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

November 14, 2023

Directorate of Public Works

Subject: Submission of the Final 2022 OU6 Annual Monitoring Report to the State of Alaska Department Environmental Conservation.

Mr. Timothy Sharp
Remediation Project Manager
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, AK 99709

Dear Mr. Sharp:

This letter documents transmission of the final 2022 OU6 Annual Monitoring Report to the State of Alaska Department Environmental Conservation (ADEC).

A digital copy of the document will be provided to you. A copy of the document is also being provided to Ms. Cascade Galasso-Irish, Alternate RPM, ADEC. 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 Mr. Peter Baker, RPM at (907) 361-6623 or email peter.a.baker8.civ@army.mil.

Sincerely,

BAKER.PETER.ARTHUR.1248233911 Digitally signed by BAKER.PETER.ARTHUR.1248233911 Date: 2023.11.14 07:42:14 -09'00'

Peter Baker
Remediation Project Manager,
Directorate of Public Works

CF:
HQ, USAG FWA CERCLA Information Repository (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

November 14, 2023

Directorate of Public Works

Subject: Submission of the Final 2022 OU6 Annual Monitoring Report to the Environmental Protection Agency.

Mr. Craig Scola
Environmental Protection Agency
Remediation Project Manager
Alaska Operations Office
222 W. 7th Ave, #19
Anchorage, AK 99513

Dear Mr. Scola:

This letter documents transmission of the final 2022 OU6 Annual Monitoring Report to the Environmental Protection Agency (EPA).

A digital copy of the document will be provided to you. A copy of this document is also being provided to Mr. Tim Sharp, Remediation Project Manager (RPM) and Ms. Cascade Galasso-Irish, Alternate RPM, Alaska Department of Environmental Conservation (ADEC); and Ms. Sandy Halstead, Alternate RPM, EPA. 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 Mr. Peter Baker, RPM, at (907) 361-6623 or email peter.a.baker8.civ@army.mil.

Sincerely,

BAKER.PETER.ARTHUR.1248233911
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Directorate of Public Works

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Final

2022 Monitoring Report

Former Communications Site, Operable Unit 6

U.S. Army Garrison Alaska

HQAES No. 02871.1088
ADEC File No. 108.38.085
ADEC Hazard ID 4140

Contract W911KB-20-D-0005 Task Order W911KB-21-F-0111

November 2023

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Final

2022 Monitoring Report

Former Communications Site, Operable Unit 6

Contract W911KB-20-D-0005
Task Order W911KB-21-F-0111

November 2023

Prepared For:

U.S. Army Garrison Alaska

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram(s) per liter
ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
btoc	below top of casing
CDQR	Chemical Data Quality Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
cy	cubic yards
DCE	dichloroethene
DO	dissolved oxygen
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
FCS	Former Communication Site
HQAES	Headquarters Army Environmental System
IC	institutional control
IDW	investigation-derived waste
LOD	limit of detection
LL	low level
MAROS	Monitoring and Remediation Optimization System
MCL	Maximum Contaminant Level
MNA	monitored natural attenuation
mV	millivolts
mg/L	milligrams per liter
NA	not analyzed
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NM	not measured
NE	not established
ORP	oxidation-reduction potential
OU6	Operable Unit 6
RAO	remedial action objective
RG	remedial goal
RI	Remedial Investigation
RRO	residual-range organics
TCE	trichloroethene
TCP	1,2,3-trichloropropane
UCL_{95}	95 percent upper confidence limit
USACE	U.S. Army Corps of Engineers
USAG Alaska	U.S. Army Garrison Alaska
VOC	volatile organic compound

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EXECUTIVE SUMMARY

This report presents results of the groundwater monitoring conducted at the Operable Unit 6 (OU6) Former Communications Site (FCS) on Fort Wainwright, Alaska. The Record of Decision (ROD)-selected remedy for OU6 consists of institutional controls (ICs) for soil and monitored natural attenuation (MNA) of contaminants of concern in groundwater. Groundwater monitoring results were evaluated to determine the effectiveness of natural attenuation with respect to ROD remedial goals (RGs), and to support decisions regarding the effectiveness of the ROD remedy.

The OU6 FCS groundwater monitoring program focuses on five areas of groundwater contamination: three adjacent diesel-range organics (DRO) groundwater plumes, one 1,2,3-trichloropropane (TCP) plume, and one trichloroethene (TCE) plume. In addition, groundwater samples are collected from background wells and sentry wells located near a water supply well.

Groundwater samples were collected from 17 wells during August 2022. Samples were submitted for analyses that varied depending upon the plume that was being monitored. Sample results were compared to ROD RGs. Groundwater monitoring results between 2007 and 2022 were used to conduct a statistical evaluation of contaminant trends and plume stability.

DRO Groundwater Plume Summary

Groundwater samples were submitted for analysis of DRO, residual-range organics (RRO), and geochemical parameters from ten wells associated with the DRO plumes. Three wells were sampled within the main DRO plume, two wells within two isolated and adjacent DRO plumes, three wells located downgradient and crossgradient of the DRO plumes, and one background well located upgradient. Although attempted sampling occurred at MW58 within the main DRO plume, a shift within the well casing has pinched sample tubing creating an obstruction preventing access to groundwater.

Three wells exceeded the DRO RG: two wells (MW06A and MW33) associated with the main DRO plume and one well (MW77) in the isolated and adjacent DRO plumes. RRO was below the RG in all wells except for one well in the main DRO plume, MW33. Overall, DRO and RRO concentrations were similar to those measured in 2021. Monitoring well MW33 located within the main DRO plume has historically had, and continues to have, the highest DRO and RRO concentrations at the site.

DRO and RRO concentrations in the interior of the main plume are expected to persist above the RG, due to residual non-aqueous phase liquid (NAPL) remaining in the soils that continues to be solubilized in the groundwater. Higher concentrations of dissolved manganese and iron, and lower concentrations of sulfate, are evidence that metal and sulfate reduction are significant biodegradation processes in the main DRO plume source area. An estimation of the time to cleanup could only be determined for (slightly upgradient) well MW12R (met in 2020) as it was the only well associated with the main DRO plume that had a decreasing trend. When NAPL within the main DRO plume is depleted and no longer generates dissolved contaminant concentrations, decreasing trends in other wells should become apparent.

The two isolated plumes appear to represent smaller, lower concentration source areas. DRO concentrations associated with one plume (identified by MW62) have only exceeded the RG once since 2012, which indicates the residual NAPL in the surrounding soil may be depleted. DRO concentrations associated with the other isolated plume (identified by MW77) have been highly variable and have typically exceeded the RG in recent sampling events from 2018 through 2022. However, this well did not exceed the DRO RG in 2021.

TCP Groundwater Plume Summary

Groundwater samples were submitted for analysis of low level volatile organic compounds and geochemical parameters from three wells associated with the TCP plume, two downgradient sentry wells, and one upgradient background well. Two wells located within the TCP plume (source area well MW79 and downgradient well MW47) consistently have TCP concentrations exceeding the RG. The slightly upgradient well MW08 historically had low-level TCP detections but has not exceeded the RG since 2012. TCP exhibits a decreasing trend in downgradient monitoring well MW47, and the 95 percent upper confidence limit (UCL_{95}) indicates statistical attainment (defined by U.S. Environmental Protection Agency [EPA] as "Attainment Complete") of the RG in 2048. Exceedances will likely continue in the two main TCP plume wells until the suspected TCP soil source is depleted.

Groundwater samples were collected from two downgradient sentry wells (MW78 and MW91) and one upgradient background well (MW13). TCP has never been detected in any of the sentry wells and has only been detected once in the background well (in 2008).

TCE Groundwater Plume Summary

Two wells are sampled within the TCE plume; however, both wells (MW61 and MW80) have had TCE concentrations less than the RG since at least 2011. In addition, statistical analysis continues to show a decreasing trend at MW61. The UCL_{95} of the regression curve suggests that RGs were met in 2014 at MW61. This indicates that the TCE RG has been achieved in accordance with EPA requirements (2014b) with eight or more samples below the RG.

TCE reductive dechlorination daughter products, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride have been detected in one well (MW61) at concentrations less than the EPA maximum contaminant levels by approximately an order of magnitude. Continued formation of daughter products shows that reductive dichlorination is occurring in the slightly anaerobic aquifer.

Institutional Control Inspection Summary

The annual IC inspection of OU6 was conducted during September 2022. The purpose of the inspection was to evaluate the implementation and effectiveness of ICs, to verify that ICs continue to function as intended, and to identify corrective actions based on findings of the site inspection. No deficiencies were identified during the 2022 IC inspections.

1.0 INTRODUCTION

This report documents groundwater sampling activities at the Operable Unit 6 (OU6) Former Communications Site (FCS) on Fort Wainwright, Alaska, during August 2022. This document also provides a summary of the institutional control (IC) inspections conducted at the OU6 site in 2022. The Paragon Professional Services, LLC-Jacobs Engineering Group Inc. Joint Venture is providing this service under contract to the U.S. Army Corps of Engineers (USACE); Contract Number W911KB-20-D-0005, Task Order W911KB-21-F-0111. The work was completed according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites Work Plan (USACE 2022b); under authority of CERCLA; and in compliance with the OU6 Record of Decision (ROD) (U.S. Army Garrison Alaska [USAG Alaska] 2014), Federal Facility Agreement, and State of Alaska regulations.

The primary objectives for the 2022 work at the OU6 FCS described in this report include the following:

- Collect and analyze groundwater for contaminants of concern (COCs) as presented in the OU6 ROD (USAG Alaska 2014), previously detected contaminants (USACE 2012b), and geochemical parameters.
- Compare results with ROD-established remedial goals (RGs) (USAG Alaska 2014).
- Assess current and historical results to identify contaminant trends and predict cleanup dates.
- Review geochemical data for consistency with the selected remedy of monitored natural attenuation (MNA).
- Summarize findings of the IC inspections conducted at OU6 during 2022.

1.1 Project Overview and Monitoring Report Organization

This sampling effort evaluates progress toward achieving remedial objectives in groundwater. The data collected are compared to historical data to evaluate trends in contaminant attenuation over time. A description of the procedures and results associated with these activities are presented in the following sections:

- Section 2 – Field Activities Summary
- Section 3 – Groundwater Sample Results
- Section 4 – Contaminant Trend and Plume Analysis
- Section 5 – Conclusions and Recommendations
- Section 6 – References

Supporting information can be found in the appendices listed. Additional information, such as laboratory reports, is not provided in the hard copy but is provided in the Supplemental Information folder on the CD accompanying this report.

- Appendix A – Sample Summary and Analytical Results
- Appendix B – Chemical Data Quality Report (CDQR) and Alaska Department of Environmental Conservation (ADEC) Laboratory Data Review Checklists
- Appendix C – Field Forms and Notes
- Appendix D – Photograph Log
- Appendix E – Long-Term-Monitoring Optimization Results

1.2 OU6 Source Area Tracking

The OU6 source area is tracked in the ADEC Contaminated Sites database, which is maintained by the ADEC project manager assigned to the source area and by the Army in the Headquarters Army Environmental System (HQAES) for funding purposes. Source area identification and historical spill numbers are presented in Table 1-1.

Table 1-1 Summary of OU6 Source Area Tracking Numbers

Source Area Name[1]	ADEC File Number[2]	ADEC Spill Numbers	ADEC HAZARD ID	Army HQAES Number[2]
OU6 Former Communications Site (Taku Gardens)	108.38.085	05309914702 05309914703 06309911001 06309931201	4140	02871.1088

Notes:

[1] The FCS source area is designated as OU7 in the EPA Superfund Enterprise Management System.

[2] Based on information from the ADEC Contaminated Sites Database available at http://dec.alaska.gov/spar/csp/db_search.htm and the Army HQAES.

For definitions, refer to the Acronyms and Abbreviations section.

1.3 Project Location and Background

1.3.1 Site History

The OU6 FCS is commonly referred to as the Tanana Trails Family Housing Development, formerly known as Taku Gardens Housing Development. This site is located on Fort Wainwright, an active U.S. Army installation occupying a 911,604-acre military reservation east of Fairbanks, Alaska (Figure 1-1). The OU6 FCS is located between Alder and Neely Roads, south of the Bassett Army Hospital. OU6 previously contained or was used for barracks, company headquarters, communications and radar systems, salvage/reclamation yard activities, debris disposal, firefighting training, and possible ammunition storage. The site was selected for construction of future military housing in 2002/2003, and construction began in 2005.

During construction of the housing development in 2005, buried debris of munitions-related items and contamination of soil and groundwater was discovered (Oasis Environmental, Inc. 2007). Review of historical documents and characterization of remedial activities conducted between 2005 and 2013 identified five source areas. Contamination found in these areas included polychlorinated biphenyls, petroleum compounds, chlorinated compounds, volatile organic compounds (VOCs), semivolatile organic compounds, metals, and discarded military munitions and munitions debris. Two of the VOCs that were found to persist in groundwater plumes were trichloroethene (TCE) and 1,2,3-trichloropropane (TCP). The TCE and TCP plumes were likely related to historical salvage and waste operations at the FCS between 1942 and 1962 (USACE 2010).

1.3.2 Investigation Summary

Groundwater monitoring to assess contaminant levels and contaminant trends began at OU6 in 2005 and continued through the remedial investigation (RI) (USACE 2010). Based on this data, MNA was the chosen remedy for the site. The effectiveness of the ROD-selected remedy continues to be assessed through ongoing groundwater monitoring. There are no data from 2013 to 2015, either because data were not

accepted or because sampling did not occur during these years. Since 2005, 96 monitoring wells have been installed at the FCS. The following is a summary of the investigation history at the FCS:

- Initially, 13 temporary monitoring wells (wells generally used to aid in determining the optimal locations for the permanent wells) were installed and sampled during preliminary source evaluations that were conducted between 2005 and 2006.
- An RI was conducted between 2007 and 2010 (USACE 2010):
  - In 2007, 64 monitoring wells were installed to investigate and delineate potential groundwater contamination and to collect data for use in a risk assessment.
  - In 2008, five additional monitoring wells were installed to delineate the boundaries of the contaminated groundwater plumes.
  - In 2009, nine additional monitoring wells were installed as part of the TCP investigation to delineate TCE and diesel-range organics (DRO) plume boundaries.
- Post-RI activities were conducted between 2010 and 2017 (USACE 2012a; 2013; 2014; 2018)
  - In 2010, two deep monitoring wells (sentry wells) were installed outside of the fence on the northeast boundary of the FCS to determine whether TCP contamination threatened the Fort Wainwright drinking water supply wells.
  - In 2012, one deep monitoring well (sentry well) was installed between the TCP plume and the Fort Wainwright drinking water supply wells within the capture zone of the Fort Wainwright drinking water supply wells.
  - In 2013, two unusable wells were decommissioned, and two permanent monitoring wells were installed to serve as replacement monitoring wells.
  - In 2016, 57 monitoring wells were decommissioned or abandoned in place with the approval and guidance of ADEC.
  - In 2017, six additional monitoring wells and one temporary well were decommissioned.
- In 2020, a post-wide preliminary assessment and site inspection for per- and polyfluoroalkyl substances was conducted, which included the northern portion of the OU6 source area (USACE 2022a).

1.3.3 Remedial Summary

Debris, drums, munitions-related items, and contaminated soil encountered during the series of investigation activities were removed to the greatest extent practical and properly disposed of, including an estimated 3,368 cubic yards (cy) of polychlorinated biphenyl-contaminated soil; 66 cy of pesticide-contaminated soil; and 3,354 cy of petroleum, oil, and lubricants)/solvent-contaminated soil (USACE 2014). In addition, 2,934 items of munitions-related debris and 1,061 drums were disposed of. Some residual debris could not be removed from the site because of concerns about the structural stability of nearby buildings. Buildings where debris appeared to continue beneath the foundation and could not be removed are shown on Figure 2-1. Soil contaminated with petroleum, oil, and lubricants and residual concentrations of VOCs, semivolatile organic compounds, pesticides, and explosive compounds remains in the subsurface between 5 and 15 feet below ground surface (bgs). A soil gas investigation was conducted at OU6, which included installation of 110 subslab soil gas probes (one in each housing unit garage) and 53 vadose zone soil gas probes in open areas of the FCS to characterize soil gas and evaluate the potential for contaminants to affect indoor and outdoor air. In addition, 67

passive soil gas samples were installed to locate a possible source area and delineate the extent of TCP contamination in the eastern portion of OU6.

1.3.4 Long-Term Monitoring

Between 2005 and 2013, a total of 96 monitoring wells were installed, including three deep monitoring wells (sentry wells) on the northeast boundary of the site to determine whether contamination threatened the Fort Wainwright drinking water supply wells (USACE 2012a, 2013). Five groundwater plumes have been identified: one TCE plume; one TCP plume; one main DRO plume; and two smaller DRO plumes associated with wells MW62 and MW77.

Since 2010, several wells have been removed from the sampling program and have been decommissioned (USACE 2018). In 2019, the sampling frequency was decreased from semi-annual to annual, and an additional seven wells were removed from the sampling program. Presently, 28 wells exist at the site, 17 of which were included in the 2022 annual monitoring program to assess remaining contaminant levels and trends.

The Fifth Five-Year Review recommended establishing a remedial timeframe for DRO and RRO at OU6 to monitor progress toward RGs. The U.S. Army plans to conduct this assessment and report the findings in a Five-Year Review Addendum.

1.4 Regulatory Considerations

Remedial action objectives (RAOs) and RGs for groundwater were identified in the OU6 ROD (USAG Alaska 2014) and are summarized in Sections 1.4.1 and 1.4.2, respectively.

1.4.1 Remedial Action Objectives

The OU6 ROD established the following RAOs for groundwater COCs at the OU6 FCS:

- Protect against human exposure to COCs in groundwater. This RAO will be attained if the exposure pathway to human receptors is limited or eliminated through administrative processes, or if COC concentrations in groundwater are reduced to meet RGs.
- Return groundwater to its beneficial use as a drinking water source. VOCs are expected to reach RGs within 25 years; it is expected that remediation of DRO and residual-range organics (RRO) will take longer. This RAO will be achieved when groundwater COCs meet RGs.

1.4.2 Project Remedial Goals

Based on the results of the baseline risk assessment for current and projected land use at the site, COCs were identified, and RGs were established. Table 1-2 presents the RGs for the OU6 FCS COCs identified in the ROD.

Table 1-2 OU6 Remedial Goals for Groundwater

COCs	ROD RGs[1] (µg/L)
1,2,3-TCP	0.12
TCE	5
DRO	1,500
RRO	1,100

Notes:

[1] OU6 ROD (USAG Alaska 2014)

For definitions, refer to the Acronyms and Abbreviations section.

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2.0 FIELD ACTIVITIES SUMMARY

This section describes the groundwater sampling activities, investigation-derived waste (IDW) handling activities, and a summary of the annual IC inspections at the OU6 site.

2.1 Groundwater Sampling and Analysis

Groundwater samples were collected from 17 monitoring wells on 7-9 August 2022. Groundwater monitoring was conducted in accordance with the procedures detailed in the 2022 CERCLA Sites Work Plan (USACE 2022b). The general contaminant plume areas and associated monitoring wells sampled during the 2022 monitoring event are depicted on Figure 2-1.

Prior to sampling, the condition of each well was inspected. All wells were found to be in satisfactory condition for continued use in monitoring the site, except well MW58 contained a shift in the well casing at approximately 8 feet bgs pinching the sample tubing. Many attempts were made to remove the tubing, but it could not be removed because the pinching causing an obstruction that prevented sample collection. The static water level was measured to the nearest 0.01 foot, relative to the top of the monitoring well casing. Water levels and total depths were measured using an electronic water level probe. The water level was within the well screen interval for all wells sampled, with four exceptions: MW78, MW80, MW12R, and MW91. Sentry wells MW78 and MW91 were intentionally screened below the water table to monitor potential diving of the contaminant plume toward the pump intake of the nearby water supply well (Building 3559), which is also screened deep; and MW80, located within the TCE plume, was also intentionally screened below the water table to evaluate the vertical extent of contamination. Water level measurements were recorded on groundwater sampling forms (provided in Appendix C) and groundwater elevations were calculated, as further discussed in Section 3.1.

Samples were collected with submersible pumps using dedicated tubing for each monitoring well. The pump intake was placed approximately 1 foot below the water table when the water level was within the screened interval, or within the top foot of the screened interval when the water level was above the screen. Groundwater was purged at a rate between 0.2 and 0.5 liters per minute. Water quality measurements were recorded every 5 minutes and monitoring wells were purged until water quality parameters stabilized. Field parameters were measured using YSI water quality meters installed in a flow through cell and a turbidity meter. The instruments were calibrated at the beginning of each day according to the manufacturer's instructions. Parameters measured included pH, temperature, specific conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity, which were recorded on groundwater sample forms.

Groundwater samples were shipped to EMAX Laboratories, Inc. of Torrance, California, for analysis on 11 August 2022. Groundwater samples were submitted for the analyses as indicated in Table 2-1 on the following page.

Table 2-1 OU6 Groundwater Sampling Summary

Contaminant Area	Number of Wells	Monitoring Wells	Analytical Parameters
Background	2	MW03	DRO, RRO, Dissolved Iron and Manganese, Sulfate
		MW13	VOC-LL, Dissolved Iron and Manganese, Sulfate
DRO Plumes	9	MW06A, MW12R, MW33, MW37, MW62, MW64, MW77, MW82	DRO, RRO, Dissolved Iron and Manganese, Sulfate
1,2,3-TCP Plume	3	MW08, MW47, MW79	VOC-LL, Dissolved Iron and Manganese, Sulfate
TCE Plume	2	MW61, MW80	VOC, VOC-LL, Dissolved Iron and Manganese, Sulfate
Sentry Wells	2	MW78, MW91	VOC-LL

Note:
For definitions, refer to the Acronyms and Abbreviations section.

The sample summary and analytical results tables are presented in Appendix A. An evaluation of data quality is detailed in the CDQR and provided in Appendix B. Groundwater sampling and calibration forms, and a summary of the field parameters (Table C-1) are presented in Appendix C. A photo log of groundwater sampling activities is provided in Appendix D. The laboratory deliverables and additional photographs not included in the report are provided electronically on CD in Supplemental Information. Groundwater sample results are discussed in Section 3.

2.2 Decontamination

Reusable sampling equipment consisted of a water level meter and submersible pumps, which were decontaminated between every well. The decontamination procedure consisted of an Alconox detergent wash followed by a potable water rinse. The decontamination water generated during groundwater sampling was containerized for offsite disposal.

2.3 Investigation-derived Waste Handling and Disposal

IDW generated during OU6 field activities in 2022 included purge water and general refuse (e.g., nitrile gloves, paper towels) from groundwater monitoring activities. All IDW and other waste streams were managed according to the procedures outlined in the 2022 CERCLA Sites Work Plan (USACE 2022b).

Purge water was containerized at the time of sampling in 55-gallon drums. The drums were labeled with a unique ID and a form was completed documenting the well ID, container ID, and purge volume from each well. The drums were taken to the Fort Wainwright Hazardous Waste Consolidation Facility (Building 3489) for temporary storage since the Defense Environmental Restoration Account building was closed for building upgrades.

The water was characterized using the laboratory results from the individual wells. Additionally, purge water from the associated drum containing the OU6 wells was sampled for per- and polyfluorinated substances to characterize waste. Sample results and the IDW tracking forms were provided to Environmental Compliance Consultants for the preparation of waste transportation requests, proper manifesting, and transportation & disposal in accordance with the CERCLA offsite rule. The nonhazardous solid wastes (e.g., disposable tubing, nitrile gloves, paper towels) were disposed of at the Fairbanks North

Star Landfill. Complete documentation of IDW analytical results and disposal will be included in a forthcoming 2022 IDW management technical memorandum (anticipated fall 2023).

2.4 Institutional Control Inspections

IC inspections were conducted at OU6 during September 2022. A summary of the IC objectives and 2022 inspection findings are presented in this section. Complete inspection results are presented in the 2022 Fort Wainwright IC Inspection Report (anticipated winter 2023).

The purpose of the inspection was to evaluate the implementation and effectiveness of ICs, to verify that ICs continue to function as intended, and to identify corrective actions based on findings of the site inspection. The 2022 IC inspections were conducted at the OU6 FCS in accordance with the Institutional Controls Implementation Action Plan, which was included in the 2015 remedial design/remedial action work plan (USACE 2015). The specific objectives of the ICs at OU6 are as follows:

- Prevent access to or use of the groundwater beneath OU6 until RGs are met.
- Maintain the effectiveness of the MNA remedy for groundwater by developing specific operation and maintenance activities for the monitoring well network, which will remain in place until RGs are met.
- Prevent unauthorized access to soil greater than 6 inches bgs until RGs are met.

In addition to an on-site inspection, reviews of the Fort Wainwright IC geographic information system layer and the site-specific information in the ADEC Contaminated Sites database were conducted.

At the approval of the remedial project managers, IC inspection of residences were reduced from 100% to 20% beginning in 2019. In 2022, 11 residential units (22 individual yards) were inspected in accordance with the 2022 CERCLA Sites Work Plan (USACE 2022b). All public use areas (i.e., playgrounds, open area/play areas, summer lawn, and pavilion area) and the two mechanical buildings continue to be inspected annually.

A summary of 2022 IC inspection findings is presented in the following list, and the complete inspection results are presented in the 2022 Fort Wainwright IC inspection report (anticipated spring 2023):

- Soil disturbances greater than 6 inches bgs were not observed and the dig permits were reviewed.
- Unauthorized installation of water wells was not observed.
- Unauthorized use of the groundwater beneath OU6 was not observed.
- All 28 wells were secured with undamaged exteriors.

Based on the findings from the source area inspections, it was determined that OU6 ICs are being implemented and are effective.

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3.0 GROUNDWATER SAMPLE RESULTS

This section presents the 2022 groundwater monitoring results for OU6. Current and historical data were used to support statistical and geochemical assessments of natural attenuation of groundwater contaminated with DRO, RRO, TCP, and TCE within the OU6 source area. The general locations of the contaminant plumes are depicted on Figure 2-1. Monitoring wells with current and/or historical DRO/RRO, TCP, and TCE results exceeding RGs are shown on Figures 3-2, 3-3, and 3-4, respectively. Complete 2022 analytical results are presented in Appendix A.

3.1 Groundwater Elevations

Groundwater levels were measured for the purposes of mapping groundwater elevation contours during the August 2022 sampling event. Due to the flat hydraulic gradient on Fort Wainwright, slight variabilities in water levels over the course of a sampling event if precipitation occurs. No precipitation occurred during the 2-day sampling event. The contours constructed from the water level measurements are depicted on Figure 3-1 and indicate that the groundwater flow direction is toward the northwest, consistent with the regional groundwater flow direction. The groundwater levels measured in 2019, 2020, and 2021 for depicting contours are also shown in Table 3-1 (located at the end of Section 3) for comparison. The depth to groundwater measured ranged from approximately 11.4 to 14.3 feet bgs.

Groundwater elevations measured in August 2022 were approximately 0.5 feet lower than the August 2021 elevations. In general, higher contaminant concentrations have been measured in areas with residual non-aqueous phase liquid (NAPL) when lower groundwater elevations are observed.

3.2 DRO Plume Sample Results

Ten monitoring wells are typically monitored for DRO and RRO: four wells (MW06A, MW12R, MW33, and MW58) located within the main DRO plume; two wells (MW62 and MW77) located within two smaller isolated DRO plumes; three wells (MW37, MW64, and MW82) located downgradient of the main and isolated DRO plumes; and one well (MW03) located upgradient that serves as a background well. In-plume well MW58 could not be sampled in 2022 due to an obstructed casing. Although not analyzed for DRO and RRO, MNA results for background well MW13 is also included in Table 3-2 (located at the end of Section 3) for comparison. DRO and RRO results between 2016 and 2022 are presented on Figure 3-2; and DRO, RRO, and MNA parameters for 2018 through 2022 sampling events are presented in Table 3-2 (located at the end of Section 3).

In general, DRO concentrations in 2022 were similar to concentrations observed in 2021. This may have been a result of the slightly lower groundwater elevations (approximately 0.5 feet) at the time of the 2022 sampling event. Typically, in areas where residual NAPL exists, highest contaminant concentrations are measured when groundwater elevations are lowest as NAPL in the smear zone drains onto the groundwater surface.

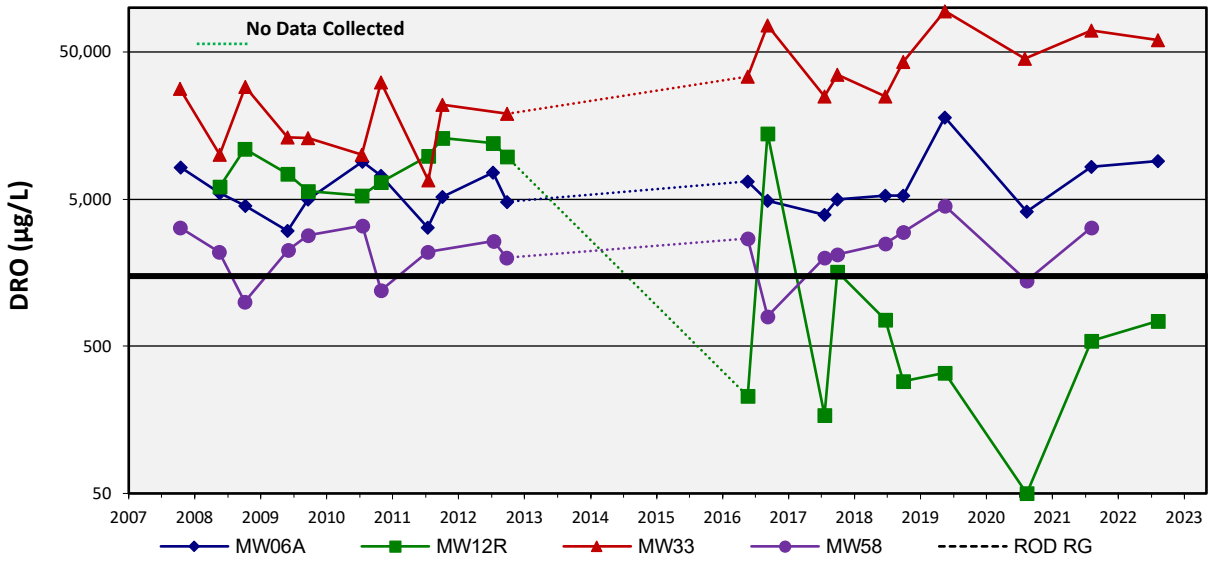
3.2.1 DRO and RRO in the Main DRO Plume

DRO concentrations exceeded the RG in main DRO plume wells MW06A and MW33 in 2022. DRO has consistently exceeded the RG (1,500 micrograms per liter [µg/L]) in wells MW06A and MW33 since sampling began in 2007, with the highest concentrations observed in MW33 ranging between 6,700 and 95,000 J µg/L. DRO periodically exceeds the RG in MW12R, with the last exceedance shown in 2017 at a concentration of 1,600 µg/L.

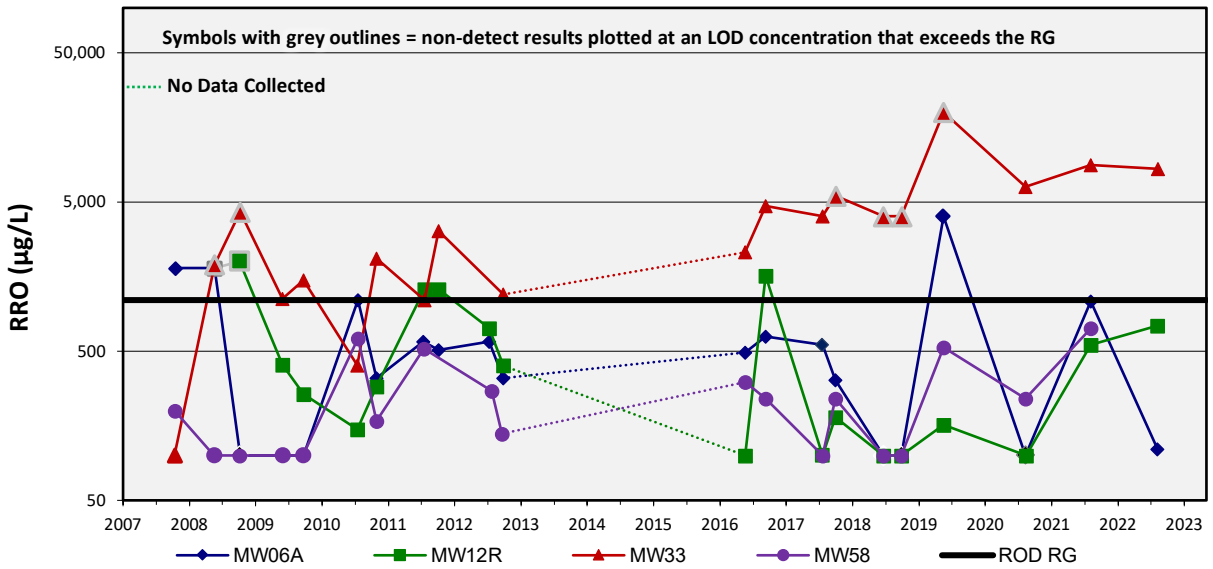
RRO exceeded the RG (1,100 µg/L) in one well, MW33, at a concentration of 8,300 µg/L in 2022. RRO detections have been shown to sporadically exceed the RG in the four main DRO plume wells, with the majority of the exceedances observed in MW33.

Graphs 3-1 and 3-2 show time-series plots of DRO and RRO concentrations, respectively, for the four main DRO plume wells. Note that RRO has periodically not been detected in the main DRO plume wells; however, several limits of detection (LODs) were elevated above the RG. The elevated LODs are predominately observed in MW33 due to matrix interference and/or sample dilutions caused by high levels of petroleum contamination. These data points are depicted with white outlines on Graph 3-2.

Graph 3-1 DRO Concentrations in the Main DRO Plume



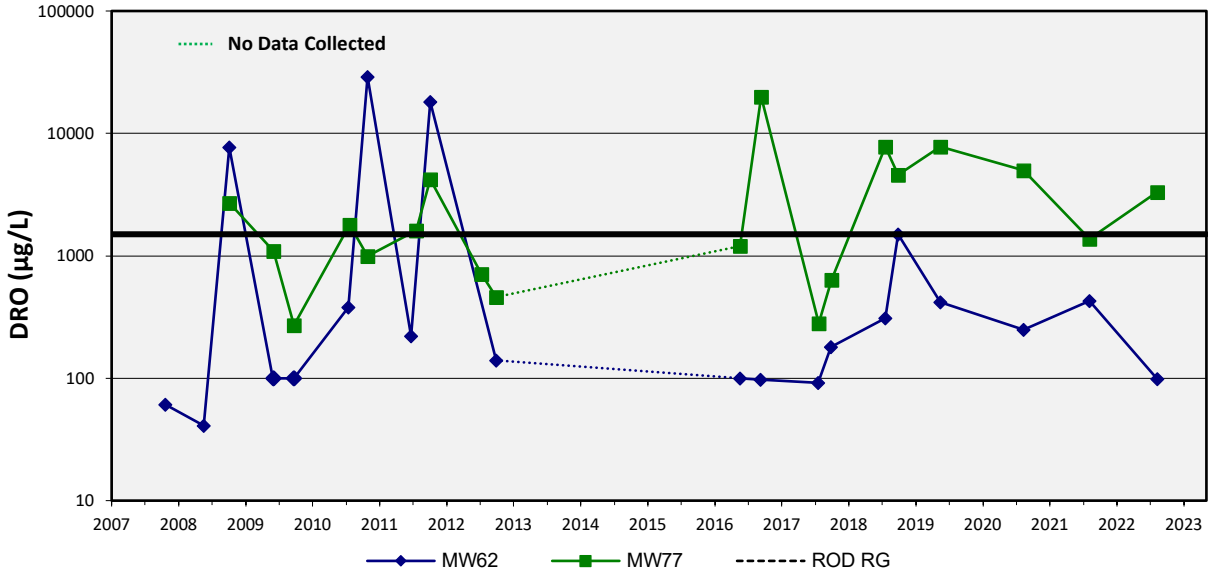
Graph 3-2 RRO Concentrations in the Main DRO Plume



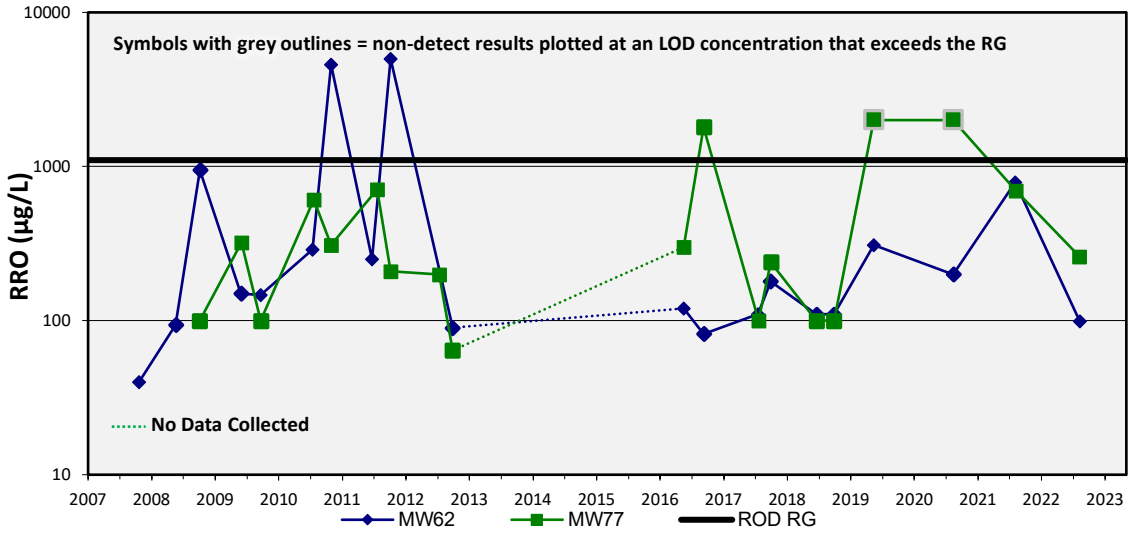
3.2.2 DRO and RRO in the Two Isolated DRO Plumes

Monitoring wells MW62 and MW77 are located within isolated DRO plumes positioned approximately 150 and 400 feet, respectively, north-northeast of the main DRO plume. The DRO concentration exceeded the RG in MW77 in five of the six most recent sampling events, including 2022 (3,300 µg/L). The DRO concentration in MW62 equaled the RG during the September 2018 sampling event but has been below the RG for the last four sampling events with a nondetect result in 2022. Prior to 2018, the last DRO exceedance observed in MW62 was in 2011. RRO in MW77 was below the RG but detected below the limit of detection in 2022 at a concentration of 360 J µg/L and was nondetect in MW62. RRO last exceeded in wells MW62 and MW77 in 2011 and 2016, respectively, and since then RRO has been detected at concentrations approximately an order of magnitude below the RG or has not been detected. However, the non-detects in well MW77 during 2019 and 2020 had LODs above the RG. Graphs 3-3 and 3-4 present historical data collected at monitoring wells MW62 and MW77 for DRO and RRO, respectively, and the non-detect RRO results in MW77 during for the 2019 and 2020 sampling events are depicted with white outlines on Graph 3-4.

Graph 3-3 DRO Concentrations in Isolated Plumes MW62 and MW77



Graph 3-4 RRO Concentrations in Isolated Plumes MW62 and MW77



3.2.3 DRO and RRO in Downgradient Wells

Three monitoring wells located downgradient of the DRO plumes were sampled. The well locations relative to the main and isolated DRO plumes are as follows and are shown on Figure 3-2.

- MW37 is located downgradient of the main DRO plume.
- MW64 is located downgradient of the isolated MW62 DRO plume.
- MW82 is located downgradient of the isolated MW77 DRO plume.

None of the wells have had DRO or RRO concentrations exceeding the RG in any sampling event.

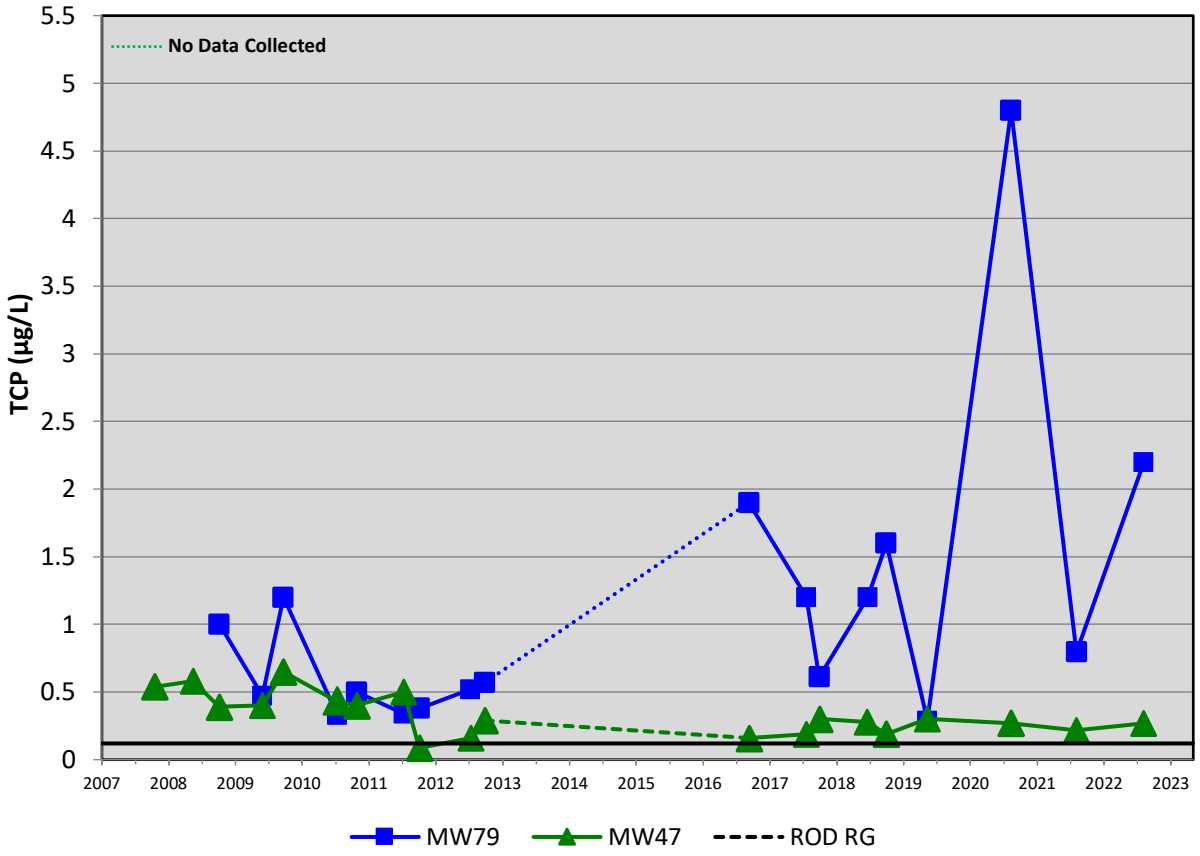
3.3 TCP Plume Sample Results

The TCP plume is characterized by two main source area wells (MW47 and MW79) and one upgradient well (MW08). In addition, one further upgradient background well (MW13) and two downgradient sentry wells (MW78 and MW91) are being monitored for potential TCP contamination. The sentry wells are screened below the water table to evaluate potential diving contaminants that may impact the deep-screened water supply wells (Building 3559). The locations of these wells are shown on Figure 3-3.

TCP has exceeded the RG (0.12 µg/L) in source area well MW79 during every sampling event since 2008 and in MW47 during every sampling event except in 2011, as shown on Graph 3-5. TCP exceeded the RG in MW79 and MW47 at concentrations of 2.2 µg/L and 0.27 µg/L, respectively in 2022. Although TCP exceeds the RG in MW79 and MW47 in nearly all sampling events, the TCP concentrations in downgradient well MW47 has a decreasing trend, as further discussed in Section 4.3. TCP is occasionally detected in the upgradient well MW08 and was detected in 2022 at a level below the RG at 0.006 µg/L. TCP has never been detected in downgradient sentry well MW91 and is occasionally detected at low levels in MW78 with a TCP concentration of 0.0038 J µg/L in 2022.

TCP results between 2016 and 2022 are presented on Figure 3-3; and TCP and MNA parameters for 2018 through 2022 sampling events are presented in Table 3-3 (located at the end of Section 3).

Graph 3-5 TCP Concentrations in MW47 and MW79



3.4 TCE Plume Sample Results

Two monitoring wells (MW61 and MW80) were sampled to evaluate the TCE and other chlorinated solvents within the FCS. Well MW80 was screened below the water table to evaluate the vertical profile of TCE contamination. The well locations and TCE results for 2016 through 2022 sampling events are presented on Figure 3-4; and TCE (and associated daughter products) and MNA parameters for 2018 through 2022 sampling events are summarized in Table 3-3 (located at the end of Section 3).

TCE concentrations in MW61 have steadily declined since 2007 and last exceeded the RG (5 µg/L) in October 2010. TCE has never exceeded the RG in MW80 and was last detected in this well in October 2010, indicating there is not a diving plume present in this area.

TCE reductive dechlorination daughter products, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride, are not identified as COCs in the OU6 ROD since groundwater samples did not exceed the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) (EPA 2009) in pre-ROD investigations. These daughter products have previously been detected in well MW61, including detections of both DCE compounds and vinyl chloride in 2022. However, all detections have remained below MCLs by approximately an order of magnitude.

3.5 Natural Attenuation Evaluation

The OU6 ROD selected MNA (with ICs) as the remedy for contaminated groundwater at the FCS. To address MNA, groundwater geochemistry has been evaluated to assess the potential for biodegradation of groundwater contaminants. Fuel contaminants such as DRO are more rapidly degraded under aerobic conditions, while chlorinated contaminants like TCP and TCE are more effectively degraded under reduced conditions. Groundwater at Fort Wainwright is generally slightly aerobic with background DO concentrations typically around 2 milligrams per liter (mg/L).

The natural attenuation evaluation included analysis of field and laboratory data. Field parameters, most importantly DO and ORP, are summarized in Tables 3-2 and 3-3 (located at the end of Section 3). All field parameter results are presented on groundwater sampling forms and Table C-1 included in Appendix C. Laboratory analyses conducted in 2022 included dissolved iron, dissolved manganese, and sulfate.

3.5.1 Geochemical Conditions Within the DRO Plumes

Geochemical data associated with the DRO plumes is presented in Table 3-2 (located at the end of Section 3). For comparison purposes, data associated with background well MW13 is included. Data for background well MW03 is also summarized in the table; however, the data (elevated dissolved iron) suggests that the well does not represent background conditions. The geochemical data indicate that groundwater near MW33 has the strongest reducing conditions, consistent with having the highest DRO concentrations. A summary of the interpretations of the 2022 geochemical data is presented following:

- DO concentrations were relatively low (0.44 mg/L) in DRO main plume wells. For wells MW62 and MW77 (located in the isolated DRO plume areas), DO ranged from 0.7 to 0.92 mg/L. Aerobic biodegradation is likely to be limited for in-plume wells based on the low dissolved oxygen levels.
- ORP values measured in three of the four main DRO plume source area wells were negative, ranging from -75 to -106 millivolts (mV). The negative ORP values within the main DRO plume are consistent with the conversion of oxygen and other electron acceptors to their reduced forms during biodegradation. Well MW12R had a positive ORP value of 76.2 mV and was less than the DRO RG.
- Ferrous iron (identified by the dissolved [field-filtered] iron analysis) is a soluble redox indicator produced under reducing conditions. Background dissolved iron concentrations at Fort Wainwright are typically around 1 mg/L. Dissolved iron in main DRO plume wells ranged between 28 to 77 mg/L. The highest dissolved iron concentrations are consistently measured in MW33, corresponding to the highest DRO concentration. Elevated ferrous iron concentrations indicate iron reduction is likely due to biodegradation of fuel constituents (Wiedemeier 1999).
- Manganese, a soluble redox indicator produced under reducing conditions, ranged between 1.37 and 6.18 mg/L in the three main DRO plume wells, while the manganese concentration in background well MW13 was 0.401 mg/L. The highest manganese concentrations were detected in MW33, corresponding to the highest DRO concentration. Elevated manganese concentrations indicate manganese reduction has occurred likely due to biodegradation of DRO and RRO, although to a lesser extent than iron reduction (Wiedemeier 1999).
- Sulfate, an electron acceptor utilized under strongly reducing conditions, ranged in concentration between 5.91 and 32.8 mg/L in the three main DRO plume wells, compared to 62.4 mg/L in background well MW13. The lowest sulfate concentrations of 5.91 and 5.92 mg/L were detected in MW33 and MW06A, respectively. Low in-plume sulfate concentrations likely reflect its

conversion to sulfide during anaerobic biodegradation after consumption of the other electron acceptors (Wiedemeier 1999).

3.5.2 Geochemical Conditions in the TCP Plume

Geochemical data for wells associated with the TCP plume (MW47, MW79, and MW08) are similar to background well MW13, with DO concentrations near background (2.49 mg/L) in wells MW47 (1.57 mg/L) and MW08 (3.97 mg/L) within values that are typically observed in these wells. Other geochemical parameters such as ORP, dissolved iron and manganese, and sulfate did not indicate reductive dechlorination within the TCP plume.

TCP is a persistent groundwater pollutant that has low abiotic and biotic degradation rates (EPA 2014a). No microbes capable of using TCP as a carbon source for growth under aerobic conditions have been isolated, but TCP may serve as an electron acceptor under anaerobic conditions (Yan et al. 2009). Data are limited, so it is unclear if any biological processes are contributing to the attenuation of the TCP plume. Physical processes that might lead to observed decreases in TCP concentration include advection, dispersion, and dilution.

3.5.3 Geochemical Conditions in the TCE Plume

Elevated dissolved iron (8.87 and 10.9 mg/L) and manganese (1.67 and 0.829 mg/L) in the two TCE plume wells (MW61 and MW80) indicate that groundwater in this area is reduced, creating a favorable environment for reductive dechlorination of TCE. The presence of daughter products cis-1,2-DCE and trans-1,2-DCE in MW61 demonstrate that reductive dechlorination is occurring.

3.6 Groundwater Sample Data Quality

Project and quality control analytical data were reviewed 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 CERCLA Sites Work Plan (USACE 2022b); ADEC Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data Technical Memo (ADEC 2019); and U.S. Department of Defense *Quality Systems Manual (QSM) for Environmental Laboratories,* Version 5.4 (2021).

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 specific data quality issues found during the review are presented in the CDQR and ADEC Laboratory Data Review Checklists in Appendix B. The reviewed data are presented in Appendix A, Table A-2, and are used in tables and figures throughout the report.

Table 3-1 Well Information and Groundwater Elevations

Well ID	Well Location Relative to Contaminant Source	Total Well Depth (feet btoc)	Screened Interval (feet btoc)	Top of Casing (NAVD88 feet) (surveyed 2019)	May-2019		August 2020		July 2021		August 2022	
					Water Level (feet btoc)	Water Elevation (NAVD88 feet)	Water Level (feet btoc)	Water Elevation (NAVD88 feet)	Water Level (feet btoc)	Water Elevation (NAVD88 feet)	Water Level (feet btoc)	Water Elevation (NAVD88 feet)
Background Wells												
MW03	Background	22.3	12.3-22.3	450.61	16.17	434.44	13.11	437.50	15.30	435.31	14.67	435.94
MW13	Background	19.2	9.2-19.2	452.05	16.95	435.10	13.83	438.22	15.92	436.13	15.38	436.67
DRO PLUME WELLS												
MW06A	Source Area	22.7	12.5-22.5	450.73	16.55	434.18	13.55	437.18	15.82	434.91	15.19	435.54
MW12R	Source Area	22.5	12.4-22.4	447.66	13.39	434.27	10.30	437.36	12.59	435.07	12.00	435.66
MW33	Source Area	20.9	10.8-20.8	450.64	16.42	434.22	13.36	437.28	15.65	434.99	15.02	435.62
MW37	Downgradient	19.4	9.3-19.3	449.94	16.02	433.92	13.60	436.34	15.41	434.53	14.82	435.12
MW58	Source Area	18.3	8.2-18.2	447.96	13.82	434.14	11.30	436.66	13.12	434.84	NM[1]	NM[1]
MW62	Source Area	20.1	10.0-20.0	449.02	14.76	434.26	11.64	437.38	13.97	435.05	13.34	435.68
MW64	Downgradient	20.1	10.0-20.0	449.58	15.33	434.25	12.30	437.28	14.59	434.99	14.00	435.58
MW77	Source Area	22.7	12.6-22.6	452.62	18.61	434.01	15.63	436.99	17.96	434.66	17.38	435.24
MW82	Downgradient	21.8	11.7-21.7	451.74	17.99	433.75	15.10	436.64	17.47	434.27	16.86	434.88
1,2,3-TCP Plume Wells												
MW08	Upgradient	22.2	12.1-22.1	453.61	18.77	434.84	15.70	437.91	17.90	435.71	17.27	436.34
MW47	Source Area	19.8	9.8-19.8	451.27	16.72	434.55	13.68	437.59	15.64	435.63	15.26	436.01
MW79	Source Area	21.6	11.5-21.5	453.45	18.79	434.66	15.77	437.68	18.05	435.40	17.47	435.98
TCE Plume Wells												
MW61	Source Area	20.2	10.1-20.1	449.88	15.46	434.42	12.46	437.42	14.72	435.16	14.13	435.75
MW80	Upgradient	46.8	26.8-46.8	449.43	14.99	434.44	11.96	437.47	14.25	435.18	13.66	435.77
Sentry Wells												
MW78	Sentry	37.2	27.2-37.2	451.66	17.31	434.35	14.27	437.39	16.58	435.08	15.87	435.79
MW91	Sentry	76.1	56.0-76.0	451.77	17.45	434.32	14.37	437.40	16.83	434.94	16.15	435.62

Notes:

[1] The well was not sampled due to an obstruction in the well casing.

For definitions, refer to the Acronyms and Abbreviations section.

Table 3-2 2018-2022 Groundwater Sample Results - Background and DRO Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes	
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	DRO (µg/L)	RRO (µg/L)
ROD RGs[1]			**NE**	**NE**	**NE**	**NE**	**NE**	**1,500**	**1,100**
Background	MW03	6/20/2018	0.61	-74.3	14.1	0.916	43.0	230	ND(200)
		9/21/2018	1.42	-92.0	12.5	0.798	44.2	270	ND(200)
		5/13/2019	0.55	-63.9	12.7	0.745	50.7	300 B	180 J,B
		8/11/2020	0.65	41.2	13.4	0.763	14.4	ND(50)	ND(200)
		8/6/2021	0.24	-109.2	13.6	0.804	43.8	276 J,B	281 J,B
		8/8/2022	0.62	-63.8	11.2	0.685	40.6	ND(110)	ND(110)
	MW13[3]	6/25/2018	2.32	31.6	1.00	0.323	39.8	NA	NA
		9/21/2018	0.60	57.2	0.455	0.0851	57.0	NA	NA
		5/13/2019	0.72	32.9	1.86	0.744	41.1	NA	NA
		8/12/2020	0.91	198.9	0.238	0.110	41.3	NA	NA
		8/5/2021	0.67	22.9	0.988	0.846	49.1	NA	NA
		8/7/2022	2.49	-26.9	0.188 J	0.401	62.4	NA	NA
Main DRO Plume	MW12R	6/20/2018	1.15	-152.3	11.2	1.02	30.1	760	ND(200)
		9/26/2018	1.51	-109.0	9.32	0.897	33.4	290	ND(200)
		5/14/2019	0.33	-104.1	9.90	0.906	35.4	330 B	160 J,B
		8/13/2020	2.87	109.3	9.55	0.916	8.5	ND(50)	ND(200)
		8/5/2021	0.01	-132.2	11.5	1.07	31.3	542 J,B	549 B
		8/8/2022	0.45	76.2	13.1	1.02	32.8	740	ND(110)
	MW33	6/20/2018	0.54	-132.0	45.9	3.17	4.0	**25,000**	ND(4,000)
		6/20/2018[2]			43.8	2.96	4.0	**25,000**	ND(4,000)
		9/26/2018	1.30	-109.0	43.9	3.58	6.8	**39,000**	ND(4,000)
		9/26/2018[2]			42.7	3.38	7.0	**43,000**	ND(4,000)
		5/14/2019	0.41	-109.4	43.4	2.88	4.5	**69,000 J**	ND(20,000)
		5/14/2019[2]			45.0	3.06	4.1	**95,000 J**	ND(20,000)
		8/12/2020	0.39	-29.7	59.8	5.69	2.9	**45,000**	**5,700 J**
		8/12/2020[2]			58.7	5.62	5.8	**55,000**	**6,300 J**
Main DRO Plume	MW33	8/5/2021	0.33	-133.3	55.1	4.47	6.12	**70,300 J-**	**8,890**
		8/5/2021[2]			55.6	4.47	6.12	**58,900 J-**	**8,160**
		8/9/2022	0.44	-106.1	74.9	6.18	5.91	**48,000**	**8,300**
		8/9/2022[2]			77.8	6.07	7.02	**60,000**	**7,200**

Table 3-2 2018-2022 Groundwater Sample Results - Background and DRO Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes	
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	DRO (µg/L)	RRO (µg/L)
ROD RGs[1]			**NE**	**NE**	**NE**	**NE**	**NE**	**1,500**	**1,100**
	MW06A	6/20/2018	0.81	-153.2	20.2	1.37	16.6	**5,300**	ND(1,000)
		9/26/2018	1.19	-60.4	15.2	1.03	16.4	**5,300**	ND(400)
		5/16/2019	0.39	-86.5	19.5	1.18	12.5	**18,000**	ND(4,000)
		8/12/2020	1.28	134.1	17.7	1.18	4.9	**4,100**	ND(1,000)
		8/6/2021	0.16	-118.2	24.2	1.51	8.64	**8,320**	1,080 B
		8/8/2022	0.41	-75.5	28.8	1.66	5.92	**9,100**	740
	MW58	6/21/2018	1.63	-68.5	14.0	1.13	16.8	**2,300**	ND(400)
		6/21/2018[2]			12.4	1.10	17.3	**2,500**	ND(400)
		9/27/2018	1.60	-108.5	15.9	1.13	19.2	**3,000**	ND(200)
		9/27/2018[2]			16.0	1.14	19.2	**3,600**	ND(200)
		5/16/2019	0.68	-67.5	17.5	1.10	15.8	**4,500**	320 J,B
		5/16/2019[2]			17.4	1.06	15.7	**4,500**	530 J,J+,B
		8/12/2020	7.04[4]	140.7	5.07	0.692	7.5	1,400	240 J
		8/5/2021	9.42[5]	-106.9	21.0	1.37	15.2	**3,210 B**	710 B
		The well was not sampled in August 2022 due to an obstruction in the well casing.							
	MW37 (downgradient)	6/21/2018	1.17	97.70	ND(0.03)	0.159	29.1	1,000	ND(200)
		9/26/2018	1.34	68.10	ND(0.03)	0.255	32.3	950	ND(200)
		5/14/2019	0.70	66.90	0.0774 B	1.11	27.9	1,400	210 J,B
		8/12/2020	6.33[4]	140.8	0.0585 B	0.0380	32.2	290	ND(200)
		8/6/2021	0.92	117.7	ND(0.3)	0.1110	12.6	236 J,B	ND(250)
		8/8/2022	2.55	147.9	ND (0.05)	0.000553 B	8.07	ND(110)	ND(110)
Isolated DRO Plumes	MW62	6/21/2018	0.38	14.5	1.46	1.39	46.0	310	ND(200)
		9/27/2018	0.55	18.2	1.54	1.27	48.5	**1,500**	ND(200)
		5/14/2019	0.63	165.1	0.127	1.43	79.5	450	310 J,B
		8/12/2020	0.95	100.1	0.026 J,B	0.832	27.8	250	ND(200)
		8/5/2021	8.24[5]	83.9	ND(0.3)	1.37	67.1	429 J,B	791 B
		8/9/2022	0.92	168.3	ND (0.05)	1.03	50.1	ND(99)	ND(99)
Isolated DRO Plumes	MW64 (downgradient of MW62)	6/21/2018	2.38	-15.70	2.78	0.415	12.8	ND(50)	ND(200)
		9/27/2018	1.81	-28.50	1.59	0.359	18.4	ND(50)	ND(200)
		5/16/2019	0.47	-37.4	2.92	0.423	9.4	ND(50)	ND(200)

Table 3-2 2018-2022 Groundwater Sample Results - Background and DRO Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes	
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	DRO (µg/L)	RRO (µg/L)
ROD RGs[1]			**NE**	**NE**	**NE**	**NE**	**NE**	**1,500**	**1,100**
		8/13/2020	10.9[4]	123.7	0.0585 B	0.0379	32.2	290	ND(200)
		8/6/2021	0.20	-71.3	2.43	0.322	11.1	ND(306)	325 J,B
		8/8/2022	2.13	131.8	0.31	0.186	15.8	ND(100)	ND(100)
	MW77	6/21/2018	0.42	47.6	0.251	1.11	64.3	**7,800**	ND(1,000)
		9/27/2018	0.10	19.9	ND(0.03)	0.667	53.9	**4,600**	ND(200)
		5/15/2019	NM	NM	0.0767 B	0.956	55.7	**7,800**	ND(2,000)
		8/12/2020	2.74	155.7	0.0214 B,J	0.617	45.9	**5,000**	ND(2,000)
		8/6/2021	0.23	119.4	ND(0.3)	0.583	42.1	1,380 B	696 B
		8/8/2022	0.7	138.3	0.064 B	0.526	44.9	**3,300**	360 J
	MW82 (downgradient of MW77)	6/21/2018	1.87	126.1	ND(0.03)	0.0875	33.2	140	ND(200)
		9/27/2018	1.57	61.10	ND(0.03)	0.0244	43.0	ND(50)	ND(200)
		5/14/2019	0.68	102.0	0.0244 J,B	0.265	13.7	210 B	130 J,B
		8/12/2020	5.16[4]	148.8	0.0607 B	0.0250	11.2	ND(50)	ND(200)
		8/6/2021	10.9[5]	139.6	ND(0.3)	0.079	24.9	ND(300)	367 J,B
		8/8/2022	2.17	147.9	ND (0.05)	0.0104	24	ND(100)	ND(100)

Notes:
For definitions, refer to Acronyms and Abbreviations section
NE = not established
Red and bold results exceed RGs
Gray shaded results are non-detect with LODs that exceed the RG
[1] RG established in the OU6 ROD
[2] Sample is a field duplicate of the sample immediately preceding.
[3] Background well MW13 is included with the DRO plume wells for comparison of background geochemical parameters.
[4] Elevated DO concentrations in select wells in 2020 were due to a malfunctioning DO probe isolated to a single instrument.
[5] Elevated DO concentrations in select wells in 2021 was due to the presence of air bubbles in the purge water caused by operator error.
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 failure. If result is biased low or high, it is specified as "J-" and "J+".
ND - not detected (LOD presented in parentheses)

Table 3-3 2018-2022 Groundwater Sample Results - TCP and TCE Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes		Non-ROD Analytes (TCE Degradation Products)		
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	TCP (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
ROD RG[1,2]			NE	NE	NE	NE	NE	0.12	5	70[2]	100[2]	2[2]
Background	MW13	6/25/2018	2.32	31.6	1.00	0.323	39.8	ND(0.005)	NA	NA	NA	NA
		9/21/2018	0.60	57.2	0.455	0.0851	57.0	ND(0.005)	NA	NA	NA	NA
		5/13/2019	0.72	32.9	1.86	0.744	41.1	ND(0.005)	NA	NA	NA	NA
		8/12/2020	0.91	198.9	0.238	0.110	41.3	ND(0.005)	NA	NA	NA	NA
		8/5/2021	0.67	22.9	0.988	0.846	49.1	ND(0.005)	NA	NA	NA	NA
		8/8/2022	2.49	-26.9	0.188 J	0.401	62.4	ND(0.005)	NA	NA	NA	NA
TCP Plume	MW47	6/22/2018	1.94	81.8	0.0380 J	0.0211	37.1	**0.28**	NA	NA	NA	ND(0.02)
		6/22/2018[3]			ND(0.04)	0.0189	35.9	**0.28**	NA	NA	NA	ND(0.02)
		9/21/2018	4.23	53.2	ND(0.03)	0.0295 J+	39.5	**0.19**	NA	NA	NA	ND(0.02)
		9/21/2018[3]			ND(0.03)	0.0311 J+	39.4	**0.20**	NA	NA	NA	ND(0.02)
		5/13/2019	1.01	144.1	0.0483 J	0.148	36.7	**0.30**	NA	NA	NA	ND(0.02)
		5/13/2019[3]			0.0353 J	0.146	32.6	**0.31**	NA	NA	NA	ND(0.02)
		8/11/2020	6.88[4]	114.8	ND(0.03) J-	0.004	39.9	**0.27**	NA	NA	NA	ND(0.02)
		8/5/2021	1.62	39.0	ND(0.3)	0.031	36.2	**0.22**	NA	NA	NA	NA
		8/7/2022	1.57	148.9	ND (0.05)	0.0275	44.5	**0.27**	NA	NA	NA	ND(0.03)
	MW79	6/20/2018	1.40	-21.2	3.34	0.612	30.9	**1.2**	NA	NA	NA	ND(0.02)
		9/26/2018	1.51	-8.7	1.88	0.496	42.3	**1.6**	NA	NA	NA	ND(0.02)
		5/14/2019	0.82	-55.8	10.6	0.793	29.2	**0.29**	NA	NA	NA	ND(0.02)
		8/11/2020	3.30	130.6	0.682	0.446	57.6	**4.8**	NA	NA	NA	ND(0.02)
		8/4/2021	0.45	0.646	3.49	0.509	33.3	**0.80**	NA	NA	NA	NA
		8/8/2022	1.6	128.6	0.887	0.406	50.3	**2.2**	NA	NA	NA	ND(0.03)
	MW08	6/20/2018	1.39	117.1	ND(0.03)	0.0047 J	31.8	ND(0.005)	NA	NA	NA	ND(0.02)
		9/26/2018	1.66	123.6	ND(0.03)	0.0026 J,B	31.9	0.062	NA	NA	NA	ND(0.02)
		5/13/2019	2.21	141.8	0.0146 J	0.0141	40.0	ND(0.005)	NA	NA	NA	ND(0.02)
		8/11/2020	1.92	140.2	ND(0.03) J-	0.0081	42.7	ND(0.005)	NA	NA	NA	ND(0.02)
		8/5/2021	2.69	71.7	ND(0.3)	0.716 J	54.5	0.016	NA	NA	NA	NA
		8/7/2022	3.97	139.7	ND (0.05)	0.00128 B	51.9	0.006	NA	NA	NA	ND(0.03)
	MW61	6/22/2018	0.84	26.9	12.2	1.87	40.5	ND(1.0)	0.73 J	5.0	5.9	ND(0.3)

Table 3-3 2018-2022 Groundwater Sample Results - TCP and TCE Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes		Non-ROD Analytes (TCE Degradation Products)		
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	TCP (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
ROD RG[1,2]			**NE**	**NE**	**NE**	**NE**	**NE**	**0.12**	**5**	**70[2]**	**100[2]**	**2[2]**
TCE Plume		6/22/2018[3]			NA	NA	NA	ND(1.0)	0.79 J	4.5	6.2	ND(0.3)
		9/21/2018	1.58	-58.5	9.19	2.07	44.5	ND(1.0)	1.0 J-	6.7 J-	6.2 J-	ND(0.3)
		9/21/2018[3]			NA	NA	NA	ND(1.0)	0.99 J	5.9	5.5	ND(0.3)
		5/14/2019	0.43	-68.4	10.5	1.44	40.2	ND(0.005)	NA	NA	NA	0.42
		5/14/2019[3]			NA	NA	NA	ND(0.005)	NA	NA	NA	0.40
		8/27/2019	0.75	-56.6	NA	NA	NA	ND(1.0)	ND(0.3)	6.1 J+	6.5 J+	ND(0.3)
		8/27/2019[3]			NA	NA	NA	ND(1.0)	0.67 J,J+	6.9 J+	7.0 J+	ND(0.3)
		8/11/2020	0.90	131.1	6.21	1.11	46.9	ND(0.005)	ND(0.3)	4.5	4.8	ND(0.02)
		8/11/2020[3]			6.37	1.12	42.1	ND(0.005)	1.3	4.6	5.0	ND(0.02)
		8/5/2021	0.28	-106.4	9.01 J+	1.57	41.0	ND(0.005)	1.1	7.5	7.1	ND(0.08)
		8/5/2021[3]			9.00 J+	1.58	40.8	ND(0.005)	1.1	7.8	7.5	ND(0.08)
		8/8/2022	0.73	138.2	8.98	1.63	51.8	ND(0.005)	1.0	5.5	6.2	0.21
		8/8/2022[3]			8.87	1.67	67.8	ND(0.005)	1.0	5.4	6.3	0.22
	MW80	6/21/2018	0.40	-5.80	10.3	0.833	29.2	ND(1.0)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.3)
		9/27/2018	1.33	-119.1	9.91	0.801	31.3	ND(1.0)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.3)
		5/15/2019	0.24	-100.4	10.6	0.812	31.8	ND(0.005)	NA	NA	NA	ND(0.02)
		8/27/2019	0.38	-112.1	NA	NA	NA	ND(1.0)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.02)
		8/11/2020	0.65	109.0	9.30	0.754	32.1	ND(0.005)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.02)
		8/5/2021	0.07	-130.1	10.1	0.919	31.2	ND(0.005)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.08)
		8/8/2022	0.72	88	10.9	0.829	34.1	ND(0.005)	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.3)
Sentry Wells	MW78	6/22/2018	0.94	-150.2	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		9/20/2018	1.51	-127.6	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		5/13/2019	0.37	-110.0	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		8/11/2020	0.89	135.4	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		8/4/2021	0.12	-115.5	NA	NA	NA	0.00418 J	NA	NA	NA	NA
		8/7/2022	0.66	118	NA	NA	NA	0.0038 J	NA	NA	NA	ND(0.03)
Sentry Wells	MW91	6/25/2018	0.63	-159.2	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		9/21/2018	0.55	-118.9	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)

Table 3-3 2018-2022 Groundwater Sample Results - TCP and TCE Plume Wells

Plume/ Location	Well ID	Date	Geochemical Parameters					ROD Analytes		Non-ROD Analytes (TCE Degradation Products)		
			Dissolved Oxygen (mg/L)	ORP (mv)	Dissolved Iron (mg/L)	Dissolved Manganese (mg/L)	Sulfate (mg/L)	TCP (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
ROD RG[1,2]			**NE**	**NE**	**NE**	**NE**	**NE**	**0.12**	**5**	**70[2]**	**100[2]**	**2[2]**
		5/13/2019	0.73	-120.2	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		8/11/2020	0.90	122.5	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.02)
		8/4/2021	0.11	-137.5	NA	NA	NA	ND(0.005)	NA	NA	NA	NA
		8/7/2022	3.63	130.9	NA	NA	NA	ND(0.005)	NA	NA	NA	ND(0.03)

Notes:

For definitions, refer to Acronyms and Abbreviations section

Red and bold results exceed RGs

Gray shaded results are non-detect with LODs that exceed the RG

[1] RG established in the OU6 ROD

[2] Non-ROD analytes (vinyl chloride; cis-1,2-DCE; and trans-1,2-DCE) are TCE reductive dechlorination daughter products and are compared to EPA MCLs.

[3] Sample is a field duplicate of the sample immediate above.

[4] Elevated DO concentrations in select wells in 2020 were due to a malfunctioning DO probe isolated to a single instrument.

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 failure. If result is biased low or high, it is specified as "J-" and "J+".

ND - not detected (LOD presented in parentheses)

4.0 CONTAMINANT TREND AND PLUME ANALYSIS

This section presents a summary of the contaminant trends and plume analysis. Current and historical data were used to support statistical analysis using the Monitoring and Remediation Optimization System (MAROS) software along with geometric regression time-series plots. The complete results of the statistical analysis are presented in Appendix E.

4.1 Statistical Evaluation of Contaminant Concentration Trends

Groundwater monitoring data collected between 2007 and 2022 were used to conduct a statistical evaluation of groundwater contamination in the FCS. This evaluation builds on the results of previous analyses and documents the progress toward achieving the RAOs described in the OU6 ROD (USAG Alaska 2014). The analysis tools and decision criteria are consistent with the previous analyses and recommendations from the remedial design/remedial action work plan for OU6 (USACE 2015).

The statistical tests used in this evaluation for individual wells include the nonparametric Mann-Kendall trend test, and a geometric (lognormal) regression plot for those wells statistically demonstrating a decreasing trend. Statistical tests for plume-wide evaluation included spatial moment analysis (for plume stability), sampling location optimization (for well redundancy), and sampling frequency optimization. The Mann-Kendall trends, spatial moment analysis, sampling location optimization, and sampling frequency optimization were calculated using the MAROS software developed by the Air Force Center for Engineering and the Environment (2006).

The Groundwater Statistics Tool developed by the EPA (EPA 2014b) was used to evaluate progress to the attainment stage of cleanup a particular COC by calculating the 95 percent upper confidence limit (UCL_{95}) on the mean. For wells with decreasing trends, the tool can predict when attainment starts. EPA recommends a minimum of eight data points in the attainment stage to provide confidence that the cleanup level has been met and is expected to continue to be met (EPA 2014b). If a well has achieved attainment for eight sampling events, it may be recommended for removal from the monitoring program and decommissioning. Geometric regression plots were completed using Microsoft Excel, and the plots provided a visual representation of the trends and another estimate of the time anticipated to begin attainment based on the UCL_{95}. The complete analysis results are presented in Appendix E.

4.2 DRO and RRO Trend and Plume Analysis

4.2.1 DRO and RRO Trend Analysis

The DRO evaluation in the main DRO plume included several elements from the MAROS software: Mann-Kendall trends of contaminant concentrations in individual wells, Mann-Kendall trends for contaminant plume stability (spatial moment analysis), sampling location optimization, and sampling frequency optimization. The evaluation of RRO consisted of Mann-Kendall trends in individual wells only, since RRO has been detected above the RG in only two wells and there was not sufficient information to conduct a plume-wide evaluation. The Mann-Kendall trends for DRO and RRO concentrations in individual wells within the DRO plumes are presented in Table 4-1. The results are associated with wells that have had RG exceedances of DRO and/or RRO since 2007.

Table 4-1 Mann-Kendall Trend Results for the DRO Plumes

Well ID	Relative Plume Location	Analyte	Mann-Kendall Statistic	Coefficient of Variation	Trend Confidence	Mann-Kendall Trend[1]
Main DRO Plume Wells						
MW12R	Upgradient	DRO	-70	0.94	98.8%	Decreasing
		RRO	-16	1.17	68.5%	No Trend
MW33	Source Area	DRO	98	0.70	99.9%	**Increasing**
		RRO	81	1.14	99.6%	**Increasing**
MW06A	Downgradient	DRO	31	0.51	81.5%	**No Trend**
MW58[2]	Downgradient	DRO	17	0.39	71.0%	No Trend
Isolated DRO Plume Wells						
MW62	Source Area	DRO	33	2.52	89.4%	No Trend
		RRO	19	2.27	71.8%	No Trend
MW77	Source Area	DRO	36	1.34	88.8%	**No Trend**
		RRO	-16	1.21	69.8%	No Trend

Notes:

[1] The previous year trend is shown in parenthesis if there was a change.

[2] MW58 was not sampled in 2022 and is presented for consistency with the 2021 monitoring report.

BOLD indicates the concentration was above the RG in 2022.

For definitions, refer to the Acronyms and Abbreviations section.

The Mann-Kendall trend results in the main DRO plume wells show a decreasing trend for DRO in the upgradient well (MW12R), an increasing trend in the main source area well (MW33), and no trend in the downgradient wells (MW06A and MW58). MW33 has had the highest DRO concentrations within the main DRO plume, with concentrations consistently more than an order of magnitude higher than the RG. This suggests that the well is located in an area with residual NAPL in the soil that continues to be solubilized in the groundwater. MW06A, located immediately downgradient of MW33, had no trend according to the Mann-Kendall analysis. Although not shown in Table 4-1, the DRO detections in further downgradient well MW37 are consistently below the RG and was non-detect for DRO in 2022. This provides evidence that the main DRO plume is not expanding at a significant rate.

The RRO concentration trends in the main DRO plume wells are similar to the DRO trends, with an increasing trend observed in source area well MW33. RRO also consistently exceeds the RG in this well, with the highest concentration to date observed in the 2021 sampling event. RRO is either not detected or detected at trace concentrations in the upgradient and downgradient wells, with the exception of downgradient well MW06A. In 2022, RRO was reported below the RG at 740 µg/L in MW06A.

The DRO concentrations within the isolated DRO plumes exhibit no trend in well MW77 and in MW62. In MW62, DRO and RRO have been detected at or below the RG in 11 consecutive sampling events (including 2022). Although the DRO and RRO concentrations have shown wide variation in the past, sampling results since 2012 have been generally consistent which indicates the residual NAPL in the surrounding soil may be depleted. DRO and RRO concentrations in downgradient well MW64 have also remained below the RG.

The DRO concentrations in MW77 exhibit no trend and were above the RG for four consecutive sampling events between 2018 and 2020, marginally below the RG in 2021, and above the RG in 2022. The sampling

events between 2018 and 2020 were the longest string of consecutive sampling events with DRO exceedances; however, the DRO concentrations in downgradient well MW82 were non-detect in 2022.

The Mann-Kendall analysis did not identify a trend for RRO in MW62 and MW77 due to the low number of detections in the dataset.

4.2.2 DRO Trend Analysis Using EPA Groundwater Statistics Tool

Geometric regression analysis and estimation of the time to reach attainment using the EPA statistics tool was completed for DRO in MW12R, since this was the only well within the DRO plumes with a decreasing trend based on Mann-Kendall trend analysis. The results of the analysis are summarized in Table 4-2, and the complete results are presented in Appendix E.

Table 4-2 Statistical Evaluation of DRO in MW12R

Well ID	Trend Result	Number of Data Points	UCL95 (mg/L)	Has RG Been Achieved?	Year Expected To Achieve RG Based on UCL95? ("Attainment Complete")[1]
MW12R	Decreasing	20	7.2	No	2022

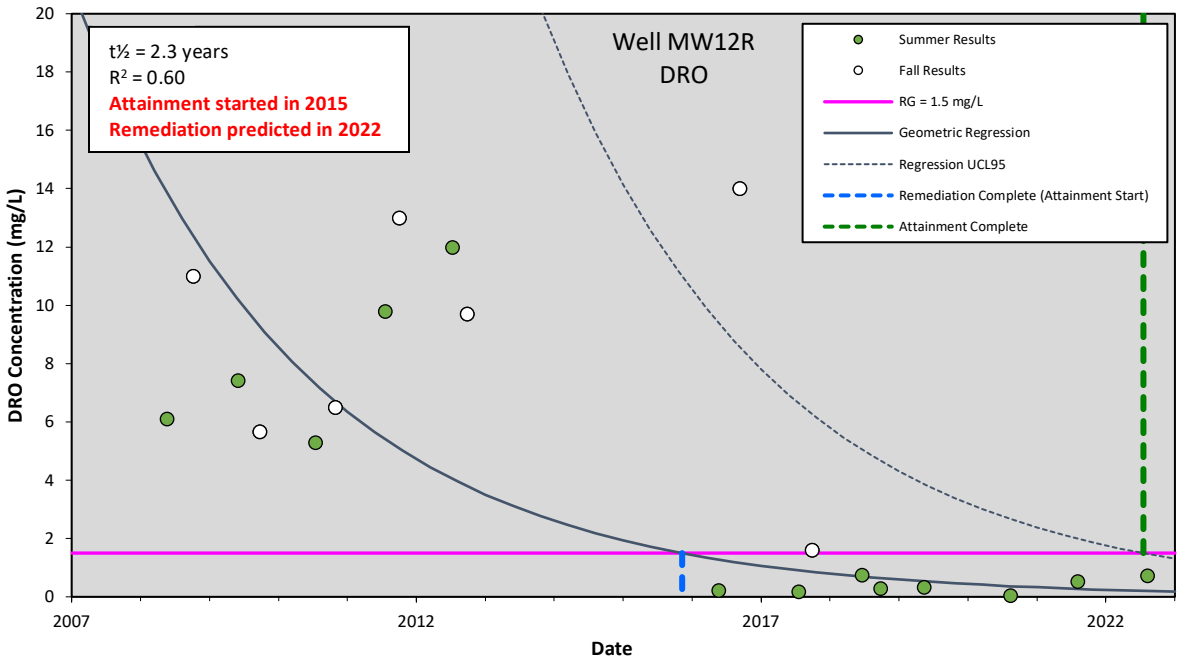
Notes:
The analysis is based on the EPA Groundwater Statistics Tool, available from https://www.epa.gov/superfund/superfund-groundwater-groundwater-response-completion.

[1] The Attainment Complete date was determined from the geometric regression plot (Graph 4-1).

For definitions, refer to the Acronyms and Abbreviations section.

The geometric regression plot is presented on Graph 4-1 and shows that DRO concentrations were expected to achieve the RG in 2015 (identified in the graph as "Remediation Complete", also defined by EPA as "Attainment Start"). The geometric regression plot for MW12R based on the UCL_{95} indicates that statistical attainment (defined by EPA as "Attainment Complete") of the RG was achieved in 2022. This is an estimated date based on the data collected after remediation was completed in 2015. However, the EPA statistics tool shows that the RG has not been achieved (Table 4-2) and is most likely caused by the high concentration (14 mg/L) observed during the September 2016 sampling event. Although the RG has not been achieved under the EPA statistics tool use of the UCL_{95}, there are six consecutive samples events below RG (2018 through 2022). EPA guidance requires at least eight data points to determine if attainment is complete; therefore, beginning in 2024 the analyses could be conducted to determine if attainment is complete at this well for DRO.

Graph 4-1 Geometric Regression of DRO Concentrations in MW12R



4.2.3 DRO and RRO Plume Analysis

Further evaluation of the stability of the main DRO plume was conducted using the spatial moment analysis tools associated with the MAROS software. The analysis consisted of the zeroth moment (estimate of contaminant dissolved mass), first moment (estimate of the location of the center of mass relative to the source), and the second moment (estimate of plume spread in the direction of and perpendicular to groundwater flow). One of the most important input parameters for this analysis is the makeup of the monitoring network. The results can be easily biased if different wells or different numbers of wells are included in the various monitoring events associated with the analysis. For consistency with this assumption, the monitoring well network used for the 2022 sampling event was used to evaluate plume trends. This includes the main DRO plume wells (MW06A, MW12R, and MW33) and surrounding wells (MW37, MW64, and MW82). A summary of the plume stability results for the main DRO plume network is presented in Table 4-3. The complete results are presented in Appendix E.

Table 4-3 Plume Stability Results for the Main DRO Plume Network

Plume Stability Parameter	Mann-Kendall DRO Trend[1]
Zeroth Moment (Dissolved Mass)	No Trend
First Moment (Distance from the Source to the Center of Mass)	Stable
Second Moment (Plume Spread) *Parallel to Groundwater Flow* *Perpendicular to Groundwater Flow*	 Probably Decreasing Probably Decreasing

Notes:

[1] Based on monitoring results between 2016 and 2022.

For definitions, refer to the Acronyms and Abbreviations section.

The plume stability results indicate there is no trend for the dissolved DRO mass since 2016. There has been wide variation in DRO concentrations over time in several wells due to fluctuations in groundwater elevations and residual NAPL remaining in source area soils; however, this has not resulted in a significant change in overall dissolved mass within the DRO plume. The first moment results indicate there is a stable trend in the distance from the source to the center of mass since 2016. Between 2017 and 2022 the center of mass has varied between 142 and 214 feet from the source.

The second moment results indicate probably decreasing trends in the plume spread parallel and perpendicular to groundwater flow. These results suggest there is no significant downgradient migration of DRO above the RG from the source area, since no exceedances of the RG for DRO have been observed outside of the four wells that are associated with the main DRO plume.

4.2.4 DRO Plume Redundancy and Sample Frequency Analysis

In addition to stability of the DRO plume, potential redundancy of the monitoring network and sampling frequency were evaluated using the MAROS software. The complete analysis results are presented in Appendix E and are summarized in this section. Results from the monitoring well redundancy evaluation showed that the DRO plume is primarily characterized by a moderate level of uncertainty and suggests the DRO plume has been adequately delineated. In addition, the redundancy evaluation recommend removal of MW37 and MW58 from the monitoring network. However, MW37 does play a key role in the downgradient edge of the plume.

The sampling frequency evaluation showed that biennial sampling was recommended for DRO concentration changes over time in the main DRO plume in all wells but MW33, for which quarterly sampling was recommended. Previous analysis has shown that there is not a strong seasonal effect on DRO concentration in the main DRO plume area, with the exception of concentrations in MW33 (USACE 2018). In areas where residual NAPL exists, typically highest contaminant concentrations are measured when groundwater elevations are lowest as NAPL is allowed to drain from soils onto the groundwater surface. The groundwater elevations in 2022 were slightly lower than the 2021 sampling event, and in general, DRO concentrations were similar to 2021. Despite seasonal effects on DRO in MW33, continued annual sampling for all wells is recommended and will be sufficient for decision making at the site.

4.3 TCP Trend Analysis

4.3.1 TCP Mann-Kendall Trend Analysis

The TCP plume was evaluated using Mann-Kendall concentration trends from the MAROS software, and geometric regression for wells with a decreasing trend. The Mann-Kendall trends for the TCP concentration in each of the wells is presented in Table 4-4. Complete results of the trend analysis are presented in Appendix E.

Table 4-4 Mann-Kendall Trend Results for the TCP Plume, MW47 and MW79

Well ID	Relative Plume Location	Analyte	Mann-Kendall Statistic	Coefficient of Variation	Trend Confidence	Trend
MW47	Downgradient	TCP	-63	0.55	98.6%	**Decreasing**
MW79	Source Area	TCP	55	1.03	98.0%	**Increasing**

Notes:
BOLD indicates the concentration was above the RG in 2022.
For definitions, refer to the Acronyms and Abbreviations section.

The trend results show the TCP concentration is decreasing in downgradient well MW47 and exhibits a probably increasing trend in well MW79. Concentrations were above the RG in both wells during 2022 and have been consistently detected above the RG since analysis began in 2007. However, TCP has remained below the RG outside of the TCP plume (including upgradient wells, and wells that are in the downgradient, but slightly crossgradient direction), suggesting minimal plume spread from the source area.

4.3.2 TCP Trend Analysis Using EPA Groundwater Statistics Tool

The TCP concentrations in MW47 were further evaluated using the EPA Groundwater Statistics tool since the concentrations exhibited a decreasing trend. MW79 was not evaluated since the well does not have a decreasing TCP trend. The TCP concentration in MW08 was also evaluated, since this upgradient well has had RG exceedances between 2007 and 2012. Mann-Kendall analysis was not performed due to the frequency of non-detect results. The results of the analysis are summarized in Table 4-5, and the complete results are presented in Appendix E.

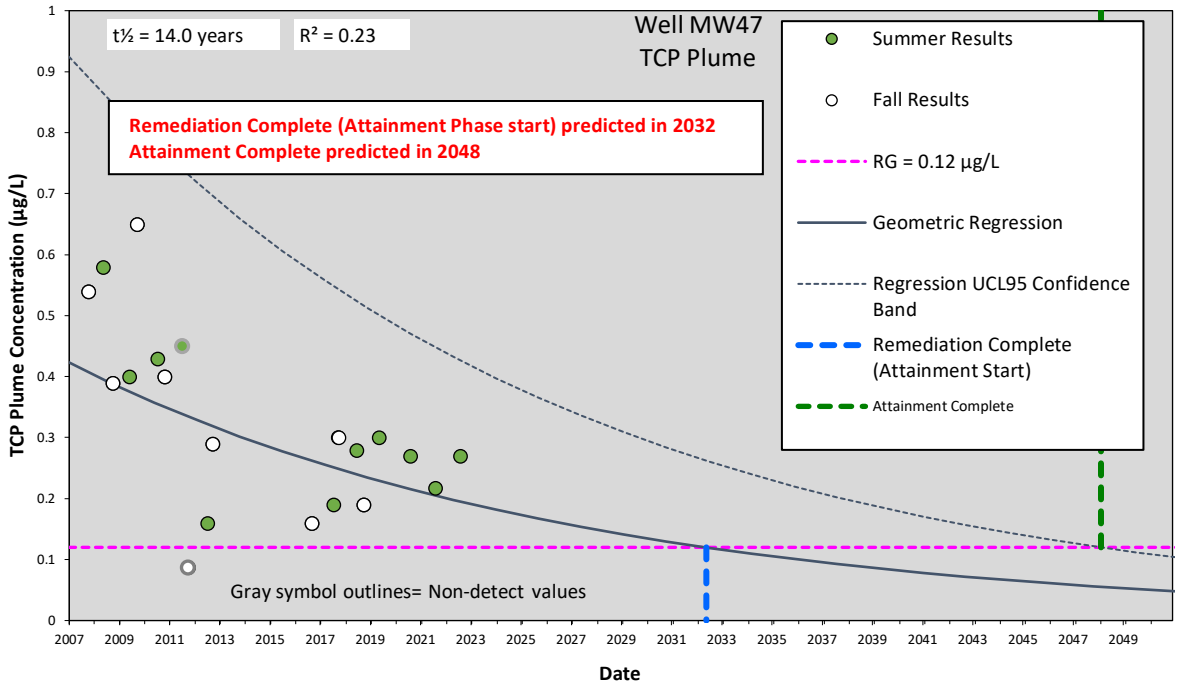
Table 4-5 Statistical Evaluation of TCP in MW47 and MW08

Well ID	Trend Result	Number of Data Points	UCL_{95} (µg/L)	Has RG been Achieved?	Year Expected to Achieve RG based on UCL_{95}? ("Attainment Complete")[1]
MW47	Decreasing	20	0.39	No	2048
MW08	Decreasing	21	0.20	No	2022

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
The analysis is based on the EPA Groundwater Statistics Tool, available from https://www.epa.gov/superfund/superfund-groundwater-groundwater-response-completion.
[1] The Attainment Complete date was determined from the geometric regression plot (Graph 4-2) for MW47. The geometric regression plot for MW08 can be found in Appendix E.

The geometric regression plot for MW47 (Graph 4-2) shows that TCP exhibits a decreasing trend and that TCP concentrations are expected to achieve the RG in 2032 (identified in the graph as "Remediation Complete", also defined by EPA as "Attainment Start"). The geometric regression plot for MW47 based on the UCL_{95} indicates that statistical attainment (defined by EPA as "Attainment Complete") of the RG could be achieved by 2048 if the present trend continues. A decreasing trend is also observed in MW08, using data from 2007 through 2022 and last 10 data points are below the based (geometric regression can be found in Appendix E).

Graph 4-2 Geometric Regression of TCP Concentrations in MW47



4.4 TCE Trend Analysis

TCE concentration trends were evaluated using the Mann-Kendall test from the MAROS software, and the cleanup complete evaluation was completed using geometric regression and the EPA statistics tool. Complete results of the trend analysis are presented in Appendix E.

4.4.1 TCE Mann-Kendall Trend Analysis

The Mann-Kendall trend analysis for MW61 is summarized in Table 4-6. A trend for MW80 was not determined since TCE has not been detected in this well since 2010. The Mann-Kendall trend results in Table 4-6 show TCE concentrations are decreasing with 100 percent confidence.

Table 4-6 Mann-Kendall Trend Results for the TCE Plume, MW61

Well ID	Analyte	Mann-Kendall Statistic	Coefficient of Variation	Trend Confidence	Trend
MW61	TCE	-139	1.04	100%	Decreasing

Note:
For definitions, refer to the Acronyms and Abbreviations section.

4.4.2 TCE Trend Analysis Using EPA Groundwater Statistics Tool

Based on the Mann-Kendall result, the TCE concentrations were further evaluated using the EPA Groundwater Statistics tool, and the results are summarized in Table 4-7.

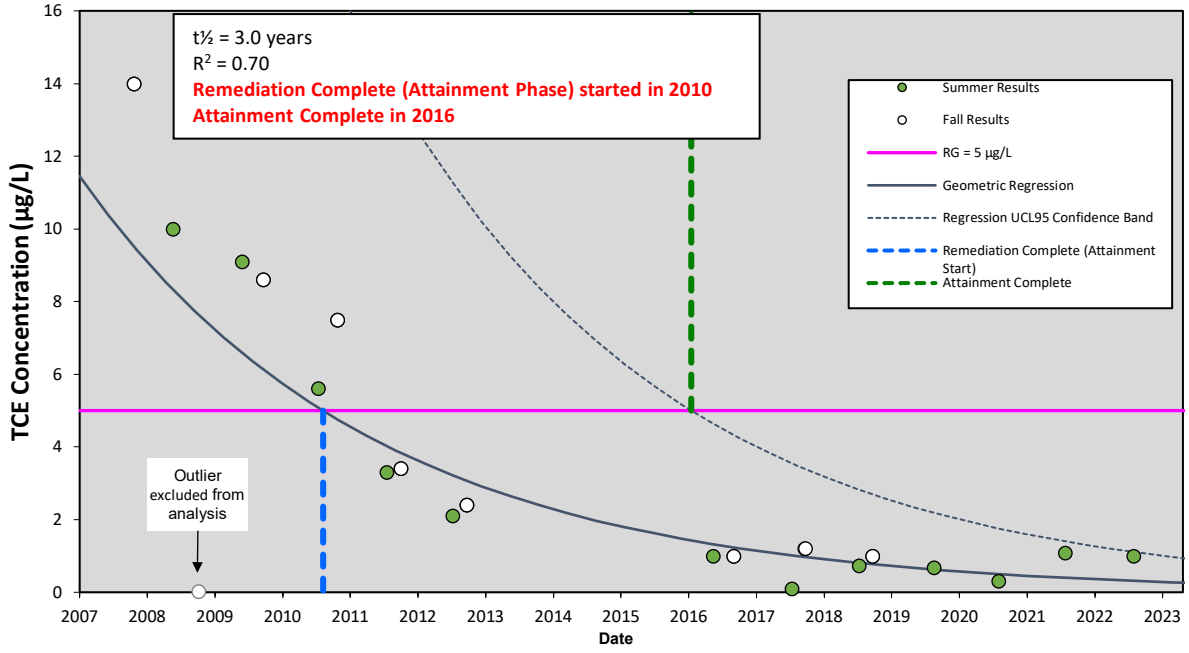
Table 4-7 Cleanup Complete Evaluation for TCE in MW61

Well ID	Trend Result	Number of Data Points[1]	UCL_{95} (µg/L)	ACHIEVE RG?
MW61	Decreasing	14	1.85	Yes

Notes:
The analysis is based on the EPA Groundwater Statistics Tool, available from https://www.epa.gov/superfund/superfund-groundwater-groundwater-response-completion.
Gray shading indicates the RG has been achieved and will continue to achieve at UCL_{95}
[1] Number of data points represents the attainment phase.
For definitions, refer to the Acronyms and Abbreviations section.

The cleanup complete evaluation was completed using results from the attainment phase, or when TCE concentrations remained below the RG beginning in 2011 and continuing 2022. This indicates that the TCE RG has been achieved in accordance with EPA requirements (EPA 2014b) based on eight or more consecutive results below the RG. The data set also shows the UCL_{95} is less than the RG and a decreasing trend is observed. The time-series results from MW61 are reasonably described by a first-order decay regression curve with a half-life of 3 years (Graph 4-3). The UCL_{95} of the regression curve confirms RGs were met at MW61.

Graph 4-3 Geometric Regression of TCE Concentrations in MW61



5.0 CONCLUSIONS AND RECOMMENDATIONS

Historical data have defined five groundwater plumes in the OU6 FCS: the main DRO plume, the isolated MW62 and MW77 DRO plumes, the TCP plume, and the TCE plume. Groundwater monitoring results between 2007 and 2022 were used to conduct an evaluation of the groundwater contaminant plumes in the OU6 FCS. In general, the results showed the contaminant plumes are adequately delineated and are not expanding. The following sections summarize the condition of the OU6 FCS plumes and discuss recommendations for future groundwater sampling activities.

5.1 DRO Plume Summary

In general, DRO concentrations within the main DRO plume were similar to those measured in 2021, likely due to the similar groundwater elevations encountered during the 2022 groundwater sampling event. An evaluation of the DRO contaminant trends shows that DRO concentrations at the edges of the main plume are stable. DRO and RRO concentrations in the interior of the plume are expected to persist above the RG, due to residual NAPL remaining in the soils that continues to be solubilized in the groundwater. Higher concentrations of dissolved iron and manganese, and lower concentrations of sulfate, are evidence that metal and sulfate reduction are significant biodegradation processes in the main DRO plume source area. An estimation of the time to cleanup could only be determined for slightly upgradient well MW12R (met in 2022 based on geometric regression) as it was the only well associated with the main DRO plume that had a decreasing trend. When NAPL within the main DRO plume is depleted and no longer generates dissolved contaminant concentrations, decreasing trends in other wells should become apparent.

The two outlying plumes that are identified by single monitoring wells, MW62 and MW77, appear to represent smaller, lower concentration source areas. The DRO concentration in MW62 did not exceed the RG in 2022 and has only exceeded the RG once since 2012. Assuming DRO remains below the RG in MW62 in 2023, the cleanup attainment timeframe could be calculated following the EPA guidance (EPA 2014b). DRO concentrations in MW77, while highly variable, exceeded the RG from the 2018 through 2020 and again in 2022 sampling events, but did not exceed the RG in the 2021 sampling event.

5.2 TCP Plume Summary

TCP concentrations in MW47 and MW79 have consistently (with the exception of the 2011 sampling events of MW47) exceeded the RG. TCP concentrations in MW47 have a decreasing Mann-Kendall trend while MW79 has an increasing trend. TCP has remained below the RG in surrounding wells, suggesting minimal plume spread from the source area has occurred. Natural attenuation processes of dilution and dispersion are expected to lower concentrations in downgradient monitoring well MW47, and the UCL_{95} indicates statistical attainment (defined by EPA as “Attainment Complete”) of the RG in 2048. In contrast, exceedances will likely continue at monitoring well MW79 until the suspected TCP soil source is depleted.

5.3 TCE Plume Summary

TCE concentrations at MW61 have been less than the RG since 2011, and TCE has never exceeded the RG in MW80 and has not been detected since 2010. This indicates that the TCE RG has been achieved in accordance with EPA requirements (EPA 2014b) based on eight or more consecutive results below the RG. Statistical analysis shows a continued decreasing trend at MW61, and the UCL_{95} of the regression curve suggests that RGs were met in 2016.

5.4 Recommendations

It is recommended that consideration be made to remove the well listed from the OU6 monitoring well program:

- DRO plume well MW58: The redundancy evaluation recommends removal of MW58 from the monitoring network; however, MW58 had an obstruction caused by pinched tubing within a shifted well casing in 2022, could not be sampled, and is therefore not recommended for replacement.

Wells MW61, MW80, MW03, and MW13 will not be sampled in 2023. No other changes to the monitoring program are recommended at this time.

6.0 REFERENCES

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FIGURES

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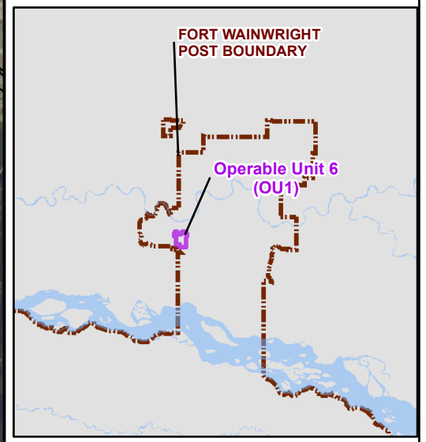
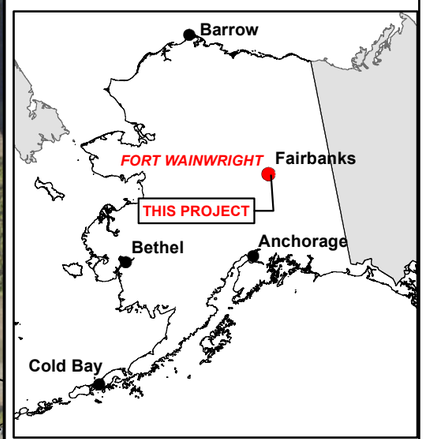
1 INCH

602nd
Neely
10th
Building 3030
3030A
3562
NA
3564
3563
3566
3567
3565
Cedar
White
River Rd
8th
Balsam
6th
9th
New Richardson
Alder
Approximate Groundwater Flow Direction

Legend:

- OU6 IC Boundary
- Alaska Railroad
- Fence Line





Note:
1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet). Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in meters.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

2022 Operable Unit Monitoring Report
Operable Unit 6
U.S. Army Garrison Alaska

SITE LOCATION MAP

0 200 400
Feet

N

DATE: 6/5/2023
Project No.: D3436302
P.M. / DRAWN K.M. / J.W.

FIGURE: **1-1**

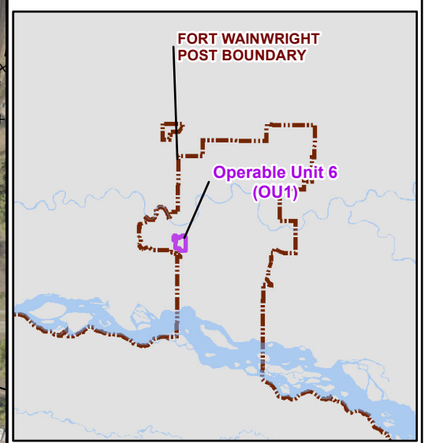
Document Path: \\dc1vs01\GISProj\A\Army\AK_FtWainwright\MapFiles\2022_OU_MonitoringReport\OU6\F 1-1.mxd

1 INCH

Pine
601st
602nd
Spruce
Bassett Army Hospital
MW-82
10th
Whidden
Montgomery
Building 3030
Main DRO Plume
Isolated DRO Plume
Backup Water Supply Well (Building 3563)
MW-37
Neely
MW-77
Water Supply Well (Building 3559)
MW-58
MW06A
MW-64
MW-62
MW-33
MW-12R
4723
4713
4711
4712
4709
4707
Sentry Wells
MW-91
MW-78
MW-47
MW-79
MW-61
MW-80
TCE Plume
TCP Plume
MW-08
4743
4741
4755
4744
4745
River Rd
White
MW-03
Tanana Trails Subdivision
MW-13
Cedar
Balsam
8th
6th
9th
New Richardson
Alder
Approximate Groundwater Flow Direction

Legend:

- DRO Plume Well
- TCP Plume Well
- TCE Plume Well
- Sentry Well
- Background Well
- Isolated DRO Plume
- Main DRO Plume
- Sentry Wells
- TCE Plume
- TCP Plume
- Building with Observed Debris Beneath Foundation
- Building with Observed Possible Debris Beneath Foundation
- OU6 IC Boundary
- Alaska Railroad
- Fence Line



Note:
1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet). Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in meters.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

2022 Operable Unit Monitoring Report
Operable Unit 6
U.S. Army Garrison Alaska

GROUNDWATER MONITORING WELLS SAMPLED IN 2022

0 200 400
Feet

N

DATE: 7/6/2023
Project No.: D3436302
P.M. / DRAWN K.M. / J.W.

FIGURE: **2-1**

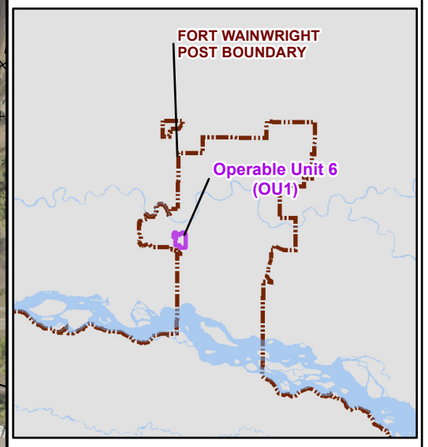
Document Path: \\dc1vs01\GISProj\A\Army\AK_FtWainwright\MapFiles\2022_OU_MonitoringReport\OU6\F 2-1.mxd

1 INCH

Pine
601st
Spruce
602nd
Cedar
White
8th
Balsam
6th
9th
New Richardson
Alder
10th
Whidden
Montgomery
River Rd
Bassett Army Hospital
Backup Water Supply Well (Building 3563)
Water Supply Well (Building 3559)
Tanana Trails Subdivision
Neely
MW-82 434.88
MW-37 435.12
MW-77 435.24
MW-58 NM
MW-64 435.58
MW-06A 435.54
MW-62 435.68
MW-78 435.79
MW-91 435.62
MW-47 436.01
MW-33 435.62
MW-80 435.77
MW-12R 435.66
MW-61 435.75
MW-79 435.98
MW-08 436.34
MW-03 435.94
MW-13 436.67
435
435.50
436
436.50
Approximate Groundwater Flow Direction

Legend:

- Groundwater Monitoing Well - Elevation in NAVD88, Feet
- Groundwater Monitoring Well - Elevation Not Used in Contour Calculation
- Groundwater Elevation Contour
- OU6 IC Boundary
- Alaska Railroad
- Fence Line



Note:
1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet). Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in meters.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

2022 Operable Unit Monitoring Report
Operable Unit 6
U.S. Army Garrison Alaska

GROUNDWATER ELEVATION CONTOURS

0 200 400
Feet

N

DATE: 7/6/2023
Project No.: D3436302
P.M. / DRAWN: K.M. / J.W.

FIGURE: **3-1**

Document Path: \\dc1vs01\GISProj\A\Army\AK_FtWainwright\MapFiles\2022_OU_MonitoringReport\OU6\F 3-1.mxd

1 INCH

MW06A 12.5-22.5' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	*435.95*	*437.14*	*434.18*	*437.18*	*434.91*	*435.54*
DRO	**6,600**	**4,900**	**3,900**	**5,000**	**5,300**	**5,300**	**18,000**	**4,100**	**8,320**	**9,100**
RRO	490	630	ND(550)	320	ND(1,000)	ND(400)	ND(4,000)*	ND(1,000)	1,080	740

MW77 12.6-22.6' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	-	-	*434.01*	*436.99*	*434.66*	*435.24*
DRO	1,200	**20,000**	280	640	**7,800**	**4,600**	**7,800**	**5,000**	1,380	**3,300**
RRO	300	**1,800**	ND(110)	240	ND(1,000)	ND(200)	ND(2,000)*	ND(2,000)*	696	260 J

MW33 10.8-20.8' btoc	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	*435.80*	*436.98*	*434.22*	*437.28*	*434.99*	*435.62*
DRO	**76,000**	**35,000**	**25,000**	**25,000**	**39,000**	**95,000**	**55,000**	**70,300**	**60,000**
RRO	**4,700**	**4,000**	ND(5,500)*	ND(4,000)*	ND(4,000)*	ND(20,000)*	**6,300**	**8,890**	**8,300**

MW12R 12.4-22.4' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	-	-	*434.27*	*437.36*	*435.07*	*435.66*
DRO	230	**14,000**	170	**1,600**	760	290	330	ND(50)	542	740
RRO	66	**1,600**	ND(1,000)	180	ND(200)	ND(200)	160	ND(200)	549	ND(110)

MW62 10.0-20.0' btoc	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	*436.04*	*437.33*	*434.26*	*437.38*	*435.05*	*435.68*
DRO	97	92	180	310	**1,500**	450	250	429	ND(99)
RRO	82	ND(110)	180	ND(200)	ND(200)	310	ND(200)	791	ND(99)

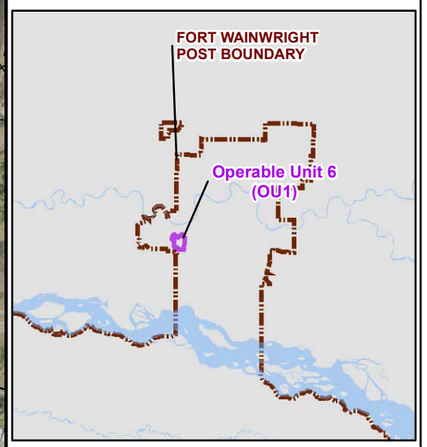
Note:
1. Contaminant concentrations that equal or exceed ROD RGs are shown in Red.
2. The ROD RG values presented in this figure are based on the remedial action objectives described in the OU6 ROD.
3. * The result is ND with an LOD greater than ROD RG.
4. Analytical results shown in µg/L.
5. The highest concentration between primary and duplicate samples is shown where duplicate samples were collected.
6. Only sample results for wells hat have exceeded the ROD RG since 2007 are shown.
7. Data flags (qualifiers) are not shown due to space limitation.
8. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet), Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in feet.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

Legend:

- DRO Plume Well
- TCP Plume Well
- TCE Plume Well
- Sentry Well
- Background Well
- Main DRO Plume
- OU6 IC Boundary
- Alaska Railroad
- Fence Line

ROD RG (µg/L)	
DRO	1,500
RRO	1,100



2022 Operable Unit Monitoring Report

Operable Unit 6
U.S. Army Garrison Alaska

DRO PLUME GROUNDWATER SAMPLE RESULTS

0 200 400
Feet

DATE: 9/19/2023
Project No.: D3436302
P.M. / DRAWN: K.M. / J.W.

FIGURE: **3-2**

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1 INCH

MW78 27.2-37.2' btoc	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	*434.35*	*437.39*	*435.08*	*435.79*
TCP	0.0062	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	0.0042	0.0038 J

MW91 56.0-76.0' btoc	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	*434.32*	*437.40*	*434.94*	*435.62*
TCP	ND(0.003)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)

MW79 11.5-21.5' btoc	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	-	*434.66*	*437.68*	*435.40*	*435.98*
TCP	1.9	1.2	0.61	1.2	1.6	0.29	4.8	0.80	2.20

MW47 9.8-19.8' btoc	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	*436.32*	*437.35*	*434.55*	*437.59*	*435.63*	*436.01*
TCP	0.16	0.19	0.30	0.28	0.20	0.31	0.27	0.22	0.27

MW08 12.1-22.1' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	*436.77*	*437.76*	*434.84*	*437.91*	*435.71*	*436.34*
TCP	ND(0.1)	0.030	0.027	0.031	ND(0.005)	0.062	ND(0.005)	ND(0.005)	0.016	0.063

MW13** 9.2-19.2' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	May 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	*436.27*	*437.37*	*435.10*	*438.22*	*436.13*	*436.67*
TCP	ND(0.1)	ND(0.04)	ND(0.003)	ND(0.003)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)

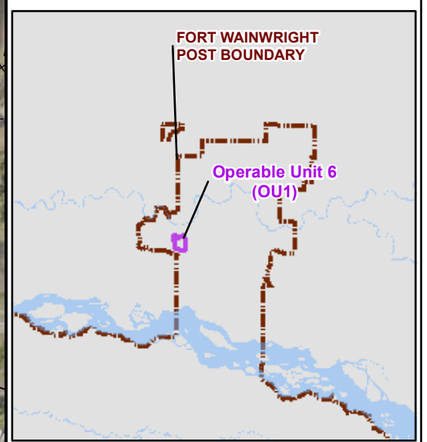
Note:
1. Contaminant concentrations that equal or exceed ROD RG are shown in Red.
2. ROD RG values presented in this figure are based on the remedial action objectives described in the OU6 ROD.
3. * The result is ND with an LOD greater than ROD RG.
4. ** MW13 is not designated as a TCP plume well; however, results are shown because TCP has historically been detected.
5. Analytical results shown in µg/L.
6. The highest concentration between primary and duplicate samples is shown where duplicate samples were collected.
7. Only sample results for wells hat have exceeded ROD RG since 2007 are shown.
8. Data flags (qualifiers) are not shown due to space limitation.
9. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet), Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in feet.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

Legend:

- DRO Plume Well
- TCP Plume Well
- TCE Plume Well
- Sentry Well
- Background Well
- TCP Plume
- OU6 IC Boundary
- Alaska Railroad
- Fence Line

ROD RG (µg/L)	
TCP	0.12



2022 Operable Unit Monitoring Report
Operable Unit 6
U.S. Army Garrison Alaska

TCP PLUME GROUNDWATER SAMPLE RESULTS

0 200 400
Feet

DATE: 6/6/2023
Project No.: D3436302
P.M. / DRAWN K.M. / J.W.

FIGURE: 3-3

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1 INCH

Pine
601st
602nd
Spruce
Bassett Army Hospital
10th
Whidden
Montgomery
Neely
White
8th
Balsam
6th
Cedar
Alder
MW-82
MW-37
MW-77
MW-58
MW-06A
MW-64
MW-62
MW-33
MW-12R
MW-61
MW-80
MW-78
MW-91
MW-47
MW-79
MW-08
MW-03
MW-13
Approximate Groundwater Flow Direction

MW61 10.1-20.1' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	Aug 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	-	-	-	*437.42*	*435.16*	*435.75*
TCE	1.0	1.0	0.94	1.2	0.79	1.0	0.67	1.3	1.1	1.0

MW80 36.8-46.8' btoc	May 2016	Sept 2016	July 2017	Sept 2017	June 2018	Sept 2018	Aug 2019	Aug 2020	Jul 2021	Aug 2022
GW Elev (ft)	-	-	-	-	-	-	-	*437.47*	*435.18*	*435.77*
TCE	ND(0.1)	ND(0.1)	ND(0.2)	ND(0.2)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.5)	ND(0.2)

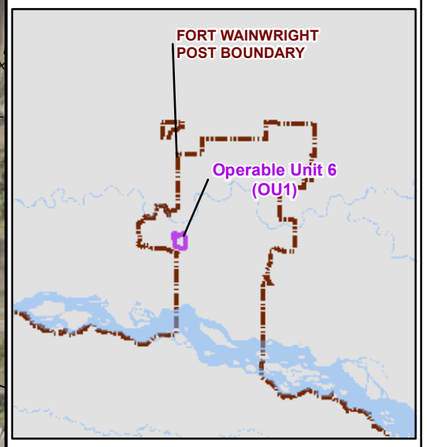
Note:
1. Contaminant concentrations that equal or exceed ROD RG are shown in Red.
2. ROD RG values presented in this figure are based on the remedial action objectives described in the OU6 ROD.
3. Analytical results shown in µg/L.
4. The highest concentration between primary and duplicate samples is shown where duplicate samples were collected.
5. Only sample results for wells hat have exceeded ROD RG since 2007 are shown.
6. Data flags (qualifiers) are not shown due to space limitation.
7. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 6N, U.S. Survey in Meters (displayed in feet), Vertical (where applicable) - North American Vertical Datum of 1988 (NAVD88) in feet.

Source:
1. Aerial imagery (dated 2020) obtained from the Fairbanks North Star Borough GIS (Geographic Information System) Department (Pictometry_2020_4in_Fairbanks.SID).

Legend:

- DRO Plume Well
- TCP Plume Well
- TCE Plume Well
- Sentry Well
- Background Well
- TCE Plume
- OU6 IC Boundary
- Alaska Railroad
- Fence Line

ROD RG (µg/L)	
TCE	5



2022 Operable Unit Monitoring Report

Operable Unit 6
U.S. Army Garrison Alaska

TCE PLUME GROUNDWATER SAMPLE RESULTS

0 200 400
Feet

DATE: 6/6/2023
Project No.: D3436302
P.M. / DRAWN: K.M. / J.W.

FIGURE: **3-4**

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APPENDIX A
Sample Summary and Analytical Results

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Table A-1 Groundwater Sample Summary
OU6 - Fort Wainwright, Alaska

Source	Location ID	Depth to Water (btoc)	Sample ID	Sample Date	Sample Time	Sampler	Matrix	QC Type	CoC	Cooler Name	Cooler Date	SDG	SW8260 (VOCs)	SW8260SIM (TCP+VC)	AK102/103 (DRO/RRO)	E300.0 (Sulfate)	SW6020 (Fe/Mn)
													3xVOA, HCl (<6°C)	3xVOA, HCl (<6°C)	2x1L AG, HCl (<6°C)	1x250ml HDPE, None (<6°C)	1x250ml HDPE, HNO3 (<6°C) (Field Filtered)
Background	MW03	14.67	22FWOU6WG01	8/8/2022	10:38	SS	WG	N	2022FWSM61	Kerry Blue	8/11/2022	22H153			X	X	X
Background	MW13	15.38	22FWOU6WG02	8/7/2022	15:41	CE	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X			
Background	MW13	15.38	22FWOU6WG02	8/7/2022	15:41	CE	WG	N	2022FWSM63	Yorkipoo	8/11/2022	22H153				X	X
DRO plume	MW06A	15.19	22FWOU6WG03	8/8/2022	16:03	SS	WG	N	2022FWSM62	Maltese	8/11/2022	22H153			X	X	X
DRO plume	MW12R	12.00	22FWOU6WG04	8/8/2022	13:29	AA	WG	N	2022FWSM61	Kerry Blue	8/11/2022	22H153			X	X	X
DRO plume	MW33	15.02	22FWOU6WG05	8/9/2022	13:43	SS	WG	N/MS/MSD	2022FWSM63	Yorkipoo	8/11/2022	22H153			X	X	X
DRO plume	MW33	15.02	22FWOU6WG06	8/9/2022	13:43	SS	WG	FD of 22FWOU6WG05	2022FWSM63	Yorkipoo	8/11/2022	22H153			X	X	X
DRO plume	MW37	14.82	22FWOU6WG07	8/8/2022	13:03	SS	WG	N	2022FWSM61	Kerry Blue	8/11/2022	22H153			X	X	X
DRO plume	MW62	13.34	22FWOU6WG09	8/9/2022	12:08	SS	WG	N	2022FWSM62	Maltese	8/11/2022	22H153			X	X	X
DRO plume	MW64	14.00	22FWOU6WG10	8/8/2022	14:54	AA	WG	N	2022FWSM62	Maltese	8/11/2022	22H153			X	X	X
DRO plume	MW77	17.38	22FWOU6WG11	8/8/2022	14:23	SS	WG	N	2022FWSM61	Kerry Blue	8/11/2022	22H153			X	X	X
DRO plume	MW82	16.86	22FWOU6WG12	8/8/2022	11:53	SS	WG	N	2022FWSM61	Kerry Blue	8/11/2022	22H153			X	X	X
1,2,3-TCP Plume	MW08	17.27	22FWOU6WG13	8/7/2022	11:21	AA	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X			
1,2,3-TCP Plume	MW08	17.27	22FWOU6WG13	8/7/2022	11:21	AA	WG	N	2022FWSM63	Yorkipoo	8/11/2022	22H153				X	X
1,2,3-TCP Plume	MW47	15.26	22FWOU6WG14	8/7/2022	13:52	CE	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X		X	X
1,2,3-TCP Plume	MW79	17.47	22FWOU6WG15	8/8/2022	10:34	AA	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X		X	X
TCE Plume	MW61	14.13	22FWOU6WG16	8/8/2022	16:00	AA	WG	N/MS/MSD	2022FWSM64	Labradoodle	8/11/2022	22H153	X	X		X	X
TCE Plume	MW61	14.13	22FWOU6WG17	8/8/2022	16:00	AA	WG	FD of 22FWOU6WG16	2022FWSM64	Labradoodle	8/11/2022	22H153	X	X		X	X
TCE Plume	MW80	13.66	22FWOU6WG18	8/8/2022	12:10	AA	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153	X	X		X	X
Sentry	MW78	15.87	22FWOU6WG19	8/7/2022	12:41	AA	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X			
Sentry	MW91	16.15	22FWOU6WG20	8/7/2022	15:36	AA	WG	N	2022FWSM64	Labradoodle	8/11/2022	22H153		X			
N/A	TB-080722	N/A	22FWOU6TB12	8/7/2022	8:00	CE	WQ	TB	2022FWSM64	Labradoodle	8/11/2022	22H153	X	X			
N/A	WQ-080822	N/A	22FWOU6WQ01	8/8/2022	18:00	AA/SS	WQ	EB	2022FWSM64	Labradoodle	8/11/2022	22H153	X	X			
N/A	WQ-080822	N/A	22FWOU6WQ01	8/8/2022	18:00	AA/SS	WQ	EB	2022FWSM62	Maltese	8/11/2022	22H153			X	X	X
N/A	WQ-080922	N/A	22FWOU6WQ02	8/9/2022	18:00	AA/SS	WQ	EB	2022FWSM62	Maltese	8/11/2022	22H153			X	X	X

Notes:
All samples are associated with NPDL 22-022.
All samples were submitted to EMAX and analyzed on a standard turnaround time (30 days).
All samples were stored in refrigerators (<6°C) and/or chilled with gel ice during transit (via AK Air Cargo and courier) until arrival at the laboratory. Refer to Table B-1 for cooler temperatures.

°C = degree(s) Celsius
AG = amber glass
btoc = below top of casing
CoC = chain-of-custody
DRO = diesel-range organics
EB = equipment blank
EMAX = EMAX Laboratories of Torrance, CA
FD = field duplicate
Fe = iron
HCL = hydrochloric acid
HDPE = high-density polyethylene
HNO3 = nitric acid
mL = milliliter(s)
Mn = manganese
MS/MSD = matrix spike/matrix spike duplicate
N = normal (primary) sample
NPDL = North Pacific Division Laboratory
RRO = residual-range organics
SDG = sample delivery group
TB = trip blank
TCE = trichloroethylene
TCP = 1,2,3-trichloropropane
VOA =volatile organic analysis
VOC = volatile organic compound
VC = vinyl chloride
WG = groundwater
WQ = water quality control sample

Table A-2 Background Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	MW03	MW13
				Sample ID	22FWOU6WG01	22FWOU6WG02
				SDG	22H153	22H153
				Lab Sample ID	22H153-10	22H153-04
				Matrix	WG	WG
				Sample Type	N	N
				Screen Interval (feet)	12.3 - 22.3	9.2 - 19.2
				Sample Date/Time	8/8/2022 10:38	8/7/2022 15:41
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2, 3]**			
General Chemistry (µg/L)						
Sulfate	E300.0	--	--		**40,600 [1,250]**	**62,400 [1,250]**
Hydrocarbons (µg/L)						
C10-C25 DRO	AK102	1,500	1,500		ND [110]	--
C25-C36 RRO	AK103	1,100	1,100		ND [110]	--
Metals (µg/L)						
Iron	6020A	--	--		**11,200 [50]**	**188 [50] J**
Manganese	6020A	--	--		**685 [0.5]**	**401 [0.5]**
VOCs (µg/L)						
1,2,3-Trichloropropane	8260B-SIM	0.12	--		--	ND [0.005]
Vinyl Chloride	8260B-SIM	--	2		--	ND [0.03]

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.

[2] EPA MCL (EPA 2009)

[3] 18AAC75 Table C Groundwater Human Health Cleanup Level (ADEC 2021) for DRO and RRO.

-- = Not analyzed or not applicable

µg/L = microgram(s) per liter

COC = contaminant of concern

FD = field duplicate

N = normal sample

SDG = sample delivery group

WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.

J+ = The result was an estimated quantity, but the result may be biased high.

J- = The result was an estimated quantity, but the result may be biased low.

B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte

Result exceeded OU6 RGs

Result exceeded EPA MCL or ADEC CUL

Nondetect value exceeded OU6 RGs or EPA MCL

Bracketed number [X.X] is the limit of detection

Table A-3 DRO Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	MW06A	MW12R	MW33	MW33	MW37	MW62	MW64	MW77	MW82
				Sample ID	22FWOU6WG03	22FWOU6WG04	22FWOU6WG05	22FWOU6WG06	22FWOU6WG07	22FWOU6WG09	22FWOU6WG10	22FWOU6WG11	22FWOU6WG12
				SDG	22H153	22H153	22H153	22H153	22H153	22H153	22H153	22H153	22H153
				Lab Sample ID	22H153-18	22H153-13	22H153-19	22H153-20	22H153-12	22H153-15	22H153-17	22H153-14	22H153-11
				Matrix	WG	WG	WG	WG	WG	WG	WG	WG	WG
				Sample Type	N	N	N	FD	N	N	N	N	N
				Screen Interval (feet)	12.4 - 22.4	12.6 - 22.6	11 - 21	11 - 21	9.7 - 19.7	10 - 20	10 - 20	12.6 - 22.6	11.7 - 21.7
				Sample Date/Time	8/8/2022 16:03	8/8/2022 13:29	8/9/2022 13:43	8/9/2022 13:43	8/8/2022 13:03	8/9/2022 12:08	8/8/2022 14:54	8/8/2022 14:23	8/8/2022 11:53
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2, 3]**										
General Chemistry (µg/L)													
Sulfate	E300.0	--	--	**5,920 [250]**	**32,800 [1,250]**	**5,910 [250]**	**7,020 [250]**	**8,070 [250]**	**50,100 [1,250]**	**15,800 [250]**	**44,900 [1,250]**	**24,000 [500]**
Hydrocarbons (µg/L)													
C10-C25 DRO	AK102	1,500	1,500	**9,100 [95]**	**740 [110]**	**48,000 [490]**	**60,000 [490]**	ND [110]	ND [99]	ND [100]	**3,300 [98]**	ND [100]
C25-C36 RRO	AK103	1,100	1,100	**740 [95]**	ND [110]	**8,300 [99]**	**7,200 [98]**	ND [110]	ND [99]	ND [100]	**260 [98] J**	ND [100]
Metals (µg/L)													
Iron	6020A	--	--	**28,800 [250]**	**13,100 [50]**	**74,900 [250]**	**77,800 [250]**	ND [50]	ND [50]	**310 [50]**	**64 [50] B**	ND [50]
Manganese	6020A	--	--	**1,660 [2.5]**	**1,020 [0.5]**	**6,180 [2.5]**	**6,070 [2.5]**	**0.553 [0.5] B**	**1,030 [0.5]**	**186 [0.5]**	**526 [0.5]**	**10.4 [0.5]**

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.
[2] EPA MCL (EPA 2009)
[3] 18AAC75 Table C Groundwater Human Health Cleanup Level (ADEC 2021) for DRO and RRO.
-- = Not analyzed or not applicable
µg/L = microgram(s) per liter
COC = contaminant of concern
FD = field duplicate
N = normal sample
SDG = sample delivery group
WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.
J+ = The result was an estimated quantity, but the result may be biased high.
J- = The result was an estimated quantity, but the result may be biased low.
B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte
Result exceeded OU6 RGs
Result exceeded EPA MCL or ADEC CUL
Nondetect value exceeded OU6 RGs or EPA MCL
Bracketed number [X.X] is the limit of detection

Table A-4 1,2,3-Trichloropropane Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	MW08	MW47	MW79
				Sample ID	22FWOU6WG13	22FWOU6WG14	22FWOU6WG15
				SDG	22H153	22H153	22H153
				Lab Sample ID	22H153-01	22H153-05	22H153-06
				Matrix	WG	WG	WG
				Sample Type	N	N	N
				Screen Interval (feet)	12.1 - 22.1	9.8 - 19.8	11.6 - 21.6
				Sample Date/Time	8/7/2022 11:21	8/7/2022 13:52	8/8/2022 10:34
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2]**				
General Chemistry (µg/L)							
Sulfate	E300.0	--	--		**51,900 [1,250]**	**44,500 [1,250]**	**50,300 [1,250]**
Metals (µg/L)							
Iron	6020A	--	--		ND [50]	ND [50]	**887 [50]**
Manganese	6020A	--	--		**1.28 [0.5] B**	**27.4 [0.5]**	**406 [0.5]**
VOCs (µg/L)							
1,2,3-Trichloropropane	8260B-SIM	0.12	--		**0.063 [0.005]**	**0.27 [0.005]**	**2.2 [0.005]**
Vinyl Chloride	8260B-SIM	--	2		ND [0.03]	ND [0.03]	ND [0.03]

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.
[2] EPA MCL (EPA 2009)
-- = Not analyzed or not applicable
µg/L = microgram(s) per liter
COC = contaminant of concern
FD = field duplicate
N = normal sample
SDG = sample delivery group
WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.
J+ = The result was an estimated quantity, but the result may be biased high.
J- = The result was an estimated quantity, but the result may be biased low.
B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte
Result exceeded OU6 RGs
Result exceeded EPA MCL
Nondetect value exceeded OU6 RGs or EPA MCL
Bracketed number [X.X] is the limit of detection

Table A-5 Trichloroethene Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	MW61	MW61	MW80
				Sample ID	22FWOU6WG16	22FWOU6WG17	22FWOU6WG18
				SDG	22H153	22H153	22H153
				Lab Sample ID	22H153-07	22H153-08	22H153-21
				Matrix	WG	WG	WG
				Sample Type	N	FD	N
				Screen Interval (feet)	10.1 - 20.1	10.1 - 20.1	36.8 - 46.8
				Sample Date/Time	8/8/2022 16:00	8/8/2022 16:00	8/8/2022 12:10
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2]**				
General Chemistry (µg/L)							
Sulfate	E300.0	--	--		**51,800 [1,250]**	**67,800 [1,250]**	**34,100 [1,250]**
Metals (µg/L)							
Iron	6020A	--	--		**8,980 [50]**	**8,870 [50]**	**10,900 [50]**
Manganese	6020A	--	--		**1,630 [0.5]**	**1,670 [0.5]**	**829 [0.5]**
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,1,1-Trichloroethane	8260B	--	200		ND [0.2]	ND [0.2]	ND [0.2]
1,1,2,2-Tetrachloroethane	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,1,2-Trichloroethane	8260B	--	5		ND [0.2]	ND [0.2]	ND [0.2]
1,1-Dichloroethane	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,1-Dichloroethene	8260B	--	7		ND [0.2]	ND [0.2]	ND [0.2]
1,1-Dichloropropene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,2,3-Trichlorobenzene	8260B	--	--		ND [0.3]	ND [0.3]	ND [0.3]
1,2,3-Trichloropropane	8260B	0.12	--		*ND [0.5]*	*ND [0.5]*	*ND [0.5]*
1,2,3-Trichloropropane	8260B-SIM	0.12	--		ND [0.005]	ND [0.005]	ND [0.005]
1,2,4-Trichlorobenzene	8260B	--	70		ND [0.3]	ND [0.3]	ND [0.3]
1,2,4-Trimethylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
1,2-Dibromo-3-Chloropropane	8260B	--	0.2		*ND [0.5]*	*ND [0.5]*	*ND [0.5]*
1,2-Dichlorobenzene	8260B	--	600		ND [0.2]	ND [0.2]	ND [0.2]
1,2-Dichloroethane	8260B	--	5		**0.11 [0.2] J**	**0.11 [0.2] J**	ND [0.2]
1,2-Dichloropropane	8260B	--	5		ND [0.2]	ND [0.2]	ND [0.2]
1,3,5-Trimethylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
1,3-Dichlorobenzene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,3-Dichloropropane	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
1,4-Dichlorobenzene	8260B	--	75		ND [0.2]	ND [0.2]	ND [0.2]
2,2-Dichloropropane	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
2-Butanone (MEK)	8260B	--	--		ND [10]	ND [10]	ND [10]
2-Chlorotoluene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
2-Hexanone	8260B	--	--		ND [10]	ND [10]	ND [10]
4-Chlorotoluene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
4-Methyl-2-Pentanone (MIBK)	8260B	--	--		ND [10]	ND [10]	ND [10]
Acetone	8260B	--	--		ND [10]	ND [10]	ND [10]
Benzene	8260B	--	5		ND [0.2]	ND [0.2]	ND [0.2]
Bromobenzene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
Bromochloromethane	8260B	--	--		ND [0.3]	ND [0.3]	ND [0.3]
Bromodichloromethane	8260B	--	80		ND [0.2]	ND [0.2]	ND [0.2]
Bromoform	8260B	--	80		ND [0.3]	ND [0.3]	ND [0.3]
Bromomethane	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Carbon Disulfide	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Carbon Tetrachloride	8260B	--	5		ND [0.2]	ND [0.2]	ND [0.2]
Chlorobenzene	8260B	--	100		ND [0.2]	ND [0.2]	ND [0.2]
Chloroethane	8260B	--	--		ND [1]	ND [1]	ND [1]
Chloroform	8260B	--	80		ND [0.2]	ND [0.2]	ND [0.2]
Chloromethane	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
cis-1,2-Dichloroethene	8260B	--	70		**5.5 [0.2]**	**5.4 [0.2]**	ND [0.2]
cis-1,3-Dichloropropene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
Dibromochloromethane	8260B	--	80		ND [0.2]	ND [0.2]	ND [0.2]
Dibromomethane	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
Dichlorodifluoromethane	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Ethylbenzene	8260B	--	700		ND [0.2]	ND [0.2]	ND [0.2]
Ethylene Dibromide (EDB)	8260B	--	0.05		*ND [0.2]*	*ND [0.2]*	*ND [0.2]*
Hexachlorobutadiene	8260B	--	--		ND [1]	ND [1]	ND [1]
Isopropylbenzene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
m- & p-Xylene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Methyl tert-Butyl Ether (MTBE)	8260B	--	--		ND [0.3]	ND [0.3]	ND [0.3]
Methylene Chloride	8260B	--	5		ND [1]	ND [1]	ND [1]
n-Butylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
n-Propylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Naphthalene	8260B	--	--		ND [1]	ND [1]	ND [1]
o-Xylene	8260B	--	--		ND [0.2]	ND [0.2]	ND [0.2]
p-Isopropyltoluene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
sec-Butylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Styrene	8260B	--	100		ND [0.5]	ND [0.5]	ND [0.5]
tert-Butylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Tetrachloroethene (PCE)	8260B	--	5		ND [0.3]	ND [0.3]	ND [0.3]
Toluene	8260B	--	1000		ND [0.2]	ND [0.2]	ND [0.2]
trans-1,2-Dichloroethene	8260B	--	100		**6.2 [0.2]**	**6.3 [0.2]**	ND [0.2]

Table A-5 Trichloroethene Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	MW61	MW61	MW80
				Sample ID	22FWOU6WG16	22FWOU6WG17	22FWOU6WG18
				SDG	22H153	22H153	22H153
				Lab Sample ID	22H153-07	22H153-08	22H153-21
				Matrix	WG	WG	WG
				Sample Type	N	FD	N
				Screen Interval (feet)	10.1 - 20.1	10.1 - 20.1	36.8 - 46.8
				Sample Date/Time	8/8/2022 16:00	8/8/2022 16:00	8/8/2022 12:10
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2]**				
trans-1,3-Dichloropropene	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Trichloroethene (TCE)	8260B	5	5		**1 [0.2]**	**1 [0.2]**	ND [0.2]
Trichlorofluoromethane	8260B	--	--		ND [0.5]	ND [0.5]	ND [0.5]
Vinyl Chloride	8260B	--	2		**0.4 [0.3] J**	**0.42 [0.3] J**	ND [0.3]
Vinyl Chloride	8260B-SIM	--	2		**0.21 [0.03]**	**0.22 [0.03]**	ND [0.03]
Xylenes, Total	8260B	--	10000		ND [0.5]	ND [0.5]	ND [0.5]

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.
[2] EPA MCL (EPA 2009)
-- = Not analyzed or not applicable
µg/L = microgram(s) per liter
COC = contaminant of concern
FD = field duplicate
N = normal sample
SDG = sample delivery group
WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.
J+ = The result was an estimated quantity, but the result may be biased high.
J- = The result was an estimated quantity, but the result may be biased low.
B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte
Result exceeded OU6 RGs
Result exceeded EPA MCL or ADEC CUL
Nondetect value exceeded OU6 RGs or EPA MCL
Bracketed number [X.X] is the limit of detection

Table A-6 Sentry Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

			Location ID	MW78	MW91
			Sample ID	22FWOU6WG19	22FWOU6WG20
			SDG	22H153	22H153
			Lab Sample ID	22H153-02	22H153-03
			Matrix	WG	WG
			Sample Type	N	N
			Screen Interval (feet)	27.2 - 37.2	56.1 - 76.1
			Sample Date/Time	8/7/2022 12:41	8/7/2022 15:36
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2]**		
VOCs (µg/L)					
1,2,3-Trichloropropane	8260B-SIM	0.12	--	**0.0038 [0.005] J**	ND [0.005]
Vinyl Chloride	8260B-SIM	--	2	ND [0.03]	ND [0.03]

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.

[2] EPA MCL (EPA 2009)

-- = Not analyzed or not applicable

µg/L = microgram(s) per liter

COC = contaminant of concern

FD = field duplicate

N = normal sample

SDG = sample delivery group

WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.

J+ = The result was an estimated quantity, but the result may be biased high.

J- = The result was an estimated quantity, but the result may be biased low.

B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte

Result exceeded OU6 RGs

Result exceeded EPA MCL or ADEC CUL

Nondetect value exceeded OU6 RGs or EPA MCL

Bracketed number [X.X] is the limit of detection

Table A-7 Quality Control Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

				Location ID	TB-080722	WQ-080822	WQ-080922
				Sample ID	22FWOU6TB12	22FWOU6WQ01	22FWOU6WQ02
				SDG	22H153	22H153	22H153
				Lab Sample ID	22H153-22	22H153-09	22H153-16
				Matrix	WQ	WQ	WQ
				Sample Type	TB	EB	EB
				Screen Interval (feet)	NA	NA	NA
				Sample Date/Time	8/7/2022 8:00	8/8/2022 18:00	8/9/2022 18:00
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2, 3]**				
General Chemistry (µg/L)							
Sulfate	E300.0	--	--		--	**618 [250]**	**674 [250]**
Hydrocarbons (µg/L)							
C10-C25 DRO	AK102	1,500	1,500		--	ND [110]	ND [100]
C25-C36 RRO	AK103	1,100	1,100		--	ND [110]	ND [100]
C6-C10 GRO	AK101	--	--		ND [50]	--	--
Metals (µg/L)							
Iron	6020A	--	--		--	**17.3 [50] J**	**13.7 [50] J**
Manganese	6020A	--	--		--	**0.298 [0.5] J**	**0.4 [0.5] J**
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane	8260B	--	--		ND [0.2]	ND [0.2]	--
1,1,1-Trichloroethane	8260B	--	200		ND [0.2]	ND [0.2]	--
1,1,2,2-Tetrachloroethane	8260B	--	--		ND [0.2]	ND [0.2]	--
1,1,2-Trichloroethane	8260B	--	5		ND [0.2]	ND [0.2]	--
1,1-Dichloroethane	8260B	--	--		ND [0.2]	ND [0.2]	--
1,1-Dichloroethene	8260B	--	7		ND [0.2]	ND [0.2]	--
1,1-Dichloropropene	8260B	--	--		ND [0.2]	ND [0.2]	--
1,2,3-Trichlorobenzene	8260B	--	--		ND [0.3]	ND [0.3]	--
1,2,3-Trichloropropane	8260B	0.12	--		*ND [0.5]*	*ND [0.5]*	--
1,2,3-Trichloropropane	8260B-SIM	0.12	--		ND [0.005]	ND [0.005]	--
1,2,4-Trichlorobenzene	8260B	--	70		ND [0.3]	ND [0.3]	--
1,2,4-Trimethylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	--
1,2-Dibromo-3-Chloropropane	8260B	--	0.2		*ND [0.5]*	*ND [0.5]*	--
1,2-Dichlorobenzene	8260B	--	600		ND [0.2]	ND [0.2]	--
1,2-Dichloroethane	8260B	--	5		ND [0.2]	ND [0.2]	--
1,2-Dichloropropane	8260B	--	5		ND [0.2]	ND [0.2]	--
1,3,5-Trimethylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	--
1,3-Dichlorobenzene	8260B	--	--		ND [0.2]	ND [0.2]	--
1,3-Dichloropropane	8260B	--	--		ND [0.2]	ND [0.2]	--
1,4-Dichlorobenzene	8260B	--	75		ND [0.2]	ND [0.2]	--
2,2-Dichloropropane	8260B	--	--		ND [0.5]	ND [0.5]	--
2-Butanone (MEK)	8260B	--	--		ND [10]	ND [10]	--
2-Chlorotoluene	8260B	--	--		ND [0.5]	ND [0.5]	--
2-Hexanone	8260B	--	--		ND [10]	ND [10]	--
4-Chlorotoluene	8260B	--	--		ND [0.5]	ND [0.5]	--
4-Methyl-2-Pentanone (MIBK)	8260B	--	--		ND [10]	ND [10]	--
Acetone	8260B	--	--		ND [10]	ND [10]	--
Benzene	8260B	--	5		ND [0.2]	ND [0.2]	--
Bromobenzene	8260B	--	--		ND [0.2]	ND [0.2]	--
Bromochloromethane	8260B	--	--		ND [0.3]	ND [0.3]	--
Bromodichloromethane	8260B	--	80		ND [0.2]	**0.17 [0.2] J**	--
Bromoform	8260B	--	80		ND [0.3]	ND [0.3]	--
Bromomethane	8260B	--	--		ND [0.5]	ND [0.5]	--
Carbon Disulfide	8260B	--	--		ND [0.5]	ND [0.5]	--
Carbon Tetrachloride	8260B	--	5		ND [0.2]	ND [0.2]	--
Chlorobenzene	8260B	--	100		ND [0.2]	ND [0.2]	--
Chloroethane	8260B	--	--		ND [1]	ND [1]	--
Chloroform	8260B	--	80		ND [0.2]	**1.7 [0.2]**	--
Chloromethane	8260B	--	--		ND [0.5]	ND [0.5]	--
cis-1,2-Dichloroethene	8260B	--	70		ND [0.2]	ND [0.2]	--
cis-1,3-Dichloropropene	8260B	--	--		ND [0.2]	ND [0.2]	--
Dibromochloromethane	8260B	--	80		ND [0.2]	ND [0.2]	--
Dibromomethane	8260B	--	--		ND [0.2]	ND [0.2]	--
Dichlorodifluoromethane	8260B	--	--		ND [0.5]	ND [0.5]	--
Ethylbenzene	8260B	--	700		ND [0.2]	ND [0.2]	--
Ethylene Dibromide (EDB)	8260B	--	0.05		ND [0.2]	ND [0.2]	--
Hexachlorobutadiene	8260B	--	--		ND [1]	ND [1]	--
Isopropylbenzene	8260B	--	--		ND [0.2]	ND [0.2]	--
m- & p-Xylene	8260B	--	--		ND [0.5]	ND [0.5]	--
Methyl tert-Butyl Ether (MTBE)	8260B	--	--		ND [0.3]	ND [0.3]	--
Methylene Chloride	8260B	--	5		ND [1]	ND [1]	--
n-Butylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	--
n-Propylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	--
Naphthalene	8260B	--	--		ND [1]	ND [1]	--
o-Xylene	8260B	--	--		ND [0.2]	ND [0.2]	--
p-Isopropyltoluene	8260B	--	--		ND [0.5]	ND [0.5]	--
sec-Butylbenzene	8260B	--	--		ND [0.5]	ND [0.5]	--
Styrene	8260B	--	100		ND [0.5]	ND [0.5]	--

Table A-7 Quality Control Groundwater Analytical Data
OU6 - Fort Wainwright, Alaska

			Location ID	TB-080722	WQ-080822	WQ-080922
			Sample ID	22FWOU6TB12	22FWOU6WQ01	22FWOU6WQ02
			SDG	22H153	22H153	22H153
			Lab Sample ID	22H153-22	22H153-09	22H153-16
			Matrix	WQ	WQ	WQ
			Sample Type	TB	EB	EB
			Screen Interval (feet)	NA	NA	NA
			Sample Date/Time	8/7/2022 8:00	8/8/2022 18:00	8/9/2022 18:00
Analyte	**Method**	**OU6 RGs[1]**	**EPA MCL[2, 3]**			
tert-Butylbenzene	8260B	--	--	ND [0.5]	ND [0.5]	--
Tetrachloroethene (PCE)	8260B	--	5	ND [0.3]	ND [0.3]	--
Toluene	8260B	--	1000	ND [0.2]	ND [0.2]	--
trans-1,2-Dichloroethene	8260B	--	100	ND [0.2]	ND [0.2]	--
trans-1,3-Dichloropropene	8260B	--	--	ND [0.5]	ND [0.5]	--
Trichloroethene (TCE)	8260B	5	5	ND [0.2]	ND [0.2]	--
Trichlorofluoromethane	8260B	--	--	ND [0.5]	ND [0.5]	--
Vinyl Chloride	8260B	--	2	ND [0.3]	ND [0.3]	--
Vinyl Chloride	8260B-SIM	--	2	ND [0.03]	ND [0.03]	--
Xylenes, Total	8260B	--	10000	ND [0.5]	ND [0.5]	--

Notes:

[1] OU6 Remedial Goals (USACE 2022b) for COCs.
[2] EPA MCL (EPA 2009)
[3] 18AAC75 Table C Groundwater Human Health Cleanup Level (ADEC 2021) for DRO and RRO.
-- = Not analyzed or not applicable
µg/L = microgram(s) per liter
COC = contaminant of concern
FD = field duplicate
N = normal sample
SDG = sample delivery group
WG = groundwater

Data Qualifer Definitions:

J = The reported result was an estimated value with an unknown bias.
J+ = The result was an estimated quantity, but the result may be biased high.
J- = The result was an estimated quantity, but the result may be biased low.
B = Analyte result is considered a high estimated value due to contamination present in an associated blank.

Cell Formatting:

Detected Analyte
Result exceeded OU6 RGs
Result exceeded EPA MCL or ADEC CUL
Nondetect value exceeded OU6 RGs or EPA MCL
Bracketed number [X.X] is the limit of detection

APPENDIX B
CDQR and ADEC Laboratory Data Review Checklists

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U.S. Army Corps of Engineers
Alaska District

2022 Fort Wainwright Groundwater Report – Operable Unit 6

Fort Wainwright, Alaska

APPENDIX B
CHEMICAL DATA QUALITY REVIEW

FINAL
NOVEMBER 2023

TABLE OF CONTENTS

SECTION **PAGE**

TABLES

ATTACHMENTS

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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
CoC	chain-of-custody
COC	contaminant of concern
CDQR	Chemical Data Quality Review
DL	detection limit
DoD	U.S. Department of Defense
DQO	data quality objective
EB	equipment blank
EPA	U.S. Environmental Protection Agency
EMAX	EMAX Laboratories, Inc
FD	field duplicate
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
ND	nondetect
OU6	Operable Unit 6
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RG	remedial goal
RPD	relative percent difference
SDG	sample delivery group
TB	trip blank
TCP	1,2,3-trichloropropane
USACE	U.S. Army Corps of Engineers
WG	groundwater

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1.0 INTRODUCTION

This Chemical Data Quality Review (CDQR) summarizes the quality assurance (QA)/quality control (QC) evaluation of laboratory data collected during groundwater sampling activities at Operable Unit 6 (OU6) sites located at Fort Wainwright, Alaska, during August 2022. The data have been reviewed to evaluate compliance with QA/QC criteria based on data quality objectives (DQOs) specified in the approved *Final 2022 CERCLA Sites Work Plan Operable Units 1 through 6* (U.S. Army Corps of Engineers [USACE] 2022), hereafter referred to as the Work Plan.

The sample summary is presented in Table A-1 and complete analytical results in crosstab format are presented in Tables A-2 through A-7 (Appendix A) of the monitoring report. The qualification tables are presented in Tables B-1 through B-4 in Attachment B-1. The associated Alaska Department of Environmental Conservation (ADEC) Laboratory Data Review Checklist is included as Attachment B-2. The level IV PDF for each sample delivery group (SDG) are included in Attachment B-3.

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2.0 DATA VERIFICATION, DATA QUALITY REVIEW, AND QUALIFICATION

EMAX Laboratories, Inc (EMAX) of Torrance, California, was the primary laboratory for this project. EMAX holds current ADEC laboratory approval and U.S. Department of Defense (DoD) Environmental Laboratory Accreditation Program certifications for all requested analyses, and chemical analyses for all parameters were performed in accordance with the DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.4 (DoD 2021). Samples were prepared and analyzed in accordance with analytical methods specified in Test Methods for Evaluating Solid Waste SW-846 (U.S. Environmental Protection Agency [EPA] 2020); Underground Storage Tanks Procedures Manual (ADEC 2017); and laboratory standard operating procedures.

The data quality review and assessment were performed by an experienced QA chemist independent of the analytical laboratory. This evaluation included completion of the ADEC Laboratory Data Review Checklist and review of analytical data including QC sample results, field and laboratory documentation, and all data submittals for each SDG.

Groundwater analytical results were compared to the OU6 remedial goals (RGs) for groundwater as defined in Worksheet #15 of the workplan for the purpose of this review and are presented in Table B-2-1 for OU6 contaminants of concern (COC). The RGs used for each analyte are presented along with analytical results in the results tables (Appendix A).

Table B-2-1 OU6 RGs for COCs

Analyte[1]	RGs[2] (µg/L)
1,2,3- TCP	0.12
Trichloroethylene	5
Diesel-range organics	1,500
Residual-range organics	1,100

Notes:
[1] Only OU6 COCs are presented.
[2] RGs defined in the Work Plan (USACE 2022).
µg/L = microgram(s) per liter
For additional definitions, refer to the Acronyms and Abbreviations section.

All project data were reviewed on an analytical-batch basis by assessing QC samples and associated field sample results. Data quality review and usability assessment were performed using the QC criteria defined in DoD QSM (DoD 2021); DoD General Data Validation Guidelines (DoD 2019); ADEC technical memorandum *Guidelines for Data Reporting* (ADEC 2022b); specific method guidance, such as the ADEC *Underground Storage Tanks Procedures Manual* (ADEC 2017); Test Methods for Evaluating Solid Waste SW-846 (EPA 2020); and the laboratory standard operating procedures, in that order.

The following information was reviewed as part of the data quality review and assessment:

- Sample handling and chain-of-custody (CoC)
- Sample preservation and holding time compliance
- Field QC samples, including trip blanks (TBs), equipment blanks (EBs), and field duplicates (FDs)
- Laboratory reporting limits, including limits of detection (LODs) and limits of quantitation (LOQs)
- Method blanks (MBs)
- Laboratory control sample (LCS) and LCS duplicate (LCSD) recoveries
- Surrogate spike recoveries
- Matrix spike (MS) and MS duplicate (MSD) recoveries
- Initial and continuing calibration summary information
- Internal standards performance (gas chromatography/mass spectrometry)
- Precision, including relative percent difference (RPD) values for duplicate analyses
- Case narrative review, laboratory flagging review, and other analytical method-specific criteria

The data quality review and assessment identified results requiring qualification and potential effects on data usability based on the measurement performance criteria (MPC) defined in the Work Plan. Precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) were used for this data quality review and assessment:

- Precision is a measure of the reproducibility of measurements, which can be used to verify laboratory procedures, determine matrix effect, or sample homogeneity. Precision was measured by the RPD between LCS and LCSDs, MS and MSDs, or primary and FD results.

- Accuracy is a measure of the correctness or closeness to the true value. Accuracy was evaluated by reviewing the following elements: calibrations, surrogates, LCS, LCSD, MS, MSD, MBs, relative response factors and relative standard deviations, tune criteria, second column confirmations, and internal standards.
- Representativeness is a measure of the degree to which the samples reflect the site characteristics. Representativeness was measured by reviewing sampling design, sampling procedures, sample documentation, holding times, and preservations.
- Completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under correct, normal conditions. For completeness requirements, valid results were all results not rejected and determined to be usable in the context of the DQOs. Completeness was evaluated for each analytical method for a particular sampling event with respect to each DQO or end data use. The completeness goal is 95 percent for this project.
- Comparability is a measure of the confidence with which one data set can be compared to another. The following were reviewed to ensure comparability: use of standard methods for sampling and analysis, reporting in standard units, operating instruments within calibrated ranges, and using standard and comprehensive reporting formats.
- Sensitivity is a measure of the ability of a method or instrument to detect the target analyte at the level of interest. The laboratory-specific limits were evaluated against the cleanup levels to determine whether the analytical methods and/or laboratory procedures were able to meet the project DQOs.

The qualifiers listed in Table B-2-2 were applied to the analytical data set, as appropriate.

Table B-2-2 Data Qualifiers

Qualifier	Description
ND [LOD]	Analyte is not detected above the DL [LOD is presented in brackets].
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
B	Analyte result is considered a high estimated value due to contamination present in an associated blank (e.g., MB or TB).
X	Analyte result is rejected – result is not usable. Note that X replaces the chemical result (no result shall be reported with an X flag).

Note:
For definitions, refer to the Acronyms and Abbreviations section.

Qualification was not required in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and dilution of the sample resulted in surrogate or spike dilution at 5 times or greater.

- MS recoveries were outside QC limits, and the spiked concentration was less than that of the parent sample.
- An analyte was detected in the associated blank, but there was no detection in the associated sample.
- MS/MSD or LCS/LCSD recoveries exceeded upper control limits and there was no detection in the sample(s).

Data were considered for rejection on the following grounds:

- Initial calibration (per compound) criteria not met
- Continuing calibration (per compound) not verified
- All nondetects (NDs) with the continuing calibration recovery less than control limits
- All NDs with the LCS recovery less than control limits
- Any compound with LCS recovery less than 10 percent
- Missed holding times greater than 2 times the method-specified holding time
- Surrogate recovery of less than 10 percent and a dilution factor of 5 or less

Data quality exceptions that do not result in qualifications are not discussed in this report and are addressed in the associated ADEC Laboratory Data Review Checklist (Attachment B-2).

3.0 CHEMICAL DATA QUALITY REVIEW

The data verification and CDQR were performed to assess the overall quality and usability of the data collected to support sampling activities at the OU6 sites.

Complete details for the review and evaluation of field samples and associated QC samples are included in this CDQR and in the ADEC Laboratory Data Review Checklist (Attachment B-2). During the data quality review, analytical results or recoveries that did not meet MPCs were identified, and qualifiers were applied to the results, where appropriate, in accordance with the project Work Plan. Qualified results are considered estimated, and whenever possible, direction of potential bias was assigned and effects on usability are discussed.

The overall data quality was assessed using the PARCCS data quality indicators and described in the ADEC Laboratory Data Review Checklist (Attachment B-2). All analytical results were acceptable, and no results were rejected (100 percent complete) and the completeness goal of 95 percent was met.

The total number and percentage of results qualified and for each QC anomaly/qualifier and the percent completeness are presented in Table B-3-1.

Table B-3-1 Summary of Qualified Results and Percent Completeness

QC Anomaly	PARCCS Affected	Qualifier	Results Qualified	Percent (%)
Method/TB contamination	Accuracy/Contamination	B	3	1
QC failure resulting in high bias	Accuracy	J+	0	0
QC failure resulting in low bias	Accuracy	J-	0	0
QC failure resulting in unknown bias	Accuracy/Precision/Comparability	J	0	0
LOD exceedance (not qualified)	Sensitivity	-	3	1
Rejected results	Accuracy/Completeness	X	0	0
Total Results[1]	**-**	**289**		
Completeness[2]	**-**	**100%**		

Notes:
[1] Total results include primary and field duplicate samples only and does not include other QC samples/analytes (i.e., spikes and surrogates)
[2] Completeness is calculated by dividing the valid (not rejected) number of results by the total results multiplied by 100 percent.
For definitions, refer to the Acronyms and Abbreviations section.

The following sections describe the results of the review and assessment of data for each analytical method. QC parameters met DoD QSM, Version 5.4 (DoD 2021) criteria except where noted.

3.1 ANALYTICAL SAMPLE AND FIELD QUALITY CONTROL SAMPLE SUMMARY

Table B-3-2 lists the primary samples and QC samples collected and analyzed in support of project activities.

Table B-3-2 Sample QC Frequency Summary

Number of Primary Samples	FDs		MS/MSD		Number of EBs[1]	Number of TBs
	Number	Frequency	Number	Frequency		
17	2	12%	2	12%	3	1

Notes:
[1]A total of three EBs were associated with OU6 samples. See Attachment B-1, Table B-2 for EB associations.
For definitions, refer to the Acronyms and Abbreviations section.

The overall project-required frequency of 1 FD for every 10 or fewer primary samples, per analyte, per matrix, was met. MS/MSDs were collected and submitted to the laboratory at the project-required frequency of one set for every 20 or fewer project samples (5 percent), which is a sufficient quantity to be included in every preparatory batch (designated MS/MSD samples were included with each shipment). EBs were collected and submitted to the laboratory at the project-required frequency of one per day when using sampling equipment that requires decontamination procedures between sampling efforts. One TB was included in the single cooler containing samples for volatile analyses (i.e., SW8260D). The sample summary is presented in Table A-1 (Appendix A) includes all field samples submitted to the analytical laboratory.

3.2 SAMPLE COLLECTION

All monitoring wells were purged and sampled with submersible pumps and 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 2022a) and the Work Plan (USACE 2022), that low-flow sampling criteria was employed (EPA 1996), and that all groundwater levels were within the screened intervals at the time of sampling, as appropriate.

All samples were collected as presented in the Work Plan, with the exception of MW58 due to stuck tubing in the well. All other monitoring wells met stabilization criteria prior to sample collection, and all water levels were within the screened interval at the time of sampling, with the exceptions noted below. The following is a summary of other notable observations discovered during groundwater sampling activities and/or review of the groundwater sample forms for each site:

- Monitoring well MW58 could not be sampled because there was an obstruction within the casing that prevented access to groundwater.
- Free product was not measured in any OU6 wells during the 2022 sampling event, a faint to strong fuel odor was detected in purge water from wells MW03 (faint), MW06A (faint), MW-12R (strong), MW33 (moderate with sheen noted), MW77 (faint), MW-61 (moderate), MW-80 (moderate), MW-78 (moderate) and MW-91 (moderate).
- All wells were found screened across the water table with four exceptions: MW12R, MW80, MW78 and MW91. Groundwater samples from these wells were collected in the middle of the screen interval in order to obtain a representative sample of the aquifer at depth. The sentry wells (MW78 and MW91) and the trichloroethylene plume well (MW80) were intentionally screened below the water level to evaluate the vertical extent of contamination.

3.3 SAMPLE HANDLING AND CHAIN-OF-CUSTODY

CoC forms and laboratory case narratives were reviewed to assess sample handling procedures that may affect the integrity of the samples and quality of the resulting data. Signed copies of CoCs and cooler receipt forms are included in the final laboratory report.

Samples and corresponding CoCs were packed in coolers and shipped with frozen gel packs to EMAX via Alaska Air Cargo and courier services. Four coolers were shipped on 11 August 2022; all sample coolers were received with temperature blank and ambient cooler temperatures between 0 and 6 degrees Celsius and presented in Table B-1 (Appendix B-1).

No discrepancies were noted upon receipt of samples at the laboratory.

3.4 SAMPLE PRESERVATION AND HOLDING TIME COMPLIANCE

All samples were extracted and/or analyzed within the recommended holding times and were properly preserved for the analytical procedures used for this project.

3.5 SAMPLE LIMITS OF DETECTION AND LIMITS OF QUANTITATION

Sample LODs for NDs results were compared to OU6 RGs to determine whether the laboratory data met MPCs for sensitivity. RGs for OU6 COCs are defined in Table B-2-1. The following LODs for ND results did not meet sensitivity MPCs:

- The LODs for ND results for SW8260D analyte 1,2,3-trichloropropane (TCP) exceeded the RGs in trichloroethylene plume wells (MW61 and MW80); however, LODs were also analyzed for TCP using the SW8260SIM method and the RGs were met. Table B-3 (Attachment B-1) presents the affected samples where LODs were greater than the OU6 RGs.

3.6 BLANKS

MBs, TBs, and EBs were reviewed to detect potential cross-contamination. MB detections are indicative of cross-contamination for preparation and analysis performed by the laboratory, TBs measure shipment and storage cross-contamination, and EBs are assessed for potential cross-contamination between samples when decontamination procedures occur between sampling efforts.

Blank evaluation is considered to be contaminated and may require qualification under the following conditions:

- Concentration of target analytes in the blank exceeds one-half the LOQ
- Concentration of target analytes in the blank is greater than one-tenth the amount measured in any sample, or concentration of target analytes in the blank is greater than one-tenth the regulatory limit (whichever is greater)

Table B-4 (Attachment B-1) presents the blank evaluation by presenting the minimum detected result associated with OU6 samples, the associated criteria (if applicable), and whether any associated blank was within one-tenth of the results or criteria (whichever was greater).

3.6.1 Method Blanks

A MB was included with each analytical batch of 20 or fewer samples, as required. All associated MB results were less than one-half the LOQ and there were no detections in MBs greater than one-tenth of the associated sample detections or regulatory criteria; therefore, no results were affected.

3.6.2 Trip Blanks

A TB was included with each cooler containing volatile samples, as required. Coolers containing volatile samples and the associated TBs are shown in Table B-1 (Attachment B-1). No target analytes were detected in the TBs above one-half the LOQ and there were no detections in the TBs greater than one-tenth of the associated sample detections or regulatory criteria; therefore, no results were affected.

3.6.3 Equipment Blanks

All OU6 wells were sampled with submersible pumps and an EB was collected at a frequency of one per day. EBs were collected by pumping deionized water though the pumps and into sample containers after the pumps were decontaminated using an Alconox solution and deionized water rinse. A summary of EBs and the associated samples are presented in Table B-2 (Attachment B-1).

A total of three results required qualification from EB detections above one-half the LOQ and are presented in Table B-5 (Attachment B-1). All affected results (iron and manganese) were from method SW6020A and are analyzed for monitoring natural attention. These results were qualified B due to potential cross-contamination from decontamination procedures, however results were not significantly affected since there is no criteria for monitoring natural attention parameters. All other equipment blank results were less than $1/10^{th}$ the amount measured in the associated samples or regulatory criteria.

3.7 LABORATORY CONTROL SAMPLES

A LCS or LCS/LCSD pair was included with each preparatory batch, as required. LCS and LCSD percent recovery and LCS/LCSD RPD were compared to the project MPCs. All LCS/LCSD recoveries were within control limits and LCS/LCSD precision was within the RPD limit. No results required qualification due to LCS/LCSD recovery and RPD outliers due to the following since associated outliers were ND samples with high recoveries/RPDs.

3.8 MATRIX SPIKE SAMPLES AND DUPLICATES

MS/MSDs were collected to evaluate the accuracy and precision of the matrix and/or laboratory procedures at a frequency of one set for every 20 or fewer project samples (5 percent). This frequency is a sufficient quantity to be included in every preparatory batch in which a designated MS/MSD samples is included in each shipment. Two sets of MS/MSDs were included for 19 samples (primary and FDs) in one single shipment. A summary of associated batches and methods is presented in Table B-3-3 and identifies two of eight (25 percent) batches (for SW8260 and SW8260SIM analysis only) that did not include an MS/MSD sample. All batches included an LCS/LCSD and met accuracy and precision criteria.

Table B-3-3 MS/MSD Batch Summary

SDG	Method	Batch	MS/MSD Sample(s)	Notes
22H153	6020A	IMH024W	22FWOU6WG05, 22FWOU6WG16	Met MPCs.
22H153	8260B	VO01H26	None	Batch included TB only. No primary samples were analyzed, and batch included an LCS/LCSD.
22H153	8260B	VO05H19	22FWOU6WG16	Met MPCs.
22H153	8260B-SIM	VO02H14	22FWOU6WG16	Met MPCs.
22H153	8260B-SIM	VOF5H03	22FWOU6WG16	Met MPCs.
22H153	8260B-SIM	VOF5H04	None	Batch included one re-extracted sample only (22FWOU6WG20) and LCS/LCSD.
22H153	AK102/103	22DSH031W	22FWOU6WG05	Met MPCs.
22H153	E300.0	ICH050W	22FWOU6WG05, 22FWOU6WG16	Met MPCs.

Note:
For definitions, refer to the Acronyms and Abbreviations section.

No results required qualification due to MS/MSD recovery and RPD outliers due to the following: ND samples with high recoveries/RPDs, spike concentrations were less than parent sample concentrations or samples were analyzed at a dilution factor of 5 or greater.

3.9 SURROGATES

For organic analyses, surrogates (a chemical with similar properties of target analytes) are used to evaluate the accuracy of laboratory procedures (extraction and analysis) and matrix effects. Surrogates were included with all laboratory QC and field samples, as required. Surrogate recoveries were reviewed and compared to project MPCs. All surrogate recoveries were within control limits for laboratory QC and field samples.

3.10 FIELD DUPLICATE PRECISION

FD samples were collected to evaluate the precision of matrix and/or laboratory procedures. Two FDs were submitted with 17 primary samples, and all RPDs between N and FD pairs were less than 30 percent per ADEC's Field Sampling Guidance (ADEC 2022a).

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4.0 OVERALL DATA QUALITY AND USABILITY ASSESSMENT

In general, the overall quality of the project data was acceptable, no results were rejected, and the completeness goal of 95 percent was met. Qualified data are considered acceptable for use, with the limitations discussed within this QA/QC report and the ADEC Laboratory Data Review Checklist regarding the qualifiers applied to the results.

The following QC issues required qualification or did not meet MPCs:

- LOD sensitivity for TCP (Table B-3, Attachment B-1)
- Equipment blank flags (Table B-5, Attachment B-1)

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5.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2017 (March) *Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Water and Standard Sampling Procedures*. Division of Spill Prevention and Response, Contaminated Sites Program.

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U.S. Department of Defense (DoD). 2019 (4 November). *General Data Validation Guidelines*.

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EPA. 2020 (May). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. Status Tables for SW-846, Third Edition, FINAL UPDATES I, II, IIA, IIB, III, IIIA, IIIB, IV, V, VI and VII.

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Attachment B-1
Qualification Tables

Table B-1 Cooler Temperatures
OU6 - Fort Wainwright, Alaska

OU	NPDL	CoC	Cooler Date	Lab	SDG	Temp Blank (°C)	Cooler Temp (°C)	Contained VOCs?	Associated TB
OU6	22-022	2022FWSM61	8/11/2022	EMAX	22H153	5.9	5.4	No	N/A
OU6	22-022	2022FWSM62	8/11/2022	EMAX	22H153	3.4	5.4	No	N/A
OU6	22-022	2022FWSM63	8/11/2022	EMAX	22H153	4.3	5.6	No	N/A
OU6	22-022	2022FWSM64	8/11/2022	EMAX	22H153	3.3	4.4	yes	22FWOU6TB12

Notes:

All samples are associated with NPDL 22-022.

All samples were submitted to EMAX of Torrance, CA analyzed on a standard turnaround time (30 days).

°C = degree(s) Celsius

CoC = chain-of-custody

EMAX = EMAX Laboratories of Torrance, CA

N/A = not applicable

NPDL = North Pacific Division Laboratory

OU = operable unit

SDG = sample delivery group

TB = trip blank

VOC = volatile organic compound

Table B-2 Equipment Blank Summary
OU6 - Fort Wainwright, Alaska

OU	Equipment Blank			Associated Sample		
	SDG	Sample Date	Associated EB	SDG	LocationID	Sample ID
OU6	22H116	8/7/2022	22FWOU5WQ04	22H153	MW08	22FWOU6WG13
				22H153	MW78	22FWOU6WG19
				22H153	MW91	22FWOU6WG20
				22H153	MW13	22FWOU6WG02
				22H153	MW47	22FWOU6WG14
	22H153	8/8/2022	22FWOU6WQ01	22H153	MW79	22FWOU6WG15
				22H153	MW03	22FWOU6WG01
				22H153	MW82	22FWOU6WG12
				22H153	MW80	22FWOU6WG18
				22H153	MW37	22FWOU6WG07
				22H153	MW12R	22FWOU6WG04
				22H153	MW77	22FWOU6WG11
				22H153	MW64	22FWOU6WG10
				22H153	MW61	22FWOU6WG16
				22H153	MW61	22FWOU6WG17
				22H153	MW06A	22FWOU6WG03
	22H153	8/9/2022	22FWOU6WQ02	22H153	MW33	22FWOU6WG05
				22H153	MW33	22FWOU6WG06
				22H153	MW62	22FWOU6WG09

Notes:

All samples are associated with NPDL 22-022

EB = equipment blank

OU = operable unit

SDG = sample delivery group

Table B-3 LOD Sensitivity Outliers
OU6 - Fort Wainwright, Alaska

SDG	Sample ID	Lab Sample ID	Method	Analyte	Result (µg/L)	OU6 RAGs[1] (µg/L)	Dilution	Qualifer
22H153	22FWOU6WG16	22H153-07	8260B	1,2,3-TCP	ND [0.5]	0.12	1	U
22H153	22FWOU6WG17	22H153-08	8260B	1,2,3-TCP	ND [0.5]	0.12	1	U
22H153	22FWOU6WG18	22H153-21	8260B	1,2,3-TCP	ND [0.5]	0.12	1	U

Notes:

[1] OU6 Remedial Action Goals for site-specific CoCs (USACE 2022).
µg/L = microgram(s) per liter
LOD = limit of detection
ND = nondetect with LODs shown in brackets [ ]
RAGs = remedial action goals
SDG = sample delivery group
TCP = 1,2,3-trichloropropane
For qualifier definitions, refer to the CDQR.

Table B-4 Blank Evaluation
OU6 - Fort Wainwright, Alaska

Method	Analyte	Detections associated with OU6 samples/batches							Requires Further Evaluation?	Rationale
		Minimum Sample Result [1]	Criteria [2]	Units	Blank Evaluation [3]	MB	TB	EB		
6020A	Iron	64	--	µg/L	6.4	ND	-	17.3	Yes	Associated samples qualifed due to EB. Refer to Table B-5.
6020A	Manganese	0.553	--	µg/L	0.0553	ND	-	0.4	Yes	Associated samples qualifed due to EB. Refer to Table B-5.
8260B	1,2-Dichloroethane	0.11	5	µg/L	0.5	ND	ND	ND	No	A
8260B	cis-1,2-Dichloroethene	5.4	70	µg/L	7	ND	ND	ND	No	A
8260B	trans-1,2-Dichloroethene	6.2	100	µg/L	10	ND	ND	ND	No	A
8260B	Trichloroethene	1	5	µg/L	0.5	ND	ND	ND	No	A
8260B	Vinyl Chloride	0.4	2	µg/L	0.2	ND	ND	ND	No	A
8260B-SIM	1,2,3-Trichloropropane	0.0038	0.12	µg/L	0.012	ND	ND	ND	No	A
8260B-SIM	Vinyl Chloride	0.21	2	µg/L	0.2	ND	ND	ND	No	A
AK102	C10-C25 DRO	740	1,500	µg/L	150	ND	-	ND	No	A
AK103	C25-C36 RRO	260	1,100	µg/L	110	ND	-	ND	No	A
E300.0	Sulfate	5860	--	µg/L	586	ND	-	674	No	B

Notes:

[1] Minimum detected result associated with OU6 samples

[2] Criteria associated with OU6 samples (OU6 Remedial Goals for COCs, EPA MCLs or ADEC Table C for fuels)

[3] Blank Evaluation is 1/10th the detected results or 1./10th criteria (whichever is greater)

µg/L = microgram(s) per liter

COC = contaminant of concern

DRO = diesel-range organics

EB = Equipment Blank

EPA = U.S. Environmental Protection Agency

MB = method blank

MCL = maximum concentration limit

ND = not detected associated in blank samples

RRO = residual-range organics

TB = trip blank

Rationale Key

A Analyte not detected in any associated blanks (MB, TB or EB)

B Analyte detected greater than five times associated blank.

Table B-5 Equipment Blank Qualifications
OU6 - Fort Wainwright, Alaska

SDG	Sample ID	Method	Analyte	Result (µg/L)	LOD (µg/L)	EB Sample	EB Result (µg/L)	Qualifier
22H153	22FWOU6WG11	6020A	Iron	64	50	22FWOU6WQ01	17.3	B
22H153	22FWOU6WG13	6020A	Manganese	1.28	0.5	22FWOU5WQ04	0.596	B
22H153	22FWOU6WG07	6020A	Manganese	0.553	0.5	22FWOU6WQ01	0.298	B

Notes:

µg/L = microgram per liter
EB = equipment blank
LOD = limit of detection
SDG = sample delivery group

Attachment B-2

ADEC Laboratory Data Review Checklist

ADEC Contaminated Sites Program Laboratory Data Review Checklist

Completed By:	Candace Ede	**CS Site Name:**	OU6 – Former Communications Site – Fort Wainwright, AK	**Lab Name:**	EMAX
Title:	Chemist	**ADEC File No.:**	108.38.085	**Lab Report No.:**	22H153
Consulting Firm:	Jacobs	**Hazard ID No.:**	4140	**Lab Report Date:**	09/26/2022

Note: *Any N/A or No box checked must have an explanation in the comments box.*

1. **Laboratory**

   a. Did an ADEC Contaminated Sites Laboratory Approval Program (CS-LAP) approved laboratory receive and perform all of the submitted sample analyses?
   Yes ☒ No ☐ N/A ☐
   Comments: EMAX is currently DOD and ADEC certified for all analyses requested.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses CS-LAP approved?
   Yes ☐ No ☐ N/A ☒
   Comments: All samples were analyzed by EMAX of Torrance, CA.

2. **Chain of Custody (CoC)**

   a. Is the CoC information completed, signed, and dated (including released/received by)?
   Yes ☒ No ☐ N/A ☐
   Comments: Signed CoCs were included in the final PDF.

   b. Were the correct analyses requested?
   Yes ☒ No ☐ N/A ☐
   Analyses requested: AK102/103 (DRO/RRO), SW6020 (Fe/Mn), SW8260 (VOCs), SW8260SIM (TCP and VC) and EPA 300.0 (sulfate).
   Comments: All methods requested were analyzed.

3. **Laboratory Sample Receipt Documentation**

   a. Is the sample/cooler temperature documented and within range at receipt (0° to 6° C)?
   Yes ☒ No ☐ N/A ☐
   Cooler temperature(s):

COC	Cooler Name	Temp Blank (° C)	Cooler Temp (° C)
2022FWSM61	Kerry Blue	5.9	5.4
2022FWSM62	Maltese	3.4	5.4
2022FWSM63	Yorkipoo	4.3	5.6
2022FWSM64	Labradoodle	3.3	4.4

Sample temperature(s): See table above
Comments: All cooler temperatures and temperature blanks were less than 6° C.

b. Is the sample preservation acceptable – acidified waters, methanol preserved soil (GRO, BTEX, VOCs, etc.)?
Yes ☒ No ☐ N/A ☐
Comments: Preservatives were acceptable.

c. Is the sample condition documented – broken, leaking, zero headspace (VOA vials); canister vacuum/pressure checked and no open valves, etc.?
Yes ☒ No ☐ N/A ☐
Comments: One of three VOA vials for equipment blank sample 22FWOU6WQ01 was received broken in the bubble bag. There was sufficient volume available to analyze all requested methods.

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, canister not holding a vacuum, etc.?
Yes ☒ No ☐ N/A ☐
Comments: All discrepancies between sample labels and the CoC were noted, and the lab was instructed to follow the CoC.

e. Is the data quality or usability affected?
Yes ☒ No ☐ N/A ☐
Comments: Data quality and usability was not affected.

4. Case Narrative

a. Is the case narrative present and understandable?
Yes ☒ No ☐ N/A ☐
Comments: Each method analyzed contained a case narrative.

b. Are there discrepancies, errors, or QC failures identified by the lab?
Yes ☐ No ☐ N/A ☐
Comments: SW8260SIM -
All project calibration requirements were satisfied, except for 2,2-Dichloropropane was detected biased high(%D=23.3) in CCV (Data File ID: RHQ502). All associated samples were ND for 2,2-Dichloropropane; therefore, no data was affected.

All other QC discrepancies are noted in the applicable section within the checklists.

c. Were all the corrective actions documented?
Yes ☐ No ☐ N/A ☒
Comments: No corrective actions were needed/performed.

d. What is the effect on data quality/usability according to the case narrative?
Comments: Data quality and usability was not affected.

5. Sample Results

a. Are the correct analyses performed/reported as requested on CoC?
Yes ☒ No ☐ N/A ☐
Comments: All analyses requested on the CoC were performed.

b. Are all applicable holding times met?
Yes ☒ No ☐ N/A ☐
Comments: All holding times were met.

c. Are all soils reported on a dry weight basis?
Yes ☐ No ☐ N/A ☒
Comments: No soils were analyzed in the SDG.

d. Are the reported limits of quantitation (LOQ) or limits of detections (LOD), or reporting limits (RL) less than the Cleanup Level or the action level for the project?
Yes ☐ No ☒ N/A ☐
Comments: Sample LODs for non-detects were compared to the OU6 remedial action goals (RAGs) to determine whether the laboratory data met MPCs for sensitivity. All reported LODs for non-detect results met project MPCs for sensitivity, expect as noted below:

Analyte	Result (ug/L)	OU6 RAGs (ug/L)	Notes
1,2,3-Trichloropropane	ND [0.5]	0.12	For TCP plume areas, method SW8260SIM was used and CUL was met.

e. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Data quality and usability was not significantly affected. TCP was analyzed using SW8260SIM and criteria was met.

6. QC Samples

a. Method Blank

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

Yes ☒ No ☐ N/A ☐
Comments: One method blank was included in every batch.

ii. Are all method blank results less than LOQ (or RL)?
Yes ☒ No ☐
Comments: All method blank results were nondetect.

iii. If above LOQ or RL, what samples are affected?
Comments: No samples were affected.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☒ N/A ☐
Comments: No samples were affected.

v. Data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Data quality and usability was not affected.

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

i. Organics – Are one LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)
Yes ☒ No ☐ N/A ☐
Comments: One LCS/LCSD was included in every batch for organic analyses.

ii. Metals/Inorganics – Are one LCS and one sample duplicate reported per matrix, analysis and 20 samples?
Yes ☒ No ☐ N/A ☐
Comments: One LCS/LCSD was included in every batch for inorganic analyses. Laboratory duplicates were included in E300.0 batches.

iii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)
Yes ☐ No ☒ N/A ☐
Comments: The following LCS recoveries were outside of criteria:

Method	Batch	Analyte	LCS Recovery (%)	LCSD Recovery (%)	QC Limits (%)
8260B-SIM (TCP)	V0F5H04	1,2,3-TCP	139	100	73-122

iv. Precision – Are all relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? Was the RPD reported from LCS/LCSD, and or sample/sample duplicate? (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)
Yes ☒ No ☐ N/A ☐
Comments: All LCS/LCSD RPD criteria was met.

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments: All associated samples were ND for 1,2,3-TCP, therefore no samples were affected by the LCS with the high recovery.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☒ N/A ☐
Comments: No samples were affected.

vii. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments Data quality and usability were not affected.:

c. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

i. Organics – Are one MS/MSD reported per matrix, analysis and 20 samples?
Yes ☐ No ☒ N/A ☐
Comments: Below is a list of organic batches and MS/MSDs if included.

SDG	Method	Batch	MS/MSD Sample	Notes
22H153	AK102_103	22DSH031W	22FWOU6WG05	Met MPCS
22H153	AK101	22VGH7H05	22FWOU5WG13 (SDG 22H116)	Met MPCS
22H153	8260B	VO01H26	None	Included TB only and no primary samples. Batch also included an LCS/LCSD.
22H153	8260B	VO05H19	22FWOU6WG16	Met MPCS
22H153	8260B-SIM	VO02H14	22FWOU6WG16	Met MPCS
22H153	8260B-SIM	VOF5H03	22FWOU6WG16	Met MPCS
22H153	8260B-SIM	VOF5H04	None	Included re-extracted sample only and LCS/LCSD.

ii. Metals/Inorganics – Are one MS/MSD reported per matrix, analysis and 20 samples?
Yes ☒ No ☐ N/A ☐
Comments: Below is a list of inorganic batches and MS/MSDs if included.

SDG	Method	Batch	MS/MSD Sample	Notes
22H153	E300.0	ICH050W	22FWOU6WG05, 22FWOU6WG16	Met MPCS
22H153	6020A	IMH024W	22FWOU6WG05, 22FWOU6WG16	Met MPCS

iii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable?

Yes ☐ No ☒ N/A ☐
Comments: The following MS/MSD recoveries were outside of criteria:

Sample ID	Method	Analyte	MS Recovery	MSD Recovery	QC Limits	Dilution
22FWOU6WG05	AK102_103	C10-C25 DRO	217	215	75-125	1
22FWOU6WG05	6020A	Iron	290	303	87-118	5
22FWOU6WG05	6020A	Manganese	600	367	87-115	5
22FWOU6WG05	E300.0	Sulfate	118	122	90-110	1
22FWOU6WG16	6020A	Iron	94	81	87-118	1
22FWOU6WG16	6020A	Manganese	867	133	87-115	1

iv. Precision – Are all relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from MS/MSD, and or sample/sample duplicate.
Yes ☒ No ☐ N/A ☐
Comments All MS/MSD RPD criteria was met.:

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

Sample ID
22FWOU6WG05
22FWOU6WG16

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☒ N/A ☐
Comments:

Sample ID	Method	Analyte	Qualifier	Reason
22FWOU6WG05	AK102_103	C10-C25 DRO	none	Parent sample concentration greater than the spike amount
22FWOU6WG05	6020A	Iron	none	
22FWOU6WG05	6020A	Manganese	none	
22FWOU6WG05	E300.0	Sulfate	none	
22FWOU6WG16	6020A	Iron	none	
22FWOU6WG16	6020A	Manganese	none	

vii. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Data quality and usability were not affected.

d. Surrogates – Organics Only or Isotope Dilution Analytes (IDA) – Isotope Dilution Methods Only

i. Are surrogate/IDA recoveries reported for organic analyses – field, QC, and laboratory samples?
Yes ☒ No ☐ N/A ☐
Comments: Surrogates were reported for organic analyses.

ii. Accuracy – Are all percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK

Petroleum methods 50-150 %R for field samples and 60-120 %R for QC samples; all other analyses see the laboratory report pages)
Yes ☒ No ☐ N/A ☐
Comments: All surrogate recoveries were within criteria.

iii. Do the sample results with failed surrogate/IDA recoveries have data flags? If so, are the data flags clearly defined?
Yes ☐ No ☐ N/A ☒
Comments No samples were affected. :

iv. Is the data quality or usability affected?
Yes ☐ No ☒ N/A ☐
Comments: Data quality and usability were not affected.

e. Trip Blanks

i. Is one trip blank reported per matrix, analysis, and for each cooler containing volatile samples? Yes ☒ No ☐ N/A ☐
Comments:

COC	Cooler Name	Contained VOCs?	Associated TB
2022FWSM64	Labradoodle	yes	22FWOU6TB12

ii. Are all results less than LOQ or RL?
Yes ☒ No ☐ N/A ☐
Comments: All trip blank results were nondetect.

iii. If above LOQ or RL, what samples are affected?
Comments: No samples were affected.

iv. Is the data quality or usability affected?
Yes ☐ No ☐ N/A ☐
Comments: Data quality and usability were not affected.

f. Field Duplicate

i. Are one field duplicate submitted per matrix, analysis, and 10 project samples?
Yes ☒ No ☐ N/A ☐
Comments: Below is a list of the FD frequencies for OU6:

Number of Primary samples	Number of FDs	Frequency of FDs
17	2	12%

ii. Was the duplicate submitted blind to lab?
Yes ☒ No ☐ N/A ☐

Comments: FDs were identified sequentially and were submitted blind to lab. Below is a list of Primary/FD IDs per site:

Primary	FD
22FWOU6WG05	22FWOU6WG06
22FWOU6WG16	22FWOU6WG17

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

$$RPD\ (\%) = \left| \frac{R_1 - R_2}{\left(\frac{R_1 + R_2}{2}\right)} \right| X\ 100$$

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

All primary/FD pair RPD criteria was met.

iv. Is the data quality or usability affected? (Explain)
Yes ☐ No ☒ N/A ☐
Comments: No samples were qualified; data quality was not affected.

g. Decontamination or Equipment Blanks

i. Were decontamination or equipment blanks collected?
Yes ☒ No ☐ N/A ☐
Comments: Associated EBs shown in table below. One EB was collected for each day sampling took place.

OU	Sample Date	SDG	Associated EB
OU6	8/7/2022	22H116	22FWOU5WQ04
OU6	8/8/2022	22H153	22FWOU6WQ01
OU6	8/9/2022	22H153	22FWOU6WQ02

ii. Are all results less than LOQ or RL?
Yes ☐ No ☒ N/A ☐
Comments: The following analytes were detected above DLs in the equipment blanks:

Equipment Blank	Method	Analyte	Result	LOD	Units
22FWOU5WQ04	6020A	Manganese	0.596	0.5	ug/L
22FWOU5WQ04	E300.0	Sulfate	311	250	ug/L
22FWOU6WQ01	E300.0	Sulfate	618	250	ug/L
22FWOU6WQ01	6020A	Iron	17.3	50	ug/L
22FWOU6WQ01	6020A	Manganese	0.298	0.5	ug/L
22FWOU6WQ01	8260B	Chloroform	1.7	0.2	ug/L
22FWOU6WQ01	8260B	Bromodichloromethane	0.17	0.2	ug/L
22FWOU6WQ02	E300.0	Sulfate	674	250	ug/L
22FWOU6WQ02	6020A	Iron	13.7	50	ug/L
22FWOU6WQ02	6020A	Manganese	0.4	0.5	ug/L

iii. If above LOQ or RL, specify what samples are affected.

Comments: All associated sample results were nondetect or greater than 5 times the equipment blank concentrations, with the following exceptions:

Sample ID	Method	Analyte	Result (ug/L)	LOD (ug/L)	EB Sample	EB Result (ug/L)	Qualifier
22FWOU6WG11	6020A	Iron	64	50	22FWOU6WQ01	17.3	B
22FWOU6WG13	6020A	Manganese	1.28	0.5	22FWOU5WQ04	0.596	B
22FWOU6WG07	6020A	Manganese	0.553	0.5	22FWOU6WQ01	0.298	B

iv. Are data quality or usability affected?
Yes ☒ No ☐ N/A ☐
Comments: Data quality and usability were not significantly affected. Affected results were qualified B and are considered biased high. There is no criteria for MNA parameters.

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

a. Are they defined and appropriate?
Yes ☒ No ☐ N/A ☐
Comments: All data flags are defined and consistent with the approved work plan.

Attachment B-3

Laboratory Deliverables

(Provided electronically)

APPENDIX C
Field Forms and Notes

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Table C-1 Water Quality Parameters
OU6 - Fort Wainwright, Alaska

Well ID	Sample ID	Sample Date	Sample Time	Field Measurements[1]													
				Depth to Water[2] (feet btoc)	Screen Interval (feet btoc)	Water Table Within Well Screen (Y/N)	Drawdown Depth to Water (feet btoc)[3]	Temp (°C)	Conductivity (µS/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Well Stabilized[4] (Y/N)	Three Well Volumes (L, calculated)	Total Volume Purged (L)	Maximum Volume Met?
Background Wells																	
MW03	22FWOU6WG01	8/8/2022	10:38	14.67	12.3 to 22.3	Y	14.67	6.9	357.8	0.62	6.93	-63.8	7.54	Y	14.12	14.50	Y
MW13	22FWOU6WG02	8/7/2022	15:41	15.38	9.2 to 19.2	Y	15.42	6.48	500	2.49	7.43	-26.9	6.37	Y	7.10	5.90	N
DRO Plume Wells																	
MW06A	22FWOU6WG03	8/8/2022	16:03	15.19	12.4 to 22.4	Y	15.19	6.1	406.7	0.41	6.77	-75.5	5.47	Y	13.81	6.70	N
MW12R	22FWOU6WG04	8/8/2022	13:29	12	12.6 to 22.6	N	12.05	6.01	255	0.45	7.01	76.2	0.6	Y	19.58	11.75	N
MW33	22FWOU6WG05/06	8/9/2022	13:43	15.02	11 to 21	Y	15.14	6.1	638	0.44	6.76	-106.1	15.08	Y	10.98	11.10	Y
MW37	22FWOU6WG07	8/8/2022	13:03	14.82	9.7 to 19.7	Y	14.82	14.9	467.8	2.55	6.91	147.9	4.92	Y	9.03	4.60	N
MW62	22FWOU6WG09	8/9/2022	12:08	13.34	10 to 20	Y	13.45	8.3	712	0.92	6.61	168.3	3.1	Y	12.51	9.60	N
MW64	22FWOU6WG10	8/8/2022	14:54	14	10 to 20	Y	14.04	8.82	311	2.13	7.28	131.8	21.91	Y	11.22	5.0	N
MW77	22FWOU6WG11	8/8/2022	14:23	17.38	12.6 to 22.6	Y	17.43	7.2	512	0.7	6.71	138.3	5.66	Y	9.66	7.0	N
MW82	22FWOU6WG12	8/8/2022	11:53	16.86	11.7 to 21.7	Y	16.86	7.7	572	2.17	6.71	147.9	3.4	Y	8.96	5.90	N
1,2,3-TCP Plume Wells																	
MW08	22FWOU6WG13	8/7/2022	11:21	17.27	12.1 to 22.1	Y	17.31	5.28	411	3.97	6.73	139.7	1.34	Y	9.03	5.50	N
MW47	22FWOU6WG14	8/7/2022	13:52	15.26	9.8 to 19.8	Y	15.31	7.07	418	1.57	7.09	148.9	1.3	Y	8.40	6.0	N
MW79	22FWOU6WG15	8/8/2022	10:34	17.47	11.6 to 21.6	Y	17.51	6.91	435	1.6	6.89	128.6	6.61	Y	9.40	8.75	N
TCE Plume Wells																	
MW61	22FWOU6WG16	8/8/2022	16:00	14.13	10.1 to 20.1	Y	14.19	8.24	423	0.73	6.95	138.2	51.87	Y	11.22	6.25	N
MW80	22FWOU6WG18	8/8/2022	12:10	13.66	36.8 to 46.8	N	13.68	5.58	235	0.72	6.98	88	0.69	Y	61.30	10.75	N
Sentry Wells																	
MW78	22FWOU6WG19	8/7/2022	12:41	15.87	27.2 to 37.2	N	15.88	7.61	299	0.66	7.02	118	22.87	Y	39.02	5.75	N
MW91	22FWOU6WG20	8/7/2022	15:36	16.15	56.1 to 76.1	N	16.15	7.73	255	3.63	7.32	130.9	27.68	Y	110.44	3.75	N

Notes:

[1] Field measurements shown in the table are the last measurments recorded after parameters have stabilized and prior to sample collection.

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

[3] Drawdown water depth measured during the last reading.

[4] Well stabilization as described in the ADEC Field Sampling Guidance (ADEC 2019).

Acronyms

bgs - below ground surface
btoc - below top of casing
°C - degree Celsius
CDQR - Chemical Data Quality Repo
DO - dissolved oxygen
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
mV - millivolts
NTU - nephelometric turbidity
ORP - oxidation reduction potential

Ft. Wainwright 2022
PID MiniRae 3000 Calibration Sheet

Date	Time	Model	Fresh Air (ppm)	Isobutylene (ppm)
7/26/22	9:35	592-901170	0.0	100.0
8-1-22	12:19	592-903698	0.0	100.0
8-1-22	12:22	592-922378	0.0	100.0
8-1-22	12:26	592-901170	0.0	100.0
8-2-22	8:32	592-903698	0.0	100.0
8-2-22	8:36	592-922378	0.0	99.8
8-2-22	8:39	592-901170	0.0	100.0
8-3-22	0852	592-903698	0.0	100.0
8-3-22	0853	592-922378	0.0	100.1
8-3-22	0854	592-901170	0.0	100.6
8-4-22	0827	592-903698	0.0	99.9
8-4-22	0828	592-922378	0.0	100.0
8-4-22	0829	592-903698	0.0	99.9
8-5-22	0821	592-901170	0.0	100.0
8-5-22	0823	592-922378	0.0	100.6
8-5-22	0825	592-903698	0.0	100.0
8-6-22	0926	592-901170	0.0	100.1
8-6-22	0927	592-922378	0.0	100.4
8-6-22	0928	592-903698	0.0	99.9
8-7-22	0912	592-901170	0.0	100.1
8-7-22	0913	592-922378	0.0	100.2
8-7-22	0914	592-903698	0.0	100.0
8-8-22	0843	592-922378	0.0	100.4
8-8-22	0847	592-903698	0.0	100.0
8-8-22	0849	592-901170	0.0	100.0
8-9-22	1011	592-922378	0.0	100.1
8-9-22	1013	592-903698	0.0	100.0
8-9-22	1015	592-901170	0.0	100.0
9-20-22	0838	592-914824	0.0	100.0
9-20-22	0843	592-901182	0.0	100.0
9-21-22	0848	592-914824	0.0	100.1
9-21-22	0852	592-901182	0.0	100.0
9-22-22	0943	592-901182	0.0	100.1
9-22-22	0946	592-914824	0.0	100.1
9-23-22	0918	592-914824	0.0	100.0
9-23-22	0921	592-901182	0.0	100.0
9/24/22	0920	592-914824	0.0	100.1
9-25-22	0838	592-914824	0.0	100.1
9-25-22	0843	592-901182	0.0	100.1
9/26/22	0859	592-914824	0.0	100.1
9/26/22	0901	592-901182	0.0	99.7
9/27/22	0836	592-901182	0.0	100.1
9/27/22	0839	592-914824	0.0	100.1

Date	Time	Model						
9/26	0855	6168	1000 ✓	1000	10	10.0 ✓	0.02	0.02 ✓
9/26	0856	6125	1000 ✓	1000	10	10.0 ✓	0.02	0.02 ✓
9/27	0831	6125	1000 ✓	1000	10	10.0 ✓	0.02	0.02 ✓
9/27	0835	6168	1000 ✓	1000	10	10.0 ✓	0.02	0.02 ✓

Ft. Wainwright 2022
Turbidity Calibration Sheet

			High (1000 NTU)			Medium (10.0 NTU)			Low (0.02 NTU)		
Date	Time	Model	Std	Reading	within 5%	Std	Reading	within 5%	Std	Reading	within 5%
7/25	0933	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
7/25	0930	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
7/25	0928	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
7/26	0927	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
7/26	0928	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/1	1227	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/1	1225	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/1	1228	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/2	0825	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/2	0828	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/2	0833	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/3	0848	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/3	0847	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/3	0845	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/4	0820	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/4	0822	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/4	0824	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/5	0811	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/5	0813	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/5	0815	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/6	0920	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/6	0922	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/6	0924	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/7	0905	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/7	0907	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/7	0908	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/8	0842	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/8	0844	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/8	0846	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/9	1005	5525	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/9	1007	6093	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
8/9	1009	6174	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/20	0823	20706125	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/20	0830	20110616 8	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/21	0832	6168	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/21	0837	6125	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/22	0922	6125	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/22	0927	6168	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/23	0901	6168	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/23	0904	6125	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/24	0902	6168	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/25	0825	6168	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓
9/25	0829	6125	1000	1000	✓	10.0	10.0	✓	0.02	0.02	✓

Ft. Wainwright 2022
YSI Multimeter 556MPS Calibration Log

Date	Time	Serial #	Calibrated (Y/N)/ Parameter	Confidence Solution Values		
				Conductivity (uS/cm)	pH	ORP (mV)
7/25/22	7:45	15E103127	Y/Cond.	8015	6.96	213.4
7/25/22	7:50	10D100478	Y/Cond.	6521	6.97	220.9
7/25/22	7:55	13H102024	Y/Cond, pH	6432	8.58	247.1
7/26/22	8:24	15E103127	Y/Cond.	9959	6.81	213.4
7/26/22	8:29	10D100478	Y/Cond.	6337	6.94	217.6
8-2-22	8:04	15E103127	Y/Cond.	6989	6.83	226.2
8-2-22	8:10	10D100478	Y/Cond. pH	7084	6.39	2175
8-2-22	8:17	16M100581	Y/Cond.	3909	6.93	229.3
8-3-22	8:47	16M100581	Y/Cond.	7056	7.03	227.2
8-3-22	8:50	15E103127	Y/Cond	5664	6.82	218.9
8-3-22	8:55	10D100478	Y/Cond	5651	7.03	221.5
8-4-22	8:12	16M100581	Y/Cond.	4933	6.97	229.4
8-4-22	8:18	10D100478	Y/Cond.	8335	7.03	220.9
8-4-22	8:24	15E103127	Y/Cond.	5870	6.80	227.4
8-5-22	8:00	10D100478	Y/Cond.	11,384	7.02	216.2
8-5-22	8:07	15E103127	Y/Cond	12,180	6.82	219.4
8-5-22	8:15	16M100581	Y/Cond.	8,994	6.99	229.3
8-6-22	9:14	15E103127	Y/pH	7809	668	226.7
8-6-22	9:25	10D100478	Y/Cond.	6401	7.05	223.4
8-6-22	9:30	16M100581	Y/Cond.	6251	6.96	231.9
8-7-22	8:53	15E103127	Y/Cond.	8235	7.06	219.7
8-7-22	9:05	10D100478	Y/Cond+ORP	8189	7.01	202.3
8-7-22	9:11	16M100581	Y/Cond.	6536	6.95	214.3
8-8-22	8:26	15E103127	Y/Cond.	6364	6.86	231.5
8-8-22	8:33	10D100478	Y/Cond.	6591	7.05	214.4
8-8-22	8:41	16M100581	Y/Cond.	6872	7.03	227.4
8-9-22	10:05	10D100478	Y/Cond.	6138	6.92	221.1
8-9-22	10:10	15E103127	Y/Cond	6264	6.83	232.6
8-9-22	10:13	16M100581	Y/Cond.	6397	6.98	230.7
9-20-22	8:55	21C104221	Y/Cond	7119	6.94	228.5
9-20-22	9:02	15E103128	Y/Cond + ORP	7092	6.97	208.3
9-20-22	8:37	21C104221	Y/ORP cond.	6315	6.98	230.4
9-21-22	8:43	15E103128	Y/Cond.	6460	6.82	233.4
9-22-22	9:32	15E103128	Y/Cond.	6333	6.92	231.3
9-22-22	9:38	21C104221	Y/Cond.	6251	6.99	228.1
9-23-22	9:08	15E103128	Y/Cond.	6424	6.96	231.2
9-23-22	9:12	21C104221	Y/Cond.	6450	6.96	223.7
9-24-22	9:04	15E103128	Y/Cond.	6131	6.92	230.1
9-25-22	8:30	15E103128	Y/Cond.	5853	6.91	234.3
9-25-22	8:35	21C103128	Y/Cond	6194	6.96	230.9
9/26/22	0925	15E103128	Y/Cond	6165 x	7.20 ✓	230.9 ✓
9/26/22	0928	21C103128	Y/Cond	5971 x	7.04 ✓	227.5 ✓
9/27/22	0827	15E103128	N	7807 ✓	7.08 ✓	228.8 ✓
9/27/22	0830	21C103128	N	7968 ✓	6.97 ✓	226.2 ✓

7.3-22.3

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 Background Wells	2022 FWA GW Sampling	MW03	D3436302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
50°F, Light Rain, Sunny (w)	Ambient 0.0 Breathing Zone 0.0 In Well 0.0	8 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	1.92	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	14.67	22.3 (final)	—

Max Purge Volume = (22.3 (Previous Total Depth) ft − 14.67 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 3.73 (Max Purge Vol) gal * 3.785 L/gal = 14.12 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1002	1036	15.67	Bailer Peristaltic Pump (Submersible Pump)

16.0L

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
Clear (Cloudy) Brown Other:	None (Faint) Moderate Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) (Max Vol) Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1002	+	0	—	7.0	357.0	2.47	6.54	127.1	220.8	14.67
1005	1.5	1.5	500	6.8	358.2	1.93	6.67	77.4	236.2	14.67
1010	2.3	3.8	460	6.7	357.6	1.32	6.81	-9.8	102.7	14.67
1015	2.2	6.0	440	7.0	359.0	1.12	6.87	-40.1	47.75	14.67
1020	2.1	8.1	420	7.0	359.1	1.04	6.89	-49.5	25.35	14.67
1025	2.1	10.2	420	6.9	357.8	0.78	6.91	-56.9	19.71	14.67
1030	2.1	12.3	420	6.8	357.2	0.73	6.92	-60.3	10.58	14.67
1035	2.2	14.5	440	6.9	357.8	0.62	6.93	-63.8	7.54	14.67
		Max			Stable		Stable	Stable		

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1038	1046	15.67	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG01		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = N/A

Container/Preservative	Analysis Requested	Notes
2x1L Amber / HCl	ARO/RRO / AK102/103	
1x HDPE 250mL / HNO3	Diss Fe / 6020	
1x250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"—" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 - Background	2022 FWA - Summer	MW13	D3436302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
Sunny, 58°F	Ambient 0.1 Breathing Zone 0.1 In Well 0.7	8/7/22	CE

Well Information

Screen: 9.2 - 19.2

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	3.2	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
n/a	15.38	(final)	n/a

Max Purge Volume = (19.2 (Previous Total Depth) ft – 15.38 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 1.9 (Max Purge Vol) gal * 3.785 L/gal = 7.1 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1503		16.5	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	YSI Multi Meter 15E103127 Hach Turbidimeter MICRO TPW 20160693

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume Total	Flow (0.013-0.13 gpm, 50-500 (mL/min))	Temperature (°C)	Water Quality ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
Stopped @ 1510 Re-start pump @ 1522										
1510	1.5	1.5	214	5.92	491	6.08	7.33	-57.2	87.06	15.44
1525	1.0	2.5	333	7.18	513	5.32	7.36	-31.2	28.26	15.42
1530	1.0	3.5	200	6.91	508 ✓	4.24	7.37 ✓	-31.1 ✓	10.75	15.42
1535	1.2	4.7	240	6.59	503 ✓	3.44	7.41 ✓	-28.6 ✓	6.87	15.42
1540	1.2	5.9	240	6.48	500 ✓	2.49	7.43 ✓	-26.9 ✓	3.67	15.42

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1541	1545	16.5	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FW OU6WG02	QC: Dup MS/MSD		Ferrous Iron (Fe^{2+}) (mg/L) = n/a

Container/Preservative	Analysis Requested	Notes
3x 40mL VOA/HCl	SW8260 SIM	TCP, VC
1x 250mL HDPE/HNO_3 filtered	SW6020	Dissolved Fe/Mn
1x 250mL HDPE/none	EPA 300.0	Sulfate

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

12,4-22,21

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 DRO Plume	2022 FWA GW Sampling	MW06A	D3436302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
57°F, Cloudy, Smph (SE)	Ambient 0.0 Breathing Zone 0.0 In Well ____	8 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	2.63	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
~~22.65~~ SAMPLE	15.19	22.65 (final)	

Max Purge Volume = (22.65 (Previous Total Depth) ft – 15.19 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 3.65 (Max Purge Vol) gal * 3.785 L/gal = 13.81 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1543	1601	16.19	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	None (Faint) Moderate Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1543	—	0	—	6.2	419	1.32	6.74	-5.8	21.59	15.19
1545	1.0	1.0	500	6.4	420.4	0.79	6.74	-46.7	17.52	15.19
1550	1.9	2.9	380	6.3	416.1✓	0.59	6.76✓	-66.0	13.01	15.19
1555	1.8	4.7	360	6.2	411.2✓	0.47	6.76✓	-71.8✓	7.85✓	15.19
1600	2.0	6.7	400	6.1	406.7✓	0.41✓	6.77✓	-75.5✓	5.47✓	15.19
1605					Stable		Stable	Stable		
1610										
1615										

7.7L

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1603	1612	16.19	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG03	QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA	

Container/Preservative	Analysis Requested	Notes
2x1L Amber / HCl	DRO/RRO/ Alk 102/103	
1x250 HDPE / HNO_3	Diss Fe / 6020	
1x250 HDPE	Sulfate / E300.0	

Suggested Notation:

"____" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
Former Communications Site OU6	2022 FWA GW Sampling	MW-12R	D34363021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
52°F, Rain, 6mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 5.9	8-8-22	AA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	Flush mount	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	12.00	22.58 (final)	NA

Max Purge Volume = (22.58 (Previous Total Depth) ft – 12.00 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 5.17 (Max Purge Vol) gal * 3.785 L/gal = 19.58 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
12:56	13:26	17.6	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	None Moderate Faint (Strong)	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters)		Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize)					Water Level
					± 3%	± 10% or 0.1 mg/L	± 0.1	± 10 mV	± 10% or 0.5 NTU	Drawdown < 0.3 ft
	Change	Total			Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	(feet btoc)
13:01	1.75	1.75	350	6.37	257	1.14	6.95	117.9	2.13	12.05
13:06	2.0	3.75	400	5.95	251	0.74	6.97	102.0	0.39	12.05
13:11	2.0	5.75	400	5.85	249	0.67	6.99	92.2	2.28	12.05
13:16	2.0	7.75	400	6.00	251	0.53	7.01	85.4	1.55	12.05
13:21	2.0	9.75	400	5.99	253	0.47	7.01	79.5	0.32	12.05
13:26	2.0	11.75	400	6.01	255	0.45	7.01	76.2	0.60	12.05

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
13:29	13:40 / 8-8-22	17.60	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG04	QC: Dup MS/MSD		Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2 x 1L Amber / HCl	DRO/RRO AK 102/105	Screen Interval 12.6 - 22.6'
1 x 250 mL HDPE / HNO3	Dissolved Mn/Fe SW6020F	
1 x 250 mL HDPE	Sulfate E 300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

11-21

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 DRO Plume	2022 FWA GW Sampling	MW33	D343.302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
47°F, Cloudy, 4mph(SW)	Ambient 0.0 Breathing Zone 0.0 In Well 1.6	9 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
Good (Fair) Poor	2.5	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	15.02	20.95 (final)	—

Max Purge Volume = (20.95 (Previous Total Depth) ft – 15.02 (Depth to Water or Depth to Top of Filter Pack) ft) • 0.163 (Gallons per Ft) gal/ft • 3 = 2.90 (Max Purge Vol) gal • 3.785 L/gal = 10.98 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1316	1341	16.02	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
Clear (Cloudy) Brown Other:	None (Faint) (Moderate) Strong	(Yes) No	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) (Max Vol) | Purge water was: Treated (Stored) Other | Note:

12.1

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1316	—	0	—	7.2	674	3.34	6.54	-0.4	149.4	15.14
1320	2.1	2.1	420	6.2	626	1.90	6.68	-69.6	65.85	15.14
1325	2.3	4.4	460	6.1	620 ✓	1.09	6.74 ✓	-90.1	14.63	15.14
1330	2.3	6.7	460	6.0	631 ✓	0.73	6.75 ✓	-98.4 ✓	16.12 ✓	15.14
1335	2.3	9.0	460	6.1	639 ✓	0.59	6.76 ✓	-103.3 ✓	16.46 ✓	15.14
1340	2.1	11.1	420	6.1	638 ✓	0.44	6.76 ✓	-106.1 ✓	15.08	15.14
1345		Max			Stable		Stable	Stable		

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1343	1417	16.02	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6W~~05~~/06		QC: (Dup) (MS/MSD)	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
4x 1x1L Amber / HCl	DRO/RRO/ AK102/103	
1x250mL HDPE / HNO_3	Diss Fe / 6020	
1x250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"—" = not measured "✓"= stable "+" = rising "-" = falling

9.7-19.7

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 DRO Plume	2022 First GW Sampling	MW37	D3436307
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
52°F, Light Rain, 6mph(SE)	Ambient 0.0 Breathing Zone 0.0 In Well 0.0	8 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
Good (Fair) Poor	2.52	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	14.82	19.7 (final)	—

Max Purge Volume = (19.7 ft (Previous Total Depth) − 14.82 ft (Depth to Water or Depth to Top of Filter Pack)) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.39 gal (Max Purge Vol) * 3.785 L/gal = 9.03 L (Max Purge Vol)

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1245	1301	15.82	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

5.6 L

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1245	—	0	—	14.2	461.4	2.78	7.10	149.3	13.91	14.82
1250	1.6	1.6	320	14.5	469.1	2.69	6.93	151.0	8.47✓	14.82
1255	1.4	3.0	280	14.9	470.5✓	2.60✓	6.92✓	149.2✓	5.80✓	14.82
1300	1.6	4.6	320	14.9	467.8✓	2.55✓	6.91✓	147.9✓	4.92✓	14.82
1305					Stable	Stable	Stable	Stable	Stable	
1310										
1315										

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1303	1316	15.82	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FW0U6WG07	QC: Dup MS/MSD		Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2x1L Amber / HCl	DRO/RRO/AK102/103	
1x250mL HDPE/HNO_3	Diss Fe. / 6020	
1x250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"—" = not measured "✓"= stable "+" = rising "-" = falling

10-20

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 ARCO Plume	2022 FWA GW Sampling	MW62	D3436302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
44°F, Cloudy, 6mph(S)	Ambient 0.0 Breathing Zone 0.0 In Well 0.7	4 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
Good (Fair) Poor	1.21	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	13.34	20.1 (final)	—

Max Purge Volume = (20.1 (Previous Total Depth) ft – 13.34 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 3.31 (Max Purge Vol) gal * 3.785 L/gal = 12.51 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1140	1206	14.34	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

10.6L

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1140	—	0	—	8.4	573	5.68	6.32	170.8	87.60	13.44
1145	1.5	1.5	300	7.9	621	3.25	6.56	172.9 ✓	52.02	13.45
1150	2.0	3.5	400	8.2	678	1.53	6.59 ✓	171.9 ✓	23.11	13.45
1155	2.0	5.5	400	8.2	699 ✓	1.39	6.61 ✓	170.1 ✓	8.26 ✓	13.45
1200	2.1	7.6	420	8.3	709 ✓	1.11	6.61 ✓	169.0	5.73 ✓	13.45
1205	2.0	9.6	400	8.3	712 ✓	0.92	6.61 ✓	168.3 ✓	3.10 ✓	13.45
1210					Stable		Stable	Stable	Stable	

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1208	1219	14.34	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG09		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2 x 1L Amber / HCl	DRO/RRO / AK102/103	
1 x 250mL HDPE / HNO_3	Diss Fe / 6020	
1 x 250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
Former Communications Site	2022 FWA GW Sampling	MW - 64	D3436021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
56°F, Cloudy, 5mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.0	8-8-22	AA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	2.5	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	14.00	20.06 (final)	NA

Max Purge Volume = (20.06 (Previous Total Depth) ft – 14.00 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.96 (Max Purge Vol) gal * 3.785 L/gal = 11.22 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
14:31	14:51	15.00	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: Stability Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
14:36	2.0	2.0	400	7.86	296	3.52	7.28	132.4	58.47	14.04
14:41	1.0	3.0	200	8.16	301	2.70	7.28	133.0	44.17	14.04
14:46	1.0	4.0	200	8.72	306	2.37	7.28	132.3	37.63	14.04
14:51	1.0	5.0	200	8.82	311	2.13	7.28	131.8	21.91	14.04

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
14:54	15:06 / 8-8-22	15.00	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWA064WG10		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2x 1L Amber / HCl	DRO / RRO AK102/103	10'-20' Screen Interval
1x 250mL HDPE / HNO3	Dissolved Fe/Mn SW6020F	
1x 250mL HDPE	Sulfate E300.0	

Suggested Notation:

"____" = not measured "✓"= stable "+" = rising "-" = falling

17.6 - 22.6

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 DRO Plume	2022 FWA GW Sampling	MW77	D3436302
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
54°F, Cloudy, Slight (SE)	Ambient 0.0 Breathing Zone 0.0 In Well 4.7	8 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
Good Fair Poor	3.52	PVC SS	1 / 0.041 2 / 0.163 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	17.38	22.6 (final)	—

Max Purge Volume = (22.6 (Previous Total Depth) ft – 17.38 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.55 (Max Purge Vol) gal * 3.785 L/gal = 9.66 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1355	1421	18.38	Bailer Peristaltic Pump Submersible Pump

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
Clear Cloudy Brown Other:	None Faint Moderate Strong	Yes No	Yes No	YSI Multi Meter Hach Turbidimeter

Purging reached: Stability Max Vol. Purge water was: Treated Stored Other Note:

8.0L

Time (HH:mm)	Volume (Gallons or Liters)		Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize)					Water Level
					± 3%	± 10% or 0.1 mg/L	± 0.1	± 10 mV	± 10% or 0.5 NTU	Drawdown < 0.3 ft
	Change	Total			Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	(feet btoc)
1355	—	0	—	8.5	628	2.00	6.52	174.3	19.25	17.38
1400	1.3	1.3	260	7.3	599	1.24	6.54 ✓	165.9 ✓	9.63 ✓	17.44
1405	1.7	3.0	340	6.7	548	0.83	6.63 ✓	155.8	5.98 ✓	17.43
1410	1.3	4.3	260	6.9	527	0.76 ✓	6.67 ✓	148.6 ✓	6.85 ✓	17.42
1415	1.4	5.7	280	6.4	517 ✓	0.62	6.68 ✓	144.1 ✓	5.18 ✓	17.43
1420	1.3	7.0	260	7.2	512 ✓	0.70 ✓	6.71 ✓	138.3 ✓	5.66 ✓	17.43
1425					Stable		Stable		Stable	

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1423	1439	18.38	Peristaltic Pump Submersible Pump
SAMPLE ID: 22FWOU6WG11		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2x1L Amber / HCl	DRO/RRO/ATK102a/103	
1x250mL HDPE / HNO_3	Diss Fe. / 6020	
1x250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"—" = not measured "✓" = stable "+" = rising "-" = falling

11.7 - 21.7

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 DRO Plume	2022 FWA GW Sampling	MW82	D3436307
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
52°F, Rain, 3mph (S)	Ambient 0.0 Breathing Zone 0.0 In Well 0.0	8 Aug 22	SS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	2.64	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
—	16.86	21.7 (final)	—

Max Purge Volume = (21.7 (Previous Total Depth) ft – 16.86 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.37 (Max Purge Vol) gal * 3.785 L/gal = 8.96 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1132	1151	17.86	Bailer Peristaltic Pump (Submersible Pump)

7.4L

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1132	—	0	—	7.0	552	3.24	6.73	153.1	13.61	16.86
1135	1.0	1.0	333	7.3	556	2.51	6.69 ✓	152.7 ✓	10.77	16.86
1140	1.2	3.2	240	7.6	567 ✓	2.36 ✓	6.71 ✓	150.0 ✓	7.59 ✓	16.86
1145	1.3	4.5	260	7.7	570 ✓	2.26 ✓	6.71 ✓	148.7 ✓	5.36 ✓	16.86
1150	1.4	5.9	280	7.7	572 ✓	2.17 ✓	6.71 ✓	147.9 ✓	3.50 ✓	16.86
1155					Stable	Stable	Stable	Stable	Stable	
1200										

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1153	1206	17.86	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6GW12		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
2x1L Amber / HCl	DRO/RRO/Alk W2/103	
1x250mL HDPE / HNO_3	Diss Fe / 6020	
1x250mL HDPE	Sulfate / E300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 Former Communications Site	2022 2nd FWA GW Sampling	~~AP-~~ MW-08	D3436302 1
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
59°F, Cloudy, 9mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.4	8-7-22	AA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	2.98	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	17.27	22.15 (final)	NA

Max Purge Volume = (22.15 (Previous Total Depth) ft – ~~Ø~~ 17.27 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.39 (Max Purge Vol) gal * 3.785 L/gal = 9.03 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1057	1117	18.27	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or (Liters))		Flow (0.013-0.13 gpm, ~~50-500~~ (mL/min))	Temperature (°C)	Water Quality (three must stabilize)					Water Level
					± 3%	± 10% or 0.1 mg/L	± 0.1	± 10 mV	± 10% or 0.5 NTU	Drawdown < 0.3 ft
	Change	Total			Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	(feet btoc)
1102	1.5	1.5	300	5.94	426	5.80	6.62	148.2	3.86	17.29
1107	1.5	3.0	300	5.07	409	4.85	6.67	143.2	2.84	17.31
1112	1.0	4.0	200	5.28	410	4.19	6.71	140.9	2.79	17.31
1117	1.5	5.5	300	5.28	411	3.97	6.73	139.7	1.34	17.31

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1121	1129 / 8-7-22	18.27	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG13		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
3x 40 mL VOA / HCl	VOC-LL 8260 SIM	12.1' - 22.1'
1x 250mL HDPE / HNO3	Dissolved Mn/Fe SW6020F	Well Screen
1x 250 mL HDPE	Sulfate E 300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
006 Former Communications Site	2022 FWA GM Sampling	MW-47	D3436321
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
54°F, Cloudy, 6mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.6	8-7-22	LA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	3.30	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	15.26	19.80 (final)	NA

Max Purge Volume = (19.80 ft – 15.26 ft) * 0.163 gal/ft * 3 = 2.22 gal * 3.785 L/gal = 8.40 L

(19.80: Previous Total Depth; 15.26: Depth to Water or Depth to Top of Filter Pack; 0.163: Gallons per Ft; 2.22: Max Purge Vol; 8.40: Max Purge Vol)

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1327	1347	16.26	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached (Stability) Max Vol. | Purge water was: Treated (Stored) Other | Note:

Time (HH:mm)	Volume (Gallons or (Liters)) Change	Volume Total	Flow (0.013-0.13 gpm, 50-500 (mL/min))	Temperature (°C)	± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1332	1.5	1.5	300	7.97	418	2.96	7.11	147.7	7.37	15.31
1337	1.5	3.0	300	7.18	416	1.93	7.10	149.5	3.03	15.31
1342	1.5	4.5	300	7.06	415	2.18	7.09	148.9	1.30	15.31
1347	1.5	6.0	300	7.07	418	1.57	7.09	148.9		

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1352	14:01 / 8-7-22	16.26	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG14		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
3x 40mL VOA / HCl	VOCs - LL 8260 - SIM	Well Screen Interval 9.8' - 19.8'
1x 250 mL HDPE / HNO3	Dissolved Fe/Mn SW6020F	
1x 250 mL HDPE	Sulfate E 300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 Former Communications Site	2022 FWA GW Sampling	MW-79	D34313021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
50°F, Rain, 3 mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.3	8-9-22	MS

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	3.18	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	17.47	22.55 (final)	NA

Max Purge Volume = (22.55 Previous Total Depth ft – 17.47 Depth to Water or Depth to Top of Filter Pack ft) * 0.163 Gallons per Ft gal/ft * 3 = 2.48 Max Purge Vol gal * 3.785 L/gal = 9.40 Max Purge Vol L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
10:06	10:31	18.47	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	(None) Moderate Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
10:11	1.75	1.75	350	7.23	462	3.35	6.76	151.5	69.81	17.51
10:16	1.75	3.50	350	7.09	451	2.29	6.82	141.9	21.44	17.51
10:21	1.75	5.25	350	6.99	442	1.87	6.86	~~141.4~~ 134.4	14.44	17.51
10:26	1.75	7.0	350	6.96	437	1.66	6.88	130.6	7.57	17.51
10:31	1.75	8.75	350	6.91	435	1.60	6.89	128.6	6.61	17.51

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
10:34	10:49	18.47	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG105	QC: Dup MS/MSD		Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
3x 40mL VOA/HCl	VOC-LL 8260 SIM	Well Screen 11.6' - 21.6'
1x 250 mL HDPE / HNO3	Dissolved Fe/Mn SW6020F	Removed stuck lock w/ bolt cutters
1x 250 mL HDPE	Sulfate E 300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
Former Communications Site OU6	2022 FWA GW Sampling	MW-61	D3436321
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
58°F, Cloudy, 6 mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.3	8-8-22	AA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	1.55	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	14.13	20.19 (final)	NA

Max Purge Volume = (20.19 (Previous Total Depth) ft – 14.13 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 2.96 (Max Purge Vol) gal * 3.785 L/gal = 11.22 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
15:30	15:55	15.13	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
Clear (Cloudy) Brown Other:	None (Moderate) Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. | Purge water was: Treated (Stored) Other | Note:

Time (HH:mm)	Volume (Gallons or Liters)		Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize)					Water Level
					± 3%	± 10% or 0.1 mg/L	± 0.1	± 10 mV	± 10% or 0.5 NTU	Drawdown < 0.3 ft
	Change	Total			Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	(feet btoc)
15:35	1.25	1.25	250	9.03	425	1.52	6.94	154.1	>1100	14.19
15:40	1.25	2.5	250	9.09	428	1.02	6.94	148.5	479.9	14.19
15:45	1.25	3.75	250	8.46	426	0.88	6.96	143.9	183.8	14.19
15:50	1.25	5.0	250	8.17	422	0.82	6.95	141.3	89.59	14.19
15:55	1.25	6.25	250	8.24	423	0.73	6.95	138.2	51.87	14.19

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
16:00	16:40 / 8-8-22	15.13	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG16		QC: (Dup) (MS/MSD)	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
12 x 40mL VOA / HCl	VOCs 8260	10.1' - 20.1' Screen Interval
12 x 40mL VOA HCl	VOC-LL 8260 SIM	Dup Sample ID 22FWOU6WG17
4 x 250mL HDPE / HNO3	Dissolved Fe/Mn SW6020F	
4 x 250mL HDPE	Sulfate E 300.0	

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
Former Communications Site OU6	2022 FWA GW Sampling	MW-80	D34363021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
52°F, Rain, 4mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.1	8-8-22	NA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	2.3'	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	13.66	46.78 (final)	NA

Max Purge Volume = (46.78 (Previous Total Depth) ft − 13.66 (Depth to Water or Depth to Top of Filter Pack) ft) * 0.163 (Gallons per Ft) gal/ft * 3 = 16.20 (Max Purge Vol) gal * 3.785 L/gal = 61.30 (Max Purge Vol) L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1136	1206	41.8	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	None (Moderate) Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume (Gallons or Liters) Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or ~~0.5~~ 10 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
11:41	2.0	2.0	400	5.77	214	2.13	7.01	121.7	6.22	13.68
11:46	1.75	3.75	350	5.57	228	1.43	6.96	113.3	7.31	13.68
11:51	1.75	5.50	350	5.61	233	1.09	6.95	104.4	6.87	13.68
11:56	1.75	7.25	350	5.57	233	0.94	6.96	99.3	7.18	13.68
12:01	1.75	9.0	350	5.54	234	0.81	6.97	93.4	2.46	13.68
12:06	1.75	10.75	350	5.58	235	0.72	6.98	88.0	0.69	13.68

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1210	1219 / 8-8-22	41.8	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG18	QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) =	NA

Container/Preservative	Analysis Requested	Notes
3x 40mL VOA/HCl	VOC 8260	Screen Interval
3x 40mL VOA HCl	VOC-LL 8260 SIM	36.8' - 46.8'
1x 250 mL HDPE/HNO3	Dissolved Fe/Mn 6020F	
1x 250 mL HDPE	Sulfate E 300.0	

Suggested Notation:

"____" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 ~~Form~~ Former Communications Site	2022 FWA GW Sampling	MW-78	D34363021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
60°F, Cloudy, 15mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.5	8-7-22	AA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	3.50	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	15.87	36.95 (final)	NA

Max Purge Volume = (36.95 ft – 15.87 ft) * 0.163 gal/ft * 3 = 10.31 gal * 3.785 L/gal = 39.02 L

(Previous Total Depth – Depth to Water or Depth to Top of Filter Pack) * Gallons per Ft * 3 = Max Purge Vol gal * 3.785 L/gal = Max Purge Vol L

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
1212	1237	32.20	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	None (Moderate) Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or (Liters)) Change	Volume Total	Flow (0.013-0.13 gpm, 50-500 (mL/min))	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
1217	1.25	1.25	250	7.52	299	1.99	7.00	139.3	23.94	15.88
1222	1.25	2.50	250	7.38	299	1.14	7.00	133.7	36.51	15.88
1227	1.25	3.75	250	7.69	300	0.89	7.01	126.4	28.28	15.88
1232	1.0	4.75	200	7.62	299	0.74	7.01	122.0	28.22	15.88
1237	1.0	5.75	200	7.61	299	0.66	7.02	118.0	22.87	15.88

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
1241	8-7-22	32.20	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG19		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
3x 40mL VOA/ HCl	VOCs - LL 8260- SIM	Well screen interval 27.2' - 37.2'

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

Groundwater Sampling Data Sheet

JACOBS

Site Name	Event	Well ID	Project Number
OU6 Former Communications Site	2022 FWA GW Sampling	MW-91	D34363021
Weather Conditions	**PID Readings of Total VOCs (ppm)**	**Date**	**Sampler Initials**
45°F, Cloudy, 7mph winds	Ambient 0.0 Breathing Zone 0.0 In Well 0.0	8-7-22	NA

NA

Well Information

Well Integrity	TOC Stickup (ft ags)	Well Casing Material	Casing Diameter(in) / Gallons per linear foot(gal/ft)
(Good) Fair Poor	3.15	(PVC) SS	1 / 0.041 (2 / 0.163) 4 / 0.653 6 / 1.47
Depth to Product (ft)	**Depth to GW (ft btoc)**	**Total Depth of Casing (ft btoc)**	**Product Thickness (ft) and Volume Recovered (mL)**
NA	16.15	75.82 (final)	NA

Max Purge Volume = (75.82 ft – 16.15 ft) * 0.163 gal/ft * 3 = 29.18 gal * 3.785 L/gal = 110.44 L

(Previous Total Depth; Depth to Water or Depth to Top of Filter Pack; Gallons per Ft; Max Purge Vol; Max Purge Vol)

Well Purging Information

Start Time	Finish Time	Depth of Tubing (ft btoc)	Equipment Used for Purging
15:15	15:35	66.1	Bailer Peristaltic Pump (Submersible Pump)

Color	Odor	Sheen	Purged Dry	Meter Used During Purging
(Clear) Cloudy Brown Other:	None (Moderate) Faint Strong	Yes (No)	Yes (No)	(YSI Multi Meter) (Hach Turbidimeter)

Purging reached: (Stability) Max Vol. Purge water was: Treated (Stored) Other Note:

Time (HH:mm)	Volume (Gallons or Liters) Change	Volume Total	Flow (0.013-0.13 gpm, 50-500 mL/min)	Temperature (°C)	Water Quality (three must stabilize) ± 3% Conductivity (µS/cm)	± 10% or 0.1 mg/L DO (mg/L)	± 0.1 pH (std units)	± 10 mV ORP (mV)	± 10% or 0.5 NTU Turbidity (NTU)	Water Level Drawdown < 0.3 ft (feet btoc)
15:20	0.75	0.75	150	9.57	256	5.37	7.43	130.8	88.63	16.15
15:25	1.0	1.75	200	7.61	252	4.52	7.37	130.6	57.11	16.15
15:30	1.0	2.75	200	8.55	258	4.05	7.32	130.1	46.84	16.15
15:35	1.0	3.75	200	7.73	255	3.63	7.32	130.9	27.68	16.15

Sample Collection Information

Start Time	Finish Time / Date	Depth of Tubing (ft btoc)	Equipment Used for Sampling
15:36	15:41 / 8-7-22	66.1	Peristaltic Pump (Submersible Pump)
SAMPLE ID: 22FWOU6WG20		QC: Dup MS/MSD	Ferrous Iron (Fe^{2+}) (mg/L) = NA

Container/Preservative	Analysis Requested	Notes
3 x 40mL VOA / HCl	VOC-LL 8260-SIM	Well Screen Interval 56.1' - 76.1' Removed stuck lock w/ bolt cutters

Suggested Notation:

"——" = not measured "✓"= stable "+" = rising "-" = falling

APPENDIX D
Photograph Log

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Well Inspection Form - Fort Wainwright, Alaska

State or CERCLA: Cercla
Operable Unit/Status: OU6
Source Area: FCS
Site Name: N/A

Well ID: MW58
Date and Time: September 30, 2022 7:25 PM
Inspector: Candace Ede

Well Condition: Needs maintenance, tubing is stuck in well. Could not sample in summer 2022.

Signature:

2022 Institutional Control Well Survey Photos - OU6 FCS N/A

Photo Date:	September 30, 2022 7:28 PM
Photo Description:	Tubing stuck in well. Tried to fish out with line and was unable to retrieve.
Photo Direction:	Down
Photo Taken By:	Candace Ede

Well Inspection Form - Fort Wainwright, Alaska

State or CERCLA: Cercla
Operable Unit/Status: OU6
Source Area: FCS
Site Name: TCE

Well ID: MW61
Date and Time: September 30, 2022 1:54 PM
Inspector: Admon Abuamsha

Well Condition: Good

Signature:

2022 Institutional Control Well Survey Photos - OU6 FCS TCE

Photo Date: September 30, 2022 1:55 PM
Photo Description: Locked well.
Photo Direction: West
Photo Taken By: Admon Abuamsha

Well Inspection Form - Fort Wainwright, Alaska

State or CERCLA: Cercla
Operable Unit/Status: OU6
Source Area: FCS
Site Name: 1,2,3-TCP

Well ID: MW79
Date and Time: September 30, 2022 1:29 PM
Inspector: Admon Abuamsha

Well Condition: Fair

Signature:

2022 Institutional Control Well Survey Photos - OU6 FCS 1,2,3-TCP

Photo Date: September 30, 2022 1:31 PM
Photo Description: Well is frost heaved a few inches, unable to lock well enclosure.
Photo Direction: Southwest
Photo Taken By: Admon Abuamsha

APPENDIX E
Long-Term-Monitoring Optimization Results

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MAROS Statistical Trend Analysis Summary

Project: 2022 OU6 DRO Main Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 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
PHC as DIESEL FUEL								
MW06A	T	21	21	6.4E+00	5.3E+00	No	NT	NT
MW12R	S	20	19	5.3E+00	5.5E+00	No	D	D
MW33	T	20	20	3.5E+01	2.9E+01	No	I	I
MW58	T	19	19	2.4E+00	2.3E+00	No	NT	NT
PHC as HEAVY/RESIDUAL RANGE ORGA								
MW12R	S	20	12	4.0E-01	1.6E-01	No	NT	NT
MW33	T	20	14	2.4E+00	1.3E+00	No	I	I

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); No Detectable Concentration (ND)

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

MAROS Mann-Kendall Statistics Summary

Project: 2022 OU6 DRO Main Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PHC as DIESEL FUEL								
MW06A	T	21	21	0.51	31	81.5%	No	NT
MW12R	S	20	19	0.94	-70	98.8%	No	D
MW33	T	20	20	0.70	98	99.9%	No	I
MW58	T	19	19	0.39	17	71.0%	No	NT
PHC as HEAVY/RESIDUAL RANGE ORGANIC								
MW12R	S	20	12	1.17	-16	68.5%	No	NT
MW33	T	20	14	1.14	81	99.6%	No	I

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); Source/Tail (S/T)

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

MAROS Statistical Trend Analysis Summary

Project: 2022 OU6 DRO Isolated Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 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
PHC as DIESEL FUEL								
MW62	S	20	17	3.0E+00	2.0E-01	No	NT	NT
MW77	T	19	19	3.5E+00	1.6E+00	No	NT	PI
PHC as HEAVY/RESIDUAL RANGE ORGA								
MW62	S	20	12	6.3E-01	1.0E-01	No	NT	NT
MW77	T	19	12	3.4E-01	2.1E-01	No	NT	NT

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); No Detectable Concentration (ND)

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

MAROS Mann-Kendall Statistics Summary

Project: 2022 OU6 DRO Isolated Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PHC as DIESEL FUEL								
MW62	S	20	17	2.52	33	84.9%	No	NT
MW77	T	19	19	1.34	36	88.8%	No	NT
PHC as HEAVY/RESIDUAL RANGE ORGANIC								
MW62	S	20	12	2.27	19	71.8%	No	NT
MW77	T	19	12	1.21	-16	69.8%	No	NT

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); Source/Tail (S/T)

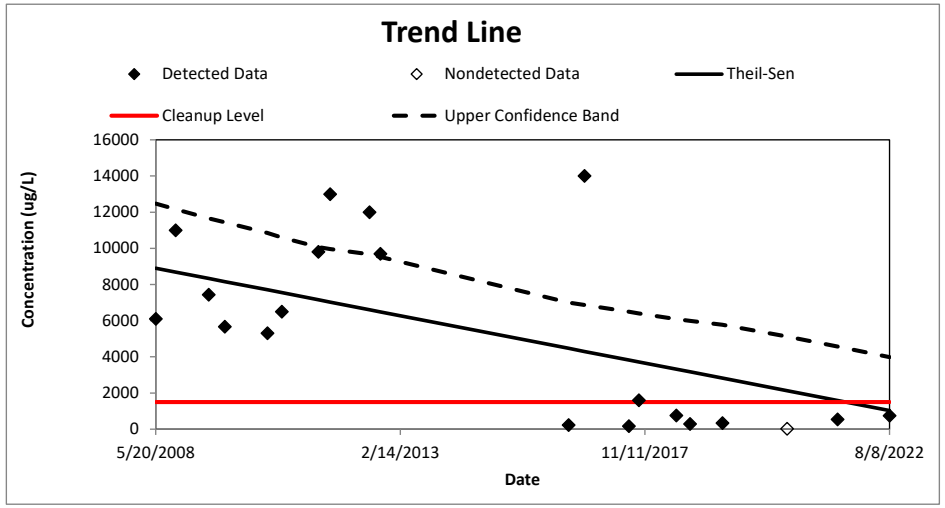
The Number of Samples and Number of Detects shown above are post-consolidation values.

Groundwater Statistics Tool

Site & Summary Statistics for Nonparametric Data Sets with Non-detects and Nonparametric Residuals

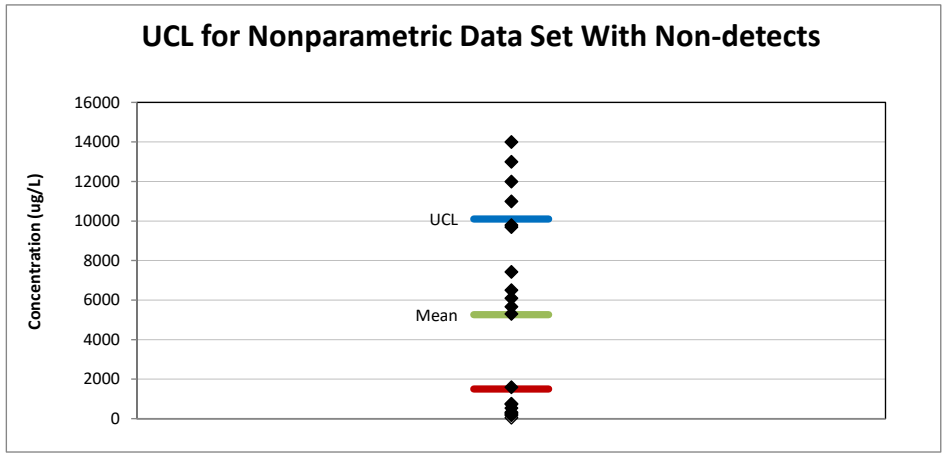
General Information

Analyst	CE
Date of Evaluation	3/3/2023
Site Name	FCS
Operable Unit	OU6
Type of Evaluation	Attainment
Well Name/Number	MW12R
Chemical of Concern	DRO
Concentration Units	ug/L
Cleanup Level	1500
Source of Cleanup Level	ADEC
Confidence Level	95%
Risk of False Outlier Rejection	1%
Number of Results	20
Outliers present?	No
Number of Non-Detects	1



Trend Analysis

Trend Type	Nonparametric
Method	Theil-Sen Line, Mann-Kendall Test
Is the Upper Confidence Band above the cleanup level?	**NA**
Slope	-1.52
Intercept	68900
Test Result	**Decreasing**
When concentration is predicted to achieve the cleanup level	**NA**
When concentration is predicted to exceed the cleanup level	**NA**



UCL Analysis

Distribution Type	Nonparametric
Test	KM Chebyshev UCL
Mean	5260
95% UCL	**10100**
Is the 95% UCL greater than the cleanup level?	**Yes**

Previous Step: Trend Screen | Previous Step: UCL Screen | Restart: Data Input Screen

MAROS Spatial Moment Analysis Summary

Project: 2022 OU6 DRO Main Plume **User Name:** KM

Location: Fort Wainwright **State:** Alaska

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	**Estimated Mass (Kg)**	**Xc (ft)**	**Yc (ft)**	**Source Distance**	**Sigma XX (sq ft)**	**Sigma YY (sq ft)**	**Number of Wells**
PHC as DIESEL FUEL							
5/19/2016	3.1E+01	1,380,610	3,960,014	251	7,697	34,286	9
9/9/2016	4.8E+01	1,380,669	3,959,945	161	7,110	32,363	9
7/20/2017	2.2E+01	1,380,586	3,960,028	277	7,983	34,365	9
9/28/2017	4.3E+01	1,380,597	3,959,986	237	7,908	38,776	9
6/20/2018	4.3E+01	1,380,584	3,960,041	289	8,289	42,736	9
9/26/2018	4.2E+01	1,380,570	3,960,030	288	7,720	33,648	9
5/16/2019	7.5E+01	1,380,576	3,960,019	276	7,018	38,581	9
8/12/2020	4.0E+01	1,380,582	3,960,029	280	7,344	30,388	9
8/6/2021	5.1E+01	1,380,577	3,959,968	237	7,285	27,268	9
8/8/2022	4.6E+01	1,380,565	3,959,945	232	6,118	23,328	9

MAROS Spatial Moment Analysis Summary

Project: 2022 OU6 DRO Main Plume **User Name:** KM

Location: Fort Wainwright **State:** Alaska

Spatial Moment Analysis Summary:

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
0th Moment	PHC as DIESEL FUEL	0.31	13	85.4%	NT
First Moment	PHC as DIESEL FUEL	0.15	-1	50.0%	S
Second Moment X	PHC as DIESEL FUEL	0.08	-17	92.2%	PD
Second Moment Y	PHC as DIESEL FUEL	0.17	-17	92.2%	PD

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

Porosity: 0.30 **Saturated Thickness:** Uniform: 30 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); (ND) Non Detect.

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 Sampling Location Optimization Results

2022 OU6 DRO Main Plume — **User Name:** KM

Fort Wainwright — **State:** Alaska

Sampling Events Analyzed: **From** Sample Event 1 (10/17/2007) **to** Sample Event 21 (8/8/2022)

Parameters used:

Constituent	Inside SF	Hull SF	Area Ratio	Conc. Ratio
PHC as DIESEL FUEL	0.3	0.1	0.9	0.85

Well Name	X (feet)	Y (feet)	Removable?	Average Slope Factor*	Minimum Slope Factor*	Maximum Slope Factor*	Eliminated?
PHC as DIESEL FUEL							
MW06A	1380643.00	3959965.00	☑	0.290	0.131	0.429	☐
MW12R	1380767.88	3959725.50	☑	0.276	0.017	0.967	☐
MW28	1380616.13	3959663.75	☑	0.525	0.279	0.921	☐
MW32R	1380483.38	3959828.00	☑	0.571	0.290	0.965	☐
MW33	1380751.38	3959808.75	☑	0.478	0.235	0.719	☐
MW35	1380346.38	3960282.00	☑	0.496	0.268	0.938	☐
MW37	1380539.63	3960388.00	☑	0.272	0.029	0.909	☑
MW58	1380547.88	3960074.25	☑	0.287	0.103	0.603	☑
MW64	1380852.63	3959938.75	☑	0.756	0.437	0.969	☐
MW82	1380712.63	3960750.75	☑	0.554	0.212	0.946	☐

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 Plane (i.e., X and Y refer to Easting and Northing, respectively) or local coordinate 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 Sampling Frequency Optimization Results

Project: 2022 OU6 DRO Main Plume **User Name:** KM

Location: Fort Wainwright **State:** Alaska

The Overall Number of Sampling Events: 21

"Recent Period" defined by events: **From** 10/17/2007 **To** 8/8/2022

"Rate of Change" parameters used:

Constituent	Cleanup Goal	Low Rate	Medium Rate	High Rate
PHC as DIESEL	1.5	0.75	1.5	3

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

Well	Recommended Sampling	Frequency Based on	Frequency Based on
PHC as DIESEL FUEL			
MW06A	Biennial	Biennial	Biennial
MW12R	Biennial	Biennial	Biennial
MW28	Biennial	Biennial	Biennial
MW32R	Biennial	Biennial	Biennial
MW33	Quarterly	Quarterly	Quarterly
MW35	Biennial	Biennial	Biennial
MW37	Biennial	Biennial	Biennial
MW58	Biennial	Biennial	Biennial
MW64	Biennial	Biennial	Biennial
MW82	Biennial	Biennial	Biennial

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 Statistical Trend Analysis Summary

Project: 2022 OU6 TCP Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 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
1,2,3-TRICHLOROPROPANE								
MW47	S	19	17	3.1E-04	2.9E-04	No	D	I
MW79	T	18	18	1.1E-03	6.9E-04	No	I	I

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); No Detectable Concentration (ND)

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

MAROS Mann-Kendall Statistics Summary

Project: 2022 OU6 TCP Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
1,2,3-TRICHLOROPROPANE								
MW47	S	19	17	0.55	-63	98.6%	No	D
MW79	T	18	18	1.03	55	98.0%	No	I

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); Source/Tail (S/T)

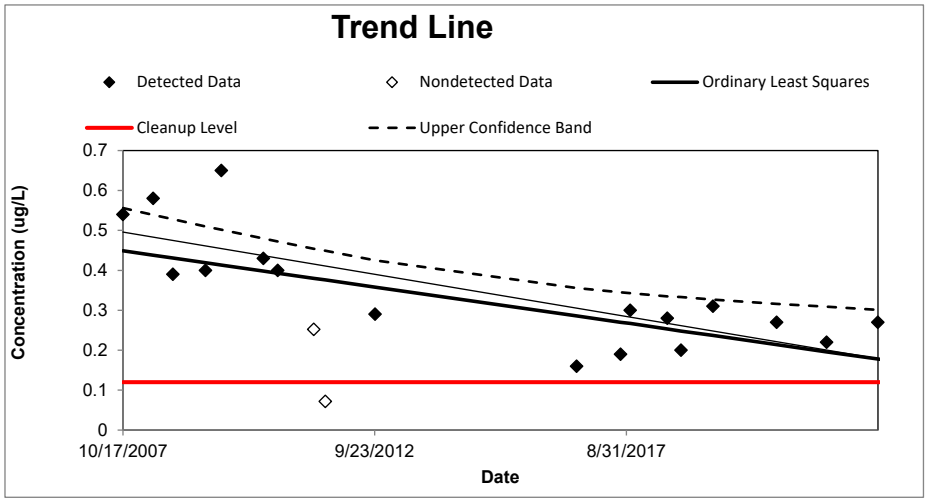
The Number of Samples and Number of Detects shown above are post-consolidation values.

Groundwater Statistics Tool

Site & Summary Statistics for Nonparametric Data Sets with Non-detects and Normal Residuals

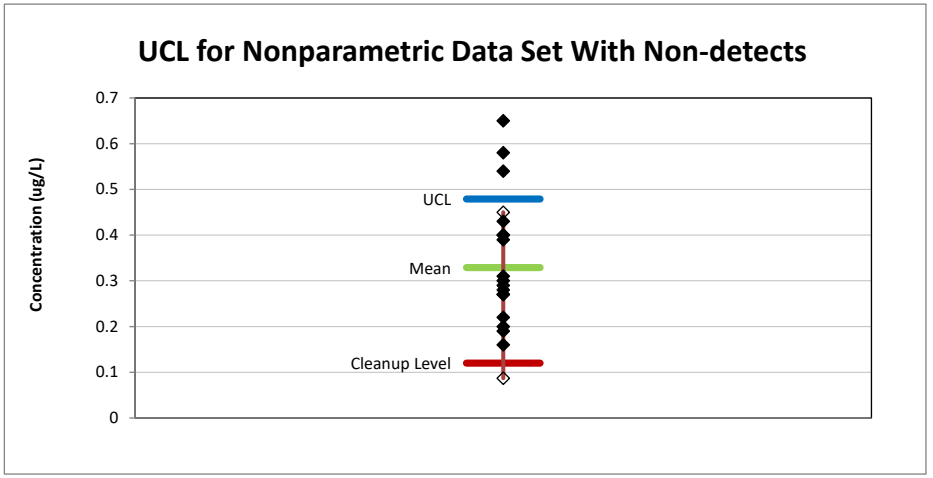
General Information

Analyst	CE
Date of Evaluation	3/3/2023
Site Name	FCS
Operable Unit	OU6
Type of Evaluation	Remediation
Well Name/Number	MW47
Chemical of Concern	TCP
Concentration Units	ug/L
Cleanup Level	0.12
Source of Cleanup Level	MCL
Confidence Level	95%
Risk of False Outlier Rejection	1%
Number of Results	19
Outliers present?	No
Number of Non-Detects	2



Trend Analysis

Trend Type	Normal
Method	Ordinary Least Squares
Is the Upper Confidence Band above the cleanup level?	**Yes**
Slope	-0.0000501
Intercept	2.42
R^2	0.6193
Test Result	**Decreasing**
When concentration is predicted to achieve the cleanup level	**10/3/2025**
When concentration is predicted to exceed the cleanup level	**NA**



UCL Analysis

Distribution Type	Nonparametric
Test	KM Chebyshev UCL
Mean	0.329
95% UCL	**0.479**
Is the 95% UCL greater than the cleanup level?	**Yes**

Previous Step: Trend Screen

Previous Step: UCL Screen

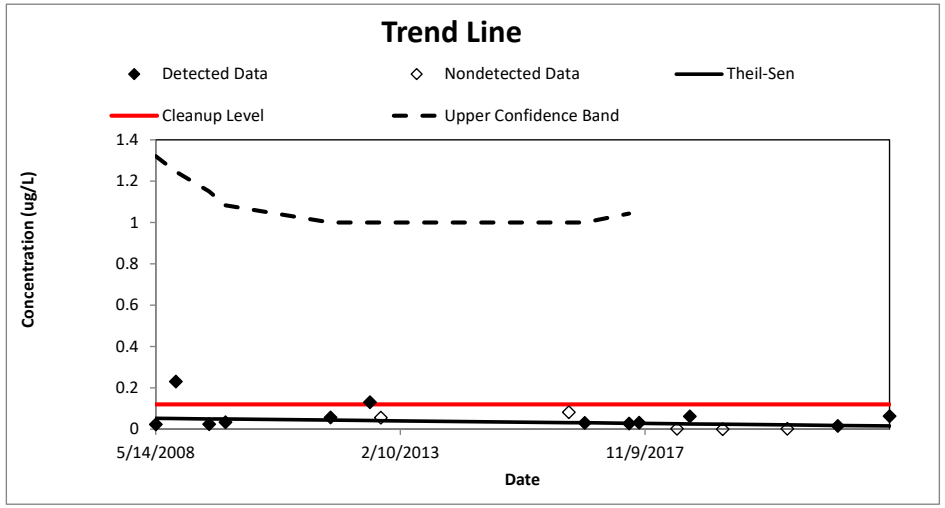
Restart: Data Input Screen

Groundwater Statistics Tool

Site & Summary Statistics for Nonparametric Data Sets with Non-detects and Nonparametric Residuals

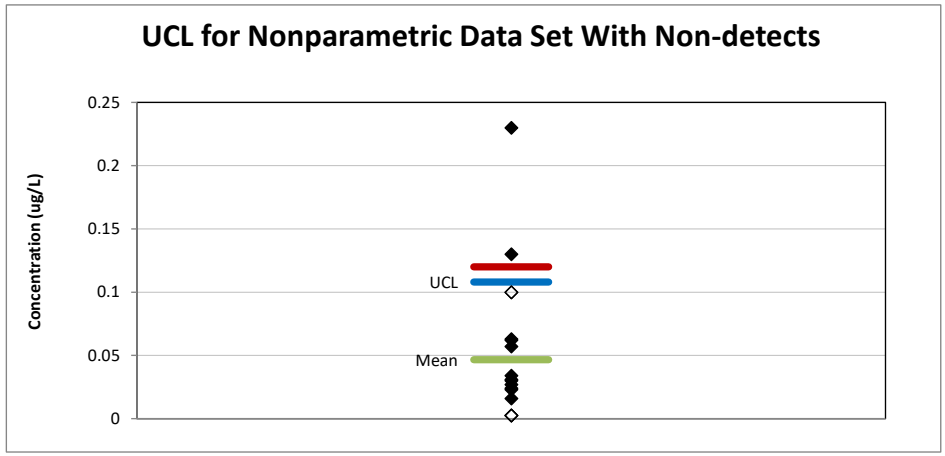
General Information

Analyst	CE
Date of Evaluation	3/3/2023
Site Name	FCS
Operable Unit	OU6
Type of Evaluation	Attainment
Well Name/Number	MW08
Chemical of Concern	TCP
Concentration Units	ug/L
Cleanup Level	0.12
Source of Cleanup Level	MCL
Confidence Level	95%
Risk of False Outlier Rejection	1%
Number of Results	17
Outliers present?	Yes
Number of Non-Detects	5



Trend Analysis

Trend Type	Nonparametric
Method	Theil-Sen Line, Mann-Kendall Test
Is the Upper Confidence Band above the cleanup level?	**NA**
Slope	-0.00000709
Intercept	0.333
Test Result	**No trend**
When concentration is predicted to achieve the cleanup level	**NA**
When concentration is predicted to exceed the cleanup level	**NA**



UCL Analysis

Distribution Type	Nonparametric
Test	KM Chebyshev UCL
Mean	0.0466
95% UCL	**0.108**
Is the 95% UCL greater than the cleanup level?	**No**

Previous Step: Trend Screen

Previous Step: UCL Screen

Restart: Data Input Screen

MAROS Statistical Trend Analysis Summary

Project: 2022 OU6 TCE Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 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
TRICHLOROETHYLENE (TCE)								
MW61	S	20	20	3.8E-03	1.7E-03	No	D	D

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); No Detectable Concentration (ND)

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

MAROS Mann-Kendall Statistics Summary

Project: 2022 OU6 TCE Plume **User Name:** CDE

Location: Fort Wainwright **State:** Alaska

Time Period: 10/17/2007 **to** 8/8/2022
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
TRICHLOROETHYLENE (TCE)								
MW61	S	20	20	1.04	-139	100.0%	No	D

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); Source/Tail (S/T)

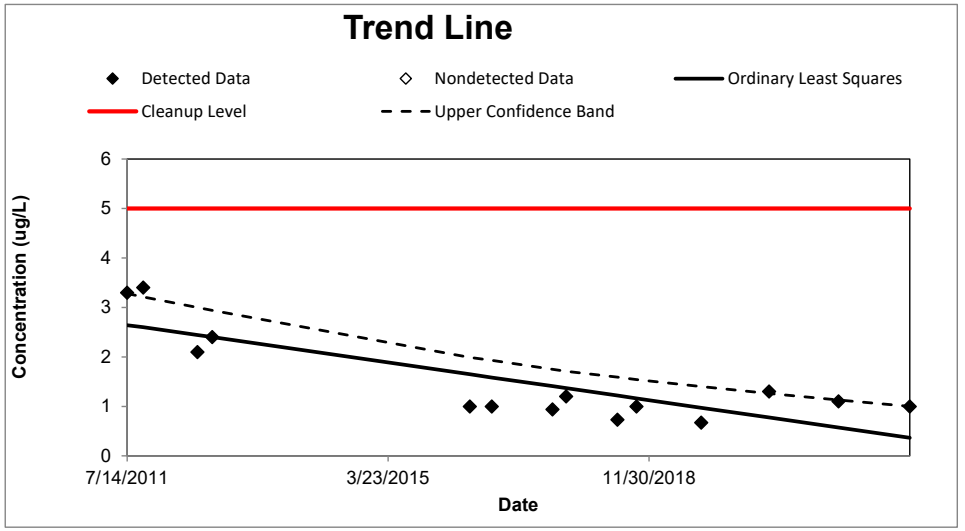
The Number of Samples and Number of Detects shown above are post-consolidation values.

Groundwater Statistics Tool

Site & Summary Statistics for Nonparametric Data Sets with Normal Residuals

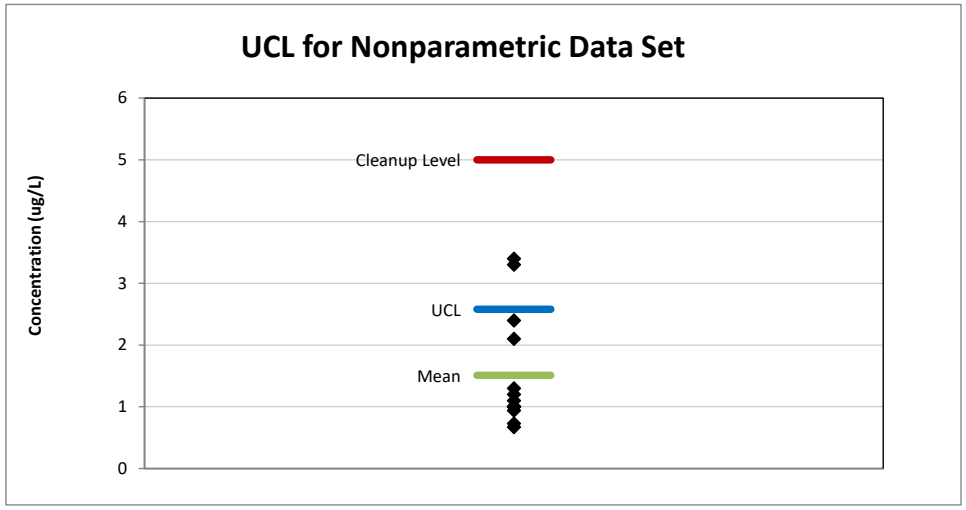
General Information

Analyst	CE
Date of Evaluation	3/4/2023
Site Name	FCS
Operable Unit	OU5
Type of Evaluation	Attainment
Well Name/Number	MW61
Chemical of Concern	TCE
Concentration Units	ug/L
Cleanup Level	5
Source of Cleanup Level	MCL
Confidence Level	95%
Risk of False Outlier Rejection	1%
Number of Results	14
Outliers present?	No
Number of Non-Detects	0



Trend Analysis

Trend Type	Normal
Method	Ordinary Least Squares
Is the Upper Confidence Band above the cleanup level?	**NA**
Slope	-0.000564
Intercept	25.6
R^2	0.6789
Test Result	**Decreasing**
When concentration is predicted to achieve the cleanup level	**NA**
When concentration is predicted to exceed the cleanup level	**NA**



UCL Analysis

Distribution Type	Nonparametric
Test	Chebyshev UCL
Mean	1.51
95% UCL	**2.58**
Is the 95% UCL greater than the cleanup level?	**No**

Previous Step: Trend Screen **Previous Step: UCL Screen** **Restart: Data Input Screen**

APPENDIX F
Review Comments

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REVIEW COMMENTS

PROJECT: Fort Wainwright, AK

DOCUMENT: Draft 2022 OU 6 Monitoring Report

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION	DATE: 08/01/2023 REVIEWER: Timothy Sharp PHONE: (907) 451-2131	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	ADEC/EPA RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)	CONTRACTOR RESPONSE
1	General Comment	Please update the Record of Decision (ROD) Remedial Goal (RG) for 1,2,3-trichloropropane (TCP) to 0.075 µg/L where applicable in the document, such as Table 1-2, Section 3.3, Graph 3-5, Table 3-3, Graph 4.2, etc. According to the Fifth Five-Year Review (2021), "Changes to a ROD ARAR have been promulgated since the Fourth Five-Year Review. Cleanup levels (CULs) in 18 AAC 75 are listed as an Applicable or Relevant and Appropriate Requirement (ARAR) in the OU6 ROD (USACE, 2014). In 2016, amendments to 18 AAC 75 updated calculation methods and values of CULs for soil and groundwater. Subsequent updates to the CULs occurred in 2018 and 2020. ROD project cleanup levels for…1,2,3-TCP were compared to current 18 AAC 75 CULs…The 1,2,3-TCP project cleanup level identified in the ROD is less conservative than the current 18 AAC 75 CUL; the project cleanup level cancer risk exceeds the acceptable range (at 1.6x10-4) and the project cleanup is no longer protective." The Fifth Five-Year Review states later in Table F-6 that "Table C establishes groundwater cleanup levels for the site (i.e., DRO, RRO, and 1,2,3-TCP)."		This comment is acknowledged. The RGs used within the report were published in the final work plan QAPP WS#15. A reevaluation will occur in the next Five-Year Review; it's not appropriate to change the RG in the monitoring report.	Accepted.	
2	Table 1-2	The RG for trichloroethylene (TCE) is above the state promulgated cleanup level found in 18 AAC 75.345, Table C. As stated above, CULs in 18 AAC 75 are listed as an ARAR in the OU6 ROD. The Army needs to meet both federal and state regulatory standards. Maximum contaminant levels (MCLs) are designed to be protective of receptors under a residential use (tap water) scenario but are not reviewed with updated		This issue will be addressed in the next Five-Year Review.	Accepted.	

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	ADEC/EPA RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)	CONTRACTOR RESPONSE
		toxicity values as frequently as the Table C values. Table C values evaluate groundwater based on drinking water standards for the state of Alaska. DEC understands the RG for TCE is enshrined in the ROD, but this value should be reevaluated either in the next Five-Year Review, or more preferably the OU2 Explanation of Significant Differences (ESD) (as the CUL for 1,2,3-TCP is) to bring it in line with the more stringent Table C value.				
3	Table 1-2	The note states that RGs are established in Table C, thought the table doesn't correlate to Table C values for 1,2,3-TCP and TCE.	A	Accepted. Consistent with Comment #1 this footnote will reference the ROD. The footnote will be updated to read: "[1] OU6 ROD (USAG Alaska 2014)"	Accepted with backcheck.	
4	Section 2.4	Potential typo: "Complete inspection results are presented in the 2021 Fort Wainwright IC Inspection Report (anticipated spring 2022)." Should this be referencing the 2022 IC Report, anticipated Winter of 2023?	A	Accepted. The text will be revised to read: "A summary of the IC objectives and 2022 inspection findings are presented in this section. Complete inspection results are presented in the 2022 Fort Wainwright IC Inspection Report (anticipated winter 2023)."	Accepted with backcheck.	
5	Graphs 3-2 and 3-4	Please increase the contrast of the graphs so the white outlined symbols are more legible.	A	Accepted. The symbols outlined white will be adjusted to be in outlined in grey.	Accepted with backcheck. Note one MW12R data point is still outlined in white in the draft-final redline.	
6	Section 5.2	As part of the discussions stemming from the Five-Year Review, DEC and EPA have both expressed concerns that cleanup timelines in the ROD are a component of the remedy effectiveness		Accepted. The following text will be added to Section 1.3.4: "The Fifth Five-Year Review recommended establishing a	Accepted with backcheck.	

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	ADEC/EPA RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)	CONTRACTOR RESPONSE
		evaluation. In the Former Communications Site's case, the RAOs have not been attained and are not expected to be attained until 2038, if not longer. The Army has been asked to reassess current remedies with remedy optimization studies or equivalent to progress sites in a more aggressive manner when possible. The Army has agreed via responses to recommendations from the Fifth Five-Year Review to conduct an evaluation to determine if additional remediation would be appropriate at the site. This proposal for evaluation should be captured in this section.		remedial timeframe for DRO and RRO at OU6 in order to monitor progress toward RGs. The U.S. Army plans to conduct this assessment and report the findings in a Five-Year Review Addendum."		
7	Section 5.4	DEC disagrees with the recommendation of not replacing MW58. Currently it is the furthest downgradient well in the identified DRO plume and historically has exceeded the RG for DRO in nearly every sampling event. If MW58 must be decommissioned due to damage, DEC recommends it be replaced with another well in the same area or slightly downgradient. This plume is not fully delineated and DEC recommends installing more wells in the future to evaluate the northwestern edge of the plume. Judging from the photograph log (PDF pg. 136) the well should be able to be cleared of obstruction with proper tools.		Clarification. MW58 is considered a redundant in-plume well since it has concentrations exceeding DRO and is near well MW06A. Downgradient wells MW-37 and MW-82 were both non-detect for DRO in 2022, indicting the DRO plume has been sufficiently delineated. Also, the Army plans to add an additional downgradient well, MW-35, to the monitoring program in 2023, which will further ensure downgradient migration of DRO is not occurring. A further description regarding the state of MW58 was added to the executive summary, Section 2.1, and Section 5.4. A shift within the well casing has pinched sample tubing creating an obstruction. The tubing could not be removed since it was pinched even after extensive efforts.	Accepted. DEC notes that the MW-35 label was removed per EPA's comments. If MW-35 is to be incorporated into future sampling, it should be identified on the figure, though in a way to differentiate it from MW-37.	11/4/23: Based on EPA's request to remove the MW-35 label, we propose that MW-35 be included in the 2023 CERCLA Sites work plan figure and the subsequent figure in the 2023 OU6 Annual Report.

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	ADEC/EPA RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)	CONTRACTOR RESPONSE
8	Section 5.4	MW61 and MW80 were recommended to be removed from the sampling program for TCE in the 2021 OU6 Monitoring Report. MW03 and MW13 additionally were recommended to cease sampling as background concentrations at the site are well established.	A	Accepted. These recommendations have been accepted in the 2021 report and the recommendations were implemented in 2023 sampling. The bullets related to MW61, MW80, MW03, and MW13 were deleted.	Accepted with backcheck.	
9	Appendix A Groundwater Analytical Data Tables	Please include Table C groundwater human health cleanup levels, as Table C cleanup levels are chemical specific ARARs as identified in the OU6 ROD.		Clarification. The results will only be compared to the ROD RGs per the approved work plan, QAPP WS #15.	Accept.	
10	Appendix B: LDRC 3.c (PDF pg. 101)	Statement: "One VOA vial for equipment blank sample 22FWOU6WQ01 was received broken in the bubble bag. There was sufficient volume available to analyze all requested methods." The matrix of this sample was water, in a broken vial. How was there sufficient volume? Additionally, as this vial was analyzed for volatiles, shouldn't results be flagged as J- due to low bias?	A	Clarification and accepted. Three vials were submitted to the laboratory; therefore, two vials were still intact, and qualification was not necessary. The text in checklist 22H153 will be updated to read: "One of three VOA vials…"	Accept.	
11		--End of Comments--				

EPA Compiled Review of the Draft 2022 Monitoring Report, Former Communications Site, Operable Unit 6, U.S. Army Garrison, Fort Wainwright, Alaska, July 2023

Number	Page	Section	Comment	Response	Evaluation of Response
GENERAL COMMENTS					
1.			The Draft Report does not discuss if the vapor intrusion (VI) pathway was evaluated to ensure no unacceptable exposure occurs due to the presence of residential housing. Section 1.3.1 (Site History) states the OU6 Former Communications Site (FCS) is commonly referred to as the Tanana Trails Family Housing Development and according to Figure 2-1 (Groundwater Monitoring Wells Sampled in 2022), several homes are located over the contaminant plumes. Please revise the Draft Report to discuss if the VI pathway was assessed at FCS Operable Unit (OU) 6.	Accepted. The following text will be added to Section 1.3.3: "A soil gas investigation was conducted at OU6, which included installation of 110 sub-slab soil gas probes (one in each housing unit garage) and 53 vadose zone soil gas probes were installed in open areas of the FCS to characterize soil gas and evaluate the potential for contaminants to affect indoor and outdoor air. In addition, 67 passive soil gas samples were installed to locate a possible source area and delineate the extent of TCP contamination in the eastern portion of OU6."	Accepted
SPECIFIC COMMENTS					
2.	PDF Page 21	2.4	It is unclear whether dig permits were reviewed as a part of the land use control (LUC) inspection process. The text asserts based on the source area inspection, it was determined that the OU6 institutional controls	Accepted. The dig permits are included in the IC Inspection Report. The first bullet will be revised to read: "Soil disturbances greater than 6 inches bgs were not observed	Accepted

Number	Page	Section	Comment	Response	Evaluation of Response
			(ICs) are being implemented and are effective; however, according to the text the IC inspection included visual observations only and review of dig permits is not discussed. Please revise the Draft Report to discuss if dig permits were reviewed as part of the IC inspection process.	and the dig permits were reviewed."	
3.	PDF Page 23	3.1	The general range in the depth to groundwater, in feet below the ground surface, that was encountered during the 2022 monitoring event is not presented. Please revise the text to provide this information.	Accepted. The following text was added to Section 3.1: "The depth to groundwater measured ranged from approximately 11.4 to 14.3 feet bgs."	Accepted
4.	PDF Page 32	Table 3-2	Well MW58 was not sampled during the 2022 sampling event; however, this information is not presented in the table. Please revise the table and add a footnote explaining that MW58 was not sampled due to an obstruction in the well casing.	Accepted. Table 3-1 will be revised to include a superscript 1 and the following note: "[1] The well was not sampled due to an obstruction in the well casing." Table 3-2 will also be updated to include the note.	Accepted
5.	54	Figure 3-2	Please remove the label for MW-35.	Accepted. The MW-35 label will be removed from Figure 3-2.	Accepted
6.	General		Has the TCP Source been removed? Or per the Exec Summary: "Exceedances will	There have been removal actions, but none have	Accepted

Number	Page	Section	Comment	Response	Evaluation of Response
			likely continue in the two main TCP plume wells until the suspected TCP soil source is depleted".	specifically been related to TCP contamination.	
7.	2-2	2.3	IDW was to be analyzed for PFAS. What were the results? I couldn't find any presented in the Report.	Clarification. The IDW was analyzed for PFAS. These results will be reported in the forthcoming IDW Technical Memorandum.	Accepted
MINOR COMMENTS					
1.	13	Executive Summary	The Acronym "NAPL" is not defined on first use. Please define all acronyms on first use in the text.	Accepted. The first use of NAPL in the executive summary will be defined.	Accepted
2.	31	Tables 3-2 and 3-3	The abbreviation "NE" is not defined in the table footnotes or in the "Acronyms and Abbreviations" section. Please define the abbreviation as appropriate.	NE was added to the Acronyms list and defined under the table with the first use.	Accepted