FINAL

2019 Monitoring Report

Operable Unit 2

U.S. Army Garrison Alaska

Site	ADEC File No.	ADEC Hazard ID
DRMO	108.38.069.01	1122

Contract No. W911KB-16-D-0005

Task Order W911KB18F0053

December 2019

FES

FAIRBANKS ENVIRONMENTAL SERVICES, INC.

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, U.S. ARMY GARRISON ALASKA
1046 MARKS ROAD #6000
FORT WAINWRIGHT, ALASKA 99703-6000

December 17, 2019

Directorate of Public Works

Subject: Submission of the Final 2019 Monitoring Report, Operable Unit 2, to State of Alaska Department Environmental Conservation.

Ms. Erica Blake
Environmental Program Specialist
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, AK 99709

Dear Ms. Blake:

This letter documents transmission of the Final 2019 Monitoring Report, Operable Unit 2, on Fort Wainwright to State of Alaska Department Environmental Conservation (ADEC).

A digital copy of the document will be provided to you and a CD will be delivered to ADEC in Fairbanks. A copy of the letter is being provided to Mr. Kevin Fraley, Environmental Program Specialist, ADEC and Ms. Sandra Halstead, Federal Facilities Superfund Site Manager, Environmental Protection Agency. If you would like to receive a hard copy of this document, please notify us within the next few weeks.

If you have questions or concerns regarding this action please contact the undersigned at (907) 361-6623 or email brian.m.adams18.civ@mail.mil, Ms. Bri Clark, Alternate Remedial Program Manager (907) 361-3001 or email brianne.r.clark.civ@mail.mil or you may contact Mr. Seth Reedy, Alternate Remedial Program Manager (907) 361-6489 or email seth.a.reedy.civ@mail.mil.

Brian M Adams

Brian Adams
Remedial Project Manager

CF:
HQ, USAG FWA CERCLA Administrative Records (w/o encls)

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, U.S. ARMY GARRISON ALASKA
1046 MARKS ROAD #6000
FORT WAINWRIGHT, ALASKA 99703-6000

December 17, 2019

Directorate of Public Works

Subject: Submission of the Final 2019 Monitoring Report, Operable Unit 2, to State of Alaska Department Environmental Conservation.

Mr. Kevin Fraley
Environmental Program Specialist
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, AK 99709

Dear Mr. Fraley:

This letter documents transmission of the Final 2018 Monitoring Report, Operable Unit 2, on Fort Wainwright to State of Alaska Department Environmental Conservation (ADEC).

A digital copy of the document will be provided to you and a CD will be delivered to ADEC in Fairbanks. A copy of the letter is being provided to Ms. Erica Blake, Environmental Program Specialist, ADEC and Ms. Sandra Halstead, Federal Facilities Superfund Site Manager, Environmental Protection Agency. If you would like to receive a hard copy of this document, please notify us within the next few weeks.

If you have questions or concerns regarding this action please contact the undersigned at (907) 361-6623 or email brian.m.adams18.civ@mail.mil, Ms. Bri Clark, Alternate Remedial Program Manager (907) 361-3001 or email brianne.r.clark.civ@mail.mil or you may contact Mr. Seth Reedy, Alternate Remedial Program Manager (907) 361-6489 or email seth.a.reedy.civ@mail.mil.

Brian Adams
Remedial Project Manager

CF:
HQ, USAG FWA CERCLA Administrative Records (w/o encls)

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, U.S. ARMY GARRISON ALASKA
1046 MARKS ROAD #4500
FORT WAINWRIGHT, ALASKA 99703-6000

REPLY TO
ATTENTION OF:

December 17, 2019

Directorate of Public Works

Subject: Submission of the Final 2019 Monitoring Report, Operable Unit 2, to Environmental Protection Agency.

Ms. Sandra Halstead
Environmental Protection Agency
Federal Facilities Superfund Site Manager
Alaska Operations Office
222 W. 7th Ave, #19
Anchorage, AK 99513

Dear Ms. Halstead:

This letter documents transmission of the Final 2019 Monitoring Report, Operable Unit 2, on Fort Wainwright to the Environmental Protection Agency.

A digital copy of the document will be provided to you. A copy of this letter is being provided to Ms. Erica Blake, Environmental Protection Specialist, and Mr. Kevin Fraley, Environmental Program Specialist, Alaska Department of Environmental Conservation. If you would like to receive a hard copy of this document, please notify us within the next few weeks.

If you have questions or concerns regarding this action please contact the undersigned at (907) 361-6623 or email brian.m.adams18.civ@mail.mil, Ms. Bri Clark, Alternate Remedial Program Manager (907) 361-3001 or email brianne.r.clark.civ@mail.mil or you may contact Mr. Seth Reedy, Alternate Remedial Program Manager (907) 361-6489 or email seth.a.reedy.civ@mail.mil.

Brian Adams
Remedial Project Manager

CF:
HQ, USAG FWA CERCLA Administrative Records (w/o encls)

FINAL

2019 Monitoring Report

Operable Unit 2
U.S. Army Garrison Alaska

ADEC File Numbers	ADEC Hazard IDs
108.38.069.01 (DRMO)	1122 (DRMO)

December 2019

Prepared for

U.S. Army Garrison Alaska

Under Contract to

U.S. Army Corps of Engineers, Alaska District

Post Office Box 6898
JBER, Alaska 99506-0898
Contract W911KB-16-D-0005, Task Order W911KB18F0053

Prepared by

Fairbanks Environmental Services

3538 International Street
Fairbanks, Alaska 99701
(907) 452-1006
FES Project No. 9011-17

TABLE OF CONTENTS

TABLES

FIGURES

GRAPHS (EMBEDDED IN THE TEXT)

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-dichloroethene
AAC	Alaska Administrative Code
AFCEE	Air Force Center for Engineering and the Environment
ADEC	Alaska Department of Environmental Conservation
AS	air sparging
AWQS	Alaska Water Quality Standards
CD	compact disc
CDQR	Chemical Data Quality Review
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	contaminants of concern
CUL	cleanup level
DERA	Defense Environmental Restoration Account
DES	Directorate of Emergency Services
DO	dissolved oxygen
DoD	Department of Defense
DOL	Directorate of Logistics
DPW	Directorate of Public Works
DRO	diesel range organics
DRMO	Defense Reutilization Marketing Office
EPA	Environmental Protection Agency
FES	Fairbanks Environmental Services Inc.
FFA	Federal Facilities Agreement
GAC	granular activated carbon
GIS	geographic information systems
GRO	gasoline range organics
HLA	Harding Lawson Associates
HQAES	Headquarters Army Environmental System
IC	Institutional Control
IDW	investigation-derived waste
ISCR	*in-situ* chemical reduction
LBE	Left Behind Equipment
LTMO	long-term monitoring optimization
MAROS	Monitoring and Remediation Optimization System
MCL	maximum contaminant level
µg/L	micrograms per liter
mg/L	milligrams per liter
mV	millivolts
NA	natural attenuation
ND	not detected
NRC	National Response Corporation
ORC	oxygen-releasing compound
ORP	oxidation-reduction potential
OU2	Operable Unit 2

LIST OF ACRONYMS AND ABBREVIATIONS CONT'D

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
QSM	Quality Systems Manual
RAG	Remedial Action Goal
RAO	remedial action objective
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Program Manager
SGS	SGS North America Inc.
SVE	soil vapor extraction
SVOC	semivolatile organic compounds
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloethene
USACE	U.S. Army Corps of Engineers
USARAK	U.S. Army Alaska
UST	underground storage tank
VOC	volatile organic compounds
WSW	Water Supply Well

EXECUTIVE SUMMARY

Operable Unit 2 (OU2) currently includes two chlorinated solvent-contaminated sites at the Defense Reutilization Marketing Office (DRMO) Yard at U.S. Army Garrison, Alaska; DRMO1 and DRMO4. Cleanup activities at these sites were conducted under the 3-Party Agreement, and groundwater monitoring was conducted at each of the sites in 2019. The results of the 2019 monitoring program and recommendations for 2020 are presented in this report.

DRMO Yard 3-Party Sites

Chlorinated compounds exceeding Record of Decision (ROD) Remedial Action Goals (RAG) have historically been present within the DRMO1 and DRMO4 3-Party subareas of the DRMO Yard. Active treatment using air sparging (AS)/soil vapor extraction (SVE) was conducted between 1997 and 2005 at the DRMO1 site. Long-term monitoring optimization (LTMO) analysis of the sites in 2008 indicated stable and decreasing trends for the contaminants of concern (COCs), but also indicated that the contaminants would likely persist for a significant time above the RAG. Based on these results, a treatability study utilizing injection of an *in-situ* chemical reduction (ISCR) compound was completed (FES, 2018b). The goals of the treatability study were to evaluate the potential to stimulate reductive dechlorination, reduce the time required to achieve the RAG, and reduce long-term monitoring costs. Injections as part of the treatability study were completed at the DRMO1 and DRMO4 sites in 2009. A second injection was completed at the DRMO1 site in 2010, and a second injection was completed at the DRMO4 site in 2011.

Post-injection groundwater monitoring has been conducted at these sites and showed the stimulation of reducing conditions and biodegradation of the residual tetrachloroethene (PCE). PCE exceeded the RAG in one well in the DRMO1 source area (AP-10016R), but did not exceed the RAG in any well at the DRMO4 site during 2019. Groundwater geochemistry indicates that reducing conditions are persistent in these areas and natural attenuation of the residual PCE contamination is continuing.

Evaluation of the PCE and trichloroethene (TCE) plumes was completed at the DRMO1 and DRMO4 sites using the Monitoring and Remediation Optimization System (MAROS) software. The results at the DRMO1 site showed:

- Contaminant concentration trends for PCE and TCE do not indicate increasing concentrations that will result in additional exceedances of the RAG.
- The estimate of dissolved mass in the PCE and TCE plumes exhibited no trend, and recent estimates show the overall dissolved mass for both contaminants is stable.
- The location of the center of mass relative to the source for PCE and TCE exhibits an increasing trend, and has moved downgradient due to decreasing contaminant concentrations in the source area. However, it does not indicate migration of the plumes with concentrations above the RAG.

- The plume spread analysis for PCE and TCE generally showed no trend. The only exception was an increasing trend for TCE perpendicular to groundwater flow. However, there was no indication from TCE concentrations in individual wells that the plume is expanding above the RAG.

The results at the DRMO4 site showed:

- Contaminant concentration trends for PCE and TCE were stable or exhibited no trend. PCE has not been detected above the RAG since 2017, and TCE has not been detected since 2017.
- Quantitative plume analysis could not be completed due to the small well network; however, the sampling results show evidence of reductive dechlorination and the contaminant concentrations in downgradient wells have remained below the RAG. These results suggest the plumes are not expanding.

Overall, the LTMO analysis showed the PCE contaminant plumes at the DRMO1 and DRMO4 sites remain stable. Based on the 2019 sampling results, annual sampling should continue in the fall at the DRMO1 and DRMO4 3-Party sites.

Contaminant Concentration Comparison to Current ADEC Cleanup Levels

In November 2016, the Alaska Department of Environmental Conservation (ADEC) cleanup levels (CUL) were revised utilizing risk-based calculations. A second update for select compounds was completed in September 2018. This resulted in a significant change in the groundwater CUL for many compounds. The current CULs are found in Title 18 of the Alaska Administrative Code (AAC), Chapter 75.345 Table C, and would apply to 2-Party sites for evaluation of cleanup under ADEC regulations. In addition, the current ADEC CULs should be applied to ROD analytes for any 3-Party site transferred to the 2-Party program after ROD objectives are achieved, or upon agreement by the Army, ADEC, and the Environmental Protection Agency (EPA).

The 2019 groundwater sampling results at the OU2 3-Party sites were compared to current ADEC CULs for ROD COCs and non-ROD COCs for informational purposes. The comparison showed:

- ROD COC: PCE in AP-10016R at the DRMO1 3-Party site exceeded the ROD RAG, but was below the current ADEC CUL.
- Non-ROD COC: DRO exceeds the ADEC CUL in DRMO1 3-Party well AP-7560

IC Inspection Summary

An annual Institutional Controls (IC) inspection was conducted at the OU2 DRMO yard in 2019. The inspection showed the ICs have been properly implemented, and minor maintenance items (such as replacing locks on monitoring wells) were completed at the time of the inspection.

A nonconformance issue was identified at the DRMO yard Water Supply Well (WSW) in 2018, and a letter detailing this issue was sent to EPA and ADEC. The well pump was locked out on November 21, 2018, and regulatory approval was requested to slowly fill the fire suppression tank with the well until permanent piping corrections could be completed. All 2019 filling events were documented, and piping modifications are anticipated to be completed in 2020. Further details regarding the IC inspection are presented in the 2019 IC inspection report (anticipated in spring 2020).

1.0 INTRODUCTION

This report describes site activities and presents groundwater monitoring results from 2019 at Operable Unit 2 (OU2) sites on Fort Wainwright, Alaska. OU2 currently consists of the DRMO1 and DRMO4 3-Party sites in the Defense Reutilization Marketing Office (DRMO) Yard, since the former Building 1168 Leach Well site was removed from OU2 in 2018 as described in the *Interim Remedial Action Completion Report* (FES, 2018). This report also provides a summary of the Institutional Control (IC) inspections conducted at the OU2 sites during 2019.

This document and the associated fieldwork were completed by Fairbanks Environmental Services Inc. (FES) under U.S. Army Corps of Engineers (USACE) contract W911KB-16-D-0005, Task Order W911KB18F0053. The work was completed according to the 2019 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites Work Plan (FES, 2019); under authority of CERCLA; and in compliance with the OU2 Record of Decision (ROD; U.S. Army Alaska [USARAK], 1997), Federal Facility Agreement (FFA), and state of Alaska regulations.

1.1 DRMO Background

The DRMO Yard is a fenced area of approximately 25 acres located in the southeast portion of the main post area of Fort Wainwright, Alaska. It lies northwest of the intersection of Badger Road and the Richardson Highway adjacent to Fairbanks, Alaska. Under a FFA between the U.S. Department of Defense (DoD), the Alaska Department of Environmental Conservation (ADEC), and the Environmental Protection Agency (EPA), the DRMO Yard was placed in OU2 for purposes of remediation under CERCLA. A site location map is included as Figure 1-1.

Historical activities conducted at the DRMO Yard included vehicle maintenance, drum storage, and open burning. The site was operated as a vehicle maintenance shop compound from 1945 until 1961 when it was converted to a salvage yard. Items stored at the salvage yard have included petroleum products, pesticides and herbicides, tar and asphalt, transformers, transformer oil [containing polychlorinated biphenyls (PCBs)], appliances, vehicles, and paint products. Currently, the DRMO Yard stores surplus equipment and supplies for the Army.

The Directorate of Logistics (DOL) has also constructed two large gravel pads in the DRMO Yard for storage and staging of equipment and vehicles prior to deployment. A number of fuel spills were observed as a result of the activities on these new pads. The nature and extent of these spills were investigated by Jacobs Engineering during 2010, and were described in the 2010 OU2 Monitoring Report (FES, 2011).

Contaminants were first observed in groundwater in the DRMO Yard during a study conducted at an adjacent facility between 1990 and 1993. Both diesel range organics (DRO) and trichloroethene (TCE) were discovered in groundwater samples collected from DRMO Yard wells

during this study. Pursuant to these findings, a preliminary source investigation was conducted at the DRMO Yard in 1992. This study consisted of groundwater and soil sampling, and indicated that diesel, naphthalene, petroleum hydrocarbons, and volatile organic compounds (VOCs) were present on site. A Remedial Investigation and Feasibility Study (RI/FS) was performed for all of OU2 in 1995 and characterized contamination throughout the DRMO Yard (Harding Lawson Associates [HLA], 1996). A ROD, prepared following completion of the RI/FS, specified the remedial actions to be undertaken to treat soil and groundwater contamination.

1.2 DRMO Subarea Descriptions

Based on the findings of the RI/FS, the OU2 ROD identified five subareas of contamination within the DRMO Yard (USARAK, 1997). The subareas are shown on Figure 1-2 and summarized in Table 1-1.

Table 1-1. Summary of DRMO Yard Subareas

Subarea	Regulatory Authority	Location within DRMO Yard	Remediation Status
3-PARTY SITES			
DRMO1	OU2 ROD (3-Party)	Central and northwest (extending northwest)	OU2 AS/SVE Treatment System (1997–2005) ISCR Treatability Study (2009, 2010)
DRMO4	OU2 ROD (3-Party)	Southwest	ISCR Treatability Study (2009, 2011)
2-PARTY SITES[1]			
DRMO1	2-Party	Central and northwest (extending northwest)	DRMO1 AS/SVE Treatment System (1996-2003)
DRMO2 Building 5010 (Former Building 5001)	2-Party	East	Long Term Monitoring
DRMO3	2-Party	South central	Long Term Monitoring
DRMO5	2-Party	Central west (across Channel B)	DRMO5 AS/SVE Treatment System (1996-2003)

[1] Monitoring results from DRMO 2-Party sites are not presented in this report.

1.2.1 DRMO1 Subarea

The DRMO1 subarea covers the central and northwest portions as well as a large area northwest of the DRMO Yard, and also includes Building 5008 and the Water Supply Well (WSW) house. Contaminants of concern (COCs) within this subarea historically have included tetrachloroethene (PCE), TCE, DRO, and gasoline range organics (GRO). Sources of contamination are believed to

have been waste oil drums and transformers previously stored in this area, and former diesel underground storage tanks (USTs). Two remediation systems, the DRMO1 (2-Party) air sparging (AS)/soil vapor extraction (SVE) treatment system and the DRMO1 (3-Party) AS/SVE treatment system, were installed in this subarea in 1996 and 1997, respectively, to treat soil and groundwater contamination. Although the treatment systems were initially effective in reducing groundwater contaminant concentrations, the systems were shutdown prior to achieving cleanup goals in all wells due to very low VOC removal rates.

Groundwater sampling of the DRMO1 (2-Party) wells following treatment system shutdown showed that there was not significant contaminant rebound, and continued operation of the system would result in limited impact to the residual contamination. As a result, the treatment system was decommissioned in 2008. Groundwater samples from the DRMO1 (2-Party) subarea are collected once every five years in coordination with the Five Year Review. Sampling at this site was conducted in 2019 and the results are presented in the Fort Wainwright Two-Party Report.

Groundwater sampling of the DRMO1 (3-Party) area between 2006 and 2008 did not identify contaminant rebound following the shutdown of the treatment system, and the system was decommissioned in October 2008. Long-term monitoring optimization (LTMO) analysis of the site completed in 2008 indicated stable and decreasing trends for the COCs, but also indicated that the contaminants will likely persist for a significant time above the Remedial Action Goal (RAG). Based on these results, an *in-situ* chemical oxidation (ISCR) treatability study was conducted to evaluate the effectiveness of reductive dechlorination to achieve RAGs in a shorter timeframe and reduce long-term monitoring costs. The treatability study (utilizing injection of the ISCR compound Adventus EHC®) was initiated in 2009 as described in the approved Work Plan (FES, 2009). Contaminant concentrations decreased as a result of the treatability study. However, the groundwater geochemistry returned to pre-injection conditions 10-months following the 2009 injection, indicating the ISCR product was depleted. As a result, a second injection was completed at this site in 2010. The second injection stimulated strong reducing conditions, and PCE and all degradation products were below RAGs in 2013. PCE concentrations were identified above the ADEC cleanup level (CUL) in one well (AP-10016) during 2014 and 2015. Groundwater monitoring was conducted in the DRMO1 (3-Party) treatment area during 2019 to continue evaluation of contaminant concentrations remaining in this area.

Groundwater samples from the WSW have been collected since 1998 to evaluate potential contaminant migration into the well. Samples are currently collected on an annual basis as part of the OU2 monitoring program.

1.2.2 DRMO2 Subarea

The DRMO2 subarea covers the eastern quarter of the DRMO Yard and includes Buildings 5003 and 5010. COCs within this subarea historically have included DRO, GRO, and benzene. The

major source of contamination is believed to have been several diesel USTs, which were removed from this area. These USTs were associated with former Building 5001, which was situated in the current location of Building 5010. In addition, an estimated 3,000 to 8,000 gallons of diesel fuel was spilled near former Building 5001 in the early 1980s. There has been no active remediation within this subarea. Long-term monitoring is conducted on an annual basis at this site, and the results are described as part of the Fort Wainwright Two-Party Report.

1.2.3 DRMO3 Subarea

DRMO3, the smallest subarea, includes Building 5007 and the area in the south central portion of the DRMO Yard, and extends south of the yard beyond the Alaska Railroad line and the Old Richardson Highway. COCs within this subarea historically have included DRO and GRO. There has been no active remediation within this subarea, and there has been no groundwater sampling in this subarea since 1994 as described in the RI (HLA, 1996).

1.2.4 DRMO4 Subarea

The DRMO4 subarea encompasses the southwest section of the DRMO Yard which includes the Alaska Railroad spur line that enters the DRMO Yard, the associated loading ramp, and a portion of the Alaska Railroad line and the Old Richardson Highway south of the DRMO Yard. COCs within this subarea historically have included PCE, TCE, DRO, and GRO. Sources of contamination are believed to have been asphalt drums and transformers previously stored in this area, and potential releases associated with the railroad spur.

Groundwater data indicated that reductive dechlorination was occurring; however, the rate may be limited by the availability of carbon sources. LTMO analysis showed that the COCs have stable and decreasing concentration trends, although the contaminants will likely remain above the RAGs for a significant period of time. A treatability study utilizing the same ISCR compound as was used at the DRMO1 site was also completed at this site to evaluate stimulation of reductive dechlorination and the potential to achieve RAGs in a shorter timeframe. The first injection was completed at the DRMO4 site in 2009 (FES, 2010). Groundwater monitoring was continued during 2010 to evaluate the effectiveness of the injection, and a second injection was completed as part of the treatability study in 2011. Groundwater sampling results showed all PCE concentrations were below the RAG in all wells during May 2012 and August 2013. However, PCE exceedances were observed in two wells in October 2014, and in one well in August 2015. Groundwater monitoring was conducted in the DRMO4 (3-Party) treatment area during 2019 to continue evaluation of contaminant concentrations remaining in this area.

1.2.5 DRMO5 Subarea

The DRMO5 subarea includes the west central portion and west gate of the DRMO Yard and extends west beyond the DRMO Yard to cover a portion of a slough (Channel B). COCs within

this subarea historically have included petroleum hydrocarbons (DRO and GRO). Sources of contamination are believed to be a former waste oil drum storage area and a former fire burn pit in the eastern portion of this subarea. One remediation system, the DRMO5 AS/SVE treatment system, was installed in this subarea in 1996 to treat soil and groundwater contamination. This system was shutdown in 2003 due to asymptotic VOC removal rates, and was decommissioned in October 2008. Groundwater samples from the DRMO5 subarea are collected once every five years in coordination with the Five Year Review. Sampling at this site was conducted in 2019 and the results are presented in the Fort Wainwright Two-Party Report.

1.3 OU2 Source Area Tracking

The remaining OU2 source areas are tracked in the ADEC Contaminated Sites database, which is maintained by the ADEC project manager assigned to the site, and by the Army in the Headquarters Army Environmental System (HQAES) for funding purposes. The source area description, along with the HQAES and ADEC IDs are summarized in Table 1-2.

Table 1-2. Crosswalk Table for OU2 Source Area Tracking Numbers[1]

OU2 Source Area	HQAES Number	ADEC File ID	ADEC Hazard ID	Site Status[2]
DRMO 3-Party Sites DRMO1 DRMO4	02871.1024	108.38.069.01	1122	Open

[1] Based on information from the ADEC Contaminated Sites Database available at http://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/Search and the Army HQAES

[2] Site status from the ADEC Contaminated Sites Database

1.4 Remediation Objectives

1.4.1 OU2 Record of Decision

The OU2 ROD was signed under the FFA in March 1997 by the USARAK, ADEC, and EPA (USARAK, 1997). The ROD identified the following remedial action objectives (RAOs):

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame through source control;
- Reduce or prevent further migration of contaminated groundwater from the source areas;
- Prevent use of groundwater containing contaminants at levels above federal Safe Drinking Water Act and State of Alaska Drinking Water Standard maximum contaminant levels (MCLs) and Alaska Water Quality Standards (AWQSs), and limit high-volume pumping from the aquifer at the DRMO Yard until state and federal MCLs are achieved;
- Use natural attenuation to attain AWQSs after reaching state and federal MCLs; and

- Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and AWQSs.

The RAGs for groundwater were established under the 3-Party FFA for DRMO1 and DRMO4. The ROD RAGs are presented in Table 1-3.

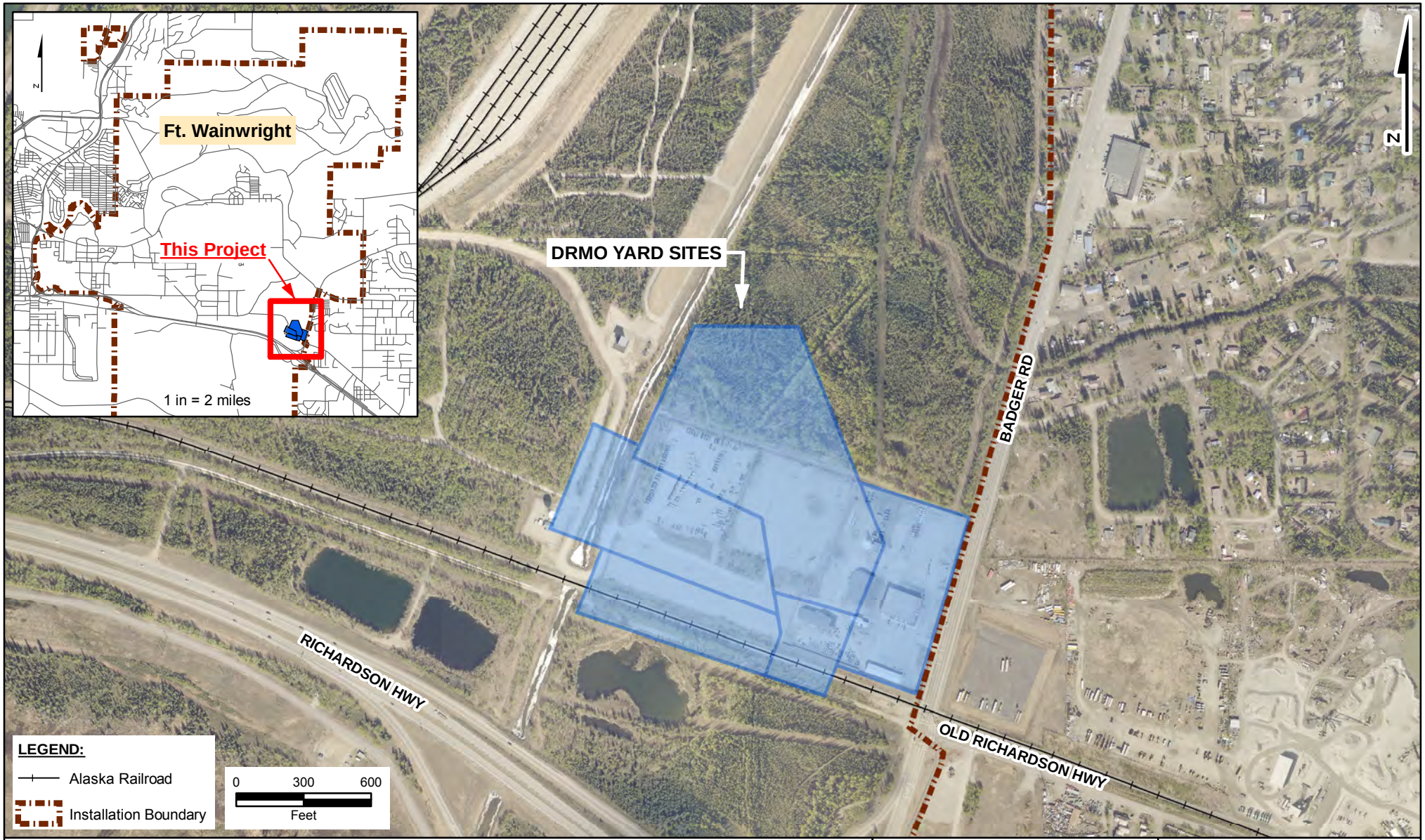
Table 1-3. DRMO ROD RAGs for Groundwater

Contaminants of Concern	ROD RAG (µg/L)	Basis
Benzene	5	MCL
PCE	5	MCL
TCE	5	MCL
Vinyl Chloride	2	MCL (breakdown product)
1,1-Dichloroethene (1,1-DCE)	7	MCL (breakdown product)
cis-1,2-Dichloroethene (cis-1,2-DCE)	70	MCL (breakdown product)

µg/L – micrograms per liter

1.4.2 2-Party Agreement

Since the primary COCs identified in subareas DRMO2, DRMO3, and DRMO5 were petroleum hydrocarbons, these areas were addressed separately under a 2-Party Agreement between USARAK and ADEC, rather than under the ROD. ADEC groundwater cleanup standards, as presented in Table C of Title 18 of the Alaska Administrative Code (AAC), Chapter 75.345 were adopted as remediation goals for areas not addressed in the ROD. In November 2016, the ADEC CULs were revised utilizing risk-based calculations. The ADEC CULs were revised again for select compounds in September 2018. These updates resulted in a significant change in the CULs from when the 2-Party Agreement was originally signed. The current levels (ADEC, 2018) will need to be utilized for 2-Party sites to attain cleanup complete under ADEC regulations. In addition, the current ADEC CULs will be applied to any 3-Party site transferred to the 2-Party program after ROD objectives are achieved, or by agreement of the Army, EPA, and ADEC.



NOTES:

1. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCES:

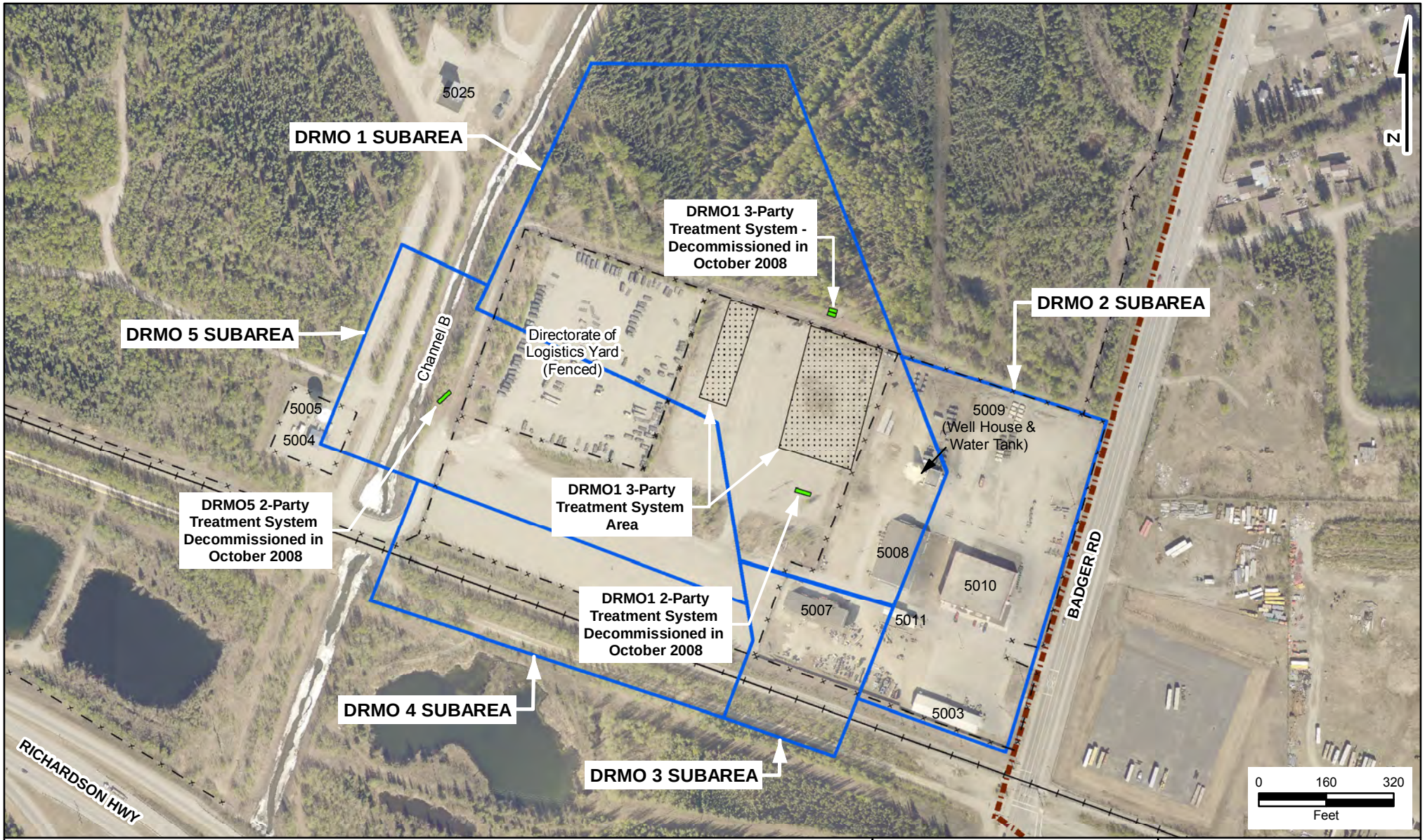
1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

Site Location Map
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005	Figure: 1-1	Date: 10/19



LEGEND:

- Fence
- Alaska Railroad
- Installation Boundary

NOTES:

1. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCES:

1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

DRMO Yard Subareas
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005	Figure: 1-2	Date: 10/19

2.0 FIELD ACTIVITIES SUMMARY

This section describes the groundwater sampling procedures, investigation-derived waste (IDW) handling procedures, and a summary of the data quality review and annual IC inspection. Each of these activities was completed in August 2019.

2.1 OU2 Groundwater Monitoring Program Summary

Groundwater samples are collected annually from the OU2 DRMO1 and DRMO4 sites. A summary of the 2019 OU2 groundwater monitoring program is summarized in Table 2-1. The 2019 groundwater sampling locations for the DRMO Yard are shown on Figure 2-1.

Table 2-1. Summary of the 2019 OU2 Groundwater Monitoring Program

OU2 Site	Subarea/ Site	Number of Wells/Probes	Contaminant Analyses[1]	NA Analyses[3]	Monitoring Frequency
DRMO1 (3-Party)	DRMO1	7	DRO[2], VOC	Iron, sulfate	Annual
DRMO4 (3-Party)	DRMO4	3	DRO[2], VOC		Annual
Water Supply Well	DRMO1	1	GRO, DRO, VOC, SVOC	--	Annual

NA – Natural Attenuation; SVOC – semivolatile organic compounds

[1] Contaminant analyses included the following methods: VOC (8260C), SVOC (8270D), GRO (AK101), and DRO (AK102)

[2] Only one well in the DRMO1 (3-Party) area (AP-7560) and one well in the DRMO4 (3-Party) area (AP-10445MW) were analyzed for DRO

[3] Natural attenuation analyses included the following methods: iron (6020A), sulfate (300.0)

Groundwater sampling at the DRMO 3-Party sites was conducted in August 2019. Groundwater monitoring was conducted in accordance with the procedures detailed in the 2019 Work Plan (FES, 2019). All groundwater samples were analyzed by SGS North America Inc., (SGS), of Anchorage, Alaska, as presented in Table 2-1.

The groundwater tracking table and analytical results are presented in Appendix A as Tables A-1 and A-2, respectively. The Chemical Data Quality Review (CDQR) and ADEC Laboratory Data Review Checklists summarizing the laboratory data review are presented in Appendix B. Copies of groundwater sample forms are included in Appendix C. Field parameters recorded on groundwater sample forms (dissolved oxygen [DO], temperature, pH, specific conductivity, oxidation-reduction potential [ORP], turbidity, and drawdown) are summarized in Table C-1.

2.2 Groundwater Sampling Procedures

Low-flow methodology (Puls and Barcelona, 1996) was used to collect water samples from all monitoring wells. The low-flow sampling method utilized variable-speed submersible pumps, and dedicated Teflon-lined tubing to purge and sample the wells. The only exception to the low-flow

methodology was sampling of the WSW. Samples from the WSW are collected from a spigot (raw water tap) located directly downstream of the WSW source.

Groundwater was purged at a rate between 0.03 and 0.15 gallons per minute. Water quality measurements were recorded every five minutes and monitoring wells were purged until water quality parameters stabilized, per ADEC guidance (ADEC, 2019a). Field parameters were measured using YSI water quality meters installed in a flow through cell. The instruments were calibrated at the beginning of each day according to the manufacturer's instructions. Parameters measured included pH, temperature, specific conductivity, DO, and ORP. In addition, turbidity and drawdown were measured for each well and were recorded on sampling forms. Groundwater sampling forms are presented in Appendix C, and a summary of the field parameters is provided on Table C-1.

Following sampling, the submersible pumps were decontaminated in accordance with the procedures described in the Work Plan (FES, 2019). Rinsate samples were also collected to evaluate decontamination of the re-usable pumps. The rinsate sample results are discussed in the CDQR.

2.3 Investigation-Derived Waste

IDW generated during OU2 field activities in 2019 included purge water, decontamination water, and general refuse (disposable tubing, nitrile gloves, etc.) from groundwater monitoring activities. All IDW and other waste streams were managed according to the procedures outlined in the Work Plan (FES, 2019).

Purge water was containerized at the time of sampling in 15-gallon polyethylene drums. The drums were labeled with a unique ID, and a form was completed documenting the ID and purge volume from each well. The drums were taken to the Fort Wainwright Defense Environmental Restoration Account (DERA) building for temporary storage. The purge water from the OU2 DRMO sites was disposed of as CERCLA waste. Complete documentation of the CERCLA waste disposal will be provided in the 2019 IDW Technical Memorandum.

Following groundwater sampling, the submersible pumps used at the DRMO site were decontaminated in accordance with the Work Plan (FES, 2019), and the decontamination water was containerized and treated using granular activated carbon (GAC). The treated water was discharged on the site where the pumps were used, at a location that was vegetated and at least 100 feet from any surface water body source. The discharge location at the DRMO site is shown on Figure 2-1.

2.4 Groundwater Sample Data Quality

The OU2 groundwater data were reviewed in order to assess whether analytical data met data quality objectives and were acceptable for use. The project data were reviewed for deviations to the requirements presented in the Work Plan (FES, 2019), the ADEC Technical Memorandum (ADEC, 2019b), and the DoD Quality Systems Manual (QSM), Version 5.1 (DoD, 2017).

Several results were qualified as potential estimates during the data review process; however, no data were rejected. In all cases, the impact to the overall project due to the data qualifications was minor. The reviewed data are presented in Appendix A, and are used in tables and figures throughout the report. The specific data quality issues found during the review are presented in the CDQR in Appendix B.

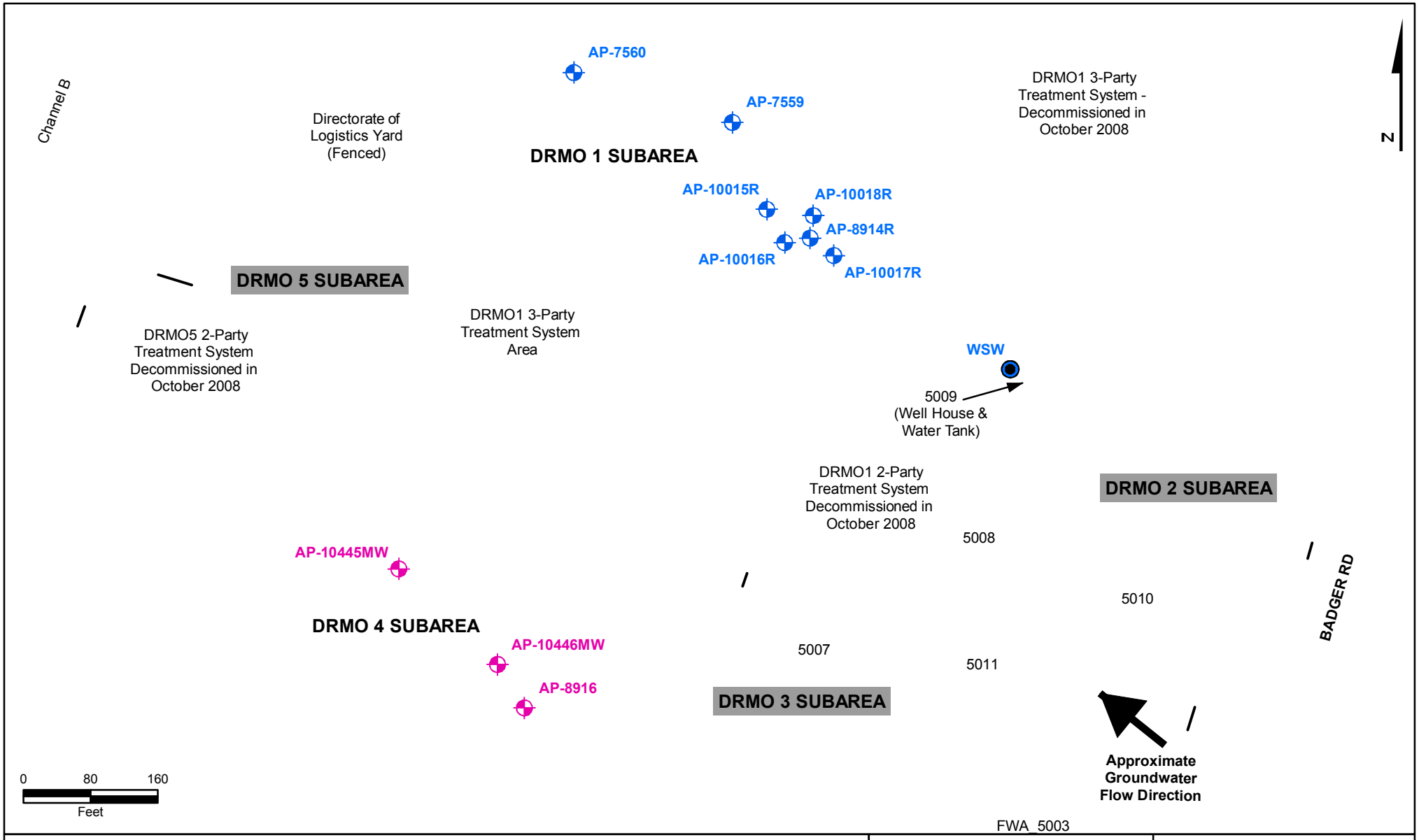
2.5 Long-Term Monitoring Optimization and Statistical Evaluation of Treatment Goals

The sampling data are used to conduct LTMO analysis of the monitoring program. The analysis was initiated in 2008 following shutdown of the OU2 treatment systems and contaminant rebound study, and has been updated each year using the most recent sampling results. The update includes an evaluation of contaminant trends, plume stability, monitoring well redundancy, and sampling frequency using the Monitoring and Remediation Optimization System (MAROS) software developed by the Air Force Center for Engineering and the Environment (AFCEE). The MAROS software utilizes basic site-specific inputs (e.g., groundwater monitoring data, hydrogeologic parameters, and well location information) to conduct a statistical analysis of the groundwater monitoring system. The MAROS software is one among several tools that has been recommended for use in LTMO (EPA, 2005). The Remedial Program Managers (RPMs) at the Fort Wainwright Directorate of Public Works (DPW) recommended using MAROS to evaluate the monitoring program at OU2.

2.6 Institutional Controls Inspection

An IC survey was completed during August 2019. The IC survey included an evaluation of the OU2 DRMO sites discussed in the OU2 ROD (DRMO1, DRMO4, and WSW). The IC inspection included a site visit to evaluate potential land use changes, site security (monitoring wells, etc., as applicable), or unauthorized excavation or groundwater use. In addition to the site visit, reviews of the Fort Wainwright IC geographic information system (GIS) layer and the site-specific information in the ADEC Contaminated Sites database were conducted. A summary of the 2019 IC survey is presented below, and the complete survey results will be included in the 2019 Fort Wainwright IC Inspection Report (expected spring 2020).

- **DRMO Yard**
  - *IC Description:*
    - "Restricted access and well development restrictions, and a groundwater monitoring and evaluation program for the potable drinking water supply wells. These controls will remain in place as long as hazardous substances remain on site at levels that preclude unrestricted use"; and
    - "Additional institutional controls, including a limitation on refilling the DRMO Yard fire suppression water tank from the existing potable water supply well, until state and federal maximum contaminant levels are met (except in emergency situations)." (USARAK, 1997)
  - *2019 IC Inspection Results:*
    - Access on the east side of the DRMO is now controlled by the Directorate of Emergency Services (DES) (formerly controlled by DRMO), and access on the west side is managed by the Left Behind Equipment (LBE) group.
    - It was determined in 2018 that the DRMO Yard fire suppression tank had been filled from the potable water well since it was installed. A notification of non-conformance was sent to the regulators on November 21, 2018, and the pump was locked out to prevent unauthorized use. The following activities were conducted in 2019:
      - No unauthorized operations of the WSW occurred during 2019.
      - Each pump operation event was recorded on a fill log which was provided to ADEC and EPA.
      - Permanent piping corrections are anticipated to be completed in 2020.



LEGEND:

- DRMO1 Groundwater Monitoring Well
- DRMO Water Supply Well
- DRMO4 Groundwater Monitoring Well
- Approximate Location of Decon Water Discharge Point
- Fence
- Alaska Railroad
- Installation Boundary

NOTES:

1. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCES:

1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

DRMO Yard Monitoring Well Locations
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005	Figure: 2-1	Date: 10/19

3.0 DRMO YARD GROUNDWATER MONITORING RESULTS (3-PARTY)

This section presents the groundwater monitoring results for the DRMO1 and DRMO4 3-Party sites through 2019. Groundwater sampling results for the DRMO1 site are summarized in Table 3-2 and Figure 3-1, and sampling results for the DRMO4 site are summarized in Table 3-3 and Figure 3-2. Groundwater geochemistry for the DRMO yard is presented in Figure 3-3. are summarized in Tables 3-2 and 3-3.

3.1 DRMO Yard Groundwater Elevations and Flow Direction

Groundwater elevations from DRMO 3-Party wells are included on Table 3-1 and Graphs 3-1 and 3-5 (represented by groundwater in AP-8914R), and were approximately 0.5 foot lower in August 2019 than in August 2018. The 2019 water level was consistent with historic levels measured at the site, and groundwater was within the screen in all OU2 wells. The groundwater flow direction was consistent with past monitoring events and followed the regional groundwater flow (northwest).

3.2 DRMO1 Subarea Groundwater Monitoring Results

Monitoring wells AP-7559, AP-7560, AP-8914R, AP-10015R, AP-10016R, AP-10017R, and AP-10018R were sampled in August 2019 to evaluate the progress towards achieving the RAGs at the DRMO1 site. The analytical results of the groundwater sampling are presented in Figure 3-1 and Table 3-2, with complete results in Table A-2. The results are discussed in the following sections.

3.2.1 Groundwater Geochemistry Trends

Groundwater geochemistry was evaluated at the DRMO1 3-Party subarea to evaluate the potential for reducing conditions and reductive dechlorination. Reducing conditions were stimulated as part of a treatability study through injection of Adventus EHC™ in 2009 and 2010. The primary groundwater geochemistry parameters used in the evaluation were ORP, DO, dissolved metals, and dissolved anions.

The area where the greatest reducing conditions were observed following each injection was in the vicinity of AP-8914R and AP-10018/AP-10018R. This area had the highest PCE concentrations in groundwater, and was also the area with the highest density of injection points in the treatability study. The 2019 groundwater geochemistry results showed reducing conditions were persistent in monitoring wells AP-8914R, AP-10015R, AP-10016R, and AP-10018R; as indicated by dissolved oxygen less than 1 milligram per liter (mg/L), elevated dissolved iron, and

lower sulfate concentrations. Monitoring well AP-7560 was also characterized by similar reducing conditions, likely a result of the DRO contamination that is persistent in the vicinity of this well. The areas of iron- and sulfate-reducing conditions identified at the time of groundwater sampling in August 2019 are shown in Figure 3-2. The area of iron-reducing conditions (as indicated by dissolved iron concentrations greater than 5 mg/L) in the PCE source area included AP-10015R, AP-10018R, and AP-8914R. Iron reducing conditions were also observed around AP-7560, which is downgradient of the PCE source area and has the highest DRO concentrations observed in the DRMO1 3-Party site. The DRO contamination is likely associated with a UST removed from the area in 2008. Sulfate reducing conditions (as indicated by sulfate concentrations less than 20 mg/L) were also observed in AP-10015R, AP-10016R, AP-10018R, and AP-8914R.

3.2.2 Contaminant Concentration Changes in the Treatability Study Area

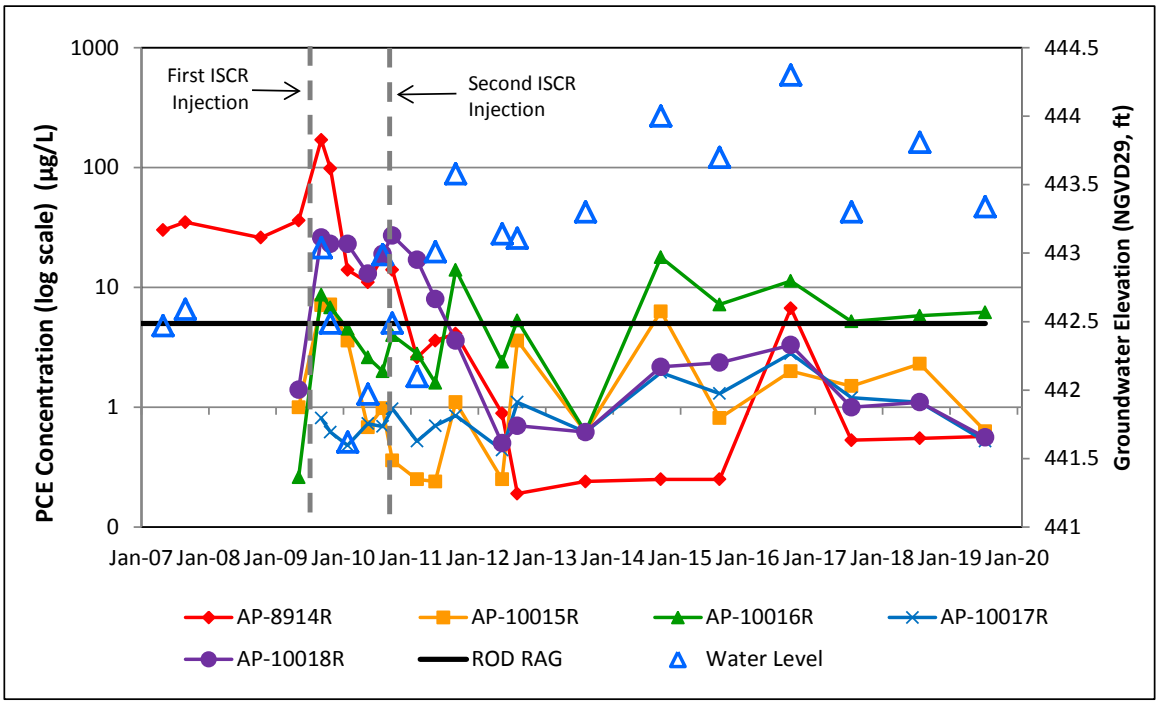
PCE Concentration Trends

The PCE concentrations over time and visual trends for monitoring wells AP-8914R, AP-10015/AP-10015R, AP-10016/AP-10016R, AP-10017/AP-10017R, and AP-10018/AP-10018R are shown in Graph 3-1. Prior to the second EHC™ injection in 2010, PCE was detected in groundwater above the RAG in AP-8914R and AP-10018. Following the 2010 injection, PCE concentrations increased slightly in these wells (as observed in the October 2010 sampling event), but then decreased below the RAG. PCE decreased below the RAG in AP-8914R and AP-10018 for the first time in 2011. The PCE concentration has remained below the RAG in subsequent sampling events in AP-10018 (and replacement AP-10018R in 2018), but exceeded the RAG in AP-8914R for the first time in 2016, as shown in Graph 3-1. The PCE concentration in AP-8914R has been below the RAG since 2017.

PCE in AP-10016 increased slightly following the 2009 injection, and exceeded the RAG in two post-injection sampling events (September and November 2009). The PCE concentration decreased below the RAG in February 2010, and did not immediately exceed the RAG following the second injection in August 2010. However, the PCE concentrations intermittently exceeded the RAG between 2011 and 2013, and have consistently exceeded the RAG since 2014 including exceedances in replacement well AP-10016R in 2018 and 2019. This well is cross-gradient of the 2010 injection area, and is characterized by sulfate reducing conditions.

The other well where PCE exceeded the RAG following the second injection was in downgradient well AP-10015. This exceedance was observed in 2014 (October). However, the PCE concentrations observed in sampling events between 2015 and 2017 were below the RAG. The PCE concentration in replacement well AP-10015R has also remained below the RAG. Iron and sulfate reducing conditions are persistent in this well, and these results suggest that natural attenuation continues to reduce contaminant concentrations in the treatment area.

The PCE concentration in upgradient well AP-10017/AP-10017R has remained below the RAG in all sampling events conducted at the site.



Graph 3-1. PCE Concentrations and Water Levels in the DRMO1 ISCR Treatment Area

Graph 3-1 includes water levels measured in the injection area (represented by water levels in AP-8914R). The relationship between the PCE concentration and water levels indicates that the wells with recent RAG exceedances (AP-10015/AP-10015R, AP-10016/AP-10016R, and AP-8914R) have been sensitive to changes in water levels since the second injection. When water level increases, the PCE concentration tends to increase, and when water level decreases, the PCE concentration decreases. These results suggest that residual source material may be trapped in low-permeability soils in the vicinity of these wells, that is not normally in contact with groundwater. During periods of high water levels, this contamination comes in contact with the groundwater, resulting in higher dissolved concentrations. Since reducing conditions are persistent in this area, the parent compound is likely degraded after it enters the groundwater system, resulting in a decrease in concentration.

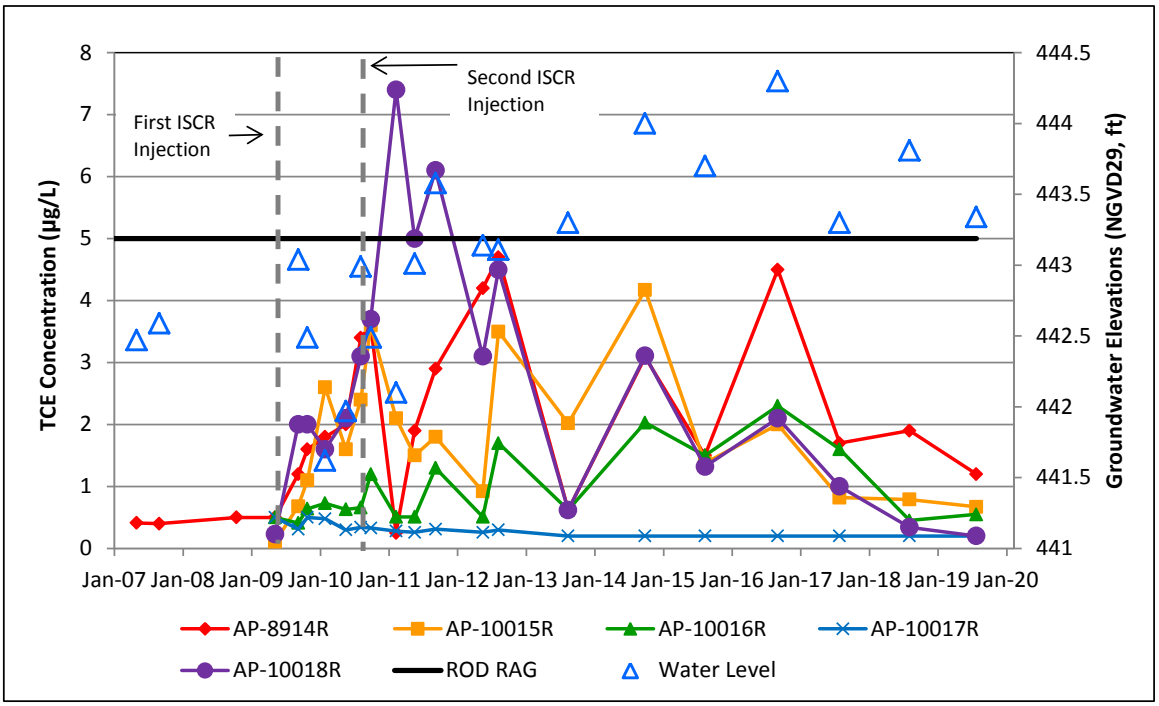
The PCE concentrations in all DRMO1 ISCR treatment area wells have remained similar between 2017 and 2019, even though water levels have continued to fluctuate. This suggests any residual source material remaining in the soil may be depleted. This trend will continue to be evaluated in future monitoring events.

Concentration Changes of Reductive Dechlorination Daughter Products

The decreases in the PCE concentrations shown in graph 3-1 were compared to concentrations of reductive dechlorination daughter products (TCE, cis-1,2-dichloroethene [cis-1,2-DCE], and trans-1,2-dichloroethene [trans-1,2-DCE]). Occurrences of these compounds are a strong indicator of

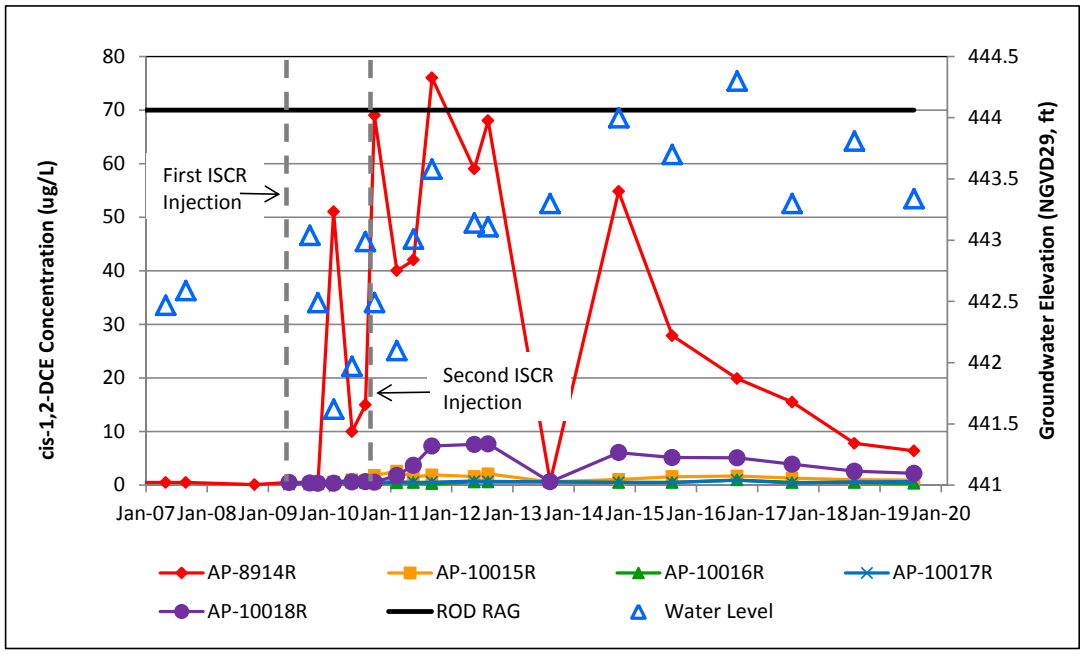
the occurrence of reductive dechlorination, as these daughter products were either not detected or were detected only at trace levels prior to the treatability study.

The TCE concentration changes over time and visual trends are shown in Graph 3-2, and complete results of the daughter product detections are presented in Table 3-2. As shown in Graph 3-2, TCE has remained below the RAG in all wells at the DRMO1 (3-Party) site since 2012. The highest concentrations have been identified in AP-8914R, AP-10015/AP-10015R, and AP-10018/AP-10018R. The graph also shows elevated TCE concentrations at different times in AP-8914R and AP-10015, although concentrations have remained below the RAG.



Graph 3-2. TCE Concentrations and Water Levels in the DRMO1 ISCR Treatment Area

Another daughter product with significant detections resulting from the treatability study injections is cis-1,2-DCE, as shown in Graph 3-3. The highest concentration of cis-1,2-DCE has been observed in AP-8914R, where an increasing trend was observed following the first injection in 2009. A decrease in cis-1,2-DCE was initially observed following the second injection event in 2010, but concentrations exceeded the RAG in the September 2011 sampling event. Cis-1,2-DCE decreased below the RAG in the 2012 events and has remained below the RAG. The next highest cis-1,2-DCE concentration has been observed in AP-10018, where some of the highest PCE and TCE concentrations have also been observed; though cis-1,2-DCE has never exceeded the RAG.



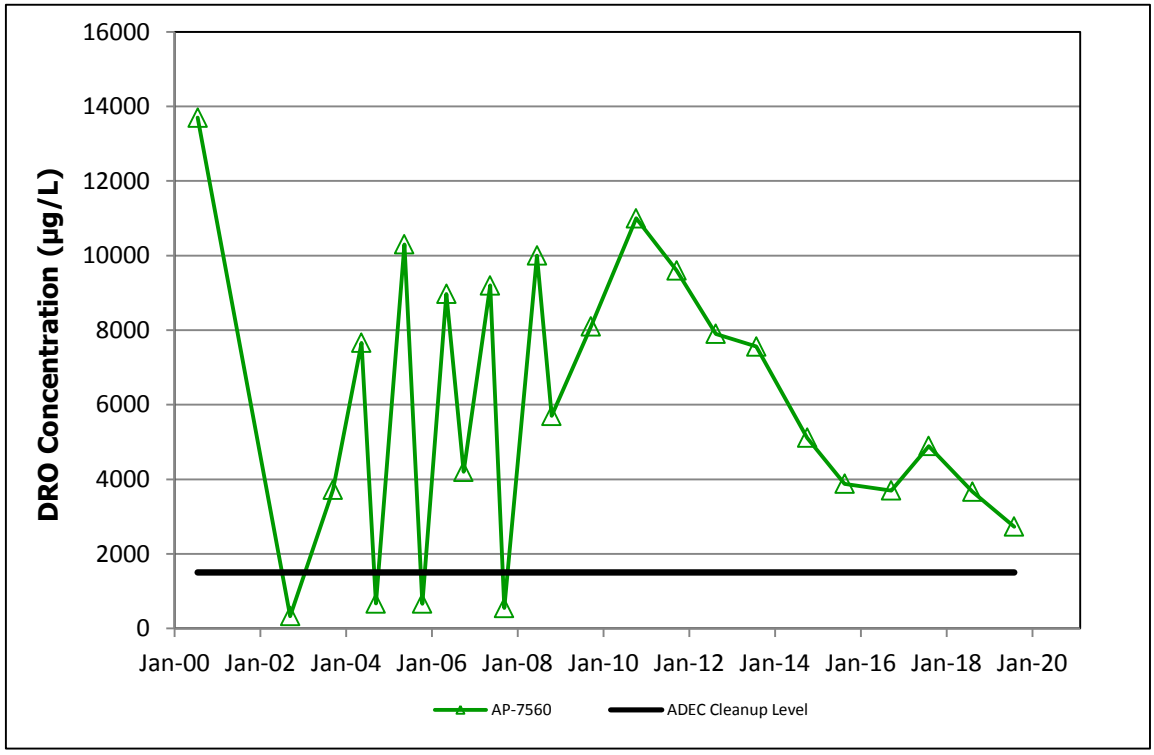
Graph 3-3. cis-1,2-DCE Concentrations and Water Levels in the DRMO1 ISCR Treatment Area

Trace detections of other reductive dechlorination daughter products including trans-1,2-DCE, 1,1-dichloroethene (1,1-DCE), and vinyl chloride have been observed in post-injection sampling events, although no RAG exceedances of any of these daughter products have been observed. Detection of these daughter products provides evidence that complete degradation of PCE through reductive dechlorination is occurring at the site. Changes in the concentrations of the daughter products (particularly vinyl chloride) will continue to be evaluated as part of the annual sampling program.

3.2.3 Contaminant Concentration Changes Outside of the Treatability Study Area

The only two monitoring wells sampled in 2019 that were outside of the treatability study area were AP-7559 and AP-7560. Other monitoring wells sampled as part of DRMO1 have been eliminated from the well network based on LTMO analysis. PCE and TCE have been consistently detected below RAGs in the areas outside of the treatability study area, likely as a result of PCE releases from drum storage areas across the DRMO1 subarea (HLA, 1996). However, in 2016, PCE exceeded the RAG in AP-7559 for the first time since 2001. The PCE concentration was below the RAG in the 2018 and 2019 monitoring events and was similar to concentrations observed since the treatment system was shut down in 2006. The PCE concentrations in this well will continue to be evaluated in future sampling events.

DRO analysis is performed for samples collected from AP-7560 since it is the only DRMO1 3-Party area having DRO exceedances. DRO is consistently detected above the ADEC CUL in AP-7560, likely due to a former UST that was identified upgradient of this well during treatment system decommissioning (see Figure 3-1). The DRO concentration changes and visual trend for AP-7560 is shown in Graph 3-4. The highest DRO detection was 13,700 micrograms per liter (µg/L) in June 2000, with typical detections between 5,000 µg/L and 10,000 µg/L. Graph 3-4 shows significantly less variability in DRO concentrations since 2008 when the sample frequency decreased from semi-annually to annually. Sampling is conducted in the fall since the DRO concentration in AP-7560 was consistently higher in the fall versus the spring sampling events. The analytical results indicate an overall decreasing trend since 2010, and the 2019 result was the lowest observed since 2007. Groundwater geochemistry results indicate biodegradation of DRO is likely occurring under iron-reducing conditions.



Graph 3-4. DRO Concentrations in AP-7560

3.3 DRMO1 (3-Party) LTMO Analysis Update

The LTMO analysis (initially conducted in 2008) was updated using data collected between 2010 and 2019 for the DRMO1 (3-Party) site to evaluate the current monitoring well network in terms of the remediation objectives. This time period of analysis was chosen to represent the site trends following the second ISCR injection in August 2010.

3.3.1 Statistical Trend Analysis Results

Plume stability was evaluated using the statistical trend analysis in the MAROS software, which determines trends of contaminant concentrations in individual wells based on the Mann-Kendall test and linear regression. The trend for each COC was selected based on the highest confidence analysis method. The trend results for PCE and TCE are presented in Table 3-4 and are based on the Mann-Kendall trend analysis. Complete MAROS results are presented in Appendix E.

Table 3-4. Mann-Kendall Trend Analysis for DRMO1 (3-Party) Wells

Well	Relative Location to Injection Area	Contaminants of Concern	
		PCE	TCE
AP-10017/AP-10017R	Upgradient	No Trend	Decreasing
AP-8914R	Within treatability study area	**No Trend**	Stable
AP-10016/AP-10016R		**No Trend**	No Trend
AP-10018/AP-10018R		**Decreasing**	**Decreasing**
AP-10015/AP-10015R	Downgradient of treatability study area	**Probably Increasing**	Stable
AP-7559		**No Trend**	No Trend
AP-7560		Stable	No Trend

Trends in **bold type** exceeded the RAG during the time period used in the LTMO analysis (2010-2019).

Table 3-4 identifies the contaminant trends for wells upgradient, within, and downgradient of the injection area, and the results showed:

- **Upgradient well AP-10017/AP-10017R:** No trend for PCE and a decreasing trend for TCE. Concentrations have remained below the RAG.

- **Injection area wells AP-8914R, AP-10016/AP-10016R, and AP-10018/AP-10018R**:

  - PCE concentration trend in AP-10018/AP-10018R was decreasing, and the PCE concentration in AP-10016/AP-10016R and AP-8914R exhibited no trend. The only PCE exceedance in 2019 was observed in AP-10016R.

  - Concentration trends for TCE were decreasing for AP-10018/AP-10018R, no trend for AP-10016/AP-10016R, and stable for AP-8914R. TCE has remained below the RAG in each of these wells since 2012.

- **Downgradient wells AP-10015R, AP-7559, and AP-7560:**

  - PCE exhibited a probably increasing trend in AP-10015/AP-10015R, no trend in AP-7559, and a stable trend in AP-7560. PCE in AP-10015 increased following the injections and was above the RAG in 2014. However, the PCE concentration has remained below the RAG in the sampling events between 2015 and 2019. These

results suggest the increasing trend identified by MAROS is a result of the PCE increases following injections and do not represent a continuing increasing trend.

- No Trend for TCE was observed in downgradient wells AP-7559 and AP-7560, and a stable trend was observed in AP-10015R. All TCE concentrations have remained below the RAG in downgradient wells since the injections.
- The trend results do not indicate significant downgradient migration of PCE or TCE from the treatability study area.

3.3.2 Spatial Moment Analysis Results

The spatial moment analysis in the MAROS software included an evaluation of dissolved contaminant mass (zeroth moment), trend of the location of the center of mass relative to the source (first moment), and trend of plume spread in the direction of groundwater flow and perpendicular to groundwater flow since the second ISCR injection in 2010. Not all wells were sampled during each monitoring event. As a result, there was variability in the spatial moment analysis as the size of the monitoring area changed. This analysis is based on an evaluation of the results considering the number of wells in each sampling event.

The results of the dissolved mass (zeroth moment) analysis for in the DRMO1 (3-Party) area showed:

- The PCE dissolved mass has been variable since the injection, and exhibited no trend. However, dissolved mass estimates have been generally stable since 2014.
- The TCE dissolved mass estimate also exhibited no trend, and TCE remains below the RAG in individual wells.

The results of the analysis of the location of the center of mass relative to the source (first moment) are summarized as follows:

- The center of mass of PCE and TCE exhibited increasing trends over the period of analysis.
- However, this does not indicate expansion of the plumes at concentrations greater than the RAG, since the primary reason for the increasing trend is decreasing contaminant concentrations in source area wells. Only one well had PCE above the RAG in 2019, and no wells had TCE concentrations exceeding the RAG.

The plume spread results in the direction of groundwater flow and perpendicular to groundwater flow (second moment) showed:

- PCE trends exhibited no trend in the direction of groundwater flow, and no trend perpendicular to groundwater flow. These results indicate that although there have been intermittent RAG exceedances, there is no significant indication of plume spread.

- TCE exhibited a stable trend in the direction of groundwater flow, and no trend perpendicular to groundwater flow. The plume spread estimated in 2019 was within the range observed since 2010, and no indication of plume spread.

3.3.3 Monitoring Well Network and Sampling Frequency Evaluation

MAROS software was also used to evaluate the redundancy of the monitoring well network and sampling frequency at the DRMO1 (3-Party) site. The goals were to verify that the monitoring network was sufficient for decision making, and then optimize it by identifying redundant wells and determining the most efficient sampling frequency.

The output from the MAROS software analysis for well redundancy and sampling frequency is provided in Appendix E, and shows that the only well recommended for removal from the monitoring program was AP-10015R based on TCE results. A qualitative evaluation of the results showed that AP-10015R should be retained in the monitoring well network since it is the closest downgradient well to the injection area and provides an indication of potential downgradient contaminant migration.

A review of the uncertainty of the residual TCE and PCE plumes within the monitoring well network showed Moderate and Small uncertainty. No wells are recommended for installation or removal based on the 2019 sampling event results.

The sampling frequency results from the MAROS software recommended annual sampling for most wells. Biennial sampling was recommended for some wells that have exhibited stable concentrations below the RAG. However, annual sampling should be continued for all DRMO1 wells since contaminants remain above the RAG.

3.4 DRMO4 Subarea Groundwater Monitoring Results

Three monitoring wells at the DRMO4 site (AP-10446MW [replacement well for PO5], AP-8916, and AP-10445MW [replacement well for Probe B]) were sampled in August 2019. The wells were sampled as part of the annual monitoring event to evaluate the progress towards achieving the RAGs. Groundwater analytical results are presented in Table 3-3. Geochemical and contaminant concentration trends are discussed in the following sections.

3.4.1 Groundwater Geochemistry Trends

Groundwater geochemistry indicators (redox potential, DO, dissolved metals, and sulfate) were measured at the DRMO4 (3-Party) site to evaluate the potential for conditions supportive of reductive dechlorination. In 2019, these parameters were measured in AP-10446MW (within the 2009 injection treatability study area), in AP-8916 (upgradient, and within the 2011 injection treatability study area), and AP-10445MW (downgradient of the injection treatability study area).

The results and approximate regions of reduced geochemistry based on the 2019 monitoring results are shown on Figure 3-2.

The 2019 results showed groundwater in the vicinity of AP-8916 was characterized by reducing conditions, with ORP less than 0 millivolts (mV) and dissolved oxygen less than 1 mg/L. A dissolved iron concentration of 20.6 mg/L and a sulfate concentration of 4.3 mg/L were also observed in AP-8916, which suggests potential for biodegradation through iron and sulfate reduction. Groundwater geochemistry in downgradient wells AP-10445MW and AP-10446MW was characterized by concentrations of dissolved iron and sulfate similar to background levels, and dissolved oxygen less than 2 mg/L. .

3.4.2 Contaminant Concentration Trends

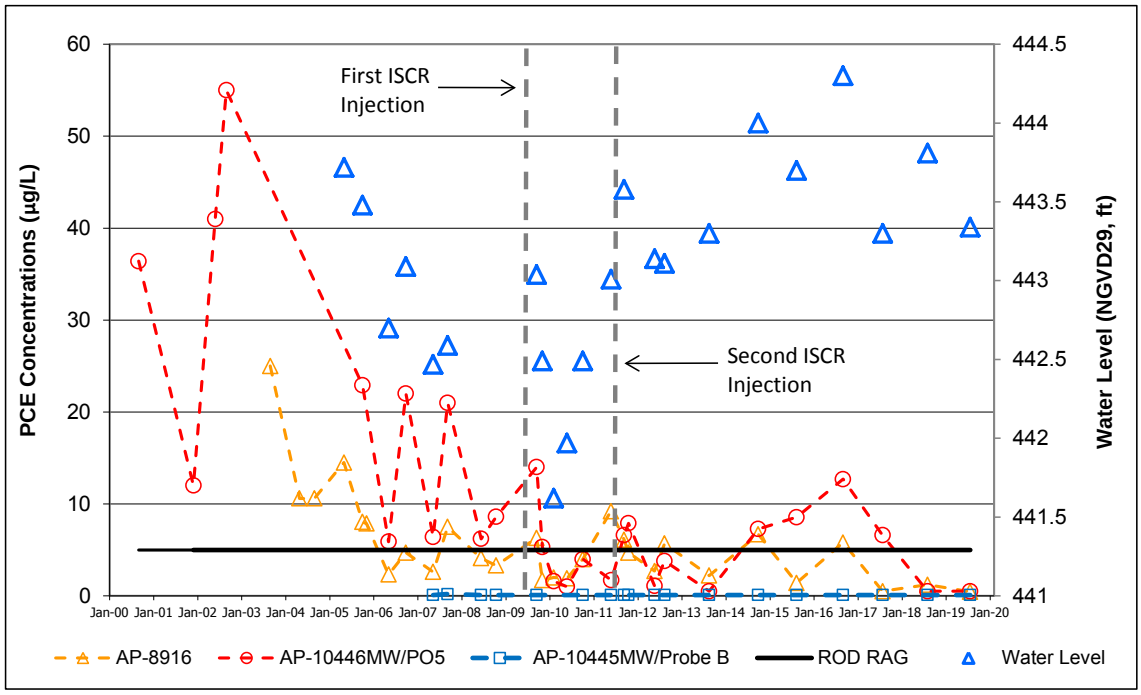
PCE Concentration Trends

The PCE concentration changes over time and visual trends for AP-10446MW/PO5, AP-8916, and downgradient well AP-10445MW/Probe B from September 2000 through August 2019 are shown in Graph 3-5. The injection events completed as part of the treatability study are also shown on the graph (August 2009 near PO5 and September 2011 near AP-8916).

As shown in Graph 3-5, the PCE concentrations in AP-10446MW/PO5 were variable following the August 2009 Adventus EHC™ injection. PCE was below the RAG in PO5 during the 2012 and 2013 sampling events, but exceeded the RAG between 2014 and 2017. PCE was not detected in replacement well AP-10446MW in the 2018 or 2019 sampling event, similar to the 2013 result. Concentrations will continue to be evaluated in the replacement well in future sampling events.

PCE concentrations in AP-8916 have also been variable; however, the September 2011 Adventus EHC™ injection was the first to target the groundwater in the vicinity of this well. PCE decreased below the RAG in AP-8916 immediately following the 2011 injection, but rebounded slightly above at the 11-month post-injection sampling event. PCE concentrations were below the RAG in the 2013 and 2015 sampling events, and above the RAG in the 2014 and 2016 sampling events. PCE has remained below the RAG since 2017.

PCE has been either not detected or detected at trace concentrations in Probe B/AP-10045MW, located approximately 150 feet downgradient from PO5/AP-10446MW. This indicates no significant downgradient migration of PCE has occurred at the DRMO4 (3-Party) site.



Graph 3-5. PCE Concentrations and Water Levels in DRMO4 Wells

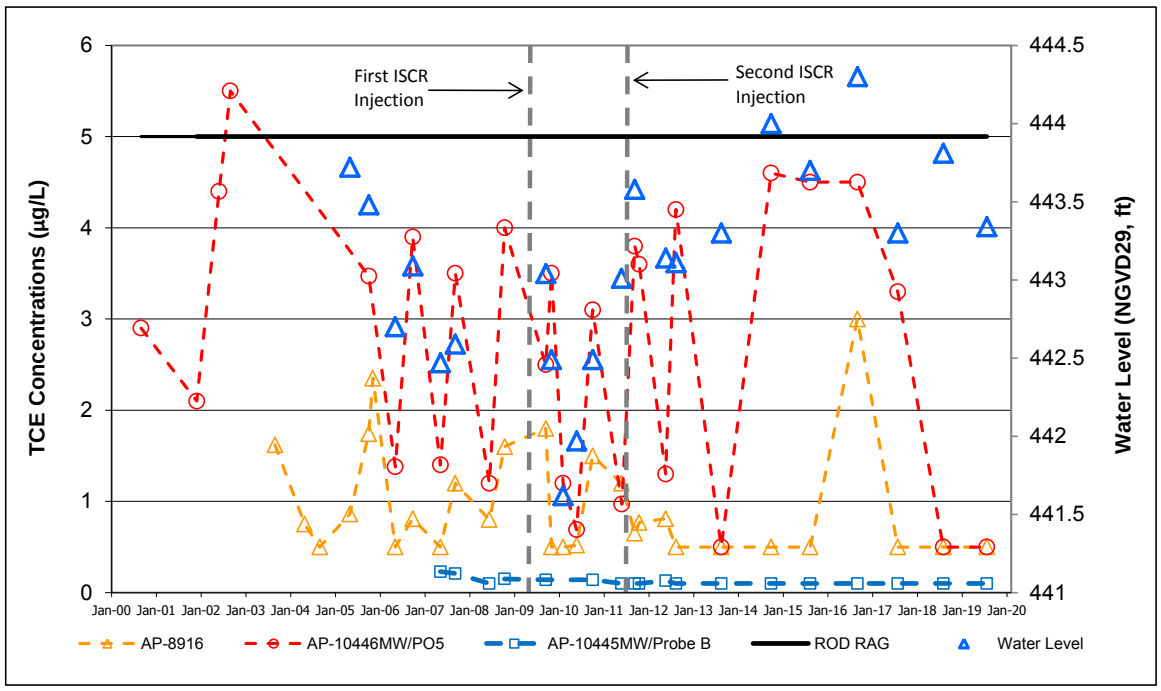
The groundwater elevation at the DRMO4 site (as measured in AP-8916) is also shown in Graph 3-5. The graph indicates some correlation between water levels and PCE concentration in PO5 prior to the first injection, with higher concentrations in the fall when water levels were typically higher. Following the injections, the sample frequency was reduced to an annual sampling event in the fall, when the highest PCE concentrations were typically observed. The association between water levels and PCE concentration is not as apparent in the sampling events following the injection, possibly due to a significant amount of source contamination being removed by the ISCR injection. .

Concentration Changes of Reductive Dechlorination Daughter Products

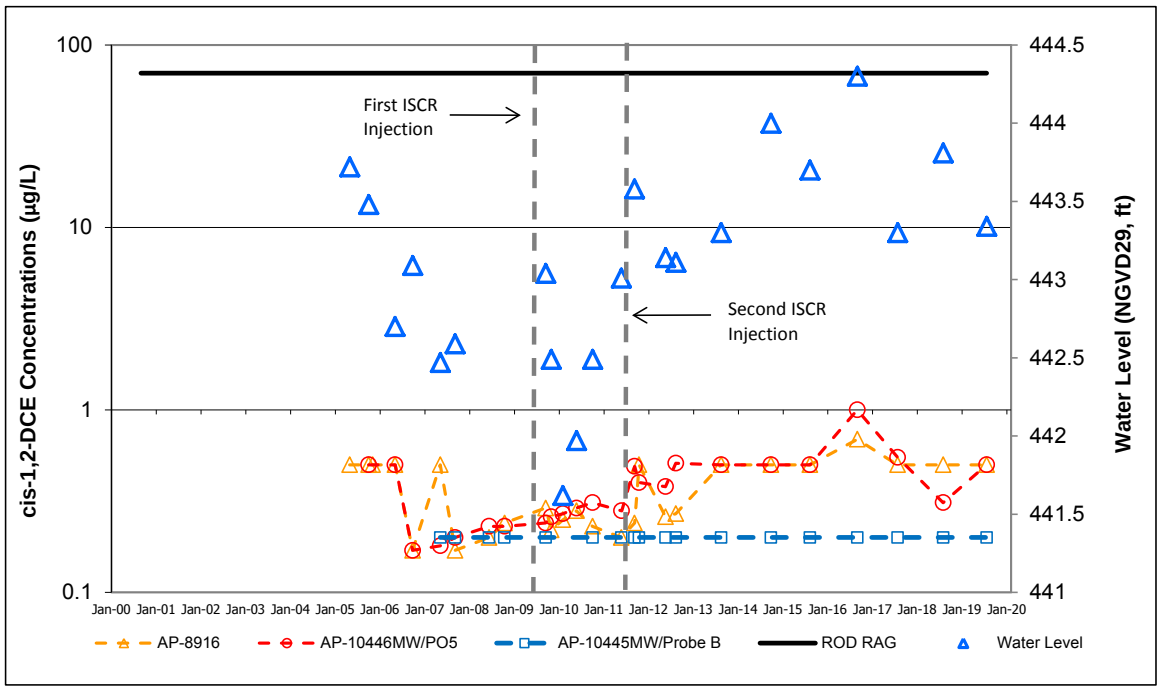
The distribution of PCE daughter products are indicative of reductive dechlorination occurring in the DRMO4 area, and the daughter products TCE and cis-1,2-DCE were detected in PO5 and AP-8916. TCE and cis-1,2-DCE has never been detected above trace concentrations in Probe B/AP-10445MW. The visual trends of TCE and cis-1,2-DCE, along with the water levels from AP-8916, are shown on graphs 3-6 and 3-7 respectively.

TCE has not been detected in AP-8916 since 2012, with the exception of 2016 when it was detected at 3 µg/L. TCE concentrations fluctuated in PO5, but TCE has not been detected in replacement well AP-10046MW. TCE has never been detected above trace levels in Probe B/AP-10045MW.

The cis-1,2-DCE concentrations in AP-10446MW/PO5 and AP-8916 increased since the injection events, indicating reductive dechlorination was stimulated as a result of the treatability study. However, cis-1,2-DCE concentrations have remained below the RAG.



Graph 3-6. TCE Concentrations and Water Levels in DRMO4 Wells



Graph 3-7. Cis-1,2-DCE Concentrations and Water Levels in DRMO4 Wells

DRO Concentration Trends

DRO concentrations have also been monitored in DRMO4 wells since sampling began in 1994. As shown on Figure 3-1, the DRO concentrations never exceeded the ADEC CUL in PO5, but exceeded the CUL in AP-8916 following the 2011 ISCR injection. The ISCR compound (Adventus EHC™) included an organic carbon source that was detected in the DRO range. This was confirmed when silica gel analysis was used on groundwater samples collected from the injection treatment area at DRMO1 (3-Party) during the 2012 sampling event. As a result, the DRO exceedances in AP-8916 were attributed to the injection product and not contamination.

DRO exceedances have been intermittently observed in Probe B since 2011, although the concentrations were only slightly above the CUL. The DRO concentration observed in replacement well AP-10445MW in 2019 was below the ADEC CUL.

3.5 DRMO4 (3-Party) LTMO Analysis Update

LTMO analysis was limited at the DRMO4 site due to the small number of wells. However, the trends in individual wells were determined using MAROS software, and the plume stability was evaluated on a qualitative basis.

3.5.1 Statistical Trend Analysis Results

A statistical trend analysis was conducted for the individual monitoring wells at the DRMO4 site using the MAROS software. The data used in the analysis were from October 2011 to August 2019 to represent the period of time following the injection events at the DRMO4 site. The trend results for PCE and TCE are presented in Table 3-5, and are based on the Mann-Kendall test. Complete MAROS results are presented in Appendix E.

Table 3-5. Mann-Kendall Trend Analysis for DRMO4 (3-Party) Wells

Well	Relative Location to Injection Area	Contaminants of Concern	
		PCE	TCE
AP-8916	Within 2011 injection area	**Probably Decreasing**	No Trend
AP-10446MW/PO5	Within 2009 injection area	**Stable**	Stable
AP-10445MW/Probe B	Downgradient	Not Detected[1]	No Trend

Trends in **bold type** exceeded the RAG during the time period used in the LTMO analysis (2011-2019).
[1] PCE was not detected in downgradient well Probe B/AP-10445MW between 2010 and 2019.

Table 3-5 shows that two of the three wells sampled at the DRMO4 site had PCE above the RAG since the injections were completed (AP-8916 and PO5). The PCE concentration in AP-8916 has fluctuated slightly above and slightly below the RAG since 2011, but has remained consistently below the RAG in recent sampling events. The trend results for PCE in PO5 showed a stable trend. The highest concentration detected in PO5 within that period was 14 µg/L immediately

following the injection. PCE concentrations subsequently decreased below the RAG and briefly exceeded the RAG again in fall 2011. PCE has not been detected in replacement well AP-10446MW.

The PCE concentrations downgradient of the injection area have remained less than the RAG, as shown in the low-level detections in AP-10445MW/Probe B. All sampling results in this well have been near the detection limit or not detected.

TCE concentrations were below the RAG in each of the three wells during the period of analysis. Concentrations have typically been less than 1 µg/L, and TCE was not detected in any of the wells in 2019.

3.5.2 Plume Stability Evaluation

The plume stability evaluation could not be conducted using the tools in the MAROS software due to the limited number of wells. As a result, a qualitative evaluation of plume stability was completed.

- PCE concentrations in PO5 initially increased following the 2009 injection, but then decreased as a result of the stimulation of reductive dehalogenation from the ISCR compound. PCE concentrations initially decreased in AP-8916 following the injection in 2011, and reducing conditions are persistent in AP-8916 and AP-10446MW/PO5.
- PCE concentrations increased above the RAG in AP-8916 and PO5 since 2014, but have decreased since 2016. PCE was below the RAG in AP-8916 and the replacement well for PO5 (AP-10446MW) in 2019.
- The PCE concentration in downgradient well Probe B/AP-10445MW has remained below the RAG (mostly non-detect results), which is an indicator that the plume is not expanding.
- TCE and cis-1,2-DCE concentrations increased since the injection, which indicates evidence of reductive dechlorination. TCE and cis-1,2-DCE concentrations have remained below the RAG.

Based on these results, annual sampling (conducted in the fall) should continue at this site to evaluate groundwater geochemistry and contaminant concentration trends, and to document progress towards achieving the remedial objectives.

3.6 Comparison of 2019 Sampling Results to Current ADEC Cleanup Levels

The 2019 groundwater contaminant concentrations were compared to the ADEC CULs to allow for an evaluation of current compliance with 2-Party program closure requirements. ADEC CUL comparisons for DRMO1 and DRMO4 3-Party wells are presented in Table A-2, and summarized in Table 3-6.

Table 3-6. Comparison of Groundwater Results for ROD COCs to Current ADEC Cleanup Levels[1] at OU2 DRMO 3-Party Sites

Contaminant	ROD RAG (µg/L)	Current ADEC Cleanup Level (µg/L)[1]	2019 ADEC Cleanup Level Exceedance	2019 Maximum Concentration (Well ID)
Benzene	5	4.6	None	ND
PCE	5	41	None	6.2 (AP-10016R)
TCE	5	2.8	None	2.8 (AP-7560)
Vinyl Chloride	2	0.19	None	ND
1,1-DCE	7	280	None	ND
1,2-DCE	70	36	None	6.4 (AP-8914R)

[1] Table C, 18 AAC 75.345 (ADEC, 2018)
ND = Not Detected

The following summarizes the ADEC CUL comparison for ROD COCs:

- PCE concentrations were above the ROD RAG in one well at the DRMO1 3-Party site. However, the PCE concentrations were below the current ADEC CUL in all wells at the DRMO1 and DRMO4 sites.
- TCE concentrations either met or were below the ROD RAG and current ADEC CUL in all wells at the DRMO1 and DRMO4 3-Party sites.
- All remaining ROD COCs had groundwater concentrations below both ROD RAG and ADEC CULs.

3.7 Summary and Recommendations for DRMO 3-Party Sites

Groundwater sampling results from 2019 showed that PCE remains slightly above the ROD RAG in one source area well at the DRMO1 3-Party site, but was below the ROD RAG in each of the three wells at the DRMO4 3-Party site for the second consecutive monitoring event. The treatability study was successful in stimulating reducing conditions, and reductive dehalogenation daughter products TCE and cis-1,2-DCE continue to be detected, but remain below RAGs at the DRMO1 (3-Party) and DRMO4 (3-Party) sites. This indicates that biodegradation continues to occur at these sites.

LTMO analysis showed that annual sampling is recommended to continue to evaluate groundwater geochemistry and contaminant concentration trends. Annual sampling (conducted in the fall) would be sufficient to document progress towards achieving the RAGs for the sites.

Table 3-1. OU2 DRMO Yard Groundwater Elevations

Location	Well Number	Total Well Depth (feet btoc)	Screened Interval (feet bgs)	Well Elevation (feet - NGVD29)	Aug-18			Aug-19		
					Date	Water Level (btoc)	Water Elevation (feet - NGVD29)	Date	Water Level (btoc)	Water Elevation (feet - NGVD29)
DRMO1 (3-Party) Treatment System Area	AP-8914R	18.2	6 - 16	454.14	8/16/18	10.33	443.81	8/6/19	10.80	443.34
	AP-7559	20.0	6 - 16	454.00	8/16/18	10.13	443.87	8/7/19	10.54	443.46
	AP-7560	20.1	6 - 16	453.31	8/16/18	9.65	443.66	8/7/19	10.07	443.24
	AP-10015R[1]	20.35	7.7 - 17.7	456.16	8/16/18	12.32	443.84	8/6/19	12.83	443.33
	AP-10016R[1]	20.40	7 - 17	456.33	8/16/18	12.46	443.87	8/6/19	12.92	443.41
	AP-10017R[1]	20.35	7 - 17	455.95	8/16/18	12.02	444.31	8/6/19	12.52	443.81
	AP-10018R[1]	20.43	7.4 - 17.4	455.72	8/16/18	11.86	443.86	8/6/19	12.34	443.38
DRMO4 (3-Party) Source Area	AP-10446MW[1]	20.5	7.5 - 17.5	455.46	8/17/18	11.47	443.99	8/7/19	11.86	443.60
	AP-8916	16.28	5 - 15	452.82	8/17/18	10.77	442.05	8/7/19	11.12	441.70
	AP-10445MW[1]	20.4	7.4 - 17.4	456.14	8/17/18	11.47	444.67	8/7/19	12.65	443.49

[1] Monitoring wells AP-10015R, AP-10016R, AP-10017R, AP-10018R, AP-10445MW, and AP-10446MW were replacement wells installed in 2018.

bgs - below ground surface
btoc - below top of casing
NGVD29 - North American Vertical Datum of 1929
NM - not measured during the sampling event
NA - not applicable since the well was not sampled

Table 3-2. 2013 - DRMO1 (3-Party) Subarea Groundwater Sample Results

Well Number	Relative Location	Sample Number	Date	Water Elevation (NGVD29 ft)	Natural Attenuation Parameters		Non-ROD COCs (µg/L) - compared against ADEC CULs[1]	ROD COCs (µg/L) - compared against ROD RGs / ADEC CULs[1]					
					Dissolved Iron (mg/L)	Sulfate (mg/L)	DRO	Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE
ROD CLEANUP LEVELS (3-Party Site) / ADEC CLEANUP LEVEL[1]							**1,500**	**5 / 4.6**	**5 / 2.8**	**5 / 41**	**2 / 0.19**	**7 / 280**	**70 / 36**
AP-10017	Upgradient	15FWOU224WG	8/24/2015	443.82	ND(0.25)	22.0	NA	ND(0.2)	ND(0.5)	1.3	ND(0.5)	ND(0.5)	ND(0.5)
		16FWOU219WG	9/14/2016	444.40	ND (0.25)	20.9	NA	ND (0.2)	ND (0.5)	2.8	ND (0.5)	ND (0.5)	0.93 J
		17FWOU217WG	8/9/2017	443.40	ND (0.25)	20.4	NA	ND (0.2)	ND (0.5)	1.2	ND (0.075)	ND (0.5)	0.4 J
AP-10017R		18FWOU216WG	8/16/2018	443.93	0.35 J	22.6	NA	ND (0.2)	ND (0.5)	1.1	ND (0.075)	ND (0.5)	0.63 J
		19FWOU201WG	8/6/2019	443.43	0.21 J	23.8	NA	ND (0.2)	ND (0.5)	0.52 J	ND (0.075)	ND (0.5)	0.67 J
AP-8914R	Source Area	15FWOU223WG	8/24/2015	443.7	56.0	21.1	NA	ND (0.2)	1.5	ND(0.5)	ND(0.5)	ND(0.5)	27.9
		16FWOU220WG	9/14/2016	444.3	33.7	23.1	NA	ND (0.2)	**4.5**	**6.7**	ND (0.5)	ND (0.5)	19.9
		17FWOU219WG	8/9/2017	443.3	27.1	8.7	NA	ND (0.2)	1.7	0.53 J	ND (0.075)	ND (0.5)	15.5
		18FWOU214WG	8/16/2018	443.8	25.2	20.4	NA	ND (0.2)	1.9	0.55 J	ND (0.075)	ND (0.5)	7.8
		19FWOU205WG	8/6/2019	443.3	27.2	19.3	NA	ND (0.2)	1.2	0.57 J	ND (0.075)	ND (0.5)	6.4
AP-10016		15FWOU220WG	8/24/2015	443.60	6.4	12.9	NA	ND (0.2)	1.5	**7.2**	ND (0.5)	ND (0.5)	ND (0.5)
		16FWOU221WG	9/14/2016	444.14	4.52	13.3	NA	ND (0.2)	2.1	**11.3**	ND (0.5)	ND (0.5)	0.97 J
		16FWOU222WG[2]			4.71	13.3	NA	ND (0.2)	2.3	**10.8**	ND (0.5)	ND (0.5)	0.95 J
		17FWOU215WG	8/9/2017	443.17	5.97	10.0	NA	ND (0.2)	1.6	**5.2**	ND (0.075)	ND (0.5)	0.50 J
AP-10016R		18FWOU213WG	8/16/2018	443.87	1.65	11.0	NA	ND (0.2)	0.45 J	**5.8**	ND (0.075)	ND (0.5)	ND (0.5)
		19FWOU204WG	8/6/2019	443.41	1.98	10.1	NA	ND (0.2)	0.55 J	**6.2**	ND (0.075)	ND (0.5)	0.32 J
AP-10018		15FWOU222WG	8/24/2015	443.66	37.5	33.9	NA	ND (0.2)	1.3	2.4	ND (0.5)	ND (0.5)	5.2
		16FWOU218WG	9/14/2016	444.21	20.9	15.5	NA	ND (0.2)	2.1	3.3	ND (0.5)	ND (0.5)	5.1
		17FWOU214WG	8/9/2017	443.23	15.1	14.3	NA	ND (0.2)	1.0	1.0	ND (0.075)	ND (0.5)	3.9
AP-10018R		18FWOU215WG	8/16/2018	443.86	8.7	9.8	NA	ND (0.2)	0.34 J	1.1	ND (0.075)	ND (0.5)	2.6
		19FWOU202WG	8/6/2019	443.38	6.0	11.0	NA	ND (0.2)	ND (0.5)	0.56 J	ND (0.075)	ND (0.5)	2.2
AP-7559	Downgradient	15FWOU219WG	8/21/2015	443.76	ND (0.25)	38	NA	ND (0.2)	ND (0.5)	4.5	ND (0.5)	ND (0.5)	ND (0.5)
		16FWOU212WG	9/16/2016	444.40	ND (0.25)	31.2	NA	ND (0.2)	0.63 J	**5.5**	ND (0.5)	ND (0.5)	0.86 J
		17FWOU221WG	8/9/2017	443.40	ND (0.25)	27.9	NA	ND (0.2)	0.46 J	3.4	ND (0.075)	ND (0.5)	ND (0.5)
		18FWOU209WG	8/16/2018	443.87	ND (0.25)	27.3	NA	ND (0.2)	0.49 J	3.5	ND (0.075)	ND (0.5)	ND (0.5)
		19FWOU208WG	8/7/2019	443.46	ND (0.25)	26.3	NA	ND (0.2)	0.51 J	3.4	ND (0.075)	ND (0.5)	ND (0.5)

Table 3-2. 2013 - DRMO1 (3-Party) Subarea Groundwater Sample Results

Well Number	Relative Location	Sample Number	Date	Water Elevation (NGVD29 ft)	Natural Attenuation Parameters		Non-ROD COCs (µg/L) - compared against ADEC CULs[1]	ROD COCs (µg/L) - compared against ROD RGs / ADEC CULs[1]					
					Dissolved Iron (mg/L)	Sulfate (mg/L)	DRO	Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE
ROD CLEANUP LEVELS (3-Party Site) / ADEC CLEANUP LEVEL[1]							**1,500**	**5 / 4.6**	**5 / 2.8**	**5 / 41**	**2 / 0.19**	**7 / 280**	**70 / 36**
AP-7560	Downgradient	15TFTOU225WG	8/24/2015	443.67	13.8	36.4	**4,320**	ND (0.2)	2.5	4.3	ND (0.5)	ND (0.5)	1.1
		15TFTOU226WG[2]			14.1	36.0	**3,880**	ND (0.2)	**3.1**	4.0	ND (0.5)	ND (0.5)	1.0
		16TFTOU213WG	9/13/2016	444.17	10.2	24.4	**3,520**	ND (0.2)	2.3	3.0	ND (0.5)	ND (0.5)	0.9 J
		16TFTOU214WG[2]			10.9	25.9	**3,700**	ND (0.2)	2.4	3.2	ND (0.5)	ND (0.5)	1.33 J
		17FWOU222WG	8/9/2017	443.21	10.1	14.3	**4,470**	ND (0.2)	1.0	1.4	ND (0.075)	ND (0.5)	0.36 J
		17FWOU223WG[2]			10.3	13.5	**4,890**	ND (0.2)	1.0	1.3	ND (0.075)	ND (0.5)	0.33 J
		18FWOU210WG	8/16/2018	443.66	11.9	22.4	**3,040**	ND (0.2)	2.3	1.8	ND (0.075)	ND (0.5)	0.88 J
		18FWOU211WG[2]			10.8	22.6	**3,670**	ND (0.2)	2.2	1.9	ND (0.075)	ND (0.5)	0.87 J
		19FWOU208WG	8/7/2019	444.24	8.6	21.2	**2,730**	ND (0.2)	2.7	1.7	ND (0.075)	ND (0.5)	1.1
		19FWOU209WG[2]			8.9	20.5	**1,910**	ND (0.2)	2.8	1.7	ND (0.075)	ND (0.5)	1.2
AP-10015		15FWOU221WG	8/24/2015	443.66	13.0	15.6	NA	ND (0.2)	1.4	0.81 J	ND (0.5)	ND (0.5)	1.6
		16FWOU217WG	9/14/2016	444.21	7.8	15.3	NA	ND (0.2)	2.0	2.0	ND (0.5)	ND (0.5)	1.7
		17FWOU213WG	8/9/2017	443.19	8.9	11.3	NA	ND (0.2)	0.82 J	1.5	ND (0.075)	ND (0.5)	1.3
AP-10015R		18FWOU212WG	8/16/2018	443.84	7.1	9.1	NA	ND (0.2)	0.79 J	2.3	ND (0.075)	ND (0.5)	1.0
		19FWOU203WG	8/6/2019	443.33	7.1	8.7	NA	ND (0.2)	0.67 J	0.63 J	ND (0.075)	ND (0.5)	0.99 J

Notes

Results in blue and bold font exceed ROD RGs.

Results in green and bold font exceed ADEC CULs.

Results in red and bold font exceed both ROD RGs and ADEC CULs.

[1] OU2 ROD analytes are compared against ROD RGs and ADEC CULs.

[2] The ADEC CUL values are Groundwater Human Health values listed in ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C (revised as of October 27, 2018).

[3] Sample is a Field Duplicate of the sample immediately above.

Data Qualifiers

ND - Not detected at the detection limit (LOD in parentheses)

B - Result is qualified as a potential high estimate due to contamination present in a blank sample

J - Result is estimated due to a QC issue or because it is less than the LOQ. If result is biased low or high, it is specified as "J-" and "J+"

Acronyms/Abbreviations

COC - contaminant of concern
CUL - cleanup level
DCE - dichloroethene
DRO - diesel range organics
LOD - limit of detection
LOQ - limit of quantitation
µg/L - micrograms per liter
mg/L - milligrams per liter
mS/cm - micro Siemens per centimeter
mV - millivolts
NA - not analyzed or not applicable
NGVD29 - North American Vertical Datum of 1929
ORP - oxidation-reduction potential
PCE - tetrachloroethene
ROD - Record of Decision
TCE - trichloroethene

Table 3-3. DRMO4 (3-Party) Subarea Groundwater Sample Results

Well Number	Relative Location	Sample Number	Date	Water Elevation (feet NGVD29)	Natural Attenuation Parameters		Non-ROD COCs (µg/L) - compared against ADEC CULs[1]	ROD COCs (µg/L) - compared against ROD RGs / ADEC CULs[1]					
					Dissolved Iron (mg/L)	Sulfate (mg/L)	DRO	Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE
ROD CLEANUP LEVELS (3-Party Site) / ADEC CLEANUP LEVEL[1]							**1,500**	**5 / 4.6**	**5 / 2.8**	**5 / 41**	**2 / 0.19**	**7 / 280**	**70 / 36**
AP-8916	Upgradient	15FWOU216WG	8/21/2015	441.97	34.1	0.9	499 B	ND (0.2)	ND (0.5)	1.4	ND(0.5)	ND(0.5)	ND(0.5)
		16FWOU215WG	9/13/2016	442.52	13.0	3.9	440 J,B	0.13 J	**3.0**	**5.79**	ND (0.5)	ND (0.5)	0.69 J
		17FWOU220WG	8/9/2017	441.61	22.6	2.4	410 J	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	ND (0.5)
		18FWOU219WG	8/17/2018	442.05	25.4	9.4	NA	ND (0.2)	ND (0.5)	1.2	ND (0.075)	ND (0.5)	ND (0.5)
		19FWOU207WG	8/7/2019	441.70	20.6	4.3	NA	ND (0.2)	ND (0.5)	0.44 J	ND (0.075)	ND (0.5)	ND (0.5)
PO5	Source Area	15FWOU217WG	8/21/2015	NM	4.4	25.9	199 J,B	ND (0.2)	**4.5**	**8.56**	ND (0.5)	ND (0.5)	ND (0.5)
		16FWOU224WG	9/14/2016	NM	4.3	27.8	278 J,B	ND (0.2)	**4.5**	**12.7**	ND (0.5)	ND (0.5)	1.0
		17FWOU216WG	8/9/2017	NM	4.1	34.9	172 J	ND (0.2)	**3.3**	**6.6**	ND (0.075)	ND (0.5)	0.55 J
AP-10446MW		18FWOU218WG	8/17/2018	443.99	3.8	27.9	NA	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	0.31 J
		19FWOU212WG	8/7/2019	443.6	3.9	27.4	NA	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	ND (0.5)
Probe B	Downgradient	15FWOU218WG	8/21/2015	443.59	2.8	32.9	613 J,B	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
		16FWOU223WG	9/14/2016	443.91	3.1	37.8	**2,020**	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
		17FWOU218WG	8/9/2017	443.20	2.6	30.7	640	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	ND (0.5)
AP-10445MW		18FWOU217WG	8/17/2018	443.83	0.9	31.1	**1,670**	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	ND (0.5)
		19FWOU208WG	8/7/2019	443.49	0.9	27.3	280 J	ND (0.2)	ND (0.5)	ND (0.5)	ND (0.075)	ND (0.5)	ND (0.5)

Notes

Results in blue and bold font exceed ROD RGs.

Results in green and bold font exceed ADEC CULs.

Results in red and bold font exceed both ROD RGs and ADEC CULs.

[1] OU2 ROD analytes are compared against ROD RGs and ADEC CULs.

[2] The ADEC CUL values are Groundwater Human Health values listed in ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C (revised as of October 27, 2018).

[3] Sample is a Field Duplicate of the sample immediately above.

Data Qualifiers

ND - Not detected at the detection limit (LOD in parentheses)

B - Result is qualified as a potential high estimate due to contamination present in a blank sample

J - Result is estimated due to a QC issue or because it is less than the LOQ. If result is biased low or high, it is specified as "J-" and "J+"

Acronyms/Abbreviations

btoc - below top of casing
COC - contaminants of concern
CUL - cleanup level
DCE - dichloroethene
DRO - diesel range organics
LOD - limit of detection
LOQ - limit of quantitation
µg/L - micrograms per liter
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
mV - millivolts
NA - not analyzed or not applicable
NGVD29 - North American Vertical Datum of 1929
NM - not measured
ORP - oxidation-reduction potential
PCE - tetrachloroethene
ROD - Record of Decision
TCE - trichloroethene

AP-7559 (16, 6-16)	May-98	Oct-98	Jun-99	Sep-99	Jun-00	Sep-00	May-01	Oct-01	Sep-03	May-04	Sep-04	May-05	Oct-05	May-06	Sep-06	May-07	Sep-07	Jun-08
DRO	NA	NA	NA	ND (316)	ND (353)	NA	NA	NA	112	146	150	80	66.7	63	97	120	57	96
PCE	13	13	4.6	4.6	4.7	4.9	7.55	6.22	4.49	4.59	4.48	3.84	2.42	ND (1)	2.4	1.6	1.7	1.8
TCE	1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	0.41	0.5	0.49	0.49	ND (1)	ND (1)	0.43	0.42	0.42	0.34
WATER ELEV.	442.39	442.96	442.38	442.77	443.53	443.95	442.98	442.7	444.33	443.87	443.18	443.66	443.34	442.59	442.98	442.36	443.33	442.75
AP-7559	Oct-08	May-09	Sep-09	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	71	NA	90	NA	NA	130	NA	NA	77	NM	80	NA	ND(300)	NA	NA	NA	NA	NA
PCE	2.2	1.1	4.1	3	3.1	3.2	2.6	2.8	4	2.9	ND(0.2)	ND(0.62)	4.6	4.5	5.5	3.4	3.5	3.4
TCE	0.51	ND(1)	0.51	0.52	0.51	0.52	0.42	0.48	0.58	0.61	0.69	ND(0.62)	0.58	ND(0.5)	0.63	0.46	0.49	0.51
WATER ELEV.	443.07	443.15	443.12	442.15	443.08	442.58	442.2	443.08	NM	443.22	443.24	443.33	444.04	443.76	444.4	443.4	443.87	443.46

AP-7560 (13.5, 6-16)	May-98	Oct-98	Jun-99	Sep-99	Jun-00	Sep-00	May-01	Oct-01	Sep-02	Sep-03	May-04	Sep-04	May-05	Oct-05	May-06	Oct-06
DRO	NA	NA	NA	ND (531)	13,700	NA	NA	NA	330	3,720	7,660	670	10,300	664	8,970	4,200
PCE	3.0	1.0	3.0	5.3	4.3	4.8	2.42	ND (1)	ND (2)	3.08	1.24	1.49	1.39	2.19	ND (1)	2.8
TCE	2.0	ND (1)	1.3	2.7	1.4	3.0	ND (1)	ND (1)	ND (2)	1.83	0.6	0.68	0.46	0.79	ND (1)	1.2
WATER ELEV.	NM	442.67	442.21	442.59	NM	443.71	442.66	442.48	443.54	444.04	443.61	443.03	443.46	443.12	442.41	442.79
AP-7560	May-07	Sep-07	Jun-08	Oct-08	Sep-09	Oct-10	Sep-11	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19	
DRO	9,200	550	10,000	5,700	8,100	11,000	9,600	7,900	7,560	5,190	4,320	3,700	4,890	3,670	2,730	
PCE	2.1	3.6	1.2	0.8	1.8	1.8	2.8	2.2	ND(0.62)	1.1	4.26	3.2	1.4	1.9	1.7	
TCE	0.98	1.9	0.4	0.82	0.9	0.95	2.0	1.2	ND(0.62)	ND(0.5)	3.14	2.4	1.0	2.3	2.8	
WATER ELEV.	442.16	443.13	442.55	442.83	442.91	442.31	443.4	443.02	443.13	443.83	443.67	444.17	443.21	443.66	444.24	

AP-10015R* (AP-10015) (18, 8-18)	May-09	Sep-09	Nov-09	Feb-10	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	NA	1,300	NA	NA	NA	NA	1,400	NA	NA	140+	NM	850	NA	947	NA	NA	NA	NA	NA
BENZENE	ND(1)	0.08	0.07	0.06	0.09	0.07	0.08	0.21	ND(0.5)	0.06	0.11	0.08	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
PCE	1.0	7.1	7.2	3.6	0.68	0.98	0.36	ND(0.5)	0.24	1.1	ND(0.2)	3.6	ND(0.62)	6.3	0.81	2.0	1.5	2.3	0.63
TCE	0.11	0.68	1.1	2.6	1.6	2.4	3.6	2.1	1.5	1.8	0.92	3.5	2.02	4.17	1.38	2.0	0.82	0.79	0.67
CIS-1,2-DCE	ND(1)	0.32	0.34	0.52	1.0	0.73	1.8	2.6	1.5	1.9	1.6	2.1	ND(0.62)	1.05	1.59	1.7	1.3	1.0	0.99
WATER ELEV.	444.53	443	442.52	443.28	443.8	444.82	442.46	442.02	442.97	443.48	443.03	443.1	443.16	443.88	443.66	444.21	443.19	443.84	443.33

AP-10016R* (AP-10016) (17, 7-17)	May-09	Sep-09	Nov-09	Feb-10	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	NA	1,500*	NA	NA	NA	NA	1,800	NA	NA	120+	NM	1,900	NA	2,120	NA	NA	NA	NA	NA
BENZENE	ND(1)	0.07	0.08	0.08	0.11	0.08	0.09	0.22	0.06	ND(0.5)	0.22	0.08	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
PCE	0.26	8.7	6.8	4.5	2.6	2.0	4.0	2.8	1.6	14	2.4	5.3	ND(0.62)	17.8	7.2	11.3	5.2	5.8	6.2
TCE	ND(1)	0.41	0.64	0.73	0.63	0.66	1.2	0.51	0.51	1.3	0.51	1.7	ND(0.62)	2.0	1.5	2.3	1.6	0.45	0.55
CIS-1,2-DCE	ND(1)	0.23	0.31	0.38	0.53	0.54	0.43	0.43	0.48	0.28	0.60	0.57	ND(0.62)	ND(0.5)	ND(0.5)	0.97	0.50	ND(0.5)	0.32
WATER ELEV.	443.04	443.04	442.53	441.45	441.93	442.93	442.47	442.04	442.97	443.42	443.04	443.08	443.1	443.81	443.6	444.14	443.17	443.87	443.41

AP-10018R* (AP-10018) (17, 7-17)	May-09	Sep-09	Nov-09	Feb-10	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	NA	4,100*	NA	NA	NA	NA	71,000	NA	NA	1,700+	NM	1,200	NA	347	NA	NA	NA	NA	NA
BENZENE	ND(1)	0.16	0.2	0.12	0.16	0.15	0.24	0.42	0.1	0.12	0.39	0.11	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
PCE	1.4	26	23	23	13	19	27	17	8.0	3.6	0.5	0.7	ND(0.62)	2.2	2.35	3.3	1.0	1.1	0.56
TCE	0.23	2.0	2.0	1.6	2.1	3.1	3.7	7.4	5.0	6.1	3.1	4.5	ND(0.62)	3.11	1.32	2.1	1.0	0.34	ND(0.5)
CIS-1,2-DCE	ND(1)	0.41	0.32	0.35	0.63	0.64	0.55	1.8	3.7	7.3	7.6	7.7	ND(0.62)	6.08	5.16	5.1	3.9	2.6	2.2
WATER ELEV.	443.03	443.05	442.53	441.38	441.94	442.97	442.49	442.06	442.91	443.55	443.13	443.1	443.21	443.96	443.66	444.21	443.23	443.86	443.38

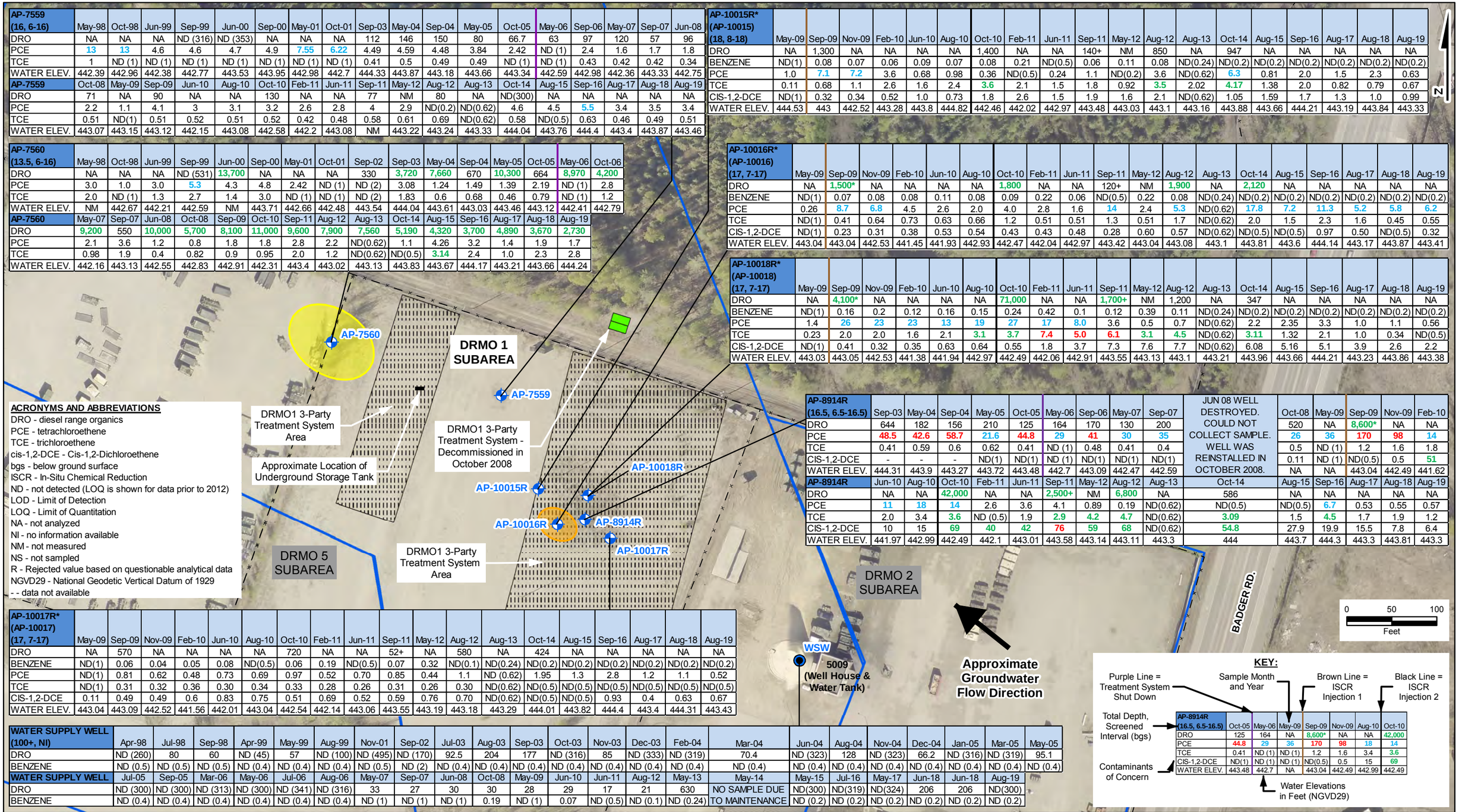
AP-8914R (16.5, 6.5-16.5)	Sep-03	May-04	Sep-04	May-05	Oct-05	May-06	Sep-06	May-07	Sep-07
DRO	644	182	156	210	125	164	170	130	200
PCE	48.5	42.6	58.7	21.6	44.8	29	41	30	35
TCE	0.41	0.59	0.6	0.62	0.41	ND (1)	0.48	0.41	0.4
CIS-1,2-DCE	-	-	-	ND(1)	ND(1)	ND (1)	ND(1)	ND(1)	ND(1)
WATER ELEV.	444.31	443.9	443.27	443.72	443.48	442.7	443.09	442.47	442.59
AP-8914R	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13
DRO	NA	NA	42,000	NA	NA	2,500+	NM	6,800	NA
PCE	11	18	14	2.6	3.6	4.1	0.89	0.19	ND(0.62)
TCE	2.0	3.4	3.6	ND (0.5)	1.9	2.9	4.2	4.7	ND(0.62)
CIS-1,2-DCE	10	15	69	40	42	76	59	68	ND(0.62)
WATER ELEV.	441.97	442.99	442.49	442.1	443.01	443.58	443.14	443.11	443.3

JUN 08 WELL DESTROYED. COULD NOT COLLECT SAMPLE. WELL WAS REINSTALLED IN OCTOBER 2008.

	Oct-08	May-09	Sep-09	Nov-09	Feb-10
	520	NA	8,600*	NA	NA
	26	36	170	98	14
	0.5	ND (1)	1.2	1.6	1.8
	0.11	ND (1)	ND(0.5)	0.5	51
	NA	NA	443.04	442.49	441.62
Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
586	NA	NA	NA	NA	NA
ND(0.5)	ND(0.5)	6.7	0.53	0.55	0.57
3.09	1.5	4.5	1.7	1.9	1.2
54.8	27.9	19.9	15.5	7.8	6.4
444	443.7	444.3	443.3	443.81	443.3

AP-10017R* (AP-10017) (17, 7-17)	May-09	Sep-09	Nov-09	Feb-10	Jun-10	Aug-10	Oct-10	Feb-11	Jun-11	Sep-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	NA	570	NA	NA	NA	NA	720	NA	NA	52+	NA	580	NA	424	NA	NA	NA	NA	NA
BENZENE	ND(1)	0.06	0.04	0.05	0.08	ND(0.5)	0.06	0.19	ND(0.5)	0.07	0.32	ND(0.1)	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
PCE	ND(1)	0.81	0.62	0.48	0.73	0.69	0.97	0.52	0.70	0.85	0.44	1.1	ND (0.62)	1.95	1.3	2.8	1.2	1.1	0.52
TCE	ND(1)	0.31	0.32	0.36	0.30	0.34	0.33	0.28	0.26	0.31	0.26	0.30	ND(0.62)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
CIS-1,2-DCE	0.11	0.49	0.49	0.6	0.83	0.75	0.51	0.69	0.52	0.59	0.76	0.70	ND(0.62)	ND(0.5)	ND(0.5)	0.93	0.4	0.63	0.67
WATER ELEV.	443.04	443.09	442.52	441.56	442.01	443.04	442.54	442.14	443.06	443.55	443.19	443.18	443.29	444.01	443.82	444.4	443.4	444.31	443.43

WATER SUPPLY WELL (100+, NI)	Apr-98	Jul-98	Sep-98	Apr-99	May-99	Aug-99	Nov-01	Sep-02	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Feb-04	Mar-04	Jun-04	Aug-04	Nov-04	Dec-04	Jan-05	Mar-05	May-05
DRO	ND (260)	80	60	ND (45)	57	ND (100)	ND (495)	ND (170)	92.5	204	177	ND (316)	85	ND (333)	ND (319)	70.4	ND (323)	128	ND (323)	66.2	ND (316)	ND (319)	95.1
BENZENE	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.5)	ND (2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
WATER SUPPLY WELL	Jul-05	Sep-05	Mar-06	May-06	Jul-06	Aug-06	May-07	Sep-07	Jun-08	Oct-08	May-09	Jun-10	Jun-11	Aug-12	May-13	May-14	May-15	Jul-16	May-17	Jun-18	Jun-18	Aug-19	
DRO	ND (300)	ND (300)	ND (313)	ND (300)	ND (341)	ND (316)	33	27	30	30	28	29	17	21	630	NO SAMPLE DUE	ND(300)	ND(319)	ND(324)	206	206	ND(300)	
BENZENE	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (1)	ND (1)	ND (1)	0.19	ND (1)	0.07	ND (0.5)	ND (0.1)	ND (0.24)	TO MAINTENANCE	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	



ACRONYMS AND ABBREVIATIONS

DRO - diesel range organics
PCE - tetrachloroethene
TCE - trichloroethene
cis-1,2-DCE - Cis-1,2-Dichloroethene
bgs - below ground surface
ISCR - In-Situ Chemical Reduction
ND - not detected (LOQ is shown for data prior to 2012)
LOD - Limit of Detection
LOQ - Limit of Quantitation
NA - not analyzed
NI - no information available
NM - not measured
NS - not sampled
R - Rejected value based on questionable analytical data
NGVD29 - National Geodetic Vertical Datum of 1929
- - data not available

KEY:

Purple Line = Treatment System Shut Down
Sample Month and Year
Brown Line = ISCR Injection 1
Black Line = ISCR Injection 2
Total Depth, Screened Interval (bgs)
Contaminants of Concern
Water Elevations in Feet (NGVD29)

AP-8914R (16.5, 6.5-16.5)	Oct-05	May-06	May-09	Sep-09	Nov-09	Aug-10	Oct-10
DRO	125	164	NA	8,600*	NA	NA	42,000
PCE	44.8	29	36	170	98	18	14
TCE	0.41	ND (1)	ND (1)	1.2	1.6	3.4	3.6
CIS-1,2-DCE	ND(1)	ND (1)	ND (1)	ND(0.5)	0.5	15	69
WATER ELEV.	443.48	442.7	NA	443.04	442.49	442.99	442.49

LEGEND

- DRMO1 Groundwater Monitoring Well
- DRMO Water Supply Well
- Fence
- Approximate 2019 DRO Plume
- Approximate 2019 PCE Plume

Analytes	ROD RG	ADEC CUL
Units in µg/L		
DRO	NA	1,500
Benzene	5.0	4.6
PCE	5.0	41
TCE	5.0	2.8
cis-1,2-DCE	70	36

NOTES:

1. Contaminant concentrations that exceed ROD RGs are shown in blue. Contaminant concentrations that exceed ADEC CULs are shown in green. Contaminant concentrations that exceed both ROD RGs and ADEC CULs are shown in red.
2. ADEC Cleanup Levels based on Table C in 18 AAC 75 (ADEC, 2018)
3. Analytical results shown in µg/L
4. DRO exceedances in AP-10016, AP-10018 and AP-8914R were most likley a result of organic material injected in August 2009.
5. + Identifies silica gel cleanup method used for AK102 (DRO) analysis in 2011 (AP-10015, AP-10016, AP-10017, AP-10018, and AP-8914R).
6. Data flags (qualifiers) are not shown due to space limitations.
7. * Replacement wells were installed in June 2018 and after are from samples colleced from replacement wells. All other results are from groundwater probe / well shown in parenthesis.
8. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCE:

1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

DRMO1 Groundwater Sample Results
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005 | Figure: 3-1 | Date: 10/19

PROBE B (16.7, 5-15)	May-07	Sep-07	Jun-08	Oct-08	Sep-09	Jun-11	Sep-11	Oct-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17
DRO	64	150	68	1,400	1,000	NA	4,500	NA	NA	2,200	299	2,320	613	2,020	640
BENZENE	0.22	0.13	ND(1)	0.18	0.15	0.09	0.07	0.09	0.22	0.08	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
PCE	0.091	0.19	ND(1)	ND(1)	0.09	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.2)	ND(0.2)	ND(0.62)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
TCE	0.23	0.21	0.1	0.15	0.14	0.14	ND(0.5)	ND(0.5)	0.13	ND(0.1)	ND(0.62)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
WATER ELEV.	NA	NA	NA	NA	NA	442.88	443.46	442.53	443.01	442.98	443.13	443.87	443.59	443.91	443.2

AP-10445MW* (17.4, 7.4-17.4)	Aug-18	Aug-19
DRO	1,670	280
BENZENE	ND(0.2)	ND(0.2)
PCE	ND(0.5)	ND(0.5)
TCE	ND(0.5)	ND(0.5)
WATER ELEV.	444.67	443.49

P05 (14.25, NI)	Jul-94	Sep-00	Dec-01	Jun-02	Sep-02	Oct-05	May-06	Oct-06	May-07	Sep-07	Jun-08	Oct-08	Sep-09	Nov-09
DRO	280	ND (429)	110	ND (170)	100	232	196	170	90	110	130	240	220	NA
BENZENE	7.5	1.33	0.84	ND (2)	1.3	ND (0.4)	ND (0.4)	0.13	0.19	0.11	0.11	0.3	0.22	0.32
PCE	51	36.4	12	41	55	22.9	5.9	22	6.4	21	6.2	8.6	14	5.3
TCE	3.8	2.9	2.1	4.4	5.5	3.47	1.38	3.9	1.4	3.5	1.2	4.0	2.5	3.5
P05	Feb-10	Jun-10	Oct-10	Jun-11	Sep-11	Oct-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	
DRO	NA	NA	140	NA	120	NA	NM	83	ND(0.39)	228	199	278	172	
BENZENE	0.32	0.39	0.28	0.09	0.11	0.11	0.28	0.10	ND(0.24)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	
PCE	1.6	1.0	4.0	1.7	6.6	7.9	1.1	3.8	ND(0.62)	7.3	8.56	12.7	6.6	
TCE	1.2	0.69	3.1	0.97	3.8	3.6	1.3	4.2	ND(0.62)	4.63	4.5	4.5	3.3	

AP-10446MW* (17.5, 7.5-17.5)	Aug-18	Aug-19
DRO	NA	NA
BENZENE	ND(0.2)	ND(0.2)
PCE	ND(0.5)	ND(0.5)
TCE	ND(0.5)	ND(0.5)
WATER ELEV.	443.99	443.60

AP-8916 (15, 5-15)	Sep-03	May-04	Sep-04	May-05	Oct-05	May-06	Oct-06	May-07	Sep-07	Jun-08	Oct-08	Sep-09	Nov-09	Feb-10
DRO	1,360	422	551	474	594	651	1,200	300	260	1,400	790	870	NA	NA
BENZENE	ND (0.4)	0.28	ND (0.4)	ND (0.4)	0.22	ND (0.4)	ND (1)	ND (5)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (0.5)
PCE	25	10.6	10.6	14.5	8.03	2.32	4.7	2.6	7.5	4.1	3.3	6.3	1.7	2.0
TCE	1.62	0.75	ND (1)	0.86	1.74	ND (1)	0.81	ND (5)	1.2	0.8	1.6	1.8	ND(0.5)	ND(0.86)
WATER ELEV.	444.42	444.00	443.45	443.70	443.57	442.82	443.26	442.48	443.52	442.87	443.14	443.17	442.66	441.76
AP-8916	Jun-10	Oct-10	Jun-11	Sep-11	Oct-11	May-12	Aug-12	Aug-13	Oct-14	Aug-15	Sep-16	Aug-17	Aug-18	Aug-19
DRO	NA	1,000	NA	170	NA	NM	10,000	1,530	630	499	440	410	NA	NA
BENZENE	0.34	0.59	ND (0.5)	0.09	0.46	ND(0.7)	0.28	ND(0.24)	ND(0.2)	ND(0.2)	0.13	ND(0.2)	ND(0.2)	ND(0.2)
PCE	1.9	4.0	9.2	6.1	4.7	2.7	5.7	2.18	6.7	1.4	5.8	ND(0.5)	1.2	0.44
TCE	0.52	1.5	1.2	0.65	0.77	0.81	ND(0.1)	ND(0.62)	ND(0.5)	ND(0.5)	3.0	ND(0.5)	ND(0.5)	ND(0.5)
WATER ELEV.	442.25	442.64	443.22	443.73	442.89	443.34	443.34	443.45	442.10	441.97	442.52	441.61	442.05	441.70

DRMO 4 SUBAREA

DRMO 5 SUBAREA

DRMO 3 SUBAREA

Probe B

AP-10445MW

P05

AP-10446MW

AP-8916

5007

Approximate Groundwater Flow Direction

N

ACRONYMS AND ABBREVIATIONS

DRO - diesel range organics
PCE - tetrachloroethene
TCE - trichloroethene
bgs - below ground surface
ISCR - In-Situ Chemical Reduction
ND - not detected (LOQ is shown for data prior to 2012)
LOD - Limit of Detection
LOQ - Limit of Quantitation
NA - not analyzed
NI - no information available
NM - not measured
NS - not sampled
NGVD29 - National Geodetic Vertical Datum of 1929
- - data not available

Analytes	ROD RG	ADEC CUL
Units in µg/L		
DRO	NA	1,500
Benzene	5.0	4.6
PCE	5.0	41
TCE	5.0	2.8

0 30 60
Feet

KEY:

Sample Month and Year

ISCR Injeciton Event

Well ID

Total Depth, Screened Interval (bgs)

Contaminants of Concern

Water Elevations in Feet (NGVD29)

AP-8916 (15, 5-15)	Sep-03	Sep-11	Oct-11
DRO	1,360	170	NA
BENZENE	ND (0.4)	0.09	0.46
PCE	25	6.1	4.7
TCE	1.62	0.65	0.77
WATER ELEV.	444.42	443.73	442.89

LEGEND

- DRMO4 Groundwater Monitoring Well
- Decommissioned Groundwater Monitoring Probe
- Fence
- Alaska Railroad

NOTES:

1. Contaminant concentrations that exceed ROD RGs are shown in blue. Contaminant concentrations that exceed ADEC CULs are shown in green. Contaminant concentrations that exceed both ROD RGs and ADEC
2. ADEC Cleanup Levels based on Table C in 18 AAC 75 (ADEC, 2018)
3. Analytical results shown in µg/L
4. Data flags (qualifiers) are not shown due to space limitations.
5. * Replacement wells were installed in June 2018 and after are from samples colleced from replacement wells. All other results are from groundwater probe / well shown in parenthesis.
6. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCE:

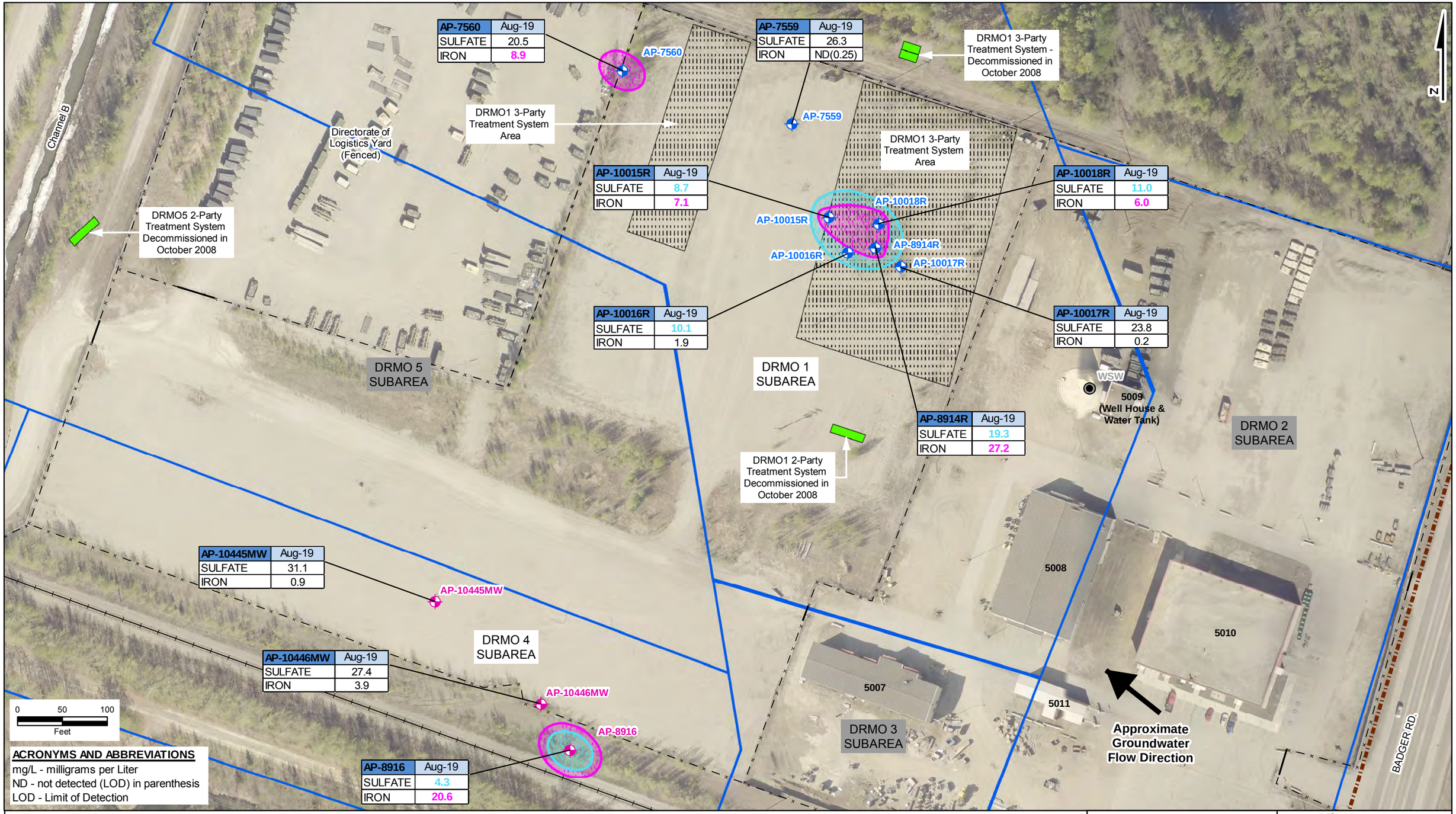
1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

DRMO4 Groundwater Sample Results
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005 | Figure: 3-2 | Date: 10/19



LEGEND

- DRMO1 Groundwater Monitoring Well
- DRMO Water Supply Well
- DRMO4 Groundwater Monitoring Well
- Fence
- Alaska Railroad
- Installation Boundary
- Ferric Iron Reducing = Iron > 5 mg/L
- Sulfate Reducing = Sulfate < 20 mg/L

NOTES:

1. Analytical results shown in mg/L
2. Coordinate System - Projection: World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM), Zone 6N

SOURCE:

1. Aerial imagery obtained from the Fairbanks North Star Borough GIS department: 2017 Fort Wainwright .SID

Fairbanks Environmental Services
3538 International Street
Fairbanks, Alaska

USAGAK

DRMO Yard Groundwater Geochemistry
DRMO Yard
2019 OU2 Monitoring Report
U.S. Army Garrison Alaska

USACE Contract: W911-KB-16-D-0005 | Figure: 3-3 | Date: 10/19

4.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019a. *Field Sampling Guidance.* October.

ADEC, 2019b. *Technical Memorandum – Data Quality Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data.* October.

ADEC, 2018. *18 AAC 75, Oil and Other Hazardous Substances Pollution Control*. As amended through October 27, 2018.

Department of Defense (DoD), 2017. *Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1.*

EPA, 2005. *Roadmap to Long-Term Monitoring Optimization*. EPA 542-R-05-003. May.

Fairbanks Environmental Services (FES), 2019. *2019 CERCLA Sites Work Plan – Operable Units 1 Through 6.* Fort Wainwright, Alaska. July.

FES, 2018a. *Interim Remedial Action Completion Report – Building 1168 Leach Well.* Fort Wainwright, Alaska. November.

FES, 2018b. *DRMO1 and DRMO4 Treatability Study Report.* Fort Wainwright, Alaska. April.

FES, 2011. *2010 Annual Monitoring Report*, Operable Unit 2, Fort Wainwright, Alaska. July.

FES, 2010. *2009 Annual Monitoring Report,* Operable Unit 2, Fort Wainwright, Alaska. June.

FES, 2009. *2009 Work Plan*. Operable Unit 2, Fort Wainwright, Alaska. May.

Harding Lawson Associates (HLA), 1996. *Operable Unit 2 Final Remedial Investigation Report*, Fort Wainwright, Alaska. (Volumes I and II). January 25.

Puls, R.W. and M. J. Barcelona, 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures.* EPA/540/S-95/504. April.

U.S. Army Alaska (USARAK), 1997. *Record of Decision for Operable Unit 2*, Fort Wainwright, Alaska. January.

APPENDIX A

SAMPLE TRACKING AND ANALYTICAL RESULTS TABLES

Table A-1. Groundwater Sample Summary
Operable Unit 2
Fort Wainwright, Alaska

Sample Number	Sample Location	Sample Depth (feet bgs)	Sample Type	Matrix	Sampler Initials	Sample Date	Sample Time	VOC 8260C	GRO AK101	DRO AK102	SVOC 8270D	Dissolved Iron 6020A	Sulfate 300.0	SDG	Cooler ID
DRMO Yard															
19FWOU201WG	AP-10017R	14.5	Primary	WG	AS	08/06/19	1030	X				X	X	1194497	080801,-02
19FWOU202WG	AP-10018R	14.3	Primary	WG	AS	08/06/19	1140	X				X	X	1194497	080801,-02
19FWOU203WG	AP-10015R	14.8	Primary	WG	AS	08/06/19	1245	X				X	X	1194497	080801,-02
19FWOU204WG	AP-10016R	14.9	Primary	WG	AS	08/06/19	1355	X				X	X	1194497	080801,-02
19FWOU205WG	AP-8914R	12.8	Primary	WG	AS	08/06/19	1500	X				X	X	1194497	080801,-02
19FWOU206WG	WSW	unknown[1]	Primary	WG	AS	08/07/19	1015	X	X[2]	X	X[2]			1194497	080801,-02
19FWOU207WG	AP-8916	13.0	Primary	WG	CB	08/07/19	1050	X				X	X	1194497	080801,-02
19FWOU208WG	AP-7560	12.1	Primary/MS/MSD*	WG	AS	08/07/19	1125	X*		X*		X*	X*	1194497	080801,-02
19FWOU209WG	AP-7070 (AP-7560)	12.1	Field Duplicate of 19FWOU208WG	WG	AS	08/07/19	1135	X		X		X	X	1194497	080801,-02
19FWOU210WG	AP-10445MW	14.6	Primary	WG	CB	08/07/19	1200	X		X		X	X	1194497	080801,-02
19FWOU211WG	AP-7559	12.5	Primary	WG	AS	08/07/19	1300	X				X	X	1194497	080801,-02
19FWOU212WG	AP-10446MW	13.8	Primary	WG	CB	08/07/19	1305	X				X	X	1194497	080801,-02
QUALITY CONTROL SAMPLES															
19FWOU2EB01WQ	Rinsate 1	--	Equipment Blank	WQ	AS	08/07/19	1530	X		X		X	X	1194497	080801,-02
19FWOU2TB01WQ	Trip Blank	--	Trip Blank	WQ	--	08/06/19	800	X	X					1194497	080801

Note: All samples were submitted to SGS North America, Inc. of Anchorage, Alaska for analysis. The standard 21-day turnaround time was requested for all analyses. All sampling activities were conducted under NPDL work order number 19-074.

* Denotes MS/MSD sample

[1] The depth at which sample 19FWOU206WG was collected is unknown. The WSW is sampled from a building faucet, per standard protocol.

[2] Neither field duplicate samples nor MS/MSD samples were collected for GRO and SVOC analyses, per the approved Work Plan (FES, 2019). These methods are only employed for samples collected from the Water Supply Well (WSW). The WSW is also sampled by a different entity under the Drink Water Program, during which all quality control criteria are met. The sample results from this sampling event are used as supplemental data and the collection of quality control samples is not required.

AS - Aaron Swank
bgs - below ground surface
°C - degrees Celsius
DRO - diesel range organics
GRO - gasoline range organics
HCl - hydrochloric acid
HDPE - high-density polyethylene
HNO_3 - nitric acid
L - liter
mL - milliliter
MS/MSD - matrix spike/matrix spike duplicate
SDG - sample data group
SVOC - semivolatile organic compounds
VOA - volatile organic analysis
VOC - volatile organic compounds
WG - groundwater matrix
WQ - water quality control
WSW - Water Supply Well

Water Sample Collection (all samples were field-preserved at 0 to 6°C)
VOC - three HCl-preserved, 40 mL VOA vials
GRO - three HCl-preserved, 40 mL VOA vials
DRO - two HCl-preserved, 250 mL amber bottles
SVOC - two non-preserved, 1 L amber bottles
Fe - one HNO_3-preserved, 250 mL HDPE bottle, field-filtered
SO_4 - one non-preserved, 125 mL HDPE bottle

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU201WG	19FWOU202WG	19FWOU203WG	19FWOU204WG	19FWOU205WG
			Location ID	AP-10017R	AP-10018R	AP-10015R	AP-10016R	AP-8914R
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497001	1194497002	1194497003	1194497004	1194497005
			Collection Date	8/6/2019	8/6/2019	8/6/2019	8/6/2019	8/6/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary	Primary	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Gasoline Range Organics	AK101	µg/L	2,200	-	-	-	-	-
Diesel Range Organics	AK102	µg/L	1,500	-	-	-	-	-
Sulfate	E300.0	µg/L	NE	23800 [200]	11000 [200]	8690 [200]	10100 [200]	19300 [200]
Iron	SW6020A	µg/L	NE	205 [250] J	6030 [250]	7100 [250]	1980 [250]	27200 [250]
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	5.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,1-Trichloroethane	SW8260C	µg/L	8,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	0.76	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,2-Trichloro-1,2,2-trifluoroethane	SW8260C	µg/L	10,000	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,1,2-Trichloroethane	SW8260C	µg/L	0.41	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
1,1-Dichloroethane	SW8260C	µg/L	28	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1-Dichloroethene	SW8260C	µg/L	**7.0** / 280	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1-Dichloropropene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichlorobenzene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichloropropane	SW8260C	µg/L	0.0075	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trichlorobenzene	SW8260C	µg/L	4.0	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trimethylbenzene	SW8260C	µg/L	56	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	NE	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,2-Dibromoethane	SW8260C	µg/L	0.075	ND [0.0375]	ND [0.0375]	ND [0.0375]	ND [0.0375]	ND [0.0375]
1,2-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dichloroethane	SW8260C	µg/L	1.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,2-Dichloropropane	SW8260C	µg/L	8.2	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3,5-Trimethylbenzene	SW8260C	µg/L	60	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichloropropane	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,4-Dichlorobenzene	SW8260C	µg/L	4.8	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
2,2-Dichloropropane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Butanone	SW8260C	µg/L	5,600	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
2-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Hexanone	SW8260C	µg/L	38	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
4-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Isopropyltoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Methyl-2-pentanone	SW8260C	µg/L	6,300	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Benzene	SW8260C	µg/L	**5.0** / 4.6	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
Bromobenzene	SW8260C	µg/L	62	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromochloromethane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromodichloromethane	SW8260C	µg/L	1.3	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Bromoform	SW8260C	µg/L	33	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromomethane	SW8260C	µg/L	7.5	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Carbon disulfide	SW8260C	µg/L	810	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Carbon tetrachloride	SW8260C	µg/L	4.6	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chlorobenzene	SW8260C	µg/L	78	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Chloroethane	SW8260C	µg/L	21,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloroform	SW8260C	µg/L	2.20	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloromethane	SW8260C	µg/L	190	0.31 [0.500] J	0.35 [0.500] J	0.39 [0.500] J	0.32 [0.500] J	ND [0.500]
cis-1,2-Dichloroethene	SW8260C	µg/L	**70** / 36	0.67 [0.500] J	2.23 [0.500]	0.99 [0.500] J	0.32 [0.500] J	6.36 [0.500]
cis-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromochloromethane	SW8260C	µg/L	8.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromomethane	SW8260C	µg/L	8.3	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Dichlorodifluoromethane	SW8260C	µg/L	200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Ethylbenzene	SW8260C	µg/L	15	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Hexachlorobutadiene	SW8260C	µg/L	1.4	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Isopropylbenzene	SW8260C	µg/L	450	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Methylene chloride	SW8260C	µg/L	110	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Methyl-tert-butyl ether (MTBE)	SW8260C	µg/L	140	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Naphthalene	SW8260C	µg/L	1.7	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
n-Butylbenzene	SW8260C	µg/L	1,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
n-Propylbenzene	SW8260C	µg/L	660	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
sec-Butylbenzene	SW8260C	µg/L	2,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU201WG	19FWOU202WG	19FWOU203WG	19FWOU204WG	19FWOU205WG
			Location ID	AP-10017R	AP-10018R	AP-10015R	AP-10016R	AP-8914R
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497001	1194497002	1194497003	1194497004	1194497005
			Collection Date	8/6/2019	8/6/2019	8/6/2019	8/6/2019	8/6/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary	Primary	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Styrene	SW8260C	µg/L	1,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
tert-Butylbenzene	SW8260C	µg/L	690	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Tetrachloroethene (PCE)	SW8260C	µg/L	5.0 / 41	0.52 [0.500] J	0.56 [0.500] J	0.63 [0.500] J	6.15 [0.500]	0.57 [0.500] J
Toluene	SW8260C	µg/L	1,100	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
trans-1,2-Dichloroethene	SW8260C	µg/L	360	ND [0.500]	6.77 [0.500]	2.28 [0.500]	0.48 [0.500] J	5.09 [0.500]
trans-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Trichloroethene (TCE)	SW8260C	µg/L	5.0 / 2.8	ND [0.500]	ND [0.500]	0.67 [0.500] J	0.55 [0.500] J	1.22 [0.500]
Trichlorofluoromethane	SW8260C	µg/L	5,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Vinyl acetate	SW8260C	µg/L	410	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Vinyl chloride	SW8260C	µg/L	2.0 / 0.19	ND [0.0750]	ND [0.0750]	ND [0.0750]	ND [0.0750]	ND [0.0750]
o-Xylene	SW8260C	µg/L	190	ND [0.500] J	ND [0.500] J	ND [0.500] J	ND [0.500] J	ND [0.500]
Xylene, Isomers m & p	SW8260C	µg/L	190	ND [1.00]	ND [1.00]	ND [1.00]	ND [1.00]	ND [1.00]
Xylenes	SW8260C	µg/L	190	ND [1.50]	ND [1.50]	ND [1.50]	ND [1.50]	ND [1.50]
1,2,4-Trichlorobenzene	SW8270D	µg/L	4.0	-	-	-	-	-
1,2-Dichlorobenzene	SW8270D	µg/L	300	-	-	-	-	-
1,3-Dichlorobenzene	SW8270D	µg/L	300	-	-	-	-	-
1,4-Dichlorobenzene	SW8270D	µg/L	4.8	-	-	-	-	-
1-Chloronaphthalene	SW8270D	µg/L	NE	-	-	-	-	-
1-Methylnaphthalene	SW8270D	µg/L	11	-	-	-	-	-
2,4,5-Trichlorophenol	SW8270D	µg/L	1,200	-	-	-	-	-
2,4,6-Trichlorophenol	SW8270D	µg/L	12	-	-	-	-	-
2,4-Dichlorophenol	SW8270D	µg/L	46	-	-	-	-	-
2,4-Dimethylphenol	SW8270D	µg/L	360	-	-	-	-	-
2,4-Dinitrophenol	SW8270D	µg/L	39	-	-	-	-	-
2,4-Dinitrotoluene	SW8270D	µg/L	2.4	-	-	-	-	-
2,6-Dichlorophenol	SW8270D	µg/L	NE	-	-	-	-	-
2,6-Dinitrotoluene	SW8270D	µg/L	0.49	-	-	-	-	-
2-Chloronaphthalene	SW8270D	µg/L	750	-	-	-	-	-
2-Chlorophenol	SW8270D	µg/L	91	-	-	-	-	-
2-Methyl-4,6-dinitrophenol	SW8270D	µg/L	NE	-	-	-	-	-
2-Methylnaphthalene	SW8270D	µg/L	36	-	-	-	-	-
2-Methylphenol (o-Cresol)	SW8270D	µg/L	930	-	-	-	-	-
2-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-	-
2-Nitrophenol	SW8270D	µg/L	NE	-	-	-	-	-
3,3'-Dichlorobenzidine	SW8270D	µg/L	1.3	-	-	-	-	-
3-Methylphenol/4-Methylphenol Coelution	SW8270D	µg/L	NE	-	-	-	-	-
3-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-	-
4-Bromophenyl phenyl ether	SW8270D	µg/L	NE	-	-	-	-	-
4-Chloro-3-methylphenol	SW8270D	µg/L	NE	-	-	-	-	-
4-Chloroaniline	SW8270D	µg/L	3.7	-	-	-	-	-
4-Chlorophenyl phenyl ether	SW8270D	µg/L	NE	-	-	-	-	-
4-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-	-
4-Nitrophenol	SW8270D	µg/L	NE	-	-	-	-	-
Acenaphthene	SW8270D	µg/L	530	-	-	-	-	-
Acenaphthylene	SW8270D	µg/L	260	-	-	-	-	-
Aniline	SW8270D	µg/L	NE	-	-	-	-	-
Anthracene	SW8270D	µg/L	43	-	-	-	-	-
Azobenzene	SW8270D	µg/L	NE	-	-	-	-	-
Benzo(a)anthracene	SW8270D	µg/L	0.30	-	-	-	-	-
Benzo(a)pyrene	SW8270D	µg/L	0.25	-	-	-	-	-
Benzo(b)fluoranthene	SW8270D	µg/L	2.5	-	-	-	-	-
Benzo(g,h,i)perylene	SW8270D	µg/L	0.26	-	-	-	-	-
Benzo(k)fluoranthene	SW8270D	µg/L	0.80	-	-	-	-	-
Benzoic acid	SW8270D	µg/L	75,000	-	-	-	-	-
Benzyl alcohol	SW8270D	µg/L	2,000	-	-	-	-	-
Benzyl butyl phthalate	SW8270D	µg/L	160	-	-	-	-	-
bis-(2-Chloroethoxy)methane	SW8270D	µg/L	NE	-	-	-	-	-
bis-(2-Chloroethyl)ether	SW8270D	µg/L	0.14	-	-	-	-	-

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU201WG	19FWOU202WG	19FWOU203WG	19FWOU204WG	19FWOU205WG
			Location ID	AP-10017R	AP-10018R	AP-10015R	AP-10016R	AP-8914R
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497001	1194497002	1194497003	1194497004	1194497005
			Collection Date	8/6/2019	8/6/2019	8/6/2019	8/6/2019	8/6/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary	Primary	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
bis(2-Chloroisopropyl)ether	SW8270D	µg/L	NE	-	-	-	-	-
bis-(2-Ethylhexyl)phthalate	SW8270D	µg/L	56	-	-	-	-	-
Carbazole	SW8270D	µg/L	NE	-	-	-	-	-
Chrysene	SW8270D	µg/L	2.0	-	-	-	-	-
Dibenzo(a,h)anthracene	SW8270D	µg/L	0.25	-	-	-	-	-
Dibenzofuran	SW8270D	µg/L	7.9	-	-	-	-	-
Diethyl phthalate	SW8270D	µg/L	15,000	-	-	-	-	-
Dimethyl phthalate	SW8270D	µg/L	16,000	-	-	-	-	-
Di-n-butyl phthalate	SW8270D	µg/L	900	-	-	-	-	-
Di-n-octyl phthalate	SW8270D	µg/L	22	-	-	-	-	-
Fluoranthene	SW8270D	µg/L	260	-	-	-	-	-
Fluorene	SW8270D	µg/L	290	-	-	-	-	-
Hexachlorobenzene	SW8270D	µg/L	0.098	-	-	-	-	-
Hexachlorobutadiene	SW8270D	µg/L	1.4	-	-	-	-	-
Hexachlorocyclopentadiene	SW8270D	µg/L	0.41	-	-	-	-	-
Hexachloroethane	SW8270D	µg/L	3.3	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	SW8270D	µg/L	0.19	-	-	-	-	-
Isophorone	SW8270D	µg/L	780	-	-	-	-	-
Naphthalene	SW8270D	µg/L	1.7	-	-	-	-	-
Nitrobenzene	SW8270D	µg/L	1.4	-	-	-	-	-
n-Nitrosodimethylamine	SW8270D	µg/L	0.0011	-	-	-	-	-
n-Nitrosodi-n-propylamine	SW8270D	µg/L	0.11	-	-	-	-	-
n-Nitrosodiphenylamine	SW8270D	µg/L	120	-	-	-	-	-
Pentachlorophenol	SW8270D	µg/L	0.41	-	-	-	-	-
Phenanthrene	SW8270D	µg/L	170	-	-	-	-	-
Phenol	SW8270D	µg/L	5,800	-	-	-	-	-
Pyrene	SW8270D	µg/L	120	-	-	-	-	-

Results in blue and bold font exceed ROD RGs.

Results in green and bold font exceed ADEC CULs.

No ROD analytes exceed both the ROD RGs and ADEC CULs

Grey shaded results are non-detect with LODs above OU2 ROD RGs and/or ADEC CULs

[1] **OU2 ROD analytes and RGs are identified in blue text.** The remaining values are ADEC Groundwater Human Health values listed in ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C (revised as of October 27, 2018).

Data Qualifiers:

B - result may be due to cross-contamination
J - result qualified as estimate because it is less than the LOQ or due to a QC
J+ - result qualified as estimate with a high-bias due to a QC failure
J- - result qualified as estimate with a low-bias due to a QC failure
ND - not detected [LOD presented in brackets]

Acronyms:

CUL - cleanup level
LOD - limit of detection
LOQ - limit of quantitation
MS/MSD - matrix spike/matrix spike duplicate
µg/L - micrograms per liter
mg/L - milligrams per liter
NE - not established
QC - quality control
RG - remedial goal
ROD - Record of Decision
WG - groundwater
WQ - water QC sample

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU206WG	19FWOU207WG	19FWOU208WG	19FWOU209WG	19FWOU210WG
			Location ID	WSW	AP-8616	AP-7560	AP-7070	AP-10445MW
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497006	1194497007	1194497008	1194497011	1194497012
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/7/2019	8/7/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary/MS/MSD	Field Duplicate of 19FWOU208WG	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Gasoline Range Organics	AK101	µg/L	2,200	ND [50]	-	-	-	-
Diesel Range Organics	AK102	µg/L	1,500	ND [300]	-	2730 [288] J	1910 [283] J	280 [283] J
Sulfate	E300.0	µg/L	NE	-	4300 [200]	21200 [200] J-	20500 [200] J-	27300 [200]
Iron	SW6020A	µg/L	NE	-	20600 [250]	8570 [250]	8880 [250]	867 [250]
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	5.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,1-Trichloroethane	SW8260C	µg/L	8,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	0.76	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,2-Trichloro-1,2,2-trifluoroethane	SW8260C	µg/L	10,000	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,1,2-Trichloroethane	SW8260C	µg/L	0.41	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
1,1-Dichloroethane	SW8260C	µg/L	28	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1-Dichloroethene	SW8260C	µg/L	7.0 / 280	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1-Dichloropropene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichlorobenzene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichloropropane	SW8260C	µg/L	0.0075	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trichlorobenzene	SW8260C	µg/L	4.0	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trimethylbenzene	SW8260C	µg/L	56	ND [0.500]	8.39 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	NE	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,2-Dibromoethane	SW8260C	µg/L	0.075	ND [0.0375]	ND [0.0375]	ND [0.0375]	ND [0.0375]	ND [0.0375]
1,2-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dichloroethane	SW8260C	µg/L	1.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,2-Dichloropropane	SW8260C	µg/L	8.2	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3,5-Trimethylbenzene	SW8260C	µg/L	60	ND [0.500]	2.46 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichloropropane	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,4-Dichlorobenzene	SW8260C	µg/L	4.8	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
2,2-Dichloropropane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Butanone	SW8260C	µg/L	5,600	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
2-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Hexanone	SW8260C	µg/L	38	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
4-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Isopropyltoluene	SW8260C	µg/L	NE	ND [0.500]	3.54 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Methyl-2-pentanone	SW8260C	µg/L	6,300	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Benzene	SW8260C	µg/L	5.0 / 4.6	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
Bromobenzene	SW8260C	µg/L	62	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromochloromethane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromodichloromethane	SW8260C	µg/L	1.3	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Bromoform	SW8260C	µg/L	33	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromomethane	SW8260C	µg/L	7.5	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Carbon disulfide	SW8260C	µg/L	810	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Carbon tetrachloride	SW8260C	µg/L	4.6	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chlorobenzene	SW8260C	µg/L	78	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Chloroethane	SW8260C	µg/L	21,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloroform	SW8260C	µg/L	2.20	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloromethane	SW8260C	µg/L	190	0.56 [0.500] J	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
cis-1,2-Dichloroethene	SW8260C	µg/L	70 / 36	ND [0.500]	ND [0.500]	1.14 [0.500]	1.17 [0.500]	ND [0.500]
cis-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromochloromethane	SW8260C	µg/L	8.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromomethane	SW8260C	µg/L	8.3	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Dichlorodifluoromethane	SW8260C	µg/L	200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Ethylbenzene	SW8260C	µg/L	15	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Hexachlorobutadiene	SW8260C	µg/L	1.4	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Isopropylbenzene	SW8260C	µg/L	450	ND [0.500]	1.53 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Methylene chloride	SW8260C	µg/L	110	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Methyl-tert-butyl ether (MTBE)	SW8260C	µg/L	140	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Naphthalene	SW8260C	µg/L	1.7	ND [0.500]	0.54 [0.500] J	0.53 [0.500] J	0.57 [0.500] J	ND [0.500]
n-Butylbenzene	SW8260C	µg/L	1,000	ND [0.500]	2.42 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
n-Propylbenzene	SW8260C	µg/L	660	ND [0.500]	3.37 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
sec-Butylbenzene	SW8260C	µg/L	2,000	ND [0.500]	2.56 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU206WG	19FWOU207WG	19FWOU208WG	19FWOU209WG	19FWOU210WG
			Location ID	WSW	AP-8616	AP-7560	AP-7070	AP-10445MW
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497006	1194497007	1194497008	1194497011	1194497012
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/7/2019	8/7/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary/MS/MSD	Field Duplicate of 19FWOU208WG	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Styrene	SW8260C	µg/L	1,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
tert-Butylbenzene	SW8260C	µg/L	690	ND [0.500]	0.37 [0.500] J	ND [0.500]	ND [0.500]	ND [0.500]
Tetrachloroethene (PCE)	SW8260C	µg/L	5.0 / 41	ND [0.500]	0.44 [0.500] J	1.65 [0.500]	1.72 [0.500]	ND [0.500]
Toluene	SW8260C	µg/L	1,100	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
trans-1,2-Dichloroethene	SW8260C	µg/L	360	ND [0.500]	ND [0.500]	1.56 [0.500]	1.64 [0.500]	ND [0.500]
trans-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Trichloroethene (TCE)	SW8260C	µg/L	5.0 / 2.8	ND [0.500]	ND [0.500]	2.7 [0.500]	2.76 [0.500]	ND [0.500]
Trichlorofluoromethane	SW8260C	µg/L	5,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Vinyl acetate	SW8260C	µg/L	410	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Vinyl chloride	SW8260C	µg/L	2.0 / 0.19	ND [0.0750]	ND [0.0750]	ND [0.0750]	ND [0.0750]	ND [0.0750]
o-Xylene	SW8260C	µg/L	190	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Xylene, Isomers m & p	SW8260C	µg/L	190	ND [1.00]	1 [1.00] J	ND [1.00]	ND [1.00]	ND [1.00]
Xylenes	SW8260C	µg/L	190	ND [1.50]	1 [1.50] J	ND [1.50]	ND [1.50]	ND [1.50]
1,2,4-Trichlorobenzene	SW8270D	µg/L	4.0	ND [5.00]	-	-	-	-
1,2-Dichlorobenzene	SW8270D	µg/L	300	ND [5.00]	-	-	-	-
1,3-Dichlorobenzene	SW8270D	µg/L	300	ND [5.00]	-	-	-	-
1,4-Dichlorobenzene	SW8270D	µg/L	4.8	ND [5.00]	-	-	-	-
1-Chloronaphthalene	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
1-Methylnaphthalene	SW8270D	µg/L	11	ND [5.00]	-	-	-	-
2,4,5-Trichlorophenol	SW8270D	µg/L	1,200	ND [5.00]	-	-	-	-
2,4,6-Trichlorophenol	SW8270D	µg/L	12	ND [5.00]	-	-	-	-
2,4-Dichlorophenol	SW8270D	µg/L	46	ND [5.00]	-	-	-	-
2,4-Dimethylphenol	SW8270D	µg/L	360	ND [5.00]	-	-	-	-
2,4-Dinitrophenol	SW8270D	µg/L	39	ND [25.0]	-	-	-	-
2,4-Dinitrotoluene	SW8270D	µg/L	2.4	ND [5.00]	-	-	-	-
2,6-Dichlorophenol	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
2,6-Dinitrotoluene	SW8270D	µg/L	0.49	ND [5.00]	-	-	-	-
2-Chloronaphthalene	SW8270D	µg/L	750	ND [5.00]	-	-	-	-
2-Chlorophenol	SW8270D	µg/L	91	ND [5.00]	-	-	-	-
2-Methyl-4,6-dinitrophenol	SW8270D	µg/L	NE	ND [25.0]	-	-	-	-
2-Methylnaphthalene	SW8270D	µg/L	36	ND [5.00]	-	-	-	-
2-Methylphenol (o-Cresol)	SW8270D	µg/L	930	ND [5.00]	-	-	-	-
2-Nitroaniline	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
2-Nitrophenol	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
3,3'-Dichlorobenzidine	SW8270D	µg/L	1.3	ND [5.00]	-	-	-	-
3-Methylphenol/4-Methylphenol Coelution	SW8270D	µg/L	NE	ND [10.0]	-	-	-	-
3-Nitroaniline	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
4-Bromophenyl phenyl ether	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
4-Chloro-3-methylphenol	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
4-Chloroaniline	SW8270D	µg/L	3.7	ND [5.00]	-	-	-	-
4-Chlorophenyl phenyl ether	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
4-Nitroaniline	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
4-Nitrophenol	SW8270D	µg/L	NE	ND [25.0]	-	-	-	-
Acenaphthene	SW8270D	µg/L	530	ND [5.00]	-	-	-	-
Acenaphthylene	SW8270D	µg/L	260	ND [5.00]	-	-	-	-
Aniline	SW8270D	µg/L	NE	ND [25.0]	-	-	-	-
Anthracene	SW8270D	µg/L	43	ND [5.00]	-	-	-	-
Azobenzene	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
Benzo(a)anthracene	SW8270D	µg/L	0.30	ND [5.00]	-	-	-	-
Benzo(a)pyrene	SW8270D	µg/L	0.25	ND [5.00]	-	-	-	-
Benzo(b)fluoranthene	SW8270D	µg/L	2.5	ND [5.00]	-	-	-	-
Benzo(g,h,i)perylene	SW8270D	µg/L	0.26	ND [5.00]	-	-	-	-
Benzo(k)fluoranthene	SW8270D	µg/L	0.80	ND [5.00]	-	-	-	-
Benzoic acid	SW8270D	µg/L	75,000	ND [25.0]	-	-	-	-
Benzyl alcohol	SW8270D	µg/L	2,000	ND [5.00]	-	-	-	-
Benzyl butyl phthalate	SW8270D	µg/L	160	ND [5.00]	-	-	-	-
bis-(2-Chloroethoxy)methane	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
bis-(2-Chloroethyl)ether	SW8270D	µg/L	0.14	ND [5.00]	-	-	-	-

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU206WG	19FWOU207WG	19FWOU208WG	19FWOU209WG	19FWOU210WG
			Location ID	WSW	AP-8616	AP-7560	AP-7070	AP-10445MW
			Sample Data Group	1194497	1194497	1194497	1194497	1194497
			Laboratory ID	1194497006	1194497007	1194497008	1194497011	1194497012
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/7/2019	8/7/2019
			Matrix	WG	WG	WG	WG	WG
			Sample Type	Primary	Primary	Primary/MS/MSD	Field Duplicate of 19FWOU208WG	Primary
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
bis(2-Chloroisopropyl)ether	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
bis-(2-Ethylhexyl)phthalate	SW8270D	µg/L	56	ND [5.00]	-	-	-	-
Carbazole	SW8270D	µg/L	NE	ND [5.00]	-	-	-	-
Chrysene	SW8270D	µg/L	2.0	ND [5.00]	-	-	-	-
Dibenzo(a,h)anthracene	SW8270D	µg/L	0.25	ND [5.00]	-	-	-	-
Dibenzofuran	SW8270D	µg/L	7.9	ND [2.50]	-	-	-	-
Diethyl phthalate	SW8270D	µg/L	15,000	ND [5.00]	-	-	-	-
Dimethyl phthalate	SW8270D	µg/L	16,000	ND [5.00]	-	-	-	-
Di-n-butyl phthalate	SW8270D	µg/L	900	ND [5.00]	-	-	-	-
Di-n-octyl phthalate	SW8270D	µg/L	22	ND [5.00]	-	-	-	-
Fluoranthene	SW8270D	µg/L	260	ND [5.00]	-	-	-	-
Fluorene	SW8270D	µg/L	290	ND [5.00]	-	-	-	-
Hexachlorobenzene	SW8270D	µg/L	0.098	ND [5.00]	-	-	-	-
Hexachlorobutadiene	SW8270D	µg/L	1.4	ND [5.00]	-	-	-	-
Hexachlorocyclopentadiene	SW8270D	µg/L	0.41	ND [15.0]	-	-	-	-
Hexachloroethane	SW8270D	µg/L	3.3	ND [5.00]	-	-	-	-
Indeno(1,2,3-cd)pyrene	SW8270D	µg/L	0.19	ND [5.00]	-	-	-	-
Isophorone	SW8270D	µg/L	780	ND [5.00]	-	-	-	-
Naphthalene	SW8270D	µg/L	1.7	ND [5.00]	-	-	-	-
Nitrobenzene	SW8270D	µg/L	1.4	ND [5.00]	-	-	-	-
n-Nitrosodimethylamine	SW8270D	µg/L	0.0011	ND [5.00]	-	-	-	-
n-Nitrosodi-n-propylamine	SW8270D	µg/L	0.11	ND [5.00]	-	-	-	-
n-Nitrosodiphenylamine	SW8270D	µg/L	120	ND [5.00]	-	-	-	-
Pentachlorophenol	SW8270D	µg/L	0.41	ND [25.0]	-	-	-	-
Phenanthrene	SW8270D	µg/L	170	ND [5.00]	-	-	-	-
Phenol	SW8270D	µg/L	5,800	ND [5.00]	-	-	-	-
Pyrene	SW8270D	µg/L	120	ND [5.00]	-	-	-	-

Results in blue and bold font exceed ROD RGs.

Results in green and bold font exceed ADEC CULs.

No ROD analytes exceed both the ROD RGs and ADEC CULs

Grey shaded results are non-detect with LODs above OU2 ROD RGs and/or ADEC CULs

[1] **OU2 ROD analytes and RGs are identified in blue text.** The remaining values are ADEC Groundwater Human Health values listed in ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C (revised as of October 27, 2018).

Data Qualifiers:

B - result may be due to cross-contamination
J - result qualified as estimate because it is less than the LOQ or due to a QC
J+ - result qualified as estimate with a high-bias due to a QC failure
J- - result qualified as estimate with a low-bias due to a QC failure
ND - not detected [LOD presented in brackets]

Acronyms:

CUL - cleanup level
LOD - limit of detection
LOQ - limit of quantitation
MS/MSD - matrix spike/matrix spike duplicate
µg/L - micrograms per liter
mg/L - milligrams per liter
NE - not established
QC - quality control
RG - remedial goal
ROD - Record of Decision
WG - groundwater
WQ - water QC sample

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU211WG	19FWOU212WG	19FWOU2EB01WQ	19FWOU2TB01WQ
			Location ID	AP-7559	AP-10446MW	Rinsate 1	Trip Blank
			Sample Data Group	1194497	1194497	1194497	1194497
			Laboratory ID	1194497013	1194497014	1194497015	1194497016
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/6/2019
			Matrix	WG	WG	WQ	WQ
			Sample Type	Primary	Primary	Equipment Blank	Trip Blank
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Gasoline Range Organics	AK101	µg/L	2,200	-	-	-	ND [50]
Diesel Range Organics	AK102	µg/L	1,500	-	-	ND [288]	-
Sulfate	E300.0	µg/L	NE	26300 [200]	27400 [200]	ND [100]	-
Iron	SW6020A	µg/L	NE	ND [250]	3910 [250]	ND [250]	-
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	5.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,1-Trichloroethane	SW8260C	µg/L	8,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	0.76	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,1,2-Trichloro-1,2,2-trifluoroethane	SW8260C	µg/L	10,000	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,1,2-Trichloroethane	SW8260C	µg/L	0.41	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
1,1-Dichloroethane	SW8260C	µg/L	28	ND [0.500]	0.33 [0.500] J	ND [0.500]	ND [0.500]
1,1-Dichloroethene	SW8260C	µg/L	**7.0** / 280	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,1-Dichloropropene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichlorobenzene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,3-Trichloropropane	SW8260C	µg/L	0.0075	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trichlorobenzene	SW8260C	µg/L	4.0	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2,4-Trimethylbenzene	SW8260C	µg/L	56	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	NE	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
1,2-Dibromoethane	SW8260C	µg/L	0.075	ND [0.0375]	ND [0.0375]	ND [0.0375]	ND [0.0375]
1,2-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,2-Dichloroethane	SW8260C	µg/L	1.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,2-Dichloropropane	SW8260C	µg/L	8.2	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3,5-Trimethylbenzene	SW8260C	µg/L	60	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichlorobenzene	SW8260C	µg/L	300	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
1,3-Dichloropropane	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
1,4-Dichlorobenzene	SW8260C	µg/L	4.8	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
2,2-Dichloropropane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Butanone	SW8260C	µg/L	5,600	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
2-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
2-Hexanone	SW8260C	µg/L	38	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
4-Chlorotoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Isopropyltoluene	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
4-Methyl-2-pentanone	SW8260C	µg/L	6,300	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Benzene	SW8260C	µg/L	**5.0** / 4.6	ND [0.200]	ND [0.200]	ND [0.200]	ND [0.200]
Bromobenzene	SW8260C	µg/L	62	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromochloromethane	SW8260C	µg/L	NE	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromodichloromethane	SW8260C	µg/L	1.3	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Bromoform	SW8260C	µg/L	33	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Bromomethane	SW8260C	µg/L	7.5	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Carbon disulfide	SW8260C	µg/L	810	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Carbon tetrachloride	SW8260C	µg/L	4.6	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chlorobenzene	SW8260C	µg/L	78	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Chloroethane	SW8260C	µg/L	21,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloroform	SW8260C	µg/L	2.20	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Chloromethane	SW8260C	µg/L	190	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
cis-1,2-Dichloroethene	SW8260C	µg/L	**70** / 36	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
cis-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromochloromethane	SW8260C	µg/L	8.7	ND [0.250]	ND [0.250]	ND [0.250]	ND [0.250]
Dibromomethane	SW8260C	µg/L	8.3	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Dichlorodifluoromethane	SW8260C	µg/L	200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Ethylbenzene	SW8260C	µg/L	15	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Hexachlorobutadiene	SW8260C	µg/L	1.4	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Isopropylbenzene	SW8260C	µg/L	450	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Methylene chloride	SW8260C	µg/L	110	ND [2.50]	ND [2.50]	ND [2.50]	ND [2.50]
Methyl-tert-butyl ether (MTBE)	SW8260C	µg/L	140	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Naphthalene	SW8260C	µg/L	1.7	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
n-Butylbenzene	SW8260C	µg/L	1,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
n-Propylbenzene	SW8260C	µg/L	660	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
sec-Butylbenzene	SW8260C	µg/L	2,000	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU211WG	19FWOU212WG	19FWOU2EB01WQ	19FWOU2TB01WQ
			Location ID	AP-7559	AP-10446MW	Rinsate 1	Trip Blank
			Sample Data Group	1194497	1194497	1194497	1194497
			Laboratory ID	1194497013	1194497014	1194497015	1194497016
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/6/2019
			Matrix	WG	WG	WQ	WQ
			Sample Type	Primary	Primary	Equipment Blank	Trip Blank
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
Styrene	SW8260C	µg/L	1,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
tert-Butylbenzene	SW8260C	µg/L	690	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Tetrachloroethene (PCE)	SW8260C	µg/L	**5.0** / 41	3.44 [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Toluene	SW8260C	µg/L	1,100	ND [0.500]	ND [0.500]	0.75 [0.500] J	ND [0.500]
trans-1,2-Dichloroethene	SW8260C	µg/L	360	0.31 [0.500] J	ND [0.500]	ND [0.500]	ND [0.500]
trans-1,3-Dichloropropene	SW8260C	µg/L	4.7	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Trichloroethene (TCE)	SW8260C	µg/L	**5.0** / 2.8	0.51 [0.500] J	ND [0.500]	ND [0.500]	ND [0.500]
Trichlorofluoromethane	SW8260C	µg/L	5,200	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Vinyl acetate	SW8260C	µg/L	410	ND [5.00]	ND [5.00]	ND [5.00]	ND [5.00]
Vinyl chloride	SW8260C	µg/L	**2.0** / 0.19	ND [0.0750]	ND [0.0750]	ND [0.0750]	ND [0.0750]
o-Xylene	SW8260C	µg/L	190	ND [0.500]	ND [0.500]	ND [0.500]	ND [0.500]
Xylene, Isomers m & p	SW8260C	µg/L	190	ND [1.00]	ND [1.00]	ND [1.00]	ND [1.00]
Xylenes	SW8260C	µg/L	190	ND [1.50]	ND [1.50]	ND [1.50]	ND [1.50]
1,2,4-Trichlorobenzene	SW8270D	µg/L	4.0	-	-	-	-
1,2-Dichlorobenzene	SW8270D	µg/L	300	-	-	-	-
1,3-Dichlorobenzene	SW8270D	µg/L	300	-	-	-	-
1,4-Dichlorobenzene	SW8270D	µg/L	4.8	-	-	-	-
1-Chloronaphthalene	SW8270D	µg/L	NE	-	-	-	-
1-Methylnaphthalene	SW8270D	µg/L	11	-	-	-	-
2,4,5-Trichlorophenol	SW8270D	µg/L	1,200	-	-	-	-
2,4,6-Trichlorophenol	SW8270D	µg/L	12	-	-	-	-
2,4-Dichlorophenol	SW8270D	µg/L	46	-	-	-	-
2,4-Dimethylphenol	SW8270D	µg/L	360	-	-	-	-
2,4-Dinitrophenol	SW8270D	µg/L	39	-	-	-	-
2,4-Dinitrotoluene	SW8270D	µg/L	2.4	-	-	-	-
2,6-Dichlorophenol	SW8270D	µg/L	NE	-	-	-	-
2,6-Dinitrotoluene	SW8270D	µg/L	0.49	-	-	-	-
2-Chloronaphthalene	SW8270D	µg/L	750	-	-	-	-
2-Chlorophenol	SW8270D	µg/L	91	-	-	-	-
2-Methyl-4,6-dinitrophenol	SW8270D	µg/L	NE	-	-	-	-
2-Methylnaphthalene	SW8270D	µg/L	36	-	-	-	-
2-Methylphenol (o-Cresol)	SW8270D	µg/L	930	-	-	-	-
2-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-
2-Nitrophenol	SW8270D	µg/L	NE	-	-	-	-
3,3'-Dichlorobenzidine	SW8270D	µg/L	1.3	-	-	-	-
3-Methylphenol/4-Methylphenol Coelution	SW8270D	µg/L	NE	-	-	-	-
3-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-
4-Bromophenyl phenyl ether	SW8270D	µg/L	NE	-	-	-	-
4-Chloro-3-methylphenol	SW8270D	µg/L	NE	-	-	-	-
4-Chloroaniline	SW8270D	µg/L	3.7	-	-	-	-
4-Chlorophenyl phenyl ether	SW8270D	µg/L	NE	-	-	-	-
4-Nitroaniline	SW8270D	µg/L	NE	-	-	-	-
4-Nitrophenol	SW8270D	µg/L	NE	-	-	-	-
Acenaphthene	SW8270D	µg/L	530	-	-	-	-
Acenaphthylene	SW8270D	µg/L	260	-	-	-	-
Aniline	SW8270D	µg/L	NE	-	-	-	-
Anthracene	SW8270D	µg/L	43	-	-	-	-
Azobenzene	SW8270D	µg/L	NE	-	-	-	-
Benzo(a)anthracene	SW8270D	µg/L	0.30	-	-	-	-
Benzo(a)pyrene	SW8270D	µg/L	0.25	-	-	-	-
Benzo(b)fluoranthene	SW8270D	µg/L	2.5	-	-	-	-
Benzo(g,h,i)perylene	SW8270D	µg/L	0.26	-	-	-	-
Benzo(k)fluoranthene	SW8270D	µg/L	0.80	-	-	-	-
Benzoic acid	SW8270D	µg/L	75,000	-	-	-	-
Benzyl alcohol	SW8270D	µg/L	2,000	-	-	-	-
Benzyl butyl phthalate	SW8270D	µg/L	160	-	-	-	-
bis-(2-Chloroethoxy)methane	SW8270D	µg/L	NE	-	-	-	-
bis-(2-Chloroethyl)ether	SW8270D	µg/L	0.14	-	-	-	-

Table A-2. Groundwater Sample Results
Operable Unit 2
Fort Wainwright, Alaska

			Sample ID	19FWOU211WG	19FWOU212WG	19FWOU2EB01WQ	19FWOU2TB01WQ
			Location ID	AP-7559	AP-10446MW	Rinsate 1	Trip Blank
			Sample Data Group	1194497	1194497	1194497	1194497
			Laboratory ID	1194497013	1194497014	1194497015	1194497016
			Collection Date	8/7/2019	8/7/2019	8/7/2019	8/6/2019
			Matrix	WG	WG	WQ	WQ
			Sample Type	Primary	Primary	Equipment Blank	Trip Blank
Analyte	**Method**	**Units**	**OU2 ROD RG / ADEC CUL [1]**	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier
bis(2-Chloroisopropyl)ether	SW8270D	µg/L	NE	-	-	-	-
bis-(2-Ethylhexyl)phthalate	SW8270D	µg/L	56	-	-	-	-
Carbazole	SW8270D	µg/L	NE	-	-	-	-
Chrysene	SW8270D	µg/L	2.0	-	-	-	-
Dibenzo(a,h)anthracene	SW8270D	µg/L	0.25	-	-	-	-
Dibenzofuran	SW8270D	µg/L	7.9	-	-	-	-
Diethyl phthalate	SW8270D	µg/L	15,000	-	-	-	-
Dimethyl phthalate	SW8270D	µg/L	16,000	-	-	-	-
Di-n-butyl phthalate	SW8270D	µg/L	900	-	-	-	-
Di-n-octyl phthalate	SW8270D	µg/L	22	-	-	-	-
Fluoranthene	SW8270D	µg/L	260	-	-	-	-
Fluorene	SW8270D	µg/L	290	-	-	-	-
Hexachlorobenzene	SW8270D	µg/L	0.098	-	-	-	-
Hexachlorobutadiene	SW8270D	µg/L	1.4	-	-	-	-
Hexachlorocyclopentadiene	SW8270D	µg/L	0.41	-	-	-	-
Hexachloroethane	SW8270D	µg/L	3.3	-	-	-	-
Indeno(1,2,3-cd)pyrene	SW8270D	µg/L	0.19	-	-	-	-
Isophorone	SW8270D	µg/L	780	-	-	-	-
Naphthalene	SW8270D	µg/L	1.7	-	-	-	-
Nitrobenzene	SW8270D	µg/L	1.4	-	-	-	-
n-Nitrosodimethylamine	SW8270D	µg/L	0.0011	-	-	-	-
n-Nitrosodi-n-propylamine	SW8270D	µg/L	0.11	-	-	-	-
n-Nitrosodiphenylamine	SW8270D	µg/L	120	-	-	-	-
Pentachlorophenol	SW8270D	µg/L	0.41	-	-	-	-
Phenanthrene	SW8270D	µg/L	170	-	-	-	-
Phenol	SW8270D	µg/L	5,800	-	-	-	-
Pyrene	SW8270D	µg/L	120	-	-	-	-

Results in blue and bold font exceed ROD RGs.

Results in green and bold font exceed ADEC CULs.

No ROD analytes exceed both the ROD RGs and ADEC CULs

Grey shaded results are non-detect with LODs above OU2 ROD RGs and/or ADEC CULs

[1] **OU2 ROD analytes and RGs are identified in blue text.** The remaining values are ADEC Groundwater Human Health values listed in ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C (revised as of October 27, 2018).

Data Qualifiers:

B - result may be due to cross-contamination
J - result qualified as estimate because it is less than the LOQ or due to a QC
J+ - result qualified as estimate with a high-bias due to a QC failure
J- - result qualified as estimate with a low-bias due to a QC failure
ND - not detected [LOD presented in brackets]

Acronyms:

CUL - cleanup level
LOD - limit of detection
LOQ - limit of quantitation
MS/MSD - matrix spike/matrix spike duplicate
µg/L - micrograms per liter
mg/L - milligrams per liter
NE - not established
QC - quality control
RG - remedial goal
ROD - Record of Decision
WG - groundwater
WQ - water QC sample

APPENDIX B

CHEMICAL DATA QUALITY REVIEW, ADEC CHECKLISTS, AND SUPPORTING INFORMATION

FINAL

CHEMICAL DATA QUALITY REVIEW

Operable Unit 2

Fort Wainwright, Alaska

NPDL # 19-074

Prepared: September 25, 2019

Prepared for and Under Contract to

Army Corps of Engineers - Alaska District

Prepared by

Fairbanks Environmental Services, Inc.

I certify that all data quality review criteria described in Section 1.1 were assessed, and that qualifications were made according to the criteria outlined in the Final Postwide Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP).

_____

Vanessa Ritchie
Project Chemist

Page intentionally left blank

LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AK	Alaska
B	analytical result is qualified as a potential high estimate due to contamination present in a blank sample
°C	degrees Celsius
CCV	continuing calibration verification
CDQR	Chemical Data Quality Review
COC	chain-of-custody
DL	detection limit
DoD	United States Department of Defense
DQO	data quality objective
DRO	diesel range organics
DRMO	Defense Reutilization Marketing Office
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FES	Fairbanks Environmental Services, Inc
GRO	gasoline range organics
ICV	internal calibration verification
J	analytical result is qualified as an estimated value because the concentration is less than the LOQ
J+	analytical result is qualified as an estimated value with a high-bias due to a QC deviation
J-	analytical result is qualified as an estimated value with a low-bias due to a QC deviation
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
µg/L	micrograms per liter
MS	matrix spike sample
MSD	matrix spike duplicate sample
NA	not applicable
ND	non-detect result
NPDL	North Pacific Division Laboratory
OU2	Operable Unit 2
QC	quality control
QSM	Quality Systems Manual for Environmental Laboratories
R	analytical result is rejected and is not suitable for project use
ROD	Record of Decision
RPD	relative percent difference
SDG	sample data group

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SGS	SGS North America, Inc.
SVOC	semi-volatile organic compound
UFP-QAPP	Postwide Uniform Federal Policy Quality Assurance Project Plans
USACE	United States Army Corps of Engineers
VOC	volatile organic compound
WSW	Water Supply Well

1.0 INTRODUCTION

This Chemical Data Quality Review (CDQR) summarizes the technical review of analytical results generated in support of groundwater sample collection at the Operable Unit 2 (OU2) Defense Reutilization Marketing Office (DRMO) Yard during 2019. The groundwater events are summarized in Section 1.3. Groundwater sample summary and analytical results tables are presented in Appendix A.

FES reviewed project and quality control (QC) analytical data to assess whether the data met the designated quality objectives and were acceptable for project use. The project data were reviewed for deviations to the requirements presented in the Final 2019 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites Work Plan (FES, 2019); Final Postwide Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP; FES, 2016); Alaska Department of Environmental Conservation (ADEC) Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data Technical Memo (ADEC, 2019a); and United States Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (QSM), Version 5.1 (DoD, 2017). The review included evaluation of the following: sample collection and handling, holding times, blanks (to assess contamination), project sample and laboratory QC sample duplicates (to assess precision), laboratory control samples (LCSs) and sample surrogate recoveries (to assess accuracy), and matrix spike sample (MS) recoveries (to assess matrix effects). Calibration curves and continuing calibration verification (CCV) recoveries were not reviewed unless a QC discrepancy was noted by the laboratory in a case narrative. QC deviations that do not impact data quality (e.g., high LCS recovery associated with non-detect results), are not discussed. More elaborate data quality descriptions are reported in the ADEC Laboratory Data Review Checklists, which are included at the end of Appendix B.

Groundwater results and limits of detection (LODs) for non-detect results were compared to OU2 Record of Decision (ROD) remedial goals, or cleanup levels presented in Title 18 of the Alaska Administrative Code (AAC) Chapter 75.345, Table C (ADEC, 2018), as appropriate.

Groundwater data quality is discussed in Section 2. Applicable data quality indicators are discussed for each method under separate subheadings. Data which did not meet acceptance criteria have been described and the associated samples and data quality implications or qualifications are summarized. All cited documents within the CDQR are listed in Section 3.

1.1 Analytical Methods and Data Quality Objectives

The analytical methods and associated DQOs used for this review were established in the Postwide UFP-QAPP (FES, 2016). The data quality objectives (DQOs) represent the minimum acceptable QC limits and goals for analytical measurements and are used as comparison criteria during data quality review to determine both the quality and usability of the analytical data. Table B-1 on the following page summarizes the analytical methods employed, and the associated DQO goals for groundwater samples.

Table B-1. Groundwater Analytical Methods and Data Quality Objectives

Parameter[1]	Preparation Method	Analytical Method	Limit of Detection (µg/L)	Accuracy (%)	Precision (%RPD)	Completeness (%)
Gasoline Range Organics (GRO)	SW5030B	AK101	50	60-120	20	90
Diesel Range Organics (DRO)	SW3520C	AK102	300	75-125	20	90
Benzene	SW5030B	SW8260C	0.200	79-120	20	90
Tetrachloroethene			0.500	74-129	20	90
Trichloroethene			0.500	79-123	20	90
cis-1,2-Dichloroethene			0.500	78-123	20	90
1,1-Dichloroethene			0.500	71-131	20	90
Vinyl Chloride			0.075	58-137	20	90
Semivolatile Organic Compounds (SVOCs)	SW3520C	SW8270D	Analyte Specific[1]	Analyte Specific[1]	20	90
Dissolved Iron	SW3010A	SW6020A	250	87-118	20	90
Sulfate	300.0	300.0	100	90-110	15	90

[1] The full suites of VOCs and SVOCs were analyzed, but only OU2 ROD analytes, GRO, DRO, and natural attenuation parameters are shown. Limits for all analytes are presented in the 2019 Work Plan (FES, 2019) and associated laboratory reports.
µg/L – micrograms per liter; RPD – relative percent difference

The six DQOs used for this review were accuracy, precision, representativeness, comparability, sensitivity, and completeness.

- *Accuracy* measures the correctness, or the closeness, between the true value and the quantity detected. It is measured by calculating the percent recovery of known concentrations of spiked compounds that were introduced into the appropriate sample matrix. Surrogate, LCS, and MS sample recoveries were used to measure accuracy for this project. LCS and surrogate recovery criteria are defined in the QSM.
- *Precision* measures the reproducibility of repetitive measurements. It is measured by calculating the relative percent difference (RPD) between duplicate samples. Laboratory duplicate samples, field duplicate samples, MS and matrix spike duplicate sample (MSD) pairs, and LCS and laboratory control sample duplicate (LCSD) pairs were used to measure precision for this project. LCS/LCSD precision criteria are defined in the QSM and field duplicate precision criteria are defined in the ADEC Laboratory Data Review Checklist (water: ≤30%).
- *Representativeness* describes the degree to which data accurately and precisely represents site characteristics. This is addressed in more detail in the following section(s).
- *Comparability* describes whether two data sets can be considered equivalent with respect to the project goal. This is addressed in more detail in the following section(s).

- *Sensitivity* describes the lowest concentration that the analytical method can reliably quantitate, and is evaluated by verifying that the detected results and/or LODs meet the project-specific cleanup levels and/or screening levels.
- *Completeness* describes the amount of valid data obtained from the sampling event(s). It is calculated as the percentage of valid measurements compared to the total number of measurements. The completeness goal for this project was set at 90 percent.

In addition to these criteria for the six DQOs described above, sample collection and handling procedures and blank samples were reviewed to ensure overall data quality. Sample collection forms were reviewed to verify that representative samples were collected and samples were without headspace (if applicable). Sample handling was reviewed to assess parameters such as chain-of-custody (COC) documentation, the use of appropriate sample containers and preservatives, shipment cooler temperature, and method-specified sample holding times. Blank samples were analyzed to detect potential field or laboratory cross-contamination. Each of these parameters contributes to the general representativeness and comparability of the project data. The combination of evaluations of the above-mentioned parameters will lead to a determination of the overall project data completeness.

1.2 Data Qualifiers

Table B-2 below outlines general flagging criteria used for this project, listed in increasing severity, to indicate QC deficiencies. Data are qualified pursuant to findings determined in the review of project data.

Table B-2. Data Qualifier Definitions

Qualifier	Definition
ND	The analyte was analyzed for, but not detected.
J	The analyte is considered an estimated value. The analyte may be estimated due to its quantitation level (≥ DL and <LOQ), or it may signify that there is a QC deviation and the bias is unknown.
J+	The analyte is considered an estimated value with a high-bias due to a QC deviation.
J-	The analyte is considered an estimated value with a low-bias due to a QC deviation.
B	The analyte is detected in an associated blank. Result is less than 5x or 10x (for the common lab contaminants) the concentration. Therefore, the result may be high-biased.
R	Analyte result is rejected because of deficiencies in meeting QC criteria and may not be used for decision making.

1.3 Summary of Groundwater Samples

Groundwater samples were collected from monitoring wells at the OU2 DRMO Yard. A total of 12 groundwater samples (including 1 field duplicate) were collected. In addition, MS/MSD samples were submitted for every analysis (minimum of one per 20 samples), one trip blank sample

accompanied the cooler containing samples for volatile analysis, and one equipment blank sample was collected to assess the potential for cross-contamination of the submersible pump. Samples were analyzed by one or more of the methods presented in Table B-1.

All project and quality control samples were analyzed by SGS North America, Inc. (SGS) of Anchorage, Alaska. The laboratory is validated by the State of Alaska through the Contaminated Sites Program for all methods employed, with the exception of sulfate by United States Environmental Protection Agency (EPA) Method 300.0 (method 300.0 is not listed as a Contaminated Sites analysis). In addition, the laboratory is Environmental Laboratory Accreditation Program (ELAP) certified for all methods.

Samples were shipped in one sample data group (SDG) and assigned the SGS report number 1194497. A sample summary table (Table A-1) and analytical results table (Table A-2) are included in Appendix A. Groundwater sample data quality is discussed in Section 2.

2.0 GROUNDWATER DATA QUALITY REVIEW

This section presents the findings of the data quality review and the resulting data qualifications for groundwater samples. In general, findings that did not result in data qualification are not discussed in this review. See the associated ADEC Laboratory Data Review Checklists for more elaborate data quality review descriptions.

2.1 Sample Collection

All monitoring wells were purged and sampled with submersible pumps, per the UFP-QAPP, with the exception of the well bulleted below. Groundwater sampling activities were recorded on the groundwater sample forms provided in Appendix C. Groundwater sample forms were reviewed to ensure that well drawdown and groundwater parameters met the stabilization criteria identified in the ADEC Field Sampling Guidance (ADEC, 2019b) and the UFP-QAPP (FES, 2016), that low-flow sampling criteria was employed (Puls and Barcelona, 1996), and that all groundwater levels were within the screened intervals at the time of sampling.

Groundwater sample forms indicate all samples met stabilization criteria. Additional noteworthy observations are listed below.

- The Water Supply Well (WSW) was sampled at a raw water tap located upstream of the building water treatment system after purging the well for approximately 30 minutes, per standard protocol. The well is purged for 30 minutes to obtain a representative sample of the aquifer. Given the design of the water system, the well is sampled with a dedicated high-flow, non-variable speed submersible pump and the water level cannot be measured.
- No free product was measured and sheen was not observed on purge water from any well. Fuel odor was noted on purge water from wells AP-7560 and AP-10446MW; and strong fuel odor and black staining on dedicated pump tubing was noted in well AP-8916.

An equipment blank sample was collected to evaluate the potential for submersible pump cross-contamination. Equipment blank results are further discussed in Section 2.3.

2.2 Sample Handling

The evaluation of proper sample handling procedures include verification of the following: correct COC documentation, appropriate sample containers and preservatives, sample analyses performed within method-specified holding times, and cooler temperatures maintained within the ADEC-recommended temperature range (0 to 6 degrees Celsius [°C]). No discrepancies were noted upon receipt at the laboratory.

2.3 Blanks

Method blanks, trip blanks, and equipment blanks were utilized to detect potential cross-contamination of project samples. Method blanks detect laboratory cross-contamination, trip blanks assess shipment and storage cross-contamination, and equipment blanks evaluate the potential for cross-contamination associated with wells that were sampled with non-dedicated submersible pumps. The following blank contaminations were noted.

Method Blanks

Method blank samples were analyzed in every batch. No method blank contamination was noted.

Trip Blanks

Trip blank samples were shipped in the cooler containing samples for volatile analyses. No trip blank contamination was noted.

Equipment Blanks

One equipment blank sample was collected to evaluate the potential for submersible pump cross-contamination. The results of the equipment blank sample were compared against results of all project samples collected at the DRMO Yard, with the exception of the WSW. The WSW was sampled with a dedicated high-flow, non-variable speed submersible pump (as discussed in Section 2.1). Toluene was detected at a concentration below the LOQ; however, toluene was not detected in the associated samples and no data were qualified.

2.4 Laboratory Control Samples

The LCS/LCSD samples were prepared by adding spike compounds to blank samples in order to assess laboratory extraction and instrumentation performance. The performance of a LCS sample is a requirement for every QC batch to evaluate recovery accuracy. In addition, a LCSD is required for all Alaska fuel methods to evaluate batch precision. For QC batches that do not contain a LCSD, precision is evaluated by performing a sample duplicate, which is further discussed in Section 2.5.

All LCS and/or LCSD samples were performed, as required. The accuracy of analyte recoveries for LCS samples, and precision of the LCS/LCSD sample pair (when applicable), was evaluated. No LCS and/or LCSD accuracy or precision discrepancies requiring qualifications were noted.

2.5 Matrix Spike Samples and Sample Duplicates

MS samples were prepared by adding spike compounds to project samples in order to assess potential matrix interference. Only MS samples prepared from project samples were assessed for impact to project data quality. The performance of a MS sample analysis is a requirement in every QC batch, at a minimum frequency of 1 for every 20 samples, to evaluate recovery accuracy; and precision of each QC batch is evaluated by performing either a MSD sample analysis or a sample

duplicate analysis and calculating the RPD. Two exceptions to this requirement at the OU2 DRMO site are SVOC and GRO analyses performed on samples collected only at the Water Supply Well (WSW). The WSW is also sampled by a different entity under the Drink Water Program, during which all QC criteria (including MS/MSD samples) are met. The sample results from this sampling event are used as supplemental data and the collection of QC samples is not required, as detailed in the approved Work Plan (FES, 2019). All QC batches have met these criteria, except for the aforementioned SVOC and GRO batches and the VOC batch listed below.

- VOC: batch VXX34654

Although potential sample matrix interference cannot be examined in the above listed QC batches, acceptable LCS recoveries indicate that the analytical batches were operating within the control criteria. Precision in these batches also was evaluated from the analysis of an LCSD sample.

The accuracy of the analyte recoveries, and the precision of the MS/MSD or laboratory duplicate pairs, was evaluated (when analyzed). The MS/MSD recovery and/or RPD exceedances that resulted in data qualification are summarized below.

- The sulfate MS and MSD prepared from sample 19FWOU208WG did not meet the lower control limit (84%/83% vs. 90%). Sulfate was detected in the parent sample and associated field duplicate sample. The sulfate result in samples 19FWOU208WG and 19FWOU209WG was qualified as estimated with a low bias (J-) due to low MS/MSD recovery. Impact to the project is negligible as the recovery failure was not significant (up to 7% low) and the affected analyte is not an environmental contaminant.

2.6 Surrogate Recovery

Surrogate compounds were added to project samples by the laboratory prior to analysis, in accordance with method requirements. Surrogate recoveries were then calculated as percentages and reported by the laboratory as a measure of analytical extraction efficiency. All surrogate recoveries were recovered within acceptance limits and no data qualification was required.

2.7 Field Duplicates

One field duplicate sample was collected and submitted to the laboratory as a blind sample during groundwater sampling operations at the OU2 site. Field duplicate samples were collected at a minimum frequency of 10 percent for each analytical method, with the exception for GRO and SVOC. GRO and SVOC samples were only collected from the Water Supply Well (WSW) at the DRMO Yard. Field duplicates are not collected for these analyses, per the UFP-QAPP, as the data from the WSW are used for informational purposes only (the WSW is also sampled by a different entity under the Drinking Water Program, during which all QC criteria are met).

Field duplicate results for all detected analytes, contaminants of concern (detected and not detected), and natural attenuation parameters are shown in Table B-3. In the case where a result was non-detect, the LOD was used for RPD calculation purposes. The non-detect results are

identified with the LOD value followed by "U". If both results of the field duplicate pair were less than the LOQ (i.e., J-flagged or non-detect), the RPD was calculated but the comparison criterion is not applicable, per the UFP-QAPP.

All (applicable) results for field duplicate sample pair 19FWOU208WG/19FWOU209WG were comparable (RPD ≤ 30%) with the exception of DRO (35%); identified in grey shading in Table B-3. Consequently, the DRO results of the field duplicate pair were qualified as estimates (J) due to imprecision. Impact to the project is negligible as the RPD exceedance was marginal (5% high) and both affected results were more than two orders of magnitude less than the ADEC cleanup level.

Table B-3. Groundwater Field Duplicate Sample Results Evaluation

Analyte	Method	Units	Primary 19FWOU208WG (AP-7560)	Field Duplicate 19FWOU2096WG (AP-7070)	RPD, %	Comparable Criteria Met?
1,1-Dichloroethene	8260C	µg/L	0.500U	0.500U	0	Not applicable
Benzene	8260C	µg/L	0.200U	0.200U	0	Not applicable
cis-1,2-Dichloroethene	8260C	µg/L	1.14	1.17	3	Not applicable
Tetrachloroethene	8260C	µg/L	1.65	1.72	4	Yes
Trichloroethene	8260C	µg/L	2.70	2.76	2	Yes
Vinyl chloride	8260C	µg/L	0.0750U	0.0750U	0	Not applicable
Naphthalene	8260C	µg/L	0.530J	0.570J	7	Not applicable
trans-1,2-Dichloroethene	8260C	µg/L	1.56	1.64	5	Yes
Dissolved Iron	6020A	µg/L	8570	8880	4	Yes
Sulfate	300.0	µg/L	21200	20500	3	Yes
DRO	AK102	mg/L	2.73	1.91	35	No

2.8 Additional Quality Control Discrepancies

Additional QC samples and procedures not discussed in the preceding sections of this CDQR are evaluated if deviations are noted by the laboratory in the case narratives. Additional QC samples/procedures may include, but are not limited to, instrument tuning, initial calibration verification (ICV) samples, continuing calibration verification (CCV) samples, and internal standards. A QC discrepancy noted by the laboratory is discussed below.

- The CCV in VOC analysis batch VXX34654 reported recovery of 2-hexanone (131%) above the upper control limit (120%). The analyte result in associated sample 19FWOU205WG was non-detect. Since the result was biased high, no data were qualified.

2.9 Analytical Sensitivity

Several project data analytes were reported above the DL but below the LOQ and were thus qualified as estimates due to the unknown accuracy of the analytical method at those

concentrations. These data qualifications are not reported again in this CDQR, but they are noted with a "J" in the associated results table in Appendix A.
Analytical sensitivity was evaluated to verify that LODs met the applicable ROD remedial goal or ADEC cleanup level for non-detect results, as appropriate. 1,2,3-Trichloropropane in all samples analyzed by 8260C, and several SVOC analytes in the WSW sample analyzed by 8270C, did not meet applicable ADEC groundwater cleanup levels listed in 18 AAC 75.345. These analytes may not be detected, if present, at the respective cleanup levels. Impact to the project is not significant as the analytes are not OU2 contaminants of concern. Moreover, the data obtained from the WSW sample associated with this sampling program are used for informational purposes only. The WSW is also sampled by a different entity under the Drinking Water Program.

All analytes that are non-detect with LODs elevated above cleanup levels are identified with gray shading in the results table (Table A-2) presented in Appendix A of the Annual Monitoring Report.

2.10 Summary of Qualified Results

Overall, the review process deemed the groundwater project data acceptable for use. Several results were qualified as estimates; however, data quality impact is minor and no data were rejected pursuant to FES's data quality review.

Table B-4 below summarizes the qualified 2019 groundwater results associated with the sampling events at the OU2 DRMO Yard, including the associated sample numbers, analytes, and the reason for qualification.

Table B-4. Summary of Groundwater Data Qualifications

SDG	Sample Numbers	Analytes	Qualification	Explanation
1194497	19FWOU208WG 19FWOU209WG	DRO	J	Field duplicate imprecision
		Sulfate	J-	Low biased MS and/or MSD recovery

2.11 Completeness

Completeness scores were calculated for each analytical method employed for the project. Scores were obtained by assigning points to 14 different data quality categories during the review process. A maximum of 10 points was awarded for each category; points were based on the number of samples successfully meeting data quality objectives for that category. Points were subtracted when failure to meet DQOs resulted in data qualification or data rejection. The scores were then summed to determine the total points for a method, and completeness scores were determined as follows: (total points received)/(total points possible) x 100.

A breakdown of the points received for each category and method is shown in Table B-5 below. All OU2 site data quality categories met the completeness criteria of 90 percent established in the QAPP for the sampling events. No data were rejected pursuant to the data quality review, and all data may be used, as qualified, for the purposes of the 2019 OU2 Annual Monitoring Report.

Table B-5. Completeness Scores for Groundwater Samples

Data Quality Category	Points GRO	Points DRO	Points VOC	Points SVOC	Points Fe	Points Sulfate
Sample Collection	10	10	10	10	10	10
COC Documentation	10	10	10	10	10	10
Sample Containers/ Preservation	10	10	10	10	10	10
Cooler Temperature	10	10	10	10	10	10
Holding Times	10	10	10	10	10	10
Method Blanks	10	10	10	10	10	10
Trip Blanks	10	NA	10	NA	NA	NA
Equipment Blank	NA	10	10	NA	10	10
LCS/LCSD Recovery & RPD	10	10	10	10	10	10
MS/MSD Recovery & RPD	NR	10	10	NR	10	5
Surrogate Recovery	10	10	10	10	NA	NA
Field Duplicate	NR	5	10	NR	10	10
CCV, Internal Stds, other	10	10	10	10	10	10
Sensitivity (DL/LOD)	10	10	10	10	10	10
Total Points Received	110	125	140	100	120	115
Total Points Possible	110	130	140	100	120	120
Percent Completeness	100	96	100	100	100	96

NA – not applicable; NR – not required per UFP-QAPP

3.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019a. *Technical Memorandum – Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data.* October.

ADEC, 2019b. *Field Sampling Guidance*. October.

ADEC, 2018. *18 AAC 75, Oil and Other Hazardous Substances Pollution Control*. As amended through October 27, 2018.

Department of Defense (DoD), 2017. *Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1.*

Fairbanks Environmental Services (FES), 2019. *Final 2019 CERCLA Sites Work Plan – Operable Units 1 through 6.* July.

FES, 2016. *Final Postwide Uniform Federal Policy for Quality Assurance Project Plans, Fort Wainwright, Alaska.* August.

Puls, R.W. and M. J. Barcelona, 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures.* EPA/540/S-95/504. April.

Laboratory Data Review Checklist

Completed By:

Checklist: Laura Soeten; Validator: Christina Rink-Ashdown (reviewed and revised by Vanessa Ritchie (FES Senior Chemist)

Title:

Executive Administrator, Senior Chemist

Date:

09/18/2019

CS Report Name:

Fort Wainwright Operable Unit 2

Report Date:

09/03/2019

Consultant Firm:

Fairbanks Environmental Services

Laboratory Name:

SGS North America

Laboratory Report Number:

1194497

ADEC File Number:

108.38.069.01

Hazard Identification Number:

1122

1194497

1. Laboratory

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

   (•) Yes ( ) No Comments:

Yes; however, EPA Method 300.0 is not listed as a CS analysis.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   ( ) Yes (•) No Comments:

Not applicable, samples were not transferred to another laboratory.

2. Chain of Custody (CoC)

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

   (•) Yes ( ) No Comments:

   b. Correct Analyses requested?

   (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   (•) Yes ( ) No Comments:

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

   (•) Yes ( ) No Comments:

   c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

   (•) Yes ( ) No Comments:

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

(•) Yes ( ) No Comments:

No discrepancies were noted.

e. Data quality or usability affected?

Comments:

No data quality or usability was affected by the sample receipt findings or documentation.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

The case narrative described CCV and MS/MSD recovery discrepancies discussed in sections 6c and 7a.

c. Were all corrective actions documented?

(•) Yes ( ) No Comments:

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

Comments:

Case narrative does not discuss effect on data quality, it only discusses discrepancies. Any notable data quality issues mentioned in the case narrative are discussed above in 4b or elsewhere within this ADEC checklist.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

(•) Yes ( ) No Comments:

b. All applicable holding times met?

(•) Yes ( ) No Comments:

c. All soils reported on a dry weight basis?

○ Yes ◉ No Comments:

No soil samples were included in this work order.

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

◉ Yes ○ No Comments:

Analytical sensitivity was evaluated to verify that LODs met the applicable ROD remedial goal or ADEC cleanup level for non-detect results, as appropriate. 1,2,3-Trichloropropane in all samples analyzed by 8260C did not meet the applicable ADEC groundwater cleanup level listed in 18 AAC 75.345. This analyte may not be detected, if present, at the respective cleanup level. Impact to the project is negligible as the analyte is not a site contaminant of concern.

In addition, twenty-four SVOC compounds in sample 19FWOU206WG collected from the Water Supply Well (WSW) did not meet the ADEC cleanup level. Impact to the project is negligible as the analytes are not site contaminants of concern. Moreover, the data obtained from the WSW associated with this sampling program are used for informational purposes only. The WSW is also sampled by a different entity under the Drinking Water Program.

All analytes that are non-detect with LODs elevated above cleanup levels are identified with gray shading in the results table (Table A-2) presented in the Annual Monitoring Report.

e. Data quality or usability affected?

○ Yes ◉ No Comments:

See discussion in 5d above.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No Comments:

ii. All method blank results less than limit of quantitation (LOQ)?

◉ Yes ○ No Comments:

No detected results were reported.

iii. If above LOQ, what samples are affected?

Comments:

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

(•) Yes ( ) No Comments:

v. Data quality or usability affected?

Comments:

No data quality or usability was affected by the method blanks.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

( ) Yes (•) No Comments:

LCS/LCSD and MS/MSD samples were analyzed in every batch as required, with the exception that VOC batch VXX34654, SVOC batch XXX41985, and GRO batch VXX34631 did not contain a project specific MS/MSD sample. Although matrix interference cannot be evaluated in these batches, batch accuracy and precision can be evaluated through the LCS/LCSD samples. The VOC batch only contained sample 19FWOU205WG. The SVOC and GRO batches contained results for WSW (19FWOU206WG) and the data obtained from this sampling program is for information purposes only. The WSW is also sampled by a different entity under the Drinking Water Program, during which all QC criteria are met.

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

( ) Yes (•) No Comments:

LCS was analyzed in every batch as required. Although a sample duplicate was not performed for the dissolved iron and sulfate analyses, a MS/MSD was performed to evaluate the precision.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

( ) Yes (•) No Comments:

The sulfate MS/MSD prepared from sample 19FWOU208WG did not meet the lower control limit (84%/83% vs. 90%). Sulfate was detected in the parent sample and associated field duplicate sample. The sulfate result in samples 19FWOU208WG and 19FWOU209WG were qualified as estimated with a low bias (J-) due to low MS/MSD recovery. Impact to the project is negligible as the recovery failure was not significant (up to 7% low) and the affected analyte is not an environmental contaminant.

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

(•) Yes ( ) No Comments:

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

Comments:

See 6biii above.

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

(•) Yes ( ) No Comments:

See 6biii above.

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

Comments:

See 6biii above.

c. Surrogates – Organics Only

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

(•) Yes ( ) No Comments:

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

No surrogate failures were reported.

iv. Data quality or usability affected?

Comments:

Neither data quality nor usability was affected by surrogates.

d. Trip blank – Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples?
(If not, enter explanation below.)

(•) Yes ( ) No Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

(•) Yes ( ) No Comments:

Trip blank sample 19FWOU2TB01WQ for VOC and GRO analyses was included in cooler 80101.

iii. All results less than LOQ?

(•) Yes ( ) No Comments:

No VOC or GRO target analytes were detected in the trip blank sample.

iv. If above LOQ, what samples are affected?

Comments:

v. Data quality or usability affected?

Comments:

Neither data quality nor usability was affected by the trip blank sample.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

(•) Yes ( ) No Comments:

One groundwater field duplicate was collected for the eleven primary samples associated with this work order.

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

Sample 19FWOU209WG was a field duplicate of 19FWOU208WG.

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

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ◉ No Comments:

All detected analytes and contaminants of concern (detected and not detected) are shown in the tables below. In the case where a result was non-detect, the LOD was used for RPD calculation purposes. The non-detect results are identified with the LOD value followed by "U". In the event that both results are less than the LOQ (i.e., J-flagged or non-detect), the RPD was calculated but the comparison criterion is not applicable, per the Postwide UFP-QAPP.

All (applicable) results for field duplicate sample pair 19FWOU208WG/19FWOU209WG were comparable (RPD ≤ 30%) with the exception of DRO (35%) (identified in grey shading in the table below). Consequently, the DRO results of the field duplicate pair were qualified as estimates (J) due to imprecision. Impact to the project is negligible as the RPD exceedance was marginal (5% high) and both affected results were more than two orders of magnitude less than the ADEC cleanup level.

Analyte	Method	Units	Primary 19FWOU208WG (AP-7560)	Field Duplicate 19FWOU2096WG (AP-7070)	RPD, %	Comparable Criteria Met?
1,1-Dichloroethene	8260C	µg/L	0.500U	0.500U	0	Not applicable
Benzene	8260C	µg/L	0.200U	0.200U	0	Not applicable
cis-1,2-Dichloroethene	8260C	µg/L	1.14	1.17	3	Not applicable
Tetrachloroethene	8260C	µg/L	1.65	1.72	4	Yes
Trichloroethene	8260C	µg/L	2.70	2.76	2	Yes
Vinyl chloride	8260C	µg/L	0.0750U	0.0750U	0	Not applicable
Naphthalene	8260C	µg/L	0.530J	0.570J	7	Not applicable
trans-1,2-Dichloroethene	8260C	µg/L	1.56	1.64	5	Yes
Dissolved Iron	6020A	µg/L	8570	8880	4	Yes
Sulfate	300.0	µg/L	21200	20500	3	Yes
DRO	AK102	mg/L	2.73	1.91	35	No

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

Comments:

See 6eiii above.

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

◉ Yes ○ No ○ Not Applicable

Equipment blank sample 19FWOU2EB01WQ was included in this work order to assess the potential for cross-contamination of the submersible pump. All wells in this SDG except 19FWOU206WG from location WSW were sampled with a submersible pump, per the UFP-QAPP.

i. All results less than LOQ?

○ Yes ◉ No Comments:

No VOC target analytes were detected above the LOQ; however, toluene (0.750 µg/L) was detected at a concentration below the LOQ. Toluene was not detected in the associated samples and no data were qualified.

No dissolved iron, sulfate, or DRO target analytes were detected in the equipment blank sample.

ii. If above LOQ, what samples are affected?

Comments:

See 6fi above.

iii. Data quality or usability affected?

Comments:

Neither data quality nor usability was affected by the equipment blank sample.

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

a. Defined and appropriate?

◉ Yes ○ No Comments:

The calibration verification (CCV) in VOC analysis batch VXX34654 reported recovery of 2-hexanone (131%) above the upper control limit (120%). The analyte result in associated sample 19FWOU205WG was non-detect. Since the result was biased high, no data were qualified.

APPENDIX C

FIELD FORMS

Table C-1 - 2019 OU2 Groundwater Sample Field Measurements

Well ID	Sample ID	Sample Date	Sample Time	Pump Type	Field Measurements									
					Water Depth[1] (feet btoc)	Water Table Within Well Screen Interval (Y/N)	Drawdown[2] (feet)	Temp (°C)	Conductivity (mS/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Well Stabilized[3] (Y/N)
Operable Unit 2 - DRMO4 3-Party														
AP-10445MW	19FWOU210WG	8/7/2019	1200	Submersible	12.65	Y	0.01	9.29	0.881	0.59	6.68	43.8	5.16	Y
AP-10446MW	19FWOU212WG	8/7/2019	1305	Submersible	11.86	Y	0.00	5.90	0.439	0.60	7.20	-87.1	11.40	Y
AP-8916	19FWOU207WG	8/7/2019	1050	Submersible	11.12	Y	0.01	6.27	0.519	0.66	6.90	-98.1	2.36	Y
Operable Unit 2 - DRMO1 3-Party														
AP-8914R	19FWOU205WG	8/6/2019	1500	Submersible	10.80	Y	0.00	9.2	0.356	0.30	6.20	-14.9	4.10	Y
AP-7559	19FWOU211WG	8/7/2019	1300	Submersible	10.54	Y	0.00	9.82	0.405	0.49	6.59	178.0	3.43	Y
AP-7560	19FWOU208WG	8/7/2019	1125	Submersible	10.07	Y	0.00	7.92	0.400	0.46	6.19	108.6	2.77	Y
AP-10015R	19FWOU203WG	8/6/2019	1245	Submersible	12.83	Y	0.00	8.90	0.393	0.52	6.32	57.7	5.85	Y
AP-10016R	19FWOU204WG	8/6/2019	1355	Submersible	12.92	Y	0.00	10.50	0.372	0.38	6.35	100.0	4.93	Y
AP-10017R	19FWOU201WG	8/6/2019	1030	Submersible	12.52	Y	0.00	10.38	0.363	0.53	6.19	218.2	5.72	Y
AP-10018R	19FWOU202WG	8/6/2019	1140	Submersible	12.34	Y	0.00	9.23	0.384	0.35	6.48	26.5	4.31	Y
Operable Unit 2 - Water Supply Well														
WSW[4]	19FWOU206WG	8/7/2019	1015	Raw Water Tap	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

[1] Water depth shown was measured on the date shown prior to removing purge water

[2] Drawdown measured during the last three readings.

[3] Stabilization parameters described in ADEC Field Sampling Guidance (ADEC, 2017b). Impact to data quality is discussed in the CDQR.

[4] Parameters were not measured as the sample was collected from a spigot inside the pump building

Acronyms

bgs - below ground surface
btoc - below top of casing
°C - degree Celsius
CDQR - Chemical Data Qualification Report
DO - dissolved oxygen
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
mV - millivolts
NA - not applicable
NTU - nephelometric turbidity units
ORP - oxidation reduction potential
WSW - Water Supply Well

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17
Site Location: (DRMO1) / DRMO4 / WSW
Date: 8/6/19
Probe/Well #: AP-100 7R
Time: 1030
Sample ID: 19FWOU2 01 WG
Sampler: AS
Weather: Mostly Cloudy
Outside Temperature: 60°F
QA/QC Sample ID/Time/LOCID: — small clip
MS/MSD Performed? Yes/ (No)

Purge Method: Peristaltic Pump / (Submersible) / Bladder
Sample Method: Peristaltic Pump / (Submersible) / Hydrasleeve / Bladder / Other
Equipment Used for Sampling: YSI # 6 Turbidity Meter #: 14
Water Level: Veek
Free Product Observed in Probe/Well? Yes/(No) If Yes, Depth to Product: —
Dedicated teflon-lined tubing

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.33
Depth to Water from TOC (feet): - 12.52
Column of Water in Probe/Well (feet): = 7.81
Circle: Gallons per foot of 1.25" (X 0.064) or (2" (X 0.163)) or 4" (X 0.65)
Volume of Water in 1 Probe/Well Casing (gal): 1.27

Sampling Depth

Well Screened (Across) / Below water table
Depth tubing / pump intake set* approx. 14.5 feet below top of casing
*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	10.56	0.368	0.75	6.20	229.9	17.36	12.56
2.0	20	10.50	0.367	0.67	6.24	220.5	15.13	12.56
2.5	25	10.46	0.365	0.62	6.26	219.4	10.99	12.56
3.0	30	10.40	0.363	0.56	6.17	219.0	8.26	12.56
3.5	35	10.38	0.363	0.53	6.19	218.2	5.72	12.56

Did groundwater parameters stabilize? (Yes) / No If no, why not? —
Did drawdown stabilize? (Yes) / No If no, why not? —
Was flowrate between 0.03 and 0.15 GPM? (Yes)/No If no, why not? —
Water Color: (Clear) Yellow Orange Brown/Black (Sand/Silt) Other: —
Well Condition: Lock (Y) / N Labeled with LOC ID: (Y) / N Comments: —
Sheen: Yes / (No) Odor: Yes / (No) Notes/Comments: —

Laboratory Analyses (Circle): (VOC) SVOC, GRO, DRO, (Dissovled Iron, Sulfate)
pH checked of samples: Y / (N) Approximate volume added (mL): HCl = — HNO3 = —

Purge Water

Gallons generated: 4.0 Containerized and disposed as IDW? (Yes) / No If No, why not?
Disposal method*: POL Water / (CERCLA Waste) * Purge water stored in the DERA Building for characterization prior to disposal
Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17 | Site Location: (DRMO1) DRMO4 / WSW

Date: 8/6/19 | Probe/Well #: AP-100 18R

Time: 1140 | Sample ID: 19FWOU2 02 WG

Sampler: AS

Weather: Cloudy | Outside Temperature: 65°F

QA/QC Sample ID/Time/LOCID: 2 | Small clip | MS/MSD Performed? Yes/(No)

Purge Method: Peristaltic Pump / (Submersible) / Bladder | Sample Method: Peristaltic Pump / (Submersible) / Hydrasleeve / Bladder / Other

Equipment Used for Sampling: YSI # 6 | Turbidity Meter #: 14 | Water Level: Rock

Free Product Observed in Probe/Well? Yes/(No) | If Yes, Depth to Product: — | Dedicated teflon-tubing

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.37

Depth to Water from TOC (feet): - 12.34

Column of Water in Probe/Well (feet): = 8.03

Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal): 1.31

Sampling Depth

Well Screened (Across) / Below water table

Depth tubing / pump intake set* approx. 14.3 feet below top of casing

*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		✓ ±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize: ✓ ±3%	✓ ±10% (<1mg/L, ±0.2 mg/L)	✓ ±0.1 units	±10 mV	✓ ±10% (<10NTU, ±1NTU)	<0.33 feet after initial drawdown
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	9.16	0.386	0.58	6.24	149.8	7.58	12.40
2.0	20	9.20	0.386	0.54	6.42	126.2	6.69	12.45
2.5	25	9.21	0.385	0.38	6.40	101.9	4.82	12.45
3.0	30	9.18	0.384	0.33	6.44	73.5	3.91	12.45
3.5	35	9.20	0.384	0.34	6.47	45.1	4.25	12.45
4.0	40	9.23	0.384	0.35	6.48	26.5	4.31	12.45

Did groundwater parameters stabilize? (Yes) / No If no, why not?

Did drawdown stabilize? (Yes) / No If no, why not?

Was flowrate between 0.03 and 0.15 GPM? (Yes)/No If no, why not?

Water Color: (Clear) Yellow Orange Brown/Black (Sand/Silt) Other:

Well Condition: Locked (Y) / N Labeled with LOC ID (Y) / N Comments:

Sheen: Yes / (No) Odor: Yes / (No) Notes/Comments:

Laboratory Analyses (Circle): (VOC,) SVOC, GRO, DRO, (Dissovled Iron, Sulfate)

pH checked of samples: Y / (N) Approximate volume added (mL): HCl = — HNO3 = —

Purge Water

Gallons generated: 4.5 Containerized and disposed as IDW? (Yes) / No If No, why not?

Disposal method*: POL Water (CERCLA Waste) * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17 | Site Location: DRMO1 / DRMO4 / WSW

Date: 8/6/19 | Probe/Well #: AP-10015R

Time: 1245 | Sample ID: 19FWOU2 03 WG

Sampler: AS

Weather: P. Cloudy | Outside Temperature: 70 °F

QA/QC Sample ID/Time/LOCID: Small clip | MS/MSD Performed? Yes/ No

Purge Method: Peristaltic Pump / Submersible / Bladder | Sample Method: Peristaltic Pump / Submersible / Hydrasleeve / Bladder / Other

Equipment Used for Sampling: YSI # 6 | Turbidity Meter #: 14 | Water Level: Kick

Free Product Observed in Probe/Well? Yes/No | If Yes, Depth to Product: — | Dedicated, teflon-lined tubing

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.29

Depth to Water from TOC (feet): - 12.83

Column of Water in Probe/Well (feet): = 7.46

Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal): 1.22

Sampling Depth

Well Screened Across / Below water table

Depth tubing / pump intake set* approx. 14.83 feet below top of casing

*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	8.95	0.394	0.68	6.22	107.7	11.29	12.87
2.0	20	8.72	0.393	0.54	6.22	95.6	6.30	12.87
2.5	25	8.92	0.393	0.54	6.25	78.3	5.68	12.87
3.0	30	8.95	0.393	0.50	6.30	66.5	6.65	12.87
3.5	35	8.90	0.393	0.52	6.32	57.7	5.85	12.87

Did groundwater parameters stabilize? Yes / No If no, why not?

Did drawdown stabilize? Yes / No If no, why not?

Was flowrate between 0.03 and 0.15 GPM? Yes/No If no, why not?

Water Color: Clear / Yellow / Orange / Brown/Black (Sand/Silt) / Other:

Well Condition: Locked Y / N | Labeled with LOC ID Y / N | Comments:

Sheen: Yes / No | Odor: Yes / No | Notes/Comments:

Laboratory Analyses (Circle): VOC, SVOC, GRO, DRO, Dissolved Iron, Sulfate

pH checked of samples: Y / N | Approximate volume added (mL): HCl = — HNO3 = —

Purge Water

Gallons generated: 4.5 | Containerized and disposed as IDW? Yes / No | If No, why not?

Disposal method*: POL Water / CERCLA Waste | * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17
Site Location: (DRMO1) / DRMO4 / WSW
Date: 8/6/19
Probe/Well #: AP-1001bR
Time: 1355
Sample ID: 19FWOU2 04 WG
Sampler: AS
Weather: Cloudy
Outside Temperature: 70°F
QA/QC Sample ID/Time/LOCID: —
small clip
MS/MSD Performed? Yes/(No)

Purge Method: Peristaltic Pump / (Submersible) / Bladder
Sample Method: Peristaltic Pump / (Submersible) / Hydrasleeve / Bladder / Other
Equipment Used for Sampling: YSI # 6 Turbidity Meter #: 14 Water Level: Keck
Free Product Observed in Probe/Well? Yes/(No) If Yes, Depth to Product: —
Dedicated teflon lined tubing

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.32
Depth to Water from TOC (feet): - 12.92
Column of Water in Probe/Well (feet): = 7.40
Circle: Gallons per foot of 1.25" (X 0.064) or (2" (X 0.163)) or 4" (X 0.65)
Volume of Water in 1 Probe/Well Casing (gal): 1.21

Sampling Depth

Well Screened (Across) / Below water table
Depth tubing / pump intake set* approx. 14.9 feet below top of casing
*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize: ±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	<0.33 feet after initial drawdown
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	11.32	0.378	0.39	6.25	120.3	19.49	12.93
2.0	20	10.93	0.377	0.41	6.32	115.0	12.92	12.93
2.5	25	10.65	0.375	0.41	6.36	107.1	8.72	12.93
3.0	30	10.52	0.374	0.38	6.34	103.5	6.62	12.93
3.5	35	10.50	0.372	0.38	6.35	100.0	4.93	12.93

Did groundwater parameters stabilize? (Yes) / No If no, why not?
Did drawdown stabilize? (Yes) / No If no, why not?
Was flowrate between 0.03 and 0.15 GPM? (Yes)/No If no, why not?
Water Color: (Clear) Yellow Orange Brown/Black (Sand/Silt) Other: Initial purge cloudy, then clear
Well Condition: Lock (Y) / N Labeled with LOC ID: (Y) / N Comments:
Sheen: Yes / (No) Odor: Yes / (No) Notes/Comments:

Laboratory Analyses (Circle): (VOC) SVOC, GRO, DRO, (Dissolved Iron, Sulfate)
pH checked of samples: Y / (N) Approximate volume added (mL): HCl = — HNO3 = —

Purge Water

Gallons generated: 4.5 Containerized and disposed as IDW? (Yes) / No If No, why not?
Disposal method*: POL Water / (CERCLA Waste) * Purge water stored in the DERA Building for characterization prior to disposal
Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17
Site Location: (DRMO1) / DRMO4 / WSW
Date: 8/6/19
Probe/Well #: AP-8914R
Time: 1500
Sample ID: 19FWOU2 05 WG
Sampler: AS
Weather: P. Cloudy
Outside Temperature: 70°F
QA/QC Sample ID/Time/LOCID: —
small clip
MS/MSD Performed? Yes/(No)

Purge Method: Peristaltic Pump / (Submersible) / Bladder
Sample Method: Peristaltic Pump / (Submersible) / Hydrasleeve / Bladder / Other
Equipment Used for Sampling: YSI # 6 Turbidity Meter #: 14 Water Level: Kick
Free Product Observed in Probe/Well? Yes/(No) If Yes, Depth to Product: —
Dedicated teflon-lined tubing

Column of Water in Probe/Well

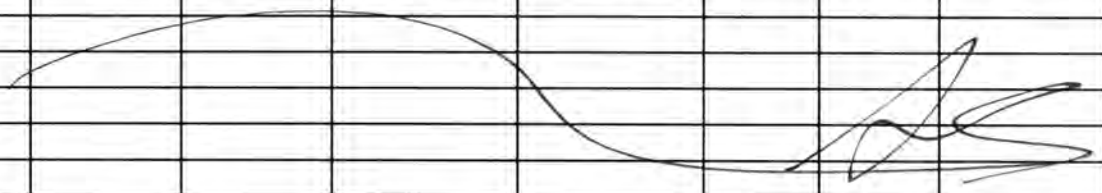
Total Depth in Probe/Well (feet btoc): 18.16
Depth to Water from TOC (feet): - 10.80
Column of Water in Probe/Well (feet): = 7.36
Circle: Gallons per foot of 1.25" (X 0.064) or (2" (X 0.163)) or 4" (X 0.65)
Volume of Water in 1 Probe/Well Casing (gal): 1.20

Sampling Depth

Well Screened (Across) / Below water table
Depth tubing / pump intake set* approx. 12.80 feet below top of casing
*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize: ±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	<0.33 feet after initial drawdown
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	9.25	0.350	0.37	6.03	76.2	20.89	10.90
2.0	20	9.23	0.351	0.34	5.90	58.5	11.86	10.90
2.5	25	9.20	0.352	0.39	6.07	37.4	7.38	10.90
3.0	30	9.15	0.354	0.30	6.12	13.6	5.79	10.90
3.5	35	9.18	0.354	0.30	6.15	-3.8	5.09	10.90
4.0	40	9.20	0.356	0.30	6.20	-14.9	4.10	10.90



Did groundwater parameters stabilize? (Yes) / No If no, why not?
Did drawdown stabilize? (Yes) / No If no, why not?
Was flowrate between 0.03 and 0.15 GPM? (Yes)/No If no, why not?
Water Color: Clear Yellow Orange Brown/Black (Sand/Silt) Other:
Well Condition: Lock (Y)/ N Labeled with LOC ID (Y)/ N Comments:
Sheen: Yes / (No) Odor: Yes / (No) Notes/Comments:

Laboratory Analyses (Circle): (VOC), SVOC, GRO, DRO, (Dissolved Iron, Sulfate)
pH checked of samples: Y / (N) Approximate volume added (mL): HCl = — HNO$_3$ = —

Purge Water

Gallons generated: 4.5 Containerized and disposed as IDW? (Yes) / No If No, why not?
Disposal method*: POL Water / (CERCLA Waste) * Purge water stored in the DERA Building for characterization prior to disposal
Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17 | Site Location: DRMO1 / DRMO4 / (WSW)

Date: 8/7/19 | Probe/Well #: WSW

Time: 1015 | Sample ID: 19FWOU2 06 WG

Sampler: AS

Weather: Cloudy | Outside Temperature: 60°F

QA/QC Sample ID/Time/LOCID: — | MS/MSD Performed? Yes / (No)

Purge Method: ~~Peristaltic Pump / Submersible / Bladder~~ Drain water through hose | Sample Method: Peristaltic Pump / Submersible / Hydrasleeve / Bladder / (Other)

Equipment Used for Sampling: YSI # N/A | Turbidity Meter #: N/A | Water Level: N/A

Free Product Observed in Probe/Well? Yes/(No) | If Yes, Depth to Product: —

Column of Water in Probe/Well — | Sampling Depth —

Total Depth in Probe/Well (feet bloc): | Well Screened **Across** / **Below** water table

Depth to Water from TOC (feet): - N/A | Depth tubing / pump intake set* approx. — feet below top of casing

Column of Water in Probe/Well (feet): = | *Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal):

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	*At least 3 of the 5 parameters below must stabilize*					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
		Purge WSW for 30 minutes into floor drain using garden hose. Then collect sample.						
		Sample collected directly from spigot - not run through hose						

Did groundwater parameters stabilize? Yes / No If no, why not? NA

Did drawdown stabilize? Yes / No If no, why not? NA

Was flowrate between 0.03 and 0.15 GPM? Yes/No If no, why not? NA

Water Color: (Clear) Yellow Orange Brown/Black (Sand/Silt) Other:

Well Condition: Lock: Y / N Labeled with LOC ID: Y / N Comments:

Sheen: Yes / (No) Odor: Yes / (No) Notes/Comments:

Laboratory Analyses (Circle): (VOC) SVOC (GRO) (DRO) Dissolved Iron, Sulfate

pH checked of samples: (Y) / N Approximate volume added (mL): HCl = — HNO$_3$ = —

Purge Water

Gallons generated: — Containerized and disposed as IDW? ~~Yes / No~~ If No, why not? No purge water collected

Disposal method*: POL ~~Water / CERCLA Waste~~ * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17
Site Location: DRMO1 / DRMO4 / WSW
Date: 8/7/15
Probe/Well #: AP-8916
Time: 1050
Sample ID: 19FWOU2 07 WG
Sampler: CB
Weather: CLOUDY
Outside Temperature: 57°F
QA/QC Sample ID/Time/LOCID:
MS/MSD Performed? Yes/ No

Purge Method: Peristaltic Pump / Submersible / Bladder
Sample Method: Peristaltic Pump / Submersible / Hydrasleeve / Bladder / Other
Equipment Used for Sampling: YSI # 9 Turbidity Meter #: 12 Water Level: Y-21
Free Product Observed in Probe/Well? Yes/No If Yes, Depth to Product: —

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 16.44
Depth to Water from TOC (feet): - 11.12
Column of Water in Probe/Well (feet): = 5.32
Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)
Volume of Water in 1 Probe/Well Casing (gal): 0.86

Sampling Depth

Well Screened Across / Below water table
Depth tubing / pump intake set* approx. 13 feet below top of casing
*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.3	10	6.70	0.525	1.05	6.78	-76.2	8.58	11.28
1.95	15	6.64	0.522	0.58	6.84	-88.7	3.65	11.29
2.6	20	6.32	0.520	0.70	6.88	-91.1	5.11	11.29
3.25	25	6.29	0.519	0.64	6.90	-96.2	2.16	11.30
3.9	30	6.27	0.519	0.46	6.90	-98.1	2.36	11.30
4.5	FINAL							
		CB						

Did groundwater parameters stabilize? Yes / No If no, why not?
Did drawdown stabilize? Yes / No If no, why not?
Was flowrate between 0.03 and 0.15 GPM? Yes/No If no, why not? 0.13 GPM
Water Color: Clear Yellow Orange Brown/Black (Sand/Silt) Other:
Well Condition: Lock: Y / N Labeled with LOC ID: Y / N Comments: FUEL
Sheen: Yes / No Odor: Yes / No STRONG
Notes/Comments: BOTTOM OF TUBING IS STAINED BLACK - POL
Laboratory Analyses (Circle): VOC, SVOC, GRO, DRO, Dissovled Iron, Sulfate
pH checked of samples: Y / N Approximate volume added (mL): HCl = — HNO3 = 0

Purge Water

Gallons generated: 4.5 Containerized and disposed as IDW? Yes / No If No, why not?
Disposal method*: POL Water / CERCLA Waste * Purge water stored in the DERA Building for characterization prior to disposal
Sampler's Initials: CB

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17 | **Site Location:** DRMO1 / DRMO4 / WSW

Date: 8/7/19 | **Probe/Well #:** AP-7560

Time: 1125 | **Sample ID:** 19FWOU2 08 WG

Sampler: AS

Weather: Cloudy | **Outside Temperature:** 65 °F

QA/QC Sample ID/Time/LOCID: 19FWOU2 09 WG / AP-7070 / 1135 small clip | **MS/MSD Performed?** Yes / No

Purge Method: Peristaltic Pump / Submersible / Bladder | **Sample Method:** Peristaltic Pump / Submersible / Hydrasleeve / Bladder / Other

Equipment Used for Sampling: YSI # 6 | **Turbidity Meter #:** 14 | **Water Level:** KECK

Free Product Observed in Probe/Well? Yes / No | **If Yes, Depth to Product:** — | Dedicated teflon-lined tubing

Column of Water in Probe/Well | **Sampling Depth**

Total Depth in Probe/Well (feet btoc): 20.02 | Well Screened **Across** / **Below** water table

Depth to Water from TOC (feet): - 10.07 | Depth tubing / pump intake set* approx. 12.1 feet below top of casing

Column of Water in Probe/Well (feet): = 9.95 | *Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal): 1.62

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	7.99	0.397	0.39	5.68	184.4	6.68	10.08
2.0	20	7.92	0.398	0.40	5.90	161.2	4.48	10.08
2.5	25	7.90	0.399	0.45	5.96	147.6	4.03	10.08
3.0	30	7.90	0.400	0.49	6.09	130.7	3.74	10.08
3.5	35	7.91	0.399	0.47	6.16	118.2	3.73	10.08
4.0	40	7.92	0.400	0.46	6.19	108.6	2.77	10.08

Did groundwater parameters stabilize? Yes / No **If no, why not?**

Did drawdown stabilize? Yes / No **If no, why not?**

Was flowrate between 0.03 and 0.15 GPM? Yes / No **If no, why not?**

Water Color: Clear / Yellow / Orange / Brown/Black (Sand/Silt) / Other: Initial purge orange

Well Condition: Locked Y / N | Labeled with LOC ID: Y / N | **Comments:** —

Sheen: Yes / No | **Odor:** Yes / No | **Notes/Comments:**

Laboratory Analyses (Circle): VOC, SVOC, GRO, DRO, Dissovled Iron, Sulfate

pH checked of samples: Y / N | **Approximate volume added (mL):** HCl = — HNO3 = —

Purge Water

Gallons generated: 5.0 | Containerized and disposed as IDW? Yes / No | If No, why not?

Disposal method*: POL Water / CERCLA Waste | * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: AS

GROUNDWATER SAMPLE FORM OU2 Ft. Wainwright, Alaska

Project #: 9011-17
Site Location: DRMO1 / DRMO3 / WSW
Date: 8/7/15
Probe/Well #: AP-10445 MW
Time: 1200
Sample ID: 19FWOU2 10 WG
Sampler: CB
Weather: CLOUDY
Outside Temperature: 59°F
QA/QC Sample ID/Time/LOCID:
MS/MSD Performed? Yes / No

Purge Method: Peristaltic Pump / Submersible / Bladder
Sample Method: Peristaltic Pump / Submersible / Hydrasleeve / Bladder / Other
Equipment Used for Sampling: YSI # 9 Turbidity Meter #: 12 Water Level: Yes
Free Product Observed in Probe/Well? Yes/No If Yes, Depth to Product:

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.30
Depth to Water from TOC (feet): - 12.65
Column of Water in Probe/Well (feet): = 7.65
Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)
Volume of Water in 1 Probe/Well Casing (gal): 1.24

Sampling Depth

Well Screened Across / Below water table
Depth tubing / pump intake set* approx. 14.6 feet below top of casing
*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.3	10	9.10	0.901	0.75	6.67	70.2	36.98	12.79
1.95	15	9.29	0.895	0.69	6.67	60.1	28.65	12.79
2.6	20	9.25	0.885	0.72	6.68	55.6	10.10	12.79
3.25	25	9.30	0.880	0.71	6.68	47.4	6.65	12.79
3.9	30	9.32	0.881	0.62	6.68	44.4	5.00	12.80
4.55	35	9.29	0.881	0.59	6.68	43.8	5.16	12.80

Did groundwater parameters stabilize? Yes / No If no, why not?
Did drawdown stabilize? Yes / No If no, why not?
Was flowrate between 0.03 and 0.15 GPM? Yes/No If no, why not?
Water Color: Clear Yellow Orange Brown/Black (Sand/Silt) Other: PINK TINT (PHOTO)
Well Condition: Lock: Y / N Labeled with LOC ID: Y / N Comments:
Sheen: Yes / No Odor: Yes / No Notes/Comments:

Laboratory Analyses (Circle): VOC, SVOC, GRO, DRO, Dissolved Iron, Sulfate
pH checked of samples: Y / N Approximate volume added (mL): HCl = 0 HNO3 = 0

Purge Water

Gallons generated: 4.55 Containerized and disposed as IDW? Yes / No If No, why not?
Disposal method*: POL Water / CERCLA Waste * Purge water stored in the DERA Building for characterization prior to disposal
Sampler's Initials: CB

GROUNDWATER SAMPLE FORM

OU2

Ft. Wainwright, Alaska

Project #: 9011-17

Site Location: (DRMO1) DRMO4 / WSW

Date: 8/7/19

Probe/Well #: AP-7559

Time: 1300

Sample ID: 19FWOU2 11 WG

Sampler: AS

Weather: Mostly cloudy

Outside Temperature: 70°F

QA/QC Sample ID/Time/LOCID: —

small clip MS/MSD Performed? Yes/(No)

Purge Method: Peristaltic Pump / (Submersible) / Bladder

Sample Method: Peristaltic Pump / (Submersible) / Hydrasleeve / Bladder / Other

Equipment Used for Sampling: YSI # 6 Turbidity Meter #: 14

Water Level: Kecк

Free Product Observed in Probe/Well? Yes/(No) If Yes, Depth to Product: —

Dedicated teflon-lined tubing

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.01

Depth to Water from TOC (feet): - 10.54

Column of Water in Probe/Well (feet): = 9.47

Circle: Gallons per foot of 1.25" (X 0.064) or (2" (X 0.163)) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal): 1.54

Sampling Depth

Well Screened (Across) / Below water table

Depth tubing / pump intake set* approx. 12.5 feet below top of casing

*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		✓ ±3% (or ±0.2°C max)	At least 3 of the 5 parameters below must stabilize					<0.33 feet after initial drawdown
			✓ ±3%	✓ ±10% (<1mg/L, ±0.2 mg/L)	✓ ±0.1 units	✓ ±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	15	9.85	0.406	0.50	6.49	184.9	6.91	10.58
2.0	20	9.83	0.407	0.53	6.58	179.4	5.88	10.58
2.5	25	9.84	0.405	0.53	6.55	180.1	5.66	10.58
3.0	30	9.80	0.406	0.49	6.56	180.1	3.47	10.58
3.5	35	9.82	0.405	0.49	6.59	178.0	3.43	10.58

Did groundwater parameters stabilize? (Yes) / No If no, why not? —

Did drawdown stabilize? (Yes) / No If no, why not? —

Was flowrate between 0.03 and 0.15 GPM? (Yes)/No If no, why not? —

Water Color: (Clear) Yellow Orange Brown/Black (Sand/Silt) Other: —

Well Condition: Lock: (Y) / N Labeled with LOC ID: (Y) / N Comments: —

Sheen: Yes / (No) Odor: Yes / No Notes/Comments: —

Laboratory Analyses (Circle): (VOC) SVOC, GRO, DRO (Dissovled Iron, Sulfate)

pH checked of samples: Y / (N) Approximate volume added (mL): HCl = — HNO3 = —

Purge Water

Gallons generated: 4.0 Containerized and disposed as IDW? (Yes) / No If No, why not?

Disposal method*: POL Water / (CERCLA Waste) * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: AS

GROUNDWATER SAMPLE FORM | **OU2** | **Ft. Wainwright, Alaska**

Project #: 9011-17 | **Site Location:** DRMO1 / DRMO4 / WSW

Date: 8/7/19 | **Probe/Well #:** AP - 10446 MW

Time: 1305 | **Sample ID:** 19FWOU2/2 WG

Sampler: CB

Weather: CLOUDY | **Outside Temperature:** 59°F

QA/QC Sample ID/Time/LOCID: | **MS/MSD Performed? Yes/ No**

Purge Method: Peristaltic Pump / Submersible / Bladder | **Sample Method:** Peristaltic Pump / Submersible / Hydrasleeve / Bladder / Other

Equipment Used for Sampling: YSI # 9 | **Turbidity Meter #:** 12 | **Water Level:** Yes

Free Product Observed in Probe/Well? Yes/No | **If Yes, Depth to Product:**

Column of Water in Probe/Well

Total Depth in Probe/Well (feet btoc): 20.39

Depth to Water from TOC (feet): - 11.86

Column of Water in Probe/Well (feet): = 8.53

Circle: Gallons per foot of 1.25" (X 0.064) or 2" (X 0.163) or 4" (X 0.65)

Volume of Water in 1 Probe/Well Casing (gal): 1.39

Sampling Depth

Well Screened Across / Below water table

Depth tubing / pump intake set* approx. 13.8 feet below top of casing

*Tubing/pump intake must be set approximately 2 feet below the water table for wells screened across the water table, or in the middle of the screened interval for wells screened below the water table

Micropurge well/probe at a rate of 0.03 to 0.15 GPM until parameters stabilize or 3 casing volumes have been removed. If well draws down below tubing or pump intake, stop purging and sample as a low-yield well using a no-purge technique.

Field Parameters:		±3% (or ±0.2°C max)	*At least 3 of the 5 parameters below must stabilize*					<0.33 feet after initial drawdown
			±3%	±10% (<1mg/L, ±0.2 mg/L)	±0.1 units	±10 mV	±10% (<10NTU, ±1NTU)	
Water Removed (gal)	Time Purged (min)	Temperature (°C)	Conductivity (mS/cm)	Dissolved O_2 (mg/L)	pH	Potential (mV)	Turbidity (NTU)	Water Level (ft)
1.5	10	6.10	0.435	0.97	7.15	-70.1	68.59	11.89
2.25	15	6.06	0.438	0.90	7.14	-80.5	55.78	11.89
3	20	6.03	0.439	0.65	7.18	-85.1	20.96	11.89
3.75	25	5.98	0.439	0.62	7.18	-88.0	13.11	11.89
4.5	30	5.90	0.439	0.60	7.20	-87.1	11.40	11.89
4.75	FINAL							
	CB							

Did groundwater parameters stabilize? Yes / No If no, why not?

Did drawdown stabilize? Yes / No If no, why not?

Was flowrate between 0.03 and 0.15 GPM? Yes/No If no, why not?

Water Color: Clear / Yellow / Orange / Brown/Black (Sand/Silt) / Other:

Well Condition: Locked Y / N | Labeled with LOC ID: Y / N | **Comments:**

Sheen: Yes / No | **Odor:** Yes / No | **Notes/Comments:**

Laboratory Analyses (Circle): VOC, SVOC, GRO, DRO, Dissolved Iron, Sulfate

pH checked of samples: Y / N | **Approximate volume added (mL):** HCl = _____ HNO3 = 0

Purge Water

Gallons generated: 4.75 | Containerized and disposed as IDW? Yes / No | If No, why not?

Disposal method*: POL Water / CERCLA Waste | * Purge water stored in the DERA Building for characterization prior to disposal

Sampler's Initials: CB

Submersible Pump Equipment Blank

Rinsate #: 1

Sample ID: 19FW0U2EB01WQ

Date: 8/7/19

Time: 1530

Analysis: VOC, DRO, Fe, SO_4

Well that the pump was last used on: AP-7560

MADE IN TACOMA
— SINCE 1916 —
Rite in the Rain®
— DEFYING MOTHER NATURE —

Name Aaron Swank
Fairbanks Environmental Services
Address 3538 International St
Fairbanks, AK 99709

Phone 907-460-0484
Email

Projects

RiteintheRain.com

8/6/19 Cloudy, 60°F 1/2

0800 Arrive @ FES and prep for sampling - Our DRMO 3-Party

0845 Left FES for FW A. Construction on the way to DRMO

0930 Arrive @ DRMO AP-10017R

1030 Sample 19FWOU201WG AP-10017R VOC, Sulfate, Iron

1140 Sample 19FWOU202WG AP-10018R VOC, Sulfate, Iron

1245 Sample 19FWOU203WG AP-10015R VOC, sulfate, iron

1355 Sample 19FWOU204WG AP-10016R VOC, sulfate, iron

1500 Sample 19FWOU205WG AP-10008914R - VOC, sulfate, iron

1515 Left site and to meet Chris Boese @ OUS

8/6/19 P. Cloudy, 70°F 2/2

1530 Pick up pump for rinsate from C. Boese (AP-10035MW - OUS)

1545 Left OUS

1600 Arrive @ FES.

- Transfer samples to fridge
- Drain pump for rinsate

1635 Rinsate #4 - OUS Sparge Curtain EB04WG

- Drain pumps for sampling tomorrow.

1730 End of Day

8/7/19 Cloudy, 60°F 1/3

0800 Arrive at FES and organize for sampling @ OU2 today.

0900 Left FES for Fort Wainwright

0925 Arrive at WSW. Met Doyon Utilities. they need to onsite the pump for purging and sampling. Pump is locked out.

Called Brian Adams - DPW Environmental - to ensure we could purge water into the floor drain and also add water to the tank. Brian approved this procedure for sampling.

Starting tank level = 22.5 ft.
Purge for 30-minutes
Ending tank level = 22.7 ft.

1015 Sample 19FWOU206WG
- VOC, SVOC, GRO, DRO

8/7/19 Cloudy, 60°F 2/3

1125 Sample 19FWOU208WG
AP-7560 VOC, DRO, Fe, SO_4
MS/MSD

1135 Sample 19FWOU209WG
AP-7070 Duplicate

1300 Sample 19FWOU211WG
AP-7559 VOC, Fe, SO_4

1330 Left DRMO to go to Milepat for disposal of decontamination water.

1345 Decon water disposal

1400 Arrive @ FES
- Unload samples into fridge
- Decon remaining OU3 pumps and run decon water through GAC
- Add new water and decon OU2 pump - AP-7560

1530 sample - rinsate 19FWOU2EB01WG
VOC, DRO, Fe, SO_4

8/7/19 P. Cloudy, 75°F 3/3

- Finish decontamination of remaing OU2 pumps.

- Clean up & finish sampling demob.

1730 End of Day

APPENDIX D

PHOTO LOG

OU2 DRMO1—Groundwater sampling at AP-7560
(view W)

OU2 DRMO1 — Groundwater sampling at AP-10017R
(view W)

OU2 DRMO4 — Groundwater sampling at AP-10445MW
(view SE)

OU2 DRMO4 — Purge water from AP-10445MW
(view N/A)

OU2 DRMO — Door at the Building 5009 Well House
(view N)

OU2 DRMO — Pump lockout for the Water Supply Well
(view N/A)

OU2 DRMO — Spigot for the WSW in the Building 5009 Well House
(view N/A)

OU2 DRMO — Hose for purge water in the Building 5009 Well House
(view N/A)

OU2 DRMO — Discharge of purge water into the floor drain at the Building 5009 Well House (view N/A)

OU2 DRMO — Pump controller for the WSW in the Building 5009 Well House (view N/A)

OU2 DRMO — Purge water prior to sampling of the WSW
(view N/A)

OU2 DRMO — Sampling of the WSW
(view N/A)

OU2 DRMO — Disposal of decontamination water at the DRMO yard
(view SE)

APPENDIX E

LTMO ANALYSIS RESULTS

MAROS Summary 1—DRMO1 Statistical Trend Analysis Summary

MAROS Statistical Trend Analysis Summary

Project: OU2 DRMO 2019
User Name: FES
Location: Fort Wainwright
State: Alaska

Time Period: 10/1/2010 **to** 8/7/2019
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
TETRACHLOROETHYLENE(PCE)								
AP-10015	T	13	10	1.5E-03	8.1E-04	No	PI	PI
AP-10016	S	13	12	6.5E-03	5.3E-03	No	NT	NT
AP-10017	S	13	12	1.1E-03	9.7E-04	No	NT	NT
AP-10018	S	13	12	5.2E-03	2.2E-03	No	D	D
AP-7559	T	13	11	3.1E-03	3.4E-03	No	NT	NT
AP-7560	T	10	9	2.0E-03	1.9E-03	No	S	NT
AP-8914	S	13	10	2.7E-03	5.7E-04	No	NT	PD
TRICHLOROETHYLENE (TCE)								
AP-10015	T	13	13	1.8E-03	1.5E-03	No	S	S
AP-10016	S	13	12	1.1E-03	1.2E-03	No	NT	NT
AP-10017	S	13	6	2.7E-04	2.5E-04	No	D	D
AP-10018	S	13	11	2.9E-03	3.1E-03	No	D	D
AP-7559	T	13	11	5.0E-04	5.1E-04	No	NT	S
AP-7560	T	10	8	1.6E-03	1.6E-03	No	NT	NT
AP-8914	S	13	11	2.4E-03	1.9E-03	No	S	NT

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Version 2.2, 2006, AFCEE Wednesday, October 02, 2019 Page 1 of 1

MAROS Summary 2—DRMO1 Spatial Moment Analysis Summary

MAROS Spatial Moment Analysis Summary

Project: OU2 DRMO 2019
Location: Fort Wainwright

User Name: FES
State: Alaska

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
TETRACHLOROETHYLENE(PCE)							
10/11/2010	2.4E-03	1,394,837	3,954,941	102	3,259	2,176	7
2/23/2011	7.3E-04	1,394,880	3,954,914	53	427	864	6
6/1/2011	6.2E-04	1,394,882	3,954,912	50	454	906	6
9/20/2011	3.1E-03	1,394,810	3,954,958	133	2,504	1,765	7
5/30/2012	2.5E-04	1,394,880	3,954,911	51	381	962	6
8/31/2012	1.8E-03	1,394,798	3,954,962	145	1,594	1,239	7
8/27/2013	2.9E-04	1,394,807	3,954,963	139	2,461	1,670	7
10/9/2014	3.9E-03	1,394,804	3,954,964	142	1,944	1,251	7
8/24/2015	2.6E-03	1,394,797	3,954,970	151	1,748	1,175	7
9/14/2016	4.2E-03	1,394,811	3,954,958	132	2,660	1,900	7
8/9/2017	2.1E-03	1,394,801	3,954,967	146	2,008	1,378	7
8/16/2018	2.7E-03	1,394,799	3,954,968	149	1,859	1,292	7
8/7/2019	1.7E-03	1,394,798	3,954,968	149	1,834	1,355	7
TRICHLOROETHYLENE (TCE)							
10/11/2010	1.8E-03	1,394,819	3,954,953	123	2,770	1,819	7
2/23/2011	3.2E-04	1,394,876	3,954,921	62	327	686	6
6/1/2011	5.2E-04	1,394,879	3,954,915	54	341	760	6
9/20/2011	1.8E-03	1,394,816	3,954,956	127	2,694	1,740	7
5/30/2012	4.7E-04	1,394,882	3,954,910	49	372	812	6
8/31/2012	2.1E-03	1,394,819	3,954,953	123	2,752	1,814	7
8/27/2013	5.6E-04	1,394,804	3,954,965	143	2,185	1,451	7
10/9/2014	1.5E-03	1,394,828	3,954,946	113	2,793	1,838	7
8/24/2015	1.3E-03	1,394,804	3,954,961	140	2,157	1,560	7
9/14/2016	1.9E-03	1,394,810	3,954,958	133	2,484	1,748	7
8/9/2017	9.6E-04	1,394,810	3,954,957	133	2,518	1,772	7
8/16/2018	9.7E-04	1,394,799	3,954,968	149	2,045	1,522	7
8/7/2019	9.8E-04	1,394,795	3,954,970	153	1,770	1,371	7

MAROS Version 2.2, 2006, AFCEE Wednesday, October 02, 2019 Page 1 of 2

MAROS Summary 2 cont'd—DRMO1 Spatial Moment Analysis Summary

Project: OU2 DRMO 2019 **User Name:** FES
Location: Fort Wainwright **State:** Alaska

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	TETRACHLOROETHYLENE(PCE)	0.64	14	78.2%	NT
	TRICHLOROETHYLENE (TCE)	0.52	10	70.5%	NT
1st Moment: Distance to Source					
	TETRACHLOROETHYLENE(PCE)	0.34	46	99.8%	I
	TRICHLOROETHYLENE (TCE)	0.31	42	99.5%	I
2nd Moment: Sigma XX					
	TETRACHLOROETHYLENE(PCE)	0.50	6	61.7%	NT
	TRICHLOROETHYLENE (TCE)	0.49	0	47.6%	S
2nd Moment: Sigma YY					
	TETRACHLOROETHYLENE(PCE)	0.29	14	78.2%	NT
	TRICHLOROETHYLENE (TCE)	0.29	8	66.2%	NT

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Uniform 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

MAROS Summary 3 —DRMO1 First Moment Analysis Plot for TCE

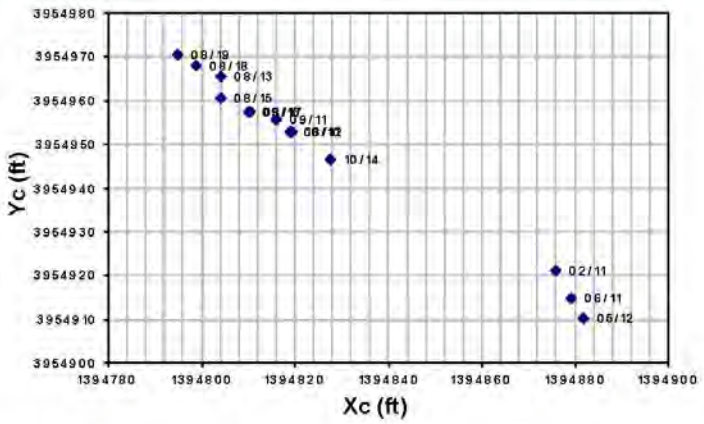
MAROS First Moment Analysis

Project: OU2 DRMO 2019 **User Name:** FES

Location: Fort Wainwright **State:** Alaska

COC: TRICHLOROETHYLENE (TCE)

Change in Location of Center of Mass Over Time



Groundwater Flow Direction:

Source Coordinate:

X: 1,394,911

Y: 3,954,871

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
10/11/2010	TRICHLOROETHYLENE (TCE	1,394,819	3,954,953	123	7
2/23/2011	TRICHLOROETHYLENE (TCE	1,394,876	3,954,921	62	6
6/1/2011	TRICHLOROETHYLENE (TCE	1,394,879	3,954,915	54	6
9/20/2011	TRICHLOROETHYLENE (TCE	1,394,816	3,954,956	127	7
5/30/2012	TRICHLOROETHYLENE (TCE	1,394,882	3,954,910	49	6
8/31/2012	TRICHLOROETHYLENE (TCE	1,394,819	3,954,953	123	7
8/27/2013	TRICHLOROETHYLENE (TCE	1,394,804	3,954,965	143	7
10/9/2014	TRICHLOROETHYLENE (TCE	1,394,828	3,954,946	113	7
8/24/2015	TRICHLOROETHYLENE (TCE	1,394,804	3,954,961	140	7
9/14/2016	TRICHLOROETHYLENE (TCE	1,394,810	3,954,958	133	7
8/9/2017	TRICHLOROETHYLENE (TCE	1,394,810	3,954,957	133	7
8/16/2018	TRICHLOROETHYLENE (TCE	1,394,799	3,954,968	149	7
8/7/2019	TRICHLOROETHYLENE (TCE	1,394,795	3,954,970	153	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Version 2.2, 2006, AFCEE 10/2/2019 Page 1 of 1

MAROS Summary 4 —DRMO1 First Moment Analysis Plot for PCE

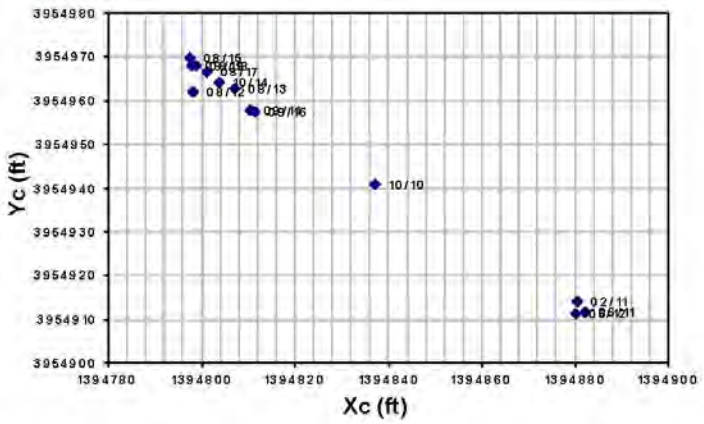
MAROS First Moment Analysis

Project: OU2 DRMO 2019 **User Name:** FES

Location: Fort Wainwright **State:** Alaska

COC: TETRACHLOROETHYLENE(PCE)

Change in Location of Center of Mass Over Time



Groundwater Flow Direction:

Source Coordinate:

X: 1,394,911

Y: 3,954,871

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
10/11/2010	TETRACHLOROETHYLENE(P	1,394,837	3,954,941	102	7
2/23/2011	TETRACHLOROETHYLENE(P	1,394,880	3,954,914	53	6
6/1/2011	TETRACHLOROETHYLENE(P	1,394,882	3,954,912	50	6
9/20/2011	TETRACHLOROETHYLENE(P	1,394,810	3,954,958	133	7
5/30/2012	TETRACHLOROETHYLENE(P	1,394,880	3,954,911	51	6
8/31/2012	TETRACHLOROETHYLENE(P	1,394,798	3,954,962	145	7
8/27/2013	TETRACHLOROETHYLENE(P	1,394,807	3,954,963	139	7
10/9/2014	TETRACHLOROETHYLENE(P	1,394,804	3,954,964	142	7
8/24/2015	TETRACHLOROETHYLENE(P	1,394,797	3,954,970	151	7
9/14/2016	TETRACHLOROETHYLENE(P	1,394,811	3,954,958	132	7
8/9/2017	TETRACHLOROETHYLENE(P	1,394,801	3,954,967	146	7
8/16/2018	TETRACHLOROETHYLENE(P	1,394,799	3,954,968	149	7
8/7/2019	TETRACHLOROETHYLENE(P	1,394,798	3,954,968	149	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Version 2.2, 2006, AFCEE 10/2/2019 Page 1 of 1

MAROS Summary 5 —DRMO1 Sampling Location Optimization Results

MAROS Sampling Location Optimization Results

Project: OU2 DRMO_2019 **User Name:** FES

Location: Fort Wainwright **State:** Alaska

Sampling Events Analyzed: **From** Sample Event 36 10/11/2010 **to** Sample Event 48 8/7/2019

Parameters used:

Constituent	Inside SF	Hull SF	Area Ratio	Conc. Ratio
TETRACHLOROETHYLENE(PCE	0.2	0.1	0.9	0.8
TRICHLOROETHYLENE (TCE)	0.2	0.1	0.9	0.8

Well	X (feet)	Y (feet)	Removable?	Average Slope Factor*	Minimum Slope Factor*	Maximum Slope Factor*	Eliminated?
TETRACHLOROETHYLENE(PCE)							
AP-10015	1394860.00	3954905.50	☑	0.358	0.000	0.752	☐
AP-10016	1394881.00	3954866.00	☑	0.361	0.000	0.576	☐
AP-10017	1394939.13	3954849.50	☑	0.301	0.000	0.595	☐
AP-10018	1394914.75	3954897.25	☑	0.203	0.000	0.452	☐
AP-7559	1394820.13	3955011.25	☑	0.350	0.000	0.737	☐
AP-7560	1394632.88	3955071.25	☑	0.171	0.000	0.492	☐
AP-8914	1394907.00	3954874.75	☑	0.302	0.000	0.778	☐
TRICHLOROETHYLENE (TCE)							
AP-10015	1394860.00	3954905.50	☑	0.145	0.012	0.465	☑
AP-10016	1394881.00	3954866.00	☑	0.172	0.017	0.432	☐
AP-10017	1394939.13	3954849.50	☑	0.494	0.000	0.735	☐
AP-10018	1394914.75	3954897.25	☑	0.195	0.002	0.630	☐
AP-7559	1394820.13	3955011.25	☑	0.355	0.108	0.474	☐
AP-7560	1394632.88	3955071.25	☑	0.261	0.037	0.526	☐
AP-8914	1394907.00	3954874.75	☑	0.241	0.103	0.487	☐

Note: The Slope Factor indicates the relative importance of a well in the monitoring network at a given sampling event; the larger the SF value of a well, the more important the well is and vice versa; the Average Slope Factor measures the overall well importance in the selected time period; the state coordinates system (i.e., X and Y refer to Easting and Northing respectively) or local coordinates systems may be used; wells that are NOT selected for analysis are not shown above.
* When the report is generated after running the Excel module, SF values will NOT be shown above.

MAROS Version 2.2, 2006, AFCEE Tuesday, October 01, 2019 Page 1 of 1

MAROS Summary 6 —DRMO1 Sampling Location Optimization, All COCs

MAROS Sampling Location Optimization

Results by Considering All COCs

Project: OU2 DRMO_2019 **User Name:** FES

Location: Fort Wainwright **State:** Alaska

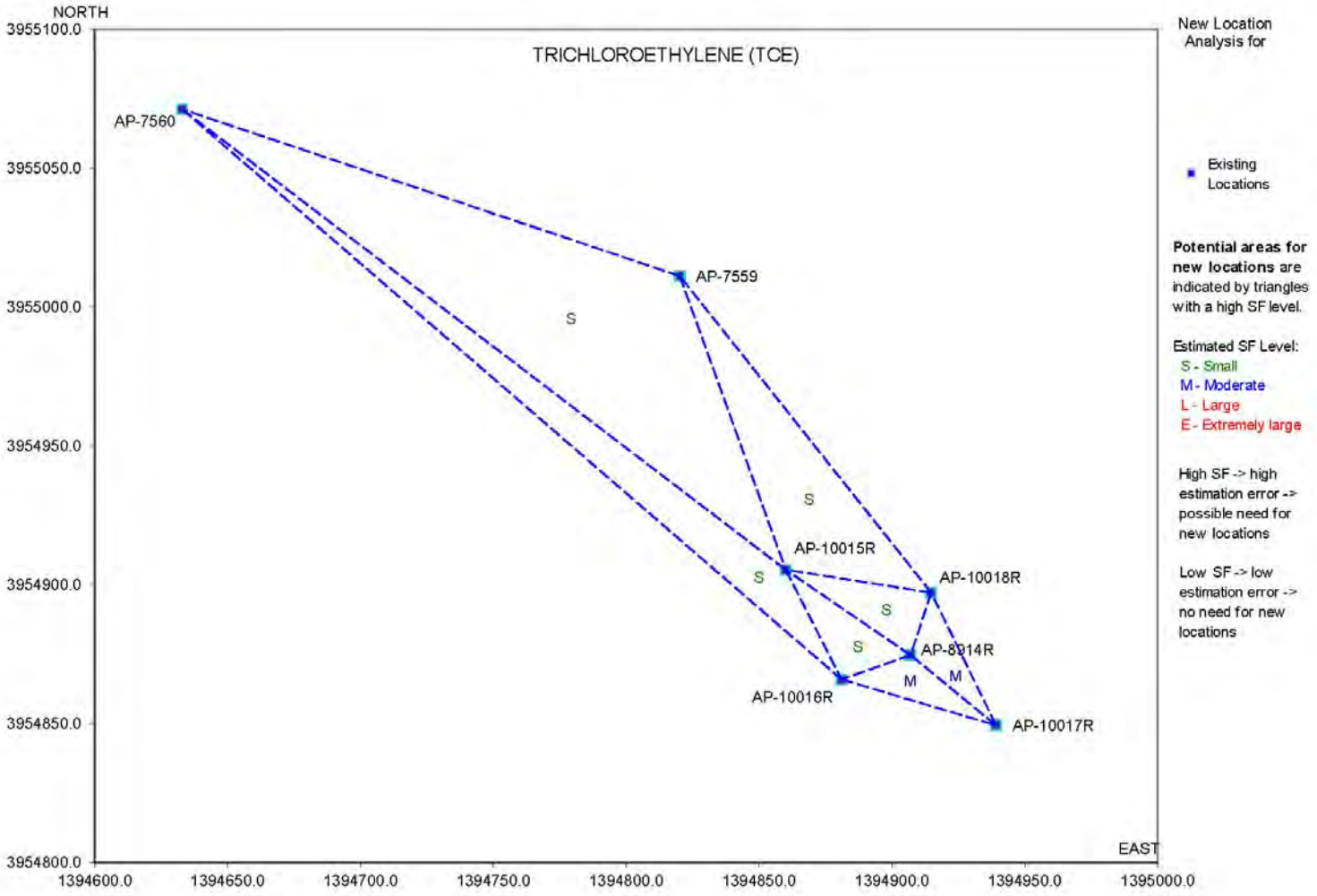
Sampling Events Analyzed: **From** Sample Event 36 10/11/2010 **to** Sample Event 48 8/7/2019

Well	X (feet)	Y (feet)	Number of COCs	COC-Averaged Slope Factor*	Abandoned?
AP-10015	1394860.00	3954905.50	2	0.251	☐
AP-10016	1394881.00	3954866.00	2	0.266	☐
AP-10017	1394939.13	3954849.50	2	0.397	☐
AP-10018	1394914.75	3954897.25	2	0.199	☐
AP-7559	1394820.13	3955011.25	2	0.352	☐
AP-7560	1394632.88	3955071.25	2	0.216	☐
AP-8914	1394907.00	3954874.75	2	0.272	☐

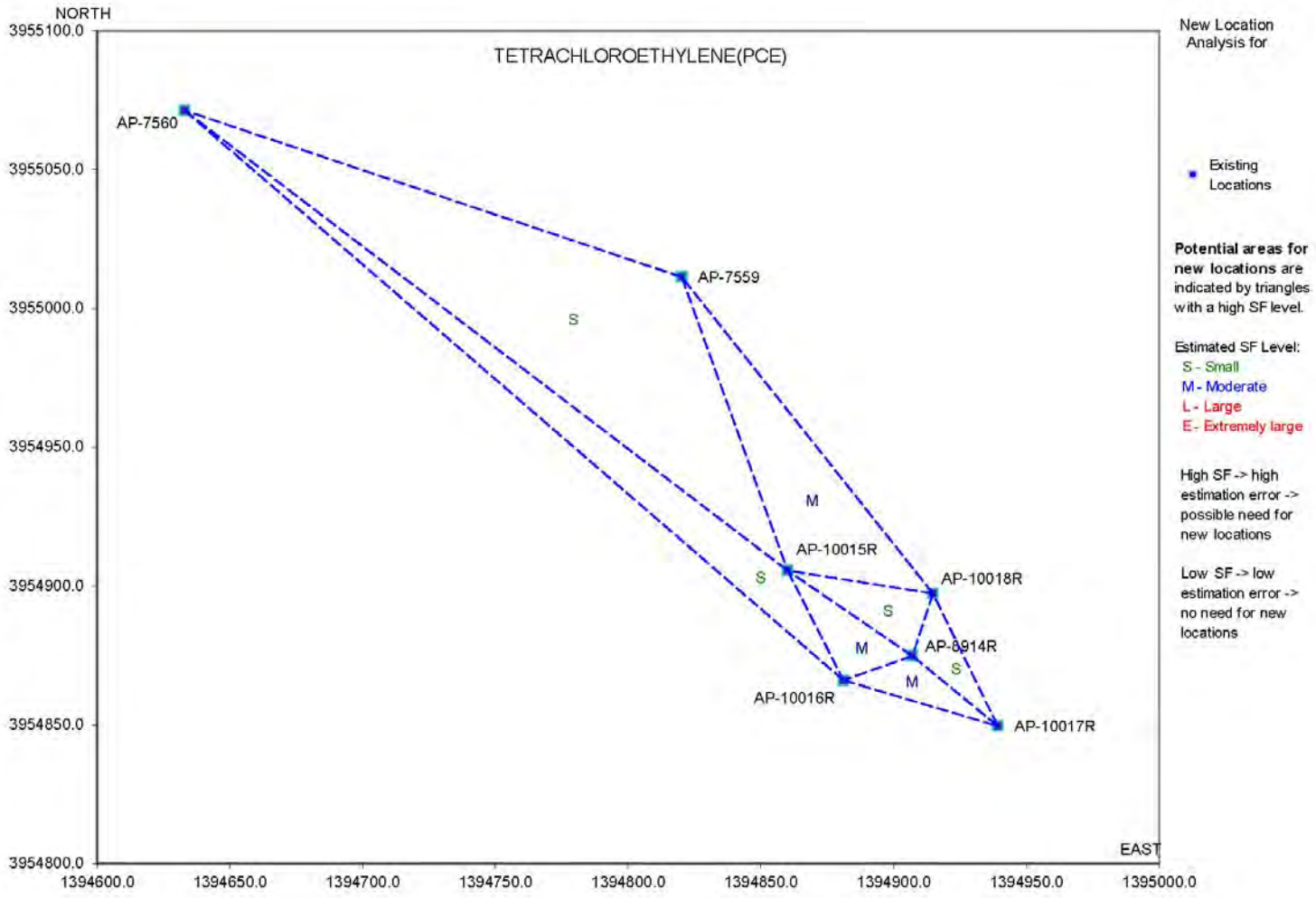
Note: the COC-Averaged Slope Factor is the value calculated by averaging those "Average Slope Factor" obtained earlier across COCs; to be conservative, a location is "abandoned" only when it is eliminated from all COCs; "abandoned" doesn't necessarily mean the abandon of well, it can mean that NO samples need to be collected for any COCs.
* When the report is generated after running the Excel module, SF values will NOT be shown above.

MAROS Version 2.2, 2006, AFCEE Tuesday, October 01, 2019 Page 1 of 1

MAROS Summary 7 —DRMO1 Well Redundancy Analysis, TCE



MAROS Summary 8 —DRMO1 Well Redundancy Analysis, PCE



MAROS Summary 9 —DRMO1 Sampling Frequency Optimization

MAROS Sampling Frequency Optimization Results

Project: OU2 DRMO 2019 **User Name:** FES

Location: Fort Wainwright **State:** Alaska

The Overall Number of Sampling Events: 13

"Recent Period" defined by events: **From** Sample Event 36 10/11/2010 **To** Sample Event 48 8/7/2019

"Rate of Change" parameters used:

Constituent	Cleanup Goal	Low Rate	Medium Rate	High Rate
TETRACHLOROETHYLENE(PCE	0.005	0.0025	0.005	0.01
TRICHLOROETHYLENE (TCE)	0.005	0.0025	0.005	0.01

Units: Cleanup Goal is in mg/L; all rate parameters are in mg/L/year.

Well	Recommended Sampling Frequency	Frequency Based on Recent Data	Frequency Based on Overall Data
TETRACHLOROETHYLENE(PCE)			
AP-10015	Annual	Annual	Annual
AP-10016	Annual	Annual	Annual
AP-10017	Annual	Annual	Annual
AP-10018	Annual	Annual	Annual
AP-7559	Annual	Annual	Annual
AP-7560	Annual	Annual	Annual
AP-8914	Annual	Annual	Annual
TRICHLOROETHYLENE (TCE)			
AP-10015	Annual	Annual	Annual
AP-10016	Biennial	Annual	Annual
AP-10017	Biennial	Annual	Annual
AP-10018	Annual	Annual	Annual
AP-7559	Biennial	Annual	Annual
AP-7560	Annual	Annual	Annual
AP-8914	Annual	Annual	Annual

Note: Sampling frequency is determined considering both recent and overall concentration trends. Sampling Frequency is the final recommendation; Frequency Based on Recent Data is the frequency determined using recent (short) period of monitoring data; Frequency Based on Overall Data is the frequency determined using overall (long) period of monitoring data. If the "recent period" is defined using a different series of sampling events, the results could be different.

MAROS Version 2.2, 2006, AFCEE Wednesday, October 02, 2019 Page 1 of 1

MAROS Summary 10 —DRMO4 Statistical Trend Analysis Summary

MAROS Statistical Trend Analysis Summary

Project: OU2 DRMO_2019
User Name: FES
Location: Fort Wainwright
State: Alaska

Time Period: 10/1/2011 **to** 8/7/2019
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
TETRACHLOROETHYLENE(PCE)								
AP-8916	S	10	9	3.1E-03	2.4E-03	No	PD	D
PO-5	S	10	7	4.9E-03	5.2E-03	No	S	S
Probe B	T	10	0	2.5E-04	2.5E-04	Yes	ND	ND
TRICHLOROETHYLENE (TCE)								
AP-8916	S	10	3	6.3E-04	2.5E-04	No	NT	NT
PO-5	S	10	7	2.7E-03	3.5E-03	No	S	S
Probe B	T	10	1	2.4E-04	2.5E-04	No	NT	NT

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Version 2.2, 2006, AFCEE Tuesday, October 01, 2019 Page 1 of 1

REVIEW COMMENTS AND RESPONSES

REVIEW COMMENTS **PROJECT: W911KB-16-D-0005**
DOCUMENT: Draft 2019 OU2 Monitoring Report **Location: Fort Wainwright, Alaska**

EPA	**DATE: 27 Nov 2019** **REVIEWER: Halstead** **PHONE: 907-271-1218**	**Action taken on comment by:** Aaron Swank – FES (12/2/19)

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Page ix	Typo; I think they mean details will be in the 2019 IC report. The 2018 IC report is nearly final in Nov 2019 "Further details regarding the IC inspection are presented in the 2018 IC inspection report (anticipated in spring 2020).	A	The typo was corrected.	Agree (via e-mail; 12/12/19)
2.	Figure 2-1	Add a GW flow direction arrow to figure 2-1	A	The groundwater flow direction arrow was added to Figure 2-1.	Agree (via e-mail; 12/12/19)
3.	Page 2-4	Do we have the fill log from the water tank fill?	A	The 2019 fill log is available and will be included as part of the 2019 Annual IC Report. A copy of the log with information through October 209 is included with these RTCs.	Agree (via e-mail; 12/12/19)
4.	Figure 3-2	Is there a possibility that the new well AP-10446MW is screened differently that the concentrations of PCE and TCE dropped from 6.6/3.3 in 2017, the last sample from PO5, to ND in 2018 & 2019? What else might account for this reduction in concentration?	A	Monitoring well AP-10446MW is a conventional 2-inch PVC well with a 10-foot pre-packed screen. The well that was replaced (PO5) was a 0.5-inch slotted steel probe with unknown screen construction. The groundwater samples collected from the replacement well are expected to be more representative of the current aquifer conditions than the previous groundwater probe.	Agree (via e-mail; 12/12/19)
5.		----- End of Comments ----			

Comments provided via e-mail

REVIEW COMMENTS **PROJECT: W911KB-16-D-0005**
DOCUMENT: Draft 2019 OU2 Monitoring Report **Location: Fort Wainwright, Alaska**

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION	**DATE: 12/05/2019** **REVIEWER: Erica Blake** **PHONE: 907-451-2182**	**Action taken on comment by:** Aaron Swank – FES (12/6/19)

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Appendix B: CDQR and ADEC Laboratory Data Review Checklist	DEC has recently updated the Laboratory Data Review Checklist, the most recent version is dated November 2019. For all future reports, please use the latest Laboratory Data Review Checklist form.	Noted	The new ADEC Laboratory Data Review Checklist will be used for all future reports.	Agree.
2.		----- End of Comments ----			

Comments provided via e-mail