of data generated for the site, standard sample collection procedures and U.S. EPA-approved analytical methods were used.

3.5.5 SENSITIVITY

Sensitivity is related to the ability to compare analytical results with project-specific quantitation limit goals (PQLG). Analytical quantitation limits for the various sample analytes should be below the level of interest to allow an effective comparison or use of the analytical results.

The analytical methods used during Phase II were selected because they have a Limit of Quantitation (LOQ) at or below the PQLG. Laboratory results are reported according to rules that provide established certainty of detection at sample-specific quantitation limit. The numerical value of the sample-specific LOQ is based on the LOQ as adjusted for sample characteristics, such as dilutions or percent moisture, and laboratory judgment. If an analyte is present at a concentration between the LOD and LOQ, the analytical result is flagged with a "J," indicating an estimated quantity.

In general, the sample-specific LOQs achieved the PQLGs, although elevated sample quantitation limits (SQLs) for non-detects occurred in some samples where target analyte concentrations of other analytes (primarily petroleum) were high and thus caused matrix interference.

The laboratory LOQ for ethylene dibromide (EDB) via Method 8260 in groundwater exceeds the Method A groundwater cleanup level. EDB analysis was not detected in any wells above the cleanup level during the June 2014 (Phase I) investigation via low-level analysis (8260 SIM); EDB via low-level analysis was therefore recommended for removal from the Phase II groundwater analyses (USACE, 2015). However, due to laboratory contractual obligations, EDB was still reported in groundwater via Method 8260 in Phase II investigation, even though the LOQ for EDB via the standard Method 8260 was known to exceed the clean up level. Phase II EDB groundwater data via Method 8260 should therefore not be used to make comparisons to the groundwater cleanup levels.

The impact on usability from elevated SQLs for all other compounds is assessed on a case-by-case basis in the main narrative within the context of the conclusions relevant to that dataset.

3.5.6 COMPLETENESS

Analytical completeness is defined as the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

SECTION 4 CONCLUSIONS

The field and analytical results reported are of sufficient quantity and quality to support the intended use as stated in the QAPP.

SECTION 5 – REFERENCES

Department of Defense, 2013b. Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0, July 2013.

EPA, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA 540-R-08-005.

USACE, 2014. Quality Assurance Project Plan (Final Revision 1), UST Site Investigation, Former Makah AFS, Neah Bay, Washington.

USACE, 2015. Phase I Technical Memorandum, UST Site Investigation, Former Makah AFS. Prepared for Air Force Civil Engineer Center, January 27, 2015.

TABLES

Table 1. Sample Cross Reference Table

Sample ID No.	Location	Matrix	Sample Type	Sample Date	NWTPH Dx	NWTPH Gx	8260	8260 SIM	8270 SIM	6020 Total Pb	6020 Diss Mn	8082	EPA 300.0	MEE RSK 175	TCLP Metals	TCLP VOCs	TCLP SVOCs
GP-11-A6-13	A6	Soil	N	3/3/2015	ZY89		ZY91										
GP-11-A6-8	A6	Soil	N	3/3/2015	ZY90		ZY91										
GP-11-A4-12	A4	Soil	N	3/3/2015	ZY89		ZY91										
GP-11-A4-8	A4	Soil	N	3/3/2015	ZY89		ZY91										
GP-11-A7-8	A7	Soil	N	3/3/2015	ZY90		ZY91										
GP-11-A7-13	A7	Soil	N	3/3/2015	ZY90		ZY91										
AQTB1	na	AQ	TB	3/3/2015			ZY91										
GP-11-A5-15	A5	Soil	N	3/3/2015	ZY90		ZY91										
GP-11-A5-10	A5	Soil	N	3/3/2015	ZY90		ZY91										
GP-11-CD9-15	CD9	Soil	N	3/3/2015	ZY90		ZY91		ZY91								
GP-11-CD91-15	CD9	Soil	FD	3/3/2015	ZY90		ZY91		ZY91								
GP-11-CD9-10	CD9	Soil	N	3/3/2015	ZY90		ZY91		ZY91								
GP-11-CD8-6	CD8	Soil	N	3/3/2015	ZY89		ZY91		ZY91								
GP-11-CD8-10	CD8	Soil	N	3/3/2015	ZY89		ZY91		ZY91								
GP-11-CD2-10	CD2	Soil	N	3/4/2015	ZZ11		ZZ13		ZZ13								
GP-11-CD2-11	CD2	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD3-10	CD2	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD31-10	CD3	Soil	FD	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD3-15	CD3	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
AQRB1	shoe	AQ	RB	3/4/2015			ZZ13										
GP-11-CD1-5	CD1	Soil	N	3/4/2015	ZZ11		ZZ13		ZZ13								
GP-11-CD1-10	CD1	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD4-5	CD4	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD4-10	CD4	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD7-5	CD7	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD7-10	CD7	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD5-5	CD5	Soil	N	3/4/2015	ZZ11		ZZ13		ZZ13								
GP-11-CD5-10	CD5	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD5-18	CD5	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-CD6-5	CD6	Soil	N	3/4/2015	ZZ11		ZZ13		ZZ13								
GP-11-CD6-10	CD6	Soil	N	3/4/2015	ZZ11		ZZ13		ZZ13								
GP-11-CD6-20	CD6	Soil	N	3/4/2015	ZZ12		ZZ13		ZZ13								
GP-11-E5-15	E5	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E5-10	E5	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E51-15	E5	Soil	FD	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E10-10	E10	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E10-15	E10	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E9-5	E9	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E9-10	E9	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
AQTB2	na	AQ	TB	3/5/2015		ZZ29	ZZ30										
GP-11-E6-15	E6	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E6-10	E6	Soil	N	3/5/2015	ZZ28	ZZ28	ZZ30										
GP-11-E11-10	E11	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E11-15	E11	Soil	N	3/5/2015	ZZ28	ZZ28	ZZ30										
GP-11-E7-10	E7	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E7-15	E7	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
AQRB2	shoe	AQ	RB	3/5/2015													
GP-11-E8-5	E8	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-11-E8-10	E8	Soil	N	3/5/2015	ZZ29	ZZ29	ZZ30										
GP-06-P1-10	P1	Soil	N	3/6/2015					ZZ45			ZZ45					
GP-06-P1-14	P1	Soil	N	3/6/2015					ZZ45			ZZ45					
GP-06-P2-5	P2	Soil	N	3/6/2015					ZZ45			ZZ45					
GP-06-P2-10	P2	Soil	N	3/6/2015					ZZ45			ZZ45					
GP-06-H3-10	H3	Soil	N	3/6/2015	ZZ44		ZZ45										
GP-06-H3-12	H3	Soil	N	3/6/2015	ZZ44		ZZ45										
GP-06-H4-5	H4	Soil	N	3/6/2015	ZZ44		ZZ45										
GP-06-H4-9	H4	Soil	N	3/6/2015	ZZ44		ZZ45										
GP-06-H5-5	H5	Soil	N	3/6/2015	ZZ44		ZZ45										
GP-06-H5-10	H5	Soil	N	3/6/2015	ZZ44		ZZ45										
AQTB3	na	AQ	TB	3/8/2015		ZZ46	ZZ46										
AQMW05	MW05	AQ	N	3/8/2015	ZZ46		ZZ46				ZZ46		ZZ46	ZZ46			
AQMW06	MW06	AQ	N	3/8/2015	ZZ46	ZZ46	ZZ46				ZZ46		ZZ46	ZZ46			
AQMW08	MW08	AQ	N	3/8/2015	ZZ46		ZZ46				ZZ46		ZZ46	ZZ46			
AQMW09	MW09	AQ	N	3/8/2015	ZZ46	ZZ46	ZZ46				ZZ46		ZZ46	ZZ46			
AQMW10	MW06	AQ	FD	3/8/2015	ZZ46	ZZ46	ZZ46				ZZ46		ZZ46	ZZ46			
GP-06-H6-5	H6	Soil	N	3/9/2015	ZZ58		ZZ59										
GP-06-H1-5	H1	Soil	N	3/9/2015	ZZ58		ZZ59										
GP-06-H1-8	H1	Soil	N	3/9/2015	ZZ58		ZZ59										
GP-06-H2-10	H2	Soil	N	3/9/2015	ZZ58		ZZ59										
GP-06-H2-11	H2	Soil	N	3/9/2015	ZZ58		ZZ59										
GP-06-RS1-5	RS1	Soil	N	3/9/2015	ZZ58	ZZ58	ZZ59			ZZ59							
GP-06-RS2-4	RS2	Soil	N	3/9/2015	ZZ58	ZZ58	ZZ59			ZZ59							
GP-06-RS3-3	RS3	Soil	N	3/9/2015	ZZ58	ZZ58	ZZ59			ZZ59							
GP-06-RS6-5	RS6	Soil	N	3/9/2015	ZZ58	ZZ58	ZZ59			ZZ59							

Sample ID No.	Location	Matrix	Sample Type	Sample Date	NWTPH Dx	NWTPH Gx	8260	8260 SIM	8270 SIM	6020 Total Pb	6020 Diss Mn	8082	EPA 300.0	MEE RSK 175	TCLP Metals	TCLP VOCs	TCLP SVOCs
GP-06-RS61-5	RS6	Soil	FD	3/9/2015	ZZ58	ZZ58	ZZ59			ZZ59							
GP-06-RS5-3	RS5	Soil	N	3/10/2015	ZZ88	ZZ88	ZZ89			ZZ89							
GP-06-RS8-2	RS8	Soil	N	3/10/2015	ZZ88	ZZ88	ZZ89			ZZ89							
GP-06-RS7-3	RS7	Soil	N	3/10/2015	ZZ88	ZZ88	ZZ89			ZZ89							
GP-11-A9-5	A9	Soil	N	3/10/2015	ZZ88		ZZ89										
GP-11-A9-10	A9	Soil	N	3/10/2015	ZZ88		ZZ89										
GP-11-A8-10	A8	Soil	N	3/10/2015	ZZ88		ZZ89										
GP-11-A8-15	A8	Soil	N	3/10/2015	ZZ88		ZZ89										
GP-11-A10-10	A10	Soil	N	3/10/2015	ZZ88		ZZ89										
GP-11-A10-15	A10	Soil	N	3/10/2015	ZZ88		ZZ89										
AQTB4	na	AQ	TB	3/10/2015			ZZ89										
GP-11-CD15-5	CD15	Soil	N	3/11/2015	ZZ88		ZZ89		ZZ89								
GP-11-CD15-10	CD15	Soil	N	3/11/2015	ZZ88		ZZ89		ZZ89								
GP-11-CD151-10	CD15	Soil	FD	3/11/2015	ZZ88		ZZ89		ZZ89								
GP-11-CD16-5	CD16	Soil	N	3/11/2015	AA06		AA08		AA08								
GP-11-CD16-10	CD16	Soil	N	3/11/2015	AA06		AA08		AA08								
GP-11-CD16-15	CD16	Soil	N	3/11/2015	AA06		AA08		AA08								
GP-11-CD20-10	CD20	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD20-15	CD20	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD19-5	CD19	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD19-10	CD19	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD191-10	CD19	Soil	FD	3/11/2015	AA07		AA08		AA08								
GP-11-CD17-5	CD17	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD17-10	CD17	Soil	N	3/11/2015	AA07		AA08		AA08								
GP-11-CD14-5	CD14	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD14-10	CD14	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD18-10	CD18	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD18-15	CD18	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD181-10	CD18	Soil	FD	3/12/2015	AA31		AA32		AA32								
AQRB3		Soil	RB	3/12/2015			AA32										
GP-11-CD13-5	CD13	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD13-10	CD13	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD12-5	CD12	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD12-10	CD12	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD10-5	CD10	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD10-10	CD10	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD11-5	CD11	Soil	N	3/12/2015	AA31		AA32		AA32								
GP-11-CD11-10	CD11	Soil	N	3/12/2015	AA31		AA32		AA32								
AQCD1	CD6	AQ	N	3/12/2015	AA25		AA25				AA25		AA25	AA25			
AQCD7	CD6	AQ	FD	3/12/2015	AA25		AA25				AA25		AA25	AA25			
AQCD2	CD5	AQ	N	3/12/2015	AA25		AA25				AA25		AA25	AA25			
AQA1	near A6	AQ	N	3/13/2015	AA25		AA25				AA25		AA25	AA25			
GP-11-E12-10	E12	Soil	N	3/13/2015	AA31	AA31	AA32										
GP-11-E12-15	E12	Soil	N	3/13/2015	AA31	AA31	AA32										
AQE1	near E11	AQ	N	3/13/2015	AA25	AFQ3	AA25				AA25		AA25	AA25			
GP-11-E13-5	E13	Soil	N	3/13/2015	AA31	AA31	AA32										
GP-11-E13-10	E13	Soil	N	3/13/2015	AA31	AA31	AA32										
GP-11-E14-5	E14	Soil	N	3/13/2015	AA31	AA31	AA32										
GP-11-E14-10	E14	Soil	N	3/13/2015	AA31	AA31	AA32										
AQTB5	na	AQ	TB	3/16/2015		AB04	AB04										
AQE2	E2	AQ	N	3/16/2015	AB04	AB04	AB04				AB04		AB04	AB04			
AQE3	E3	AQ	N	3/16/2015	AB04	AB04	AB04				AB04		AB04	AB04			
GP-05-T2-10	T2	Soil	N	3/16/2015	AB05		AB07										
GP-05-T2-12	T2	Soil	N	3/16/2015	AB05		AB07										
GP-05-T3-5	T3	Soil	N	3/16/2015	AB05		AB07										
GP-05-T3-10	T3	Soil	N	3/16/2015	AB05		AB07										
GP-05-T3-12	T3	Soil	N	3/16/2015	AB05		AB07										
GP-05-V1-5	V1	Soil	N	3/16/2015	AB05		AB07										
GP-05-V1-7	V1	Soil	N	3/16/2015	AB05		AB07										
GP-05-V3-5	V3	Soil	N	3/16/2015	AB06		AB07										
GP-05-V3-8	V3	Soil	N	3/16/2015	AB05		AB07										
GP-05-T1-5	T1	Soil	N	3/16/2015	AB06		AB07										
GP-05-T1-8	T1	Soil	N	3/16/2015	AB05		AB07										
GP-06-RS4-3	RS4	Soil	N	3/17/2015	AB35	AB35	AB36			AB36							
GP-06-H7-5	H7	Soil	N	3/17/2015	AB35		AB36										
GP-06-H7-7	H7	Soil	N	3/17/2015	AB34		AB36										
GP-06-H8-10	H8	Soil	N	3/17/2015	AB35		AB36										
GP-06-H8-12	H8	Soil	N	3/17/2015	AB34		AB36										
GP-06-H9-10	H9	Soil	N	3/17/2015	AB35		AB36										
GP-06-H9-13	H9	Soil	N	3/17/2015	AB35		AB36										
GP-06-H91-13	H9	Soil	FD	3/17/2015	AB35		AB36										
GP-05-V2-5	V2	Soil	N	3/17/2015	AB35		AB36										
GP-05-V2-8	V2	Soil	N	3/17/2015	AB35		AB36										
GP-05-U1-5	U1	Soil	N	3/17/2015	AB35		AB36										
GP-05-U1-10	U1	Soil	N	3/17/2015	AB35		AB36										
GP-05-U2-5	U2	Soil	N	3/17/2015	AB35		AB36										
GP-05-U2-10	U2	Soil	N	3/17/2015	AB35		AB36										
GP-05-U2-12	U2	Soil	N	3/17/2015	AB35		AB36										
AQRB4	AQRB4	AQ	RB	3/17/2015			AB36										

Sample ID No.	Location	Matrix	Sample Type	Sample Date	NWTPH Dx	NWTPH Gx	8260	8260 SIM	8270 SIM	6020 Total Pb	6020 Diss Mn	8082	EPA 300.0	MEE RSK 175	TCLP Metals	TCLP VOCs	TCLP SVOCs
AQTUV1	AQTUV1	AQ	N	3/18/2015	AB57		AB57				AB57		AB57	AB57			
GP-05-U3-5	U3	Soil	N	3/18/2015	AB58		AB59										
GP-05-U3-9	U3	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV1-5	TUV1	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV1-8	TUV1	Soil	N	3/18/2015	AB58		AB59										
AQTB6	na	AQ	N	3/18/2015			AB59										
GP-05-TUV2-5	TUV2	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV2-10	TUV2	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV3-5	TUV3	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV3-6	TUV3	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV4-3	TUV4	Soil	N	3/18/2015	AB58		AB59										
GP-05-TUV41-3	TUV4	Soil	FD	3/18/2015	AB58		AB59										
DRUM1	Drum	soil	N	3/18/2015											AB68	AB68	AB68
DRUM2		AQ	N	3/18/2015			AB85		AB85					AB85			
DRUM3		AQ	N	3/18/2015			AB85		AB85					AB85			
DRUM4		soil	N	3/18/2015											AB68	AB68	AB68
DRUM5		AQ	N	3/18/2015			AB85		AB85					AB85			

Note: Sample dates are separated using grey and white shading.

APPENDIX E DATA VALIDATION REPORTS

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
AA06	3	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AA07	7	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AA08	10	soil	VOCs, SVOCs	8260, 8270 SIM	EPA Stage 2a
ZZ58	10	soil	DRO & motor oils, gasoline	NWTPH-Dx, NWTPH-Gx	EPA Stage 2a
ZZ59	10	soil	VOCs, Metals (Pb)	8260, 6020	EPA Stage 2a
AA32	20	soil (19) AQ (1)	VOCs, SVOCs	8270 SIM,8260	EPA Stage 2a

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Attachment 1 – Output reports generated by ADR.net.

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This section describes the data review findings for NWTPH-Dx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None.

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None.

2.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None.

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions.

Exceptions:

SDG	Comments
AA07	SDGs AA06 and AA07 were run together and thus shared one MS/MSD result.

Percent recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AA06	GP-11-CD16-10	DRO	J (detects)	Matrix spike MS recovery not applicable due to high target analyte concentrations

2.6 Laboratory Duplicates

A laboratory duplicate is not required as long as a matrix spike duplicate is performed.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within the laboratory control limits (50-150) with the following exceptions.

Exceptions: None.

2.8 Trip Blank

A trip blank was not analyzed with the reviewed SDGs.

2.9 Equipment (Rinsate) Blank
No equipment blanks were reviewed.

2.10 Field Duplicate Samples
The following field duplicate(s) were collected as part of the SDGs reviewed:

SDG	Sample	Parent Sample	Flag	Notes
AA07	GP-11-CD191-10	GP-11-CD19-10	None	All RPDs within control limits.
ZZ58	GP-06-RS61-5	GP-06-RS6-5	None	RPDs not applicable because target concentrations are < 5x LOQ.

All field duplicate RPDs are within the QAPP-defined control limit of 40%.

3 Volatile Organic Compounds (8260)
This section describes the data review findings for 8260.

3.1 Sampling Documentation
All samples were received under proper chain of custody with the following exceptions:

No exceptions.

3.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

No exceptions.

3.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

3.4 Method Blanks
A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

3.5 MS/MSD
One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
ZZ59	GP-06-H2-10	ethylbenzene, m,p-xylene, naphthalene, o-xylene, toluene	J- (all detects) UJ (all non-detects)	All MS & MSD %recovery out of control low.
AA32	GP-11-CD14-10	Naphthalene	J- (all detects) UJ (all non-detects)	MSD %recovery out of control low.

3.6 Laboratory Duplicates
A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

SDG	Sample	Flag	Notes
AA08	GP-11-CD16-5, GP-11-CD16-10	J+ (detects)	Surrogate % recovery for bromofluorobenzene was out of control high. No target analytes were detected in the samples. No data qualified.

3.8 Trip Blanks
The following trip blanks were reviewed: None.

3.9 Equipment (Rinsate) Blank
The following equipment blanks were reviewed:

SDG	Sample	Flag	Notes
AA32	AQRB3	None	No target analytes detected.

3.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
AA08	GP-11-CD191-10	GP-11-CD19-10	None	RPDs are within control limits or not applicable.
ZZ59	GP-06-RS61-5	GP-06-RS6-5	None	RPDs within control limits or not applicable because target concentrations are < 5x LOQ.
AA32	GP-11-CD181-10	GP-11-CD18-10	None	All RPDs are within control limits except ethylbenzene. This could be due to the sample not being completely homogenized or the generally low concentrations of ethylbenzene detected.

4 Volatile Organic Compounds (8270 SIM)
This section describes the data review findings for 8270D SIM.

4.1 Sampling Documentation
All samples were received under proper chain of custody.

4.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples.

4.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.4 Method Blanks

The laboratory analyzed at least one method blank with each analytical batch. No target analytes were detected in the method blanks.

4.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AA08	GP-11-CD16-10	2-methylnaphthalene	J (all detects); UJ (all non-detects)	MS %recovery out of control low. MSD %recovery out of control high.
AA08	GP-11-CD16-10	1-methylnaphthalene	J- (all detects); UJ (all non-detects)	MSD %recovery out of control low.
AA32	GP-11-CD14-10	chrysene, naphthalene	J- (all detects) UJ (all non-detects)	Both MS & MSD, except for chrysene MSD, %recovery out of control low.
AA32	GP-11-CD14-10	1-methylnaphthalene, 2-methylnaphthalene	J- (all detects) UJ (all non-detects)	MS & MSD %recovery NA due to high concentration of analyte in original sample.

4.6 Laboratory Duplicates

A laboratory duplicate was not run for 8270 SIM. A laboratory duplicate is not required if a matrix spike duplicate is run.

4.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

SDG	Parent Sample	Analyte	Flag	Notes
AA32	GP-11-CD13-5 (DL)	2-methylnaphthalene, dibenzo(a,h)anthracene	none	NR because it is a diluted sample.
AA32	GP-11-CD18-10 (DL)	2-methylnaphthalene, dibenzo(a,h)anthracene	none	NR because it is a diluted sample.

4.8 Trip Blank

The following trip blanks were reviewed: None.

4.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed: None.

4.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
AA08	GP-11-CD191-10	GP-11-CD19-10	None	RPD's not applicable because detected concentrations are less than 5 times LOQ.
AA32	GP-11-CD181-10	GP-11-CD18-10	None	RPD's are within control limits or not applicable because target concentrations are < 5x LOQ, except for 1-methylnaphthalene and 2-methylnaphthalene. This

				could be due to the sample not being completely homogenized and the relatively low concentrations detected.

5 Gasoline Range Organics (NWTPH-Gx)

This section describes the data review findings for NWTPH-Gx.

5.1 Sampling Documentation

All samples were received under proper chain of custody.

5.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

5.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions:

SDG	Comments
AB35	No MS/MSD was analyzed because of insufficient amount of sample provided. No data qualified because LCS was within control limits.
ZZ58	No MS/MSD was run. No data qualified because LCS was within control limits.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.6 Laboratory Duplicates

A laboratory duplicate was not run. A laboratory duplicate is not required if a matrix spike duplicate is run.

5.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

5.8 Trip Blank

Trip blanks are not required for this analysis.

5.9 Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

5.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ58	GP-06-RS61-5	GP-06-RS6-5	None	All RPD are within control limits.

6 Metals (Pb) (6020)

This section describes the data review findings for method 6020

6.1 Sampling Documentation

All samples were received under proper chain of custody.

6.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

6.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

6.5 Matrix Spike (MS) Analysis

One matrix spike a (MS) was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.6 Laboratory Duplicates

One laboratory duplicate was analyzed with each SDG or at a frequency of 1 duplicate per 20 samples with the following exceptions: None

All lab duplicate % recoveries and RPDs are within control limits with the following exceptions:

SDG	Sample(s)	Analyte	Flag	Notes
ZZ59	GP-06-RS1-5	Lead	J (all detects) UJ (all non-detects)	Laboratory duplicate RPD out of control high.

6.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

6.8 Trip Blank

Trip blanks are not required for this analysis.

6.9 Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

6.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ59	GP-06-RS61-5	GP-06-RS6-5	None	RPD within control limit.

7 Data Usability Assessment

This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

7.1 Precision

Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. All MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

- ZZ58 no MS/MSD was run for Gx
- ZZ59 lab duplicate RPD for 6020
- AA32 field duplicate RPD for 8260
- AA32 field duplicate RPD for 8270

The overall precision of the data set is considered acceptable.

7.2 Accuracy

Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- AA08 MS & MSD %recovery for 8270 SIM
- AA06 MS %recovery for Dx
- AA08 surrogate %recovery for 8260
- ZZ59 MS & MSD %recovery for 8260
- AA32 MSD %recovery for 8260
- AA32 MS & MSD %recovery for 8270

7.3 Representativeness

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, contaminants were not detected in method blanks, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. The representativeness of the project data is considered acceptable.

7.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

7.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

8 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

9 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: AA06-150317 **Laboratory: ARIS**

EDD Filename: aa06 **eQAPP Name: Makah 20150416**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-11-CD16-10** ***Collected:*** **3/11/2015 12:05:00 PM** ***Analysis Type:*** **DL** ***Dilution:*** **10.0**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
DIESEL RANGE ORGANICS	12000		160	DL	590	LOQ	mg/kg	J	ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA06-150317

Laboratory: ARIS

EDD Filename: aa06

eQAPP Name: Makah 20150416

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Rejection
ProfJudg	Professional Judgment

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AA06-150317
eQapp Name: Makah 20150416

	Associated Samples	Sample Collection Date

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AA06-150317 **Laboratory: ARIS**

EDD Filename: aa06 **eQAPP Name: Makah 20150416**

Method: **NWTPH-DX**
Matrix: **SO**

QC Sample ID (Associated Samples)	*Compound*	*MS %R*	*MSD %R*	*%R Limits*	*RPD (Limits)*	*Affected Compounds*	*Flag*
GP-11-CD16-10MS GP-11-CD16-10MSD (GP-11-CD16-10)	DIESEL RANGE ORGANICS	0	0	62.00-120.00	-	DIESEL RANGE ORGANICS	J- (all detects) R (all non-detects)

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Jacob Williams

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD16-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	11000	mg/kg	Matrix Spike Lower Rejection	J-		4/20/2015 15:16
Reason for change:	Matrix spike MS recovery not applicable due to high target analyte concentrations							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	11000	mg/kg	Professional Judgment		J	4/20/2015 15:16
Reason for change:	Matrix spike MS recovery not applicable due to high target analyte concentrations							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	12000	mg/kg	Matrix Spike Lower Rejection	J-		4/20/2015 15:13
Reason for change:	Recovery not applicable due to high target analyte concentrations							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	12000	mg/kg	Professional Judgment		J	4/20/2015 15:14
Reason for change:	Matrix spike MS recovery not applicable due to high target analyte concentrations							
MOTOR OILS	NWTPH-DX	DL	1200	mg/kg	Professional Judgment		J	4/20/2015 15:15
Reason for change:	Matrix spike MS recovery not applicable due to high target analyte concentrations							
MOTOR OILS	NWTPH-DX	DL	1200	mg/kg	Professional Judgment	J		4/20/2015 15:16
Reason for change:	Not a matrix spike compound. Validator error							

Data Qualifier Summary

Lab Reporting Batch ID: AA07-150319

Laboratory: ARIS

EDD Filename: aa07

eQAPP Name: Makah 20150414

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: AA07-150319
eQapp Name: Makah 20150414

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD191-10 **QC Type:** FD		
	GP-11-CD19-10	3/11/2015 2:20:00 PM

Field Duplicate RPD Report

Lab Reporting Batch ID: AA07-150319 **Laboratory: ARIS**

EDD Filename: aa07 **eQAPP Name: Makah 20150414**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD19-10	GP-11-CD191-10			
DIESEL RANGE ORGANICS	22	16	32	40.00	No Qualifiers Applied
MOTOR OILS	120	92	26	40.00	

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method Category: SVOA

Method: 8270D SIM **Matrix:** SO

Sample ID: GP-11-CD16-10 **Collected:** 3/11/2015 12:05:00 PM **Analysis Type:** DL-BASE/NEUTRAL **Dilution:** 5.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-Methylnaphthalene	9.1		0.071	DL	0.22	LOQ	mg/kg	J-	Ms
2-METHYLNAPHTHALENE	9.5		0.074	DL	0.22	LOQ	mg/kg	J	Ms, Ms

Sample ID: GP-11-CD16-10 **Collected:** 3/11/2015 12:05:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.030	J	0.019	DL	0.044	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD16-15 **Collected:** 3/11/2015 12:05:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
Total Benzofluoranthenes	0.0031	J	0.0031	DL	0.0067	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD16-5 **Collected:** 3/11/2015 12:05:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
Total Benzofluoranthenes	0.010	J	0.0075	DL	0.016	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD17-10 **Collected:** 3/11/2015 3:10:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0042	J	0.0019	DL	0.0049	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD17-5 **Collected:** 3/11/2015 3:10:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 3.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0096	J	0.0059	DL	0.013	LOQ	mg/kg	J	RI
DIBENZO(A,H)ANTHRACENE	0.0080	J	0.0069	DL	0.013	LOQ	mg/kg	J	RI
INDENO(1,2,3-CD)PYRENE	0.010	J	0.0081	DL	0.013	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD191-10 **Collected:** 3/11/2015 2:40:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 3.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.011	J	0.0063	DL	0.014	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method Category: SVOA

Method: 8270D SIM **Matrix: SO**

Sample ID: GP-11-CD19-5 **Collected:** 3/11/2015 2:20:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0030	J	0.0019	DL	0.0050	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0038	J	0.0022	DL	0.0050	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0024	J	0.0023	DL	0.0050	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD20-15 **Collected:** 3/11/2015 1:25:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0030	J	0.0021	DL	0.0046	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0026	J	0.0021	DL	0.0046	LOQ	mg/kg	J	RI

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-11-CD16-15 **Collected:** 3/11/2015 12:05:00 PM **Analysis Type:** RES **Dilution:** 1.24

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0009	J	0.00019	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD17-10 **Collected:** 3/11/2015 3:10:00 PM **Analysis Type:** RES **Dilution:** 1.37

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0013	J	0.00021	DL	0.0014	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD17-5 **Collected:** 3/11/2015 3:10:00 PM **Analysis Type:** RES **Dilution:** 1.17

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0010	J	0.00035	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD19-10 **Collected:** 3/11/2015 2:20:00 PM **Analysis Type:** RES **Dilution:** 1.26

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0007	J	0.00037	DL	0.0013	LOQ	mg/Kg	J	RI
TOLUENE	0.0012	J	0.00019	DL	0.0013	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-CD191-10** ***Collected:*** **3/11/2015 2:40:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.39**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0012	J	0.00021	DL	0.0014	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Upper Estimation
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Upper Estimation

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AA08-150420
eQapp Name: Makah 20150421

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD191-10 **QC Type:** FD		
	GP-11-CD19-10	3/11/2015 2:20:00 PM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method: **8270D SIM**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD16-10MS GP-11-CD16-10MSD (GP-11-CD16-10)	2-METHYLNAPHTHALENE	135	23.8	35.00-120.00	-	2-METHYLNAPHTHALENE	J (all detects) UJ (all non-detects)
GP-11-CD16-10MSD (GP-11-CD16-10)	1-Methylnaphthalene	-	15.6	39.00-120.00	-	1-Methylnaphthalene	J-(all detects) UJ(all non-detects)

Surrogate Outlier Report

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method: **8260C**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-CD16-10	4-Bromofluorobenzene	123	80-120	All Target Analytes	J+ (all detects)
GP-11-CD16-5	4-Bromofluorobenzene	131	80-120	All Target Analytes	J+(all detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: AA08-150420 **Laboratory: ARIS**

EDD Filename: aa08 **eQAPP Name: Makah 20150421**

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD19-10	GP-11-CD191-10			
BENZENE	0.0007	0.0014 U	200	40.00	No Qualifiers Applied
TOLUENE	0.0012	0.0012	0	40.00	

Method: 8270D SIM
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD19-10	GP-11-CD191-10			
1-Methylnaphthalene	0.0087	0.014	47	40.00	No Qualifiers Applied
2-METHYLNAPHTHALENE	0.013	0.021	47	40.00	
CHRYSENE	0.0088	0.021	82	40.00	
NAPHTHALENE	0.0053	0.011	70	40.00	

EDD Warning Log

Lab Reporting Batch ID: AA08-150420

eQAPP: Makah 20150421 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis	12	PreparationBatch	NT5-032315A	17	This batch has more that one sample with QCType LCS.
Sample Analysis	34	PreparationBatch	NT5-032315A	17	This batch has more that one sample with QCType LCS.

Data Qualifier Summary

Lab Reporting Batch ID: ZZ58-150317 **Laboratory: ARIS**

EDD Filename: zz58 **eQAPP Name: Makah 20150427**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-06-RS6-5** ***Collected:*** **3/9/2015 2:15:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
DIESEL RANGE ORGANICS	5.2	J	1.5	DL	5.5	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ58-150317

Laboratory: ARIS

EDD Filename: zz58

eQAPP Name: Makah 20150427

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ58-150317
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: GP-06-RS61-5 **QC Type:** FD		
	GP-06-RS6-5	3/9/2015 2:15:00 PM

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ58-150317 **Laboratory: ARIS**

EDD Filename: zz58 **eQAPP Name: Makah 20150427**

Method: **NWTPH-DX**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-06-RS6-5	DIESEL RANGE ORGANICS	J	5.2	5.5	LOQ	mg/kg	J (all detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ58-150317 **Laboratory: ARIS**

EDD Filename: zz58 **eQAPP Name: Makah 20150427**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-06-RS6-5	GP-06-RS61-5			
DIESEL RANGE ORGANICS	5.2	9.8	61	40.00	No Qualifiers Applied
MOTOR OILS	23	45	65	40.00	

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method Category: METALS

Method: 6020 **Matrix: SO**

Sample ID: GP-06-RS1-5 **Collected:** 3/9/2015 11:15:00 AM **Analysis Type:** RES/TOT **Dilution:** 20.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
LEAD	5.8		0.057	DL	0.1	PQL	mg/kg	J	Ld

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-06-H1-8 **Collected:** 3/9/2015 9:20:00 AM **Analysis Type:** RES **Dilution:** 1.04

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0006	J	0.00041	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H2-10 **Collected:** 3/9/2015 10:05:00 AM **Analysis Type:** RES **Dilution:** 1.15

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0011	U	0.00023	DL	0.0011	LOQ	mg/Kg	UJ	Ms
m,p-Xylene	0.0011	U	0.00045	DL	0.0011	LOQ	mg/Kg	UJ	Ms
NAPHTHALENE	0.0057	U	0.00049	DL	0.0057	LOQ	mg/Kg	UJ	Ms
O-XYLENE	0.0011	U	0.00026	DL	0.0011	LOQ	mg/Kg	UJ	Ms
TOLUENE	0.0011	J	0.00017	DL	0.0011	LOQ	mg/Kg	J-	Ms

Sample ID: GP-06-H6-5 **Collected:** 3/9/2015 8:50:00 AM **Analysis Type:** RES **Dilution:** 1.31

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0010	J	0.00020	DL	0.0013	LOQ	mg/Kg	J	RI

Sample ID: GP-06-RS1-5 **Collected:** 3/9/2015 11:15:00 AM **Analysis Type:** RES **Dilution:** 1.08

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0010	J	0.00016	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-06-RS3-3 **Collected:** 3/9/2015 1:15:00 PM **Analysis Type:** RES **Dilution:** 1.09

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-06-RS61-5** ***Collected:*** **3/9/2015 2:25:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.46**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0012	J	0.00022	DL	0.0015	LOQ	mg/Kg	J	RI

Sample ID: **GP-06-RS6-5** ***Collected:*** **3/9/2015 2:15:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.11**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ59-150420

Laboratory: ARIS

EDD Filename: zz59

eQAPP Name: Makah 20150427

Reason Code Legend

Reason Code	*Description*
Ld	Laboratory Duplicate Precision
Ms	Matrix Spike Lower Estimation
Rl	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ59-150420
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: GP-06-RS61-5 **QC Type:** FD		
	GP-06-RS6-5	3/9/2015 2:15:00 PM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method: **8260C**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-06-H2-10MS GP-06-H2-10MSD (GP-06-H2-10)	ETHYLBENZENE m,p-Xylene NAPHTHALENE O-XYLENE TOLUENE	67.2 65.7 43 67 75.1	65.2 64 41.5 64.5 66	80.00-120.00 80.00-123.00 71.00-122.00 80.00-120.00 78.00-120.00	- - - - -	ETHYLBENZENE m,p-Xylene NAPHTHALENE O-XYLENE TOLUENE	J- (all detects) UJ (all non-detects)

Project Name and Number: Task Order #18 - Makah

Lab Duplicate Outlier Report

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method: 6020
Matrix: SO

QC Sample ID (Associated Sample ID)	Analyte	Sample RPD	eQAPP RPD	Flag
GP-06-RS1-5DUP (TOT) (GP-06-RS1-5)	LEAD	26.9	20.00	J (all detects) UJ (all non-detects)

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method: **8260C**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-06-H1-8	m,p-Xylene	J	0.0006	0.0010	LOQ	mg/Kg	J (all detects)
GP-06-H6-5	TOLUENE	J	0.0010	0.0013	LOQ	mg/Kg	J (all detects)
GP-06-RS1-5	TOLUENE	J	0.0010	0.0011	LOQ	mg/Kg	J (all detects)
GP-06-RS3-3	TOLUENE	J	0.0008	0.0011	LOQ	mg/Kg	J (all detects)
GP-06-RS61-5	TOLUENE	J	0.0012	0.0015	LOQ	mg/Kg	J (all detects)
GP-06-RS6-5	TOLUENE	J	0.0006	0.0011	LOQ	mg/Kg	J (all detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ59-150420 **Laboratory: ARIS**

EDD Filename: zz59 **eQAPP Name: Makah 20150427**

Method: 6020
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-06-RS6-5 (TOT)	GP-06-RS61-5 (TOT)			
LEAD	5.1	5.3	4	40.00	No Qualifiers Applied

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-06-RS6-5	GP-06-RS61-5			
TOLUENE	0.0006	0.0012	67	40.00	No Qualifiers Applied

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AA32-150420
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQRB3 **QC Type:** EB		
	GP-11-CD10-10	3/12/2015 1:25:00 PM
	GP-11-CD10-5	3/12/2015 1:25:00 PM
	GP-11-CD11-10	3/12/2015 2:10:00 PM
	GP-11-CD11-5	3/12/2015 2:10:00 PM
	GP-11-CD12-10	3/12/2015 12:25:00 PM
	GP-11-CD12-5	3/12/2015 12:25:00 PM
	GP-11-CD13-10	3/12/2015 11:20:00 AM
	GP-11-CD13-5	3/12/2015 11:20:00 AM
	GP-11-CD14-10	3/12/2015 8:55:00 AM
	GP-11-CD14-5	3/12/2015 8:55:00 AM
	GP-11-CD18-10	3/12/2015 10:20:00 AM
	GP-11-CD181-10	3/12/2015 10:50:00 AM
	GP-11-CD18-15	3/12/2015 10:20:00 AM
	GP-11-E12-10	3/13/2015 9:40:00 AM
	GP-11-E12-15	3/13/2015 9:40:00 AM
	GP-11-E13-10	3/13/2015 11:15:00 AM
	GP-11-E13-5	3/13/2015 11:15:00 AM
	GP-11-E14-10	3/13/2015 12:15:00 PM
	GP-11-E14-5	3/13/2015 12:15:00 PM
Field QC Sample: GP-11-CD181-10 **QC Type:** FD		
	GP-11-CD18-10	3/12/2015 10:20:00 AM

Data Qualifier Summary

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method Category: **SVOA**

Method: **8270D SIM** ***Matrix:*** **SO**

Sample ID: **GP-11-CD10-10** ***Collected:*** **3/12/2015 1:25:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0029	J	0.0021	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD10-5** ***Collected:*** **3/12/2015 1:25:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-Methylnaphthalene	0.0045	J	0.0015	DL	0.0047	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0036	J	0.0021	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD11-10** ***Collected:*** **3/12/2015 2:10:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0033	J	0.0018	DL	0.0047	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0025	J	0.0021	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD11-5** ***Collected:*** **3/12/2015 2:10:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **3.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.012	J	0.0057	DL	0.015	LOQ	mg/kg	J	RI
NAPHTHALENE	0.010	J	0.0067	DL	0.015	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD12-10** ***Collected:*** **3/12/2015 12:25:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-Methylnaphthalene	0.0042	J	0.0015	DL	0.0046	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0035	J	0.0021	DL	0.0046	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD12-5** ***Collected:*** **3/12/2015 12:25:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
Total Benzofluoranthenes	0.0040	J	0.0022	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD13-10** ***Collected:*** **3/12/2015 11:20:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-Methylnaphthalene	0.0042	J	0.0022	DL	0.0067	LOQ	mg/kg	J	RI
2-METHYLNAPHTHALENE	0.0052	J	0.0023	DL	0.0067	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method Category: **SVOA**

Method: **8270D SIM** ***Matrix:*** **SO**

Sample ID: **GP-11-CD13-10** ***Collected:*** **3/12/2015 11:20:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0035	J	0.0030	DL	0.0067	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD14-10** ***Collected:*** **3/12/2015 8:55:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **3.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-Methylnaphthalene	0.20		0.0048	DL	0.015	LOQ	mg/kg	J-	Ms
2-METHYLNAPHTHALENE	0.27		0.0050	DL	0.015	LOQ	mg/kg	J-	Ms
BENZO(A)ANTHRACENE	0.0076	J	0.0066	DL	0.015	LOQ	mg/kg	J	RI
CHRYSENE	0.031		0.0057	DL	0.015	LOQ	mg/kg	J-	Ms
NAPHTHALENE	0.068		0.0068	DL	0.015	LOQ	mg/kg	J-	Ms

Sample ID: **GP-11-CD14-5** ***Collected:*** **3/12/2015 8:55:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0039	J	0.0022	DL	0.0049	LOQ	mg/kg	J	RI
BENZO(A)PYRENE	0.0030	J	0.0023	DL	0.0049	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0047	J	0.0022	DL	0.0049	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD18-10** ***Collected:*** **3/12/2015 10:20:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.0033	J	0.0025	DL	0.0049	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD18-15** ***Collected:*** **3/12/2015 10:20:00 AM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0096	J	0.0053	DL	0.012	LOQ	mg/kg	J	RI
BENZO(A)PYRENE	0.0061	J	0.0057	DL	0.012	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0067	J	0.0055	DL	0.012	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method Category: VOA

Method: 8260C **Matrix:** SO

Sample ID: GP-11-CD10-10 **Collected:** 3/12/2015 1:25:00 PM **Analysis Type:** RES **Dilution:** 1.08

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00016	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD11-10 **Collected:** 3/12/2015 2:10:00 PM **Analysis Type:** RES **Dilution:** 1.14

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD11-5 **Collected:** 3/12/2015 2:10:00 PM **Analysis Type:** RES **Dilution:** 1.14

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0007	J	0.00034	DL	0.0011	LOQ	mg/Kg	J	RI
TOLUENE	0.0006	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD12-10 **Collected:** 3/12/2015 12:25:00 PM **Analysis Type:** RES **Dilution:** 1.14

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD12-5 **Collected:** 3/12/2015 12:25:00 PM **Analysis Type:** RES **Dilution:** 1.20

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0007	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: GP-11-CD18-15 **Collected:** 3/12/2015 10:20:00 AM **Analysis Type:** RES **Dilution:** 1.13

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0006	J	0.00033	DL	0.0011	LOQ	mg/Kg	J	RI
m,p-Xylene	0.0006	J	0.00044	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-11-E13-10 **Collected:** 3/13/2015 11:15:00 AM **Analysis Type:** RES **Dilution:** 1.08

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0005	J	0.00032	DL	0.0011	LOQ	mg/Kg	J	RI
ETHYLBENZENE	0.0006	J	0.00022	DL	0.0011	LOQ	mg/Kg	J	RI
TOLUENE	0.0006	J	0.00016	DL	0.0011	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-E13-5** ***Collected:*** **3/13/2015 11:15:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.06**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
m,p-Xylene	0.0008	J	0.00042	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E14-10** ***Collected:*** **3/13/2015 12:15:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.09**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
m,p-Xylene	0.0008	J	0.00043	DL	0.0011	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Lower Rejection
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method: 8260C

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD10-10	TOLUENE	J	0.0006	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-CD11-10	TOLUENE	J	0.0006	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-CD11-5	BENZENE TOLUENE	J J	0.0007 0.0006	0.0011 0.0011	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-11-CD12-10	TOLUENE	J	0.0008	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-CD12-5	TOLUENE	J	0.0007	0.0012	LOQ	mg/Kg	J (all detects)
GP-11-CD18-15	BENZENE m,p-Xylene	J J	0.0006 0.0006	0.0011 0.0011	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-11-E13-10	BENZENE ETHYLBENZENE TOLUENE	J J J	0.0005 0.0006 0.0006	0.0011 0.0011 0.0011	LOQ LOQ LOQ	mg/Kg mg/Kg mg/Kg	J (all detects)
GP-11-E13-5	m,p-Xylene	J	0.0008	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-E14-10	m,p-Xylene	J	0.0008	0.0011	LOQ	mg/Kg	J (all detects)

Method: 8270D SIM

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD10-10	NAPHTHALENE	J	0.0029	0.0047	LOQ	mg/kg	J (all detects)
GP-11-CD10-5	1-Methylnaphthalene NAPHTHALENE	J J	0.0045 0.0036	0.0047 0.0047	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD11-10	CHRYSENE Total Benzofluoranthenes	J J	0.0033 0.0025	0.0047 0.0047	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD11-5	CHRYSENE NAPHTHALENE	J J	0.012 0.010	0.015 0.015	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD12-10	1-Methylnaphthalene NAPHTHALENE	J J	0.0042 0.0035	0.0046 0.0046	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD12-5	Total Benzofluoranthenes	J	0.0040	0.0047	LOQ	mg/kg	J (all detects)
GP-11-CD13-10	1-Methylnaphthalene 2-METHYLNAPHTHALENE NAPHTHALENE	J J J	0.0042 0.0052 0.0035	0.0067 0.0067 0.0067	LOQ LOQ LOQ	mg/kg mg/kg mg/kg	J (all detects)
GP-11-CD14-10	BENZO(A)ANTHRACENE	J	0.0076	0.015	LOQ	mg/kg	J (all detects)
GP-11-CD14-5	BENZO(A)ANTHRACENE BENZO(A)PYRENE Total Benzofluoranthenes	J J J	0.0039 0.0030 0.0047	0.0049 0.0049 0.0049	LOQ LOQ LOQ	mg/kg mg/kg mg/kg	J (all detects)
GP-11-CD18-10	CHRYSENE DIBENZO(A,H)ANTHRACENE	J J	0.050 0.0033	0.097 0.0049	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD18-15	BENZO(A)ANTHRACENE BENZO(A)PYRENE Total Benzofluoranthenes	J J J	0.0096 0.0061 0.0067	0.012 0.012 0.012	LOQ LOQ LOQ	mg/kg mg/kg mg/kg	J (all detects)

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD14-10MSD (GP-11-CD14-10)	NAPHTHALENE	-	68.1	71.00-122.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)

Method: 8270D SIM
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD14-10MS GP-11-CD14-10MSD (GP-11-CD14-10)	1-Methylnaphthalene 2-METHYLNAPHTHALENE	-26.2 -57.7	-25.5 -47	39.00-120.00 35.00-120.00	- -	1-Methylnaphthalene 2-METHYLNAPHTHALENE	J-(all detects) R(all non-detects)
GP-11-CD14-10MS GP-11-CD14-10MSD (GP-11-CD14-10)	CHRYSENE NAPHTHALENE	43.4 22.5	- 19.4	48.00-120.00 36.00-120.00	- -	CHRYSENE NAPHTHALENE	J-(all detects) UJ(all non-detects)

Surrogate Outlier Report

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method: **8270D SIM**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-CD13-5 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD18-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	

Field Duplicate RPD Report

Lab Reporting Batch ID: AA32-150420 **Laboratory: ARIS**

EDD Filename: aa32 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD18-10	GP-11-CD181-10			
ETHYLBENZENE	0.0060	0.010	50	40.00	
NAPHTHALENE	0.033	0.039	17	40.00	No Qualifiers Applied
TOLUENE	0.0014	0.0019	30	40.00	

Method: 8270D SIM
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD18-10	GP-11-CD181-10			
1-Methylnaphthalene	2.8	1.8	43	40.00	
2-METHYLNAPHTHALENE	1.3	0.77	51	40.00	
BENZO(A)ANTHRACENE	0.038	0.033	14	40.00	
BENZO(A)PYRENE	0.027	0.024	12	40.00	
CHRYSENE	0.050	0.049	2	40.00	No Qualifiers Applied
DIBENZO(A,H)ANTHRACENE	0.0033	0.020 U	200	40.00	
INDENO(1,2,3-CD)PYRENE	0.011	0.020 U	200	40.00	
NAPHTHALENE	0.11	0.089	21	40.00	
Total Benzofluoranthenes	0.050	0.051	2	40.00	

Project Name and Number: Task Order #18 - Makah

EDD Warning Log

Lab Reporting Batch ID: AA32-150420

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	550	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQRB3.

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015
Reviewer: Jacob Williams

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
AB05	9	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AB06	2	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AB07	11	soil	VOCs	8260	EPA Stage 2a
AB58	10	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AB59	11	soil (10) AQ (1)	VOCs	8260	EPA Stage 2a

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Attachment 1 – Output reports generated by ADR.net.

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This section describes the data review findings for NWTPH-Dx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None

2.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions.

SDG	Comments
AB06	SDGs AB06 and AB05 were run together and thus shared one MS/MSD result.

Percent recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AB05	GP-05-V1-7	DRO	J- (detects) UJ (all non-detects)	MSD % recovery was out of control low.

2.6 Laboratory Duplicates

A laboratory duplicate is not required by QAPP as long as a matrix spike duplicate is performed.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

Exceptions: None

2.8 Trip Blank

The following trip blanks were reviewed: None

2.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed: None

2.10 Field Duplicate Samples

The following field duplicate(s) were collected as part of the SDGs reviewed:

SDG	Sample	Parent Sample	Flag	Notes
AB58	GP-05-TUV41-3	GP-05-TUV4-3	None	Diesel & Motor oil RPDs are greater than 40%. This may suggest that sample material was not sufficiently homogenized.

All field duplicate RPDs are within the QAPP-defined control limit of 40%.

3 Volatile Organic Compounds (8260)

The following SDGs contained samples analyzed for 8260.

3.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

No exceptions.

3.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

No exceptions.

3.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

3.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

3.5 MS/MSD

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AB07	GP-050V1-7	Naphthalene	None	RPD NA due to high concentration in original sample.
AB07	GP-050V1-7	1,2-dibromoethane, benzene, ethylbenzene, m,p-xylene, o-xylene, toluene	J- (all detects) UJ (all non-detects)	All MS & MSD (with the exception of benzene MS) %recovery out of control low.
AB59	GP-05-TUV1-8	Naphthalene	J- (all detects) UJ (all non-detects)	MS & MSD %recovery out of control low.
AB59	GP-05-TUV1-8	m,p-Xylene	J- (all detects) UJ (all non-detects)	MS %recovery out of control low.

3.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits.

3.8 Trip Blanks

The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
AB59	AQTB6	None	All within control limits

3.9 Equipment (Rinsate) Blank
The following equipment blanks were reviewed: None

3.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Sample	Parent Sample	Flag	Notes
AB59	GP-05-TUV41-3	GP-05-TUV4-3	None	All RPDs within control limits.

4 Data Usability Assessment
This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

4.1 Precision
Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. All MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

- AB58 Field duplicate RPD for Dx

The overall precision of the data set is considered acceptable.

4.2 Accuracy
Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- AB05 MSD %Recovery for Dx
- AB07 MS %Recovery for 8260
- AB07 MSD %Recovery for 8260

4.3 Representativeness
Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. The representativeness of the project data is considered acceptable.

4.4 Completeness
Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

4.5 Sensitivity
The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

5 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

6 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: AB05-150324 **Laboratory: ARIS**

EDD Filename: ab05 **eQAPP Name: Makah 20150421_v3**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-05-V1-7** ***Collected:*** **3/16/2015 1:50:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
DIESEL RANGE ORGANICS	1200		17	DL	63	LOQ	mg/kg	J-	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB05-150324 **Laboratory: ARIS**

EDD Filename: ab05 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AB05-150324
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB05-150324 **Laboratory: ARIS**

EDD Filename: ab05 **eQAPP Name: Makah 20150421**

Method: **NWTPH-DX**
Matrix: **SO**

QC Sample ID (Associated Samples)	*Compound*	*MS %R*	*MSD %R*	*%R Limits*	*RPD (Limits)*	*Affected Compounds*	*Flag*
GP-05-V1-7MSD (GP-05-V1-7)	DIESEL RANGE ORGANICS	-	60.6	62.00-120.00	-	DIESEL RANGE ORGANICS	J- (all detects) UJ (all non-detects)

Data Qualifier Summary

Lab Reporting Batch ID: AB06-150324

Laboratory: ARIS

EDD Filename: ab06

eQAPP Name: Makah 20150421_v3

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: AB06-150324
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

EDD Warning Log

Lab Reporting Batch ID: AB06-150324

eQAPP: Makah 20150421_v3 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch SW3546-201503191215 is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-DX
Sample Analysis				38	MethodBatch SW3546-201503191215 is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-DX

Data Qualifier Summary

Lab Reporting Batch ID: AB07-150420 **Laboratory: ARIS**

EDD Filename: ab07 **eQAPP Name: Makah 20150421_v3**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-05-T1-5** ***Collected:*** **3/16/2015 2:55:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.17**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-T1-8** ***Collected:*** **3/16/2015 2:55:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.09**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0010	J	0.00043	DL	0.0011	LOQ	mg/Kg	J	RI
TOLUENE	0.0008	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-T2-10** ***Collected:*** **3/16/2015 12:15:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **0.97**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.0008	J	0.00022	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-T2-12** ***Collected:*** **3/16/2015 12:15:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.05**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0008	J	0.00041	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-T3-12** ***Collected:*** **3/16/2015 1:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.03**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0005	J	0.00016	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-V1-7** ***Collected:*** **3/16/2015 1:50:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.24**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1,2-DIBROMOETHANE	0.0012	U	0.00022	DL	0.0012	LOQ	mg/Kg	UJ	Ms
BENZENE	0.0008	J	0.00037	DL	0.0012	LOQ	mg/Kg	J	RI, Ms
ETHYLBENZENE	0.010		0.00025	DL	0.0012	LOQ	mg/Kg	J-	Ms
m,p-Xylene	0.0063		0.00049	DL	0.0012	LOQ	mg/Kg	J-	Ms
O-XYLENE	0.0031		0.00028	DL	0.0012	LOQ	mg/Kg	J-	Ms
TOLUENE	0.0016		0.00019	DL	0.0012	LOQ	mg/Kg	J-	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB07-150420 **Laboratory: ARIS**

EDD Filename: ab07 **eQAPP Name: Makah 20150421_v3**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-05-V3-8** ***Collected:*** **3/16/2015 2:35:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.17**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0010	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB07-150420 **Laboratory: ARIS**

EDD Filename: ab07 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Lower Rejection
Ms	Matrix Spike Precision
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: AB07-150420
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB07-150420 **Laboratory: ARIS**

EDD Filename: ab07 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **SO**

QC Sample ID (Associated Samples)	*Compound*	*MS %R*	*MSD %R*	*%R Limits*	*RPD (Limits)*	*Affected Compounds*	*Flag*
GP-05-V1-7MS GP-05-V1-7MSD (GP-05-V1-7)	NAPHTHALENE	0	0	71.00-122.00	34.7 (30.00)	NAPHTHALENE	J (all detects) R (all non-detects)
GP-05-V1-7MS GP-05-V1-7MSD (GP-05-V1-7)	1,2-DIBROMOETHANE BENZENE ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	67.2 - 50.4 54.7 53.9 72.5	59.6 77.7 59.1 59.7 57.8 68.1	79.00-120.00 80.00-120.00 80.00-120.00 80.00-123.00 80.00-120.00 78.00-120.00	- - - - - -	1,2-DIBROMOETHANE BENZENE ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	J-(all detects) UJ(all non-detects)

Reporting Limit Outliers

Lab Reporting Batch ID: AB07-150420 **Laboratory: ARIS**

EDD Filename: ab07 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-05-T1-5	TOLUENE	J	0.0006	0.0012	LOQ	mg/Kg	J (all detects)
GP-05-T1-8	m,p-Xylene TOLUENE	J J	0.0010 0.0008	0.0011 0.0011	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-05-T2-10	O-XYLENE	J	0.0008	0.0010	LOQ	mg/Kg	J (all detects)
GP-05-T2-12	m,p-Xylene	J	0.0008	0.0011	LOQ	mg/Kg	J (all detects)
GP-05-T3-12	TOLUENE	J	0.0005	0.0010	LOQ	mg/Kg	J (all detects)
GP-05-V1-7	BENZENE	J	0.0008	0.0012	LOQ	mg/Kg	J (all detects)
GP-05-V3-8	TOLUENE	J	0.0010	0.0012	LOQ	mg/Kg	J (all detects)

Data Qualifier Summary

Lab Reporting Batch ID: AB58-150326 **Laboratory: ARIS**

EDD Filename: ab58 **eQAPP Name: Makah 20150421_v3**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-05-TUV1-8** ***Collected:*** **3/18/2015 10:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
MOTOR OILS	9.2	J	2.8	DL	11	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB58-150326 **Laboratory: ARIS**

EDD Filename: ab58 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AB58-150326
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date
Field QC Sample: GP-05-TUV41-3 **QC Type:** FD		
	GP-05-TUV4-3	3/18/2015 12:30:00 PM

Field Duplicate RPD Report

Lab Reporting Batch ID: AB58-150326 **Laboratory: ARIS**

EDD Filename: ab58 **eQAPP Name: Makah 20150427**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-05-TUV4-3	GP-05-TUV41-3			
DIESEL RANGE ORGANICS	1100	99	167	40.00	No Qualifiers Applied
MOTOR OILS	1600	120	172	40.00	

Project Name and Number: Task Order #18 - USACE Project: Makah

Reporting Limit Outliers

Lab Reporting Batch ID: AB58-150326 **Laboratory: ARIS**

EDD Filename: ab58 **eQAPP Name: Makah 20150421_v3**

Method: **NWTPH-DX**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-05-TUV1-8	MOTOR OILS	J	9.2	11	LOQ	mg/kg	J (all detects)

Data Qualifier Summary

Lab Reporting Batch ID: AB59-150420 **Laboratory: ARIS**

EDD Filename: ab59 **eQAPP Name: Makah 20150421_v3**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-05-TUV1-5** ***Collected:*** **3/18/2015 10:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.97**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0008	J	0.00015	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: **GP-05-TUV1-8** ***Collected:*** **3/18/2015 10:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.91**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
m,p-Xylene	0.0009	U	0.00036	DL	0.0009	LOQ	mg/Kg	UJ	Ms
NAPHTHALENE	0.0045	U	0.00039	DL	0.0045	LOQ	mg/Kg	UJ	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB59-150420 **Laboratory: ARIS**

EDD Filename: ab59 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AB59-150420
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date
Field QC Sample: AQTB6 **QC Type:** TB		
	GP-05-TUV1-5	3/18/2015 10:50:00 AM
	GP-05-TUV1-8	3/18/2015 10:50:00 AM
	GP-05-TUV2-10	3/18/2015 11:30:00 AM
	GP-05-TUV2-5	3/18/2015 11:30:00 AM
	GP-05-TUV3-5	3/18/2015 12:10:00 PM
	GP-05-TUV3-6	3/18/2015 12:10:00 PM
	GP-05-TUV41-3	3/18/2015 12:50:00 PM
	GP-05-TUV4-3	3/18/2015 12:30:00 PM
	GP-05-U3-5	3/18/2015 10:20:00 AM
	GP-05-U3-9	3/18/2015 10:20:00 AM
Field QC Sample: GP-05-TUV41-3 **QC Type:** FD		
	GP-05-TUV4-3	3/18/2015 12:30:00 PM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB59-150420 **Laboratory: ARIS**

EDD Filename: ab59 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **SO**

QC Sample ID (Associated Samples)	*Compound*	*MS %R*	*MSD %R*	*%R Limits*	*RPD (Limits)*	*Affected Compounds*	*Flag*
GP-05-TUV1-8MS GP-05-TUV1-8MSD (GP-05-TUV1-8)	m,p-Xylene NAPHTHALENE	79.2 47.3	- 56.5	80.00-123.00 71.00-122.00	- -	m,p-Xylene NAPHTHALENE	J- (all detects) UJ (all non-detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: AB59-150420

Laboratory: ARIS

EDD Filename: ab59

eQAPP Name: Makah 20150427

No Field Duplicate Data

Reporting Limit Outliers

Lab Reporting Batch ID: AB59-150420 **Laboratory: ARIS**

EDD Filename: ab59 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-05-TUV1-5	TOLUENE	J	0.0008	0.0010	LOQ	mg/Kg	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: AB59-150420

eQAPP: Makah 20150421_v3 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	186	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQTB6.

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015
Reviewer: H. Fourie

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
ZZ28	2	Soil	DRO & Motor Oils, GRO	NWTPH-Dx NWTPH-Gx	Stage 2A
ZZ29	13	Soil	DRO & Motor Oils, GRO	NWTPH-Dx NWTPH-Gx	Stage 2A
	1	AQ	GRO	NWTPH-Gx	Stage 2A
ZZ88	12	Soil	DRO & Motor Oils	NWTPH-Dx	Stage 2A
	3	Soil	GRO	NWTPH-Gx	Stage 2A
ZZ89	12	Soil	VOCs	8260	Stage 2A
	1	AQ	VOCs	8260	Stage 2A
	3	Soil	SVOCs	8270	Stage 2A
	3	Soil	Metals (Pb)	6020	Stage 2A
AA31	19	Soil	DRO & Motor Oils	NWTPH-Dx	Stage 2A
	6	Soil	GRO	NWTPH-Gx	Stage 2A

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Attachment 1 – Output reports generated by ADR.net.

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This section describes the data review findings for NWTPH-Dx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None

2.4 Method Blanks

[Check that method blank was run with each SDG. Check for any contamination]

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions

Exceptions: None

Percent recoveries and RPDs are within control limits with the following exceptions: None

2.6 Laboratory Duplicates

A laboratory duplicate is not required by QAPP as long as a matrix spike duplicate is performed.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

SDG	Sample	Flag	Notes
AA31	GP-11-CD18-10 GP-11-CD181-10	J- (all detects) UJ (all non-detects)	Surrogate not recovered due to chromatographic interference and/or surrogate was lost due to required sample extract dilution.

2.8 Trip Blank

Trip blanks are not required for this analysis.

2.9 Equipment (Rinsate) Blank
The following equipment blanks were reviewed: None

2.10 Field Duplicate Samples
The following field duplicate(s) were collected as part of the SDGs reviewed:

SDG	Sample	Parent Sample	Flag	Notes
ZZ29	GP-11-E51-15	GP-11-E5-15	None	RPDs within control limits.
ZZ88	GP-11-CD151-10	GP-11-CD15-10	None	RPDs within control limits or not applicable because concentrations are <5x LOQ.
AA31	GP-11-CD181-10	GP-11-CD18-10	None	RPDs within control limits or not applicable because concentrations are < 5x LOQ.

3 Gasoline Range Organics (NWTPH-Gx)
This section describes the data review findings for NWTPH-Gx.

3.1 Sampling Documentation
All samples were received under proper chain of custody with the following exceptions:

No exceptions.

3.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

No exceptions.

3.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG or at a frequency of 1 LCS/LCSD pair per 20 samples with the following exceptions:

SDG	Comments
ZZ29	ZZ28 and ZZ29 were run together and thus shared an LCS/LCSD pair.

All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

3.4 Method Blanks
A minimum of one method blank was analyzed with each SDG or at a frequency of one method blank per 20 samples. No target analytes were detected in the method blanks.

Exceptions: None

3.5 MS/MSD
One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

SDG	Comments
ZZ29	ZZ28 and ZZ29 were run together and thus shared an MS/MSD result.
ZZ88	No MS/MSD due to insufficient sample volume provided to lab. LCS/LCSD was run. No data qualified.
AA31	No MS/MSD due to insufficient sample volume provided to lab. LCS/LCSD was run. No data qualified.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

SDG	Parent Sample	Analyte	Flag	Notes
ZZ29	GP-11-E8-10	GRO	J (all detects)	RPD slightly exceeds control limit of 30%.

3.6 Laboratory Duplicates
A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

3.8 Trip Blanks
The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
ZZ29	AQTB2	None	No target analytes detected.

3.9 Equipment (Rinsate) Blank
The following equipment blanks were reviewed: None

3.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ59	GP-11-E51-15	GP-11-E5-15	None	RPDs within control limits or not applicable.

4 Volatile Organic Compounds (8260)
This section describes the data review findings for 8260.

Sample GP-11-CD15-15 was mis-labeled as GP-11-CD15-15 within the laboratory database. Sample ID as been corrected in all references here in the DVR.

4.1 Sampling Documentation
All samples were received under proper chain of custody. Sample GP-11-CD15-15 was mis-entered into the laboratory database as GP-11-CD15-15. Sample ID as been corrected in all references here in the DVR, but remains listed as “GP-11-CD15-15” in the laboratory’s pdf data package.

4.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

No exceptions.

4.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG or at a frequency of 1 LCS/LCSD per 20 samples with the following exceptions:

SDG	Comments
ZZ89	No LCS was run from ZZ89. SDGs ZZ89 and AA08 were run together and shared an LCS. No data qualified.

All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.4 Method Blanks
A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

4.5 MS/MSD
One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

SDG	Comments
ZZ89	Insufficient sample was provided for an MS/MSD pair. SDGs ZZ89 and AA08 were run together and shared an MS/MSD pair. No data qualified.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.6 Laboratory Duplicates
A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

4.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

4.8 Trip Blanks
The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
ZZ89	AQTB4	None	No target analytes detected.

4.9 Equipment (Rinsate) Blank
The following equipment blanks were reviewed: None

4.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ89	GP-11-CD151-10	GP-11-CD15-10	None	RPDs not applicable because detected target analyte concentrations are < 5x LOQ.

5 Semi-Volatile Organic Compounds (8270 SIM)
This section describes the data review findings for 8270D SIM.

5.1 Sampling Documentation
All samples were received under proper chain of custody. Sample GP-11-CD15-15 was mis-entered into the laboratory database as GP-11-CD15-15. Sample ID as been corrected in all references here in the DVR, but remains listed as “GP-11-CD15-15” in the laboratory’s pdf data package.

5.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples.

5.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

SDG	Comments
ZZ89	Lab did not run an MS/MSD from ZZ89. SDGs ZZ89 and AA08 shared an MS/MSD pair. No data qualified.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.6 Laboratory Duplicates

A laboratory duplicate was not run for 8270 SIM. A laboratory duplicate is not required if a matrix spike duplicate is run.

5.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

5.8 Trip Blank

Trip blanks are not required for this analysis.

5.9 Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

5.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ89	GP-11-CD151-10	GP-11-CD15-10	None	RPDs not applicable because detected target analyte concentrations are < 5x LOQ.

6 Metals (6020)

This section describes the data review findings for metals.

6.1 Sampling Documentation

All samples were received under proper chain of custody. Sample GP-11-CD15-15 was mis-entered into the laboratory database as GP-11-CD15-15. Sample ID as been corrected in all references here in the DVR, but remains listed as “GP-11-CD15-15” in the laboratory’s pdf data package.

6.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

No exceptions.

6.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

6.5 MS

One matrix spike was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries are within control limits with the following exceptions:

Exceptions: None

6.6 Laboratory Duplicates

A laboratory duplicate is required. A minimum of one laboratory duplicate was analyzed with each SDG or at a frequency of 1 duplicate per 20 samples with the following exceptions:

Exceptions: None

All laboratory duplicate RPDs are within control limits with the following exceptions:

Exceptions: None

6.7 Surrogate Spike Performance

Surrogates are not part of the method.

6.8 Trip Blanks

Trip blanks are not required for this analysis.

6.9 Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

6.10 Field Duplicate Samples

The following field duplicate(s) were reviewed: None

7 Data Usability Assessment

This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

7.1 Precision

Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. All MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

No exceptions

The overall precision of the data set is considered acceptable.

7.2 Accuracy

Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- AA08 MSD %Recovery for 8260
- AA06 MS %Recovery
- AA08 Surrogate %Recovery

7.3 Representativeness

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. The criteria for representativeness were within control limits with the following exceptions:

No exceptions.

7.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

7.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

8 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

9 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: ZZ28-150317

Laboratory: ARIS

EDD Filename: zz28

eQAPP Name: Makah 20150427

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: ZZ28-150317
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZZ29-150317 **Laboratory: ARIS**

EDD Filename: zz29 **eQAPP Name: Makah 20150427**

Method: **NWTPH-GX**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-E8-10MSD (GP-11-E8-10)	GASOLINE RANGE ORGANICS	-	-	80.00-120.00	31.5 (30.00)	GASOLINE RANGE ORGANICS	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: ZZ28-150317

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	6	ReportingLimit	140	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	12	ReportingLimit	70	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	17	ReportingLimit	70.3	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	22	ReportingLimit	70.3	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID		Sample Type	Preparation Method		Validation Code
Lab Reporting Batch: ZZ28-150317					
Method: NWTPH-DX					
GP-11-E11-15	15-4226-ZZ28A	SO	N	SW3546	3/5/2015 11:10:00 AM	S2AVE
GP-11-E6-10	15-4227-ZZ28B	SO	N	SW3546	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MS	15-4227-ZZ28BMS	SO	MS	SW3546	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MSD	15-4227-ZZ28BMSD	SO	MSD	SW3546	3/5/2015 10:35:00 AM	S2AVE
Method: NWTPH-GX					
GP-11-E11-15	15-4226-ZZ28A	SO	N	SW5035	3/5/2015 11:10:00 AM	S2AVE
GP-11-E6-10	15-4227-ZZ28B	SO	N	SW5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MS	15-4227-ZZ28BMS	SO	MS	SW5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MSD	15-4227-ZZ28BMSD	SO	MSD	SW5035	3/5/2015 10:35:00 AM	S2AVE
Lab Reporting Batch: ZZ29-150317					
Method: NWTPH-DX					
GP-11-E10-10	15-4234-ZZ29G	SO	N	SW3546	3/5/2015 9:05:00 AM	S2AVE
GP-11-E10-15	15-4235-ZZ29H	SO	N	SW3546	3/5/2015 9:05:00 AM	S2AVE
GP-11-E11-10	15-4228-ZZ29A	SO	N	SW3546	3/5/2015 11:10:00 AM	S2AVE
GP-11-E5-10	15-4232-ZZ29E	SO	N	SW3546	3/5/2015 8:10:00 AM	S2AVE
GP-11-E51-15	15-4233-ZZ29F	SO	FD	SW3546	3/5/2015 8:30:00 AM	S2AVE
GP-11-E5-15	15-4231-ZZ29D	SO	N	SW3546	3/5/2015 8:10:00 AM	S2AVE
GP-11-E6-15	15-4238-ZZ29K	SO	N	SW3546	3/5/2015 10:35:00 AM	S2AVE
GP-11-E7-10	15-4229-ZZ29B	SO	N	SW3546	3/5/2015 1:15:00 PM	S2AVE
GP-11-E7-15	15-4230-ZZ29C	SO	N	SW3546	3/5/2015 1:15:00 PM	S2AVE
GP-11-E8-10	15-4240-ZZ29M	SO	N	SW3546	3/5/2015 2:00:00 PM	S2AVE
GP-11-E8-5	15-4239-ZZ29L	SO	N	SW3546	3/5/2015 2:00:00 PM	S2AVE
GP-11-E9-10	15-4237-ZZ29J	SO	N	SW3546	3/5/2015 9:50:00 AM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

	Lab Sample ID		Sample Type	Preparation Method		Validation Code
Method: NWTPH-DX						
GP-11-E9-5	15-4236-ZZ29I	SO	N	SW3546	3/5/2015 9:50:00 AM	S2AVE
GP-11-E9-5MS	15-4236-ZZ29IMS	SO	MS	SW3546	3/5/2015 9:50:00 AM	S2AVE
GP-11-E9-5MSD	15-4236-ZZ29IMSD	SO	MSD	SW3546	3/5/2015 9:50:00 AM	S2AVE
Method: NWTPH-GX						
AQTB2	15-4241-ZZ29N	AQ	TB	SW5030B	3/5/2015	S2AVE
GP-11-E10-10	15-4234-ZZ29G	SO	N	SW5035	3/5/2015 9:05:00 AM	S2AVE
GP-11-E10-15	15-4235-ZZ29H	SO	N	SW5035	3/5/2015 9:05:00 AM	S2AVE
GP-11-E11-10	15-4228-ZZ29A	SO	N	SW5035	3/5/2015 11:10:00 AM	S2AVE
GP-11-E5-10	15-4232-ZZ29E	SO	N	SW5035	3/5/2015 8:10:00 AM	S2AVE
GP-11-E51-15	15-4233-ZZ29F	SO	FD	SW5035	3/5/2015 8:30:00 AM	S2AVE
GP-11-E5-15	15-4231-ZZ29D	SO	N	SW5035	3/5/2015 8:10:00 AM	S2AVE
GP-11-E6-15	15-4238-ZZ29K	SO	N	SW5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E7-10	15-4229-ZZ29B	SO	N	SW5035	3/5/2015 1:15:00 PM	S2AVE
GP-11-E7-15	15-4230-ZZ29C	SO	N	SW5035	3/5/2015 1:15:00 PM	S2AVE
GP-11-E8-10	15-4240-ZZ29M	SO	N	SW5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E8-10MS	15-4240-ZZ29MMS	SO	MS	SW5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E8-10MSD	15-4240-ZZ29MMSD	SO	MSD	SW5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E8-5	15-4239-ZZ29L	SO	N	SW5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E9-10	15-4237-ZZ29J	SO	N	SW5035	3/5/2015 9:50:00 AM	S2AVE
GP-11-E9-5	15-4236-ZZ29I	SO	N	SW5035	3/5/2015 9:50:00 AM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID	Sample Type	Preparation Method	Validation Code

Validation Label Legend

Label Code	Label Decription	EPA Level
S1VE	Stage_1_Validation_Electronic	N/A
S1VM	Stage_1_Validation_Manual	N/A
S1VEM	Stage_1_Validation_Electronic_and_Manual	N/A
S2AVE	Stage_2A_Validation_Electronic	Level 3 w/o calibration
S2AVM	Stage_2A_Validation_Manual	Level 3 w/o calibration
S2AVEM	Stage_2A_Validation_Electronic_and_Manual	Level 3 w/o calibration
S2BVE	Stage_2B_Validation_Electronic	Level 3 with calibration
S2BVM	Stage_2B_Validation_Manual	Level 3 with calibration
S2BVEM	Stage_2B_Validation_Electronic_and_Manual	Level 3 with calibration
S3VE	Stage_3_Validation_Electronic	Level 4
S3VM	Stage_3_Validation_Manual	Level 4
S3VEM	Stage_3_Validation_Electronic_and_Manual	Level 4
S4VE	Stage_4_Validation_Electronic	Level 4
S4VM	Stage_4_Validation_Manual	Level 4
S4VEM	Stage_4_Validation_Electronic_and_Manual	Level 4
NV	Not_Validated	N/A

Data Qualifier Summary

Lab Reporting Batch ID: ZZ29-150317

Laboratory: ARIS

EDD Filename: zz29

eQAPP Name: Makah 20150427

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: ZZ29-150317
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQTB2 **QC Type:** TB		
	GP-11-E10-10	3/5/2015 9:05:00 AM
	GP-11-E10-15	3/5/2015 9:05:00 AM
	GP-11-E11-10	3/5/2015 11:10:00 AM
	GP-11-E5-10	3/5/2015 8:10:00 AM
	GP-11-E51-15	3/5/2015 8:30:00 AM
	GP-11-E5-15	3/5/2015 8:10:00 AM
	GP-11-E6-15	3/5/2015 10:35:00 AM
	GP-11-E7-10	3/5/2015 1:15:00 PM
	GP-11-E7-15	3/5/2015 1:15:00 PM
	GP-11-E8-10	3/5/2015 2:00:00 PM
	GP-11-E8-5	3/5/2015 2:00:00 PM
	GP-11-E9-10	3/5/2015 9:50:00 AM
	GP-11-E9-5	3/5/2015 9:50:00 AM
Field QC Sample: GP-11-E51-15 **QC Type:** FD		
	GP-11-E5-15	3/5/2015 8:10:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ29-150317

Laboratory: ARIS

EDD Filename: zz29

eQAPP Name: Makah 20150427

No Field Duplicate Data

EDD Warning Log

Lab Reporting Batch ID: ZZ29-150317

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	21	ReportingLimit	140	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).

Data Qualifier Summary

Lab Reporting Batch ID: ZZ88-150317 **Laboratory: ARIS**

EDD Filename: zz88 **eQAPP Name: Makah 20150427**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-11-A10-10** ***Collected:*** **3/10/2015 3:05:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	10	J	3.0	DL	12	LOQ	mg/kg	J	RI

Sample ID: **GP-11-A10-15** ***Collected:*** **3/10/2015 3:05:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	3.9	J	1.6	DL	6.1	LOQ	mg/kg	J	RI

Sample ID: **GP-11-A8-15** ***Collected:*** **3/10/2015 2:35:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	7.4	J	3.1	DL	13	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD15-10** ***Collected:*** **3/10/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	4.2	J	1.6	DL	5.8	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD151-10** ***Collected:*** **3/10/2015 10:45:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	4.9	J	1.6	DL	6.1	LOQ	mg/kg	J	RI
MOTOR OILS	8.8	J	3.0	DL	12	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ88-150317

Laboratory: ARIS

EDD Filename: zz88

eQAPP Name: Makah 20150427

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ88-150317
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD151-10 **QC Type:** FD		
	GP-11-CD15-10	3/10/2015 10:35:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ88-150317 **Laboratory: ARIS**

EDD Filename: zz88 **eQAPP Name: Makah 20150427**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD15-10	GP-11-CD151-10			
DIESEL RANGE ORGANICS	4.2	4.9	15	40.00	No Qualifiers Applied
MOTOR OILS	12 U	8.8	200	40.00	

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ88-150317 **Laboratory: ARIS**

EDD Filename: zz88 **eQAPP Name: Makah 20150427**

Method: **NWTPH-DX**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-11-A10-10	MOTOR OILS	J	10	12	LOQ	mg/kg	J (all detects)
GP-11-A10-15	DIESEL RANGE ORGANICS	J	3.9	6.1	LOQ	mg/kg	J (all detects)
GP-11-A8-15	MOTOR OILS	J	7.4	13	LOQ	mg/kg	J (all detects)
GP-11-CD15-10	DIESEL RANGE ORGANICS	J	4.2	5.8	LOQ	mg/kg	J (all detects)
GP-11-CD151-10	DIESEL RANGE ORGANICS MOTOR OILS	J J	4.9 8.8	6.1 12	LOQ LOQ	mg/kg mg/kg	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: ZZ88-150317

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch P1031215A is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-GX
Sample Analysis				38	MethodBatch P1031215A is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-GX

Data Qualifier Summary

Lab Reporting Batch ID: ZZ89-150420 **Laboratory: ARIS**

EDD Filename: zz89 **eQAPP Name: Makah 20150427**

Method Category: SVOA

Method: 8270D SIM **Matrix: SO**

Sample ID: GP-11-CD15-10 **Collected:** 3/10/2015 10:35:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0033	J	0.0018	DL	0.0046	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD15-5 **Collected:** 3/10/2015 10:35:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
Total Benzofluoranthenes	0.0026	J	0.0023	DL	0.0049	LOQ	mg/kg	J	RI

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-06-RS7-3 **Collected:** 3/10/2015 9:45:00 AM **Analysis Type:** RES **Dilution:** 1.20

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: GP-06-RS8-2 **Collected:** 3/10/2015 9:10:00 AM **Analysis Type:** RES **Dilution:** 0.97

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00015	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-11-A10-10 **Collected:** 3/10/2015 3:05:00 PM **Analysis Type:** RES **Dilution:** 1.02

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00015	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-11-A8-10 **Collected:** 3/10/2015 2:35:00 PM **Analysis Type:** RES **Dilution:** 1.16

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0009	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: GP-11-A9-10 **Collected:** 3/10/2015 1:45:00 PM **Analysis Type:** RES **Dilution:** 1.04

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0007	J	0.00016	DL	0.0010	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ89-150420 **Laboratory: ARIS**

EDD Filename: zz89 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-A9-5** ***Collected:*** **3/10/2015 1:45:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.17**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0006	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD151-10** ***Collected:*** **3/10/2015 10:45:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.24**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0006	J	0.00019	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD15-5** ***Collected:*** **3/10/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.14**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
TOLUENE	0.0006	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ89-150420

Laboratory: ARIS

EDD Filename: zz89

eQAPP Name: Makah 20150427

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ89-150420
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQTB4 **QC Type:** TB		
	GP-06-RS5-3	3/10/2015 8:45:00 AM
	GP-06-RS7-3	3/10/2015 9:45:00 AM
	GP-06-RS8-2	3/10/2015 9:10:00 AM
	GP-11-A10-10	3/10/2015 3:05:00 PM
	GP-11-A10-15	3/10/2015 3:05:00 PM
	GP-11-A8-10	3/10/2015 2:35:00 PM
	GP-11-A8-15	3/10/2015 2:35:00 PM
	GP-11-A9-10	3/10/2015 1:45:00 PM
	GP-11-A9-5	3/10/2015 1:45:00 PM
	GP-11-CD15-10	3/10/2015 10:35:00 AM
	GP-11-CD151-10	3/10/2015 10:45:00 AM
	GP-11-CD15-5	3/10/2015 10:35:00 AM
Field QC Sample: GP-11-CD151-10 **QC Type:** FD		
	GP-11-CD15-10	3/10/2015 10:35:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ89-150420 **Laboratory: ARIS**

EDD Filename: zz89 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD15-10	GP-11-CD151-10			
TOLUENE	0.0013	0.0006	74	40.00	No Qualifiers Applied

Method: 8270D SIM
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD15-10	GP-11-CD151-10			
1-METHYLNAPHTHALENE	0.018	0.0074	83	40.00	No Qualifiers Applied
2-METHYLNAPHTHALENE	0.024	0.010	82	40.00	
CHRYSENE	0.0033	0.0050 U	200	40.00	
NAPHTHALENE	0.011	0.0050	75	40.00	

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ89-150420 **Laboratory: ARIS**

EDD Filename: zz89 **eQAPP Name: Makah 20150427**

Method: 8260C

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-06-RS7-3	TOLUENE	J	0.0006	0.0012	LOQ	mg/Kg	J (all detects)
GP-06-RS8-2	TOLUENE	J	0.0008	0.0010	LOQ	mg/Kg	J (all detects)
GP-11-A10-10	TOLUENE	J	0.0006	0.0010	LOQ	mg/Kg	J (all detects)
GP-11-A8-10	TOLUENE	J	0.0009	0.0012	LOQ	mg/Kg	J (all detects)
GP-11-A9-10	TOLUENE	J	0.0007	0.0010	LOQ	mg/Kg	J (all detects)
GP-11-A9-5	TOLUENE	J	0.0006	0.0012	LOQ	mg/Kg	J (all detects)
GP-11-CD151-10	TOLUENE	J	0.0006	0.0012	LOQ	mg/Kg	J (all detects)
GP-11-CD15-5	TOLUENE	J	0.0006	0.0011	LOQ	mg/Kg	J (all detects)

Method: 8270D SIM

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD15-10	CHRYSENE	J	0.0033	0.0046	LOQ	mg/kg	J (all detects)
GP-11-CD15-5	Total Benzofluoranthenes	J	0.0026	0.0049	LOQ	mg/kg	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: ZZ89-150420

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	259	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQTB4.

Data Qualifier Summary

Lab Reporting Batch ID: AA31-150322 **Laboratory: ARIS**

EDD Filename: aa31 **eQAPP Name: Makah 20150427**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-11-CD12-10** ***Collected:*** **3/12/2015 12:25:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	3.3	J	1.6	DL	5.9	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD12-5** ***Collected:*** **3/12/2015 12:25:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	4.8	J	1.5	DL	5.6	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD18-10** ***Collected:*** **3/12/2015 10:20:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	100		2.9	DL	12	LOQ	mg/kg	J-	Surr

Sample ID: **GP-11-CD181-10** ***Collected:*** **3/12/2015 10:50:00 AM** ***Analysis Type:*** **DL** ***Dilution:*** **50.0**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	3700		73	DL	270	LOQ	mg/kg	J-	ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA31-150322 **Laboratory: ARIS**

EDD Filename: aa31 **eQAPP Name: Makah 20150427**

Reason Code Legend

Reason Code	*Description*
ProfJudg	Professional Judgment
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: AA31-150322
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD181-10 **QC Type:** FD		
	GP-11-CD18-10	3/12/2015 10:20:00 AM
	GP-11-CD18-10	3/12/2015 10:20:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: AA31-150322 **Laboratory: ARIS**

EDD Filename: aa31 **eQAPP Name: Makah 20150427**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD18-10	GP-11-CD181-10			
DIESEL RANGE ORGANICS	3600	3700	3	40.00	No Qualifiers Applied
MOTOR OILS	100	110 U	200	40.00	

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: AA31-150322 **Laboratory: ARIS**

EDD Filename: aa31 **eQAPP Name: Makah 20150427**

Method: **NWTPH-DX**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-11-CD12-10	DIESEL RANGE ORGANICS	J	3.3	5.9	LOQ	mg/kg	J (all detects)
GP-11-CD12-5	DIESEL RANGE ORGANICS	J	4.8	5.6	LOQ	mg/kg	J (all detects)

Surrogate Outlier Report

Lab Reporting Batch ID: AA31-150322 **Laboratory: ARIS**

EDD Filename: aa31 **eQAPP Name: Makah 20150427**

Method: **NWTPH-DX**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-CD18-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J- (all detects) R (all non-detects)
GP-11-CD18-10 (DL)	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD181-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD181-10 (DL)	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Heather Whitney

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD18-10								
DIESEL RANGE ORGANICS	NWTPH-DX	DL	3600	mg/kg		J-		4/28/2015 8:40
Reason for change:	Surrogate not recovered due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	DL	290	mg/kg		R		4/28/2015 8:40
Reason for change:	Surrogate not recovered due to sample extract dilution.							
Field Sample ID: GP-11-CD181-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	3600	mg/kg		J-		4/28/2015 8:43
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	3600	mg/kg	Professional Judgment		J-	4/28/2015 8:43
Reason for change:	Surrogate not recovered due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	3700	mg/kg		J-		4/28/2015 8:41
Reason for change:	Surrogate not recovered due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	3700	mg/kg	Professional Judgment		J-	4/28/2015 8:42
Reason for change:	Surrogate not recovered due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	110	mg/kg		R		4/28/2015 8:43
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	DL	540	mg/kg		R		4/28/2015 8:41
Reason for change:	Surrogate not recovered due to sample extract dilution.							

EDD Warning Log

Lab Reporting Batch ID: AA31-150322

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch P3031615A is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-GX
Sample Analysis				38	MethodBatch P3031615A is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-GX

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015
Reviewer: Jacob Williams

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
ZZ44	6	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
ZZ45	10	soil	VOCs, SVOCs, PCBs	8260, 8270 SIM, 8082	EPA Stage 2a
AB34	2	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
AB35	13	soil	DRO & motor oils, gasoline	NWTPH-Dx, NWTPH-Gx	EPA Stage 2a
AB36	16	soil, AQ	VOCs, Metals (Pb)	8260, 6020	EPA Stage 2a

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Attachment 1 – Output reports generated by ADR.net.

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This section describes the data review findings for NWTPH-Dx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None

2.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions

Exceptions:

SDG	Comments
ZZ44	No MS/MSD was run. LCS is in control, therefore no data qualified.

Percent recoveries and RPDs are within control limits with the following exceptions: None

2.6 Laboratory Duplicates

A laboratory duplicate is not required by QAPP as long as a matrix spike duplicate is performed.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

2.8 Trip Blank

The following trip blanks were reviewed: None

2.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed: None

2.10 Field Duplicate Samples

The following field duplicate(s) were collected as part of the SDGs reviewed:

SDG	Sample	Parent Sample	Flag	Notes
AB35	GP-06-H91-13	GP-06-H9-13	None	All RPD are within control limits

All field duplicate RPDs are within the QAPP-defined control limit of 40%.

3 Volatile Organic Compounds (8260)

This section describes the data review findings for 8260.

3.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions: None

3.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions: None

3.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

3.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

3.5 MS/MSD

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

SDG	Comments
ZZ45	No MS/MSD was run. LCS is in control, therefore no data qualified.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

SDG	Parent Sample	Analyte	Flag	Notes
AB36	GP-06-H8-12	Ethylbenzene, m,p,-Xylene, O-Xylene, Toluene	J-(all detects) UJ (all non detects)	All MS & MSD (except for toluene MSD) %recovery out of control low.

3.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

3.8 Trip Blanks

The following trip blanks were reviewed: None

3.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed:

SDG	Sample	Flag	Notes
AB36	AQRB4	None	No target analytes detected.

3.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
AB36	GP-06-H91-13	GP-06-H9-13	none	RPDs are greater than 40%. This may suggest that sample material was not sufficiently homogenized.

4 Semi-Volatile Organic Compounds (8270 SIM)

This section describes the data review findings for 8270D SIM

4.1 Sampling Documentation

All samples were received under proper chain of custody.

4.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

4.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

4.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.6 Laboratory Duplicates

A laboratory duplicate was not run for 8270 SIM. A laboratory duplicate is not required if a matrix spike duplicate is run.

4.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

4.8 Trip Blank

The following trip blanks were reviewed: None

4.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed: None

4.10 Field Duplicate Samples

The following field duplicate(s) were reviewed: None

5 Polychlorinated biphenyls (8082)

This section describes the data review findings for method 8082.

5.1 Sampling Documentation

All samples were received under proper chain of custody.

5.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples.

5.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.4 Method Blanks
A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis
One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.6 Laboratory Duplicates
A laboratory duplicate was not run for 8082 SIM. A laboratory duplicate is not required if a matrix spike duplicate is run.

5.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

5.8 Trip Blank

5.9 Trip blanks are not required for this analysis.Equipment (Rinsate) Blank
Equipment blanks are not required for this analysis.

5.10 Field Duplicate Samples
The following field duplicate(s) were reviewed: None

6 Gasoline Range Organics (NWTPH-Gx)
This section describes the data review findings for method NWTPH-Gx.

6.1 Sampling Documentation
All samples were received under proper chain of custody.

6.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples.

6.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.4 Method Blanks
A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

6.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis
One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

SDG	Comments
AB35	No MS/MSD was analyzed because of insufficient amount of sample provided. No data qualified because LCS was within control limits.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.6 Laboratory Duplicates
A laboratory duplicate was not run. A laboratory duplicate is not required if a matrix spike duplicate is run.

6.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

6.8 Trip Blank

6.9 Trip blanks are not required for this analysis. Equipment (Rinsate) Blank
Equipment blanks are not required for this analysis.

6.10 Field Duplicate Samples
The following field duplicate(s) were reviewed: None

7 Metals (Pb) (6020)
This section describes the data review findings for method 6020

7.1 Sampling Documentation
All samples were received under proper chain of custody.

7.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples.

7.3 Laboratory Control Samples (LCS)
One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

7.4 Method Blanks
A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

7.5 Matrix Spike (MS) Analysis

One matrix spike a (MS) was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions:

SDG	Comments
AB36	MS not analyzed due to insufficient amount of sample provided.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

7.6 Laboratory Duplicates

One laboratory duplicate was analyzed with each SDG or at a frequency of 1 duplicate per 20 samples with the following exceptions:

SDG	Sample(s)	Flag	Notes
AB36	All (GP-06-RS4-3)	J	Lab duplicate was not analyzed with SDG.

7.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

7.8 Trip Blank

7.9 Trip blanks are not required for this analysis. Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

7.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

8 Data Usability Assessment

This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

8.1 Precision

Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP, and all MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

- AB35 Gx, no MS/MSD was analyzed.
- AB36 6020, missing laboratory duplicate
- ZZ45 8260, no MS/MSD was performed.

The overall precision of the data set is considered acceptable.

8.2 Accuracy

Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples

were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- AB36 MS and/or MSD %Recovery for 8260

8.3 Representativeness

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. Trip blanks were analyzed and no contaminants were detected. The criteria for representativeness were within control limits with the following exceptions:

No exceptions.

8.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

8.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

9 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

10 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: ZZ44-150317

Laboratory: ARIS

EDD Filename: zz44

eQAPP Name: Makah 20150421_v3

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: ZZ44-150317
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

EDD Warning Log

Lab Reporting Batch ID: ZZ44-150317

eQAPP: Makah 20150421_v3 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch SW3546-201503101645 is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-DX
Sample Analysis				38	MethodBatch SW3546-201503101645 is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-DX

Data Qualifier Summary

Lab Reporting Batch ID: ZZ45-150420 **Laboratory: ARIS**

EDD Filename: zz45 **eQAPP Name: Makah 20150421_v3**

Method Category: SVOA

Method: 8270D SIM **Matrix: SO**

Sample ID: GP-06-P1-14 **Collected:** 3/6/2015 8:15:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.0033	J	0.0025	DL	0.0048	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0024	J	0.0022	DL	0.0048	LOQ	mg/kg	J	RI

Sample ID: GP-06-P2-10 **Collected:** 3/6/2015 9:15:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.0033	J	0.0024	DL	0.0047	LOQ	mg/kg	J	RI

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-06-H3-10 **Collected:** 3/6/2015 9:55:00 AM **Analysis Type:** RES **Dilution:** 58.3

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.040	J	0.012	DL	0.058	LOQ	mg/Kg	J	RI
m,p-Xylene	0.049	J	0.023	DL	0.058	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H4-9 **Collected:** 3/6/2015 10:30:00 AM **Analysis Type:** RES **Dilution:** 0.88

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0005	J	0.00026	DL	0.0009	LOQ	mg/Kg	J	RI
m,p-Xylene	0.0005	J	0.00035	DL	0.0009	LOQ	mg/Kg	J	RI
NAPHTHALENE	0.0035	J	0.00038	DL	0.0044	LOQ	mg/Kg	J	RI
TOLUENE	0.0005	J	0.00013	DL	0.0009	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H5-10 **Collected:** 3/6/2015 10:55:00 AM **Analysis Type:** RES **Dilution:** 62.3

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.10	J	0.027	DL	0.31	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H5-5 **Collected:** 3/6/2015 10:55:00 AM **Analysis Type:** RES **Dilution:** 1.01

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0007	J	0.00015	DL	0.0010	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ45-150420

Laboratory: ARIS

EDD Filename: zz45

eQAPP Name: Makah 20150421_v3

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ45-150420 **Laboratory: ARIS**

EDD Filename: zz45 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ45-150420
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

EDD Warning Log

Lab Reporting Batch ID: ZZ45-150420

eQAPP: Makah 20150421_v3 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch NT5-031815A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-031815A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis	2	PreparationBatch	NT5-031815A	17	This batch has more that one sample with QCType LCS.
Sample Analysis	7	PreparationBatch	NT5-031815A	17	This batch has more that one sample with QCType LCS.

Data Qualifier Summary

Lab Reporting Batch ID: AB34-150324

Laboratory: ARIS

EDD Filename: ab34

eQAPP Name: Makah 20150421_v3

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: AB34-150324
eQapp Name: Makah 20150421_v3

	Associated Samples	Sample Collection Date

Data Qualifier Summary

Lab Reporting Batch ID: AB35-150324

Laboratory: ARIS

EDD Filename: ab35

eQAPP Name: Makah 20150427

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: AB35-150324
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: GP-06-H91-13 **QC Type:** FD		
	GP-06-H9-13	3/17/2015 9:35:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: AB35-150324 **Laboratory: ARIS**

EDD Filename: ab35 **eQAPP Name: Makah 20150427**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-06-H9-13	GP-06-H91-13			
DIESEL RANGE ORGANICS	590	550	7	40.00	No Qualifiers Applied
MOTOR OILS	150	160	6	40.00	

Project Name and Number: Task Order #18 - Makah

EDD Warning Log

Lab Reporting Batch ID: AB35-150324

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch P3031915A is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-GX
Sample Analysis				38	MethodBatch P3031915A is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-GX

Data Qualifier Summary

Lab Reporting Batch ID: AB36-150420 **Laboratory: ARIS**

EDD Filename: ab36 **eQAPP Name: Makah 20150427**

Method Category: METALS

Method: 6020 **Matrix: SO**

Sample ID: GP-06-RS4-3 **Collected:** 3/17/2015 7:55:00 AM **Analysis Type:** RES/TOT **Dilution:** 20.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
LEAD	7.0		0.048	DL	0.1	PQL	mg/kg	J	ProfJudg

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-05-U1-10 **Collected:** 3/17/2015 12:05:00 PM **Analysis Type:** RES **Dilution:** 0.97

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.0007	J	0.00022	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-05-U2-10 **Collected:** 3/17/2015 12:45:00 PM **Analysis Type:** RES **Dilution:** 1.04

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0005	J	0.00041	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-05-V2-5 **Collected:** 3/17/2015 11:25:00 AM **Analysis Type:** RES **Dilution:** 1.15

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00017	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: GP-05-V2-8 **Collected:** 3/17/2015 11:25:00 AM **Analysis Type:** RES **Dilution:** 1.31

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0009	J	0.00020	DL	0.0013	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H7-7 **Collected:** 3/17/2015 8:55:00 AM **Analysis Type:** RES **Dilution:** 1.01

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0006	J	0.00015	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: GP-06-H8-12 **Collected:** 3/17/2015 10:15:00 AM **Analysis Type:** RES **Dilution:** 0.91

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0005	J	0.00018	DL	0.0009	LOQ	mg/Kg	J	RI, Ms
m,p-Xylene	0.0009	U	0.00036	DL	0.0009	LOQ	mg/Kg	UJ	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB36-150420 **Laboratory: ARIS**

EDD Filename: ab36 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-06-H8-12** ***Collected:*** **3/17/2015 10:15:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.91**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.0009	U	0.00020	DL	0.0009	LOQ	mg/Kg	UJ	Ms
TOLUENE	0.0009	U	0.00014	DL	0.0009	LOQ	mg/Kg	UJ	Ms

Sample ID: **GP-06-H9-10** ***Collected:*** **3/17/2015 9:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.01**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0006	J	0.00030	DL	0.0010	LOQ	mg/Kg	J	RI
O-XYLENE	0.0007	J	0.00023	DL	0.0010	LOQ	mg/Kg	J	RI

Sample ID: **GP-06-H91-13** ***Collected:*** **3/17/2015 9:55:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.16**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0008	J	0.00045	DL	0.0012	LOQ	mg/Kg	J	RI
TOLUENE	0.0007	J	0.00017	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-06-RS4-3** ***Collected:*** **3/17/2015 7:55:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.91**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0027	J	0.00039	DL	0.0045	LOQ	mg/Kg	J	RI
TOLUENE	0.0005	J	0.00014	DL	0.0009	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB36-150420 **Laboratory: ARIS**

EDD Filename: ab36 **eQAPP Name: Makah 20150427**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
ProfJudg	Professional Judgment
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: AB36-150420
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQRB4 **QC Type:** EB		
	GP-05-U1-10	3/17/2015 12:05:00 PM
	GP-05-U1-5	3/17/2015 12:05:00 PM
	GP-05-U2-10	3/17/2015 12:45:00 PM
	GP-05-U2-12	3/17/2015 12:45:00 PM
	GP-05-U2-5	3/17/2015 12:45:00 PM
	GP-05-V2-5	3/17/2015 11:25:00 AM
	GP-05-V2-8	3/17/2015 11:25:00 AM
	GP-06-H7-5	3/17/2015 8:55:00 AM
	GP-06-H7-7	3/17/2015 8:55:00 AM
	GP-06-H8-10	3/17/2015 10:15:00 AM
	GP-06-H8-12	3/17/2015 10:15:00 AM
	GP-06-H9-10	3/17/2015 9:35:00 AM
	GP-06-H91-13	3/17/2015 9:55:00 AM
	GP-06-H9-13	3/17/2015 9:35:00 AM
	GP-06-RS4-3	3/17/2015 7:55:00 AM
Field QC Sample: GP-06-H91-13 **QC Type:** FD		
	GP-06-H9-13	3/17/2015 9:35:00 AM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB36-150420 **Laboratory: ARIS**

EDD Filename: ab36 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-06-H8-12MS GP-06-H8-12MSD (GP-06-H8-12)	ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	77.5 76.6 77.8 76.5	77.3 77.1 78.3 -	80.00-120.00 80.00-123.00 80.00-120.00 78.00-120.00	- - - -	ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	 J- (all detects) UJ (all non-detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: AB36-150420 **Laboratory: ARIS**

EDD Filename: ab36 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-06-H9-13	GP-06-H91-13			
BENZENE	0.0017	0.0012	34	40.00	No Qualifiers Applied
ETHYLBENZENE	0.0073	0.0017	124	40.00	
m,p-Xylene	0.0033	0.0008	122	40.00	
NAPHTHALENE	0.018	0.0058 U	200	40.00	
O-XYLENE	0.0012	0.0012 U	200	40.00	
TOLUENE	0.0017	0.0007	83	40.00	

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Jacob Williams

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-06-RS4-3								
LEAD	6020	RES/TOT	7.0	mg/kg	Professional Judgment		J	4/28/2015 9:34
Reason for change:	No lab duplicate or MS analyzed, therefore result needs to be J flagged.							

EDD Warning Log

Lab Reporting Batch ID: AB36-150420

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	2	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQRB4.
Sample Analysis				38	PreparationBatch NT5-033015A is missing a sample of QCType LCS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-033015A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-033015A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-033015A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-033015A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch T3050B-201503200755 is missing a sample of QCType MS for LabAnalysisRefMethodID 6020
Sample Analysis				38	MethodBatch T3050B-201503200755 is missing a sample of QCType DUP for LabAnalysisRefMethodID 6020

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015
Reviewer: Cathy Martin

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
ZZ46, AB04, AB57, AA25	13	Water	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
	7	Water	GRO	NWTPH-Gx	
	14	Water	VOCs	SW-8260	
	13	Water	Dissolved Metals	SW-6020	
	13	Water	Anions	EPA 300.0	
	13	Water	Dissolved Gases	RSK-175	

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;

- Attachment 1 – Output reports generated by ADR.net.

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This section describes the data review findings for NWTPH-Dx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None

2.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions

Exceptions:

SDG	Comments
AB57	No matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG AB57 due to a laboratory oversight. LCS/LCSD was run. No data qualified.

Percent recoveries and RPDs are within control limits with the following exceptions:

Exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AA25	AQA1	DRO	J- (all detects); UJ (all nondetects)	MS/MSD %R out of control low

2.6 Laboratory Duplicates

A laboratory duplicate is not required by QAPP as long as a matrix spike duplicate is performed. Laboratory duplicates were required but not analyzed for the following:

SDG	Comments
AB57	No laboratory duplicates was analyzed with each SDG AB57 due to a laboratory oversight.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

Exceptions:

SDG	Sample	Flag	Notes
AA25	AQA1 AQCD1	J- (all detects) UJ (all non-detects)	Surrogate out of control low

2.8 Trip Blank

Trip blanks are not required for this analysis.

2.9 Equipment (Rinsate) Blank

An equipment rinsate was not required by the QAPP.

2.10 Field Duplicate Samples

The following field duplicate(s) were collected as part of the SDGs reviewed:

SDG	Sample	Parent Sample	Flag	Notes
ZZ46	AQMW10	AQMW06	None	The RPD was within control limits.
AA25	AQCD7	AQCD1	None	The RPD was within control limits or not applicable because target analyte concentrations are < 5x LOQ.

All field duplicate RPDs are within the QAPP-defined control limit of 40%.

3 Volatile Organic Compounds (8260)

This section describes the data review findings for 8260.

3.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

No exceptions.

3.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

Exceptions: None

SDG	Sample	Flag	Notes
AB57	AQTUV1	None.	MS/MSD was analyzed one day out of hold time. No target analytes detected in parent sample. No data qualified.

3.3 Laboratory Control Samples (LCS)/ Laboratory Control Samples Duplicate (LCSD)

One LCS/LCSD pair was run with this SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

SDG	Analyte	LCS %R	LCSD %R	RPD	Flag	Notes
ZZ46	naphthalene	78	78	--	J- (all detects); UJ (all non-detects)	LCS/LCSD %R slightly out of control low.
AB04	naphthalene	71	75	--	J- (all detects); UJ (all non-detects)	LCS/LCSD %R out of control low.
AA25	naphthalene	70	75	--	J- (all detects); UJ (all non-detects)	LCS/LCSD %R out of control low.

	naphthalene	71	75	--	J- (all detects); UJ (all non-detects)	LCS/LCSD %R out of control low.

3.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected with the following exceptions:

Exceptions:

SDG	Analyte	Result (ug/L)	Flag	Reason
ZZ46	naphthalene	0.59	U	Analyte detected in method blank < LOQ.
AB04	naphthalene	0.97	U	Analyte detected in method blank < LOQ.
AA25	naphthalene	1.3	U	Analyte detected in method blank < LOQ.

3.5 MS/MSD

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions:

SDG	Analyte	MS %R	MSD %R	RPD	Flag	Notes
AA25	naphthalene	-	69	-	J- (all detects); UJ (all non-detects)	MSD %R out of control low
AB04	naphthalene	74	79	--	J- (all detects); UJ (all non-detects)	MS/MSD %R out of control low.

3.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

Exceptions:

SDG	Sample	Flag	Notes
AA25	AQE1	J+ (detects)	Surrogate % recovery for 1,2-dichloroethane-D4 was out of control high. Detected target analytes were qualified J+.

3.8 Trip Blanks

The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
ZZ46	AQTB3	none	No target analytes detected.
AB04	AQTB5	none	No target analytes detected.
AB57	AQTB6	none	No target analytes detected.

No analytes were detected in the TB

3.9 Equipment (Rinsate) Blank

The QAPP does not require an equipment rinsate.

3.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ46	AQMW10	AQMW06	None	RPDs within control limits or not applicable.
AB04	AQMW10	AQMW06	None	RPDs within control limits or not applicable.
AA25	AQCD7	AQCD1	None	RPDs within control limits or not applicable.

All FD RPDs were in control.

4 Gasoline Range Organics (NWTPH-Gx)

This section describes the data review findings for NWTPH-Gx.

4.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

Exceptions: None

4.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

Exceptions: None

4.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

4.5 MS/MSD

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

4.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

Exceptions: None

4.8 Trip Blanks

The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
ZZ46	AQTB3	None	No analytes detected.
AB04	AQTB5	None	No analytes detected.
AB57	AQTB6	none	No target analytes detected.

4.9 Equipment (Rinsate) Blank

The QAPP does not require a EB for this analysis.

4.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ46	AQMW10	AQMW06	None	RPDs within control limits.

5 Metals (6020)

This section describes the data review findings for metals.

5.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

Exceptions: None

5.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

Exceptions: None

5.3 Laboratory Control Samples (LCS)

One LCS was run with each SDG. The LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

5.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

5.5 MS

One matrix spike was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries are within control limits with the following exceptions:

Exceptions: None

5.6 Laboratory Duplicates

A laboratory duplicate is required. A minimum of one laboratory duplicate was analyzed with each SDG or at a frequency of 1 duplicate per 20 samples with the following exceptions:

Exceptions: None

All laboratory duplicate RPDs are within control limits with the following exceptions:

Exceptions: None

5.7 Equipment (Rinsate) Blank

Equipment blanks are not required by the QAPP.

5.8 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ46	AQMW10	AQMW06	None	RPDs within control limits.
AA25	AQCD7	AQCD1	None	RPDs within control limits.

6 Anions (300.0)

This section describes the data review findings for EPA Method 300.0.

6.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

Exceptions: none

6.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

SDG	Samples	Affected Analytes	Flag	Comment
ZZ46		Nitrate	none	Some samples for nitrate which have a 48 hour holding time were marginally out of hold (up to 3 hours). No qualifiers were applied on this basis.
AA25	AQE1	Nitrate	J- (all detects) UJ (all non-detects)	Sample analyzed 1 day out of holding time for nitrate.

6.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: none

6.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: none

6.5 MS

One matrix spike (MS) was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions:

Exceptions: None

6.6 Laboratory Duplicates

A laboratory duplicate (LD) is analyzed when an MSD is not analyzed. One laboratory duplicates was analyzed. All duplicate RPDs were within control limits with the following exceptions:

Exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
ZZ46	AQMW06	Nitrate	None	RPD not applicable because target analytes are non-detect

All LD % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

6.7 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZZ46	AQMW10	AQMW06	None	RPDs within control limits.
AA25	AQCD7	AQCD1	None	RPDs not applicable because target analyte concentrations are < 5x LOQ.

All FD RPD results were in control with the following exceptions:

Exceptions: None

7 Dissolved Gases (RSK 175)

This section describes the data review findings for RSK 175.

7.1 Sampling Documentation

All samples were received under proper chain of custody with the following exceptions:

Exceptions: None

7.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

Exceptions: None

7.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

7.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

7.5 MS/MSD

One matrix spike (MS) was analyzed with each SDG or at a frequency of 1 MS per 20 samples with the following exceptions:

Exceptions: None

7.6 Laboratory Duplicates
Laboratory duplicates are not required for this method.

7.7 Surrogate Spike Performance
Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

Exceptions: None

7.8 Trip Blanks
Trip blanks are not required for this analysis.

7.9 Equipment (Rinsate) Blank
Equipment blanks are not required for this analysis.

7.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	RPD
ZZ46	AQMW10	AQMW06	None	RPDs within control limits.
AA25	AQCD7	AQCD1	None	RPDs within control limits.

All FD RPD results were in control with the following exceptions:

Exceptions: None

8 Data Usability Assessment
This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

8.1 Precision
Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. All MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

- ZZ46 LCS/LCSD %R for naphthalene by 8260.

The overall precision of the data set is considered acceptable.

8.2 Accuracy
Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- ZZ46 LCS/LCSD %Recovery for 8260
- AB04 MS/MSD % recovery for naphthalene by 8260
- AB04 LCS/LCSD % recovery for naphthalene by 8260
- AA25 MS/MSD % recovery for DRO was low for Dx
- AA25 surrogate recovery was low for DRO for Dx
- AA25 LCS/LCSD recovery was low for naphthalene by 8260.
- AA25 MS/MSD recovery was low for naphthalene by 8260.

- AA25 surrogate recovery for 1,2-dichloroethane-D4 was high by 8260.
- AB57 Missing MS/MSD for Dx

8.3 Representativeness

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. The criteria for representativeness were within control limits with the following exceptions:

- ZZ46 Naphthalene detected in 8260 method blank at <LOQ.
- ZZ46 Nitrate holding times were marginally exceeded for method 300.0
- AB04 naphthalene detected in 8260 method blank at <LOQ.
- AA25 naphthalene detected in 8260 method blank at <LOQ.
- AA25 nitrate was out of holding time for method 300.0
- AB57 MS/MSD exceeded holding time for method 8260

8.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

8.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria. Sensitivity is considered acceptable.

9 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) or have elevated reporting limits (UJ) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

10 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net). Version 1.9.0.325.

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: ZZ46-150408 **Laboratory: ARIS**

EDD Filename: zz46 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **AQ**

Sample ID: **AQMW05** ***Collected:*** **3/8/2015 12:23:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs

Sample ID: **AQMW06** ***Collected:*** **3/8/2015 9:00:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.59	QB	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs, Mb

Sample ID: **AQMW08** ***Collected:*** **3/8/2015 1:10:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs

Sample ID: **AQMW09** ***Collected:*** **3/8/2015 11:25:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs

Sample ID: **AQMW10** ***Collected:*** **3/8/2015 9:15:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.65	QB	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs, Mb

Sample ID: **AQTB3** ***Collected:*** **3/8/2015 12:00:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ46-150408

Laboratory: ARIS

EDD Filename: zz46

eQAPP Name: Makah 20150427

Reason Code Legend

Reason Code	*Description*
Lcs	Laboratory Control Spike Lower Estimation
Mb	Method Blank Contamination

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ46-150408
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQMW10 **QC Type:** FD		
	AQMW06	3/8/2015 9:00:00 AM
Field QC Sample: AQTB3 **QC Type:** TB		
	AQMW05	3/8/2015 12:23:00 PM
	AQMW06	3/8/2015 9:00:00 AM
	AQMW08	3/8/2015 1:10:00 PM
	AQMW09	3/8/2015 11:25:00 AM
	AQMW10	3/8/2015 9:15:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ46-150408 **Laboratory: ARIS**

EDD Filename: zz46 **eQAPP Name: Makah 20150427**

Method: 300.0
Matrix: AQ

Analyte	Concentration (mg/L)		Sample RPD	eQAPP RPD	Flag
	AQMW06	AQMW10			
SULFATE AS SO4	2.7	4.0	39	40.00	No Qualifiers Applied

Method: 6020
Matrix: AQ

Analyte	Concentration (ug/L)		Sample RPD	eQAPP RPD	Flag
	AQMW06 (DIS)	AQMW10 (DIS)			
MANGANESE	44.4	46	4	40.00	No Qualifiers Applied

Method: 8260C
Matrix: AQ

Analyte	Concentration (ug/L)		Sample RPD	eQAPP RPD	Flag
	AQMW06	AQMW10			
ETHYL BENZENE	0.68	0.61	11	40.00	No Qualifiers Applied
m,p-Xylene	3.0	2.5	18	40.00	
NAPHTHALENE	0.59	0.65	10	40.00	
O-XYLENE	0.38	0.34	11	40.00	

Method: NWTPH-DX
Matrix: AQ

Analyte	Concentration (ug/l)		Sample RPD	eQAPP RPD	Flag
	AQMW06	AQMW10			
DIESEL RANGE ORGANICS	390	420	7	40.00	No Qualifiers Applied

Method: NWTPH-GX
Matrix: AQ

Analyte	Concentration (ug/L)		Sample RPD	eQAPP RPD	Flag
	AQMW06	AQMW10			
GASOLINE RANGE ORGANICS	3700	3500	6	40.00	No Qualifiers Applied

Method: RSK-175
Matrix: AQ

Analyte	Concentration (ug/l)		Sample RPD	eQAPP RPD	Flag
	AQMW06	AQMW10			
METHANE	32.7	41.7	24	40.00	No Qualifiers Applied

Lab Control Spike/Lab Control Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZZ46-150408 **Laboratory: ARIS**

EDD Filename: zz46 **eQAPP Name: Makah 20150427**

Method: **8260C**
Matrix: **AQ**

QC Sample ID (Associated Samples)	Compound	LCS %R	LCSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
LCSDW0319151349 LCSW0319150942 (AQMW05 AQMW06 AQMW08 AQMW09 AQMW10 AQTB3)	NAPHTHALENE	78	78	80.00-128.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)

Method Blank Outlier Report

Lab Reporting Batch ID: ZZ46-150408 **Laboratory: ARIS**

EDD Filename: zz46 **eQAPP Name: Makah 20150427**

Method: **8260C**
Matrix: **AQ**

Method Blank Sample ID	Analysis Date	Analyte	Result	Associated Samples
MBW0319151006	3/19/2015 10:06:00 AM	NAPHTHALENE	0.31 ug/L	AQMW05 AQMW06 AQMW08 AQMW09 AQMW10 AQTB3

The following samples and their listed target analytes were qualified due to contamination reported in this blank

Sample ID	Analyte	Reported Result	Modified Final Result
AQMW06(RES)	NAPHTHALENE	0.59 ug/L	0.59U ug/L
AQMW10(RES)	NAPHTHALENE	0.65 ug/L	0.65U ug/L

EDD Warning Log

Lab Reporting Batch ID: ZZ46-150408

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	9	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	32	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	61	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	83	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	108	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	131	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	157	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	180	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	204	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	225	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	248	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Sample Analysis				38	MethodBatch P3031715A is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-GX
Sample Analysis				38	MethodBatch P3031715A is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-GX

Data Qualifier Summary

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method Category: SVOA

Method: NWTPH-DX **Matrix: AQ**

Sample ID: AQA1 **Collected:** 3/13/2015 8:25:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	170	J	40	DL	200	LOQ	ug/l	J	RI, Surr
DIESEL RANGE ORGANICS	730		20	DL	100	LOQ	ug/l	J-	Ms, Surr

Sample ID: AQCD1 **Collected:** 3/12/2015 3:15:00 PM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	440		40	DL	200	LOQ	ug/l	J-	Surr

Method Category: VOA

Method: 8260C **Matrix: AQ**

Sample ID: AQA1 **Collected:** 3/13/2015 8:25:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	1.3	QB	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs, Mb

Sample ID: AQCD1 **Collected:** 3/12/2015 3:15:00 PM **Analysis Type:** RES **Dilution:** 5.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.70	J	0.13	DL	1.0	LOQ	ug/L	J	RI
ETHYL BENZENE	0.70	J	0.19	DL	1.0	LOQ	ug/L	J	RI
NAPHTHALENE	130	QB	0.59	DL	2.5	LOQ	ug/L	J-	Lcs

Sample ID: AQCD2 **Collected:** 3/12/2015 3:49:00 PM **Analysis Type:** RES **Dilution:** 5.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	210	QB	0.59	DL	2.5	LOQ	ug/L	J-	Lcs
TOLUENE	0.65	J	0.20	DL	1.0	LOQ	ug/L	J	RI

Sample ID: AQCD7 **Collected:** 3/12/2015 3:40:00 PM **Analysis Type:** RES **Dilution:** 5.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.65	J	0.13	DL	1.0	LOQ	ug/L	J	RI
ETHYL BENZENE	0.70	J	0.19	DL	1.0	LOQ	ug/L	J	RI
NAPHTHALENE	130	QB	0.59	DL	2.5	LOQ	ug/L	J-	Lcs

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **AQ**

Sample ID: **AQE1** ***Collected:*** **3/13/2015 10:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
BENZENE	0.26	M	0.03	DL	0.20	LOQ	ug/L	J+	Surr
ETHYL BENZENE	17		0.04	DL	0.20	LOQ	ug/L	J+	Surr
m,p-Xylene	94		0.05	DL	0.40	LOQ	ug/L	J+	Surr
NAPHTHALENE	10	QB	0.12	DL	0.50	LOQ	ug/L	J	Lcs, Surr
O-XYLENE	8.2		0.03	DL	0.20	LOQ	ug/L	J+	Surr
TOLUENE	1.0		0.04	DL	0.20	LOQ	ug/L	J+	Surr

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Reason Code Legend

Reason Code	*Description*
Lcs	Laboratory Control Spike Lower Estimation
Mb	Method Blank Contamination
Ms	Matrix Spike Lower Estimation
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Estimation
Surr	Surrogate/Tracer Recovery Upper Estimation

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: AA25-150408
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date
Field QC Sample: AQCD7 **QC Type:** FD		
	AQCD1	3/12/2015 3:15:00 PM
	AQCD1	3/12/2015 3:15:00 PM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: AQ

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
AQA1MSD (AQA1)	NAPHTHALENE	-	69	80.00-128.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)

Method: NWTPH-DX
Matrix: AQ

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
AQA1MS AQA1MSD (AQA1)	DIESEL RANGE ORGANICS	51.3	42.3	64.00-120.00	-	DIESEL RANGE ORGANICS	J-(all detects) UJ(all non-detects)

Field Duplicate RPD Report

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: 300.0
Matrix: AQ

Analyte	Concentration (mg/L)		Sample RPD	eQAPP RPD	Flag
	AQCD1	AQCD7			
NITRATE	0.1 U	0.1	200	40.00	No Qualifiers Applied
SULFATE AS SO4	0.5	1.8	113	40.00	

Method: 6020
Matrix: AQ

Analyte	Concentration (ug/L)		Sample RPD	eQAPP RPD	Flag
	AQCD1 (DIS)	AQCD7 (DIS)			
MANGANESE	1410	1400	1	40.00	No Qualifiers Applied

Method: 8260C
Matrix: AQ

Analyte	Concentration (ug/L)		Sample RPD	eQAPP RPD	Flag
	AQCD1	AQCD7			
BENZENE	0.70	0.65	7	40.00	No Qualifiers Applied
ETHYL BENZENE	0.70	0.70	0	40.00	
NAPHTHALENE	130	130	0	40.00	

Method: NWTPH-DX
Matrix: AQ

Analyte	Concentration (ug/l)		Sample RPD	eQAPP RPD	Flag
	AQCD1	AQCD7			
DIESEL RANGE ORGANICS	8500	6200	31	40.00	No Qualifiers Applied
MOTOR OILS	440	280	44	40.00	

Method: RSK-175
Matrix: AQ

Analyte	Concentration (ug/l)		Sample RPD	eQAPP RPD	Flag
	AQCD1	AQCD7			
METHANE	1840	1780	3	40.00	No Qualifiers Applied

QC Outlier Report: HoldingTimes

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: 300.0 **Preparation Method: Gen Prep**

Matrix: AQ

Sample ID	Type	Actual	Criteria	Units	Flag
AQE1 (DL)	Sampling To Analysis	3.00	2.00	DAYS	J- (all detects) UJ (all non-detects)

Lab Control Spike/Lab Control Spike Duplicate Outlier Report

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: **8260C**
Matrix: **AQ**

QC Sample ID (Associated Samples)	Compound	LCS %R	LCSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
LCSDW0320151153 LCSW0320151129 (AQE1)	NAPHTHALENE	70	75	80.00-128.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)
LCSDW0326151141 LCSW0326151117 (AQA1 AQCD1 AQCD2 AQCD7)	NAPHTHALENE	71	75	80.00-128.00	-	NAPHTHALENE	J-(all detects) UJ(all non-detects)

Surrogate Outlier Report

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: 8260C
Matrix: AQ

Sample ID (Analysis Type)	Surrogate	Sample % Recovery	% Recovery Limits	Affected Compounds	Flag
AQE1	1,2-DICHLOROETHANE-D4	128	80.00-120.00	All Target Analytes	J+(all detects)

Method: NWTPH-DX
Matrix: AQ

Sample ID (Analysis Type)	Surrogate	Sample % Recovery	% Recovery Limits	Affected Compounds	Flag
AQA1	o-Terphenyl	23.2	50.00-150.00	All Target Analytes	J- (all detects) UJ (all non-detects)
AQCD1	o-Terphenyl	40.6	50.00-150.00	All Target Analytes	J-(all detects) UJ(all non-detects)

Method Blank Outlier Report

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: **8260C**
Matrix: **AQ**

Method Blank Sample ID	Analysis Date	Analyte	Result	Associated Samples
MBW0320151218	3/20/2015 12:18:00 PM	NAPHTHALENE	0.40 ug/L	AQE1
MBW0326151206	3/26/2015 12:06:00 PM	NAPHTHALENE	0.35 ug/L	AQA1 AQCD1 AQCD2 AQCD7

The following samples and their listed target analytes were qualified due to contamination reported in this blank

Sample ID	Analyte	Reported Result	Modified Final Result
AQA1(RES)	NAPHTHALENE	1.3 ug/L	1.3U ug/L

Project Name and Number: Task Order #18 - USACE Project: Makah

Reporting Limit Outliers

Lab Reporting Batch ID: AA25-150408 **Laboratory: ARIS**

EDD Filename: aa25 **eQAPP Name: Makah 20150427**

Method: 8260C

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQCD1	BENZENE ETHYL BENZENE	J J	0.70 0.70	1.0 1.0	LOQ LOQ	ug/L ug/L	J (all detects)
AQCD2	TOLUENE	J	0.65	1.0	LOQ	ug/L	J (all detects)
AQCD7	BENZENE ETHYL BENZENE	J J	0.65 0.70	1.0 1.0	LOQ LOQ	ug/L ug/L	J (all detects)

Method: NWTPH-DX

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQA1	MOTOR OILS	J	170	200	LOQ	ug/l	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: AA25-150408

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	11	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	37	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	56	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	78	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	104	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	130	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	155	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	178	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	191	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	206	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	219	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	236	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	249	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Sample Analysis				38	MethodBatch NT7-032615A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT7-032615A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch 300.0-201503161313 is missing a sample of QCType MS for LabAnalysisRefMethodID 300.0
Sample Analysis				38	MethodBatch 300.0-201503161313 is missing a sample of QCType DUP for LabAnalysisRefMethodID 300.0

Data Qualifier Summary

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Method Category: SVOA

Method: NWTPH-DX **Matrix: AQ**

Sample ID: AQE2 **Collected:** 3/16/2015 9:10:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	60	J	20	DL	100	LOQ	ug/l	J	RI

Method Category: VOA

Method: 8260C **Matrix: AQ**

Sample ID: AQE2 **Collected:** 3/16/2015 9:10:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.97	QB	0.12	DL	0.50	LOQ	ug/L	UJ	Ms, Lcs, Mb
O-XYLENE	0.12	J	0.03	DL	0.20	LOQ	ug/L	J	RI

Sample ID: AQE3 **Collected:** 3/16/2015 9:10:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.10	J	0.05	DL	0.40	LOQ	ug/L	J	RI
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs
TOLUENE	0.16	J	0.04	DL	0.20	LOQ	ug/L	J	RI

Sample ID: AQTB5 **Collected:** 3/16/2015 12:00:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.50	U	0.12	DL	0.50	LOQ	ug/L	UJ	Lcs

Method Category: VOA

Method: NWTPH-GX **Matrix: AQ**

Sample ID: AQE2 **Collected:** 3/16/2015 9:10:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
GASOLINE RANGE ORGANICS	200	J	57	DL	250	LOQ	ug/L	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Reason Code Legend

Reason Code	*Description*
Lcs	Laboratory Control Spike Lower Estimation
Mb	Method Blank Contamination
Ms	Matrix Spike Lower Estimation
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: AB04-150408

eQapp Name: Makah 20150421_v3

	Associat Samples	Sample Collectio Date
Sample: AQTB5 **QC Type:** TB		
	AQE2	3/16/2015 9:10:00 AM
	AQE3	3/16/2015 9:10:00 AM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **AQ**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
AQE2MS AQE2MSD (AQE2)	NAPHTHALENE	74	79	80.00-128.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)

Lab Control Spike/Lab Control Spike Duplicate Outlier Report

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **AQ**

QC Sample ID (Associated Samples)	Compound	LCS %R	LCSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
LCSDW0326151141 LCSW0326151117 (AQE2 AQE3 AQTB5)	NAPHTHALENE	71	75	80.00-128.00	-	NAPHTHALENE	J- (all detects) UJ (all non-detects)

Project Name and Number: Task Order #18 - Makah

Method Blank Outlier Report

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Method: **8260C**
Matrix: **AQ**

Method Blank Sample ID	Analysis Date	Analyte	Result	Associated Samples
MBW0326151206	3/26/2015 12:06:00 PM	NAPHTHALENE	0.35 ug/L	AQE2 AQE3 AQTB5

The following samples and their listed target analytes were qualified due to contamination reported in this blank

Sample ID	Analyte	Reported Result	Modified Final Result
AQE2(RES)	NAPHTHALENE	0.97 ug/L	0.97U ug/L

Reporting Limit Outliers

Lab Reporting Batch ID: AB04-150408 **Laboratory: ARIS**

EDD Filename: ab04 **eQAPP Name: Makah 20150421_v3**

Method: 8260C

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQE2	O-XYLENE	J	0.12	0.20	LOQ	ug/L	J (all detects)
AQE3	m,p-Xylene	J	0.10	0.40	LOQ	ug/L	J (all detects)
	TOLUENE	J	0.16	0.20	LOQ	ug/L	

Method: NWTPH-DX

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQE2	DIESEL RANGE ORGANICS	J	60	100	LOQ	ug/l	J (all detects)

Method: NWTPH-GX

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQE2	GASOLINE RANGE ORGANICS	J	200	250	LOQ	ug/L	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: AB04-150408

eQAPP: Makah 20150421_v3 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	78	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	79	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	80	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	81	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	82	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	83	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	150	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	170	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).

Data Qualifier Summary

Lab Reporting Batch ID: AB57-150408

Laboratory: ARIS

EDD Filename: ab57

eQAPP Name: Makah 20150427

No Data Review Qualifiers Applied.

Field QC Assignments and Associated Samples

EDD File Name: AB57-150408
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date

QC Outlier Report: HoldingTimes

Lab Reporting Batch ID: AB57-150408 **Laboratory: ARIS**

EDD Filename: ab57 **eQAPP Name: Makah 20150421_v3**

Method: 300.0 **Preparation Method: Gen Prep**

Matrix: AQ

Sample ID	Type	Actual	Criteria	Units	Flag
AQTUV1 (DL)	Sampling To Analysis	12.00	2.00	DAYS	J- (all detects)
AQTUV1DUP (DL)		12.00	2.00	DAYS	R (all non-detects)
AQTUV1MS (DL)		12.00	2.00	DAYS	

Method: 8260C **Preparation Method: Gen Prep**

Matrix: AQ

Sample ID	Type	Actual	Criteria	Units	Flag
AQTUV1MS (RES)	Sampling To Analysis	15.00	14.00	DAYS	J-(all detects)
AQTUV1MSD (RES)		15.00	14.00	DAYS	UJ(all non-detects)

EDD Warning Log

Lab Reporting Batch ID: AB57-150408

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	58	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	59	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	60	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	61	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	62	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	63	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	130	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	131	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	132	ReportingLimit	0.20	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Sample Analysis				38	MethodBatch SW3510C-201503251345 is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-DX
Sample Analysis				38	MethodBatch SW3510C-201503251345 is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-DX
Sample Analysis				38	MethodBatch NT2-040115A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT2-040115A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis				16	PreparationBatch NT2-040215A does not have any client samples associated to it.
Sample Analysis				16	MethodBatch NT2-040215A does not have any client samples associated to it.

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: April 2015
Reviewer: H. Fourie

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
ZY89	5	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
ZY90	8	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
ZY91	14	soil, aqueous	VOCs, SVOCs	8260, 8270D SIM	EPA Stage 2a
ZZ11	5	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
ZZ12	12	soil	DRO & motor oils	NWTPH-Dx	EPA Stage 2a
ZZ13	18	soil, aqueous	VOCs, SVOCs	8260, 8270D SIM	EPA Stage 2a
ZZ30	17	soil, aqueous	VOCs	8260	EPA Stage 2a

Table 1 (end of report) provides a cross reference between sample names and sample delivery group associations.

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may

be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Table 3 - field duplicate results and relative percent difference (RPD) calculated as defined in the QAPP;
- Attachment 1 – Output reports generated by ADR.net.
- Attachment 2 – ADR.net project library

2 Diesel Range Organics and Motor Oil (NWTPH-Dx)

This sections contains data validation findings for the NWTPH-Dx analyses.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples.

Exceptions: None

2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

One LCS/LCSD pair was run with each analytical batch. All LCS % recoveries and RPDs are within laboratory control limits for all target analytes.

Exceptions: None

2.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

Percent recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	MS %R	MSD %R	RPD	Flag	Notes
ZY89	GP-11-CD8-10	DRO	53.6	38.6	-	J- (all detects) UJ (all non-detects)	
ZZ11	GP-11-CD2-10	DRO	42.2	53.8	-	J- (all detects) UJ (all non-detects)	

2.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

2.7 Surrogate Spike Performance

The surrogate o-terphenyl was run with every sample. All surrogate % recoveries are within the laboratory control limits with the following exceptions:

Exceptions:

SDG	Sample	Surr %R	Flag	Notes
ZY90	GP-11-A6-8	Not Recovered	J (detects); UJ (non-detects)	Surrogate not recovered due to chromatographic interference.
ZZ11	GP-11-CD5-5	Not Recovered	J (detects);	Surrogate not recovered due to chromatographic

	GP-11-CD6-5		UJ (non-detects)	interference.
ZZ12	GP-11-CD1-10 GP-11-CD3-10 GP-11-CD31-10 GP-11-CD5-10	Diluted	J (detects); UJ (non-detects)	The spiked compound was not detected due to sample extract dilution.

2.8 Trip Blank
Trip blanks are not required for this analysis.

2.9 Equipment (Rinsate) Blank
No equipment blanks were analyzed.

2.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZY90	GP-11-CD91-15	GP-11-CD9-15	None	No target analytes detected. RPDs not applicable.
ZZ12	GP-11-CD31-10	GP-11-CD3-10	None	RPDs within control limits.

All field duplicate RPDs are within the QAPP-defined control limit of 40%.

3 Volatile Organic Compounds (8260)
This sections contains data validation findings for EPA Method 8260 analyses.

In ZY91, samples GP-11-CD8-10 and GP-11-CD8-6 were re-analyzed because the lab analyst noticed that the associated vials did not appear to look the same in appearance. To be conservative, the highest detected concentrations are reported.

3.1 Sampling Documentation
All samples were received under proper chain of custody.

3.2 Holding Times and Sample Preservation
Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions:

Exceptions: None

3.3 Laboratory Control Samples (LCS)
A minimum of one LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

3.4 Method Blanks
One method blank was analyzed with each SDG. No target analytes were detected in the method blanks with the following exceptions:

Exceptions:

SDG	Analyte	Associated Samples	Flag	Reason

ZZ13	Toluene	GP-11-CD31-10 GP-11-CD1-5 GP-11-CD1-10 GP-11-CD7-5 GP-11-CD5-5 GP-11-CD5-10 GP-11-CD5-18 GP-11-CD6-5 GP-11-CD6-10 GP-11-CD6-20	J (detects > 29 mg/kg); U (detects < 29 mg/kg)	Toluene was detected in one of two method blanks for SDG ZZ13 at a concentration (29 mg/kg) that is greater than that detected in any of its associated samples.

3.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

SDG	Parent Sample	Analyte	Flag	Notes
ZY91	GP-11-CD8-10	Ethylbenzene m,p-xylene o-xylene toluene	J- (all detects); UJ (all non-detects)	MS and/or MSD %R out of control low.
ZZ13	GP-11-CD2-10	MTBE	J- (all detects) UJ (all non-detects)	MS/MSD %R out of control low.

3.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

3.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions: None

3.8 Trip Blanks

The following trip blanks were reviewed:

SDG	Sample	Flag	Notes
ZY91	AQTB1	None	No target analytes detected.
ZZ30	AQTB2	None	No target analytes detected.

3.9 Equipment (Rinsate) Blank

The following equipment blanks were reviewed:

SDG	Sample	Affected Analyte	Flag	Notes
ZZ30	AQRB2	None	None	Sample was collected in incorrect vials and could not be analyzed by the lab.
ZZ13	AQRB1	Ethylbenzene m,p-xylenes	J+ (all detects in all samples in SDG)	Ethylbenzene and m,p-xylenes were detected at < LOQ in the equipment blank.

3.10 Field Duplicate Samples

The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag	Notes
ZY91	GP-11-CD91-15	GP-11-CD9-15	None	Target analytes not detected in one or both samples. RPDs not applicable.
ZZ13	GP-11-CD31-10	GP-11-CD3-10	None	Target analytes not detected in one or both samples; or detected concentrations < 5x LOQ (RPDs not applicable)

4 Low-level Semi Volatile Organic Compounds (8270 SIM)

This section contains data validation findings for EPA Method 8270 SIM analyses.

4.1 Sampling Documentation

All samples were received under proper chain of custody.

4.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples with the following exceptions: None

4.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

4.4 Method Blanks

One method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

4.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

Percent recoveries and RPDs are within control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
ZY91	GP-11-CD8-10	1-Methylnaphthalene	J (all detects)	MSD % R out of control high.
ZZ13	GP-11-CD2-10	1-Methylnaphthalene 2-Methylnaphthalene Benzo(a)anthracene Benzo(a)pyrene Chrysene Indeno(1,2,3-CD)Pyrene Total Benzofluoranthenes	None	MS/MSD %R not applicable due to high concentration (>4x) of analyte in original sample.
		Naphthalene	J+ (all detects)	MS/MSD %R out of control high

4.6 Laboratory Duplicates

A laboratory duplicate is not required unless an MSD is not analyzed. No laboratory duplicates were analyzed.

4.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

SDG	Sample	Flag	Notes
ZZ13	Various (all samples that were diluted)	None	The spiked compound was not detected due to sample extract dilution.

4.8 Trip Blank
Trip blanks are not required for this method.

4.9 Equipment (Rinsate) Blank
No equipment blanks were collected for this analysis.

4.10 Field Duplicate Samples
The following field duplicate(s) were reviewed:

SDG	Field Duplicate	Parent Sample	Flag(s)	Notes
ZY91	GP-11-CD91-15	GP-11-CD9-15	None	RPDs within control limits.
ZZ13	GP-11-CD31-10	GP-11-CD3-10	None	RPDs within control limits.

5 Data Usability Assessment
This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

5.1 Precision
Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP. All MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

No exceptions.

The overall precision of the data set is considered acceptable.

5.2 Accuracy
Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- ZY89 MS/MSD % Recovery for NWTPH-Dx
- ZZ11 MS/MSD % Recovery for NWTPH-Dx
- ZY90 Surrogate % Recovery for NWTPH-Dx
- ZZ11 Surrogate % Recovery for NWTPH-Dx
- ZZ12 Surrogate % Recovery for NWTPH-Dx
- ZY91 MS/MSD % Recovery for 8260
- ZZ13 MS/MSD % Recovery for 8260
- ZY91 MSD % Recovery for 8270 SIM
- ZZ13 MS/MSD % Recovery for 8270 SIM

5.3 Representativeness
Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. The criteria for representativeness were within control limits with the following exceptions:

- ZZ13 Toluene was detected in the method blank for 8260.
- ZZ13 Target analytes detected in equipment blank for 8260.

No exceptions.

5.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

5.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

6 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

7 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Table 3. Field duplicate results and RPD evaluation.

Chemical	Method	LOQ	Units	20140610-MW06		20140610-MW10		% RPD	Comments
NITRATE	300.0	0.10	mg/l	0.10	U	0.10	U	0.00	
SULFATE AS SO4	300.0	0.10	mg/l	3.40		4.20		21.05	
LEAD	6020	0.10	ug/l	1.30		0.80		**47.62**	RPD > 40%.
MANGANESE	6020	0.5	ug/l	43.40		46		5.82	
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8260C	0.20	ug/l	0.20	U	0.20	U	0.00	
1,2-DICHLOROETHANE	8260C	0.20	ug/l	0.20	U	0.20	U	0.00	
BENZENE	8260C	0.20	ug/l	0.20	U	0.20	U	0.00	
ETHYLBENZENE	8260C	0.20	ug/l	0.28		0.25		11.32	
M,P-XYLENE	8260C	0.40	ug/l	1.20		1.10		8.70	
METHYL TERT-BUTYL ETHER	8260C	0.50	ug/l	0.50	U	0.50	U	0.00	
NAPHTHALENE	8260C	0.50	ug/l	0.79		0.50	U	44.96	RPD not applicable because both results < 5x LOQ.
O-XYLENE	8260C	0.20	ug/l	0.13	J	0.12	J	8.00	
TOLUENE	8260C	0.20	ug/l	0.13	J	0.11	J	16.67	
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8260C SIM	0.01	ug/l	0.01	U	0.01	U	0.00	

DIESEL RANGE ORGANICS	NWTPH-DX	100	ug/l	290		310		6.67	
MOTOR OILS	NWTPH-DX	100	ug/l	200	U	200	U	0.00	
GASOLINE RANGE ORGANICS	NWTPH-GX	250	ug/l	3000		2800		6.90	
Ethane	RSK-175	1.2	ug/l	1.20	U	1.20	U	0.00	
Ethene	RSK-175	1.1	ug/l	1.10	U	1.10	U	0.00	
METHANE	RSK-175	0.7	ug/l	61.60		61.10		0.81	

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: ZY89-150317, ZY90-150317 **Laboratory: ARIS**

EDD Filename: zy89, zy90 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

SDG: ZY89-150317

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **DL** ***Dilution:*** **5.00**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
DIESEL RANGE ORGANICS	5000		79	DL	290	LOQ	mg/kg	J-	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY89-150317, ZY90-150317 **Laboratory: ARIS**

EDD Filename: zy89, zy90 **eQAPP Name: Makah 20150414**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID		Sample Type	Preparation Method		Validation Code
Lab Reporting Batch: ZY89-150317					
Method: NWTPH-DX					
GP-11-A4-12	15-4079-ZY89D	SO	N	SW3546	3/3/2015 9:18:00 AM	S2AVE
GP-11-A4-8	15-4080-ZY89E	SO	N	SW3546	3/3/2015 9:18:00 AM	S2AVE
GP-11-A6-13	15-4078-ZY89C	SO	N	SW3546	3/3/2015 8:45:00 AM	S2AVE
GP-11-CD8-10	15-4076-ZY89A	SO	N	SW3546	3/3/2015 2:02:00 PM	S2AVE
GP-11-CD8-10	15-4076-ZY89ADL	SO	N	SW3546	3/3/2015 2:02:00 PM	S2AVE
GP-11-CD8-10MS	15-4076-ZY89AMS	SO	MS	SW3546	3/3/2015 2:02:00 PM	S2AVE
GP-11-CD8-10MSD	15-4076-ZY89AMSD	SO	MSD	SW3546	3/3/2015 2:02:00 PM	S2AVE
GP-11-CD8-6	15-4077-ZY89B	SO	N	SW3546	3/3/2015 2:02:00 PM	S2AVE
GP-11-CD8-6	15-4077-ZY89BDL	SO	N	SW3546	3/3/2015 2:02:00 PM	S2AVE
Lab Reporting Batch: ZY90-150317					
Method: NWTPH-DX					
GP-11-A5-10	15-4087-ZY90G	SO	N	SW3546	3/3/2015 10:45:00 AM	S2AVE
GP-11-A5-15	15-4088-ZY90H	SO	N	SW3546	3/3/2015 10:45:00 AM	S2AVE
GP-11-A5-15MS	15-4088-ZY90HMS	SO	MS	SW3546	3/3/2015 10:45:00 AM	S2AVE
GP-11-A5-15MSD	15-4088-ZY90HMSD	SO	MSD	SW3546	3/3/2015 10:45:00 AM	S2AVE
GP-11-A6-8	15-4084-ZY90D	SO	N	SW3546	3/3/2015 8:45:00 AM	S2AVE
GP-11-A6-8	15-4084-ZY90DDL	SO	N	SW3546	3/3/2015 8:45:00 AM	S2AVE
GP-11-A7-13	15-4086-ZY90F	SO	N	SW3546	3/3/2015 9:53:00 AM	S2AVE
GP-11-A7-8	15-4085-ZY90E	SO	N	SW3546	3/3/2015 9:53:00 AM	S2AVE
GP-11-CD9-10	15-4082-ZY90B	SO	N	SW3546	3/3/2015 1:10:00 PM	S2AVE
GP-11-CD91-15	15-4083-ZY90C	SO	FD	SW3546	3/3/2015 1:40:00 PM	S2AVE
GP-11-CD9-15	15-4081-ZY90A	SO	N	SW3546	3/3/2015 1:10:00 PM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID	Sample Type	Preparation Method	Validation Code

Validation Label Legend

Label Code	Label Decription	EPA Level
S1VE	Stage_1_Validation_Electronic	N/A
S1VM	Stage_1_Validation_Manual	N/A
S1VEM	Stage_1_Validation_Electronic_and_Manual	N/A
S2AVE	Stage_2A_Validation_Electronic	Level 3 w/o calibration
S2AVM	Stage_2A_Validation_Manual	Level 3 w/o calibration
S2AVEM	Stage_2A_Validation_Electronic_and_Manual	Level 3 w/o calibration
S2BVE	Stage_2B_Validation_Electronic	Level 3 with calibration
S2BVM	Stage_2B_Validation_Manual	Level 3 with calibration
S2BVEM	Stage_2B_Validation_Electronic_and_Manual	Level 3 with calibration
S3VE	Stage_3_Validation_Electronic	Level 4
S3VM	Stage_3_Validation_Manual	Level 4
S3VEM	Stage_3_Validation_Electronic_and_Manual	Level 4
S4VE	Stage_4_Validation_Electronic	Level 4
S4VM	Stage_4_Validation_Manual	Level 4
S4VEM	Stage_4_Validation_Electronic_and_Manual	Level 4
NV	Not_Validated	N/A

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZY89-150317 **Laboratory: ARIS**

EDD Filename: zy89 **eQAPP Name: Makah 20150414**

Method: **NWTPH-DX**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD8-10MS GP-11-CD8-10MSD (GP-11-CD8-10)	DIESEL RANGE ORGANICS	53.6	38.6	62.00-120.00	-	DIESEL RANGE ORGANICS	J- (all detects) UJ (all non-detects)

Field QC Assignments and Associated Samples

EDD File Name: ZY90-150317
eQapp Name: Makah 20150414

	Associat Samples	Sample Collectio Date
Sample: GP-11-CD91-15 **QC Type:** FD		
	GP-11-CD9-15	3/3/2015 1:10:00 PM

Surrogate Outlier Report

Lab Reporting Batch ID: ZY90-150317 **Laboratory: ARIS**

EDD Filename: zy90 **eQAPP Name: Makah 20150414**

Method: **NWTPH-DX**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-A6-8	o-Terphenyl	0	50.00-150.00	All Target Analytes	J- (all detects) R (all non-detects)
GP-11-A6-8 (DL)	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Heather Whitney

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time	
Field Sample ID: GP-11-A6-8									
DIESEL RANGE ORGANICS	NWTPH-DX	RES	3900	mg/kg		J-		4/16/2015	15:16
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	3900	mg/kg	Professional Judgment		J	4/16/2015	15:18
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
DIESEL RANGE ORGANICS	NWTPH-DX	DL	4000	mg/kg		J-		4/16/2015	15:16
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
DIESEL RANGE ORGANICS	NWTPH-DX	DL	4000	mg/kg	Professional Judgment		J	4/16/2015	15:19
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
MOTOR OILS	NWTPH-DX	RES	160	mg/kg		J-		4/16/2015	15:16
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
MOTOR OILS	NWTPH-DX	RES	160	mg/kg	Professional Judgment		J	4/16/2015	15:18
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
MOTOR OILS	NWTPH-DX	DL	600	mg/kg		R		4/16/2015	15:16
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								
MOTOR OILS	NWTPH-DX	DL	600	mg/kg	Professional Judgment		UJ	4/16/2015	15:19
Reason for change:	Surrogate not recovered due to chromatographic interference associated with high target analyte concentrations.								

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **8270D SIM** ***Matrix:*** **SO**

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-METHYLNAPHTHALENE	0.42		0.0064	DL	0.020	LOQ	mg/kg	J	Ms, Ms

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.018	J	0.010	DL	0.020	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD8-6** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.023	J	0.016	DL	0.031	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD9-10** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-METHYLNAPHTHALENE	0.0045	J	0.0015	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD91-15** ***Collected:*** **3/3/2015 1:40:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0025	J	0.0018	DL	0.0048	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0042	J	0.0022	DL	0.0048	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD9-15** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0029	J	0.0018	DL	0.0048	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0046	J	0.0022	DL	0.0048	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.13**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0011	U	0.00023	DL	0.0011	LOQ	mg/Kg	UJ	Ms
m,p-Xylene	0.0006	J	0.00044	DL	0.0011	LOQ	mg/Kg	J	RI, Ms
O-XYLENE	0.0011	U	0.00025	DL	0.0011	LOQ	mg/Kg	UJ	Ms
TOLUENE	0.0025		0.00017	DL	0.0011	LOQ	mg/Kg	J-	Ms

Sample ID: **GP-11-CD8-6** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.37**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0009	J	0.00028	DL	0.0014	LOQ	mg/Kg	J	RI
m,p-Xylene	0.0008	J	0.00054	DL	0.0014	LOQ	mg/Kg	J	RI
TOLUENE	0.0008	J	0.00021	DL	0.0014	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD9-10** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.28**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00019	DL	0.0013	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416

Laboratory: ARIS

EDD Filename: zy91

eQAPP Name: Makah 20150414

Reason Code Legend

Reason Code	*Description*
Mb	Method Blank Contamination
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Precision
Ms	Matrix Spike Upper Estimation
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Estimation

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **8270D SIM** ***Matrix:*** **SO**

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-METHYLNAPHTHALENE	0.42		0.0064	DL	0.020	LOQ	mg/kg	J	Ms, Ms

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.018	J	0.010	DL	0.020	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD8-6** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.023	J	0.016	DL	0.031	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD9-10** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-METHYLNAPHTHALENE	0.0045	J	0.0015	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD91-15** ***Collected:*** **3/3/2015 1:40:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0025	J	0.0018	DL	0.0048	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0042	J	0.0022	DL	0.0048	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD9-15** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0029	J	0.0018	DL	0.0048	LOQ	mg/kg	J	RI
NAPHTHALENE	0.0046	J	0.0022	DL	0.0048	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-CD8-10** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.13**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0011	U	0.00023	DL	0.0011	LOQ	mg/Kg	UJ	Ms
m,p-Xylene	0.0006	J	0.00044	DL	0.0011	LOQ	mg/Kg	J	RI, Ms
O-XYLENE	0.0011	U	0.00025	DL	0.0011	LOQ	mg/Kg	UJ	Ms
TOLUENE	0.0025		0.00017	DL	0.0011	LOQ	mg/Kg	J-	Ms

Sample ID: **GP-11-CD8-6** ***Collected:*** **3/3/2015 2:02:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.37**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0009	J	0.00028	DL	0.0014	LOQ	mg/Kg	J	RI
m,p-Xylene	0.0008	J	0.00054	DL	0.0014	LOQ	mg/Kg	J	RI
TOLUENE	0.0008	J	0.00021	DL	0.0014	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD9-10** ***Collected:*** **3/3/2015 1:10:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.28**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0008	J	0.00019	DL	0.0013	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Reason Code Legend

Reason Code	*Description*
Mb	Method Blank Contamination
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Precision
Ms	Matrix Spike Upper Estimation
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Estimation

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZY91-150416
eQapp Name: Makah 20150414

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD91-15 **QC Type:** FD		
	GP-11-CD9-15	3/3/2015 1:10:00 PM

Field QC Assignments and Associated Samples

EDD File Name: ZY91-150416
eQapp Name: Makah 20150414

	Associat Samples	Sample Collectio Date
Sample: GP-11-CD91-15 **QC Type:** FD		
	GP-11-CD9-15	3/3/2015 1:10:00 PM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method: 8270D SIM
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD9-15	GP-11-CD91-15			
1-METHYLNAPHTHALENE	0.0063	0.0065	3	40.00	No Qualifiers Applied
2-METHYLNAPHTHALENE	0.0084	0.0091	8	40.00	
CHRYSENE	0.0029	0.0025	15	40.00	
NAPHTHALENE	0.0046	0.0042	9	40.00	

Project Name and Number: Task Order #18 - Makah

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method: 8260C
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD8-10MS GP-11-CD8-10MSD (GP-11-CD8-10)	ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	64.9 61 61 72.8	77.1 77 78 -	80.00-120.00 80.00-123.00 80.00-120.00 78.00-120.00	- - - -	ETHYLBENZENE m,p-Xylene O-XYLENE TOLUENE	J- (all detects) UJ (all non-detects)

Method: 8270D SIM
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD8-10MSD (GP-11-CD8-10)	1-METHYLNAPHTHALENE	-	165	39.00-120.00	38.9 (30.00)	1-METHYLNAPHTHALENE	J(all detects)

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: ZY91-150416 **Laboratory: ARIS**

EDD Filename: zy91 **eQAPP Name: Makah 20150414**

Method: 8260C

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD8-10	m,p-Xylene	J	0.0006	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-CD8-6	ETHYLBENZENE m,p-Xylene TOLUENE	J J J	0.0009 0.0008 0.0008	0.0014 0.0014 0.0014	LOQ LOQ LOQ	mg/Kg mg/Kg mg/Kg	J (all detects)
GP-11-CD9-10	TOLUENE	J	0.0008	0.0013	LOQ	mg/Kg	J (all detects)

Method: 8270D SIM

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD8-10	DIBENZO(A,H)ANTHRACENE	J	0.018	0.020	LOQ	mg/kg	J (all detects)
GP-11-CD8-6	DIBENZO(A,H)ANTHRACENE	J	0.023	0.031	LOQ	mg/kg	J (all detects)
GP-11-CD9-10	1-METHYLNAPHTHALENE	J	0.0045	0.0047	LOQ	mg/kg	J (all detects)
GP-11-CD91-15	CHRYSENE NAPHTHALENE	J J	0.0025 0.0042	0.0048 0.0048	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD9-15	CHRYSENE NAPHTHALENE	J J	0.0029 0.0046	0.0048 0.0048	LOQ LOQ	mg/kg mg/kg	J (all detects)

EDD Warning Log

Lab Reporting Batch ID: ZY91-150416

eQAPP: Makah 20150414 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	71	ReportingLimit	0.070	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	106	ReportingLimit	0.070	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	120	ReportingLimit	0.070	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	163	ReportingLimit	0.086	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	173	ReportingLimit	0.086	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	177	ReportingLimit	0.086	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	327	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	328	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	329	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	330	ReportingLimit	0.090	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	347	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	348	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	349	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	350	ReportingLimit	0.090	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	355	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	356	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	357	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	358	ReportingLimit	0.090	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	392	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQTB1.
Sample Analysis				38	MethodBatch NT5-031215A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-031215A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C
Sample Analysis				38	PreparationBatch NT5-031115A is missing a sample of QCType LCS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-031115A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-031115A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C

Data Qualifier Summary

Lab Reporting Batch ID: ZZ11-150317 **Laboratory: ARIS**

EDD Filename: zz11 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-11-CD2-10** ***Collected:*** **3/4/2015 7:55:00 AM** ***Analysis Type:*** **DL** ***Dilution:*** **10.0**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	11000		160	DL	580	LOQ	mg/kg	J-	Ms

Sample ID: **GP-11-CD5-5** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **DL** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	24000		1500	DL	5600	LOQ	mg/kg	J	ProfJudg

Sample ID: **GP-11-CD5-5** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	210		28	DL	110	LOQ	mg/kg	J	ProfJudg

Sample ID: **GP-11-CD6-5** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **DL** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	34000		1700	DL	6200	LOQ	mg/kg	J	ProfJudg

Sample ID: **GP-11-CD6-5** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	380		31	DL	120	LOQ	mg/kg	J	ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ11-150317

Laboratory: ARIS

EDD Filename: zz11

eQAPP Name: Makah 20150414

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
ProfJudg	Professional Judgment
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ11-150317, ZZ12-150317 **Laboratory: ARIS**

EDD Filename: zz11, zz12 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

SDG: ZZ11-150317

Sample ID: **GP-11-CD2-10** ***Collected:*** **3/4/2015 7:55:00 AM** ***Analysis Type:*** **DL** ***Dilution:*** **10.0**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
DIESEL RANGE ORGANICS	11000		160	DL	580	LOQ	mg/kg	J-	Ms

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ11-150317, ZZ12-150317 **Laboratory: ARIS**

EDD Filename: zz11, zz12 **eQAPP Name: Makah 20150414**

Reason Code Legend

Reason Code	*Description*
Ms	Matrix Spike Lower Estimation
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID		Sample Type	Preparation Method		Validation Code
Lab Reporting Batch: ZZ11-150317					
Method: NWTPH-DX					
GP-11-CD1-5	15-4149-ZZ11A	SO	N	SW3546	3/4/2015 10:30:00 AM	S2AVE
GP-11-CD1-5	15-4149-ZZ11ADL	SO	N	SW3546	3/4/2015 10:30:00 AM	S2AVE
GP-11-CD2-10	15-4151-ZZ11C	SO	N	SW3546	3/4/2015 7:55:00 AM	S2AVE
GP-11-CD2-10	15-4151-ZZ11CDL	SO	N	SW3546	3/4/2015 7:55:00 AM	S2AVE
GP-11-CD2-10MS	15-4151-ZZ11CMS	SO	MS	SW3546	3/4/2015 7:55:00 AM	S2AVE
GP-11-CD2-10MSD	15-4151-ZZ11CMSD	SO	MSD	SW3546	3/4/2015 7:55:00 AM	S2AVE
GP-11-CD5-5	15-4150-ZZ11B	SO	N	SW3546	3/4/2015 2:00:00 PM	S2AVE
GP-11-CD5-5	15-4150-ZZ11BDL	SO	N	SW3546	3/4/2015 2:00:00 PM	S2AVE
GP-11-CD6-10	15-4153-ZZ11E	SO	N	SW3546	3/4/2015 2:40:00 PM	S2AVE
GP-11-CD6-10	15-4153-ZZ11EDL	SO	N	SW3546	3/4/2015 2:40:00 PM	S2AVE
GP-11-CD6-5	15-4152-ZZ11D	SO	N	SW3546	3/4/2015 2:40:00 PM	S2AVE
GP-11-CD6-5	15-4152-ZZ11DDL	SO	N	SW3546	3/4/2015 2:40:00 PM	S2AVE
Lab Reporting Batch: ZZ12-150317					
Method: NWTPH-DX					
GP-11-CD1-10	15-4157-ZZ12D	SO	N	SW3546	3/4/2015 10:30:00 AM	S2AVE
GP-11-CD2-11	15-4162-ZZ12I	SO	N	SW3546	3/4/2015 7:55:00 AM	S2AVE
GP-11-CD3-10	15-4154-ZZ12A	SO	N	SW3546	3/4/2015 9:00:00 AM	S2AVE
GP-11-CD31-10	15-4155-ZZ12B	SO	FD	SW3546	3/4/2015 9:10:00 AM	S2AVE
GP-11-CD3-15	15-4156-ZZ12C	SO	N	SW3546	3/4/2015 9:00:00 AM	S2AVE
GP-11-CD4-10	15-4164-ZZ12K	SO	N	SW3546	3/4/2015 11:10:00 AM	S2AVE
GP-11-CD4-5	15-4163-ZZ12J	SO	N	SW3546	3/4/2015 11:10:00 AM	S2AVE
GP-11-CD5-10	15-4160-ZZ12G	SO	N	SW3546	3/4/2015 2:00:00 PM	S2AVE
GP-11-CD5-18	15-4161-ZZ12H	SO	N	SW3546	3/4/2015 2:00:00 PM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

	Lab Sample ID		Sample Type	Preparation Method		Validation Code
Method: NWTPH-DX						
GP-11-CD6-20	15-4165-ZZ12L	SO	N	SW3546	3/4/2015 2:40:00 PM	S2AVE
GP-11-CD7-10	15-4159-ZZ12F	SO	N	SW3546	3/4/2015 12:50:00 PM	S2AVE
GP-11-CD7-5	15-4158-ZZ12E	SO	N	SW3546	3/4/2015 12:50:00 PM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID	Sample Type	Preparation Method	Validation Code

Validation Label Legend

Label Code	Label Decription	EPA Level
S1VE	Stage_1_Validation_Electronic	N/A
S1VM	Stage_1_Validation_Manual	N/A
S1VEM	Stage_1_Validation_Electronic_and_Manual	N/A
S2AVE	Stage_2A_Validation_Electronic	Level 3 w/o calibration
S2AVM	Stage_2A_Validation_Manual	Level 3 w/o calibration
S2AVEM	Stage_2A_Validation_Electronic_and_Manual	Level 3 w/o calibration
S2BVE	Stage_2B_Validation_Electronic	Level 3 with calibration
S2BVM	Stage_2B_Validation_Manual	Level 3 with calibration
S2BVEM	Stage_2B_Validation_Electronic_and_Manual	Level 3 with calibration
S3VE	Stage_3_Validation_Electronic	Level 4
S3VM	Stage_3_Validation_Manual	Level 4
S3VEM	Stage_3_Validation_Electronic_and_Manual	Level 4
S4VE	Stage_4_Validation_Electronic	Level 4
S4VM	Stage_4_Validation_Manual	Level 4
S4VEM	Stage_4_Validation_Electronic_and_Manual	Level 4
NV	Not_Validated	N/A

Field QC Assignments and Associated Samples

EDD File Name: ZZ11-150317
eQapp Name: Makah 20150414

	Associated Samples	Sample Collection Date

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZZ11-150317 **Laboratory: ARIS**

EDD Filename: zz11 **eQAPP Name: Makah 20150414**

Method: **NWTPH-DX**
Matrix: **SO**

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD2-10MS GP-11-CD2-10MSD (GP-11-CD2-10)	DIESEL RANGE ORGANICS	42.2	53.8	62.00-120.00	-	DIESEL RANGE ORGANICS	J- (all detects) UJ (all non-detects)

Surrogate Outlier Report

Lab Reporting Batch ID: ZZ11-150317 **Laboratory: ARIS**

EDD Filename: zz11 **eQAPP Name: Makah 20150414**

Method: **NWTPH-DX**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-CD5-5	o-Terphenyl	0	50.00-150.00	All Target Analytes	J- (all detects) R (all non-detects)
GP-11-CD5-5 (DL)	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD6-5	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD6-5 (DL)	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Heather Whitney

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD5-5								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	20000	mg/kg		J-		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	20000	mg/kg	Professional Judgment		J	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	24000	mg/kg		J-		4/20/2015 9:56
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	24000	mg/kg	Professional Judgment		J	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	RES	210	mg/kg		J-		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	RES	210	mg/kg	Professional Judgment		J	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	DL	11000	mg/kg		R		4/20/2015 9:56
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	DL	11000	mg/kg	Professional Judgment		UJ	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
Field Sample ID: GP-11-CD6-5								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	28000	mg/kg		J-		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD6-5								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	28000	mg/kg	Professional Judgment		J	4/20/2015 9:58
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	34000	mg/kg		J-		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
DIESEL RANGE ORGANICS	NWTPH-DX	DL	34000	mg/kg	Professional Judgment		J	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	RES	380	mg/kg		J-		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	RES	380	mg/kg	Professional Judgment		J	4/20/2015 9:58
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	DL	12000	mg/kg		R		4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							
MOTOR OILS	NWTPH-DX	DL	12000	mg/kg	Professional Judgment		UJ	4/20/2015 9:57
Reason for change:	Surrogate not recovered due to chromatographic interference.							

Data Qualifier Summary

Lab Reporting Batch ID: ZZ12-150317 **Laboratory: ARIS**

EDD Filename: zz12 **eQAPP Name: Makah 20150414**

Method Category: **SVOA**

Method: **NWTPH-DX** ***Matrix:*** **SO**

Sample ID: **GP-11-CD1-10** ***Collected:*** **3/4/2015 10:30:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
MOTOR OILS	1200	U	300	DL	1200	LOQ	mg/kg	UJ	ProfJudg
DIESEL RANGE ORGANICS	4800		160	DL	600	LOQ	mg/kg	J	ProfJudg

Sample ID: **GP-11-CD3-10** ***Collected:*** **3/4/2015 9:00:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	5300		160	DL	600	LOQ	mg/kg	J	ProfJudg
MOTOR OILS	1200	U	300	DL	1200	LOQ	mg/kg	UJ	ProfJudg

Sample ID: **GP-11-CD31-10** ***Collected:*** **3/4/2015 9:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	5100		160	DL	600	LOQ	mg/kg	J	ProfJudg
MOTOR OILS	1200	U	300	DL	1200	LOQ	mg/kg	UJ	ProfJudg

Sample ID: **GP-11-CD5-10** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIESEL RANGE ORGANICS	10000		160	DL	590	LOQ	mg/kg	J	ProfJudg
MOTOR OILS	1200	U	290	DL	1200	LOQ	mg/kg	UJ	ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ12-150317

Laboratory: ARIS

EDD Filename: zz12

eQAPP Name: Makah 20150414

Reason Code Legend

Reason Code	*Description*
ProfJudg	Professional Judgment
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - USACE Project: Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ12-150317
eQapp Name: Makah 20150414

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-CD31-10 **QC Type:** FD		
	GP-11-CD3-10	3/4/2015 9:00:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ12-150317 **Laboratory: ARIS**

EDD Filename: zz12 **eQAPP Name: Makah 20150414**

Method: NWTPH-DX
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD3-10	GP-11-CD31-10			
DIESEL RANGE ORGANICS	5300	5100	4	40.00	No Qualifiers Applied

Surrogate Outlier Report

Lab Reporting Batch ID: ZZ12-150317 **Laboratory: ARIS**

EDD Filename: zz12 **eQAPP Name: Makah 20150414**

Method: **NWTPH-DX**
Matrix: **SO**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
GP-11-CD1-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J- (all detects) R (all non-detects)
GP-11-CD3-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD31-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)
GP-11-CD5-10	o-Terphenyl	0	50.00-150.00	All Target Analytes	J-(all detects) R(all non-detects)

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Heather Whitney

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD1-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	4800	mg/kg		J-		4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	4800	mg/kg	Professional Judgment		J	4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg		R		4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg	Professional Judgment		UJ	4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
Field Sample ID: GP-11-CD3-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	5300	mg/kg		J-		4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	5300	mg/kg	Professional Judgment		J	4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg		R		4/16/2015 15:37
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg	Professional Judgment		UJ	4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD31-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	5100	mg/kg		J-		4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	5100	mg/kg	Professional Judgment		J	4/16/2015 15:39
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg		R		4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg	Professional Judgment		UJ	4/16/2015 15:39
Reason for change:	Spiked compound not detected due to sample extract dilution.							
Field Sample ID: GP-11-CD5-10								
DIESEL RANGE ORGANICS	NWTPH-DX	RES	10000	mg/kg		J-		4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
DIESEL RANGE ORGANICS	NWTPH-DX	RES	10000	mg/kg	Professional Judgment		J	4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg		R		4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							
MOTOR OILS	NWTPH-DX	RES	1200	mg/kg	Professional Judgment		UJ	4/16/2015 15:38
Reason for change:	Spiked compound not detected due to sample extract dilution.							

EDD Warning Log

Lab Reporting Batch ID: ZZ12-150317

eQAPP: Makah 20150414 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch SW3546-201503071105 is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-DX
Sample Analysis				38	MethodBatch SW3546-201503071105 is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-DX

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method Category: SVOA

Method: 8270D SIM **Matrix:** SO

Sample ID: GP-11-CD1-5 **Collected:** 3/4/2015 10:30:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 10.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.034	J	0.023	DL	0.045	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD2-10 **Collected:** 3/4/2015 7:55:00 AM **Analysis Type:** DL **Dilution:** 50.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
1-METHYLNAPHTHALENE	20		0.075	DL	0.23	LOQ	mg/kg	J-	Ms

Sample ID: GP-11-CD2-10 **Collected:** 3/4/2015 7:55:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 10.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.48		0.021	DL	0.046	LOQ	mg/kg	J+	Ms

Sample ID: GP-11-CD2-11 **Collected:** 3/4/2015 7:55:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
DIBENZO(A,H)ANTHRACENE	0.0043	J	0.0023	DL	0.0044	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD31-10 **Collected:** 3/4/2015 9:10:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 10.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)PYRENE	0.044	J	0.021	DL	0.045	LOQ	mg/kg	J	RI
INDENO(1,2,3-CD)PYRENE	0.031	J	0.027	DL	0.045	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD4-10 **Collected:** 3/4/2015 11:10:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 10.0

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.030	J	0.018	DL	0.046	LOQ	mg/kg	J	RI

Sample ID: GP-11-CD4-5 **Collected:** 3/4/2015 11:10:00 AM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0037	J	0.0019	DL	0.0044	LOQ	mg/kg	J	RI
DIBENZO(A,H)ANTHRACENE	0.0027	J	0.0022	DL	0.0044	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method Category: **SVOA**

Method: **8270D SIM** ***Matrix:*** **SO**

Sample ID: **GP-11-CD5-10** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **10.0**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.037	J	0.022	DL	0.049	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD5-18** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0043	J	0.0021	DL	0.0047	LOQ	mg/kg	J	RI
BENZO(A)PYRENE	0.0025	J	0.0023	DL	0.0047	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD5-5** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **100**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.30	J	0.17	DL	0.45	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD6-10** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **10.0**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.023	J	0.020	DL	0.045	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD6-20** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0030	J	0.0020	DL	0.0045	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD6-5** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **10.0**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)PYRENE	0.036	J	0.023	DL	0.049	LOQ	mg/kg	J	RI

Sample ID: **GP-11-CD7-10** ***Collected:*** **3/4/2015 12:50:00 PM** ***Analysis Type:*** **RES-BASE/NEUTRAL** ***Dilution:*** **1.00**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
CHRYSENE	0.0032	J	0.0018	DL	0.0046	LOQ	mg/kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method Category: SVOA

Method: 8270D SIM **Matrix: SO**

Sample ID: GP-11-CD7-5 **Collected:** 3/4/2015 12:50:00 PM **Analysis Type:** RES-BASE/NEUTRAL **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZO(A)ANTHRACENE	0.0032	J	0.0022	DL	0.0049	LOQ	mg/kg	J	RI
Total Benzofluoranthenes	0.0047	J	0.0022	DL	0.0049	LOQ	mg/kg	J	RI

Method Category: VOA

Method: 8260C **Matrix: AQ**

Sample ID: AQRB1 **Collected:** 3/4/2015 9:50:00 AM **Analysis Type:** RES **Dilution:** 1.00

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYL BENZENE	0.6	J	0.18	DL	1.0	LOQ	ug/L	J	RI, ProfJudg
m,p-Xylene	1.5	J	0.36	DL	2.0	LOQ	ug/L	J	RI, ProfJudg

Method Category: VOA

Method: 8260C **Matrix: SO**

Sample ID: GP-11-CD1-10 **Collected:** 3/4/2015 10:30:00 AM **Analysis Type:** RES **Dilution:** 76.3

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.11		0.015	DL	0.076	LOQ	mg/Kg	J+	ProfJudg

Sample ID: GP-11-CD1-5 **Collected:** 3/4/2015 10:30:00 AM **Analysis Type:** RES **Dilution:** 67.9

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.10		0.014	DL	0.068	LOQ	mg/Kg	J+	ProfJudg

Sample ID: GP-11-CD2-10 **Collected:** 3/4/2015 7:55:00 AM **Analysis Type:** RES **Dilution:** 71.6

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.14		0.014	DL	0.072	LOQ	mg/Kg	J+	ProfJudg

Sample ID: GP-11-CD2-11 **Collected:** 3/4/2015 7:55:00 AM **Analysis Type:** RES **Dilution:** 1.20

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0008	J	0.00024	DL	0.0012	LOQ	mg/Kg	J	RI, ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-CD3-10** ***Collected:*** **3/4/2015 9:00:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.12**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0007	J	0.00023	DL	0.0011	LOQ	mg/Kg	J	RI, ProfJudg
m,p-Xylene	0.0010	J	0.00044	DL	0.0011	LOQ	mg/Kg	J	RI, ProfJudg
O-XYLENE	0.0009	J	0.00025	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD31-10** ***Collected:*** **3/4/2015 9:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **70.4**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.036	J	0.014	DL	0.070	LOQ	mg/Kg	J	RI, ProfJudg
m,p-Xylene	0.056	J	0.028	DL	0.070	LOQ	mg/Kg	J	RI, ProfJudg

Sample ID: **GP-11-CD3-15** ***Collected:*** **3/4/2015 9:00:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.10**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0044	JM	0.00047	DL	0.0055	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD4-5** ***Collected:*** **3/4/2015 11:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.92**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0011	J	0.00040	DL	0.0046	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD5-10** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **66.1**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.25		0.013	DL	0.066	LOQ	mg/Kg	J+	ProfJudg

Sample ID: **GP-11-CD5-18** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.25**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0008	J	0.00037	DL	0.0013	LOQ	mg/Kg	J	RI
ETHYLBENZENE	0.0014		0.00025	DL	0.0013	LOQ	mg/Kg	J+	ProfJudg
TOLUENE	0.0018	B	0.00019	DL	0.0013	LOQ	mg/Kg	U	Mb

Sample ID: **GP-11-CD5-5** ***Collected:*** **3/4/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **248**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	3.2		0.050	DL	0.25	LOQ	mg/Kg	J+	ProfJudg

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-CD6-10** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **68.4**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.041	J	0.014	DL	0.068	LOQ	mg/Kg	J	RI, ProfJudg

Sample ID: **GP-11-CD6-20** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.15**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0011	J	0.00034	DL	0.0012	LOQ	mg/Kg	J	RI
m,p-Xylene	0.0006	J	0.00045	DL	0.0012	LOQ	mg/Kg	J	RI, ProfJudg

Sample ID: **GP-11-CD6-5** ***Collected:*** **3/4/2015 2:40:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **108**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.15		0.022	DL	0.11	LOQ	mg/Kg	J+	ProfJudg

Sample ID: **GP-11-CD7-10** ***Collected:*** **3/4/2015 12:50:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.42**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0048	J	0.00061	DL	0.0071	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-CD7-5** ***Collected:*** **3/4/2015 12:50:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.15**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0022	B	0.00017	DL	0.0012	LOQ	mg/Kg	U	Mb

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Reason Code Legend

Reason Code	*Description*
Mb	Method Blank Contamination
Ms	Matrix Spike Lower Estimation
Ms	Matrix Spike Lower Rejection
Ms	Matrix Spike Upper Estimation
ProfJudg	Professional Judgment
RI	Reporting Limit Trace Value
Surr	Surrogate/Tracer Recovery Lower Estimation
Surr	Surrogate/Tracer Recovery Lower Rejection

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ13-150420
eQapp Name: Makah 20150421

	Associated Samples	Sample Collection Date
Field QC Sample: AQRB1 **QC Type:** EB		
	GP-11-CD1-10	3/4/2015 10:30:00 AM
	GP-11-CD1-5	3/4/2015 10:30:00 AM
	GP-11-CD2-10	3/4/2015 7:55:00 AM
	GP-11-CD2-11	3/4/2015 7:55:00 AM
	GP-11-CD3-10	3/4/2015 9:00:00 AM
	GP-11-CD31-10	3/4/2015 9:10:00 AM
	GP-11-CD3-15	3/4/2015 9:00:00 AM
	GP-11-CD4-10	3/4/2015 11:10:00 AM
	GP-11-CD4-5	3/4/2015 11:10:00 AM
	GP-11-CD5-10	3/4/2015 2:00:00 PM
	GP-11-CD5-18	3/4/2015 2:00:00 PM
	GP-11-CD5-5	3/4/2015 2:00:00 PM
	GP-11-CD6-10	3/4/2015 2:40:00 PM
	GP-11-CD6-20	3/4/2015 2:40:00 PM
	GP-11-CD6-5	3/4/2015 2:40:00 PM
	GP-11-CD7-10	3/4/2015 12:50:00 PM
	GP-11-CD7-5	3/4/2015 12:50:00 PM
Field QC Sample: GP-11-CD31-10 **QC Type:** FD		
	GP-11-CD3-10	3/4/2015 9:00:00 AM
	GP-11-CD3-10	3/4/2015 9:00:00 AM

Matrix Spike/Matrix Spike Duplicate Outlier Report

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: 8260C
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD2-10MS GP-11-CD2-10MSD (GP-11-CD2-10)	METHYL TERT-BUTYL ETHER	61.2	61.7	68.00-124.00	-	METHYL TERT-BUTYL ETHER	J- (all detects) UJ (all non-detects)

Method: 8270D SIM
Matrix: SO

QC Sample ID (Associated Samples)	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Affected Compounds	Flag
GP-11-CD2-10MS GP-11-CD2-10MSD (GP-11-CD2-10)	1-METHYLNAPHTHALENE	0	0	39.00-120.00	-	1-METHYLNAPHTHALENE	J-(all detects) R(all non-detects)
	2-METHYLNAPHTHALENE	0	0	35.00-120.00	-	2-METHYLNAPHTHALENE	
	BENZO(A)ANTHRACENE	0	0	42.00-120.00	-	BENZO(A)ANTHRACENE	
	BENZO(A)PYRENE	0	0	36.00-120.00	-	BENZO(A)PYRENE	
	CHRYSENE	0	0	48.00-120.00	-	CHRYSENE	
	INDENO(1,2,3-CD)PYRENE	0	0	40.00-120.00	-	INDENO(1,2,3-CD)PYRENE	
	Total Benzofluoranthenes	0	0	30.00-160.00	-	Total Benzofluoranthenes	
GP-11-CD2-10MS GP-11-CD2-10MSD (GP-11-CD2-10)	NAPHTHALENE	130	137	36.00-120.00	-	NAPHTHALENE	J+(all detects)

Project Name and Number: Task Order #18 - Makah

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: 8260C
Matrix: SO

Analyte	Concentration (mg/Kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD3-10	GP-11-CD31-10			
ETHYLBENZENE	0.0007	0.036	192	40.00	
m,p-Xylene	0.0010	0.056	193	40.00	
NAPHTHALENE	0.021	0.58	186	40.00	No Qualifiers Applied
O-XYLENE	0.0009	0.070 U	NC	40.00	
TOLUENE	0.0031	0.070 U	NC	40.00	

Method: 8270D SIM
Matrix: SO

Analyte	Concentration (mg/kg)		Sample RPD	eQAPP RPD	Flag
	GP-11-CD3-10	GP-11-CD31-10			
1-METHYLNAPHTHALENE	10	11	10	40.00	
2-METHYLNAPHTHALENE	2.2	2.5	13	40.00	
BENZO(A)ANTHRACENE	0.064	0.055	15	40.00	
BENZO(A)PYRENE	0.051	0.044	15	40.00	No Qualifiers Applied
CHRYSENE	0.085	0.093	9	40.00	
INDENO(1,2,3-CD)PYRENE	0.046 U	0.031	NC	40.00	
NAPHTHALENE	0.22	0.18	20	40.00	
Total Benzofluoranthenes	0.081	0.082	1	40.00	

Project Name and Number: Task Order #18 - Makah

Surrogate Outlier Report

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: **8270D SIM**
Matrix: **SO**

Sample ID (Analysis Type)	Surrogate	Sample % Recovery	% Recovery Limits	Affected Compounds	Flag
GP-11-CD1-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD1-5 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD2-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD3-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD31-10 (DL2)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD5-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD5-10 (DL2)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD5-5	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD5-5 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD6-10 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	
GP-11-CD6-5 (DL)	d10-2-Methylnaphthalene d14-Dibenzo(a,h)anthracene	0 0	32.00-120.00 21.00-133.00	No Affected Compounds	

Equipment Rinsate Blank Outlier Report

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: **8260C**
Matrix: **SO**

Equipment Blank Sample ID	Collected Date	Analyte	Result	Associated Samples
AQRB1(RES)	3/4/2015 9:50:00 AM	ETHYL BENZENE m,p-Xylene	0.6 ug/L 1.5 ug/L	GP-11-CD1-10 GP-11-CD1-5 GP-11-CD2-10 GP-11-CD2-11 GP-11-CD3-10 GP-11-CD31-10 GP-11-CD3-15 GP-11-CD4-10 GP-11-CD4-5 GP-11-CD5-10 GP-11-CD5-18 GP-11-CD5-5 GP-11-CD6-10 GP-11-CD6-20 GP-11-CD6-5 GP-11-CD7-10 GP-11-CD7-5

The following samples and their listed target analytes were qualified due to contamination reported in this blank

Sample ID	Analyte	Reported Result	Modified Final Result
GP-11-CD3-10(RES)	m,p-Xylene	0.0010 mg/Kg	0.0011U mg/Kg
GP-11-CD6-20(RES)	m,p-Xylene	0.0006 mg/Kg	0.0012U mg/Kg

Project Name and Number: Task Order #18 - Makah

Method Blank Outlier Report

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: **8260C**
Matrix: **SO**

Method Blank Sample ID	Analysis Date	Analyte	Result	Associated Samples
MBSL0313150003	3/13/2015 12:03:00 AM	TOLUENE	0.0006 mg/Kg	AQRB1 GP-11-CD1-10 GP-11-CD1-5 GP-11-CD2-10 GP-11-CD2-11 GP-11-CD3-10 GP-11-CD31-10 GP-11-CD3-15 GP-11-CD4-10 GP-11-CD4-5 GP-11-CD5-10 GP-11-CD5-18 GP-11-CD5-5 GP-11-CD6-10 GP-11-CD6-5 GP-11-CD7-10 GP-11-CD7-5
MBSM0313150003	3/13/2015 12:03:00 AM	TOLUENE	0.029 mg/Kg	AQRB1 GP-11-CD1-10 GP-11-CD1-5 GP-11-CD2-10 GP-11-CD2-11 GP-11-CD3-10 GP-11-CD31-10 GP-11-CD3-15 GP-11-CD4-10 GP-11-CD4-5 GP-11-CD5-10 GP-11-CD5-18 GP-11-CD5-5 GP-11-CD6-10 GP-11-CD6-5 GP-11-CD7-10 GP-11-CD7-5

The following samples and their listed target analytes were qualified due to contamination reported in this blank

Sample ID	Analyte	Reported Result	Modified Final Result
GP-11-CD5-18(RES)	TOLUENE	0.0018 mg/Kg	0.0018U mg/Kg
GP-11-CD7-5(RES)	TOLUENE	0.0022 mg/Kg	0.0022U mg/Kg

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: 8260C

Matrix: AQ

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
AQRB1	ETHYL BENZENE m,p-Xylene	J J	0.6 1.5	1.0 2.0	LOQ LOQ	ug/L ug/L	J (all detects)

Method: 8260C

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD2-11	ETHYLBENZENE	J	0.0008	0.0012	LOQ	mg/Kg	J (all detects)
GP-11-CD3-10	ETHYLBENZENE m,p-Xylene O-XYLENE	J J J	0.0007 0.0010 0.0009	0.0011 0.0011 0.0011	LOQ LOQ LOQ	mg/Kg mg/Kg mg/Kg	J (all detects)
GP-11-CD31-10	ETHYLBENZENE m,p-Xylene	J J	0.036 0.056	0.070 0.070	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-11-CD3-15	NAPHTHALENE	JM	0.0044	0.0055	LOQ	mg/Kg	J (all detects)
GP-11-CD4-5	NAPHTHALENE	J	0.0011	0.0046	LOQ	mg/Kg	J (all detects)
GP-11-CD5-18	BENZENE	J	0.0008	0.0013	LOQ	mg/Kg	J (all detects)
GP-11-CD6-10	ETHYLBENZENE	J	0.041	0.068	LOQ	mg/Kg	J (all detects)
GP-11-CD6-20	BENZENE m,p-Xylene	J J	0.0011 0.0006	0.0012 0.0012	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-11-CD7-10	NAPHTHALENE	J	0.0048	0.0071	LOQ	mg/Kg	J (all detects)

Method: 8270D SIM

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-CD1-10	CHRYSENE	J	0.13	0.22	LOQ	mg/kg	J (all detects)
GP-11-CD1-5	BENZO(A)PYRENE DIBENZO(A,H)ANTHRACENE	J J	0.42 0.034	0.45 0.045	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD2-11	DIBENZO(A,H)ANTHRACENE	J	0.0043	0.0044	LOQ	mg/kg	J (all detects)
GP-11-CD31-10	BENZO(A)PYRENE INDENO(1,2,3-CD)PYRENE	J J	0.044 0.031	0.045 0.045	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD3-15	NAPHTHALENE	J	0.034	0.046	LOQ	mg/kg	J (all detects)
GP-11-CD4-10	CHRYSENE	J	0.030	0.046	LOQ	mg/kg	J (all detects)
GP-11-CD4-5	BENZO(A)ANTHRACENE DIBENZO(A,H)ANTHRACENE	J J	0.0037 0.0027	0.0044 0.0044	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD5-10	BENZO(A)ANTHRACENE	J	0.037	0.049	LOQ	mg/kg	J (all detects)
GP-11-CD5-18	BENZO(A)ANTHRACENE BENZO(A)PYRENE	J J	0.0043 0.0025	0.0047 0.0047	LOQ LOQ	mg/kg mg/kg	J (all detects)
GP-11-CD5-5	CHRYSENE	J	0.30	0.45	LOQ	mg/kg	J (all detects)
GP-11-CD6-10	BENZO(A)ANTHRACENE	J	0.023	0.045	LOQ	mg/kg	J (all detects)
GP-11-CD6-20	BENZO(A)ANTHRACENE	J	0.0030	0.0045	LOQ	mg/kg	J (all detects)
GP-11-CD6-5	BENZO(A)PYRENE	J	0.036	0.049	LOQ	mg/kg	J (all detects)

Project Name and Number: Task Order #18 - Makah

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ13-150420 **Laboratory: ARIS**

EDD Filename: zz13 **eQAPP Name: Makah 20150421**

Method: **8270D SIM**

Matrix: **SO**

SampleID	*Analyte*	*Lab Qual*	*Result*	*Reporting Limit*	*RL Type*	*Units*	*Flag*
GP-11-CD7-10	CHRYSENE	J	0.0032	0.0046	LOQ	mg/kg	J (all detects)
GP-11-CD7-5	BENZO(A)ANTHRACENE	J	0.0032	0.0049	LOQ	mg/kg	J (all detects)
	Total Benzofluoranthenes	J	0.0047	0.0049	LOQ	mg/kg	

History of Manual Changes to Automated Data Review Qualifiers

Changed by: Heather Whitney

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: AQRB1								
ETHYL BENZENE	8260C	RES	0.6	ug/L	Professional Judgment		J+	4/21/2015 14:33
Reason for change:	Analyte detected in equipment blank.							
m,p-Xylene	8260C	RES	1.5	ug/L	Professional Judgment		J+	4/21/2015 14:33
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD1-10								
1-METHYLNAPHTHALENE	8270D SIM	DL	13	mg/kg		J-		4/21/2015 14:50
Reason for change:	Surrogate % R not applicable due to dilution.							
ETHYLBENZENE	8260C	RES	0.11	mg/Kg	Professional Judgment		J+	4/21/2015 14:33
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD1-5								
1-METHYLNAPHTHALENE	8270D SIM	DL	35	mg/kg		J-		4/21/2015 14:50
Reason for change:	Surrogate % R not applicable due to dilution.							
ETHYLBENZENE	8260C	RES	0.10	mg/Kg	Professional Judgment		J+	4/21/2015 14:33
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD2-10								
1-METHYLNAPHTHALENE	8270D SIM	RES	14	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD2-10								
1-METHYLNAPHTHALENE	8270D SIM	DL	20	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							
2-METHYLNAPHTHALENE	8270D SIM	RES	0.89	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
BENZO(A)ANTHRACENE	8270D SIM	RES	3.4	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
BENZO(A)PYRENE	8270D SIM	RES	2.4	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
CHRYSENE	8270D SIM	RES	3.6	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
ETHYLBENZENE	8260C	RES	0.14	mg/Kg	Professional Judgment		J+	4/21/2015 14:33
Reason for change:	Analyte detected in equipment blank.							
INDENO(1,2,3-CD)PYRENE	8270D SIM	RES	1.0	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
Total Benzofluoranthenes	8270D SIM	RES	4.6	mg/kg	Matrix Spike Lower Rejection	J-		4/21/2015 14:43
Reason for change:	%Recovery not applicable due to high concentration of analyte in original sample.							
Field Sample ID: GP-11-CD2-11								
ETHYLBENZENE	8260C	RES	0.0008	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
TOLUENE	8260C	RES	0.0046	mg/Kg	Method Blank Contamination	U		4/21/2015 14:21
Reason for change:	Analyte not detected in associated method blank.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD3-10								
1-METHYLNAPHTHALENE	8270D SIM	DL	10	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							
ETHYLBENZENE	8260C	RES	0.0007	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
m,p-Xylene	8260C	RES	0.0010	mg/Kg	Equipment Blank Contamination	U		4/21/2015 14:32
Reason for change:	Analyte detected in equipment blank.							
m,p-Xylene	8260C	RES	0.0010	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
TOLUENE	8260C	RES	0.0031	mg/Kg	Method Blank Contamination	U		4/21/2015 14:21
Reason for change:	Analyte not detected in associated method blank.							
Field Sample ID: GP-11-CD31-10								
1-METHYLNAPHTHALENE	8270D SIM	DL2	9.5	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							
ETHYLBENZENE	8260C	RES	0.036	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
m,p-Xylene	8260C	RES	0.056	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD3-15								
TOLUENE	8260C	RES	0.0015	mg/Kg	Method Blank Contamination	U		4/21/2015 14:22
Reason for change:	Analyte not detected in associated method blank.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time
Field Sample ID: GP-11-CD4-10								
TOLUENE	8260C	RES	0.0032	mg/Kg	Method Blank Contamination	U		4/21/2015 14:22
Reason for change:	Analyte not detected in associated method blank.							
Field Sample ID: GP-11-CD4-5								
TOLUENE	8260C	RES	0.0009	mg/Kg	Method Blank Contamination	U		4/21/2015 14:22
Reason for change:	Analyte not detected in associated method blank.							
Field Sample ID: GP-11-CD5-10								
1-METHYLNAPHTHALENE	8270D SIM	DL	29	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							
1-METHYLNAPHTHALENE	8270D SIM	DL2	25	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							
ETHYLBENZENE	8260C	RES	0.25	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD5-18								
ETHYLBENZENE	8260C	RES	0.0014	mg/Kg	Professional Judgment		J+	4/21/2015 14:34
Reason for change:	Analyte detected in equipment blank.							
Field Sample ID: GP-11-CD5-5								
1-METHYLNAPHTHALENE	8270D SIM	RES	80	mg/kg		J-		4/21/2015 14:58
Reason for change:	Surrogate % R not applicable due to sample dilution.							
1-METHYLNAPHTHALENE	8270D SIM	DL	84	mg/kg		J-		4/21/2015 14:51
Reason for change:	Surrogate % R not applicable due to dilution.							

Analyte	Method	Analysis Type	Result	Unit	Reason Code	Original Value	New Value	Edit Time	
Field Sample ID: GP-11-CD5-5									
ETHYLBENZENE	8260C	RES	3.2	mg/Kg	Professional Judgment		J+	4/21/2015	14:34
Reason for change:	Analyte detected in equipment blank.								
Field Sample ID: GP-11-CD6-10									
1-METHYLNAPHTHALENE	8270D SIM	DL	18	mg/kg		J-		4/21/2015	14:52
Reason for change:	Surrogate % R not applicable due to dilution.								
ETHYLBENZENE	8260C	RES	0.041	mg/Kg	Professional Judgment		J+	4/21/2015	14:35
Reason for change:	Analyte detected in equipment blank.								
Field Sample ID: GP-11-CD6-20									
m,p-Xylene	8260C	RES	0.0006	mg/Kg	Equipment Blank Contamination	U		4/21/2015	14:33
Reason for change:	Analyte detected in equipment blank.								
m,p-Xylene	8260C	RES	0.0006	mg/Kg	Professional Judgment		J+	4/21/2015	14:35
Reason for change:	Analyte detected in equipment blank.								
Field Sample ID: GP-11-CD6-5									
1-METHYLNAPHTHALENE	8270D SIM	DL	56	mg/kg		J-		4/21/2015	14:52
Reason for change:	Surrogate % R not applicable due to dilution.								
ETHYLBENZENE	8260C	RES	0.15	mg/Kg	Professional Judgment		J+	4/21/2015	14:35
Reason for change:	Analyte detected in equipment blank.								
Field Sample ID: GP-11-CD7-10									
TOLUENE	8260C	RES	0.0029	mg/Kg	Method Blank Contamination	U		4/21/2015	14:22
Reason for change:	Analyte not detected in associated method blank.								

EDD Warning Log

Lab Reporting Batch ID: ZZ13-150420

eQAPP: Makah 20150421 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	741	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results				10	1,2-DICHLOROETHANE (107-06-2) is a required target analyte for Method: 8260C and Matrix: AQ , but is not reported for sample AQRB1.
Sample Analysis	4	PreparationBatch	NT5-031215A	17	This batch has more that one sample with QCType LCS.
Sample Analysis	19	PreparationBatch	NT5-031215A	17	This batch has more that one sample with QCType LCS.
Sample Analysis	24	PreparationBatch	NT5-031215A	17	This batch has more that one sample with QCType LCS.
Sample Analysis	46	PreparationBatch	NT5-031215A	17	This batch has more that one sample with QCType LCS.
Sample Analysis				38	PreparationBatch NT5-031315A is missing a sample of QCType LCS for LabAnalysisRefMethodID 8260C

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-E11-10** ***Collected:*** **3/5/2015 11:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.06**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.062	J	0.014	DL	0.063	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E11-15** ***Collected:*** **3/5/2015 11:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.07**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.049	J	0.015	DL	0.066	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E5-10** ***Collected:*** **3/5/2015 8:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.11**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0006	J	0.00022	DL	0.0011	LOQ	mg/Kg	J	RI
NAPHTHALENE	0.0050	J	0.00048	DL	0.0055	LOQ	mg/Kg	J	RI
O-XYLENE	0.0007	J	0.00025	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E6-10** ***Collected:*** **3/5/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.06**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.041	J	0.018	DL	0.059	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E6-15** ***Collected:*** **3/5/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.10**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0009	J	0.00033	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E8-10** ***Collected:*** **3/5/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.17**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0009	J	0.00035	DL	0.0012	LOQ	mg/Kg	J	RI
O-XYLENE	0.0006	J	0.00026	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E8-5** ***Collected:*** **3/5/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.12**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0038	J	0.00048	DL	0.0056	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-E9-10** ***Collected:*** **3/5/2015 9:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.08**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0009	J	0.00016	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E9-5** ***Collected:*** **3/5/2015 9:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.18**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0011	J	0.00046	DL	0.0012	LOQ	mg/Kg	J	RI
TOLUENE	0.0011	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420

Laboratory: ARIS

EDD Filename: zz30

eQAPP Name: Makah 20150414

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-E11-10** ***Collected:*** **3/5/2015 11:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.06**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.062	J	0.014	DL	0.063	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E11-15** ***Collected:*** **3/5/2015 11:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.07**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
O-XYLENE	0.049	J	0.015	DL	0.066	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E5-10** ***Collected:*** **3/5/2015 8:10:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.11**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
ETHYLBENZENE	0.0006	J	0.00022	DL	0.0011	LOQ	mg/Kg	J	RI
NAPHTHALENE	0.0050	J	0.00048	DL	0.0055	LOQ	mg/Kg	J	RI
O-XYLENE	0.0007	J	0.00025	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E6-10** ***Collected:*** **3/5/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **0.06**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.041	J	0.018	DL	0.059	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E6-15** ***Collected:*** **3/5/2015 10:35:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.10**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0009	J	0.00033	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E8-10** ***Collected:*** **3/5/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.17**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
BENZENE	0.0009	J	0.00035	DL	0.0012	LOQ	mg/Kg	J	RI
O-XYLENE	0.0006	J	0.00026	DL	0.0012	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E8-5** ***Collected:*** **3/5/2015 2:00:00 PM** ***Analysis Type:*** **RES** ***Dilution:*** **1.12**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
NAPHTHALENE	0.0038	J	0.00048	DL	0.0056	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Method Category: **VOA**

Method: **8260C** ***Matrix:*** **SO**

Sample ID: **GP-11-E9-10** ***Collected:*** **3/5/2015 9:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.08**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
TOLUENE	0.0009	J	0.00016	DL	0.0011	LOQ	mg/Kg	J	RI

Sample ID: **GP-11-E9-5** ***Collected:*** **3/5/2015 9:50:00 AM** ***Analysis Type:*** **RES** ***Dilution:*** **1.18**

Analyte	Lab Result	Lab Qual	DL	DL Type	RL	RL Type	Units	Data Review Qual	Reason Code
m,p-Xylene	0.0011	J	0.00046	DL	0.0012	LOQ	mg/Kg	J	RI
TOLUENE	0.0011	J	0.00018	DL	0.0012	LOQ	mg/Kg	J	RI

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Data Qualifier Summary

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Reason Code Legend

Reason Code	*Description*
RI	Reporting Limit Trace Value

* denotes a non-reportable result

Project Name and Number: Task Order #18 - Makah

Field QC Assignments and Associated Samples

EDD File Name: ZZ30-150420
eQapp Name: Makah 20150414

	Associated Samples	Sample Collection Date
Field QC Sample: GP-11-E51-15 **QC Type:** FD		
	GP-11-E5-15	3/5/2015 8:10:00 AM

Field QC Assignments and Associated Samples

EDD File Name: ZZ30-150420
eQapp Name: Makah 20150414

	Associat Samples	Sample Collectio Date
Sample: GP-11-E51-15 **QC Type:** FD		
	GP-11-E5-15	3/5/2015 8:10:00 AM

Field Duplicate RPD Report

Lab Reporting Batch ID: ZZ30-150420

Laboratory: ARIS

EDD Filename: zz30

eQAPP Name: Makah 20150414

No Field Duplicate Data

Reporting Limit Outliers

Lab Reporting Batch ID: ZZ30-150420 **Laboratory: ARIS**

EDD Filename: zz30 **eQAPP Name: Makah 20150414**

Method: 8260C

Matrix: SO

SampleID	Analyte	Lab Qual	Result	Reporting Limit	RL Type	Units	Flag
GP-11-E11-10	O-XYLENE	J	0.062	0.063	LOQ	mg/Kg	J (all detects)
GP-11-E11-15	O-XYLENE	J	0.049	0.066	LOQ	mg/Kg	J (all detects)
GP-11-E5-10	ETHYLBENZENE NAPHTHALENE O-XYLENE	J J J	0.0006 0.0050 0.0007	0.0011 0.0055 0.0011	LOQ LOQ LOQ	mg/Kg mg/Kg mg/Kg	J (all detects)
GP-11-E6-10	BENZENE	J	0.041	0.059	LOQ	mg/Kg	J (all detects)
GP-11-E6-15	BENZENE	J	0.0009	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-E8-10	BENZENE O-XYLENE	J J	0.0009 0.0006	0.0012 0.0012	LOQ LOQ	mg/Kg mg/Kg	J (all detects)
GP-11-E8-5	NAPHTHALENE	J	0.0038	0.0056	LOQ	mg/Kg	J (all detects)
GP-11-E9-10	TOLUENE	J	0.0009	0.0011	LOQ	mg/Kg	J (all detects)
GP-11-E9-5	m,p-Xylene TOLUENE	J J	0.0011 0.0011	0.0012 0.0012	LOQ LOQ	mg/Kg mg/Kg	J (all detects)

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Reporting Batch: ZZ30-150420

Method: 8260C

Lab Sample ID		Sample Type		Preparation Method			Validation Code
AQTB2	15-4258-ZZ30P	AQ	N	5030B		3/5/2015	S2AVE
GP-11-E10-10	15-4250-ZZ30H	SO	N		5035	3/5/2015 9:05:00 AM	S2AVE
GP-11-E10-15	15-4251-ZZ30I	SO	N		5035	3/5/2015 9:05:00 AM	S2AVE
GP-11-E11-10	15-4243-ZZ30A	SO	N		5035	3/5/2015 11:10:00 AM	S2AVE
GP-11-E11-15	15-4244-ZZ30B	SO	N		5035	3/5/2015 11:10:00 AM	S2AVE
GP-11-E5-10	15-4248-ZZ30F	SO	N		5035	3/5/2015 8:10:00 AM	S2AVE
GP-11-E51-15	15-4249-ZZ30G	SO	FD		5035	3/5/2015 8:30:00 AM	S2AVE
GP-11-E5-15	15-4247-ZZ30E	SO	N		5035	3/5/2015 8:10:00 AM	S2AVE
GP-11-E6-10	15-4255-ZZ30M	SO	N		5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MS	15-4255-ZZ30MMS	SO	MS		5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-10MSD	15-4255-ZZ30MMSD	SO	MSD		5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E6-15	15-4254-ZZ30L	SO	N		5035	3/5/2015 10:35:00 AM	S2AVE
GP-11-E7-10	15-4245-ZZ30C	SO	N		5035	3/5/2015 1:15:00 PM	S2AVE
GP-11-E7-15	15-4246-ZZ30D	SO	N		5035	3/5/2015 1:15:00 PM	S2AVE
GP-11-E8-10	15-4257-ZZ30O	SO	N		5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E8-5	15-4256-ZZ30N	SO	N		5035	3/5/2015 2:00:00 PM	S2AVE
GP-11-E9-10	15-4253-ZZ30K	SO	N		5035	3/5/2015 9:50:00 AM	S2AVE
GP-11-E9-5	15-4252-ZZ30J	SO	N		5035	3/5/2015 9:50:00 AM	S2AVE

Data Review Sample Summary Report by Analysis Method

Reviewed By: **Approved By:** **Laboratory: ARIS**

Lab Sample ID	Sample Type	Preparation Method	Validation Code

Validation Label Legend

Label Code	Label Decription	EPA Level
S1VE	Stage_1_Validation_Electronic	N/A
S1VM	Stage_1_Validation_Manual	N/A
S1VEM	Stage_1_Validation_Electronic_and_Manual	N/A
S2AVE	Stage_2A_Validation_Electronic	Level 3 w/o calibration
S2AVM	Stage_2A_Validation_Manual	Level 3 w/o calibration
S2AVEM	Stage_2A_Validation_Electronic_and_Manual	Level 3 w/o calibration
S2BVE	Stage_2B_Validation_Electronic	Level 3 with calibration
S2BVM	Stage_2B_Validation_Manual	Level 3 with calibration
S2BVEM	Stage_2B_Validation_Electronic_and_Manual	Level 3 with calibration
S3VE	Stage_3_Validation_Electronic	Level 4
S3VM	Stage_3_Validation_Manual	Level 4
S3VEM	Stage_3_Validation_Electronic_and_Manual	Level 4
S4VE	Stage_4_Validation_Electronic	Level 4
S4VM	Stage_4_Validation_Manual	Level 4
S4VEM	Stage_4_Validation_Electronic_and_Manual	Level 4
NV	Not_Validated	N/A

EDD Warning Log

Lab Reporting Batch ID: ZZ30-150420

eQAPP: Makah 20150414 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Analytical Results	1	ReportingLimit	0.063	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	6	ReportingLimit	0.063	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	8	ReportingLimit	0.063	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	13	ReportingLimit	0.066	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	18	ReportingLimit	0.066	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	20	ReportingLimit	0.066	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	181	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	182	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	183	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	184	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	185	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	186	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	211	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	212	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	213	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	214	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	215	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	216	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	223	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	224	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	225	ReportingLimit	0.050	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	226	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	227	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	228	ReportingLimit	0.059	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	301	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	302	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	303	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Analytical Results	304	ReportingLimit	1.0	8	This reporting limit exceeds the allowable project reporting limit (corrected for %moisture and dilution).
Sample Analysis				38	MethodBatch NT5-031615A is missing a sample of QCType MS for LabAnalysisRefMethodID 8260C
Sample Analysis				38	MethodBatch NT5-031615A is missing a sample of QCType MSD for LabAnalysisRefMethodID 8260C

Data Validation Report

PROJECT/EVENT: Underground Storage Tank Site Investigation Phase II, Former Makah Air Force Station, Neah Bay, Washington.
SAMPLING DATE(S): March 3-18, 2015
ANALYSES: Diesel Range Organics (DRO) and motor oils by NWTPH-Dx;
Gasoline Range Organics (GRO) by NWTPH-Gx;
Volatile Organic Compounds by EPA Method 8260;
Volatile Organic Compounds (low-level) by EPA Method 8260-Selected Ion Monitoring (SIM);
Metals (total lead and dissolved manganese) by EPA Method 6020;
Anions (Nitrate, sulfate) by EPA Method 300.0;
Dissolved gases (Methane, ethane, ethane) by RSK-175
LABORATORY: Analytical Resources, Inc (ARI), Tukwila, WA
DATE: May 2015
Reviewer: Jacob Williams

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1 Introduction

This report documents the review of the data from the analysis of soil and groundwater samples and the associated laboratory and field quality control (QC) samples. The samples were analyzed by Analytical Resources, Inc. (ARI), Tukwila, Washington.

Sample Data Group (SDG)	No. of Samples	Matrix	Analyte(s)	Method	Validation Level
AFQ3	1	soil	Gasoline range organics	NWTPH-Gx	EPA Stage 2a

In accordance with the Quality Assurance Project Plan Revision 1 (USACE, 2014), analytical data were reviewed using Automated Data Review (ADR.net) software following EPA's Stage 2a Data Validation Electronic Process (S2AVE) as defined in *Guidance for Labeling Externally Validated Laboratory Analytical Data* (EPA-540-R08-005).

Analytical results are qualified based on the following guidance:

- QAPP Worksheet #36 – Data Validation Procedures (USACE 2014);
- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (July 2013);
- Principles of the most recent version of the Contract Laboratory Program National Functional Guidelines (NFG); and
- Internal (laboratory) control limits.

Per Worksheet #28 of the QAPP, project-specific quality control (QC) limits are used when evaluating data. The most current available laboratory QC limits are used in this data review. All detections below the limit of quantitation (LOQ) are automatically assigned the "J" flag to indicate that the value is estimated. Some data may be qualified using the reviewer's professional judgment. The conclusions presented herein are based on the information available for the review. Additional tables and attachments at the end of the narrative include the following:

- Table 1 – Data qualifier definitions;
- Attachment 1 – Output reports generated by ADR.net.

2 Gasoline Range Organics (NWTPH-Gx)

This section describes the data review findings for method NWTPH-Gx.

2.1 Sampling Documentation

All samples were received under proper chain of custody.

2.2 Holding Times and Sample Preservation

Analytical holding times, temperatures, and preservation requirements were met for all samples except for the following:

SDG	Parent Sample	Flag	Notes
AFQ3	AQE1	J- (all detects)	Holding time not within limits due to sampling error. Sampler neglected to collect sample volume for Gx. Omission was discovered ~6 weeks after sampling. Extra saved sample was still analyzed for Gx, even though the analysis exceeded the holding time. A decline in concentration is expected after 6 weeks past the holding time due to volatilization and biological degradation, however the degree of decline is unknown. It is likely the result would be higher if the holding time was not exceeded.

2.3 Laboratory Control Samples (LCS)

One LCS/LCSD pair was run with each SDG. All LCS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

2.4 Method Blanks

A minimum of one method blank was analyzed with each SDG. No target analytes were detected in the method blanks.

Exceptions: None

2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

One matrix spike and matrix spike duplicate (MS/MSD) pair was analyzed with each SDG or at a frequency of 1 MS/MSD per 20 samples with the following exceptions:

Exceptions: None

SDG	Comments
AFQ3	No MS/MSD was analyzed because sample was analyzed long after all other SDG's; therefore no MS/MSD was included with this SDG. No data qualified because LCS was within control limits.

All MS % recoveries and RPDs are within control limits with the following exceptions:

Exceptions: None

2.6 Laboratory Duplicates

A laboratory duplicate was not run. A laboratory duplicate is not required if a matrix spike duplicate is run.

2.7 Surrogate Spike Performance

Surrogates were analyzed with every sample. All surrogate % recoveries are within laboratory control limits with the following exceptions:

SDG	Parent Sample	Analyte	Flag	Notes
AFQ3	AQE1	Trifluorotoluene (TFT)	J+ (all detects)	Holding time qualifier supersedes surrogate performance qualifier.

2.8 Trip Blank

Trip blanks are not required for this analysis.

2.9 Equipment (Rinsate) Blank

Equipment blanks are not required for this analysis.

2.10 Field Duplicate Samples

The following field duplicate(s) were reviewed: None

3 Data Usability Assessment

This section provides an overall quantitative and qualitative assessment of the laboratory analytical data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability. The data quality indicators defined in the QAPP and presented in this section include precision, accuracy, representativeness, completeness, and sensitivity.

The overall quality of the data is acceptable.

3.1 Precision

Precision is evaluated by evaluating duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicates, and field duplicate samples. Duplicate pairs were run as required by the QAPP, and all MS/MSD, LCS/LCSD, laboratory, and field duplicates were within the precision criteria with the exception of the following:

- AFQ3 Gx, no MS/MSD was analyzed.

The overall precision of the data set is considered acceptable.

3.2 Accuracy

Accuracy, expressed as %Recovery (%R), was assessed for each method, analyte, and matrix, by comparing surrogate, MS/MSD, and LCS/LCSD recoveries to the laboratory control limits. Performance evaluation samples were not required for the sampling event. All percent recoveries were within control limits with the exception of the following:

- AFQ3 surrogate %recovery for Gx

3.3 Representativeness

Representativeness was evaluated by ensuring that approved analytical methods were used, samples were preserved correctly, and holding times were met. All holding times and temperature requirements were met. Method blanks were performed at the required frequency and no contaminants were detected. Trip blanks were analyzed and no contaminants were detected. The criteria for representativeness were within control limits with the following exceptions:

- AFQ3 Gx, holding time exceeded

3.4 Completeness

Analytical completeness is the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use. No data were rejected; analytical completeness for this sampling event is 100%.

3.5 Sensitivity

The analytical methods were selected to provide for sufficient sensitivity for comparison of project results to decision criteria.

4 Conclusions and Recommendations

The overall assessment of data indicates that the data reviewed meets project requirements. Sample results that were found to be estimated (J) should be used with caution if results are close to the regulatory benchmarks. Based upon the data review performed, all results are considered valid and usable for all purposes.

5 References

Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

Laboratory Data Consultants (LDC), Inc., 2013, Automated Data Review.net (ADR.net).

USACE, 2014. Quality Assurance Project Plan, Underground Storage Tank Site Investigation, Former Makah Air Force Station, Neah Bay, Washington. Final Revision 1, 06 May 2014.

USEPA, 2009. Guidance for Labeling Externally Validated Data for Superfund Use, EPA 540-R-08-005.

Tables

Table 1. Data qualifier definitions.

Flag	Description
J	The analyte was positively identified; Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
J+	Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
J-	Data are qualified as estimated, with a low bias likely to occur.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Attachment 1

ADR.net output reports

Data Qualifier Summary

Lab Reporting Batch ID: AFQ3-150518 **Laboratory: ARIS**

EDD Filename: afq3 **eQAPP Name: Makah 20150427**

Method Category: **VOA**

Method: **NWTPH-GX** ***Matrix:*** **AQ**

Sample ID: **AQE1** ***Collected:*** **3/13/2015 10:10:00 AM** ***Analysis Type:*** **DL** ***Dilution:*** **25.0**

Analyte	*Lab Result*	*Lab Qual*	*DL*	*DL Type*	*RL*	*RL Type*	*Units*	*Data Review Qual*	*Reason Code*
GASOLINE RANGE ORGANICS	27000		1400	DL	6200	LOQ	ug/L	J-	StoA

* denotes a non-reportable result

Project Name and Number: Task Order 18 - USACE Project: Makah

Data Qualifier Summary

Lab Reporting Batch ID: AFQ3-150518 **Laboratory: ARIS**

EDD Filename: afq3 **eQAPP Name: Makah 20150427**

Reason Code Legend

Reason Code	*Description*
StoA	Sampling to Analysis Rejection
Surr	Surrogate/Tracer Recovery Upper Estimation

* denotes a non-reportable result

Project Name and Number: Task Order 18 - USACE Project: Makah

QC Outlier Report: HoldingTimes

Lab Reporting Batch ID: AFQ3-150518 **Laboratory: ARIS**

EDD Filename: afq3 **eQAPP Name: Makah 20150427**

Method: NWTPH-GX **Preparation Method: SW5030B**

Matrix: AQ

Sample ID	Type	Actual	Criteria	Units	Flag
AQE1 (RES)	Sampling To Analysis	56.00	14.00	DAYS	J- (all detects)
AQE1 (DL)		56.00	14.00	DAYS	R (all non-detects)

Surrogate Outlier Report

Lab Reporting Batch ID: AFQ3-150518 **Laboratory: ARIS**

EDD Filename: afq3 **eQAPP Name: Makah 20150427**

Method: **NWTPH-GX**
Matrix: **AQ**

Sample ID (Analysis Type)	*Surrogate*	*Sample % Recovery*	*% Recovery Limits*	*Affected Compounds*	*Flag*
AQE1	Trifluorotoluene (TFT)	162	80.00-120.00	All Target Analytes	J+ (all detects)

Field QC Assignments and Associated Samples

EDD File Name: AFQ3-150518
eQapp Name: Makah 20150427

	Associated Samples	Sample Collection Date

EDD Warning Log

Lab Reporting Batch ID: AFQ3-150518

eQAPP: Makah 20150427 **Laboratory: ARIS**

Table	Line	Column	alue	Warning	Description
Sample Analysis				38	MethodBatch P1050815A is missing a sample of QCType MS for LabAnalysisRefMethodID NWTPH-GX
Sample Analysis				38	MethodBatch P1050815A is missing a sample of QCType MSD for LabAnalysisRefMethodID NWTPH-GX

APPENDIX F LABORATORY DATA PACKAGES

Available on CD

APPENDIX G PHASE I TECHNICAL MEMORANDUM

Available on CD