UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

THIRD CERCLA FIVE-YEAR REVIEW REPORT

JBER-RICHARDSON, ALASKA

FINAL
FEBRUARY 2013

UNITED STATES AIR FORCE
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LEAD AGENCY ACCEPTANCE
THIRD FIVE-YEAR REVIEW, JBER-RICHARDSON, ALASKA

This signature sheet documents the United States Air Force acceptance of the third Five-Year Review for JBER-Richardson.

[signature]	1 APR 13
BRIAN P. DUFFY **Colonel, United States Air Force** **Commander**	**DATE**

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ACRONYMS AND ABBREVIATIONS

673 CES	673d Civil Engineer Squadron
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFCEE	Air Force Center for Engineering and the Environment
ARAR	applicable or relevant and appropriate requirements
ATV	all-terrain vehicle
AVMA	Armored Vehicle Maintenance Area
bgs	below ground surface
BLM	Bureau of Land Management
BRAC	base realignment and closure
CAIS	chemical agent identification sets
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLOSES	Cleanup Operations and Site Exit Strategy
COC	chemical of concern
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
DNAPL	dense non-aqueous phase liquid
DPW	Directorate of Public Works
DRO	diesel-range organics
EIS	environmental impact statement
EM	electromagnetic induction
EPA	U.S. Environmental Protection Agency
ERF	Eagle River Flats
ERP	Environmental Restoration Program (formerly known as Installation Restoration Program – *see* IRP)
FFA	Federal Facilities Agreement
FFCA	Federal Facilities Compliance Agreement
FS	Feasibility Study
GIS	geographical information system
GRO	gasoline-range organics
HVE	high-vacuum extraction

ACRONYMS AND ABBREVIATIONS (Continued)

IRP	Installation Restoration Program (now known as Environmental Restoration Program – *see* ERP)
Jacobs	Jacobs Engineering Group Inc.
JBER	Joint Base Elmendorf-Richardson
JBER-E	Joint Base Elmendorf-Richardson former Elmendorf Air Force Base area
JBER-R	Joint Base Elmendorf-Richardson former Fort Richardson area
LUC	land-use controls (formerly known as institutional controls)
MCL	maximum contaminant level
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NPL	National Priorities List
O&M	operations and maintenance
OB/OD	open burning/open detonation
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pg/g	pictograms per gram
POL	petroleum, oil, and lubricants
ppm	parts per million
ppt	parts per trillion
PRDA	Poleline Road Disposal Area
PSE	preliminary source evaluation
RA	remedial action
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	record of decision
RSL	regional screening level

ACRONYMS AND ABBREVIATIONS (Continued)

SARA	Superfund Amendments and Reauthorization Act (1986)
SOP	standard operating procedure
SPSH	six-phase soil heating
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TBC	to be considered
TCE	trichloroethylene
TSCA	Toxic Substances Control Act (1976)
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USARAK	U.S. Army Alaska
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
UXO	unexploded ordnance
VOC	volatile organic compound
1,1,2,2-PCA	1,1,2,2-tetrachloroethane
1,1,1-TCA	1,1,1-trichloroethane
1,1,2-TCA	1,1,2-trichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
cis-1,2-DCE	cis-1,2-dichloroethylene
ºF	degrees Fahrenheit
µg/L	micrograms per liter

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EXECUTIVE SUMMARY

The U.S. Air Force (USAF) 673d Civil Engineer Squadron (673 CES) conducted the third Five-Year Review of selected remedies for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites on Joint Base Elmendorf-Richardson (JBER)-Richardson, Anchorage, Alaska, beginning in May 2012. This report presents the results of the review for the JBER-Richardson (JBER-R) sites.

The purpose of this review is to ensure that remedies selected in each of the JBER-R Records of Decision (ROD) have been implemented, are performing effectively, and continue to be protective of human health and the environment. This review evaluates the remedy and its implementation status (as selected in the RODs), identifies discrepancies, and makes recommendations for resolving the identified discrepancies and improving performance of the selected remedies.

This statutory review is required by CERCLA. All of the RODs for this National Priorities List (NPL) site were signed after the effective date of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and some of the selected remedies result in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The contaminant sources at JBER-R, Alaska are grouped into five areas including OUs A through E (U.S. Army Alaska [USARAK] 2008). Four RODs were written and signed covering all sites within the five OUs. RODs were signed for OUs A and B in August 1997; OUC in September 1998; OUD in September 2000; and OUE in September 2005. Sites identified in the RODs where only petroleum contamination remained were recommended for No Further Action (NFA) under CERCLA and were transferred to a Two-Party Agreement between the U.S. Army and ADEC. No additional CERCLA documentation is required for those sites.

Please note that all sites located within OUs A and D have since been either assigned a status of NFA, transferred to OUE (Building 35-752 Area), or were referred to the Two-Party Agreement

(explained in Section 1.3.2), and are therefore not included in this 2012 Five-Year Review for JBER-R. OUs A and D will not be discussed any further in this review.

This Five-Year Review found that the implemented remedy for JBER-R OUB is currently protective, but may not be protective in the future. Toxicity changes associated with the chemicals of concern indicate the cleanup levels in the ROD will not support unrestricted site use.

The Five-Year Review found that the implemented remedy for JBER-R OUC is currently protective, and will be protective in the future.

This Five-Year Review found that the protectiveness determination of the implemented OUE remedy could not be made at the time of this review. The protectiveness determination will be made after the evaluation of the completed vapor intrusion study. Protectiveness statements for these OUs B, C and E are discussed in Section 10.0.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: JBER-R (former Fort Richardson area)		
EPA ID: AK6214522157		
Region: 10	**State:** AK	**City/County:** Anchorage
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes (28 September 2006)	
REVIEW STATUS		
Lead agency: USAF **If "Other Federal Agency" was selected above, enter Agency name:** N/A		
Author name (Federal or State Project Manager): Jacobs Engineering Group Inc. on behalf of the 673d Civil Engineer Squadron, Asset Management Flight, Natural Resources Element, Cleanup Section Federal Project Manager: Gary Fink		
Author affiliation: Contractor		
Review period: 22 February 2008 – 22 February 2013		
Date of site inspection: 25 June 2012 – 30 June 2012		
Type of review: Statutory		
Review number: 3		
Triggering action date: 22 February 2008		
Due date *(five years after triggering action date)*: 22 February 2013		

Notes:
JBER-R = Former Fort Richardson Area on Joint Base Elmendorf-Richardson
USAF = United States Air Force

Five-Year Review Summary Form (Continued)

ISSUES/RECOMMENDATIONS

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
All sites located within OUs A and D were assigned a no further action status under CERCLA, transferred to OUE (Building 35-752 Area), or were referred to the Two-Party Agreement for State oversight.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OUB	**Issue Category:** Monitoring			
	Issue: The downgradient margin of the OUB plume at the Poleline Road Disposal Area is not defined. A downgradient monitoring well (AP-3747), is located to the north-northeast of the "hot spot". However, the plume boundary appears to extend beyond this well.			
	Recommendation: Augment the monitoring well network in the shallow aquifer to define the downgradient limit of the plume.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	USAF	EPA/State	2015

OU(s): OUB	**Issue Category:** Monitoring			
	Issue: Chemical specific toxicity updates affect the OUB RAOs for 1,1,2,2 PCA (groundwater and soil) and PCE (soil) because they were risk based at the time of the ROD (no regulatory MCL). The toxicity changes result in an unacceptable exposure (Hazard Index >1) when the residential exposure assumption, used to support the OUB ROD, and the ROD RAOs are considered.			
	Recommendation: Update the OUB COC RAOs to provide future protectiveness of human health.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	USAF	EPA/State	2015

Five-Year Review Summary Form (Continued)

<table>
<tr><td rowspan="3">OU(s): OUE</td><td colspan="4">Issue Category: Monitoring</td></tr>
<tr><td colspan="4">Issue: Manned facilities are present in the vicinity of the PCE plume associated with the AVMA site indicating a potential for vapor intrusion to occur at those facilities.</td></tr>
<tr><td colspan="4">Recommendation: The potential vapor-intrusion exposure pathway should be assessed at the AVMA site.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>Yes</td><td>Yes</td><td>USAF</td><td>EPA/State</td><td>2014</td></tr>
</table>

PROTECTIVENESS STATEMENT(S)

Operable Unit: OUB	*Protectiveness Determination:* Short Term Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement: The remedy at OUB currently protects human health and the environment because the LUCs are preventing exposure to contaminated groundwater, soil, and potential UXO hazards. However, in order for the remedy to be protective in the long term, the COC RAOs established in the ROD will need to be re-evaluated to consider current COC toxicity information and the recommendation for defining the downgradient extent of the plume will need to be addressed. Changes in toxicity values for some COCs currently result in an unacceptable risk (Hazard Index >1) when the residential exposure scenario is considered.

Operable Unit: OUC	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement: The remedy at OUC is protective of human health and the environment.

Operable Unit: OUE	*Protectiveness Determination:* Protectiveness Deferred	*Addendum Due Date: 12/31/2014*

Protectiveness Statement: Protectiveness determination of the remedy at OUE is deferred until the potential impacts associated with the vapor intrusion pathway at the site are evaluated. The vapor intrusion assessment is expected to be performed in 2014.

Notes:
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
LUC = land-use control
OU = operable unit
RAO = remedial action objective
ROD = Record of Decision
UXO = unexploded ordnance
PCE = tetrachloroethylene

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1.0 INTRODUCTION

The U.S. Air Force (USAF) 673d Civil Engineer Squadron (673 CES) conducted the third Five-Year Review of the selected remedies at the Joint Base Elmendorf-Richardson (JBER)-Richardson National Priorities List (NPL) site (JBER-R) in Anchorage, Alaska (Figure 1-1), beginning in May 2012. Jacobs Engineering Group Inc. (Jacobs) performed work in support of this review.

In 1988, U.S. Environmental Protection Agency (EPA) Region 10 placed JBER-R on the hazardous waste compliance docket. The U.S. Army's investigation of contaminated sites at JBER-R under the Installation Restoration Program (IRP) began in 1988. The objectives of the IRP are to assess sites where potentially hazardous material may exist and to develop and recommend remedial actions for those sites that pose a threat to human health and welfare or the environment. The IRP is the basis for response actions under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Fort Richardson was identified for realignment/joint basing with Elmendorf Air Force Base during the 2005 base closure and realignment (BRAC) selection process. On 1 October 2010, Elmendorf Air Force Base, located just north of Anchorage, and Fort Richardson, located northeast of Anchorage, merged under the joint basing initiative to form JBER. While military missions of USAF and U.S. Army units will remain separate, JBER consolidates service-specific programs that perform installation support functions, including environmental remediation services. USAF, as the supporting component of JBER, is now responsible for the cleanup of sites formerly managed by the US Army and all of the environmental restoration agreements formerly between the U.S. Army, EPA, and Alaska Department of Environmental Conservation (ADEC).

Despite the consolidation of the JBER environmental program, a separate Five-Year Review report was generated for each former installation (JBER Elmendorf [JBER-E] and JBER-R). This Five-Year Review was intended for the sites originally assigned to Fort Richardson under the previously signed Records of Decision (ROD). Five-year reviews are required due to the fact that hazardous substances, pollutants, and/or contaminants remain at the sites above levels that allow for unlimited use and unrestricted exposure (UU/UE).

EPA OSWER no. 9355.7-03B-P states:

> *Unlimited use and unrestricted exposure (UU/UE) means that the selected remedy will place no restrictions on the potential use of land or other natural resources. In general, if the selected remedy relies on restrictions of land and/or groundwater use by humans and/or ecological populations to be protective, then the use has been limited and a five-year review should be conducted. For example, if a site is cleaned up to an industrial-use level, and/or other types of uses are restricted (e.g., residential use), then, generally, UU/UE is not met.*

This report presents the results of the third Five-Year Review for operable units (OUs) B, C, and E (shown on Figure 1-2). Note that all sites located within OUs A and D have either been assigned a status of No Further Action (NFA), transferred to OUE (Building 35-752 Area), or referred to the Two-Party Agreement (see Section 1.3.2).

1.1 PURPOSE

The purpose of this review is to ensure that remedies selected for each of the JBER RODs have been implemented, are performing effectively, and continue to be protective of human health and the environment. To achieve this purpose, this review evaluates the remedies and the implementation status of the remedies (as selected in the RODs), identifies discrepancies with the RODs, and makes recommendations to resolve the identified discrepancies and improve the performance of the selected remedies. In addition, the review identifies any new information that may affect the remedies effectiveness and documents whether new contaminant sources or exposure pathways were discovered.

The initiation or trigger date that starts the statutory Five-Year Review period, in cases where there are multiple remedial actions, is the date of the earliest remedial action that leaves hazardous substances, pollutants, or contaminants on site above levels that allow for UU/UE (EPA 2001). The first ROD was signed for OUs A and B on 8 August 1997, and selected remedy construction began at OUB on 22 February 1998; this date represents the initial trigger action. The trigger date for subsequent reviews is the signature date of the previous Five-Year Review report. The previous (second) Five-Year Review Report for JBER-R was signed on 22 February 2008.

1.2 AUTHORITY FOR CONDUCTING THE FIVE-YEAR REVIEW

Executive Order 12580 delegated lead agency status to the Department of Defense for all CERCLA remedial actions. Authority was further delegated to the USAF which is the lead agency for remedial actions at JBER-R. The selected final remedial actions for JBER-R, Alaska, were chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986. The USAF 673 CES has conducted this Five-Year Review in accordance with the following agencies and their regulations and requirements:

- CERCLA Section 121 [United States Code (USC) Title 42, Section 9621(c); 7 January 2011
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR § 300.430(f)(4)(ii)
- Section 19.1 of the Federal Facility Agreement (FFA); December 1984
- Executive Order 12580, 23 January 1987
- EPA *Comprehensive Five-Year Review Guidance* (EPA 2001)

CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with Section (104) or (106), the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Section 19.1 of the FFA for Fort Richardson states:

> *If a remedial action is selected that results in any hazardous substances, pollutants, or contaminants remaining at the site, the Parties shall review such remedial action no less often than each five (5) years after the initiation of such remedial action to ensure that human health and the environment are being protected by the remedial action being implemented. The U.S. EPA Project Manager and the ADEC Project Manager shall advise the Army project manager of their findings in this regard. If any Party determines that additional action is required, the Agreement may be amended pursuant to Part XXXIII. If the Parties are unable to agree on the need to amend this Agreement, dispute resolution under Part XXI shall be available to any Party.*

The United States EPA interpreted this requirement further in the NCP 40 Code of Federal Regulations (CFR) 300.430(f) (4)(ii) as follows:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The EPA *Comprehensive Five-Year Review Guidance* (EPA 2001) states that:

> *The first Five-Year Review generally should be completed and signed by the EPA Region within five years of the initial trigger date.*

Five-year review guidelines state "an entire site is subject to a statutory review if any one of its RAs is subject to a statutory review." A full Five-Year Review was conducted for three of the JBER-R OUs: OUB (discussed in Section 4.1), OUC (discussed in Section 4.2), and OUE (discussed in Section 4.3). A Five-Year Review was not conducted for OUs A and D because all of the source areas within these OUs were exclusively petroleum sites that are excluded from CERCLA and referred to the Two-Party Agreement, or were transferred to OUE.

1.3 AGENCY OVERSIGHT AGREEMENTS

The USAF assumed responsibility for all previous environmental agreements between the U.S. Army and regulating agencies when Fort Richardson and Elmendorf Air Force Base merged in 2010. These include the Federal Facility Agreement and the Two-Party Agreements discussed below. The two-party agreements address petroleum-contaminated source areas in a manner consistent with the State of Alaska Administrative Code (AAC), Title 18, Chapters 75, *Oil & Hazardous Substances Pollution Control* (ADEC 2012b), and 18 AAC 78, *Underground Storage Tanks* (ADEC 2012a). These areas are not subject to CERCLA oversight due to the petroleum-exclusion rule.

1.3.1 Federal Facility Agreement

The U.S. Army, EPA, and the ADEC signed a FFA for Fort Richardson on 5 December 1994. The FFA is a Memorandum of Agreement that outlines the investigation and remedial approach for suspected historical hazardous-substance sources and calls for cleanup activities that would protect public health and welfare and the environment in accordance with state and federal laws. The FFA divided Fort Richardson into four OUs, named with letters A through D) to represent the potential source areas for hazardous substances based on the amount of existing information, the similarity of contamination, and the level of effort required to complete a Remedial Investigation (RI). Additions to the FFA include OUE (added in 2000) and the Nike Site Summit (added in May 2011). OUD was originally established as the final OU to be investigated at Fort Richardson. However, OUE was established in 2000 to integrate all previous and any new sources not addressed under the RODs for OUA through OUD.

1.3.2 Two-Party Agreement

The source areas where petroleum contamination was identified (OUA and OUD) were referred to the Two-Party Agreement between the U.S. Army and the State of Alaska. The Two-Party Agreement is composed of two separate agreements, one of which is focused on source areas at JBER-R contaminated with petroleum originating from underground storage tanks (UST) and the other is associated with petroleum source areas not originating from USTs.

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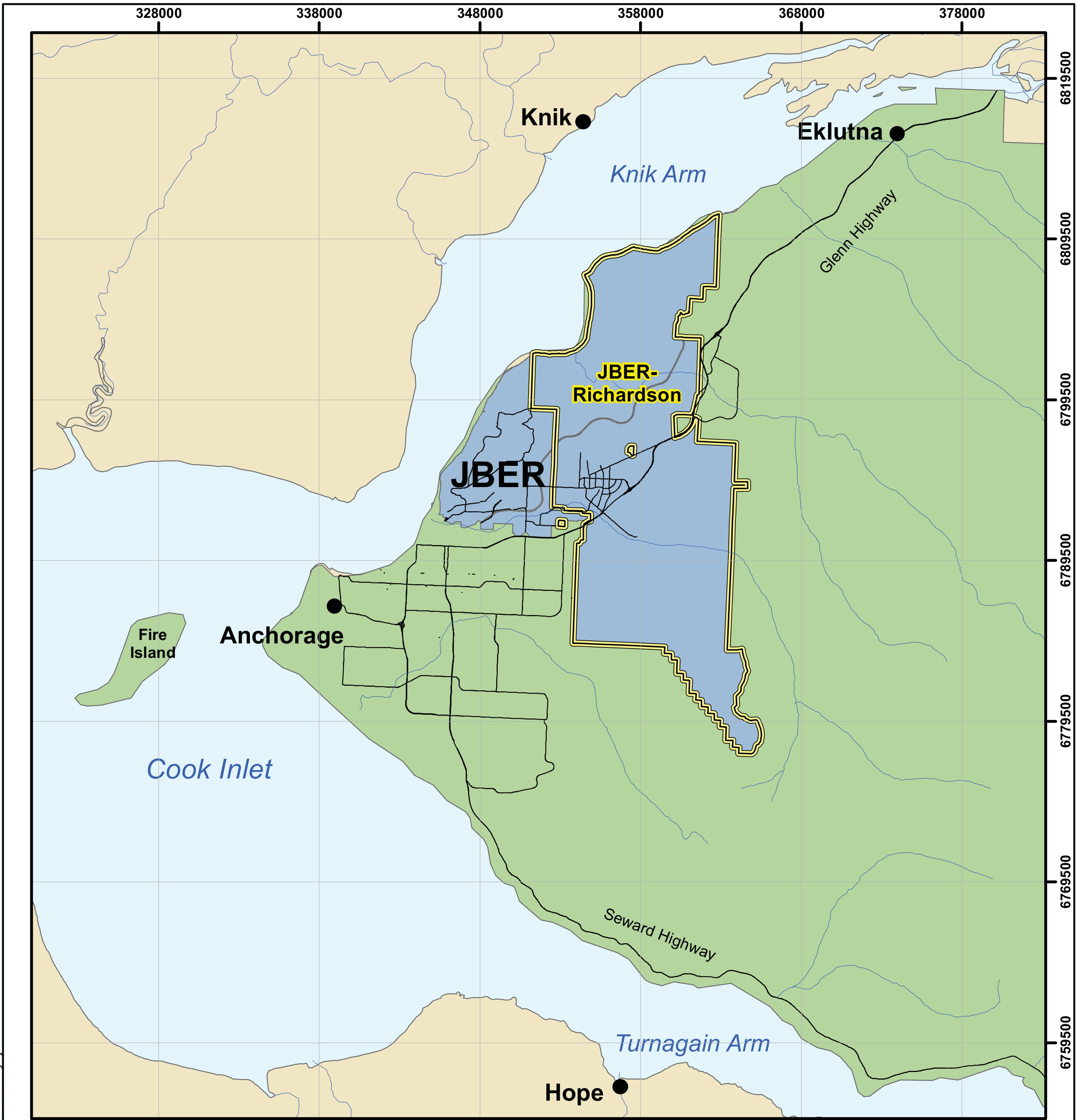

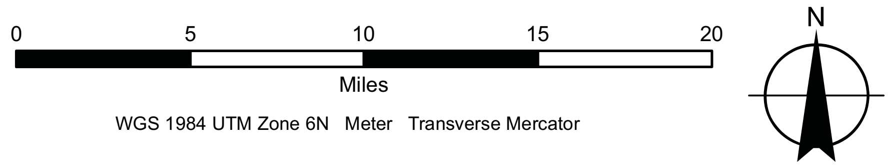

WGS 1984 UTM Zone 6N Meter Transverse Mercator

LOCATION AND VICINITY

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 31 JUL 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 1-1

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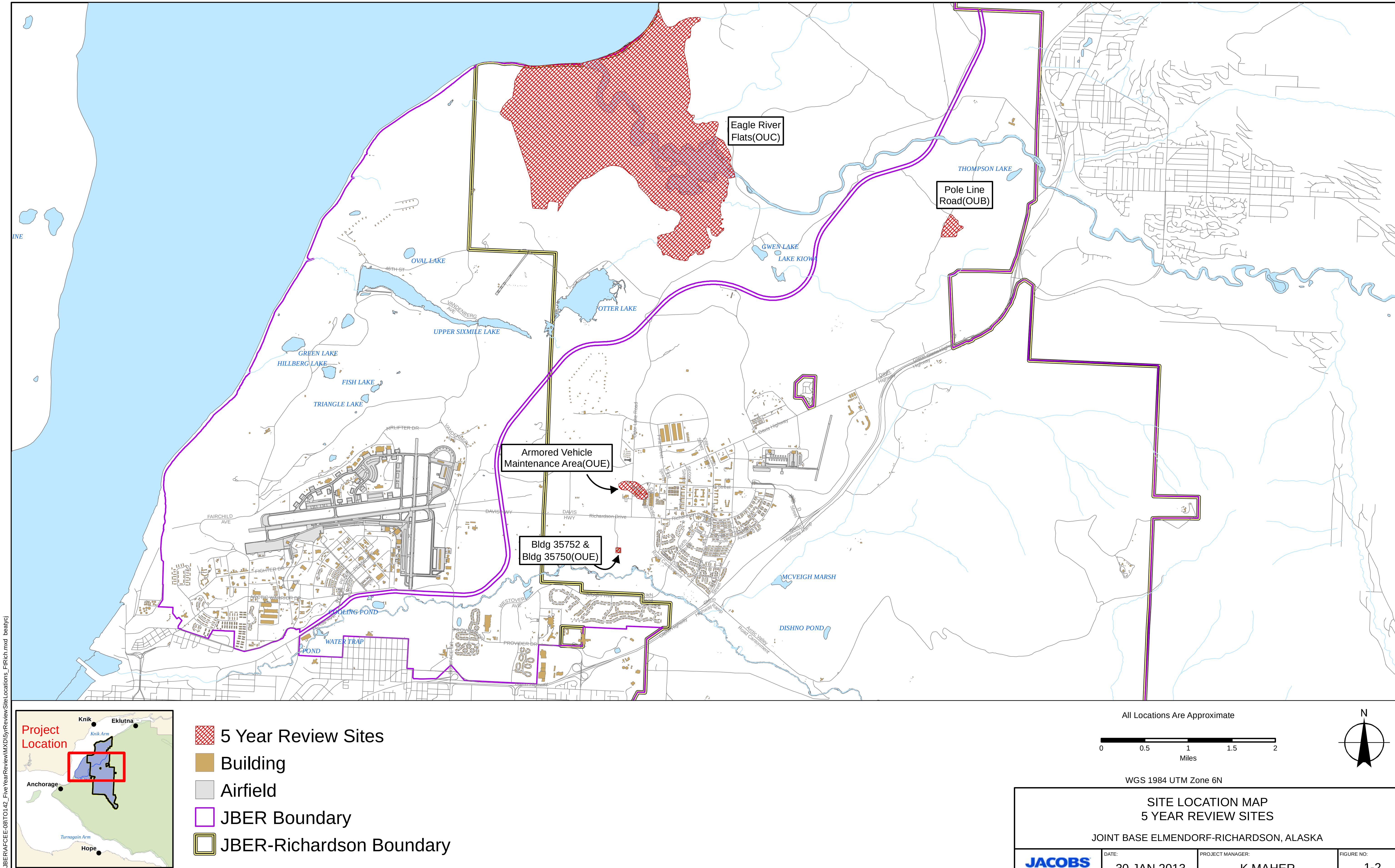
Eagle River Flats(OUC)
Pole Line Road(OUB)
Armored Vehicle Maintenance Area(OUE)
Bldg 35752 & Bldg 35750(OUE)
THOMPSON LAKE
GWEN LAKE
LAKE KIOWA
OTTER LAKE
OVAL LAKE
UPPER SIXMILE LAKE
GREEN LAKE
HILLBERG LAKE
FISH LAKE
TRIANGLE LAKE
MCVEIGH MARSH
DISHNO POND
COOLING POND
WATER TRAP
POND
DAVIS HWY
FAIRCHILD AVE
Project Location
Knik
Eklutna
Knik Arm
Anchorage
Turnagain Arm
Hope
5 Year Review Sites
Building
Airfield
JBER Boundary
JBER-Richardson Boundary
All Locations Are Approximate
0 0.5 1 1.5 2
Miles
N
WGS 1984 UTM Zone 6N
SITE LOCATION MAP
5 YEAR REVIEW SITES
JOINT BASE ELMENDORF-RICHARDSON, ALASKA
JACOBS
DATE: 30 JAN 2013
PROJECT MANAGER: K.MAHER
FIGURE NO: 1-2
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2.0 SITE CHRONOLOGY

Tables 2-1 through 2-3 present a chronology of site events for each operable unit (OU).

Table 2-1
Chronology of Site Events at OUB

Event	Date
Chemical disposal activities conducted	1950s to 1972
Poleline Road Disposal Area identified by former soldiers	1990
Site investigation activities conducted	1990 and 1992
Rapid Response Removal began	1993
Rapid Response Removal completed	1994
Geophysical investigation conducted in disposal areas A-3 and A-5 using ground-penetrating radar and EM61 to locate buried debris	1994
Fort Richardson added to National Priorities List	June 1994
Federal Facility Agreement signed	December 1994
Remedial Investigation Management Plan issued	July 1995
Additional geophysical investigations in disposal areas A-1 and A-2 using ground-penetrating radar and EM61 to locate buried objects	August 1995
Human Health Risk Assessment conducted in conjunction with an Ecological Risk Assessment	1995
Final Remedial Investigation report for OUB	September 1996
Final Risk Assessment report for OUB	September 1996
Soil vapor extraction/Air sparging treatment study conducted	1997
Final Feasibility Study report for OUB	January 1997
Proposed Plan for Remediation for Operable Unit B issued	January 1997
Final Treatability Study report for OUB	March 1997
First six-phase soil heating treatability study initiated	June 1997
Long-Term Monitoring Work Plan prepared	September 15 1997
Record of Decision for Operable Units A and B signed	September 18, 1997
Long-term groundwater monitoring/sampling initiated	November 1997 – Present
Remedial design/Remedial action management plan implemented	December 5, 1997
Selected remedy construction initiated, trigger date for Five-Year Review	February 22, 1998
Dual-phase high-vacuum extraction test conducted	March – October 1998
Begin operating six-phase soil-heating system treatability study	July 31, 1999
Discontinue operation of the six-phase soil-heating system	October 31, 1999
Preliminary hydrogeologic interpretations in 3D geologic model	November 2001
Additional geophysics in Areas A-1 and A-2 using ground-penetrating radar, EM61, and GEM 300 to locate any remaining buried objects	January 2002
4 monitoring wells installed	July 2002
Technical Memorandum details long-term groundwater monitoring results	September 2002
Decommissioned remaining components of the six-phase soil-heating system	October 2002
Collection of monthly manual water level measurements from all wells at the site begins	October 2002
Geophysical investigations conducted to determine subsurface geology using ground-penetrating radar, shallow seismic, and electrical resistivity	November 2002

Table 2-1
Chronology of Site Events at OUB (Continued)

Event	Date
Draft Interim Remedial Action Report issued	January 2003
Fort Richardson First Five-Year Review Report issued	April 2003
Installed fencing around Areas A-1 and A-2. Warning signs were placed around the enclosure.	June 2003
Chemical agent identification sets that were recovered from the site during the initial removal actions chemically treated using the U.S. Army's Rapid Response System	2003
Hydrogeologic model updated	October 2003
Water level pressure transducers installed in select wells	2004
Three monitoring wells decommissioned and replaced, and six new monitoring wells installed	2004
Soil vapor extraction system re-installed at a few wells at the site to treat residual solvent contamination in near surface soils utilizing existing wells and other existing infrastructure	2004
Groundwater tracer study started	August 2004
Wetland investigated by hand coring; temporary wells installed in wetland	October 2004
Updated 3D geologic model based on lithology	March 2005
Fort Richardson Construction Complete status achieved	September 2006
Geophysical investigation of possible additional source area south of the cleared area conducted	June 2007
One monitoring well installed	2007
Fort Richardson Second Five-Year Review Report issued	February 2008
Groundwater monitoring data collection to investigate trends	February 2009 June 2009 October 2009 November 2010 August – November 2011
Elmendorf Air Force Base and Fort Richardson merged under the Joint Base Initiative	October 2010
One Monitoring Well was installed (AP-5683) to replace AP-4019, which was subsequently decommissioned	September 2011
Five-Year Review site visit	June 2012

Table 2-2
Chronology of Site Events at OUC

Event	Date
Artillery training at Eagle River Flats using white phosphorus	1949 to 1990
Dead ducks and swans discovered during field reconnaissance	1980
Conducted studies to determine the extent of the waterfowl mortality	1982 to 1987
Conducted investigations to determine the cause of the mortality	1988 to 1990
Conducted investigations to understand and define the extent of the contamination	1991 to 1993
Fort Richardson added to the National Priority List	June 1994
Federal Facilities Agreement signed	December 1994
Identified contamination hot spots and began developing remedial technologies	1994 to 1996
Final Remedial Investigation report presenting the results of the Operable Unit C Remedial Investigation, including the primary ordnance impact area at Eagle River Flats and the adjacent gravel pad used for open burning/open detonation	May 1997
Final Feasibility Study report for Operable Unit C	September 1997
Final Proposed Plan for Operable Unit C	December 1997
Record of Decision for Operable Unit C signed	September 30, 1998
Remedial Action Work Plan and final design submitted	April 1999
First remediation season	May – September, 1999
Second remediation season	May – September, 2000
Third remediation season	May – September, 2001
Fourth remediation season	May – September, 2002
Fort Richardson first Five-Year Review Report issued	April 2003
Fifth remediation season	May – September, 2003
Sixth remediation season (limited)	May – September, 2004
Draft final Cleanup Operation and Site Exit Strategy evaluation	June 2004
Seventh remediation season (limited)	May – September, 2005
Eight remediation season (limited)	May – September, 2006
Fort Richardson Preliminary Close Out Report signed	September 2006
Fort Richardson Construction Complete status achieved	September 2006
Ninth remediation season (limited)	May – September, 2007
Fort Richardson second five-year report issued	February 2008
Tenth remediation season (limited)	May – September, 2008
Monitoring activities	May – September, 2009
Monitoring activities	May – September, 2010
Elmendorf Air Force Base and Fort Richardson merged under the Joint Base Initiative	October 2010
Monitoring activities	May – September, 2011
Five-Year Review site visit	June 2012

Table 2-3
Chronology of Site Events at OUE

Event	Date
Armored vehicle maintenance, oil, and other waste material disposal	1950-1956
Underground storage tank remediation sampling program conducted at Armored Vehicle Maintenance Area	1990
Site assessment at underground storage tank location	1993
Solvent contamination (carbon tetrachloride and PCE) first discovered in groundwater at the site	1994
Fort Richardson added to the National Priority List	June 1994
Federal Facilities Agreement signed	December 1994
Geophysical investigations conducted	2000
Historical aerial photographs taken analysis and additional geophysical investigations conducted	2001
Remedial investigations and risk assessments conducted	2000-2003
Operable Unit E management plan finalized	2002
Fort Richardson first Five-Year Review issued	April 2003
Operable Unit E Feasibility Study submitted	2004
Final Operable Unit E Proposed Plan	2004
Operable Unit E groundwater monitoring program initiated	2004
Annual groundwater monitoring	2004-2005
Operable Unit E Record of Decision signed	September 2005
Fort Richardson Preliminary Close Out Report signed	September 2006
Fort Richardson Construction Complete status achieved	September 2006
Semiannual groundwater monitoring	2006-2007
Operable Unit E Interim RA Report	August 2007
Fort Richardson second Five-Year Review issued	February 2008
Annual groundwater monitoring	2008
Semiannual groundwater monitoring	2009
Annual groundwater monitoring	2010
Elmendorf Air Force Base and Fort Richardson merged under the Joint Base Initiative	October 2010
Annual groundwater monitoring	2011
Five-year review site visit	June 2012

Note:
For definitions, see the Acronyms and Abbreviations section.

3.0 BACKGROUND

This is the third Five-Year Review for JBER-R. Five-year reviews are required by CERCLA Section 121 at all NPL sites where contamination was left in place above cleanup goals. The first section below is intended to describe the general conditions of JBER-R in its entirety; individual site histories, physical characteristics, and land uses are discussed in detail in the OU-specific sections that follow.

3.1 JBER-RICHARDSON

3.1.1 Physical Characteristics at JBER-Richardson

JBER-R encompasses approximately 61,376 acres. The Post is located in south-central Alaska, adjacent to Anchorage and the community of Eagle River. The Knik Arm of Cook Inlet borders the north side of the Post, and Chugach State Park lies to the south and southeast. The town of Eagle River lies along the northeast border; the city of Anchorage and the JBER-E areas form the western boundary.

Eagle River and Ship Creek are the main streams traversing the installation. Ship Creek is the primary water supply source for JBER-R. Three standby water supply wells supplement the surface water system with a maximum of two of the wells in use at a time during peak demand. The water source for the standby wells is a confined aquifer in the Knik outwash deposit. The estimated population served by the water system is 10,000 to 11,000. Water storage for JBER is provided by a permanent 2.5 million gallon underground reservoir in the Elmendorf Moraine, and by the Ship Creek Dam Reservoir at the base of the Chugach Mountain Range. A water treatment plant near the dam processes the drinking water. A drinking water well with a single service connection to the Otter Lake Recreational facility, about 2 miles from the cantonment area, serves a transient population.

Physiographic

JBER-R lies in an alluvial plain, the coastal lowland of Anchorage, Alaska, which is bordered on the east by the Chugach Mountains and on the north, south, and west by waters of the Cook Inlet.

JBER-R is situated in a transitional zone on the eastern edge of the coastal lowlands, and is inundated with four major drainages that originate in the Chugach Mountains. The topography of JBER-R has been highly influenced by glacial activity and the effects of stream deposition and erosion.

The Chugach Mountains rise rather abruptly to more than 5,000 feet along their front facing the coastal lowlands. Only a small western section of the Chugach Mountains is contained within the boundaries of JBER-R. The valleys of the Chugach Mountains are occupied by major and minor drainages including Ship Creek, Eagle River, Campbell Creek, and Chester Creek.

The coastal lowland is characterized by rolling hills with 50 to 250 feet of relief in eastern areas along the Chugach Mountains. Towards the west, the terrain flattens into an alluvial plain that is inundated with broad shallow channels and wetlands. This area is characteristic of glaciated terrain and contains various landforms, including moraines, esker deposits, outwash plains, and estuarine sediments.

The principal features transecting JBER-R are the Elmendorf Moraine, the Mountain View alluvial fan, ground moraines, and Eagle River Flats (ERF) tidal marsh. The Mountain View fan originates at the mouth of the Eagle River Valley. The fan slopes gently to the west-southwest and underlies most of the main cantonment area of JBER-R. The main deposits of the Elmendorf Moraine form a low-lying ridge that tends to run east to west across the region immediately north of the main cantonment area of JBER-R.

The ground moraines were formed by a number of physical processes that operate underneath glaciers. The ground moraine found on the northern part of JBER-R was probably formed at the same time as the Elmendorf Moraine. The southern ground moraine lies much deeper and was likely created by a glacial event that preceded formation of the northern ground moraine. The ground moraines tend to be extensive deposits of glacial till with hummocky surfaces and moderately gentle slopes.

ERF is a low-lying tidal marsh that was created by various estuarine processes. It is located north-northwest of the main cantonment area on JBER-R. Modern estuarine sediments are continually deposited during spring flood events and by tidal fluctuations of up to 30 feet or more. Older estuarine deposits are found extensively in ERF and were likely deposited during the Holocene Epoch (12,000 years ago). Estuarine deposits are generally composed of well-bedded and sorted silt and fine sands.

Geologic

The geology of JBER-R and adjacent lands has been extensively mapped. The thick sequences of unconsolidated Quaternary deposits that underlie JBER-R have accumulated primarily as a result of glacial and marine sedimentation. These deposits thicken westward from the base of the Chugach Mountains. Below the JBER-R cantonment, glacial sediments range from 230 to 320 feet thick according to well logs. They are up to 1,000 feet thick elsewhere in the Anchorage basin.

The underlying geology of JBER-R is complex and highly variable due to deposition that occurred during the advance and retreat of glaciers with intermittent marine incursion (marine sedimentary processes). The following paragraphs provide descriptions of the various geologic units, but are not intended to reflect exact conditions underlying any given site on JBER-R.

The Mountain View fan is commonly on the order of 40 to 60 feet thick under most of the main cantonment area. The fan consists mostly of sands and gravels with a high concentration of silt and clay. The formation is highly layered, and it is common to find lenses of clay and silt interbedded within the sand and gravel. Silt and clay lenses were likely deposited during floods and also could have resulted from deposition in small ponds and lakes.

The Elmendorf Moraine lies beneath the Mountain View fan in the area of the main cantonment. The Elmendorf Moraine is an end moraine and consists primarily of diamicton (poorly sorted mixtures of silt, sand, and gravel) along with coarse gravel, fine well-sorted sand, dense silt, and moderately to well-compacted clay. The lateral and ground moraine deposits tend to consist of diamicton of variable thickness with interbedded lenses of sand, silt, and gravel. In areas where the Mountain View fan is absent, the moraine deposits represent the upper geologic unit. Coarse outwash deposits intermingled with deposits of unsorted material can be found along the front of the moraine. Older ground moraine deposits can be found in the southern part of the cantonment area.

The Bootlegger Cove Formation, an intermediate formation often referred to as the Bootlegger Cove Clay, was formed during the advance and retreat of glacial ice, with an intermittent period of marine intrusion. The thickness of the Bootlegger Cove Formation is quite variable, but has been found to be almost 300 feet thick in parts of the Anchorage Lowland. Even though the Bootlegger Cove Formation is extensive, evidence exists to suggest that the formation does not extend much further northeast than the edge of the cantonment area. The formation is likely not found north and east of the cantonment area and is suspected to be only about 30 feet thick in the south-southwest areas of the Post.

The lower geologic sequences (Dishno Pond moraines, JBER-R moraines, and Rabbit Creek moraines) all tend to be glacial diamictons. Because of a lack of deep geologic borings and geophysical surveys, many of the descriptions of these sequences are speculative and varied. The Dishno Pond Sequence appears to underlie much of the Anchorage Lowland and the diamicton should be similar to the JBER-R diamicton, which is a few to tens of meters thick. The JBER-R diamicton is thought to be highly stratified with sand and gravel horizons. This description is based on the proposed glacial history of the Anchorage basin. The Rabbit Creek moraine lies on top of the Kenai Formation (sedimentary bedrock). There is some evidence that layers of silt and clay were deposited between these moraines during periods of marine inundation.

Hydrologic

Groundwater on JBER-R is found in both an unconfined aquifer and a confined aquifer. Water recharges the groundwater on JBER-R and the Anchorage Bowl in several ways. Along the mountains, groundwater seeps from bedrock fractures into the glacial deposits. In the foothills and lowlands, water flows from streams into the unconfined aquifer where the water table is below the stream elevation. In the lowlands, rain and snowmelt seep from the surface into the groundwater.

The hydrogeology of JBER-R is complicated due to deposits from multiple glacial advances through the region. There is an unconfined aquifer and multiple confined aquifers that connect in some places. The unconfined aquifer is generally composed of poorly sorted sandy gravel with varying amounts of silt. In general, low-permeability layers containing clay and sand underlie the unconfined aquifer. The clay is present at depths ranging from 30 to 175 feet. The low-permeability clays create a lower boundary for the unconfined aquifer and an upper boundary for the confined aquifer. The confined aquifer joins the unconfined aquifer just north of the Davis Highway, where the clay layers end. The hydraulic gradient of the unconfined aquifer generally trends northwesterly, following the topography of the Mountain View fan. The overall trend in flow direction in the confined aquifer is to the northwest, except to the north of Bryant Airfield where groundwater flow patterns are unclear.

Perched groundwater tables are common on JBER-R. They form when water from precipitation infiltrates the ground surface and forms pools on top of discontinuous layers of low-permeability silt and clay layers. These perched groundwater tables are found at a higher elevation than the main unconfined groundwater table. Contaminants that enter the ground from the surface can also pool on discontinuous low-permeability layers. Groundwater depths on JBER-R range from near the surface at Ship Creek, to 200 feet near Bryant Airfield.

Four major streams and rivers pass through sections of JBER-R. In addition, numerous other small streams, lakes, and wetland areas are found on JBER-R. JBER-R has twelve named lakes and ponds and myriad other unnamed surface water bodies. The named lakes and ponds comprise 359 acres. Five relatively large lakes, Clunie, Otter, Gwen, Thompson, and Waldon, are managed for recreational fishing.

Eagle River is a glacial waterway that originates at the base of the Eagle Glacier in the Chugach Mountains. Eagle River meanders across JBER-R, where it flows over an alluvial base of glacial outwash and into ERF, a 2,200-acre estuarine tidal marsh.

Ship Creek, a non-glacial stream, originates at Ship Lake in the Chugach Mountains and flows 25 miles to the Knik Arm. A water supply dam located at the base of the Chugach Mountains on

JBER-R, approximately ten miles from the mouth of the river diverts water from the stream. The watershed encompasses 90.5 square miles above the diversion dam.

Chester Creek and Campbell Creek, both non-glacial streams, are located south of Ship Creek and flow through the southwestern portion of JBER-R. The creeks flow into marsh wetlands at the base of the Chugach Mountains on Fort Richardson but re-channels near the western boundary of the Post.

3.1.2 Land and Resource Use at JBER-Richardson

The majority of the land currently used by U.S. Army Alaska (USARAK) is on long-term withdrawal from the public domain and was originally assigned to the Bureau of Land Management (BLM). Residual responsibility for USARAK withdrawn lands remains with the BLM, which retains interest in the stewardship of the transferred parcel even though the land is under the U.S. Department of Defense’s long-term management.

Elmendorf Field was established just outside of Anchorage in 1939 as a result of increasing world tensions. One year later, the name Fort Richardson was adopted by the U.S. War Department in memory of Brigadier General Wilde P. Richardson.

Japanese aggression in the Aleutian Islands emphasized the strategic importance of Alaska. Fort Richardson’s first mission was the defense of southern Alaska by establishing a permanent air base, supply depot, and garrison. When the Japanese attacked Pearl Harbor in 1941 (World War II), Fort Richardson was charged with defending Alaska from invasion and coordinating the Alaskan war effort. Before the outbreak of World War II, military strength in Alaska was less than 3,000; it soon grew to 7,800 troops stationed at the Fort Richardson Army Post alone, including the 4th Infantry, 85th Field Artillery, and 75th Coast Artillery (Anti-Aircraft). As the war progressed, Fort Richardson’s mission expanded significantly as the logistics base for numerous U.S. Army garrisons and the U.S. Army Air Corps. Troops were re-designated as the USARAK on 15 November 1947, and assigned to the Alaskan Command, the nation’s unified command staffed jointly by the U.S. Army, U.S. Navy, and USAF officers. USARAK headquarters were established at Fort Richardson. At that time the Post was located on what later became Elmendorf Air Force Base. After the establishment of USAF as a separate service in 1947, the U.S. Army Post was rebuilt on its present location in 1950.

In December 1974, as part of worldwide realignments, USARAK was deactivated and the Post became headquarters for the 172nd Infantry Brigade (Separate) in January 1975. As in previous years, subordinate posts were maintained at Fort Wainwright, Alaska near Fairbanks and Fort Greely near Delta Junction.

In a subsequent realignment in March 1986, the newly reactivated 6th Infantry Division (Light) replaced the 172nd Infantry Brigade (Separate). This marked a new mission for the U.S. Army in Alaska as a light, deployable force capable of defending U.S. interests across the globe. The division then aligned more closely with U.S. Department of Defense forces in the Pacific when, in 1989, it began reporting to the U.S. Army Western Command in Hawaii (later re-designated U.S. Army Pacific).

Headquarters were established on Fort Richardson, Alaska and remained there until 1990. In 1990, headquarters for the 6th Infantry Division (Light) was moved to Fort Wainwright, Alaska. In 1993, as part of a U.S. Army-wide downsizing, the 6th Infantry Division (Light) was reorganized as a light infantry brigade. The 6th Infantry Division (Light) was inactivated July 1994 and Fort Richardson became headquarters for USARAK when it was restructured. In 1998, the 1st Brigade, 6th Infantry Division (Light) was deactivated, and the 172nd Infantry Brigade (Separate) was reactivated.

Land use at JBER-R is varied. More than 75 percent of the total land area in JBER-R is dedicated to ranges, combat courses, drop zones, airfields, troop loading yards, training facilities, open storage areas, and ammunition storage areas. Other industrial-type activities that take place at JBER-R occur mostly in the cantonment area and include the following: vehicle maintenance, general equipment and building maintenance, pest control and grounds-keeping, photographic processing, printing, dry-cleaning, drinking water treatment, and dental and medical services. A portion of the base has been developed for troop training and support operations, including housing and recreational facilities. The remaining acreage is basically undeveloped and includes wetlands, lakes, and ponds. JBER-R also provides the services, facilities, and infrastructure necessary to support the rapid deployment of U.S. Army forces from Alaska to the Pacific Theater. Force transformation for USARAK has resulted in construction of new infrastructure including barracks, motor pools, and housing. Recreational uses are permitted where consistent with the military mission.

On 1 October 2010, Elmendorf Air Force Base, located just north of Anchorage, and Fort Richardson, located northeast of Anchorage, merged under the joint basing initiative to form JBER. While military missions of USAF and U.S. Army units will remain separate, JBER consolidates service-specific programs that perform installation support functions, including environmental remediation services. Future land use at JBER is not expected to differ from current land use.

3.1.3 History of Contamination at JBER-Richardson

Since World War II, JBER-R has supported combat unit training and operations (primarily light infantry) that have resulted in various hazardous substances being released into the soil, sediment, and groundwater. Used oils, solvents, and fuel spills were reportedly discharged to the floor drains that went directly to the sanitary sewer or to dry wells, which discharged to subsurface soils. Spent solvents and contaminated fuels were routinely mixed with waste oils in the past. Waste oils, solvents, and contaminated fuels have been used for fire training practice at the fire bum pits. Waste oil USTs were installed at many of the maintenance facilities in the 1940s. U.S. Army practices no longer allow uncontrolled or unpermitted releases of pollutants into the environment.

3.1.4 Initial Response at JBER-Richardson

The former Fort Richardson Army Post (now known as JBER-R) was proposed for placement on the CERCLA NPL on 18 June 1993 and listed on 1 June 1994. As a result, remediation activities at JBER-R are being performed to comply with CERCLA, as amended by SARA of 1986 and subsequent amendments.

All sites that contain concentrations of fuel-related contamination above cleanup levels are excluded from cleanup under the CERCLA process due to the petroleum-exclusion rule. On 5

December 1994, the U.S. Army, EPA, and ADEC signed an FFA that outlines the procedures and schedules required for a thorough investigation of suspected historical hazardous-substance sources at the former Fort Richardson. Potential source areas were grouped into OUs based on the amount of existing information and the similarity of potential hazardous-substance contamination. Attachment I to the FFA describes the investigation and restoration approach agreed upon by the U.S. Army and the regulatory agency parties to the Agreement. The FFA identified a number of source areas based on historical uses and past investigations and initially listed 102 potential source areas at JBER-R. Of these source areas, 70 were designated for NFA or response complete. An additional nine source areas were identified for NFA under CERCLA following the FFA, and 19 of the remaining 23 potentially contaminated source areas were initially grouped into four OUs (A through D, and E was added in 2000 as detailed in Section 1.3.1). The other four source areas had known or suspected petroleum (non-UST) contamination and were transferred for investigation in accordance with a Two-Party Agreement between the US Army and ADEC (see Section 1.3.2). A table listing all of the sites identified in the FFA and their current disposition is provided in Appendix F.

Source areas were evaluated through a screening process called a Preliminary Source Evaluation (PSE). The PSE included record searches, interviews, and limited field investigations, if warranted. During the investigations, analytical data was generated for many chemicals. The target analyte list for each source area was determined based on site history and previous investigations. PSEs were followed by RI and feasibility studies (FS) for the selection of remedies, proposed plans, RODs, remedial designs, RAs, operations and maintenance (O&M) associated with RAs, and long-term monitoring. The history of contamination and remediation of source areas are summarized in the OU-specific sections of this report. Documents that record all investigation and cleanup decisions are found in the Administrative Record located at the Alaska Resource Library and Information Service.

Under OUD, a Post-wide human health and ecological risk assessment was performed for all of JBER-R to supplement the individual risk assessments conducted for each source area. The objectives of the Post-wide risk assessment were to evaluate potential risks to wide-ranging receptors that may be exposed to multiple source areas and to fill data gaps that became evident upon thorough review of all data collected during the RIs for each OU.

Pursuant to the 1991 Federal Facilities Compliance Agreement (FFCA), the U.S. Army conducted sampling activities at solid waste management units addressed in the FFCA to establish whether hazardous wastes were managed at these units, and in some instances, prepared closure plans. These closure plans, developed under RCRA program guidelines, were used as an integral part of the CERCLA cleanup actions.

The U.S. Army has established standard operating procedures (SOP) and a geographical information system (GIS)-based tracking system to ensure that restrictions on land use are enforced. This system of for tracking institutional controls, now referred to as land-use controls (LUC), has been incorporated into the Post-Wide Master Plan, and compliance with LUCs is reported in the Annual Monitoring Reports for each OU. The LUC Policy applies to all USARAK units and activities, military and civilian support activities, tenants' organizations and agencies and government and civilian contractors. The initial *Institutional Control Memorandum* was signed by Major General Cash in February 1999. The LUC Policy required a Work Authorization Permit for disturbance of any groundwater and soils on USARAK lands. The memorandum was updated in February 2002 and signed by the Commanding General. The major revision was the addition of a section on areas with LUCs mandated by a ROD; a section on areas where contamination is not suspected was also added. Currently, all contracts that include intrusive activities require a Work Authorization Permit. The permit was recently updated to clearly alert the user on procedures to follow when potential contamination is encountered. Following the base merger, as described above, a JBER Land-Use Control Management Instruction (673d Air Wing Base Instruction, 32-7003, 19 May 2011) was created, which prescribes:

> *The processes and responsibilities for the management of and compliance with land-use controls on Joint Base Elmendorf-Richardson (JBER) and applies to all military and civilian organizations that occupy facilities, or conduct business, on the installation.*

A copy of the JBER-R instruction is provided in Appendix G of this document.

3.1.5 Basis for Taking Action at JBER-Richardson

The primary environmental contaminants at JBER-R are white phosphorus, volatile organic compounds (VOC), usually solvents and cleaners, polychlorinated biphenyls (PCB), fuel products, and polycyclic aromatic hydrocarbons (PAH), which are commonly used in wood preservatives and also given off in automobile or truck exhaust, or during burning activities.

During historical operations conducted at JBER-R (as described above in Section 3.1.2), sources have been released that have resulted in the contamination of soil, sediment, and groundwater at a variety of locations across the installation. The initial risk assessments performed at the individual sites determined the human and/or ecological risks exceeded the EPA average or reasonable maximum exposure risk management criteria. Site chemicals of concern (COC) are presented in Table 3-1, below. OU-specific COCs are described in detail in the sections that follow.

Table 3-1
Contaminants of Concern

Contaminant	JBER-Richardson Operable Unit (OU)		
	OUB	OUC	OUE
Groundwater			
Benzene	X		
Carbon tetrachloride	X		
cis-1,2 dichloroethene	X		
trans-1,2 dichloroethene	X		
PCE	X		X
TCE	X		X
1,1,2,2-PCA	X		
Soil			
PCE	X		
1,1,2,2-PCA	X		
Sediment			
White phosphorus		X	

Notes:
X indicates the presence of contamination.
OUA and OUD are not part of this 5-year review; they are governed under the Two-Party Agreement (see Section 1.3.2).
For definitions, see the Acronyms and Abbreviations section.

3.2 OUB POLELINE ROAD DISPOSAL AREA

The source area for OUs A and B were the first sites to undergo RI at JBER-R and to reach a final-action ROD. The RODs for the two OUs were contained in a single document, which was signed on 18 September 1997. The ROD for OUs A and B initially addressed four source areas. The three sites located within OUA were granted NFA status in the ROD. OUB consists of a single source area, the Poleline Road Disposal Area (PRDA).

Two former soldiers stationed at JBER-R in the 1950s assisted in the identification of the PRDA site (OUB) during interviews conducted in 1990. Based on the available information, it was determined that four chemical disposal areas were utilized from 1950 to 1972. During that time, chemical agent identification sets (CAIS) and other military debris were burned and disposed of in trenches at the site. The chemical agents were neutralized with a mixture of bleach or lime and chlorinated solvents before burial. Based on maps, aerial photography, and geophysical surveys, the PRDA was divided into four disposal areas: Areas A-1, A-2, A-3, and A-4 (Figure 3-1).

During the RI, it was determined that chlorinated solvents in soil and groundwater were the principal contaminants at OUB. In accordance with the ROD, the selected remedy was accomplished through a dual-phased, high-vacuum extraction (HVE) treatability study (conducted from March through October 1998) and six-phase soil-heating (SPSH) treatability studies (conducted in 1997 and 1999). The SPSH treatability studies incorporated soil heating and HVE to facilitate the removal of contaminants from soil and groundwater. The SPSH treatability study was discontinued in 1999 and decommissioned in 2002. Results of the SPSH treatability studies indicated that about 95 percent of the contaminants in soil had been removed during system operations, thus effectively reducing the source of groundwater contamination at the site. Analytical results from the chemical analysis of soil samples collected upon the completion of the SPSH treatability studies indicated that remedial action objectives (RAO) had been achieved for soil.

A groundwater monitoring plan was developed in 1997 to assist in the determination of the effectiveness of the HVE treatment system and to evaluate for groundwater contaminant concentration trends. With the exception of 2008, groundwater samples have been collected at least yearly since 1997, and while there have been increases of contaminant concentrations in individual wells, overall trends indicate that the contaminant plume does not appear to be expanding. Groundwater sampling was not conducted in 2008 due to funding/contracting delays. In 2004 a cleanup operations and site exit strategy (CLOSES) evaluation was completed (CH2M HILL 2004). The CLOSES evaluation concluded that while soil and groundwater RAOs had not yet been achieved at OUB, the LUCs in place at the PRDA site provided adequate protection of human health and the environment; however, the LUCs were determined to be insufficient, by themselves, to meet the RAOs as stated in the ROD.

Dates related to the history of the PRDA contamination and remediation activities are summarized in Table 2-1.

3.2.1 Physical Characteristics at OUB

The PRDA is located on JBER-R, approximately 1.1 miles southwest of the Eagle River, at the intersection of Poleline Road and Barrs Boulevard. Figure 1-2 shows the PRDA in relation to the JBER-R main cantonment area. Poleline Road, a gravel road that travels northeast-southwest along a powerline route and the Eklutna Water Line, provides access to PRDA. PRDA is a low-lying, flat area bordered by an 80-foot hill to the west, wetlands to the south and southwest, and low, wooded hills on the remaining borders. Areas A-1 through A-4 represent the main disposal area, which comprises approximately 1.5 acres (Figure 3-1). Vegetation was cleared from the main disposal area in 1994, which is now mostly populated by sapling birches, poplars, and alders.

Four water-bearing intervals have been identified at the PRDA:

- A perched zone – The top of the perched interval was encountered at 4 feet to 10 feet below ground surface (bgs) and is approximately 5 feet thick.
- A shallow groundwater zone – The shallow saturated zone is 10 feet thick on average. The top was encountered at 20 feet to 25 feet bgs. Groundwater in the shallow zone flows in a northeasterly direction.
- An intermediate groundwater zone – The intermediate zone was encountered at approximately 65 feet to 95 feet bgs. Groundwater flow in this zone is not well defined.

- A deep aquifer – The deep aquifer is an advance moraine/till complex with a thickness between 3 feet and 40 feet and was encountered at 80 feet to 125 feet bgs. Groundwater elevations indicate that the flow direction in the deep aquifer is locally to the northeast and regionally to the northwest.

Zones of very dense, low-porosity, compact tills separate the saturated intervals, but the detection of contaminants in all four intervals suggests that they are interconnected to some degree. According to the latest groundwater monitoring report (USAF 2012a), the groundwater hydraulics at the site appears to be driven primarily by recharge from the wetlands area and secondarily from surface infiltration across the site. Figure 3-2 shows a conceptual cross-sectional model of the geology and hydrology at the PRDA site.

3.2.2 Land and Resource Use at OUB

The OUB site (approximately 300 acres) is off-limits to all except authorized personnel. Access to the site is controlled by locked gates. Signs posted along the perimeter of PRDA clearly indicate that the site is a contaminated and controlled area. The land surrounding OUB is currently used for U.S. Army training activities and limited recreational purposes. Access to OUB and the surrounding area must be coordinated with Range Control; visitors must notify Range Control before entering and upon departure from the site.

At present, there are no plans for development of OUB (U.S. Army Corps of Engineers [USACE] 2001). The Eklutna Water Line, which supplies drinking water to Anchorage and parts of Eagle River, runs directly west of the PRDA. The deep aquifer may provide sufficient yield for installation of drinking water wells; however, future development of the deep aquifer for this purpose is unlikely.

3.2.3 History of Contamination at OUB

The PRDA was identified in 1990 through interviews conducted by the U.S. Army with two former soldiers who were stationed at JBER-R in the 1950s. The interviewed soldiers recalled the disposal of chemicals, smoke bombs, and Japanese cluster bombs in the PRDA. The disposal location was subsequently corroborated by a 1954 USACE map showing a “Chemical Disposal Area” at Poleline Road and by a 1957 aerial photograph showing trenches in the area. Two separate burial areas identified at the PRDA, Areas A-1 and A-2, were suspected to contain buried munitions, and Areas A-3 and A-4 were suspected to contain chemical warfare decontamination kits and CAIS. The disposal areas were active from approximately 1950 to 1972. The standard practice at PRDA to dispose of chemical agents and munitions materials consisted of a series of four steps:

1. A layer of bleach/lime was laid down in the bottom of the trench
2. The materials contaminated with chemical agent were placed on a pallet in the trench
3. Diesel fuel was poured on the agent and then ignited with thermal grenades
4. After burning was completed, a mixture of either bleach or lime, combined with chlorinated solvent carrier was poured over the materials to neutralize the chemical agent

No known documentation exists detailing what types of chemicals were buried. However, a removal action at Areas A-3 and A-4 uncovered CAIS and other general debris. Few COCs were observed in subsurface soil samples collected near burial trenches A-1 and A-2. For this reason, and because of the dangers associated with potential unexploded ordnance (UXO), Areas A-1 and A-2 were not excavated.

3.2.4 Initial Response at OUB

Pre-RI activities began in 1993 and included removal action in Areas A-3 and A-4. The removal action was subsequently halted when CAIS and other chemical agent-related materials were discovered during excavation activities. A geophysical survey performed in early 1994 indicated that anomalies were present in the trenches that were consistent with buried metallic debris. Of the four disposal areas, A-3 and A-4 displayed the greatest evidence of buried debris, including possible stacked canisters and/or cylinders. The removal action resumed in 1994, at which time approximately 3,600 cubic yards of soils contaminated with chlorinated hydrocarbons (1,1,2,2-tetrachloroethane [1,1,2,2-PCA], trichloroethylene [TCE], and tetrachloroethylene [PCE]) and diesel fuel were excavated and stockpiled onsite. The contaminated soils were subsequently thermally treated onsite via a thermal desorption system. The treated soil remains in place at the former treatment location.

Another geophysical survey was performed in June 1995 to determine whether any anomalous material remained in the recently excavated areas and to thoroughly investigate areas not excavated during the 1994 remedial action. Results of the survey confirmed that buried material previously encountered in Areas A-3 and A-4 had been removed, thereby removing a primary source of subsurface contaminants.

During the fall of 1996, a treatability study was conducted at the site to evaluate the effectiveness of potential remedial technologies addressed in the FS. The treatability study involved field tests to evaluate the potential performance of soil vapor extraction (SVE) and air sparging (AS) of groundwater. The study also involved characterization of hydraulic conductivity of water-bearing zones underlying the site and the collection of groundwater samples to assess which types of natural attenuation processes may be degrading contaminants in the local aquifer.

In June 1997, prior to the signing of the ROD, a design verification study was initiated to evaluate the applicability of six-phase heating as an in situ technology for remediating solvent-contaminated soils. The remedial system design involved incorporation of both SVE and soil heating. The soil was heated using SPSH elements and vapors generated through the soil-heating process were extracted using an HVE system. Results of this treatability study are discussed in Section 4.1.2.

3.2.5 Basis for Taking Action at OUB

Several investigations and a removal action have been conducted at PRDA since its discovery in 1990. The information obtained during these investigations was used to focus the RI. Site investigations were conducted between 1990 and 1992 and included a geophysical survey, a water level study, aquifer tests, and soil, soil gas, and groundwater sampling. The results of the site investigations indicated the presence of VOCs in the subsurface. Based on the RI, chlorinated solvent contamination in the soils and groundwater were the principal contaminants at PRDA, and that the highest concentrations of contaminants were identified in Areas A-3 and A-4. No measurable levels of chemical agent have been detected in the groundwater at the site.

The specific reasons for conducting RAs at PRDA are provided below, with the main focus being protection of groundwater in accordance with the NCP Groundwater Protection Strategy:

- VOCs, including PCE, TCE, and 1,1,2,2-PCA, in contaminated soils were a continuing source of groundwater contamination; and
- VOCs (i.e., PCE, TCE, and 1,1,2,2-PCA) in groundwater at the PRDA were present at concentrations above state and federal maximum contaminant levels (MCL) and risk-based criteria.

A Human Health Risk Assessment was performed at the site in 1995. The risk assessment was based on groundwater fate and transport modeling and showed it would take 120 years for concentrations of TCE exceeding the drinking water MCL (0.005 milligrams per liter [mg/L]) to reach the Eagle River and 170 years for concentrations of 1,1,2,2-PCA exceeding 0.005 mg/L to reach the Eagle River.

Soil (OUB)

Contaminated soils associated with past disposal practices at the PRDA appear to have been the source of contamination detected in the groundwater. Soil data collected from the excavation during the removal action and from soil borings drilled during the RI indicated that a layer of soil with high concentrations of 1,1,2,2-PCA (greater than 2,000 milligrams per kilogram [mg/kg]) existed at approximately 15 to 25 feet bgs.

Areas A-1 and A-2 were not excavated because of the potential presence of UXO. The concentration of COCs detected in soils near Areas A-1 and A-2 were less than RAOs. Solvents released in Areas A-3 and A-4 are the suspected source of contamination in the vicinity of Areas A-1 and A-2; therefore, Areas A-1 and A-2 were not considered to be source areas.

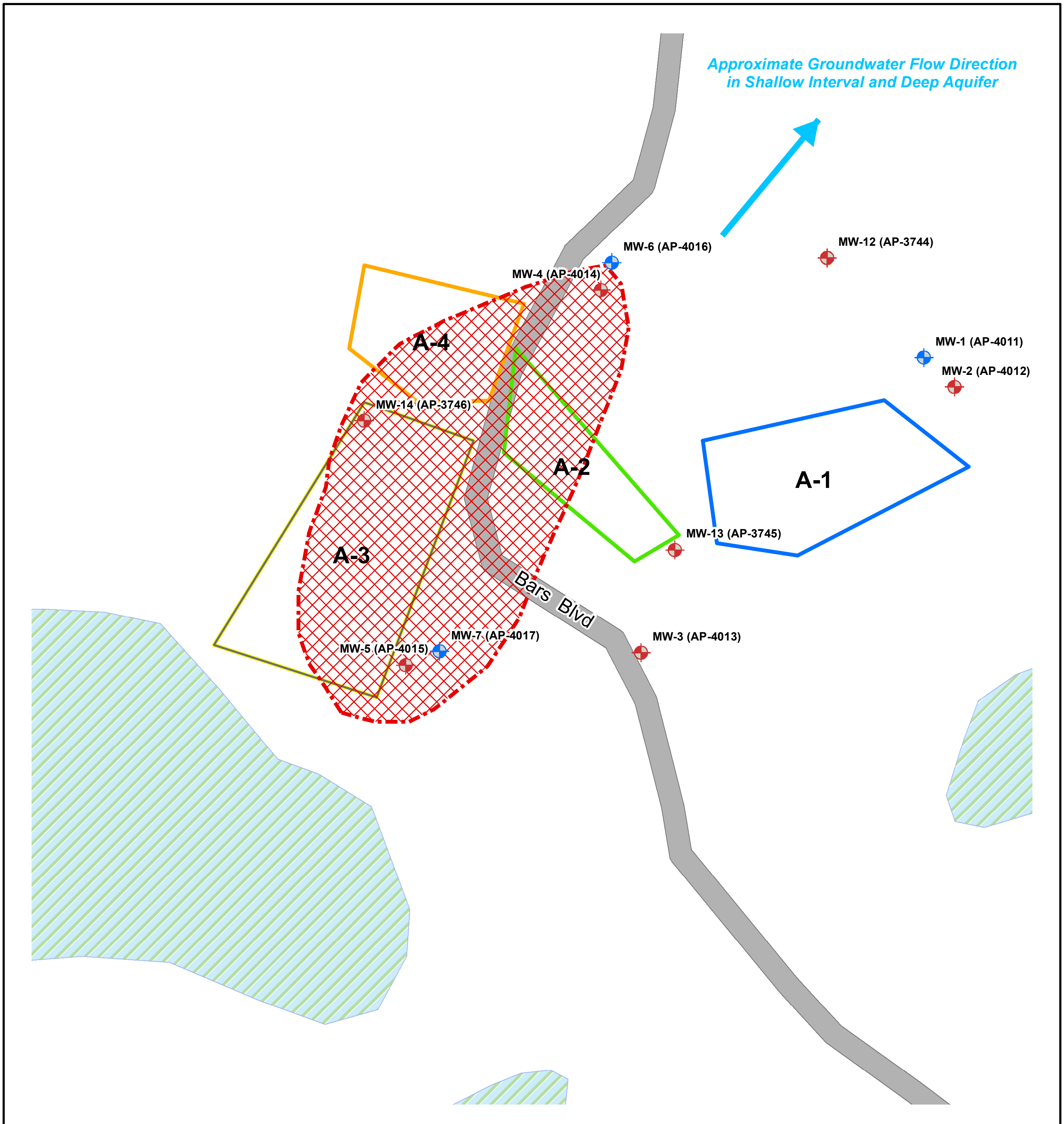
Groundwater (OUB)

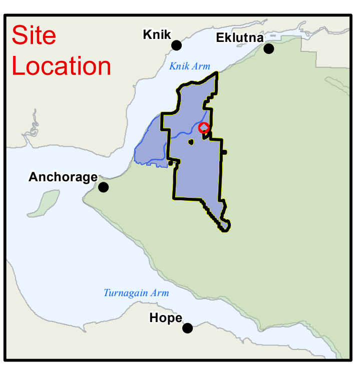
Groundwater sampling conducted prior to the 1993 and 1994 removal action indicated a localized area of groundwater was contaminated with chlorinated solvents. There was no evidence of the contamination migrating; however, the concentrations of solvents were sufficient to indicate the presence of a substantial source area.

During the RI, 1,1,2,2-PCA and TCE were discovered in groundwater at concentrations significantly higher, and over a greater extent, than any other contaminant constituent detected at the site. Contaminants were detected in each of the four saturated intervals. Samples collected from a well installed near Area A-3 and screened in the perched interval exhibited the highest concentrations of 1,1,2,2-PCA and TCE. Contaminants were also detected in samples collected from wells screened in the deep aquifer. Contamination in the deep aquifer indicates that there is interconnection between the saturated intervals that allow contaminants to migrate vertically.

A review of information on the PRDA indicated that Areas A-1 and A-2 may potentially contain buried ordnance. Investigations conducted around Areas A-1 and A-2 detected only low concentrations of solvents; no chemical agent or breakdown products were detected in the soil or groundwater. Available data suggests that chlorinated solvents were not disposed of in Areas A-1 and A-2, and that any solvents detected most likely migrated from the adjacent Areas A-3 and A-4. Thus, Areas A-1 and A-2 were not considered to be source areas for groundwater contamination.

The area of greatest contamination identified at the site during the RI was referred to as the "hot spot," the subsurface area containing greater than 1.0 mg/L of 1,1,2,2-PCA in groundwater and/or free-phase solvents. It encompasses an area approximately 150 feet by 300 feet and is bounded by a 1 mg/L or greater concentration of 1,1,2,2-PCA. The hot spot, as estimated in 1999, is shown on Figure 3-1.





Disposal Areas

- Area A-1
- Area A-2
- Area A-3
- Area A-4
- Estimated Hotspot Boundary

Monitoring Well Completion Type

- Deep Aquifer
- Perched or Shallow Interval
- Wetland

All Locations Are Approximate

0 50 100 150 200
Feet

WGS 1984 UTM Zone 6N

N

OUB DISPOSAL AND HOT SPOT AREAS IDENTIFIED AT POLELINE SITE FROM THE ROD

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 09 JAN 2013	PROJECT MANAGER: K. MAHER	FIGURE NO: 3-1

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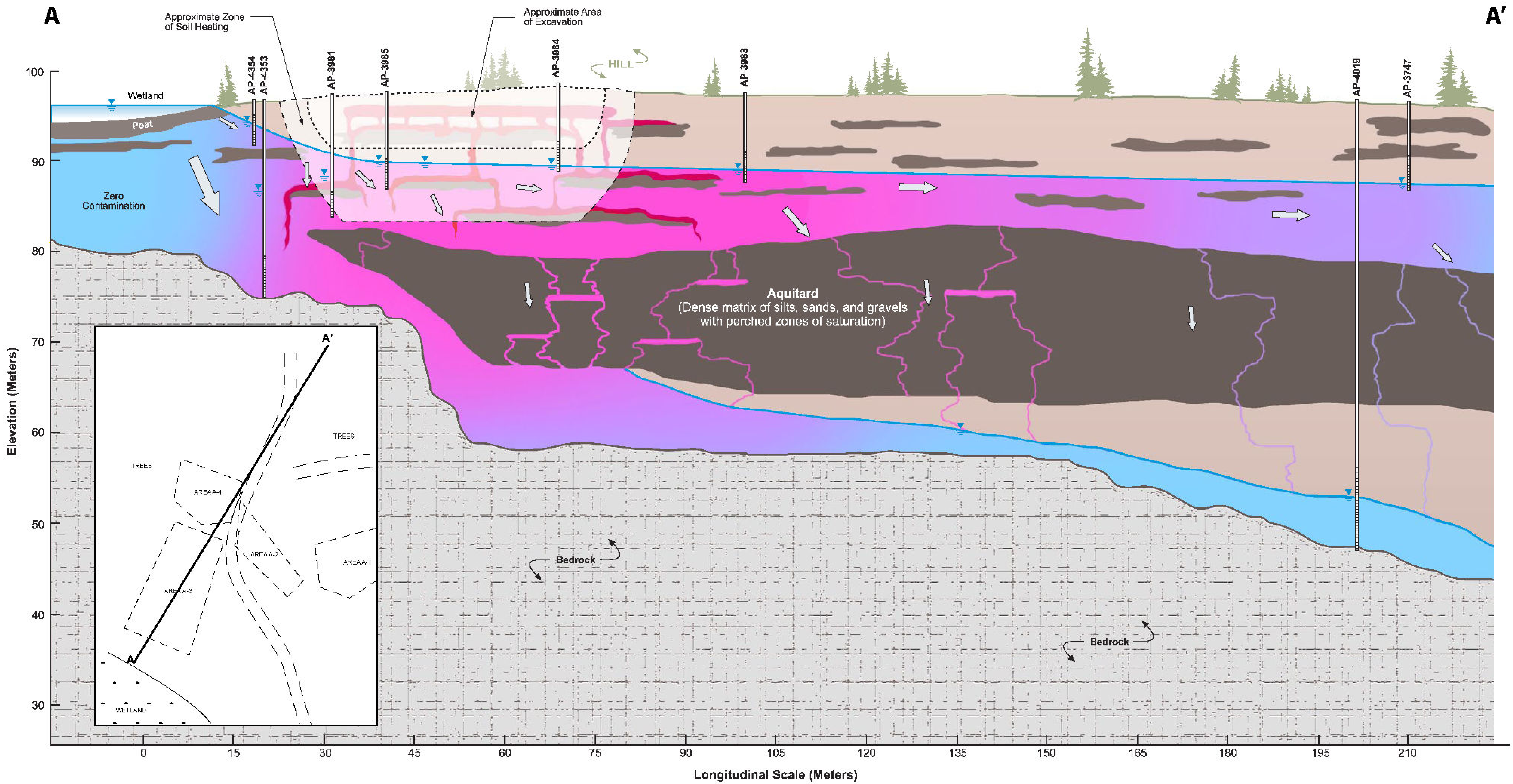

Legend

- Interpreted Groundwater Flow Direction
- Low Permeability Lens
- Hydraulic Grade Line

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

Figure Prepared by CH2MHill Consultants.
Used with permission of US Army Corps of Engineers.

0 500 1,000
Feet

N

OUB CROSS SECTIONAL CONCEPTUAL GROUNDWATER MODEL

<<LOCATION OF PROJECT, STATE>>

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	01 OCT 2012	K. MAHER	3-2

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3.3 OUC EAGLE RIVER FLATS

OUC was the third OU to reach the final-action ROD; it was signed 30 September 1998. OUC has two source areas, ERF and the open burning/open detonation (OB/OD) pad. The ROD for OUC addresses sediment contamination at the ERF source area. NFA under CERCLA was selected for the OB/OD pad. It will be closed under RCRA concurrently with final clearance of the operating range.

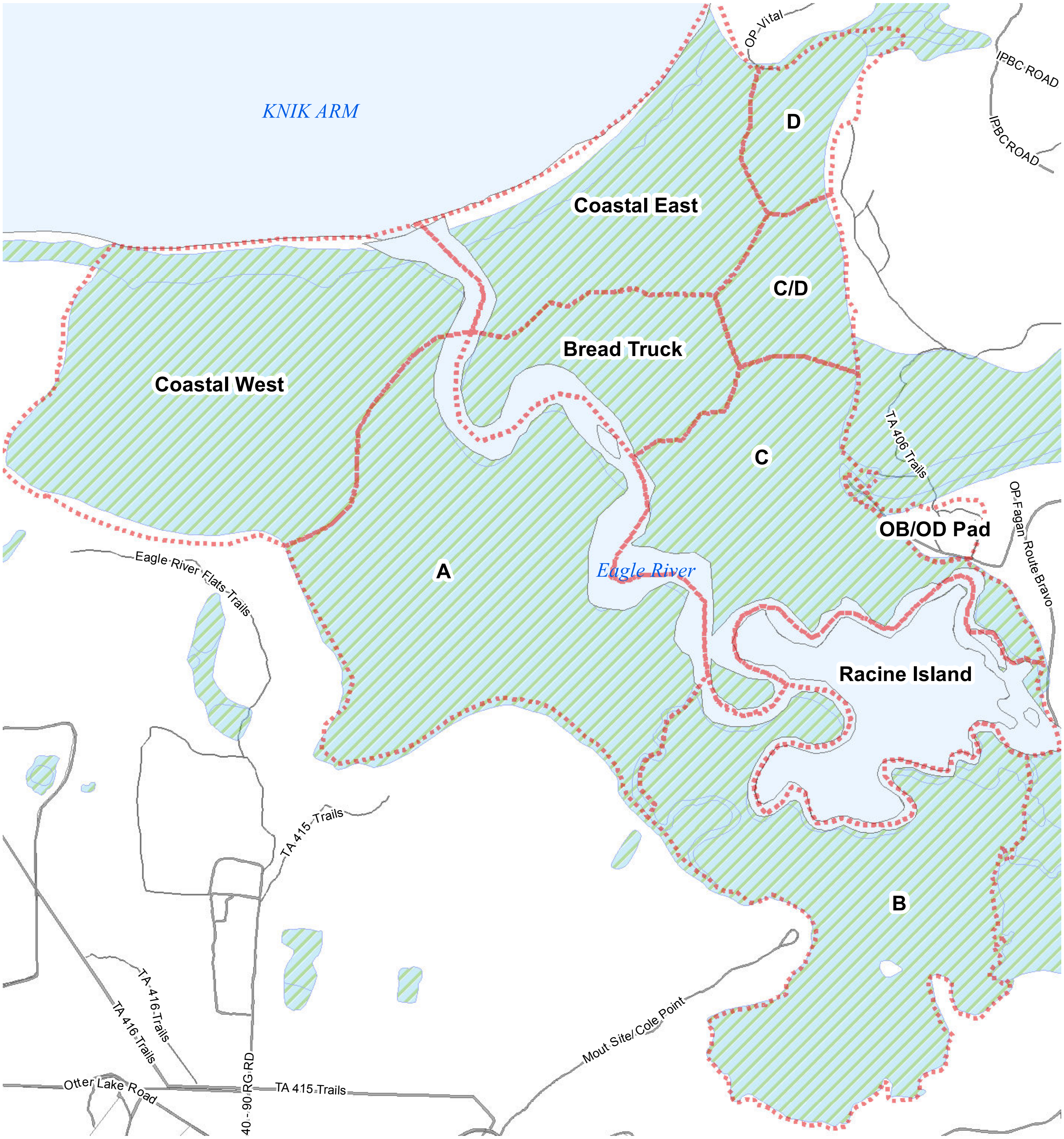
ERF is a 2,160-acre salt marsh on JBER-R where Eagle River meets tidal waters in Knik Arm. Figure 3-3 shows the locations and approximate boundaries for the ERF areas. ERF has been used for artillery training since 1949. In the early 1980s, the U.S. Army noticed an unusually high number of waterfowl deaths at the site. In response, the U.S. Army initiated a comprehensive sampling program to determine if munitions or munitions constituents were the cause of the increase in the mortalities. During the RIs conducted in 1990, 172 sediment samples were analyzed for 14 COCs (munitions constituents). In 1991, it was determined that white phosphorus was the cause of the increase in the waterfowl mortalities. Areas used more frequently as targets received higher amounts of white phosphorus. Therefore, white phosphorus particles are not distributed uniformly throughout sediments at ERF.

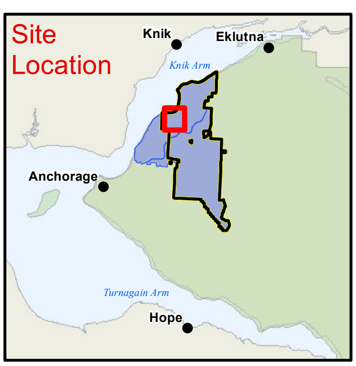
As a result of the discoveries, the U.S. Army stopped using white phosphorus during training at wetland impact areas nationwide. ERF was divided into nine areas for RI/FS activities and other investigation purposes: A, B, C, C/D, D, Racine Island, Bread Truck, Coastal East, and Coastal West. To define areas most likely to contain white phosphorus, investigations focused on (1) areas with the most craters, (2) areas preferred by the waterfowl at risk (dabblers), and (3) areas where carcasses were observed. The sediments in the open ponds in these areas were extensively sampled for white phosphorus. From 1994 through 1997, the ERF investigations focused on finding a feasible remedy for white phosphorus contamination in sediments. Priority cleanup areas were evaluated by using data from white phosphorus sampling, waterfowl telemetry, carcass transects, physical system dynamics, and mapping of landcovers (combinations of topographical features such as ponds and vegetation). Based on the results of these studies, pond draining via pumping was chosen as the preferred alternative for remediating the contaminated areas of ERF. The RI for ERF was completed in July 1996.

The original objective of the selected remedy was to temporarily drain ponds to allow the pond sediments to dry, which would allow the white phosphorus to sublimate and oxidize. Remediation occurred beginning in 1999 through 2008; only monitoring is ongoing. Dates relating to the history of the ERF source area contamination and remediation are summarized in Table 2-2. Detailed information concerning specific pre-ROD investigations and reports can be found in the Administrative Record and the OUC ROD.

3.3.1 Physical Characteristics at OUC

ERF is an estuary salt marsh at the mouth of the Eagle River that is surrounded by forested uplands on the west, south, and east sides, and bounded by the Knik Arm on the north. Although ERF is an active impact area, it remains a productive wetland and serves as an important staging ground for migrating waterfowl during the spring and fall. ERF also supports local populations of fish, birds, mammals, and macro invertebrates. A series of ponds distributed throughout ERF provides excellent habitat for dabbling ducks and other waterfowl. The topography of ERF is relatively flat, with landform and vegetation changes. Measured elevations in ERF range from 3 feet above mean sea level at the river bottom of the Eagle River to 18 feet above mean sea level on top of the highest levees along the river. The discharge from Eagle River bisects ERF. Distributaries cut through the mudflats and connect ponds with Eagle River. Subtle changes in elevation of the channel floors dictate whether tidal flooding occurs daily, occasionally, or rarely. In summer, there may be long periods between flooding tides, and parts of ERF can become relatively dry. During winter, the Eagle River continues to flow, but ice thickens over ERF with succeeding flood events during cold temperatures. Ice breakup typically occurs in April or early May. It appears that the river dominates the hydrology and sedimentology of the upper third of ERF; the remainder of the area is dominated by the tides.





Eagle River Flats Area

OUC Site

Wetland

All Locations Are Approximate

0 0.25 0.5 0.75 1

Miles

WGS 1984 UTM Zone 6N

N

OUC EAGLE RIVER FLATS
SITE LOCATION MAP

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 01 OCT 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 3-3

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3.3.2 Land and Resource Use at OUC

ERF is the only impact area for heavy artillery and mortars on JBER-R. It is situated on land that is withdrawn from the public domain for military purposes by Executive Order. Land is currently used for military readiness activities and ERF is considered an operational range. In 1990, the U.S. Army banned the firing of munitions containing white phosphorus into ERF. Several additional restrictions currently apply and are listed in the Record of Environmental Consideration, Modified Firing Regime for the ERF Impact Area, Fort Richardson, Alaska, 9 October 2001. The U.S. Army is in the process of developing an environmental impact statement (EIS) that identifies and evaluates a range of alternatives to accommodate training needs at JBER-R. The EIS is currently being revised based on comments made during the public opinion process in 2010, and is tentatively scheduled for finalization in 2013.

The community of Eagle River lies within the boundaries of the Municipality of Anchorage, about 4 miles upstream of the nearest point of ERF. The 2000 census estimated the population of Eagle River to be approximately 29,917. The primary source of drinking water for the residents of the Eagle River community is surface water from Eklutna Lake, 15 miles to the northeast. Most residents of the urban/suburban Eagle River area are served by the Municipality of Anchorage water system. Those residences and businesses outside of the Municipality of Anchorage water system service area tend to utilize private wells for their water supplies. The surface water and near surface groundwater are high in saline because of the estuarine nature of the site; consequently, surface water and groundwater from the site are not currently used as potable water supplies and future use is not expected. Because the site continues to be used as an active range, access to the site will continue to be restricted. At this time, the military plans to continue using the site as an operational range. Potential UXO and the estuarine habitat prevent use of the area as future residential or industrial sites.

3.3.3 History of Contamination at OUC

OUC underwent considerable investigation before being placed on the NPL. As described in Section 3.3.2, numerous sediment samples were analyzed for 14 COCs (munitions constituents) during RI activities; all of the munitions constituents, except white phosphorous, were eliminated as COCs prior to the implementation of the formal CERCLA process.

Investigations into the mortality of birds began in 1988-1990, with extensive fieldwork to determine whether munitions or munitions compounds were the cause of bird deaths. During this time, over 200 samples of water and sediments were analyzed for explosive compounds, metals, and VOCs. The only COC detected at ERF was white phosphorus. The contaminant constituent 2,4-dinitrotoluene was detected near the OB/OD pad at concentrations exceeding 1 part per million (ppm), which was well below the risk-based criteria of 4,100 mg/kg for soil ingestion at an industrial site. The OB/OD pad has restricted public access. Entry onto the pad is by road with a locked gate. Access is controlled and monitored by the Range Control at JBER-R. These restrictions are not expected to change. Because of the potential UXO hazard in the area, OB/OD pad is not available for future development.

A baseline risk assessment was conducted in 1990 to analyze the potential, current, and future adverse health and environmental effects caused by releases and exposure to site-related chemicals. To develop the baseline risk assessment, a data quality review was conducted on all pre-RI data to demonstrate the adequacy and quality required under CERCLA and RCRA. The risk assessment confirmed that white phosphorus was the only COC at ERF.

In 1990, after extensive investigation to monitor by-products, it was discovered that ingestion of particles of white phosphorus, a component in smoke munitions, was the cause of waterfowl deaths. White phosphorus and hexachloroethane-zinc mixture smokes are the two most common agents used by the military to produce white smokes in the visible spectrum. White phosphorus consists primarily of elemental phosphorus and has been used as a smoke-producing material in munitions since World War I. When munitions containing white phosphorus are detonated, the phosphorus breaks up into minute particles that disperse over a large area; white phosphorus reacts spontaneously with air, creating a column of smoke. Unburned particles from exploded white phosphorus munitions can rain down and become buried in the wet, soft mud. Dabbling waterfowl can pick up the embedded particles of white phosphorus as they sieve in the mud for food.

Because white phosphorus persists (does not sublimate and oxidize) when wet or submerged, the water and sediment conditions at ERF are conducive to the long-term retention of white phosphorus. ERF investigations performed after 1990 focused on defining the extent of the white phosphorus contamination, determining site conditions and other factors that affect the likelihood of exposure to white phosphorus, and understanding the physical dynamics of ERF.

In 1993, waterfowl telemetry studies were initiated. Results of a 1994 U.S. Cold Regions Research and Engineering Laboratory study showed that white phosphorus particles remained intact and relatively unaffected in water-saturated sediments, but began to immediately degrade when the sediments became unsaturated, especially at warmer temperatures. Therefore, sublimation/oxidation was determined to be a viable remedial option for mudflats and intermittent ponds that have the potential to drain and dry. This conclusion initiated the preparation of a FS to determine potential technologies that could be used in ERF to remediate white phosphorus from 1994 through 1998.

Investigations performed to define contaminant hot spots determined that the most significant areas of concern for exposure to white phosphorus were the sediments in ponds and some marshes. Twenty-two hot spots (ponds) were identified, covering 57 acres. Figure 3-4 illustrates the pond groups within the ERF areas.

3.3.4 Initial Response at OUC

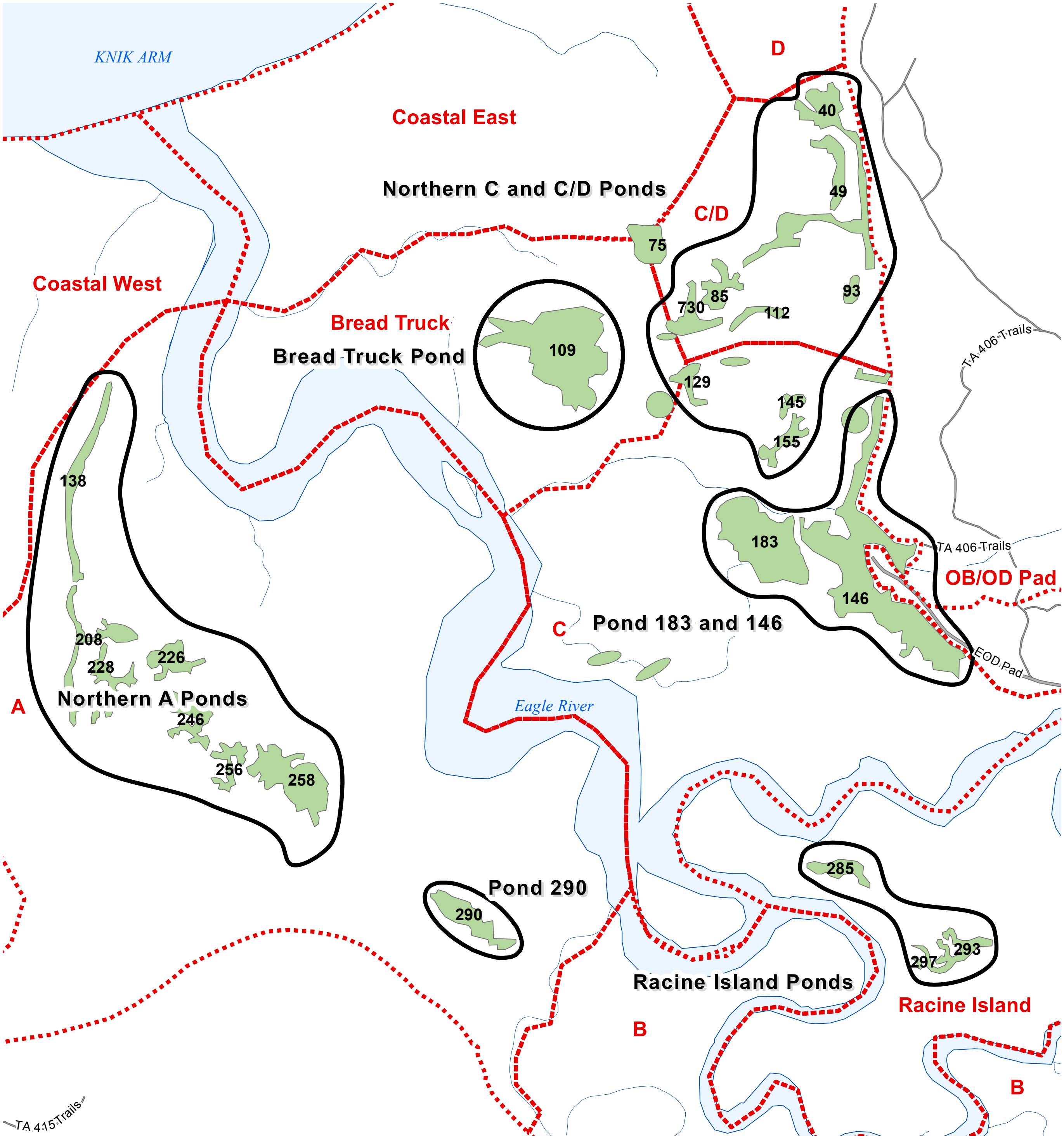
Several treatability studies were conducted at ERF from 1994 through 1998, prior to the signing of the ROD, as described below:

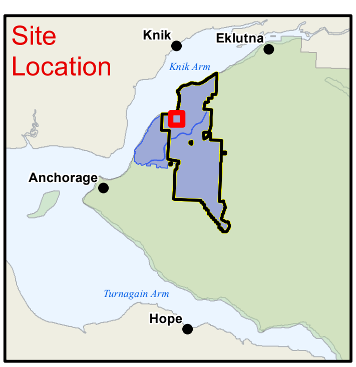
- In 1995, cap-and-fill technology was tested at Pond 285 on Racine Island. This pond was filled with AquaBlok, a gravel-clay mixture that was intended to prevent ducks from feeding in the contaminated sediment. The mixture also supported the growth of vegetation.
- In 1995 and 1996, small areas of contaminated sediments (< 1.5 acres) were removed from Pond 146 by a remote-controlled dredge during another treatability study.
- In 1996, Pond 109 (8.2 acres) was drained with a blasted ditch. Draining by breaching has discouraged waterfowl and has initiated a slow remediation by sediment drying.
- In 1997, Ponds 293 and 297 (1.5 acres) on Racine Island were drained with a blasted ditch.

- Also in 1997, a single 2,000-gallon per minute pump powered by a separate floating diesel genset was used to drain Pond 183 in Area C to test the equipment and determine feasibility.
- In 1998, a full-scale pump system treatability study was conducted using six pump systems. Pumps were deployed in Ponds 183, 155, and 146 in Area C and Ponds 290, 256, and 258 in Area A.

3.3.5 Basis for Taking Action at OUC

ERF represents a productive wetland that serves as an important staging ground for migrating waterfowl and supports local populations of fish, birds, mammals, and macro invertebrates. A 1990 risk assessment identified white phosphorus as the COC causing waterfowl mortality at OUC, and the OUC ROD was signed in 1998 based on the results of several treatability studies conducted to address white phosphorus at ERF.





OUC Site

Pond

Pond Group

All Locations Are Approximate

0 500 1,000 1,500 2,000

Feet

WGS 1984 UTM Zone 6N

N

OUC EAGLE RIVER FLATS
POND GROUPS

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 09 JAN 2013	PROJECT MANAGER: K. MAHER	FIGURE NO: 3-4

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3.4 OUE ARMORED VEHICLE MAINTENANCE AREA & BUILDING 35-752

OUE is the fifth OU to reach a final-action ROD, which was signed 29 September 2005. OUE was established because two potential hazardous-substance source areas, the AVMA and Building 35-752 (Figure 3-5), required further investigation to determine the nature and extent of contamination at the sites:

- The soils in the AVMA were also recommended for NFA under CERCLA; however, groundwater at the AVMA was identified for continued action due to identified solvent contamination at the site in excess of MCLs.
- Based on the RI/Remedial Action (RA) report, soil and groundwater at the Building 35-752 area were recommended for NFA under CERCLA with the stipulation that groundwater monitoring occur at the site prior to the Five-Year Review.

AVMA

The OUD ROD also specified that an area north of Buildings 726 and 732 (a motor pool) would be investigated as part of OUE, referring to the area as the Armored Vehicle Maintenance Area (AVMA). The suspected source areas within the AVMA included areas of buried debris and drainage ditches east of former Building 45-590, as identified on historic aerial photographs. Additionally, the area north of Building 726 (including Building 732) was considered to be a potential source of contamination requiring further investigation.

The AVMA is located in the western region of the cantonment area of Fort Richardson (as shown on Figures 1-2 and 3-5). The area consists of open fields, grasslands, woods, and several buildings covering approximately 140 acres. The AVMA site encompasses an area that lies between two sites investigated during the OUD RI. The former Building 45-590 site is located downgradient from the AVMA, and the Building 726 site is located immediately upgradient from the AVMA site; both of those sites have been designated as NFA under CERCLA. Historic aerial photographs displayed a large disturbed area east of former Building 45-590 that had been reportedly used for the field maintenance of armored vehicles (tanks). This area was identified as a potential source of PCE groundwater contamination; however, the soil was characterized and no significant source of contamination was identified during the investigation activities.

The OUE RI, risk assessment, FS, and Proposed Plan were completed in 2004. The data and assessments indicated that solvent-contaminated groundwater at the AVMA site required action under CERCLA. Contaminant constituents in the soils were determined to not pose an unacceptable risk to human health or the environment and, therefore, contamination in the soils at the site did not require further action. Based on these assessments, it was determined that further action at the site was only required to address the contaminated groundwater. Periods of use and dates related to the history of the AVMA source area contamination are summarized in Table 2-3.

Building 35-752

Building 35-752 is located in the southwestern portion of JBER-R. It is a former generator/power supply building for a high-frequency transmitter facility located in the adjacent structure (35-750). The potential hazardous source areas at the Building 35-752 area are related to transformer maintenance and operations, the discharge and burning of transformer cooling oil containing PCBs, the use of PCB-contaminated soils as a base for the peripheral road, and residual PCB contamination associated with on-site stockpiles including bags of PCB-contaminated soil that were stored in the building in 1989 and seven fuel USTs that were removed from outside the building in 1990 (U.S. Army Directorate of Public Works [DPW] 1994).

The Building 35-752 site had originally been included in OUD; however, a potential source of PCB contamination was discovered prior to the finalization of the OUD ROD. It was determined that the Building 35-752 site had not been fully characterized and would require additional RI work. To prevent any delays associated with the OUD ROD, the Building 35-752 site was subsequently transferred to OUE for further characterization.

In 1997, approximately 1,500 cubic yards of soils were excavated from the gravel parking lot at the Building 35-752 site to facilitate the construction of a permanent asphalt surface. Soil samples collected during excavation activities exhibited high concentrations of PCBs. A definitive source of the PCBs was never determined at that time. The Proposed Plan for OUD stated that the soils removed during excavation activities would be subsequently treated using phytoremediation. The soils were initially stockpiled at the site prior to being shipped to a Toxic

Substances Control Act (TSCA)-permitted TSDF for disposal. While the OUD ROD was being developed based on the Proposed Plan, new information was discovered concerning the source of PCB contamination in this area. Interviews with Fort Richardson personnel indicated that oil from four 750-kilovolt transformers located behind Building 35-750 was drained into a pit located adjacent to Building 35-752, and burned with diesel fuel. The interviews also indicated that another transformer was drained onto the ground in the area directly east of Building 35-752. Considering the new information obtained after issuing the Proposed Plan, it was determined that the site had not been adequately characterized for PCBs and potential dioxins. As a result, the site was transferred to OUE.

3.4.1 Physical Characteristics at OUE

The AVMA site lies on an alluvial plain, often referred to as the Anchorage Lowland. The Elmendorf Moraine can be found approximately one-half mile north of the site. The underlying geology at the AVMA is complex and highly variable. The Mountain View fan is on the order of 40- to 60-feet thick beneath the majority of the site. The fan consists mostly of sands and gravels with localized deposits of silt and clay. There are no wetlands or surface water features located on the site.

Groundwater underlying the AVMA is encountered in both shallow and deep aquifers separated by a confining layer. The thickness of the confining layer varies across the site and pinches out towards the north edge of the site. The confining layer is about 37 feet thick at the Monitoring Well AP-4412/AP-4413 location and 30 feet thick at the Monitoring Well AP-4415/AP-4416 location. The northern extent of the confining unit was determined to be adjacent to the Davis Highway, northwest of Building 732.

In areas where the confining layer is present, a shallow unconfined aquifer is encountered at approximately 60 feet bgs and a deeper confined aquifer is encountered at approximately 100 feet bgs. The aquifers merge where the confining layer pinches out, forming a thick unconfined aquifer. Groundwater flow at the site is complex due the nature of the geology, but the general groundwater flow direction is towards the northwest. Hydraulic conductivities at the AVMA site were estimated to average 0.5 feet per day for all saturated zones except the intermediate zone, which averaged 0.05 feet per day. These relatively low hydraulic conductivities suggest that groundwater flow in the site area would not significantly disperse dissolved contaminants.

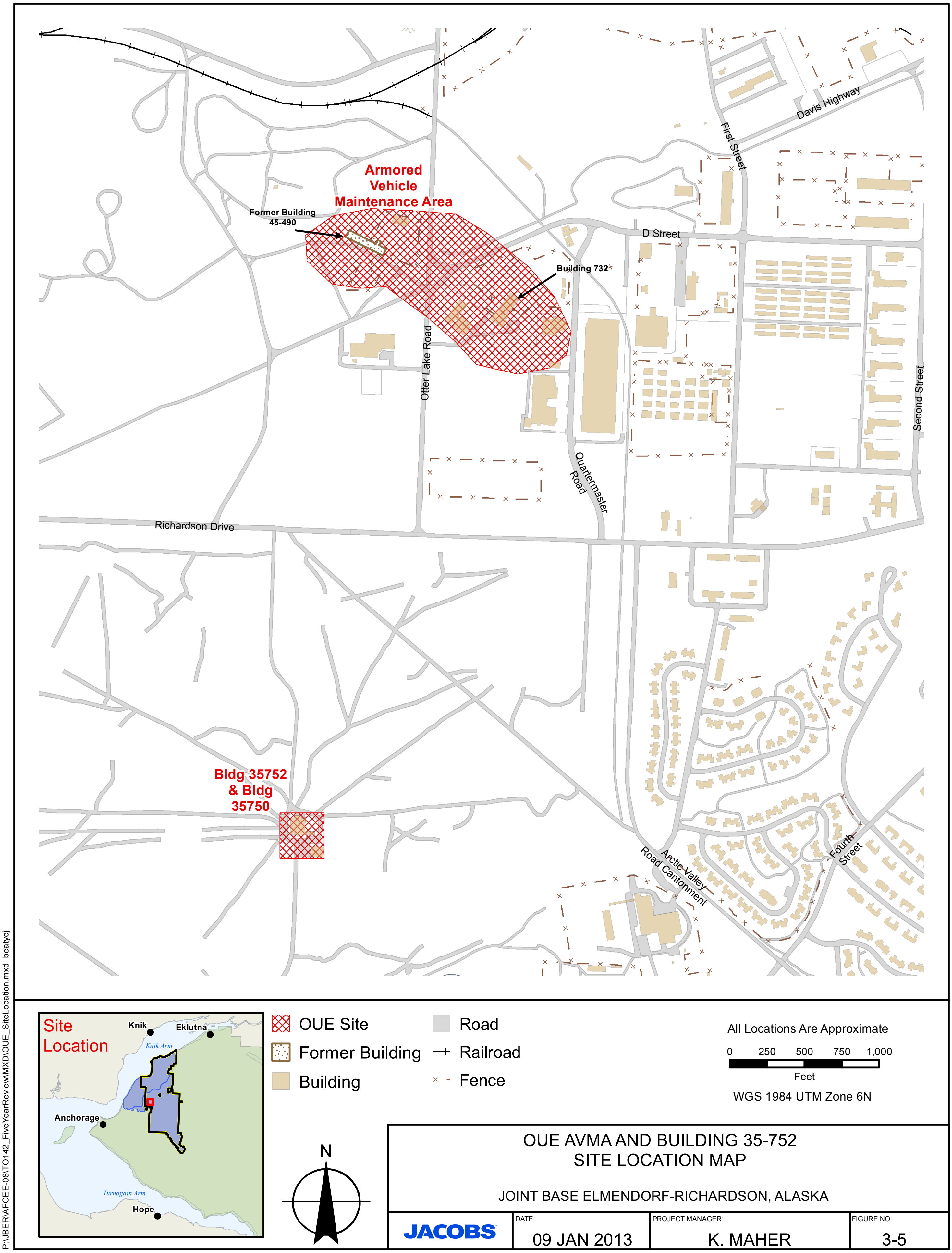
Figure 3-6 shows a conceptual cross-sectional model of the geology and hydrology at the site.

At Building 35-752, well-sorted gravels predominate the vicinity of the main cantonment area. Outwash and alluvial sediments are approximately 200 feet thick, and the Bootlegger Cove Formation underlies alluvial sediments. Soil borings installed by USACE near the building suggest sandy clay/gravel with occasional interbedded sand lenses to 40 feet bgs; groundwater was encountered at approximately 13 feet bgs in all of the borings immediately south of the building. Local groundwater flow is toward the east-southeast (DPW 1994).

3.4.2 Land and Resource Use at OUE

The AVMA was used as a gravel source during construction of the railroad on JBER-R in 1950. Later in the 50s and 60s, military vehicles were washed at the eastern end of the AVMA.

During this time, pits, drainage ditches, and other ditches were excavated (Astley and Lawson 2001). Most of these excavations were later filled and graded with unknown material that may have included various solid and liquid wastes. The area had been used as a physical training area and obstacle course since 1973, although much of the obstacle course has been leveled or removed (Astley et al. 2001 [see Management Plan])


Armored Vehicle Maintenance Area
Former Building 45-490
Building 732
Davis Highway
First Street
D Street
Otter Lake Road
Quartermaster Road
Second Street
Richardson Drive
Bldg 35752 & Bldg 35750
Arctic Valley Road Cantonment
Fourth Street
Site Location
Knik
Eklutna
Knik Arm
Anchorage
Turnagain Arm
Hope
OUE Site
Former Building
Building
Road
Railroad
Fence
All Locations Are Approximate
0 250 500 750 1,000
Feet
WGS 1984 UTM Zone 6N
N
OUE AVMA AND BUILDING 35-752
SITE LOCATION MAP
JOINT BASE ELMENDORF-RICHARDSON, ALASKA
JACOBS
DATE: 09 JAN 2013
PROJECT MANAGER: K. MAHER
FIGURE NO: 3-5
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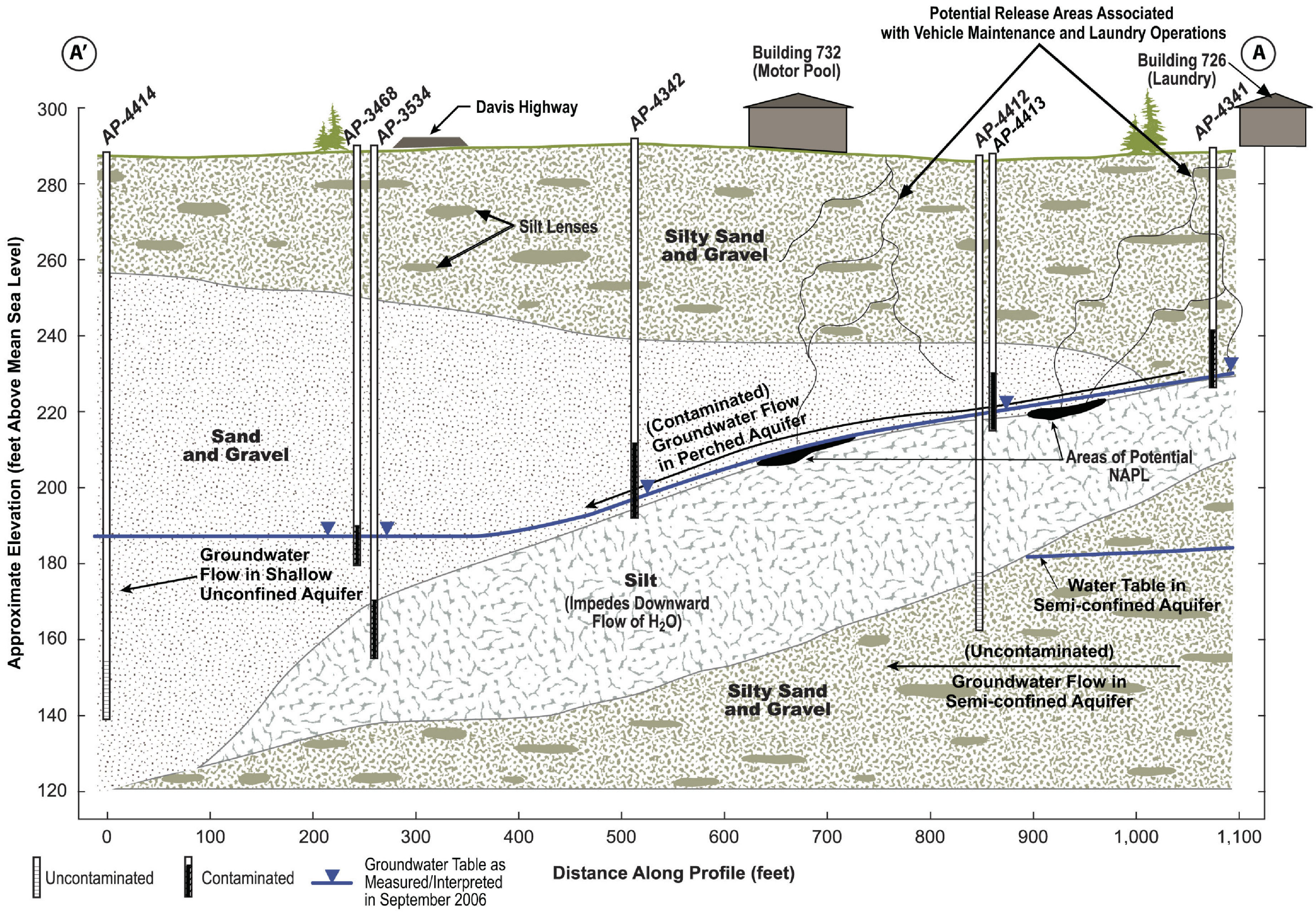

Figure prepared by CH2Hill Consultants. Used with permission of US Army Corps of Engineers.

OUE AVMA CONCEPTUAL CROSS-SECTIONAL MODEL SITE			
JOINT BASE ELMENDORF-RICHARDSON, ALASKA			
JACOBS	DATE: 02 OCT 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 3-6

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The AVMA area covers approximately 140 acres of developed and undeveloped land. The undeveloped land consists of forested areas and some open fields. Land use at the AVMA and neighboring areas is industrial and will remain industrial for the reasonably anticipated future. Future residential use of the OUE land is not reasonable, nor is it consistent with the Master Plan for Fort Richardson. The AVMA area does not fit the criteria for residential land use as outlined in the *U.S. Army's Master Planning Guidance*, AR 210-20 (U.S. Army 2005).

The Building 35-752 area is located approximately one-third of a mile south of the Davis Highway, in a relatively undeveloped part of Fort Richardson that includes high-frequency transmitter antennas.

The primary industrial activities conducted at the site that contributed to the soil and groundwater contamination included operation of USTs and electrical power generation equipment (generators and transformers). Diesel generators were operated at the site from 1953 to 1987. The generators were housed inside Building 35-752 and were used to power a high-frequency transmitter array and control center located in the adjacent building (35-750). Fuel for the generators was stored in seven 5,000-gallon USTs located on the south side of the building. Cooling ponds, located southwest of the building, stored water to cool the generators. The generators were removed in 1987 and the building was used as general storage for several years. The building was eventually boarded up and secured with a locked fence in 1995.

Four large transformers (750-kilovolt) were located at the site during operation of the power generation facility. The transformers were located on the northwest side of the adjacent Building 35-750. These transformers were reportedly replaced and removed from the site around 1982.

3.4.3 History of Contamination at OUE

Solvent contamination (specifically PCE) was first detected in the groundwater at the AVMA during a 1994 UST investigation. The highest concentrations of PCE were observed in the shallow, unconfined aquifer located in an area between Building 726 and the former Building 45-590; both of these adjacent sites were recommended for NFA as part of the OUD ROD. The contaminated groundwater plume extends approximately 600 feet northwest of Building 726.

Current data indicates that the plume is stable and contained. After significant sampling efforts, including soil borings and monitoring wells installed during the OUD investigations, contaminated soil source areas were not detected, and therefore a specific release site or mechanism could not be identified at the AVMA site.

The data collected during the OUE RI strongly suggests that PCE contamination in the groundwater at the AVMA resulted from vehicle maintenance and laundry operations conducted at Buildings 732 and 726, respectively. Historical data indicates that PCE was utilized at the laundry facility; additionally, low concentrations of PCE were detected in soils at the Building 726 site during the OUD RI. There appears to be a direct link between the Building 726 site and the downgradient contamination. It is highly likely that PCE contamination from the former USTs located at Building 726 had been removed during excavation of the USTs or had migrated downgradient prior to the time the OUD RI had been conducted. Therefore, soil and groundwater samples collected directly at the site did not contain high concentrations of solvents.

In addition, the OUD data appears to be potentially biased due to the fact that the groundwater samples were not collected from the unconfined aquifer in the area between Building 726 and Building 45-590. Groundwater samples collected during the OUE RI from wells installed in the unconfined aquifer indicated that PCE contamination was present, and that there was a contaminant pathway linking the Building 726 site with the PCE contamination found near Building 45-590.

Groundwater contamination was detected immediately downgradient from the Building 732 location during the OUD RI. Low concentrations of PCE contamination were detected in Monitoring Well AP-3789 and may be associated with the vehicle maintenance activities conducted at Building 732.

Seven USTs were excavated from the south side of Building 35-752 in 1990. During the UST closure activities, petroleum hydrocarbon contamination was discovered in the excavation; additionally, PCB and Aroclor 120 contaminated soils were also discovered in the associated stockpiled soils.

A PSE was conducted at Building 35-752 in 1994 and 1995. PCBs were detected in samples collected from the floor of Building 35-752. PCBs and petroleum hydrocarbons were detected in the soil and groundwater samples collected from the former UST area; PCBs and petroleum hydrocarbons were also detected in subsurface soil samples collected from the drum storage area. Petroleum hydrocarbons, PCBs, pesticides, and solvents were identified in sediments collected from the cooling pond and petroleum products and metals were detected in groundwater samples collected near the cooling pond. Petroleum products and solvents were also present in groundwater samples collected from monitoring wells located in the vicinity of the building.

The OUD RI that originally included Building 35-752 (now part of OUE) began in 1996 and was completed in 1998. The RI focused on the contamination previously identified in the interior of Building 35-752 (PCB-contaminated dust); soils in the vicinity of the former UST area, the former drum accumulation area, the cooling pond area, and groundwater. The above described areas included reported releases in the vicinity of a transformer mounting pad, a suspected PCB burn area, PCB-contaminated soils potentially used as fill during the construction of the peripheral road, and an area where soils containing PCBs had been stockpiled. The OUD RI confirmed the results of previous investigations that had identified low levels of PCBs, petroleum hydrocarbons, and solvents at the site. However, the OUD risk assessment indicated that contaminant concentrations present at the site did not pose an unacceptable risk to human health or the environment.

3.4.4 Initial Response at OUE

A groundwater monitoring plan was initiated for the AVMA site in 2004.

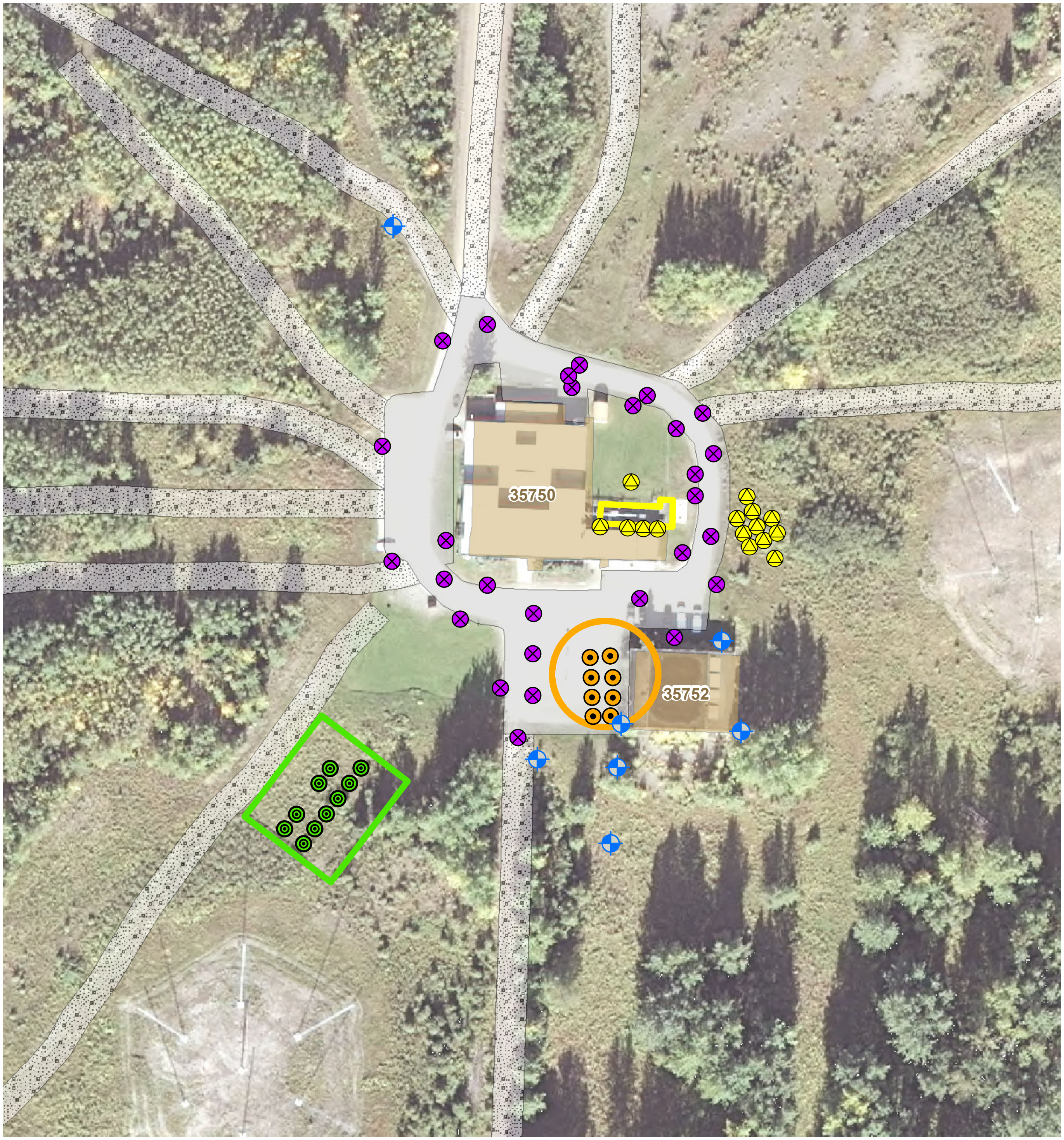
The OUE RI began in 2002 and was completed in 2003. The OUE investigations at the Building 35-752 site focused on areas where PCBs had reportedly been disposed of and burned. The contaminants of potential concern investigated at this site were PCBs and dioxin/furan compounds that might have been generated as a result of burning PCB-containing oil at the site.

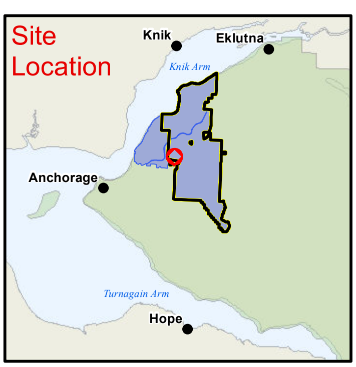
During the OUE RI, 87 soil samples were collected from the various areas of investigation at the site. Soil samples were analyzed for PCBs, dioxin/furans, solvents, and petroleum compounds.

Groundwater samples were collected from seven monitoring wells located at the site. Groundwater samples were analyzed for PCBs, VOCs, semivolatile organic compounds (SVOC), metals, and petroleum compounds. Figure 3-7 shows locations where samples were collected at the Building 35-752 site.

Soil Investigation: The highest concentration of PCBs detected during the RI (99.9 mg/kg) was confined to an area less than one square meter in size that was located in close proximity to a transformer mounting pad near Building 35-750. This area has limited accessibility as it is located between the transformer enclosure and the building and is not commonly utilized except during the maintenance of transformers and other electrical equipment. However, due to concerns for potential exposure, the surface soils around the transformer mounting pad were excavated upon completion of the RI activities.

All areas outside the building fit the definition of low-occupancy under the Toxic Substances Control Act (TSCA) regulation (e.g., unoccupied areas outside a building, electrical equipment vaults, or non-office space in a warehouse where occupancy is transitory). For this reason, a TSCA cleanup level of 25 ppm was established for the site. All of the surface soils located in the vicinity of the transformer mounting pad that contained PCBs exceeding a concentration of 1 mg/kg were excavated and disposed of at a TSCA landfill. The highest concentration of PCBs detected in the subsurface soils upon completion of excavation activities was 14.1 mg/kg; the sample had been collected at a depth of approximately 1 foot bgs. The concrete surface of the mounting pad was tested using wipe samples; PCB concentrations identified during the wipe sampling were less than detection limits (1 microgram per 100 square centimeters [1 µg/100 cm^2]). The entire area was subsequently capped with geotextile fabric and a minimum of 0.5 foot of clean soil.





- Burn Pit Soil Sample
- Peripheral Road Sample
- Stockpile Soil Sample
- Transformer Soil Borings
- Existing Monitoring Well
- Burn Pit Area
- Soil Stockpile Footprint
- Transformer Mounting Area
- Building
- Paved
- Unpaved

All Locations Are Approximate

0 50 100 150 200

Feet

WGS 1984 UTM Zone 6N

N

OUE BUILDING 35-752
SAMPLE AND MONITORING WELL LOCATION

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 01 OCT 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 3-7

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Toxicity equivalent quotients (TEQ) for dioxin/furan compounds ranged from 0.79 pictogram per gram (pg/g) to 32 pg/g (parts per trillion [ppt]). Only two samples contained dioxin/furan compounds at concentrations exceeding screening criteria (Region 9 PRG, 16 ppt); the sample exhibiting the highest concentration (32 ppt) had been collected from underneath the asphalt driveway. The identified concentrations of dioxin/furan detected at the site did not result in calculation of unacceptable risk for exposure to soil.

Groundwater Investigation. Data collected during the OUD RI (1996) indicated that shallow groundwater beneath Building 35-752 was contaminated with low levels of benzene, TCE, and metals (primarily aluminum, iron, and manganese), the same constituents that had been identified in groundwater samples collected during the OUE RI that was conducted in 2002/2003.

Only two compounds were detected in the groundwater at the Building 35-752 site during the OUE RI that exceeded their applicable MCLs (benzene and TCE). Benzene was detected at a concentration of 8.2 μg/L in Monitoring Well AP-2892 in 2002. However, during the 2003 sampling event, benzene was detected at a concentration of 1.6 μg/L, which is below the MCL (5 μg/L). In 2003, TCE was detected in Monitoring Well AP-3231 at a concentration of 8.6 μg/L, which slightly exceeds the MCL. However, the concentration of TCE in the groundwater at the site has decreased since 1995 and has periodically dropped below the MCL. Chemical concentrations of cis-1,2-dichloroethylene (cis-1,2-DCE) and vinyl chloride, while still much lower than MCLs, have increased slightly in areas where TCE was discovered. The increase in concentrations of the daughter products, vinyl chloride and cis-1,2-DCE, combined with the generally decreasing concentration of TCE, indicates that natural attenuation of the TCE contamination is occurring in the groundwater at the site.

Only one groundwater sample collected during the OUE RI contained PCBs (Aroclor 1260) at a concentration that exceeded the screening criteria (0.034 μg/L). Naphthalene was the only PAH compound detected at concentrations exceeding the screening level criteria; however, the concentration of naphthalene (8.3 μg/L) in groundwater at the site was well below the ADEC cleanup criterion of 1,460 μg/L. Several VOCs (specifically benzene, ethylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene) were detected at concentrations exceeding screening criteria. However, concentrations of these contaminant constituents have decreased since 1996 and are below their respective MCL values and/or ADEC cleanup criteria. Cumulative risk calculations for the groundwater contaminants at the site fell within acceptable risk ranges for unrestricted use. Groundwater at the site is not used as a drinking water supply, and in general the shallow groundwater is non-potable due to high turbidity levels.

3.4.5 Basis for Taking Action at OUE

Soil at the AVMA site has been recommended for NFA, but groundwater monitoring continues to track solvent contamination in groundwater. Both soil and groundwater have been recommended for NFA at Building 35-752; however, groundwater monitoring must occur as a stipulation of this determination, and Building 35-752 was transferred from OUD to OUE so that this groundwater monitoring would continue to occur as part of the CERCLA Five-Year Review process.

3.5 NIKE SUMMIT SITE

SS047 (also known as the Nike Site Summit) is located approximately 12.5 miles east of Anchorage, Alaska on a ridgeline in the Chugach Mountains, adjacent to Mount Gordon Lyon near the eastern boundary of JBER. SS047 covers approximately 244 acres and was used between 1959 and 1979 as a ground-based anti-aircraft defensive system to protect the surrounding communities from incoming enemy missiles during the Cold War. Live missile firings were conducted between 1960 and 1964, at which point it was determined to be unsafe due to population growth in the immediate area. There are no manned operations at these facilities; however, the area continues to be used for various aspects of military training.

In 1996, a limited preliminary assessment and site investigation (PA/SI) was conducted to evaluate possible environmental impacts from past operations and disposal practices and to identify/characterize any contamination that may remain at the site. The results of the PA/SI identified four areas requiring further investigation (Upper Site Summit, Lower Site Summit, and Areas A and C), and no further investigation at two areas (Areas B and D).

In 2010 and 2011 a remedial investigation was conducted to determine the type and extent of contamination at SS047. Field investigations were conducted at all six areas studied during the PA/SI, as well as one background areas. Areas B and D were confirmed to require no further action, while a remedy will selected during the proposed plan and record of decision (ROD) process for Upper Site Summit, Lower Site Summit, and Areas A and C. The release of the final ROD is scheduled for September 2013.

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4.0 REMEDIAL ACTIONS

This section presents initial plans, RAOs, selected remedy descriptions, remedy implementation history, and current status of the remedies associated with each OU.

4.1 OUB POLELINE ROAD DISPOSAL AREA REMEDIAL ACTION

4.1.1 OUB Remedy Selection

Remedial Action Objectives (OUB)

RAOs were developed in accordance with NCP and EPA guidance as a part of the RI/FS process. The overall objective is to reduce contamination in groundwater at OUB to levels that do not pose a threat to human health and the environment.

RAOs are based on either human health risk estimates that exceed or fall within the 1×10^{-6} to 1×10^{-4} risk range, or on federal and state ARARs. The objectives of the selected remedies at OUB, per the ROD signed in 1997, are as follows:

- Reduce contaminant levels in the groundwater to comply with drinking water standards;
- Prevent contaminated soil from continuing to act as a source of groundwater contamination;
- Prevent the contaminated groundwater from adversely affecting the Eagle River surface water and sediments; and
- Minimize degradation of the State of Alaska's groundwater resources at the site as a result of past disposal practices.

ARARs (OUB)

The OUB ROD cited the most significant ARAR for the remedy selection at the PRDA to be:

> *State and federal MCLs are relevant and appropriate for groundwater. These MCLs set the active remediation goals for groundwater contaminants regulated by state and federal drinking water regulations.*

Groundwater (OUB)

- Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for benzene, carbon tetrachloride, cis-1,2-dichloroethene, trans-1,2-dichloroethene, PCE, and TCE
- The concentration corresponding to the EPA Region 3 risk-based concentration (10-4) in residential drinking water was adopted as the cleanup goal for 1,1,2,2-PCA

Numeric values for cleanup goals in groundwater are presented below in Table 4-1.

Table 4-1
OUB Remedial Cleanup Goals for Groundwater

Contaminant of Concern	Remedial Action Objective (mg/L)	Source of RAO
benzene	0.005	MCL
carbon tetrachloride	0.005	MCL
cis-1,2-dichloroethene	0.07	MCL
trans-1,2-dichloroethene	0.1	MCL
PCE	0.005	MCL
TCE	0.005	MCL
1,1,2,2-PCA	0.052	RBC

Notes:
MCL = maximum contaminant level
RBC = risk-based concentration
For additional definitions, see the Acronyms and Abbreviations section.

Soils (OUB)

RAOs for soil are based on protection of the groundwater from leaching of the contaminants (Region 3 RBCs, EPA 1995). Numeric values for cleanup goals in soil are presented in Table 4-2.

Table 4-2
OUB Remedial Cleanup Goals For Soil

Contaminant of Concern	Remedial Action Objective (mg/kg)	Source of RAO
PCE	4.0	RBC
1,1,2,2-PCA	0.1	RBC

Notes:
RBC = risk-based concentration
For definitions, see the Acronyms and Abbreviations section.

Remedy Selection (OUB)

The major components of the preferred remedy and their status are listed in Table 4-3 below.

Table 4-3
OUB Remedy Status

Remedy Component	Status
Treat the Hot Spot through HVE	
Treat the hot spot through HVE of soil vapor and groundwater in the perched and shallow zones to prevent the main source of contamination from continuing as a threat to groundwater. Soil vapors extracted from the hot spot soil will be treated as necessary to meet state and federal air quality standards before release to the atmosphere. Extraction wells will be placed in areas of highest contamination and operated until state and federal MCLs and risk-based criteria are achieved in the hot spot.	Completed in 1998
Treat Extracted Groundwater	
Extracted groundwater was additionally treated through air stripping (SPSH) to achieve state and federal MCLs before discharge.	Completed in 1998
Natural Attenuation	
Allow natural attenuation of groundwater contamination in areas outside the hot spot.	Ongoing
Evaluate/Modify Treatment System	
Evaluate and modify the treatment system as necessary to optimize effectiveness in achieving RAOs – in a 2011 Memorandum to the Site File (USAF 2011c), a new well sampling protocol was established.	Ongoing; occurred most recently in 2009
Monitor Groundwater	
Monitor groundwater measurements to determine the attainment of RAOs and to detect and thoroughly characterize possible dense non-aqueous phase liquid (DNAPL). Note that the well sampling protocol was amended in 2011 (See Section 4.21.2, Component 4).	Ongoing
Evaluate Effectiveness of HVE System	
Evaluate the effectiveness of the HVE system to meet long-term restoration goals during initial implementation. It was determined that the HVE system failed to meet RAOs in the originally anticipated duration (7-12 years).	Completed in 1998
Conduct Treatability Study	
Conduct treatability studies to evaluate innovative technologies with potential to enhance the selected remedy, and implement successful innovative technologies if the initial remedy proves ineffective.	Completed in 1999

Table 4-3
OUB Remedy Status (Continued)

Remedy Component	Status
Maintain LUCs	
Maintain LUCs, including restrictions governing site access, construction, and well development, as long as hazardous substances remain at levels that preclude unrestricted use on-site. Implement restrictions on groundwater until contaminant levels are below state and federal MCLs and risk-based criteria.	Ongoing

Notes:
DNAPL = dense non-aqueous phase liquid
HVE = high = high-vacuum extraction
MCL = maximum contaminant level
SPSH = six-phase soil heating
For definitions, see the Acronyms and Abbreviations section.

4.1.2 OUB Remedy Implementation

The following sections identify the status of remediation for each component of the selected remedy.

Treat the Hot Spot through HVE (OUB)

***Component 1a** – Treat the hot spot through HVE of soil vapor and groundwater in the perched and shallow zones to prevent the main source of contamination from continuing as a threat to groundwater.*

The hot spot is defined in the ROD as the subsurface area containing greater than 1.0 mg/L of 1,1,2,2-PCA in groundwater and/or free-phase solvents. The remedy prescribed by the ROD was implemented through a series of treatability studies. The first treatability study evaluated dual-phased HVE and was conducted from 18 March 1998 through 16 October 1998. The HVE system combined the benefits of the SVE system (evaluated pre-ROD) with a separate groundwater extraction system. This treatability study also included groundwater sampling, additional soil borings and monitoring wells. An additional SPSH design verification study was conducted in 1999. This remedial action was similar to the treatability study conducted in 1997 because it incorporated both SVE and SPSH technologies. Because the SPSH performed in 1997 was very successful at removing contaminants in a short period of time, this technology was, in accordance with the ROD, selected as the final remedy. Soil and groundwater samples collected after completion of the second SPSH treatability study indicated that about 95 percent of the contaminants in soil had been removed during system operations, thus reducing the source of groundwater contamination at the site. The system was less successful at treating groundwater contamination; however, approximately 76 percent of groundwater contaminants were removed during system operations.

Component 1b *– Soil vapors extracted from the "hot spot" soil will be treated as necessary to meet state and federal air quality standards before release to the atmosphere*

A catalytic oxidizer was initially used to treat off-gas from the condenser while heating array 1. The catalytic oxidize removed solvents in the off-gas by heating the off-gas to 650 degrees Fahrenheit (ºF) in the presence of a catalyst. EPA regulations limit discharge to the atmosphere to 10 tons per year of one hazardous contaminant or 25 tons per year of two or more in combination (40 CFR 264.1032). Since the concentration of solvents in the off-gas vapor was less than expected, the catalytic oxidize was removed from the site before the first array was completed. To comply with ADEC regulations (18 MC 50.110) air was discharged away from the operations area and the breathing zone was monitored to ensure that the contents of soil vapor did not exceed health and safety standards.

Component 1c *– Extraction wells will be placed in areas of highest contamination and operated until state and federal MCLs and risk-based criteria are achieved in the hot spot.*

Soil gas and groundwater were extracted from two HVE wells (DPE-1 and DPW-2) that were located within the hot spot in the area of highest known contaminant concentrations. Undiluted off-gas and condensate samples were collected approximately every other day while the system was running. Analytical results were utilized, along with system instrument readings, to calculate the mass of contaminants removed via the extracted soil gas and condensate water. The system removed approximately 500,000 gallons of groundwater and approximately 230 lbs of chlorinated solvents. Analysis of the test data indicated that the cost to operate the system and treat the groundwater produced during system operation greatly exceeded previous estimates. The increased cost was due in large part to an increase in the time estimated for the HVE system to remediate the groundwater plume. Additionally, the groundwater samples collected during the test did not clearly indicate that the HVE system effectively reduced the concentration of chlorinated solvents in the groundwater at this site. Because HVE alone was not expected to be effective at treating the hot spot, the remedy was enhanced with the introduction of six-phase heating (as prescribed in the ROD).

Treat Extracted Groundwater (OUB)

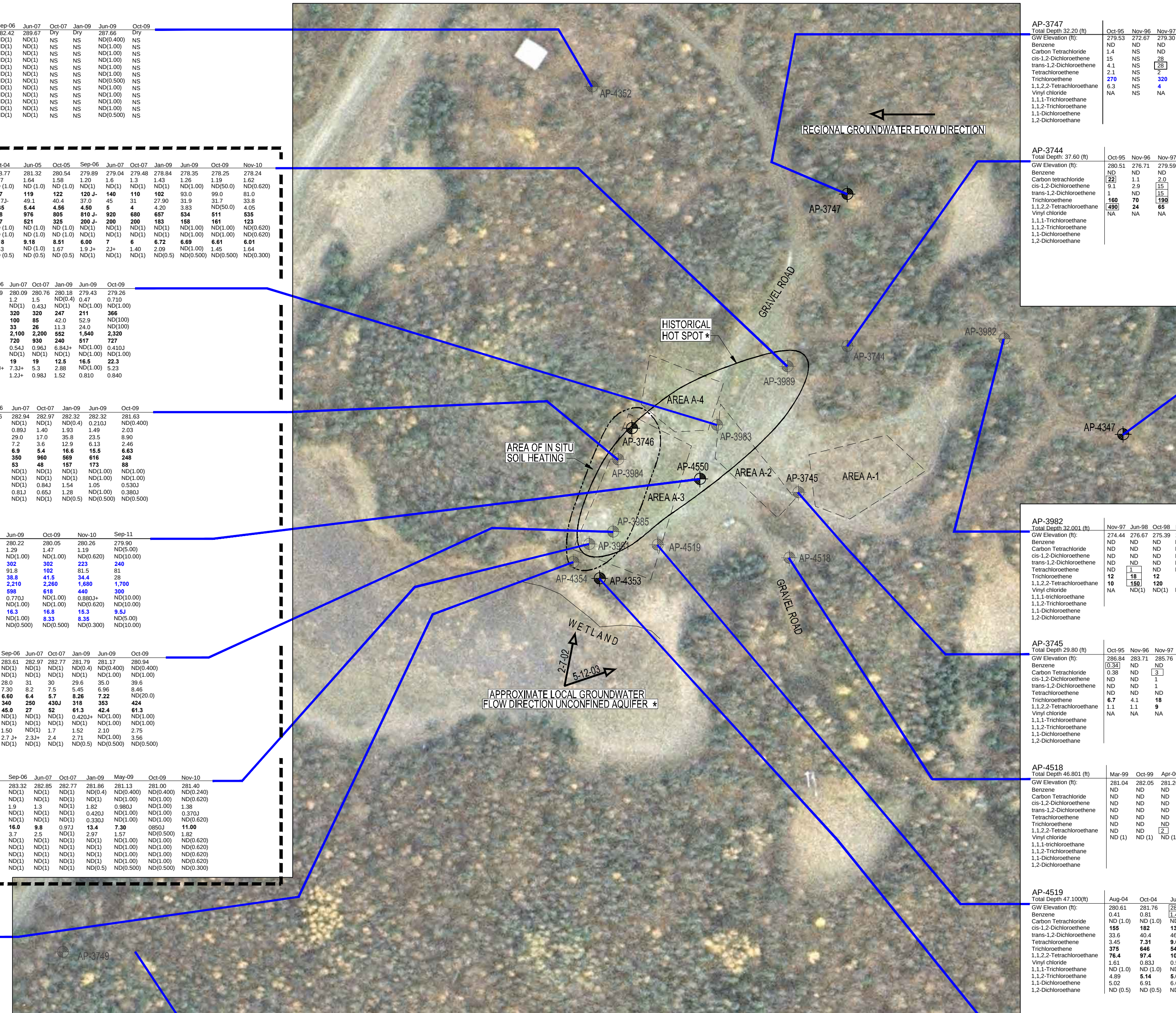
Component 2 – *Treat extracted groundwater through air stripping to achieve state and federal MCLs before discharge*

Groundwater and condensed soil vapors were collected in a knockout tank attached to the extraction system. Contaminants were removed from the water using a cooling tower equipped with an air-stripper. Up to 50 percent of the water added to the cooling tower evaporated. When treated water accumulated in the tower, it was pumped into drip tubes and discharged to the soil surface. Water samples were periodically collected from the treated water tank and analyzed for contaminants. None of the samples were found to contain contaminants.

Allow Natural Attenuation Outside the Hot Spot (OUB)

Component 3 – *Allow natural attenuation of groundwater contamination in areas outside the hot spot*

According to the most recent draft groundwater monitoring report (USAF 2012a), based on the Mann-Kendall analysis performed in 2011, shallow and deep wells sampled downgradient of the hot spot continue to show decreasing trends of one or more of the primary contaminants (Figures 4-1 and 4-2). Natural attenuation parameters continue to provide supporting evidence that reductive dechlorination is occurring in the shallow aquifer within the hot spot area. Additionally, increasing trends of chlorinated daughter products associated with the natural attenuation process have been identified in the groundwater at the site.



HISTORICAL HOT SPOT WELLS

0 100 200 300
Scale in Feet

NOTES *

Groundwater elevation datum mean sea level (NAVD 88) in meters.
Previous groundwater elevations taken from archived reports.
All non-detect values from 2010 to present are reported a the Limit of Detection (LOD)
All non-detect values before August 2004 are reported as the Method Detection Limit (MDL)
2004 August and October non-detect values are reported as the Practical Quantitation Limit (PQL)
All concentrations are measured in µg/L
Exceedances compared against RAO or MCL
Regulatory Exceedances of RAO's or MCL's in **Bold, Blue**
Bold , non-detect indicates LOD exceeded MCL
Historical maximun concentrations/elevations are indicated by a box
Approximate Groundwater flow directions were obtained from Hydrogeology of the Poleline Road Disposal Area, (CRREL, 2003).
Hot Spot has been defined in the OUB ROD as the Area of Groundwater where 1,1,2,2-PCA concentrations exceed 1,000 µg/L.
No results for monitoring well AP-3746 are available, as this well has been dry since installation.

ABBREVIATIONS:

ADEC = Alaska Department of Environmental Conservation
J = Estimated Quantity
J+ = Analyte is present, but value may not be accurate or precise (estimated high)
J- = Analyte is present, but value may not be accurate or precise (estimated low)
MCL = Maximum Contaminant Level
NA = Not Available
ND = No Analyte Detected
NS = Not Sampled
RAO = Remedial Action Objectives
ROD = Record of Decision

Cleanup Level Values

Chemical of Concern (COC)	ROD RAO
Benzene	5 µg/L
Carbon Tetrachloride	5 µg/L
cis-1,2-Dichloroethene	70 µg/L
Tetrachloroethene	5 µg/L
trans-1,2-Dichloroethene	100 µg/L
Trichloroethene	5 µg/L
1,1,2,2-Tetrachloroethane	5.2 µg/L
Post ROD COC	**ADEC MCL**
Vinyl chloride	2 µg/L
1,1,1-Trichloroethane	200 µg/L
1,1,2-Trichloroethane	5 µg/L
1,1-Dichloroethene	7 µg/L
1,2-Dichloroethane	5 µg/L

LEGEND

Monitoring Well Sampled in 2011
Monitoring Well Not Sampled in 2011
1.44 Maximum Historic Concentrations

N

ORIGINAL FILE PREPARED BY CH2M HILL

OUB 2011 SHALLOW AQUIFER MONITORING WELLS AND RESULTS

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 05 Feb 2013	PROJECT MANAGER: K. Maher	FIGURE NO.: 4-1

I:\4PAE-AFCEE-08\TO142-Five Year Review\COMMON\Reference Documents\OUB - Poleline\Poleline Road\OUB_ShallowAquifer.dwg FIG4-1 05 February 2013 - jaronitj

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AP-4350

Total Depth 188.599 (ft)	Jun-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09
GW Elevation (ft):	162.6	157.48	157.61	160.70	161.71	160.57	160.48	160.68	160.73	159.61	159.51
Benzene	ND	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	ND(0.400)
Carbon Tetrachloride	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
cis-1,2-Dichloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
trans-1,2-Dichloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
Tetrachloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	0.41J	ND(1)	ND(1.00)	ND(1.00)
Trichloroethene	0.15J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2,2-Tetrachloroethane	ND	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)
Vinyl chloride	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,1-trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2-Trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1-Dichloroethene	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,2-Dichloroethane	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)

AP-4345

Total Depth 186.499 (ft)	Jun-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09
GW Elevation (ft):	167.32	163.61	163.16	165.52	166.53	165.26	165.12	165.38	165.55	164.24	164.27
Benzene	0.15J	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	ND(0.400)
Carbon Tetrachloride	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
cis-1,2-Dichloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
trans-1,2-Dichloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
Tetrachloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	0.32J	ND(1)	ND(1.00)	ND(1.00)
Trichloroethene	0.39J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2,2-Tetrachloroethane	ND	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)
Vinyl chloride	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,1-trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2-Trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1-Dichloroethene	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,2-Dichloroethane	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)

AP-5246

Total Depth 161.00 (ft)	Jul-07	Oct-07	Jan-09	May-09	Oct-09	Nov-10	Aug-11
GW Elevation (ft)	163.05	163.13	163.32	132.01	162.01	160.62	160.24
Benzene	ND (1)	ND (1)	ND(0.4)	ND(0.400)	ND(0.400)	ND(0.240)	ND(0.2)
Carbon Tetrachloride	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
cis-1,2-Dichloroethene	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
trans-1,2-Dichloroethene	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
Tetrachloroethene	ND (1)	0.39J	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Trichloroethene	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,2,2-Tetrachloroethane	ND (1)	ND (1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.2)
Vinyl chloride	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,1-Trichloroethane	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,2-Trichloroethane	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1-Dichloroethene	ND (1)	ND (1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
1,2-Dichloroethane	ND (1)	ND (1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.4)

AP-4344

Total Depth 49.835 (ft)	Jun-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09	Nov-10	Sep-11
GW Elevation (ft):	165.45	161.84	162.04	163.54	164.47	163.31	163.19	163.41	163.61	162.34	162.30	160.91	160.49
Benzene	0.63	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	ND(0.400)	ND(0.240)	ND(0.2)
Carbon Tetrachloride	0.49J	0.61J	0.58J	0.630J	0.660J-	ND(1)	ND(1)	0.43J	ND(1)	ND(1.00)	ND(1.00)	0.590J	0.63J
cis-1,2-Dichloroethene	0.51	0.54J	0.48J	0.520J	0.910J-	ND(1)	ND(1)	0.48J	ND(1)	0.410J	0.340J	0.470J	0.59J
trans-1,2-Dichloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
Tetrachloroethene	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	0.35J	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Trichloroethene	**13.0**	**16.8**	**16.1**	**18.2**	**26.6J-**	**14**	**15**	**13**	**12.3**	**10.3**	**11.2**	**11.5**	**13**
1,1,2,2-Tetrachloroethane	0.22J	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.2)
Vinyl chloride	ND	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,1-trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,2-Trichloroethane	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1-Dichloroethene	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
1,2-Dichloroethane	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.4)

AP-3748

Total Depth 171.60 (ft)	Oct-95	Nov-96	Nov-97	Jun-98	Oct-98	Mar-99	Oct-99	Apr-00	Oct-00	Apr-01	Mar-02	Sep-02	Mar-03	Sep-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09	Nov-10	Sep-11
GW Elevation (ft):	169.52	167.16	166.64	169.19	169.39	169.91	168.96	168.67	170.28	169.62	162.96	163.02	164.37	163.78	164.83	164.99	166.57	167.58	167.56	166.14	166.43	166.53	165.35	165.39	163.91	163.70
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.32)	ND (0.32)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	ND(0.400)	ND(0.240)	ND(0.2)
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.43)	ND (0.43)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.47)	ND (0.47)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.61)	ND (0.61)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.45)	ND (0.45)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	0.35J	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Trichloroethene	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.55)	ND (0.55)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	0.71 J	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.48)	ND (0.48)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.2)
Vinyl chloride	NA	NA	NA	ND(1)	ND(1)	ND (1)	ND (1)	ND (1)	ND (0.3)	ND (0.5)	ND	ND	ND (0.53)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,1-trichloroethane											ND	ND	ND (0.61)	ND (0.61)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1,2-Trichloroethane											ND	ND	ND (0.41)	ND (0.41)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
1,1-Dichloroethene											ND	ND	ND (0.53)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
1,2-Dichloroethane											ND	ND	ND (0.37)	ND (0.37)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)	ND(0.300)	ND(0.4)

AP-5683 (AP-4019R)

Total Depth 150.800 (ft)	Sep-11
GW Elevation (ft):	162.90
Benzene	ND(0.2)
Carbon tetrachloride	ND(0.4)
cis-1,2-Dichloroethene	ND(0.4)
trans-1,2-Dichloroethene	ND(0.4)
Tetrachloroethene	ND(0.2)
Trichloroethene	0.81J
1,1,2,2-Tetrachloroethane	ND(0.2)
Vinyl chloride	ND(0.4)
1,1,1-trichloroethane	ND(0.4)
1,1,2-Trichloroethane	ND(0.4)
1,1-Dichloroethene	ND(0.4)
1,2-Dichloroethane	ND(0.4)

AP-4019

Total Depth 153.100 (ft)	Oct-95	Nov-97	Jun-98	Oct-98	Mar-99	Oct-99	Apr-00	Oct-00	Apr-01	Mar-02	Sep-02	Mar-03	Sep-03	Oct-04	Jun-05	Oct-05	Oct-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09
GW Elevation (ft):	-	-	164.72	167.15	166.76	165.78	165.52	167.32	166.4	162.63	162.57	164.17	163.42	163.25	164.99	165.06	164.67	164.49	164.76	164.89	163.68	162.30
Benzene	0.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.32)	ND (0.32)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	ND(0.400)
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.43)	ND (0.43)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.47)	ND (0.47)	0.36J	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.61)	ND (0.61)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.45)	ND (0.45)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	0.31J	ND(1)	ND(1.00)	ND(1.00)
Trichloroethene	0.91	ND	ND	ND	ND	ND	ND	0.2J	ND	ND	0.65J	ND (0.55)	ND (0.55)	0.41J	ND (1.0)	**8.02**	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	0.360J
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.48)	ND (0.48)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)
Vinyl chloride			ND(10)	ND(1)	ND (1)	ND (1)	ND (1)	ND (0.3)	ND (0.5)	ND	ND	ND (0.53)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,1-trichloroethane										ND	ND	ND (0.61)	ND (0.61)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2-Trichloroethane										ND	ND	ND (0.41)	ND (0.41)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1-Dichloroethene										ND	ND	ND (0.53)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,2-Dichloroethane										ND	ND	ND (0.37)	ND (0.37)	ND (1.0)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)

AP-4525

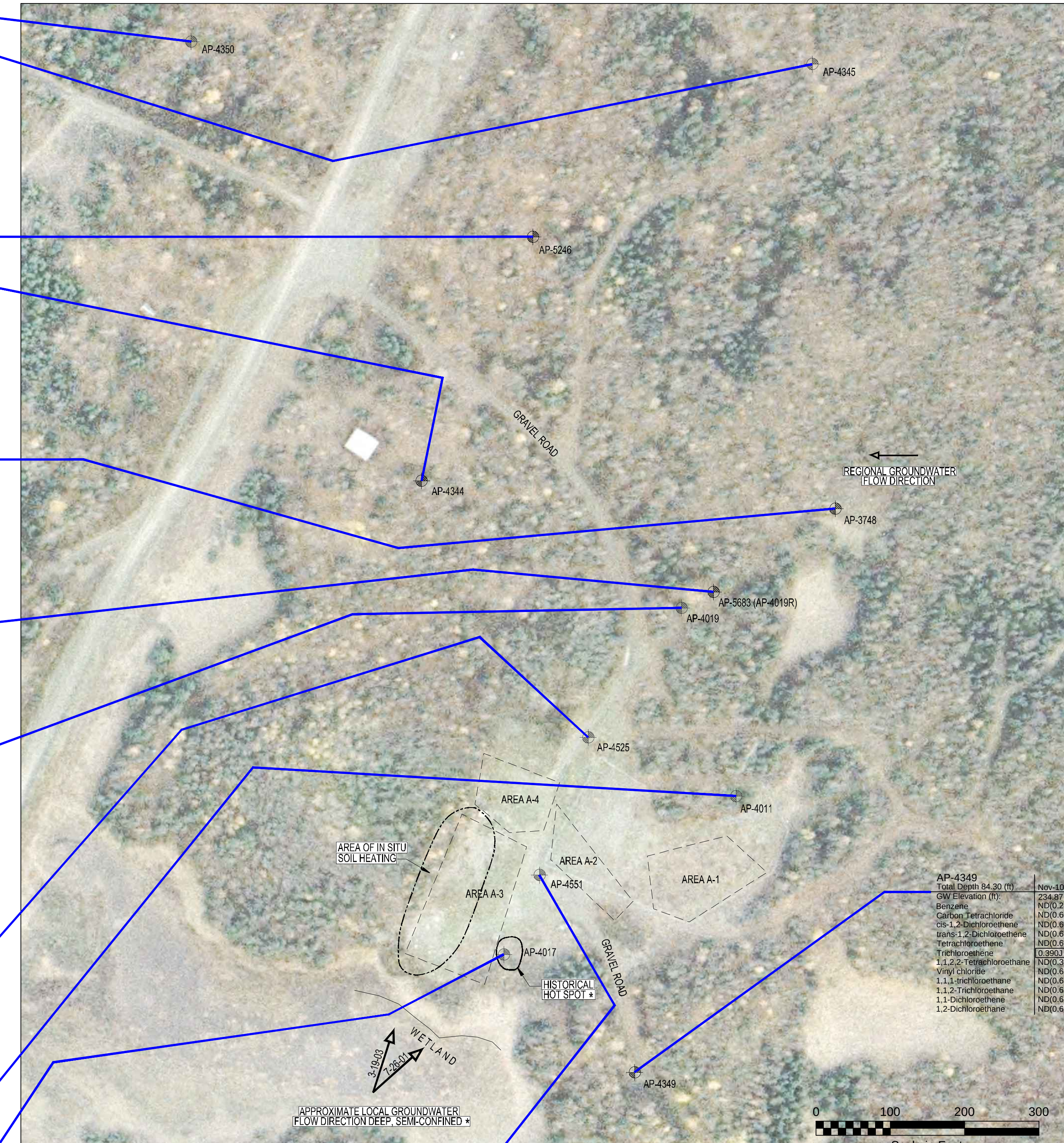
Total Depth 127.202 (ft)	Aug-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	May-09	Oct-09
GW Elevation (ft):	186.88	179.89	180.08	180.07	179.84	179.81	179.75	179.79	179.79
Benzene	0.69	0.54	ND (0.4)	ND(1)	0.58 J	ND(1)	NS	ND(0.400)	0.240J
Carbon tetrachloride	**13.9**	**7.6**	0.660J	3.2	ND (1)	0.92J	NS	2.16	ND(20.0)
cis-1,2-Dichloroethene	**384**	**387**	67.70	**340**	**81**	**140**	NS	**192**	**199**
trans-1,2-Dichloroethene	75.4	70.5	10.2	46.0	9.0	18.0	NS	33.8	36.5
Tetrachloroethene	**24.4**	**27.1**	**5.62**	**14**	2.7	5.1	NS	**11.4**	ND(20.0)
Trichloroethene	**5,720**	**4,530**	**865**	**3,500**	**600**	**1,800**	NS	2,060	2,270
1,1,2,2-Tetrachloroethane	**453**	**883**	**386**	**370**	**120**	**180**	NS	**82.0**	**108**
1,1-Dichloroethene	**9.04**	**9.94**	ND (1.0)	6.1 J+	ND (1.0)	1.50	NS	ND(1.00)	4.86
1,1,2-Trichloroethane	**34.5**	**29.2**	**13.9**	25.0	12	17	NS	**14.7**	**15.6**

AP-4011

Total Depth 138.799 (ft)	Oct-95	Nov-97	Jun-98	Oct-98	Mar-99	Oct-99	Apr-00	Oct-00	Apr-01	Mar-02	Sep-02	Mar-03	Sep-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	Jun-09	Oct-09
GW Elevation (ft):	181.33	181.43	181.40	181.17	181.50	181.66	181.33	181.07	181.30	178.18	178.54	178.48	178.61	179.86	179.79	179.72	179.46	179.91	179.86	179.78	179.79	179.82	179.49
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.64)	ND (0.32)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND(1)	ND(1)	ND(1)	ND(0.4)	ND(0.400)	1.72J+
Carbon Tetrachloride	ND	ND	1	ND	ND	1	1	1.2	0.85	0.67J	0.79J	0.11J	ND (0.43)	0.52J	0.58J	0.640 J	0.640 J	0.55 J	ND(1)	0.63J	ND(1)	0.440J	ND(1.00)
cis-1,2-Dichloroethene	5.3	ND	5	6	4	4.1	4	6	4.8	3.3	4.8	0.8	3.9J	3.73	3.3	3.25	2.49	3	3.1	2.7	2.52	2.41	2.52
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	0.56	ND	ND	0.71J	ND (0.12)	ND (0.61)	0.38J	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (0.09)	ND (0.45)	0.4J	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
Trichloroethene	**43**	**30**	**34**	**29**	**35**	**34**	**38**	**38**	**37**	**27**	**35**	**5.8**	**23J**	**24.2**	**24.9**	**24.8**	**18.2**	**19**	**17**	**17**	**16.9**	**15.8**	**15.5**
1,1,2,2-Tetrachloroethane	**82**	**47**	**54**	**29**	**18**	**47**	**71**	**33**	**18**	**12**	**8.8**	2.1	**10J**	3.39	3.56	2.7	ND (0.5)	1.3	1.3	1.2	0.78	1.05	0.590
Vinyl chloride	NA	NA	ND(1)	ND(1)	ND (1)	ND (1)	ND (1)	ND (0.3)	ND (0.5)	ND (0.31)	ND (0.31)	ND (0.11)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,1-trichloroethane										ND	ND	ND (0.12)	ND (0.61)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2-Trichloroethane										ND	0.51J	ND (0.082)	0.58J	0.32J	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1-Dichloroethene										ND	ND	ND (0.11)	ND (0.53)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,2-Dichloroethane										ND	ND	ND(0.074)	ND (0.37)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)

AP-4017

Total Depth 98.199 (ft)	Oct-95	Nov-97	Jun-98	Oct-98	Mar-99	Oct-99	Apr-00	Oct-00	Apr-01	Mar-02	Sep-02	Mar-03	Sep-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jun-07	Oct-07	Feb-09	Jun-09	Oct-09
GW Elevation (ft):	232.24	233.39	233.72	233.95	234.22	235.10	235.17	235.53	235.60	232.81	233.69	238.55	237.37	241.90	241.44	242.03	240.81	240.64	240.70	241.00	241.08	240.78	240.06
Benzene	ND	ND	ND	ND	ND	ND	ND	0.3J	ND	ND	0.53J	ND (3.2)	ND (3.2)	1.01	0.92	ND (0.4)	0.43	ND(1)	0.54 J	ND(1)	ND(0.4)	0.380J	0.370J
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND (4.3)	ND (4.3)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
cis-1,2-Dichloroethene	**280**	**ND**	**300**	**310**	**380**	**290**	**180**	**260**	**390**	**320**	**300**	**330**	**360**	**217**	**416**	**357**	**427**	**460**	**370**	**490**	**358**	**328**	**304**
trans-1,2-Dichloroethene	58	ND	82	74	75	59	49	56	100	110	120	100	83	21.2	**142**	**113**	**142**	**140**	**120**	**130**	**117**	97.8	91.0
Tetrachloroethene	ND	4	**5**	3	4	2	2	2.1	ND	4.2	3.9	ND (2.5)	ND (4.5)	2.4	2.44	2.90J	2.73	1.4	1.2	1.5	1.48	1.34	1.55
Trichloroethene	**1000**	**1300**	**920**	**850**	**1100**	**860**	**660**	**730**	**1300**	**810**	**1000**	**1000**	**1100**	**902**	**1430**	**1300**	**1530**	**1500**	**1200**	**1800**	**1,240**	**1,170**	**884**
1,1,2,2-Tetrachloroethane	**3100**	**1500**	**1800**	**1500**	**950**	**1500**	**690**	**1000**	**1200**	**700**	**780**	**690J**	**890J**	**483**	**526**	**481**	**458**	**370**	**280**	**420**	**250**	**204**	**206**
Vinyl chloride			ND(1)	ND(1)	ND (1)	ND (1)	ND (1)	0.089	ND (5)	2.7	2.7	ND (5.3)	ND (5.3)	0.7J	**2.54**	**2.00J**	**3.18**	**4 J+**	**2.5**	**2.3**	**5.5J+**	3.28	ND(50.0)
1,1,1-trichloroethane										ND	ND	ND (6.1)	ND (6.1)	ND (1.0)	ND (1.0)	ND (5.0)	ND (1.0)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1.00)	ND(1.00)
1,1,2-Trichloroethane										**21**	**25**	**23**	**31**	**18.7**	**25.7**	**23**	**25.9**	**18**	**16**	**20**	**18.0**	**16.2**	**16.8**
1,1-Dichloroethene										**12**	**11**	**9J**	ND (5.3)	**8.02**	**11.2**	**10.5**	**13.8**	**14 J+**	**11 J+**	**11**	**14.1**	ND(1.00)	13.2
1,2-Dichloroethane										ND	ND	ND (3.7)	ND (3.7)	ND (0.5)	ND (0.5)	ND (2.50)	ND (0.5)	ND(1)	ND(1)	ND(1)	ND(0.5)	ND(0.500)	ND(0.500)



AP-4349

Total Depth 84.30 (ft)	Nov-10
GW Elevation (ft):	234.87
Benzene	ND(0.240)
Carbon Tetrachloride	ND(0.620)
cis-1,2-Dichloroethene	ND(0.620)
trans-1,2-Dichloroethene	ND(0.620)
Tetrachloroethene	ND(0.620)
Trichloroethene	0.390J
1,1,2,2-Tetrachloroethane	ND(0.300)
Vinyl chloride	ND(0.620)
1,1,1-trichloroethane	ND(0.620)
1,1,2-Trichloroethane	ND(0.620)
1,1-Dichloroethene	ND(0.620)
1,2-Dichloroethane	ND(0.620)

AP-4551

Total Depth 97.999 (ft)	Oct-05	Sep-06	Jun-07	Oct-07	Jan-09	Jun-09	Oct-09
GW Elevation (ft):	210.92	210.98	211.18	211.11	210.98	211.09	210.83
Benzene	0.290J	ND(1)	0.67 J	ND(1)	NS	ND(0.400)	0.270J
cis-1,2-Dichloroethene	**85.5**	**150**	**180**	**180**	NS	**106**	**139**
trans-1,2-Dichloroethene	9.97	18	12	11	NS	7.96	10.2
Tetrachloroethene	2.52	4.2	1.9	2.9	NS	3.24	3.03
Trichloroethene	**1610**	**2300**	**1900**	**3000**	NS	**2,040**	**1,810**
1,1,2,2-Tetrachloroethane	**90.5**	**130**	**120**	**130**	NS	**65.6**	**101**
1,1,2-Trichloroethane	**8.27**	**12**	**9.8**	**11**	NS	**7.42**	**7.36**
1,1-Dichloroethene	**7.4**	**15 J+**	**11 J+**	**12**	NS	ND(1.00)	**7.57**

LEGEND

- Monitoring Well Location Sampled in 2011
- Monitoring Well Not Sampled in 2011
- ND Maximum Historic Concentrations

NOTES *

Groundwater elevation datum mean sea level (NAVD 88) in meters.
Previous groundwater elevations taken from archived reports.

All non-detect values before August 2004 are reported as the Method Detection Limit (MDL)

All non-detect values from 2010 to present are reported as the Limit of Detection (LOD)

2004 August and October non-detect values are reported as the Practical Quantitation Limit (PQL)

All concentrations are measured in µg/L

Exceedances compared against RAO or MCL

Regulatory Exceedances of RAO's or MCL's in **Bold, Blue**

Historical maximun concentrations/elevations are indicated by a box

Approximate Groundwater flow directions were obtained from Hydrogeology of the Poleline Road Disposal Area, (CRREL, 2003).

Hot Spot has been defined in the OUB ROD as the Area of Groundwater where 1,1,2,2-PCA concentrations exceed 1,000 µg/L.

ABBREVIATIONS:

ADEC = Alaska Department of Environmental Conservation

J = Estimated Quantity

J+ = Analyte is present, but value may not be accurate or precise (estimated high)

J- = Analyte is present, but value may not be accurate or precise (estimated low)

MCL = Maximum Contaminant Level

NA = Not Available

ND = No Analyte Detected

RAO = Remedial Action Objectives

ROD = Record of Decision

Cleanup Level Values

Chemical of Concern (COC)	ROD RAO
Benzene	5 µg/L
Carbon Tetrachloride	5 µg/L
cis-1,2-Dichloroethene	70 µg/L
Tetrachloroethene	5 µg/L
trans-1,2-Dichloroethene	100 µg/L
Trichloroethene	5 µg/L
1,1,2,2-Tetrachloroethane	5.2 µg/L
Post ROD COC	**ADEC MCL**
Vinyl chloride	2 µg/L
1,1,1-Trichloroethane	200 µg/L
1,1,2-Trichloroethane	5 µg/L
1,1-Dichloroethene	7 µg/L
1,2-Dichloroethane	5 µg/L

ORIGINAL FILE PREPARED BY CH2M HILL

OUB 2011 DEEP AQUIFER MONITORING WELLS AND RESULTS

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS®

DATE:	PROJECT MANAGER:	FIGURE NO. :
23 Jan 2013	K. Maher	4-2

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Evaluate and Modify the Treatment System (OUB)

Component 4 *– Evaluate and modify the treatment system as necessary to optimize effectiveness in achieving RAOs*

The dual-phase HVE treatability study completed during the summer of 1998 showed that further design work would be necessary before installation of a reliable system. The dual-phase system, as installed, was prone to shut down and took several hours to restart. The crux of the problem was the drop tubes used to extract air and water. The bottom of the drop tube was set just above the water table in the well. If the water level in the well rose rapidly, the drop tube would be flooded and unable to further extract either water or air. Groundwater samples collected during the test did not clearly indicate that the HVE system was effective at reducing the concentration of chlorinated solvents in the groundwater; therefore, the HVE system was never fully implemented and was decommissioned in October of 1998. Rather than exclusively use the selected remedy (HVE), SPSH was also used to treat the hot spot. The ROD stated that if HVE alone failed to remediate the source area within a reasonable time frame, then soil heating would be combined with the selected remedy.

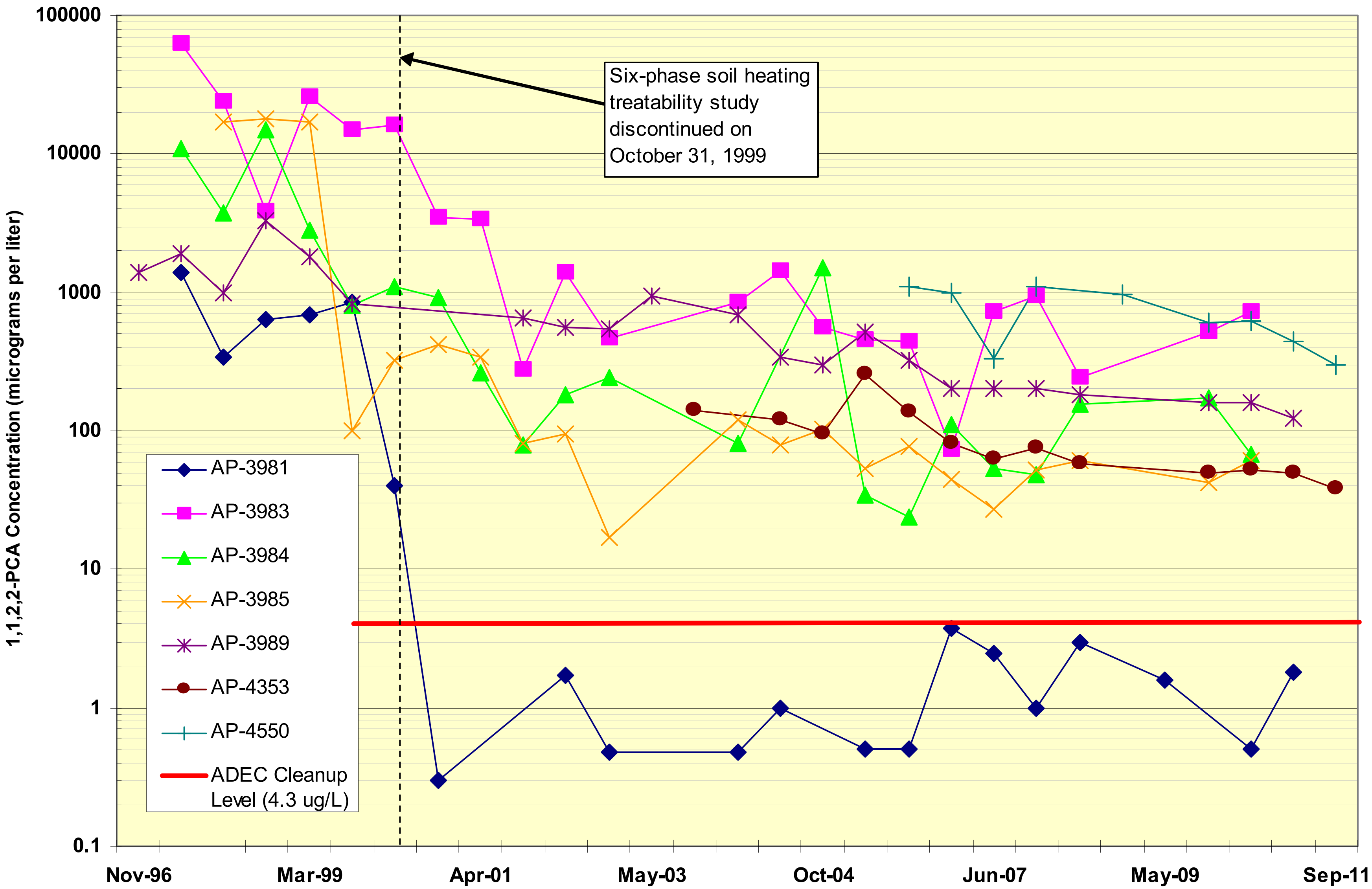
Monitor Groundwater (OUB)

Component 5a *– Monitor groundwater measurements to determine the attainment of RAOs and to detect and thoroughly characterize possible DNAPL. The HVE system is expected to operate from seven to twelve years for soil and shallow groundwater in the hot spot and natural attenuation is expected to last 150 years before the remaining groundwater meets state and federal MCLs and risk-based criteria.*

After a significant earthquake in 2004, free-phase solvent was identified in Monitoring Well AP-3746 (MW-14). In response, the groundwater sampling contractor began hand bailing of the free-phase solvent during site visits. No free-phase product has been observed at the site since January 2006.

Groundwater monitoring at OUB continues to provide data on groundwater contaminant trends. Samples are collected in accordance with, and the rationale for sampling each well is presented in, the *Long-term Groundwater Monitoring Work Plan* for OUB (USACE 2001). Twenty-three rounds of groundwater samples have been collected from November 1997 through November 2011. Separate reports for each of the groundwater monitoring events are available and included in the Administrative Record. Results of the groundwater samples collected during the groundwater monitoring have shown that the concentrations of the primary VOCs (1,1,2,2-PCA, TCE, and PCE) were reduced as a result of the SPSH treatment in 1997 and 1999. Figures 4-3 and 4-4 show contaminant concentrations over time for 1,1,2,2-PCA, TCE, and cis-1,2 dichloroethene. The latest groundwater monitoring report (USAF 2012a) includes a table with contaminant trends for 10 compounds in four wells. Using the Mann-Kendall statistical analysis, no compounds exhibit increasing trends, 10 have decreasing trends and 30 have no statistically significant trend.

In 2011, based on discussions concerning possible improvements to long-term monitoring at the March 2009 Fort Richardson FFA meeting, a Memorandum to the Site File (USAF 2011c) was compiled to amend the well sampling protocol at OUB. Key elements include a reduction in the number of wells sampled annually, identification of 'contingency' wells that can be used to increase the overall number of wells to be sampled if necessary (for example, following a seismic event), and the determination that a small number of 'sentinel' wells would be sampled in the year preceding each Five-Year Review. The six sentinel wells scheduled for pre-Five-Year Review sampling are: AP-3744, AP-3745, AP-3981, AP-3982, AP-3989, and AP-4350.



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OUB 1,1,2,2 - PCA CONCENTRATIONS VS TIME FOR SHALLOW WELLS			
JACOBS	DATE: 25 OCT 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 4-3

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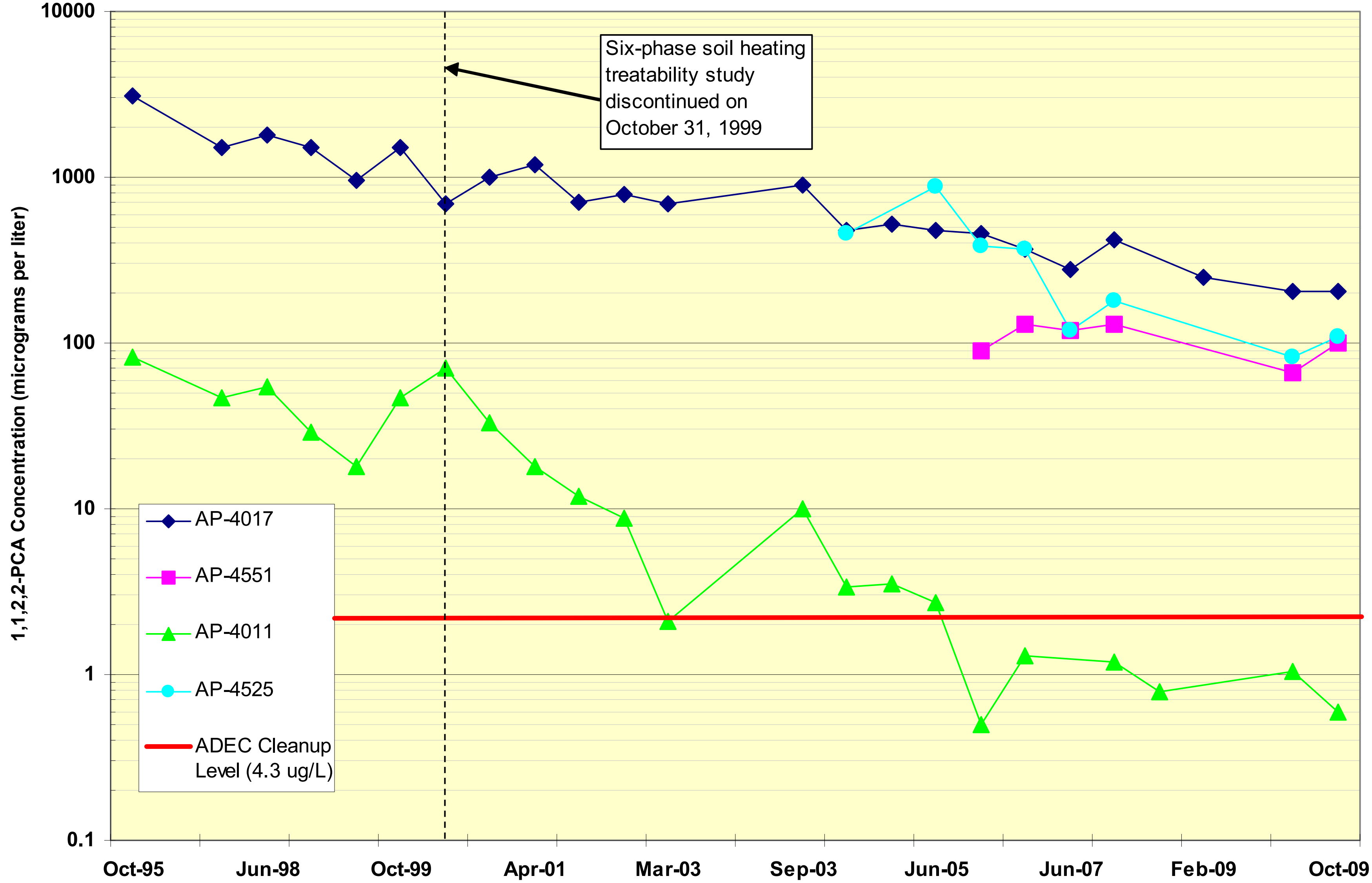

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OUB 1,1,2,2 - PCA CONCENTRATIONS VS TIME
FOR DEEP WELLS

JOINT BASE ELMENFORF-RICHARDSON, ALASKA

JACOBS	DATE: 25 OCT 2012	PROJECT MANAGER: K. MAHER	FIGURE NO: 4-4

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Evaluate HVE for Meeting Goals (OUB)

Component 6 *– Evaluate the effectiveness of the HVE system to meet long-term restoration goals during initial implementation*

An HVE pilot study was conducted in 1998. Soil gas and groundwater were extracted from two extraction wells. The HVE system primarily removed soil gas from low-permeability formations; groundwater removal was a secondary function. System monitoring was conducted twice weekly for the duration of the HVE system test. Extracted soil gas and groundwater were periodically sampled and analyzed for VOCs to monitor the effectiveness of the HVE system. Approximately 500,000 gallons of groundwater were extracted and treated during system operation, and an estimated 230 pounds of chlorinated solvents were removed from groundwater. Additionally, the system was estimated to have removed approximately 490 pounds of contaminants from the soil.

There were many equipment failures and shutdowns during operation of the system. Groundwater samples collected during the test did not clearly indicate that the HVE system was effective at reducing the concentration of chlorinated solvents in the groundwater. Because the system was not effective at reducing groundwater contaminants, HVE as a remedy for this site did not appear to meet the long-term restoration goals prescribed in the ROD and was therefore never fully implemented and was decommissioned in October of 1998.

Conduct Treatability Studies (OUB)

Component 7 *– Conduct treatability studies to evaluate innovative technologies with potential to enhance the selected remedies, and implement successful innovative technologies if the initial remedy proves ineffective*

Because the HVE system was not as effective at treating groundwater as anticipated by the ROD, the U.S. Army implemented a second treatability study to evaluate SPSH as an enhancement for the selected remedy. The SPSH treatability study ran from July to October 1999. SPSH uses six-phase electricity to resistively heat soils and groundwater and create an in situ source of steam to strip contaminants that are then captured using SVE. Both the 1997 and 1999 studies removed COCs from saturated and unsaturated soil. The 1999 study also showed that SPSH could remove

COCs from groundwater. In 1999, the SPSH system was used to heat a region approximately 110 feet long by 50 feet wide by 35 feet deep for 9 weeks. The volume of soil treated in 1999 was about 20 percent greater than treated in 1997. The mass of chlorinated solvents removed via the extracted soil in 1999 (1,450 pounds) was nearly twice the mass removed in 1997 (756 pounds). During the 1999 study, soil temperatures showed that soil at a depth of 25 feet in most locations was heated to approximately 100 °C, the boiling point of water. Once soil was heated to this temperature, water in the soil turned to steam and was removed by the SVE system. The volume of condensate from extracted soil gas averaged approximately 1,100 gallons per day. Concentrations of the primary VOCs detected in the off-gas and condensate generally decreased during operation of the SPSH system. The estimated mass of TCE, PCE, and 1,1,2,2-PCA removed via the off-gas was 1,385 pounds, while the mass of these contaminants removed in the condensate was 65 pounds. The concentration of solvents in the extracted soil gas during the 1999 Design Verification Study were very similar to the 1997 Design Verification Study and much higher than the concentration of solvents from the 1996 unheated SVE test. This result clearly demonstrates that heat enhancement increases the concentration of solvents in the extracted soil gas.

Soil samples collected before SPSH indicated the highest VOC concentrations were detected near the groundwater interface (about 15 to 25 ft bgs). After SPSH was completed, soil samples collected from borings located adjacent to the initial borings showed that approximately 99.9 percent of the 1,1,2,2-PCA present before treatment was removed from the soil within the treatment area. Removal of PCE ranged from 79.5 to 99.6 percent and removal of TCE ranged from 68.5 to 97.2 percent.

Maintain Institutional Controls (OUB)

***Component 8** – Maintain institutional controls, including restrictions governing site access, construction, and well development, as long as hazardous substances remain at levels that preclude unrestricted use on-site. Implement restrictions on groundwater until contaminant levels are below state and federal MCLs and risk-based criteria.*

LUCs are in effect at the PRDA site. LUCs include both engineering controls and administrative controls to restrict site access. Engineering controls include a locked gate on Poleline Road, signs posted around the perimeter of the site, the placement of concrete barriers at the nearby recreational trail, and fencing with signage at Areas A-1 and A-2 that prevent exposure to suspected discarded military munitions. Administrative controls in place for the site include groundwater use restrictions, construction restrictions, and restrictions for excavations through the Base Civil Engineer Work Clearance Request process (JBER-R 673 ABW Form 3). The JBER-R LUC instruction (673D Air Wing Instruction 32-7003, 11 May 2011) establishes the procedures, responsibilities, and policies for complying with LUCs at JBER-R. This document is provided in Appendix G of this document.

According to the project manager for this site, the U.S. Army conducted visual inspections at the site to verify effectiveness of the engineering and administrative LUCs before joint basing. However, no records used to document the inspections were identified. Since joint basing, LUC inspections were incorporated into tasks associated with annual monitoring. The site inspection conducted to support this Five-Year Review found the engineering controls were in place. One set of all-terrain vehicle (ATV) tracks were found on the site. It was not determined whether the ATV access was authorized for site work, or if unauthorized recreational users had gained site access.

4.1.3 OUB System Operations & Maintenance Plan

No active systems are currently operated as part of remediation at OUB.

4.2 OUC EAGLE RIVER FLATS AREA REMEDIAL ACTION

Particulate white phosphorus in sediment is the principal COC at the ERF source area. When white phosphorus particles settle into pond and marsh sediments that remain saturated, they can last for an indefinite time. However, white phosphorus particles will break down into harmless materials when exposed to air and temperatures above 15 °C. A grid for collecting composite samples was established in 1998, which was the first year that a decline in white phosphorus concentration was evident. Sampling results showed that the highest concentration of white phosphorus was found on Racine Island, followed by Bread Truck, and Pond 183 in Area C. The average depth of white phosphorus is generally within the top 8 inches of sediment, but it has been found as deep as 24 inches.

Only small amounts of white phosphorus were found in Areas A and C/D. However, bird use and deaths in Area A were historically high. No white phosphorus was detected in Areas B and D. White phosphorus has not been detected in the water of the gullies or the Eagle River. Only trace amounts of white phosphorus contamination have been detected in the gully sediments. No evidence of movement of white phosphorus through Eagle River to Knik Arm was found.

4.2.1 OUC Remedy Selection

Remedial Action Objectives (OUC)

As part of the RI/FS process, RAOs were developed in accordance with NCP and EPA guidance for conducting RI/FS investigations. The primary objective of the selected remedies is to reduce the number of waterfowl deaths attributable to white phosphorus. At the time of this review, both the short and long-term objectives have been met. Short- and long-term RAOs for the selected remedies at OUC are as follows:

- Within five years of the ROD being signed, reduce the dabbling duck mortality rate attributable to white phosphorus to 50 percent of the 1996 mortality rate attributable to white phosphorus. Radio tracking and aerial surveys suggest that about 1,000 birds died from white phosphorus at ERF in 1996. Therefore, the allowable number of duck deaths from white phosphorus would be approximately 500.
- Within 20 years of the ROD being signed, reduce the mortality attributable to white phosphorus to no more than 1 percent of the total annual fall population of dabbling ducks in the ERF. The 2010 dabbling duck population was about 5,000. Therefore, the allowable number of duck deaths from white phosphorus would be approximately 50. This long-term goal could be adjusted based on future population studies conducted during the monitoring program.

It was determined that these objectives would be achieved by reducing the area of white phosphorus -contaminated media; thus, reducing waterfowl exposure to white phosphorus. Reducing the exposure to white phosphorus reduces the availability of white phosphorus to ducks, which in turn reduces duck deaths.

ARARs (OUC)

The OUC ROD cited the most significant ARARs for the remedy selection at OUC ERF to be:

- Section 404 of the Clean Water Act, which coincides with Alaska water quality standards, for protection of wetlands.
- Provisions in the Migratory Bird Treaty Act of 1972 that prohibit unregulated "taking" of birds, including poisoning at waste sites.

Selected Remedies (OUC)

The major components of the preferred remedy and their status are listed in Table 4-4 below.

Table 4-4
OUC Remedy Status

Remedy Component	Status
Treat Contaminated Sediment	
Treat white phosphorus -contaminated sediment by draining ponds with pumps. Pumping will allow the sediments to dry and the white phosphorus to sublimate and oxidize. The treatment season will begin in May and end in August or September. A pond elevation survey will be conducted to determine the optimal pump placement. To enhance drainage, explosives may be used to make small sumps for the pumps and shallow drainage channels. These shallow drainage channels will enhance the hydraulic connectivity between ponds to encourage drainage.	Completed in 2012
Minimize Disturbance to Wetlands	
Implement the following protective procedures to minimize disturbances to wetlands habitat: Restriction of activities that disturb wildlife in Area B and Area D, which are prime waterfowl habitat areas • Selection of the narrowest and shortest walking corridors to minimize disturbances to vegetation and habitat • Proper maintenance of equipment and structures • Minimize the use of equipment and staging-area footprints • Minimal localized use of explosives • Preparation of work plans and solicitation of agency reviews • Monitoring for impacts to wetlands habitat • Monitoring for waterfowl use of ERF	Ongoing
Sample Sediment Prior to Treatment	
Sample pond bottoms for white phosphorus at the beginning of the treatment season to confirm or determine that the pond or area requires remediation. The sampling would also establish a white phosphorus baseline and determine additional areas that may require remediation. The baseline sampling would be performed at the beginning of each field-pumping season.	Completed in 2012
Sample Sediment after Treatment	
Sample pond bottoms for white phosphorus after treatment to determine effectiveness of the treatment system. This verification sampling would be performed at the end of each field-pumping season.	Completed in 2012; will occur prior to Five-Year Review
Perform Telemetry Monitoring & Aerial Surveys	

Table 4-4
OUC Remedy Status (Continued)

Remedy Component	Status
Perform telemetry monitoring and aerial surveys concurrently with pumping activities to determine bird populations, usage, and mortality. These activities would begin in 1999. Monitoring continued for three additional years to verify that short-term goals were maintained.	Completed in 2012; will occur prior to Five-Year Review
Evaluate Waterfowl Mortality	
Perform limited aerial surveys and ground-truthing to evaluate waterfowl mortality, physical habitat changes, and vegetation rebound.	Completed in 2012
Perform Aerial Photography	
Perform aerial photography (beginning in 1999) to monitor habitat changes resulting from remedial actions. Changes in drainage, topography, and vegetation would be evaluated.	Completed in 2010
Perform Habitat Mapping	
Perform habitat mapping to evaluate impacts to habitat as a result of remedial actions, as well as to observe habitat rebound after pumping is discontinued.	Completed in 2012
Perform Limited Hazing	
Perform limited hazing (only as a contingency) starting in 1999, if incidental hazing from pumping operations and other fieldwork activities does not deter bird usage.	Completed in 1999
Cap-and-Fill	
After RAOs are achieved and pumping is discontinued, apply cap-and-fill material in ponded areas that did not drain and dry sufficiently to enable the white phosphorus to sublimate and oxidize.	Completed in 2012; will occur prior to Five-Year Review
Monitor Cap-and-Fill Integrity	
Monitor cap-and-fill material integrity after the material is placed.	Ongoing
Create GIS Database	
Incorporate white phosphorus sampling, telemetry, aerial survey, habitat, and physical landform data into a GIS database.	Ongoing
Maintain LUCs	
Maintain LUCs, including the restrictions governing site access, construction, road maintenance, and the required training for personnel who work at OUC source areas. The objective of these LUCs is protection of human health, safety, and the environment by limiting or preventing access to contaminated areas or otherwise denying exposure pathways.	Ongoing

Notes:
GIS = Geographical Information System
LUC = land-use control
For additional definitions, see the Acronyms and Abbreviations section.

4.2.2 OUC Remedy Implementation

At the time of this Five-Year Review, both the long and short-term objectives have been met. Remediation activities have been completed and sediment-sampling has verified a sustained decrease in concentrations of white phosphorus at the site. Additionally, waterfowl mortality rates have significantly decreased since the inception of the remedial process, indicating that RAOs are being met. Because duck mortality data are obtained concurrently with sampling activities that can cause bird hazing, the true mortality will not be known until after field activities are completed.

Treat White Phosphorus -Contaminated Sediment (OUC)

***Component 1** – Treat white phosphorus-contaminated sediment by draining ponds with pumps beginning in 1999. Pumping will allow the sediments to dry and the white phosphorus to sublimate and oxidize. The treatment season will begin in May and end in August or September. A pond elevation survey will be conducted to determine the optimal pump placement. To enhance drainage, explosives may be used to make small sumps for the pumps and shallow drainage channels. These shallow drainage channels will enhance the hydraulic connectivity between ponds to encourage drainage.*

The estimate at the time the ROD was written was that it would take five years of dewatering the ERF wetland to remediate white phosphorus contamination. Wet conditions (high precipitation and flooding tides) during several years resulted in limited sediment drying, and also previously undetected white phosphorus was discovered in the C and C/D areas. These areas were also difficult to drain and sediment drying was slower than anticipated. These factors lead to the decision to extend active pond pumping through the 2007 field season. A summary of the yearly activities performed at ERF is provided below.

2004

One pump system was deployed in Pond 146 to drain Area C in support of monitoring efforts. Interconnected drainage channels previously excavated in the area allowed the pump to reduce the water in the Northern C Marsh and in Ponds 146, 155, 171, and 183 despite monthly flooding tides. Extended drying periods were experienced in the Northern C Marsh and in Ponds 146, 171, and 183, while only marginal drying periods were experienced in Pond 155 as significant amounts of water remained in the pond's drainage system due to the lack of additional pumps.

Drainage channels were excavated at the Duck Pond Complex in southeastern Bread Truck. The drainage system had an immediate effect on the pond complex, allowing some ponds to dry prior to the first flooding tide in late August.

Several white phosphorus rounds were mistakenly detonated in the Northern C Marsh, ejecting particles of white phosphorus into Area C. The accidental release of white phosphorus coupled with the continued mortality observed in the area prompted remedial project managers to expand the treatment of Area C.

2005

Limited remediation continued in 2005 with two pump systems. The first system was deployed in Pond 146; the second system was deployed in the Bomb Crater sump. Despite the additional pump, some water remained in the Area C drainage system over the treatment season. A continuous 63-day non-flooding period from late May through late July assisted in the drying of Ponds 146, 155, 171, and 183; however, multiple flooding tides followed this period, interrupting remediation. Sensors placed in the sediment of the northern drainage channel for Area C and in the Blow-In-Place Craters east of Pond 155 showed little drying. However, sections of the marsh's southern drainage channel did appear to dry.

Favorable conditions were experienced at the Duck Pond Complex. An additional tide gate was installed and sediment at the monitoring station was desaturated for 22 days.

2006

Limited remediation continued with three pump systems. The first two systems were deployed in the same areas as 2005; the third system was deployed in the southernmost channel complex in Area C. High points in existing drainage channels were deepened and new drainage channels were excavated to promote the drying of the Northern C Marsh drainage system. Drainage channels were also excavated in southern Area C near a newly delineated contaminated area. A continuous 87-day non-flooding period from mid May through late August allowed ponds and hotspots to dry despite frequent rain. Sediment in the Northern C Marsh drainage system showed periodic drying.

Sheet flooding from the south affected remediation at the Duck Pond Complex. The complex was slow to dry but sediment at the monitoring station was desaturated for 10 days. Rusted hinges on a tide gate were replaced.

2007

Limited remediation continued in 2007 with three pump systems deployed in the same areas as 2006. The generator for the pump system in Pond 146 experienced major mechanical problems and was inoperable for a significant portion of time. As a result, the sediment in the areas typically drained by this system remained saturated during most of the treatment season. Additional drainage channels were excavated in the Northern C Marsh to further promote the drying of the drainage system sediments. Sediment monitored in the marsh’s southern drainage channel was desaturated for 24 days.

The drainage channels excavated in 2006 in southern Area C were effective in draining ponds in this area. Sediment in this area experienced intermittent drying. The drainage channels and tide gates at the Duck Pond Complex functioned effectively. Sediment monitored at the Duck Pond Complex was desaturated for 39 days.

2008 to 2012

Remediation activities were completed at the end of the 2007 field season (as described above); however, one pump system was re-installed in Pond 146 to assist in the initial drawdown of water levels to ease access for duck mortality monitoring efforts and to provide safer working conditions for future fieldwork. Per Remedial Project Manager direction, the pump will only operate periodically in the spring and fall when activities are conducted on the flats. A Memorandum to the site file, dated 23 November 2011, clarified the schedule of future activities at the ERF because the schedule in the 1998 OUC ROD had expired. Additionally the 2011 Memorandum outlined that white phosphorus sampling at the treated ponds will only occur in the year preceding Five-Year Reviews because ROD RAOs have been achieved.

Implement Protective Procedures to Minimize Disturbances to Wetlands (OUC)

Component 2 *– Implement the following protective procedures to minimize disturbances to wetlands habitat:*

a) Restriction of activities that disturb wildlife in Area B and Area D, which are prime waterfowl habitat areas

Remediation activities did not take place in Areas B and D; therefore, no access is required into or through these areas.

b) Selection of the narrowest and shortest walking corridors to minimize disturbances to vegetation and habitat

Walking paths to sampling areas are flagged, and prior to use, a UXO technician clears the areas along the paths. All access within ERF is limited to these cleared and flagged paths. This ensures the safety of the personnel by limiting potential exposure to UXO, while also limiting the potential impacts to the habitat to a few restricted paths.

c) Proper maintenance of equipment and structures

Pumping equipment is inspected and maintained prior to use by a qualified O&M contractor. During system operations, equipment is monitored through on-site inspections. External fuel tanks for the generator sets are ADEC-approved, and double-walled tanks and an oil spill prevention and cleanup plan are in place. Spill kits are deployed at each generator set in the field and at the staging area on the OB/OD pad adjacent to ERF. No fuel is stored on the OB/OD pad and the pad is maintained for cleanliness.

d) Minimize the use of equipment and staging-area footprints

Generator sets, pump systems, external fuel tanks, discharge pipe, and supplemental materials are airlifted into ERF by helicopter to minimize potential impacts. Whenever possible, generator sets are operated on shore to minimize potential spill impacts and spill containment structures are constructed beneath all deployed generator sets. Additionally, the staging area is confined to the OB/OD gravel pad located at the edge of the ERF.

e) Minimal localized use of explosives

Sumps for the floating pump systems were explosively excavated in the early spring prior to arrival of waterfowl at ERF. Sumps are located within existing pond basins. Explosives were used to excavate shallow drainage channels to link various low points within pond basins to the sump pumps. All ditching was completed within pond basin complexes and did not affect the external drainage of these ponds. Once pumping remediation was completed within a pond complex and the pump was removed, the pond refilled naturally and the sumps and ditches became part of the pond habitat. As described above, remediation was completed at the ERF in 2007; therefore, there are no plans for the use of explosives in association with the placement of remediation sumps.

f) Preparation of work plans and solicitation of agency reviews

The *2009 Long Term Monitoring and Remediation Work Plan* (ERDC/ U.S. Army Cold Regions Research and Engineering Laboratory [CRREL] 2009) was generated to assist remedial project managers in determining how wetland habitats will be monitored. Per agreement by the remedial project managers, made during a quarterly federal facility meeting in January 2008, the work plan contains a schedule that is slightly different from the ROD schedule. A modified schedule was deemed necessary due to accelerated achievement of the

RAOs outlined in the ROD. The modified schedule was clarified in the Memorandum to the Site File, Operable Unit C – Eagle River Flats Impact Area, 23 November, 2011.

g) Monitoring for impacts to wetlands habitat

A monitoring program is in place to assess changes to wetlands habitat due to remediation efforts. Aerial photography, long-term study plots, and ground-based field observations are used to monitor changes. *The 2009 Long Term Monitoring and Remediation Work Plan* (ERDC/CRREL 2009) and the Memorandum to the Site File (November 2011) have been generated to assist remedial project managers in determining how wetland habitats will be monitored in the future.

h) Monitoring for waterfowl use of ERF

U.S. Fish & Wildlife Service personnel conduct annual aerial surveys during the field season.. The aerial survey data provides detailed information on both the numbers of waterfowl using ERF and the specific areas used by waterfowl for resting and feeding activities.

Sample Pond Bottoms for White Phosphorus (OUC)

Component 3 – *Sample pond bottoms for white phosphorus at the beginning of the treatment season to confirm or determine that the pond or area requires remediation. The sampling also would establish a white phosphorus baseline and determine additional areas that may require remediation. The baseline sampling would be performed at the beginning of each field-pumping season.*

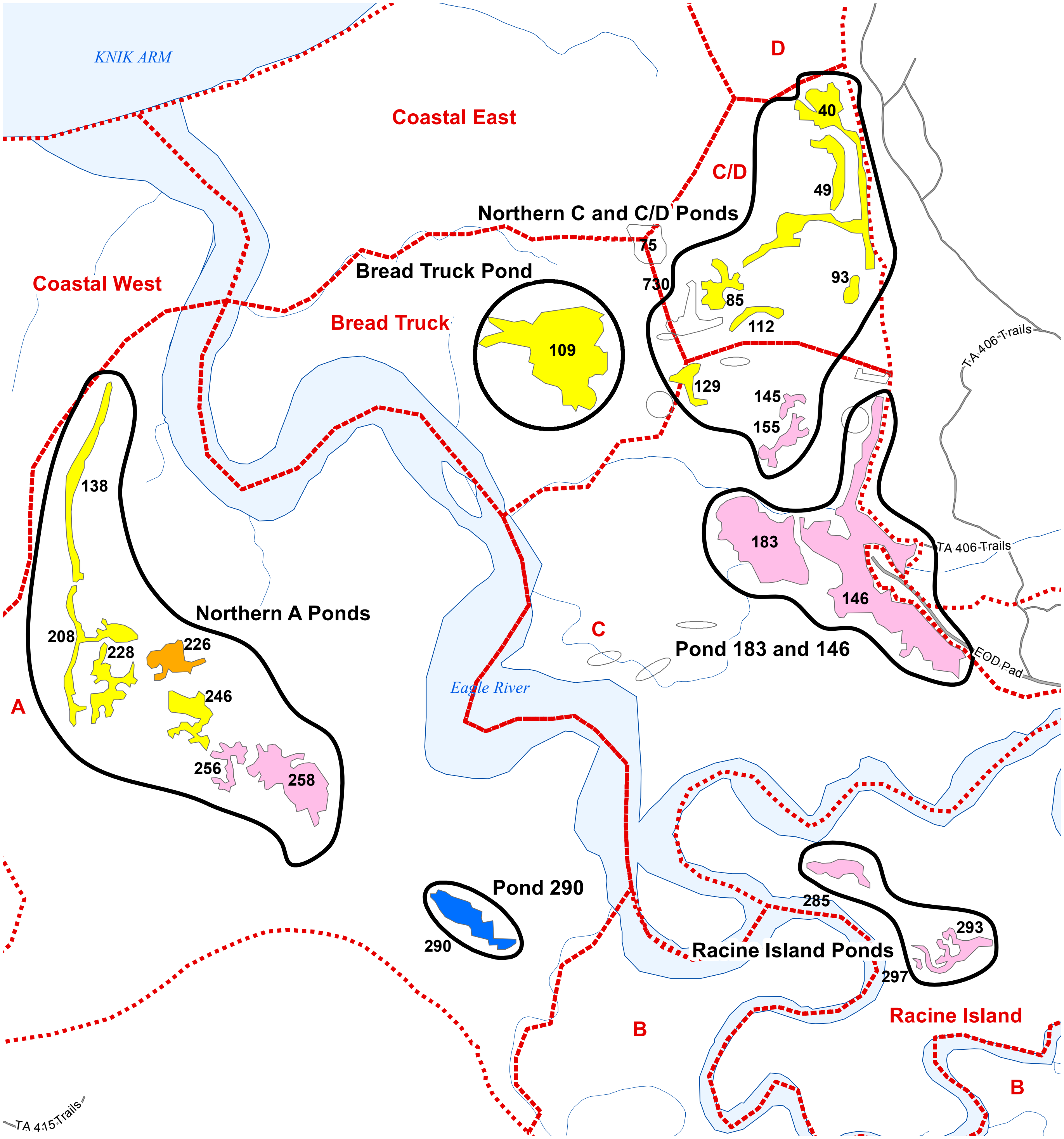
Component 4 *– Sample pond bottoms for white phosphorus after treatment to determine effectiveness of the treatment system. This verification sampling would be performed at the end of each field-pumping season.*

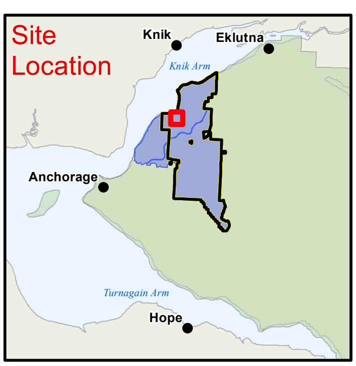
Composite sampling for white phosphorus at OUC has been conducted during each field season. Magnetometer surveys have also been performed at ERF to assist in the identification of objects that may contribute to white phosphorus contamination. Discrete sampling is conducted when UXO, ordnance scrap, or fragments potentially containing white phosphorus are discovered. Sample data for each year are compared to those from previous years and to mortality studies to determine the progress of remediation and to identify additional areas of contamination. Figures 4-5 through 4-8 illustrate pond status at the end of select treatment seasons. A summary of pond sampling results and identification of other items potentially containing white phosphorus from the latest draft RA summary report (USACE 2011a) is provided below:

- Ponds 183, 146, 171, and 109 have been periodically sampled to confirm continued clean status. Results from sediment samples collected from these ponds indicated that the concentration of white phosphorus has consistently been less than the detection limit of 0.0002 μg/g.
- Five permanent ponds located in Area A have been treated by pond pumping. However, mortalities have periodically been detected in the area. In 2010, Ponds 226 and 258 in Area A were sampled. The results from Pond 226 were 0.036, 0.036, and 0.077 μg and the results from Pond 258 were 0.068, 0.049, and 0.035 μg. However, white phosphorus was not detected in samples collected from these ponds in 2011.
- In May 2010, white phosphorus was detected in multi-incremental sediment samples collected from the southwest arm of Pond 730 at concentrations of 0.0002 and 0.009 μg/g. Ordnance scrap was discovered in the northern section of the pond in August 2011 and a sediment sample co-located with the scrap exhibited a white phosphorus concentration of 130 μg/g. A sample collected a few meters from the anomaly had a concentration of 7.2 μg/g.
- Ditches were installed in the C Marsh to promote drainage and enhance the drying of the surrounding surface sediments. These ditches bisected some of the most contaminated sediments in ERF. Based on the analytical results from the chemical analyses performed on samples collected from the ditches, four areas were capped during the winters of 2008 and 2009. Sampling at the cap perimeters in May 2009 indicated white phosphorus at a relatively high concentration at the intersection of the cross ditch and south ditch. In September 2009, white phosphorus was detected in the south ditch on the west side of the cap. In 2010, samples collected from the cross ditch and the western part of the North Ditch exhibited non-detectable concentrations of white phosphorus. Similarly, samples collected from the North Ditch, west of the sump, were all nondetect.
- Samples collected from Pond 155 in 2008 had low concentrations of white phosphorus; however, it was not detected in samples collected the following year. Low concentrations of white phosphorus were detected again in 2010 (0.0003 and 0.0009 μg/g) and in 2011 (up to 0.00043 μg/g). Ordnance has not been detected in the area.
- Due to limited accessibility, Racine Island had not been monitored to the same degree as other remediated areas. Duplicate multi-incremental samples collected in September 2009, indicated the presence of white phosphorus. In May 2010, white phosphorus was detected in samples collected from four clusters of craters that held standing water. In September

2010, a water-covered area where ordnance scrap had been discovered was sampled; subsequent sampling indicated the localized presence of white phosphorus in the vicinity of the ordnance scrap. Samples were collected from an area west of the AquaBlok Pond in July 2011; white phosphorus was not detected in these samples.

- In May 2010, a team from the JBER-R EOD Attachment found a 4.2-inch white phosphorus projectile and a 155-mm projectile while clearing a path for the beluga monitoring program. These two ordnance items were detonated in a gully near the mouth of the river. On 15 May 2010, surface sediment samples were collected from inside the detonation crater and within 1 m of the edge of the crater. Concentrations of white phosphorus were detected at 0.34 µg/g inside the crater and 4.5 µg/g outside the crater. A sample collected from the subsurface sediment exhibited a concentration of 100 µg/g.





OUC Site
Pond Group
Pond
Identified in ROD as contaminated or potentially contaminated with white phosphorus
Confirmed contaminated or newly identified as contaminated with white phosphorus
Undergoing remediation
Remediated

All Locations Are Approximate
0 500 1,000 1,500 2,000
Feet
WGS 1984 UTM Zone 6N

N

OUC EAGLE RIVER FLATS POND STATUS AT THE END OF THE 1998 SEASON AND THE SIGNING OF THE ROD

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 09 JAN 2013	PROJECT MANAGER: K. MAHER	FIGURE NO: 4-5

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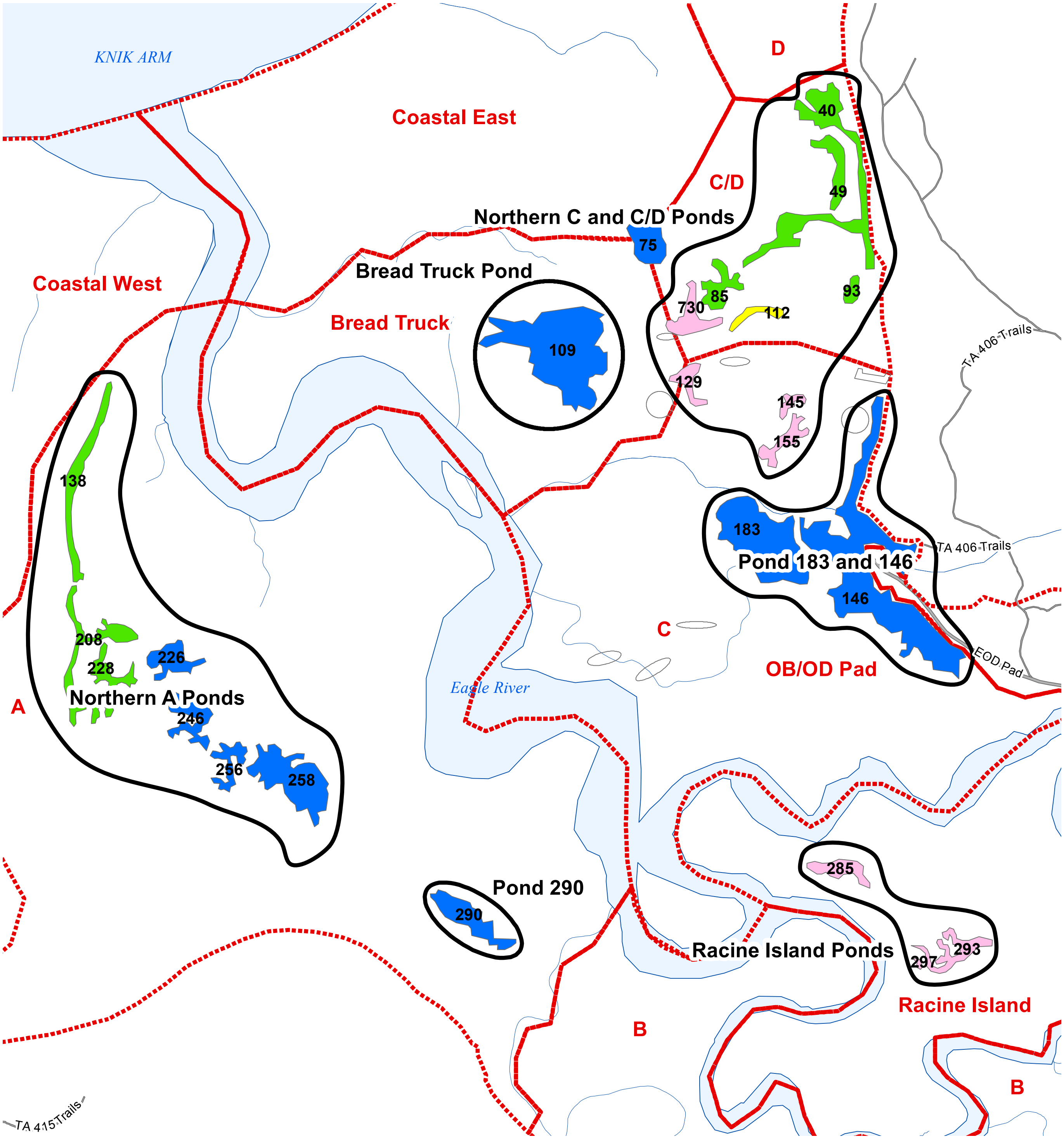

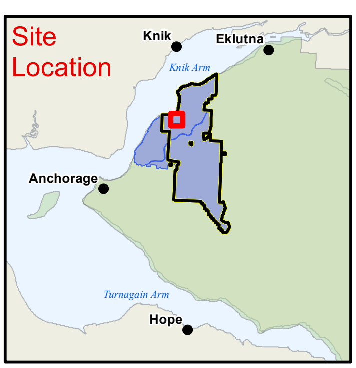

OUC Site
Pond Group
Pond
Identified in ROD as contaminated or potentially contaminated with white phosphorus
Tested and confirmed as uncontaminated with white phosphorus
Undergoing remediation
Remediated

All Locations Are Approximate

0 500 1,000 1,500 2,000
Feet

WGS 1984 UTM Zone 6N

N

OUC EAGLE RIVER FLATS POND STATUS
AT THE END OF THE 2002 SEASON

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 09 JAN 2013	PROJECT MANAGER: K. MAHER	FIGURE NO: 4-6

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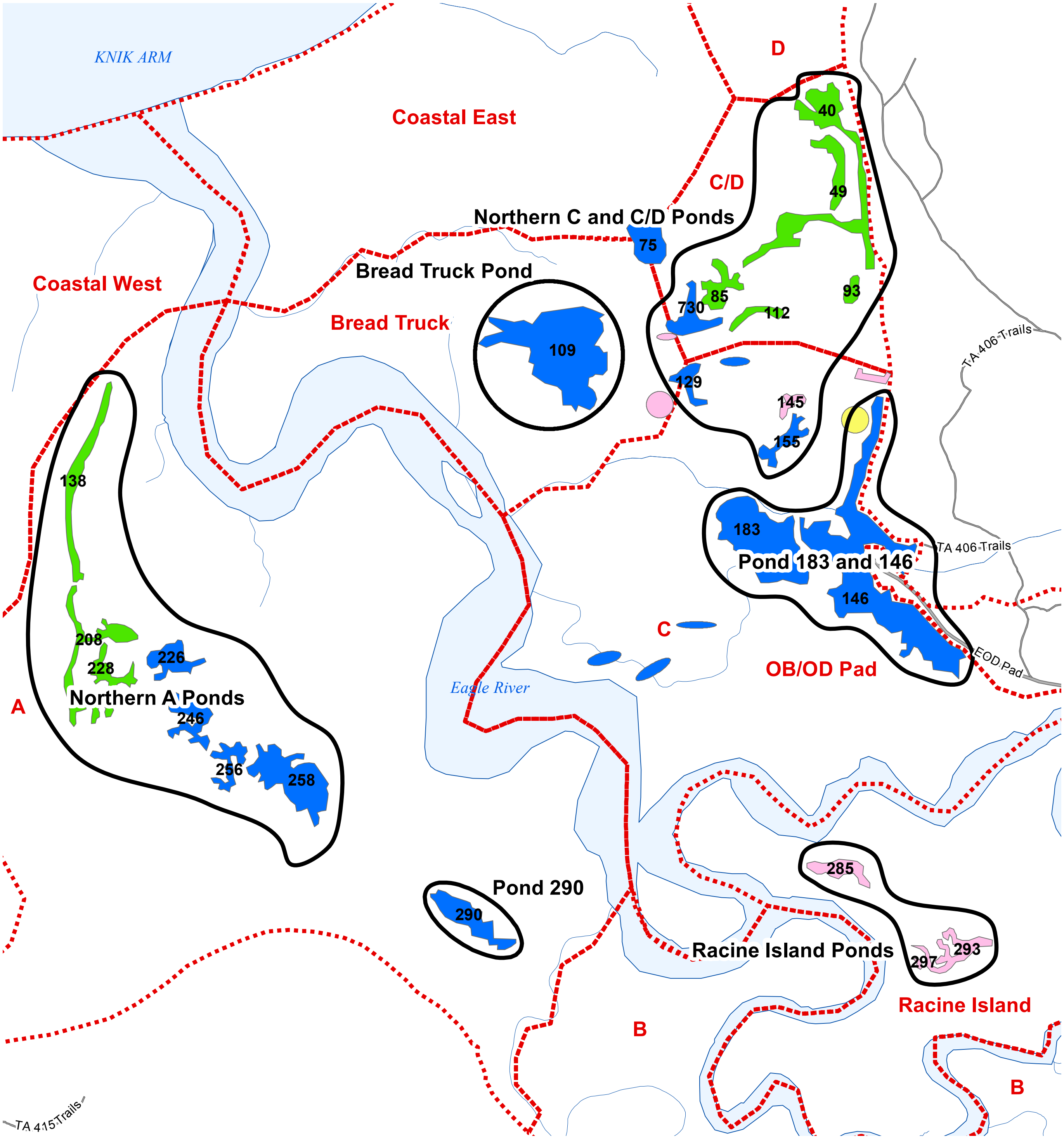

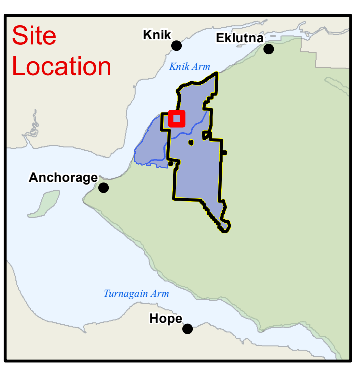

OUC Site
Pond Group
Identified in ROD as contaminated or potentially contaminated with white phosphorus
Tested and confirmed as uncontaminated with white phosporus
Undergoing Remediation
Remediated

All Locations Are Approximate
0 500 1,000 1,500 2,000
Feet
WGS 1984 UTM Zone 6N

N

OUC EAGLE RIVER FLATS POND STATUS
AT THE END OF THE 2007 SEASON

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 09 JAN 2013	PROJECT MANAGER: K. MAHER	FIGURE NO: 4-7

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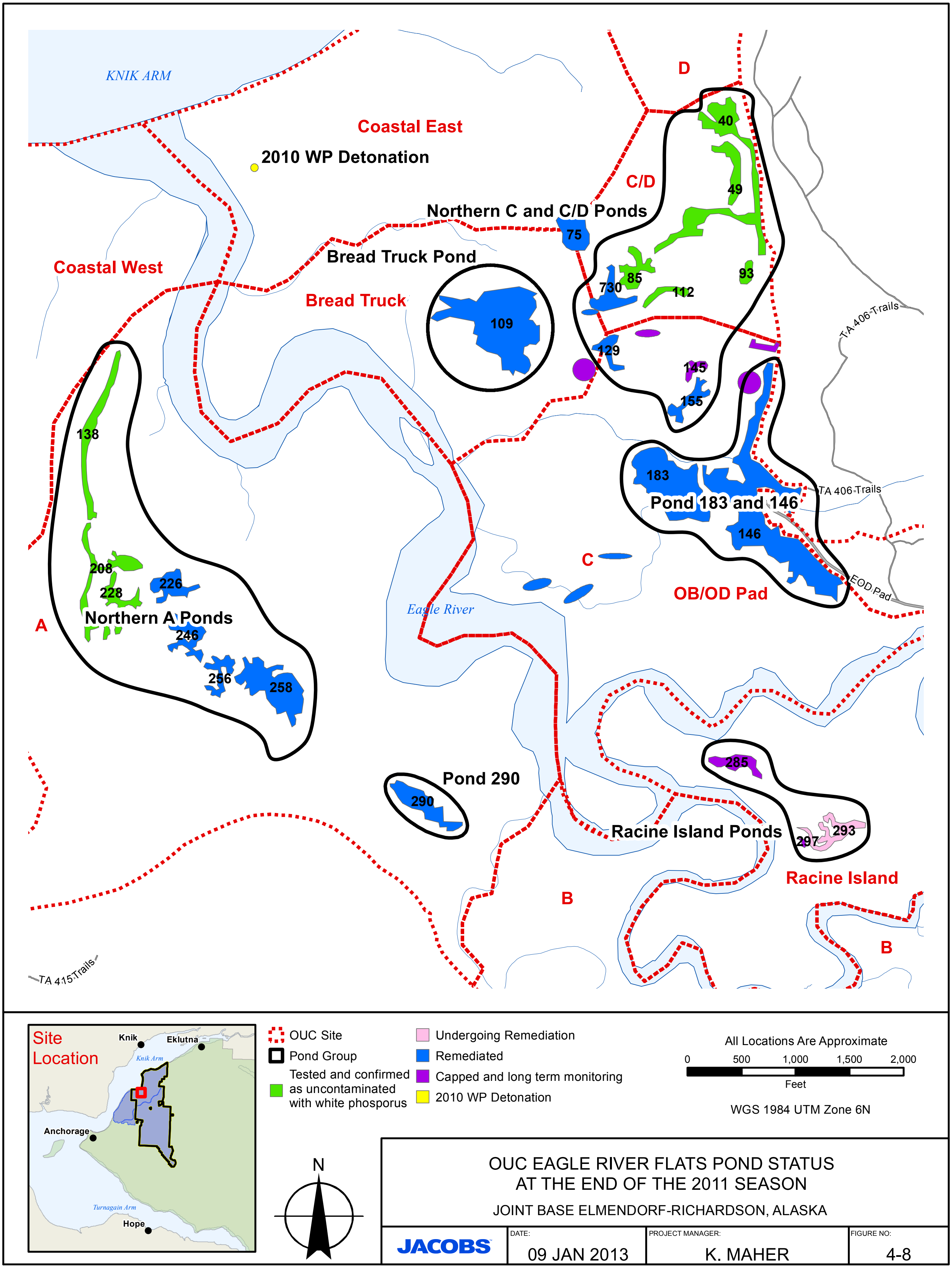

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Perform Telemetry Monitoring and Aerial Surveys (OUC)

Component 5a – *Perform telemetry monitoring and aerial surveys concurrently with pumping activities to determine bird populations, usage, and mortality beginning in 1999.*

Aerial surveys have been performed at ERF to monitor bird populations and usage. In 2004, telemetry monitoring ceased and ground-based mortality surveys were undertaken due to the helicopter procurement issues. Additionally, the weight-of-evidence approach was adopted for ERF to increase the precision of the available data. As described in the CLOSES Evaluation for OUC, the census data from the aerial surveys are combined with the transect survey data in a mortality model to estimate the dabble mortality attributable to white phosphorus. According to the data, waterfowl mortality has decreased significantly since 1996, when approximately 655 ducks died due to the ingestion of white phosphorus. Table 4-5 presents estimated mortality data from 1996 through 2011.

Table 4-5
OUC Waterfowl Mortality Rates

Year	Estimated Mortality	Estimated Mortality Rates
1996	655	10.6% to 23.9%
1997	240	4.3% to 9.7%
1998	355	7.6% to 17.1%
1999	196	13.4% to 30.2%
2000	-	-
2001	87	2.4% to 5.4%
2002	224	7.2% to 16.2%
2003	-	-
2004	111	2.5% to 5.7%
2005	49	1.9% to 4.3%
2006	25	0.5% to 1.1%
2007	35	0.6% to 1.3%
2008	12	0.2% to 0.4%
2009	44	0.7% to 1.7%
2010	22	0.3% to 0.8%
2011	14	0.4% to 0.9%

Notes:
Telemetry monitoring did not occur in 2000 and 2003. This was due to a contracting problem as well as low availability of a helicopter at the time due to the high occurrences of forest fires in other areas of Alaska (USAF 2012b).

Component 5b – *Continue Monitoring for 3 additional years to verify that short-term goals are maintained.*

As presented in the Memorandum to the Site File (November, 2011), the current estimated number of mortalities attributable to the ingestion of white phosphorus continues to satisfy the short-term RAO of less than 500 deaths attributable to white phosphorus (as stated in the OUC ROD). As presented in Table 4-5, above, mortality rates from 2008 to 2011 have fallen below the long-term RAO of less than 1 percent. Mortality monitoring will continue through 2012 and provide seven years of consistent data that can be used to determine if the long-term RAO has been met. An additional monitoring event will be conducted in 2016, prior to the Five-Year Review, and serve as a means to check the protectiveness of the remedy.

Component 6 – *Perform limited aerial surveys and ground-truthing to evaluate waterfowl mortality, physical habitat changes, and vegetation rebound.*

As presented in the Memorandum to the Site File (November 2011), limited aerial surveys were initially incorporated as some means to assess mortality until the long-term RAO was achieved (initially projected to be 2018). However, the scope of this component is not defined in the ROD and the meaning of the term “limited” is therefore unclear. The long-term RAO has been consistently met since 2006. Therefore, in accordance with the Memorandum to the Site File (November 2011), this element of the remedy is no longer necessary and will be removed from the ROD schedule.

Perform Aerial Photography (OUC)

Component 7 *– Perform aerial photography (beginning in 1999) to monitor habitat changes resulting from remedial actions. Changes in drainage, topography, and vegetation would be evaluated.*

Aerial photography was initially collected at the ERF from 1999 to 2004 and then again in 2008 and 2010. As presented in the Memorandum to the Site File (November 2011), the imagery was to be used to assess changes to vegetation and habitat.

Perform Habitat Mapping (OUC)

***Component 8** – Perform habitat mapping to evaluate impacts to habitat as a result of remedial actions, as well as to observe habitat rebound after pumping is discontinued.*

As presented in the Memorandum to the Site File (November 2011), initial maps were developed in 2000 and updated in 2004 and 2008; the maps are expected to be updated again in 2012. Because no dramatic or rapid changes to the habitat within ERF have been noted since 2000, 2012 will be the last time the maps will be updated unless changes in land use are implemented,

Perform Limited Hazing as a Contingency (OUC)

***Component 9** – Perform limited hazing (only as a contingency) starting in 1999, if incidental hazing from pumping operations and other fieldwork activities does not deter bird usage.*

Active hazing was conducted in 1998 and 1999 using propane cannons; however, observations indicated that equipment and personnel operating within the treatment area had the affect of deterring bird use of the ERF area and the process was, therefore, eliminated.

Apply and Monitor Cap-and-Fill Material (OUC)

***Component 10** – After remedial action objectives are achieved and pumping is discontinued, apply cap-and-fill material in ponded areas that did not drain and dry sufficiently to enable the white phosphorus to sublimate and oxidize. Cap-and-fill material placement is expected to occur in Year 5 (2003).*

Placement of cap-and-fill material at ERF did not occur in 2003 because white phosphorus contamination remaining in Bread Truck and Areas C and C/D prompted remedial project managers to extend limited remediation through 2007. In accordance with the Memorandum to the Site File (November, 2011) cap-and-fill operations will continue through 2012 and then only during years prior to five-year reviews, or to address newly identified white phosphorus -

contaminated areas that were not successfully remediated. Capping activities at ERF are described below in Table 4-6 and are presented in Figure 4-9:

Table 4-6
OUC Chronology of Cap-and-Fill Activities

Year	Capping Activities
2007	Test Cap was installed at Pond 23
2008	22 gravel caps installed
2009	Eight new caps installed and six existing caps extended
2010	Conditions not conducive for capping
2011	Three new sites capped; three existing caps extended; and three temporary caps installed
2012	Anticipated that three new caps will be installed; three existing caps will be extended; and three temporary caps will be installed.

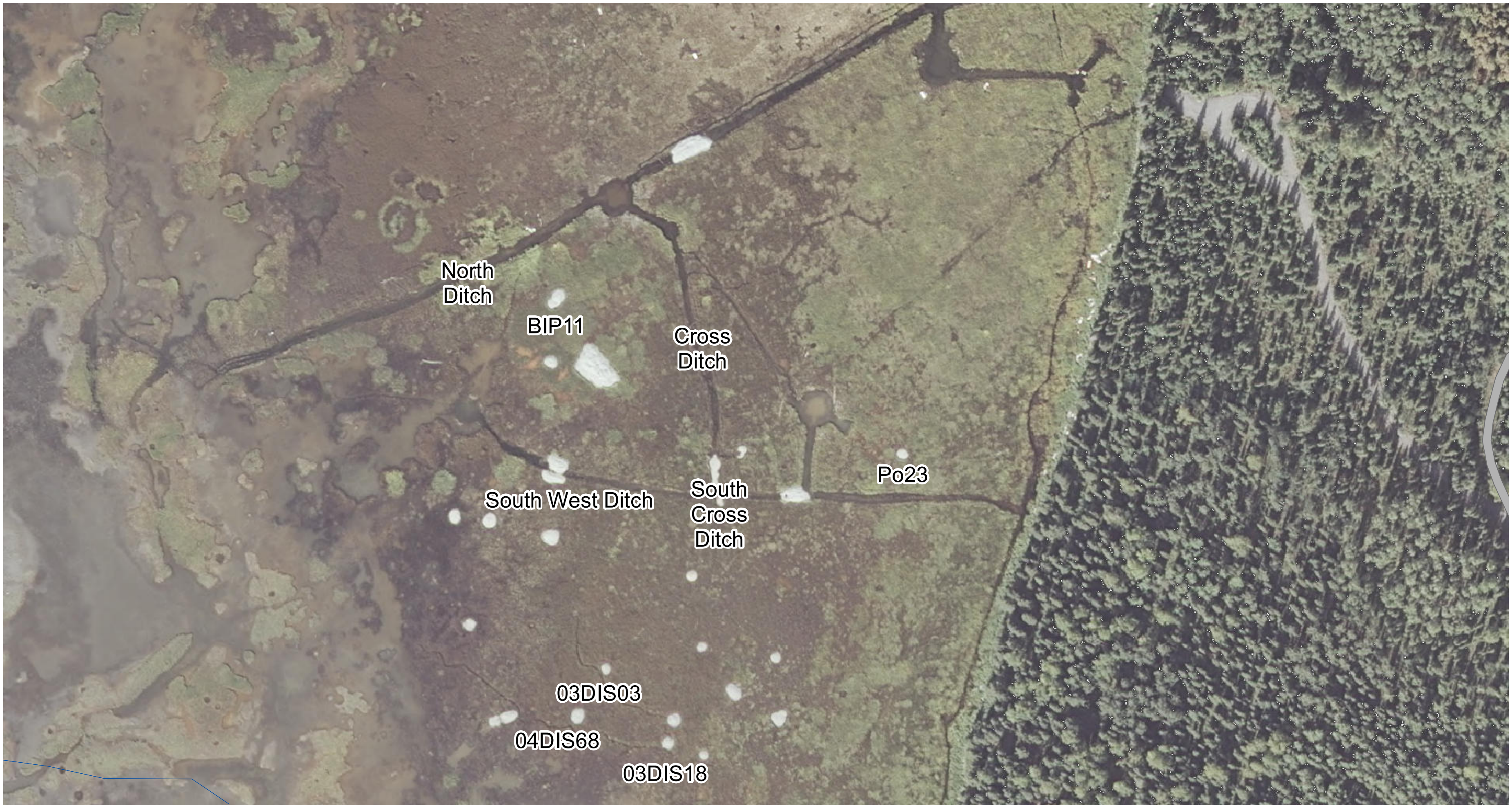
***Component 11** – Monitor cap-and-fill material integrity after the material is placed.*

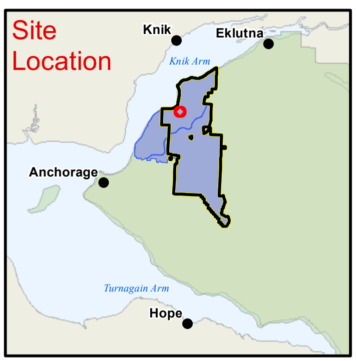
Cap integrity monitoring will be conducted in the year prior to the Five-Year Review according to the schedule found in the 2011 Memorandum to the Site File. Additionally, newly placed caps will be inspected yearly for the first four years after placement.

Incorporate Data into a GIS Database (OUC)

***Component 12** – Incorporate white phosphorus sampling, telemetry, aerial survey, habitat, and physical landform data into a GIS database.*

A comprehensive GIS database was established in 1994 and continues to be maintained by the Directorate of Public Works (DPW). The database includes ERF data and information on all contaminated sites on Post. The format of the comprehensive GIS database has been revised. Due to the system revisions and a lack of technician support, ERF data has not been continuously uploaded into this GIS database. Instead, ERF data has been regularly incorporated into a separate GIS database managed by the CRREL. The USAF will retain access to the CRREL data in the future.





Digital Orthomosaic of Elmandorf & Richardson military installations based on 04 September 2009 aerial photography with a pixel ground resolution of 0.3m. Originator: Aero-Metric, Anchorage

N

All Locations Are Approximate

0 100 200 300 400
Feet

WGS 1984 UTM Zone 6N

OUC EAGLE RIVER FLATS
GRAVEL CAP LOCATIONS

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS

DATE:	PROJECT MANAGER:	FIGURE NO:
01 FEB 2013	K. MAHER	4-9

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Maintain Institutional Controls (OUC)

***Component 13** – Maintain institutional controls, including the restrictions governing site access, construction, road maintenance, and the required training for personnel who work at OUC source areas. The objective of these institutional controls is protection of human health, safety, and the environment by limiting or preventing access to contaminated areas or otherwise denying exposure pathways.*

LUCs are in effect at OUC. LUCs include both engineering controls and administrative controls to restrict site access. Engineering controls include a locked gate at the OUC entrance, signs posted next to Eagle River to alert boaters indicating the area is an active firing range, and soil caps to prevent white phosphorus exposure to dabbling ducks. Administrative controls in place for the site include groundwater use restrictions, construction restrictions, and restrictions for excavations through the Base Civil Engineer Work Clearance Request process (JBER-R 673 ABW Form 3). The JBER-R LUC instruction (673D Air Wing Instruction 32-7003, 11 May 2011) establishes the procedures, responsibilities, and policies for complying with LUCs at JBER-R. This document is provided in Appendix G of this document. Additional administrative controls are administered through JBER-R Range Control to ensure that appropriate training occurs for authorized access.

OB/OD Evaluation (OUC)

The RI conducted at the OB\OD pad indicated that no concentrations of COCs above regulatory levels specified in the OUC RI/FS Management Plan have been discovered. In addition, the Human Health Risk Assessments and ecological assessments completed during the RI indicate that the risks are very low. Therefore, NFA under CERCLA was selected.

The OB/OD pad has restricted public access. Entry onto the pad is by road with a locked gate. Access is controlled and monitored by the Range Control at JBER-R. These restrictions are not expected to change. Because of the potential UXO hazard in the area, OB/OD pad is not available for future development.

The OUC ROD-selected closure of the OB\OD pad as the selected remedy under CERCLA. The OB\OD pad is designated as a RCRA-regulated unit and is subject to closure under 40 CFR 265, Subparts G and P. The Remedial Project Managers agreed to delay final RCRA closure of the OB\OD pad until final clearance of the operating range.

The OUC ROD requires that the viability of delayed closure of the OB/OD pad be evaluated no less often than during the CERCLA Five-Year Review. The OUC ROD stipulates three conditions under which delayed closure is no longer viable (1) the ERF range impact area is no longer operating, (2) the Post (JBER-R) is being closed, or (3) any other reason.

Fort Richardson and Elmendorf Air Force Base combined to become JBER on 1 October 2010. The base maintains two separate FFAs. At the time of the current Five-Year Review (February 2013), JBER is an operational installation with a number of active U.S. Army units that continue to use ERF as an impact area for artillery, mortar, and aircraft (fixed-wing and rotary) training. LUCs regarding the type of munitions used at the site and the time of year that the range may be used are in force. The closure plan for the OB/OD pad is under revision for inclusion into the JBER Basewide RCRA Part B permit. Nothing suggests that delayed RCRA closure of the OB/OD pad affects the overall protectiveness or viability of the selected remedy.

4.2.3 OUC System Operations & Maintenance

Pumping equipment was inspected and maintained prior to use by a qualified O&M contractor. While active remediation is not being performed, monitoring activities are still being conducted at ERF, which may require the continued use of the pumping equipment. It is expected that white phosphorus monitoring within the ERF area will be discontinued upon completion of the 2012 field season, but will continue to occur at treated locations prior to the Five-Year Review.

4.3 OUE ARMORED VEHICLE MAINTENANCE AREA & BUILDING 35-752 REMEDIAL ACTION

Laboratory analyses were performed on soil and groundwater samples collected from the AVMA site during the RIs for OUD and OUE. All the available information was evaluated to understand the amount and types of contamination that are present at the site.

Soils (OUE-AVMA)

Soil sampling conducted as part of the OUD RI detected low-level concentrations of several petroleum, oil, and lubricants (POL) compounds (diesel-range organics [DRO], gasoline-range organics [GRO], some PAHs) and PCE; however, all of the above described contaminant constituents were detected at concentrations below the applicable cleanup criteria. Although high concentrations of arsenic were discovered in the groundwater at the site, it was determined to be naturally occurring. Based on these results, it was determined that soils were not a concern at this site, as discussed below:

- During characterization activities at the disturbed area east of former Building 45-590, where historic photographs showed potential areas of contamination, no significant source of contamination was identified.
- Low concentrations of petroleum compounds (DRO, GRO), and PAHs, such as benzo(a,h)anthracene, were detected in soil samples collected during the advancement of borings and installation of monitoring wells. Contaminant concentrations did not exceed their applicable cleanup criteria, and did not indicate that a significant source area existed at the AVMA.
- Low concentrations of PCE were detected at the Building 726 site during the OUD RI, but not at concentrations exceeding cleanup or risk levels.

Groundwater (OUE-AVMA)

Even though significant concentrations of soil contamination were not detected at the AVMA site, there was anecdotal evidence to indicate that a localized source area must have existed near the northwest side of Building 726. Water sampling data indicated that dissolved-phase PCE contamination in the groundwater originated in the area immediately downgradient from Building 726. Dry-cleaning solvents (PCE and/or Stoddard solvent) were stored in USTs at the site and tank bottoms were disposed of in a dumpster at the site. Low concentrations of

PCE contamination were also detected in soils at the Building 726 site, indicating that PCE had been used at the facility.

Groundwater sampling was conducted as part of the OUE RI. The sampling results demonstrated the presence of a dissolved PCE plume in the area to the north of Bldg 726 and the following observations were made:

- Where contamination was encountered, it extended from an area immediately downgradient from Building 726 to slightly past the junction of the confined and unconfined aquifers north of the Davis Highway. PCE contamination was detected in the shallow unconfined aquifer underlying the Building 726 and Building 732 areas, but not in the deeper confined aquifer located under those sites.
- PCE contamination exceeding the MCL was detected in the area where the unconfined and confined aquifers merge (Monitoring Wells AP-3534 and AP-3468). The groundwater at and downgradient from Monitoring Wells AP-3534 and AP-3468 contains high concentrations of metals and PCE.

Ongoing monitoring indicates that the contaminant is slowly attenuating downgradient from the point of origin near Building 726. The primary means of attenuation appears to be dilution. Since no significant concentrations of breakdown products have been found, chemical degradation does not appear to be a major pathway of contaminant reduction at this site.

Soils (OUE-Building 35-752)

Soil at the Building 35-752 area was recommended for NFA under CERCLA in the OUE ROD based on the following rationale:

- Risk assessment results indicated that contamination in soils pose no unacceptable risk to human health or the environment.
- The level of PCB contamination in soils was less than the relevant TSCA cleanup standards. Surface soils containing PCBs in excess of 25 ppm were excavated and removed from the site.

Groundwater (OUE-Building 35-752)

Based on the following data, groundwater at the Building 35-752 area was recommended for NFA under CERCLA in the OUE ROD:

- Risk assessment results indicated that contamination in groundwater poses no unacceptable risk to human health or the environment.
- Shallow groundwater is not used as a drinking water source and is non-potable due to levels of turbidity and metals.
- Contaminant concentrations in groundwater were decreasing and the concentration of TCE (8.6 μg/L) only slightly exceeded the MCL (5 μg/L); additionally, data suggested that the contaminant (TCE) was degrading.
- To ensure the protectiveness of the NFA decision, the U.S. Army will monitor groundwater and site conditions in conjunction with the JBER-R five-year reviews.

Ongoing groundwater monitoring is required as a stipulation of the NFA determination at Building 35-752.

4.3.1 OUE Remedy Selection

Remedial Action Objectives (OUE)

The RAOs for groundwater at OUE are:

- Prevent exposure to and use of groundwater as a potential drinking water source where chemical concentrations pose an unacceptable risk or exceed MCLs;
- Return groundwater to beneficial use as a potential source of drinking water within a reasonable time frame; and
- Monitor groundwater PCE concentrations within the contaminated area to establish concentration trends and provide an early warning if the downward concentration trend does not continue.

ARARs (OUE)

The OUE ROD cited the following most significant ARARs for the remedy selected for the OUE sites:

- Federal Safe Drinking Water Act (40 CFR 141 and 40 CFR 143) and Alaska Drinking Water Regulations (Alaska Administrative Code [AAC], Title 18, Chapter 80): The MCLs and nonzero maximum contaminant level goals were established under the Safe Drinking

Water Act and are relevant and appropriate for groundwater that is a potential drinking water source.

- Alaska Oil and Other Hazardous Substances Pollution Control Regulations (18 AAC 75): Under these regulations, responsible parties are required to clean up oil and hazardous-substance releases in Alaska, and are consistent with Alaska UST requirements.

Cleanup Goals (OUE)

Based on the data collected during the RI and the results of the baseline risk assessment for current and projected land use at the site, one COC was identified in groundwater at the AVMA that drives the need for the selected remedy; Federal and State of Alaska drinking water MCLs were adopted as the groundwater cleanup goals. No COCs were identified in the ROD for the soils at the AVMA. While no soil COCs are identified in the OUE ROD, subsurface PCBs remain in soil at the site (transformer mounting pad and discharge area, and the peripheral road) above 1 mg/kg. Table 4-7 lists the COC identified in groundwater at the AVMA site.

Table 4-7
OUE Remedial Cleanup Goal for Groundwater

Media	Contaminant of Concern	Remedial Action Objective (mg/L)	Source of RAO
Groundwater	PCE	0.005	MCL

Notes:
MCL = maximum contaminant level
For definitions, see the Acronyms and Abbreviations section.

Selected Remedy (OUE)

The remedy selected in the ROD and their status is described in Table 4-8:

Table 4-8
OUE Remedy Status

Remedy Component	Status
Maintain LUCs	
Maintain and use controls to prevent exposure to and use of groundwater at the site.	Ongoing
Natural Attenuation	
Allow natural attenuation to reduce the overall volume and toxicity of contaminants in groundwater at the site, and to return groundwater to a beneficial use.	Ongoing
Groundwater Monitoring	
Continue monitoring to ensure that contaminant concentrations are decreasing and the remedy remains protective.	Ongoing

Note:
For definitions, see the Acronyms and Abbreviations section.

4.3.2 OUE Remedy Implementation

The following sections identify the status of remediation for each component of the selected remedy.

Implement LUCs to Prevent Unauthorized Exposure (OUE-AVMA)

Component 1 – *Land-use controls to prevent exposure to and use of groundwater at the site.*

LUCs are in effect at OUE. LUCs include engineering and administrative controls to restrict site access. The engineering control in place for the site is a fence that surrounds Building 35-752. The administrative controls are groundwater use restrictions and restrictions to excavations through the Base Civil Engineer Work Clearance Request process (JBER-R 673 ABW Form 3). The JBER-R LUC instruction (673D Air Wing Instruction 32-7003, 11 May 2011) establishes the procedures, responsibilities, and policies for complying with LUCs at JBER-R. This document is provided in Appendix G of this document. LUCs will remain in place as long as hazardous substances remain on-site at levels that preclude unrestricted use.

Allow Natural Attenuation to Reduce Contaminant Concentrations (OUE-AVMA)

Component 2 – *Natural attenuation to reduce the overall volume and toxicity of contaminants in groundwater at the site, and to return groundwater to a beneficial use.*

Approximately nine years of historic sampling results exist for the monitoring wells sampled during the latest groundwater monitoring event at the AVMA (USAF 2012a). According to the calculations performed during the latest groundwater sampling event (USAF 2012a), no significant increasing or decreasing trends in the PCE-affected area are statistically apparent from the historical monitoring data. Biodegradation results combined with the absence of PCE daughter contaminants in samples collected at the AVMA site suggest that biodegradation is limited and the primary mechanism of natural attenuation continues to be dilution. Several other VOCs (chloroform, etc.) have been detected in the samples collected at the site, at concentrations below MCLs; no increasing or decreasing trends have been established for these extraneous contaminants.

Monitor Groundwater (OUE-AVMA)

***Component 3** – Monitoring to ensure that contaminant concentrations are decreasing and the remedy remains protective.*

According to the latest groundwater monitoring report (USAF 2012a), PCE was detected in samples from seven wells, with concentrations ranging from 0.54 μg/L in Monitoring Well AP-4411 to 140.0 μg/L in Monitoring Well AP-4413 (Figure 4-10). Six of the PCE detections exceeded the MCL and occurred in wells that have known historic PCE contamination. Four of these wells (AP-4341, AP-4342, AP-4411, and AP-4413) are screened across the perched aquifer, directly below the AVMA site. The other two wells (AP-3468 and AP-3534) are screened downgradient from these four wells, at the confluence of the perched aquifer system and the locally semi-confined system (Figure 4-10). The seventh well with a PCE detection, AP-3774 (0.54 μg/L), is located approximately 450 feet downgradient of the area of PCE contamination and has had a history of low-level detections at less than 1 μg/L. PCE was not detected in the other two wells located downgradient of the extent of contamination, AP-3870, and AP-3871, or the crossgradient well, AP-3893.

The area of the extent of PCE contamination at the site appears to be stable and contained; additionally, no significant increasing or decreasing trends in the PCE-affected area are statistically apparent based on the historical monitoring data (Figure 4-10).

AP-3871

Total Depth 120.20 ft	Aug-02	Jul-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	181.08	182.37	180.93	182.15	184.51	188.12	184.15	182.96	183.23	183.22	181.52	181.80	180.89	180.80
PCE (5)	ND (0.059)	ND (0.12)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND(0.310)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Carbon tetrachloride (5)	0.49J	0.32J	0.52J	ND (1)	ND (1)	0.840J	0.51 J	ND (1)	ND (1)	ND(1)	0.550J	1.07	0.360J	0.25J
Chloroform (100)	3.6	ND (0.08)	3.26	2.70	3.00	2.92	2.2	3.0	2.8	3.73	3.86	5.58	5.77	5.8

AP-3774

Total Depth 116.40 ft	Aug-02	Jul-03	Sep-03	Aug-04	Oct-04	May-05	Oct 05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	181.09	182.34	182.04	181.01	182.25	184.49	182.72	184.00	182.74	183.14	183.13	181.43	181.69	180.80	180.84
PCE (5)	ND (2)	0.26J	ND (0.46)	ND (1)	ND (1)	0.740J	0.330J+	ND (1)	ND (1)	ND (1)	0.450J	0.650J	0.560J	0.520J	0.54
Carbon tetrachloride (5)	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	0.390J	0.51J	ND (1)	0.25 J	ND(1)	ND(1.00)	ND(1.00)	ND(0.620)	0.40
Chloroform (100)	ND (0.17)	0.18J	ND (0.43)	ND (1)	NA	NA	NA	ND (1)	ND (1)	0.26 J	ND (1)	ND(1.00)	ND(1.00)	ND(0.600)	0.20

AP-3870

Total Depth 109.95 ft	Jul-03	Sep-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	182.1	181.77	180.76	182.08	184.37	182.69	183.91	182.63	182.84	182.78	181.14	181.14	180.51	180.67
PCE (5)	ND (0.12)	ND (0.45)	ND (1)	0.41J	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Carbon tetrachloride (5)	0.25J	ND (0.43)	NA	NA	NA	ND (1)	0.53J	ND (1)	ND (1)	ND (1)	ND(1.00)	ND(1.00)	ND(0.620)	0.2J
Chloroform (100)	0.37J	ND (0.46)	ND (1)	0.3J	0.34J	0.37J	ND (1)	ND (1)	0.32 J	ND(1)	ND(1.00)	ND(1.00)	ND(0.600)	0.21J

AP-4413

Total Depth 75.40 ft:	Jun-03	Sep-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	218.93	218.87	219.71	219.71	218.86	218.86	219.37	219.08	219.31	219.15	219.18	218.94	218.87	219.10
PCE (5)	**100J**	**120**	**175**	**171**	**120**	**143**	**190**	**150**	**120**	**120**	**113**	**121**	**88.8**	**140.0**
Carbon tetrachloride (5)	1.3	0.97J	1.06	1.21	1.04	1.08	1.1	1.1 J+	0.98 J	1.32	0.800J	1.66	0.990J	1.1J
Chloroform (100)	0.48J	ND (0.46)	0.42J	0.38J	0.510J	0.660J	3.7	4.4	4.6	5.27	5.68	3.99	1.91	2.00

AP-4341

Total Depth 68.10 ft	Oct-02	Jun-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	230.41	230.16	230.05	230.37	230.27	230.26	230.31	230.22	230.29	230.21	230.21	230.13	230.06	230.26
PCE (5)	**1.8J**	**23**	**12.7**	**14.6**	**20.8**	**19.0**	**13**	**12.0**	**9.3**	ND(1)	**27.9**	**16.2J-**	**7.67**	**18**
Carbon tetrachloride (5)	0.38J	0.52J	ND (1)	0.37J	0.520J	0.370J	0.85J	0.69J+	0.61 J	ND(1)	0.500J	1.06	0.540J+	0.56J
Chloroform (100)	ND (0.5)	0.58J	ND (1)	0.50J	0.780J	0.780J	ND (1)	1.3	1.5	ND(1)	1.29	ND(1.00)	0.620J	0.57J

AP-3534

Total Depth 138.40 ft	Aug-02	Jun-03	Sep-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jun-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	181.44	182.41	NS	181.41	182.49	184.90	183.29	184.72	183.43	183.76	183.75	182.05	182.31	181.37	181.59
PCE (5)	**21.0**	**28J**	**19J**	**25.4**	**24.1**	**81.5**	**59.1**	**43**	**18**	**18**	**23**	**24.5**	**21.9**	**23.1**	**22.0**
Carbon tetrachloride (5)	0.22J	ND (0.43)	ND (0.43)	0.42J	ND (1.0)	0.49J	ND (1.0)	0.69J	ND (1)	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (0.620)	0.17J
Chloroform (100)	0.056J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1)	ND (1)	0.24 J	ND (1)	ND (1.00)	0.400J	ND (0.600)	0.22J

AP-3468

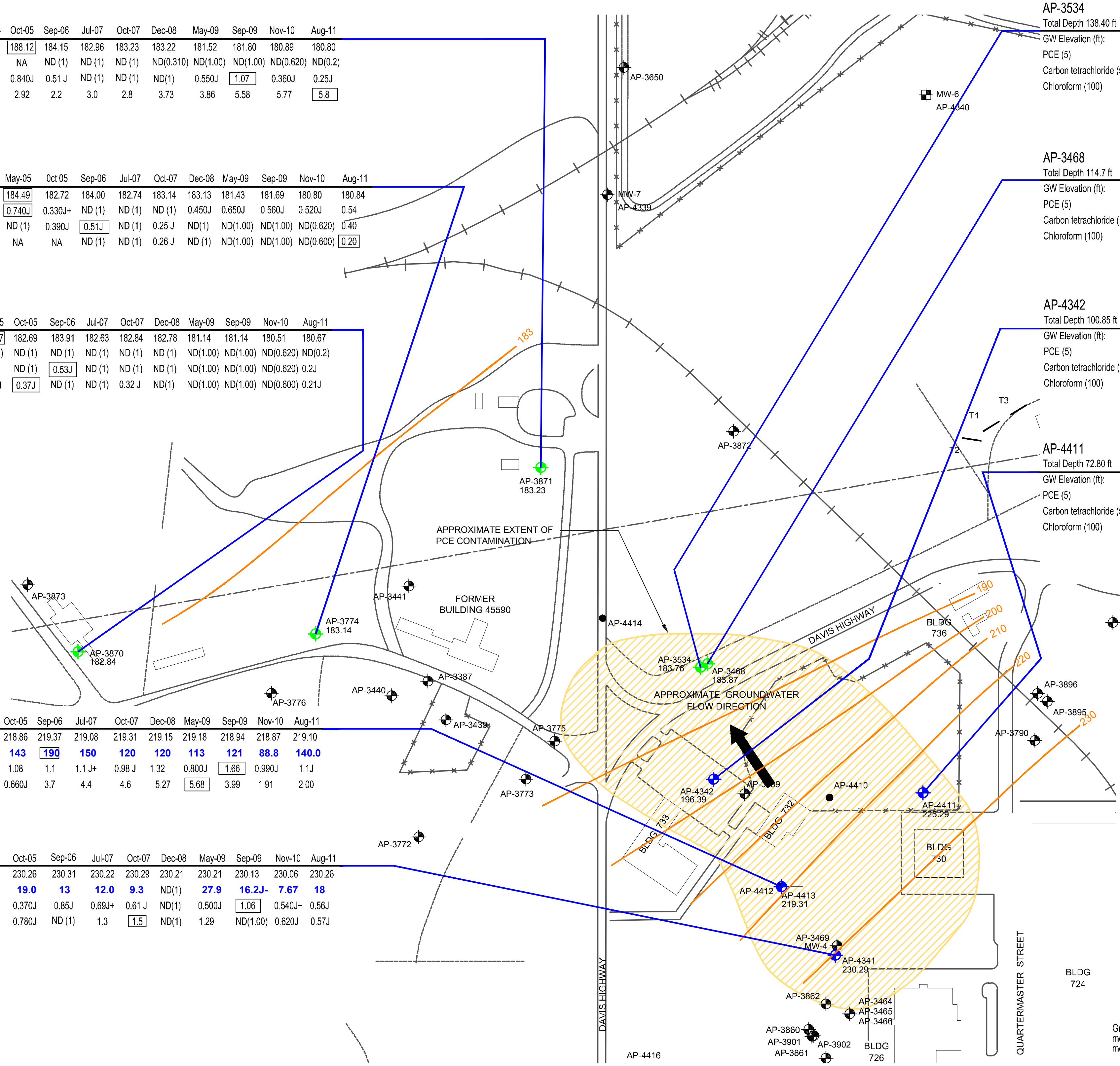
Total Depth 114.7 ft	Aug-02	Jun-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jun-07	Oct-07	Dec-08	May-09	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	183.6	183.41	183.39	183.94	180.69	183.28	184.63	183.76	183.87	183.82	183.44	183.44	183.35	183.29	183.33
PCE (5)	**30.0**	**69.0**	**60.0**	**53.3**	**93.6**	**59.4**	**72**	**47**	**61**	**63**	**53.4**	**53.4**	**64.7**	**54.3**	**55**
Carbon tetrachloride (5)	0.12J	0.44J	0.32J	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	0.26 J	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND(0.620)	0.18J
Chloroform (100)	0.35J	0.52J	0.54J	0.44J	ND (1)	0.320J	ND (1)	0.72J	0.83 J	ND (1)	0.59 J	0.59 J	1.36	ND(1.00)UJ	0.8J

AP-4342

Total Depth 100.85 ft	Oct-02	Nov-02	Jun-03	Sep-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Sep-09	Aug-11
GW Elevation (ft):	196.61	197.51	195.95	195.87	195.76	197.01	195.56	196.34	196.59	196.10	196.39	196.16	196.13	195.93	196.08	196.06
PCE (5)	**38J**	**49.0**	NA	**53.0**	**41.1**	**62.5**	**61.3J-**	**55.9**	**66**	**52.0**	**52**	**62.9**	**55.8**	**58.0**	**52.1**	**51**
Carbon tetrachloride (5)	0.75J	0.44J	NA	NA	0.58J	0.91J	0.90J-	0.680J	0.98 J	0.95 J	1	1.29	0.630J	1.28	0.920J	0.87J
Chloroform (100)	0.27J	0.28J	NA	ND (0.46)	ND (1)	ND (1)	0.35J-	ND (1)	0.81 J	2.4	2.3	2.74	2.31	ND(2.30)	ND(1.44)U	1.1

AP-4411

Total Depth 72.80 ft	Jun-03	Sep-03	Aug-04	Oct-04	Jun-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	223.62	224.72	223.72	223.71	223.03	223.03	225.23	225.20	225.29	225.17	225.13	224.80	224.66	224.92
PCE (5)	**9.8**	**8.9**	**11.2**	**20.4**	**23.9**	**24.6**	**11**	**10**	**12**	**6.64**	**7.94**	**15.6**	**10.5**	**16**
Carbon tetrachloride (5)	0.33J	ND (0.43)	0.32J	NA	NA	NA	0.59J	ND (1)	ND (1)	ND (1)	ND(1.00)	0.950J	ND(0.620)	0.3J
Chloroform (100)	ND (0.080)	ND (0.46)	0.54J	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	0.340J	ND(1.00)	ND(0.600)	ND(0.2)



AP-3893

Total Depth 124.10 ft	Aug-02	Aug-04	Oct-04	May-05	Oct-05	Sep-06	Jul-07	Oct-07	Dec-08	May-09	Sep-09	Nov-10	Aug-11
GW Elevation (ft):	212.26	212.88	214.49	216.75	215.76	217.38	216.87	217.53	217.84	214.45	214.94	214.94	215.03
PCE (5)	ND (0.059)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.2)
Carbon tetrachloride (5)	ND (0.074)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND(1.00)	ND(1.00)	ND(0.620)	ND(0.4)
Chloroform (100)	ND (0.092)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND(1.00)	ND(1.00)	ND(0.600)	ND(0.2)

Example

Well Number → AP-3468

Total Depth → Total Depth 114.7 ft

Total Depth 114.7 ft	Aug-02	Jun-03	Aug-04	Oct-04	May-05	Oct-05	Sep-06	June-07
GW Elevation (ft):	183.6	183.41	183.39	183.94	180.69	183.28	184.63	183.76
PCE (5)	**30.0**	**69.0**	**60.0**	**53.3**	**93.6**	**59.4**	**72**	**47**
Aluminum (50)	**11,000**	NA	ND (100)	ND (100)	72.8J	ND (100)	ND (50)	ND (50)
Arsenic (10)	NA	NA	3.5J	ND (10.0)	ND (10.0)	ND (10.0)	0.2J	ND (1)

← Sampling Date

Groundwater Elevation measured in feet above mean sea level → GW Elevation (ft):

← Regulatory Exceedances in **Bold, Blue**

Analyte and MCL in ug/L → Aluminum (50)

↑ MCL

↑ Maximum historic value indicated by box

ORIGINAL FILE PREPARED BY CH2M HILL

NOTES

Groundwater elevation in feet above mean sea level (Vertical elevation reference NAVD88).
Previous groundwater elevations taken from archived reports.
Data prior to August 2004 and for September 2006 through the present collected by CH2M Hill.
Data from 2004 through 2005 collected by Satori Group Inc.
All non-detect values before August 2004 are reported as the Method Detection Limit (MDL).
All non-detect values starting with August/October 2004 are reported as the Practical Quantitation Limit (PQL)
All concentrations are measured in µg/L.
Exceedances compared against EPA 40 CFR 141/143,and ADEC 18AAC80.
Regulatory Exceedances in Bold.
Maximum values are indicated by a box.
August/October 2002 metals data is for total metals with the exception of well AP-4342, which is dissolved metals.

ABBREVIATIONS

J = Estimated Quantity.
J+ = Analyte is present, but value may not be accurate or precise (estimated high).
J- = Analyte is present, but value may not be accurate or precise (estimated low).
MCL = Maximum Contaminant Level.
NA = Not Available.
ND = No Analyte Detected.
PCE = Tetrachloroethene.
U= Analyte was not detected and the specified reporting limit may not be accurate or precise (estimated), or analyte was not detected and sample handling or QC failures may have resulted in a low bias (and thus a non-detect result).

LEGEND

Monitored Well (Perched Aquifer)
Monitored Well (Unconfined Aquifer)
Existing Well Not Monitored for this Event
Ground Surface Elevation (meters)
Approximate Extent of PCE Contamination

OUE AVMA GROUNDWATER MONITORING LOCATIONS AND RESULTS

JACOBS

DATE:	PROJECT MANAGER:	FIGURE NO. :
04 Feb 2013	K. Maher	4-10

I:\MPAE-AFCEE-08T0142-Five Year Review\COMMON\Reference Documents\OUE - AVMA\FIG4-10.dwg FIG4-10 04 February 2013 - jaronitj

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Institutional Controls (Building 35-752 OUE)

The LUCs at the Building 35-752 area are functioning as intended and continue to be protective of human health and the environment. Access to Building 35-752 is restricted by a chain-link fence that surrounds the building. In addition, LUCs prohibit access to the groundwater as a source of drinking water and the land use at this source area and neighboring source areas will remain industrial for the foreseeable future.

Groundwater Monitoring (Building 35-752 OUE)

Groundwater monitoring at the Building 35-752 site is only required prior to the Five-Year Review. As described above, a groundwater sample collected at the site in 2003 exhibited a concentration of TCE at 8.6 μg/L, slightly exceeding the ADEC cleanup criterion of 5 μg/L. According to the 2008 groundwater monitoring report (USACE 2008), groundwater samples collected at the site exhibited concentrations of contaminants below their respective cleanup criteria, with the exception of one sample collected from Monitoring Well AP-3231, which exhibited a concentration of TCE at 5 μg/L, which is equal to the ADEC cleanup criterion for that particular analyte. During the most recent groundwater sampling event, performed in June of 2012, all water samples exhibited concentrations of contaminant constituents below their respective ADEC cleanup criteria (USARAK 2012a).

Site Inspection (Building 35-752 OUE)

The Building 35-752 site was inspected on 27 June 2012. The building was secured and the surrounding fence was intact and no unusual conditions were observed.

4.3.3 OUE System Operations and Maintenance

No active systems are currently operated as part of remediation at OUE.

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5.0 PROGRESS SINCE THE LAST REVIEW

Progress since the last review should be discussed when follow-up actions that affect protectiveness were noted in the previous Five-Year Review report.

5.1 PROGRESS AT OUB SINCE THE LAST REVIEW CHECKLIST

5.1.1 OUB Protectiveness Statement from Previous Review (2008)

The remedy at OUB is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, and in the interim, LUCs are preventing exposure to contaminated groundwater. The initial soil removal efforts in 1993 and 1994 and subsequent treatability studies removed the most highly contaminated soil and debris. The remedy is expected to prevent and limit human and environmental exposure to hazardous substances. LUCs that address the potential UXO hazards in Areas A-1 and A-2 have been implemented since the 2008 Five-Year Review. Fencing with warning signs has been placed around Areas A-1 and A-2.

Long-term protectiveness of the selected remedy will be verified by obtaining groundwater samples to evaluate potential migration of the contaminant plume downgradient toward Eagle River and ensure contaminant levels in groundwater are decreasing through natural attenuation. Current monitoring data indicates that the plume is not migrating and that the remedy is functioning as required. Geologic modeling at the OUB source area continues with the intent of helping to confirm that RAOs will be achieved within the timeframe required by the ROD.

5.1.2 OUB Follow-Up Actions from Previous Five-Year Review (2008)

The recommendations provided in the 2008 Five-Year Review (USARAK 2008) and actions taken/outcomes are presented in Table 5-1.

Table 5-1
OUB Recommendations and Follow-up Actions from Previous Five-Year Review (2008)

OU	Source Area	Recommendations/ Follow-Up Actions from 2008 Five-Year Review	Responsible Party	Action Completed	Action Taken and Outcome	Affects Protectiveness (Yes/No)
B	PRDA	Continue to monitor groundwater contaminant reduction and perform groundwater monitoring for a trend analysis.	USAF	Ongoing	Groundwater monitoring continues to occur at the site as concentrations of COCs above MCLs continue to be exhibited by groundwater samples collected at the site. Statistical analysis (Mann-Kendall) performed since the last Five-Year Review has shown a general decreasing trend of contaminant concentrations at the site.	No
		Continue analyzing groundwater samples for VOCs using methods that include compounds not addressed in the ROD.	USAF	Ongoing	Groundwater samples continue to be analyzed for VOCs not included in the ROD as breakdown products become more evident.	No

Note:
For definitions, see the Acronyms and Abbreviations section.

5.2 PROGRESS AT OUC SINCE THE PREVIOUS REVIEW CHECKLIST

5.2.1 OUC Protectiveness Statement from Previous Five-Year Review (2008)

The remedy at OUC is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled with LUCs. ERF is currently an active impact area. If in the future a decision is made to close ERF, the human health risk from exposure to UXO will be addressed using the ARARs that are in place at the time.

5.2.2 OUC Follow-Up Actions from Previous Five-Year Review (2008)

The recommendations provided in the 2008 Five-Year Review (USARAK 2008) and actions taken/outcomes are presented in Table 5-2.

Table 5-2
OUC Recommendations and Follow-Up Actions from Previous Five-Year Review (2008)

OU	Source Area	Recommendations/ Follow-Up Actions from 2008 Five-Year Review	Responsible Party	Action Completed	Action Taken and Outcome	Affects Protectiveness (Yes/No)
C	ERF	Complete Evaluation of recovery trends upon completion of the selected remedy.	USAF	Ongoing	Remediation activities were completed at the end of the 2007 field season and sampling activities are scheduled through 2012, at which time a complete evaluation of recovery trends can be undertaken. The evaluation of recovery trends will be included in the next Five-Year Review Report.	No
		Continue to track the progress of the Environmental Impact Statement currently under development.	USAF	Complete	The Environmental Impact Statement is currently being revised based on comments made during the public opinion process in 2010 and is expected to be finalized in 2013. The development of the Environmental Impact Statement does not impact protectiveness and is therefore not included as an issue in the 2013 Five Year Review. This action is considered complete.	No

Note:
For definitions, see the Acronyms and Abbreviations section.

5.3 PROGRESS AT OUE SINCE THE PREVIOUS REVIEW CHECKLIST

5.3.1 OUE Protectiveness Statement from Previous Five-Year Review (2008)

The remedy at OUE is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals through natural attenuation. In the interim, exposure pathways that could result in unacceptable risks are being controlled and LUCs are preventing exposure to, or ingestion of, contaminated groundwater.

5.3.2 OUE Follow-Up Actions from Previous Five-Year Review (2008)

The recommendations provided in the 2008 Five-Year Review (USARAK 2008) and actions taken/outcomes are presented in Table 5-3.

Table 5-3
OUE Recommendations and Follow-Up Actions from Previous Five-Year Review (2008)

OU	Source Area	Recommendations/Follow-Up Actions from 2008 Five-Year Review	Responsible Party	Action Completed	Action Taken and Outcome	Affects Protectiveness (Yes/No)
E*	AVMA	Perform Post-wide LUC inspection and evaluate protectiveness. Update restricted use boundaries in GIS as new information becomes available.	USAF	2011	After the base merger a JBER LUC Management policy was created stating that LUC inspections of all sites on base will be completed yearly and a report will be generated based on the inspections and data review.	No
		Make SOP coverage more inclusive (i.e., apply to tenants).	USAF	2011	According to the JBER-R LUC Management Instruction, the installation LUC policies apply to all military and civilian organizations that occupy facilities, or conduct business, on the installation.	No
		Update LUC Policy.	USAF	2011	As stated above, the JBER-R LUC Instruction was created in May 2011 after the base merger.	No

Notes:
* The previous five-year review did not address contamination at Building 35-752.
SOP = standard operating procedure
For additional definitions, see the Acronyms and Abbreviations section.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 ADMINISTRATIVE COMPONENTS OF THE FIVE-YEAR REVIEW PROCESS

The USAF 673 CES, lead agency for the JBER Environmental Restoration Program (ERP), held a kick-off meeting for the Five-Year Review with support contractor Jacobs, on 4 May 2012. In addition to representatives from Jacobs, the Five-Year Review team included individuals from the USAF 673 CES and the Air Force Center for Engineering and the Environment (AFCEE).

The schedule of this Five-Year Review extends from May 2012 through signature of the final report expected in February 2013. The Five-Year Review included the following components: document reviews, site inspection, interviews with representatives of agencies with site knowledge, an assessment of protectiveness of the remedies, community notification and involvement, and development and review of this Basewide Five-Year Review report. Documentation of the inspections and interviews are located in Attachments D and E, respectively.

6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

A fact sheet describing the Five-Year Review process and indicating the commencement of this third Five-Year Review was created and distributed to a list of interested parties. Additionally, a public notice was placed in local publications (*Arctic Warrior*, *Eagle River Star*, and *Anchorage Daily News*) announcing the Five-Year Review. The fact sheet and public notice are included in Appendix A.

6.3 DOCUMENT REVIEW

The RODs and their associated memorandums were reviewed to identify OU-specific RAOs, COCs, and cleanup levels. The potential for changes to standards identified as applicable or relevant appropriate requirements (ARARs) in the ROD, newly promulgated standards, and/or changes to be considered (TBC) that have the potential to affect the protectiveness of the remedies are discussed for each OU in Section 4.0.

The following documents were reviewed for updates to ARARs and new toxicity information:

- ADEC, 18 AAC 70, *Water Quality Standards*, amended as of 8 April 2012 (ADEC 2012)
- ADEC, 18 AAC 75, *Oil and Other Hazardous Substances Pollution Control*, current as of 24 September 2009 (ADEC 2012)
- ADEC, 18 AAC 80, *Drinking Water*, amended as of 20 May 2011 (ADEC 2011)
- ADEC, *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*, amended as of 12 December 2008 (ADEC 2008)
- ADEC, *Cleanup Levels Guidance*, amended as of 9 June 2008 (ADEC 2008)
- ADEC, *Cumulative Risk Guidance*, *Division of Spill Prevention and Response Contaminated Sites Remediation Program*, dated 9 June 2008 (ADEC 2008)
- EPA, *2012 Edition of the Drinking Water Standards and Health Advisories* (EPA 2012)
- EPA, Regional Screening Levels for Chemical Contaminants at Superfund Sites (May 2012)
- EPA, Integrated Risk Information System (IRIS) (2012)

A table presenting a compilation of reports and documents available at the time of this review is included in Appendix B. Key information sources used in this review are identified in this table.

6.4 DATA REVIEW

All relevant data obtained from remedial/monitoring activities conducted at each OU were evaluated for this Five-Year Review. For sites where the ROD remedy includes natural attenuation, parameters associated with the facilitation of natural attenuation were also reviewed. Data collected under the ERP are archived in the Air Force ERP Information Management System database. The data reviewed for each site is discussed in detail in each OU-specific section (see Sections 4.1, 4.2, and 4.3) of the report.

6.5 SITE INSPECTIONS

Site inspections were conducted by Jacobs personnel from 25 to 29 July 2012. The inspections were intended to assess the protectiveness of the remedy, including the presence of LUC measures to restrict access and site use, and the condition of the site. The site inspection checklist and photographs taken during the site inspections are included in Appendices C and D of this report, respectively.

The site inspection results were supplemented with documentation of site inspection activities conducted by individual contractors as described in annual reports, and include inspections of each monitoring well in the monitoring program to identify and repair any damage, and an annual visual inspection of each OU to assess signs of potential deviations from the prescribed LUCs.

6.6 INTERVIEWS

During the course of this third Five-Year Review, written interviews (in the form of questionnaires) were conducted with representatives from several agencies associated with the OUs and the individual sites located within each OU. Interview Record Forms documenting the issues relevant to the site are provided in Appendix E.

Interview responses were overwhelmingly positive. The principal impression was that remedial action at JBER-R has been well planned and effective. A comment was made concerning the effectiveness of the LUCs (site security) at OUB due to the continued evidence of trespassers at the site.

The overall impression of the remedy effectiveness at all the OUs was that the remedial actions undertaken pursuant to the RODs are adequately protective of human health and the environment.

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7.0 TECHNICAL ASSESSMENT

The Technical Assessment focuses on answering three key questions for each OU. Each response includes a determination of yes, no, or a variation of this, and provides the basis for each answer as a framework for the protectiveness determination(s) (presented in Section 10.0).

7.1 OUB TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended in the decision document?

Answer: Yes.

Remedial Action Performance: The ROD-selected remedy at the PRDA site included HVE supplemented with SPSH to treat adversely affected soils and groundwater within the hot spot; monitoring of groundwater to track natural attenuation; and the implementation of LUCs. The HVE/SPSH portions of the remedy were completed in 1999, resulting in contaminant reduction in the hot spot; monitoring and LUCs are the only remaining active remedies at the PRDA site.

According to the latest draft groundwater monitoring report (USAF 2012a), although a number of wells at the site have concentrations of contaminants that exceed cleanup goals, overall contaminant concentrations at the site appear to be decreasing. The extent of the contaminant plume has continued to remain stable and is bounded in the deep aquifers to the north, northwest, and northeast by Monitoring Wells AP-5246, AP-4350, and AP-3748, respectively. The contaminant plume in the shallow aquifer is bounded by Monitoring Well AP-4352 to the north and by Monitoring Wells AP-3982 and AP-4347 to the northeast; however, the boundary downgradient of Monitoring Well AP-3747 has not been fully defined. The presence of daughter products in almost all wells with contaminant concentrations above the cleanup goals, and the positive indications observed in the levels of other monitored natural attenuations parameters indicate that conditions are favorable for reductive dechlorination at the site.

System Operations/O&M: Operating procedures (in this case, monitoring), as implemented, will maintain the effectiveness of response actions. There are no large variances in O&M costs that would indicate potential remedy problems or remedy issues.

<u>Opportunities for Optimization</u>: The timeframe for natural attenuation is estimated at 150 years as stated in the ROD. Groundwater monitoring over the past 10 years indicates that overall contaminant concentrations are decreasing due to natural attenuation. Because the natural attenuation process at the PRDA site is abiotic in nature, there are no opportunities of optimization of the remedy. Abiotic degradation is the breakdown of a contaminant by chemical or physical (not biological) processes.

<u>Early Indicators of Potential Issues</u>: The contaminant plume is bounded by Monitoring Well AP-3747, located downgradient and north-northeast of the hot spot; however, the plume boundary beyond Monitoring Well AP-3747 has not been defined. Augmentation of the monitoring well network in the shallow aquifer at OUB would assist in defining the downgradient limit of the PRDA Plume. Although the downgradient margin is not defined, this data gap does not affect current protectiveness due to the LUCs that are in place, the age of the plume, and the lack of downgradient receptors.

<u>Implementation of LUCs and Other Measures</u>: Based on site inspections it appears that no unauthorized excavations or groundwater-disturbing activities have occurred at the site; however, site access control measures may not be completely effective in preventing unauthorized access by recreational ATV users. Concrete barriers were installed at the site in 2011 to assist in the prevention of unauthorized access to the site; during site inspection activities performed in 2012, no evidence of trespassing was noted. Contaminant levels at the site that exceed cleanup goals based on a UU/UE scenario are within the LUC boundary. LUCs are used to reduce the potential for exposure to hazardous substances or to enhance the protectiveness of a soil and/or water cleanup remedy. They include restrictions on the use of portions of the shallow aquifer south of the Elmendorf Moraine, limitations on the types of buildings allowed in certain areas – primarily occupancy limitations, and land-use designations for certain areas as recreational use only. Personnel at JBER-R are made aware of LUC requirements through the LUC Management Instruction (673D Air Wing Instruction, 32-7003, 11 May 2011), the Work Clearance Request process, and GeoBase.

<u>Question B</u>: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

<u>Answer</u>: No

<u>Changes in Standards and TBCs</u>: No new contaminant sources have been identified at the PRDA site; however, five post-ROD to-be-watched contaminants have been identified for OUB, including; vinyl chloride, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethane (1,2-DCA). As stated in the most recent draft groundwater monitoring report for OUB (USAF 2012a), the to-be-watched contaminant constituents are not considered new COCs, but are most likely breakdown products from the COCs identified in the ROD. These contaminants are considered breakdown products of the originally defined COCs, and monitoring data shows that the concentrations of these compounds are relatively stable.

The chemical-specific ARARs (40 CFR 141, 18 AAC 70 and 18 AAC 80) listed in the 1997 OUA-OUB ROD do not have any changes that affect regulatory-based RAOs for groundwater COCs at OUB. The only TBC listed in the ROD was the State of Alaska *Petroleum Draft Guidance*. This TBC was updated and incorporated into State of Alaska Regulations 18 AAC 75 (ADEC 2012).

<u>Changes in Exposure Pathways</u>: There are no changes in land use or the anticipated land use on or near the site and no new human health or ecological exposure pathways or receptors have been identified. Except for the one area noted, the shallow and deep contaminant plume boundaries appear to be defined by the monitoring wells present on the site.

<u>Changes in Toxicity and Other Contaminant Characteristics</u>: Changes to OUB COC chemical-specific toxicity information that occurred since the 2008 Five-Year Review affect cis-1,2-dichloroethene, trans-1,2 dichloroethene, PCE, and 1,1,2,2-PCA. These updates affect the OUB RAOs for 1,1,2,2 PCA (groundwater and soil) and PCE (soil) because they were risk based at the time of the ROD (no regulatory MCL).

The toxicity changes also result in an unacceptable exposure (Hazard Index > 1) when the residential exposure assumption, used to support the OUB ROD, and the ROD RAOs are considered. The data used to support the risk evaluation of OUB COC cleanup levels is included in Appendix B.

In the short term, the remedy for the PRDA remains protective because residential use of the site is not permitted, access to the aquifer is restricted, and the RAOs are protective for an industrial exposure scenario. It is recommended that the OUB COC RAOs be updated to provide future protectiveness of human health.

Although the 2008 Fort Richardson Five-Year Review report identifies the risk-based 1,1,2,2-PCA groundwater RAO (0.052 mg/L) as a typographical error, it is protective compared to the current EPA tap water regional screening level (RSL) (0.066mg/L) as listed.

Changes in Risk Assessment Methods: None

Expected Progress Towards Meeting RAOs: The remedy is progressing at the rate originally expected in the ROD.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Answer: No

7.2 OUC TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended in the decision documents?

Answer: Yes

Remedial Action Performance: All major components of the preferred remedy scheduled to occur from 1997 through 2004 have been instituted, with two exceptions. Due to contracting issues and/or the availability of helicopters, telemetry monitoring did not take place in 2000 and

2003, as originally prescribed in the ROD. For this reason, ground-based transect surveys were utilized in lieu of telemetry monitoring to determine waterfowl mortality. Additionally, cap-and-fill activities, originally scheduled to occur in 2003, were postponed due to remediation activities occurring at ERF through 2007.

According to the latest draft RA summary report (USACE 2011a), refinement of the mortality model in 2005 reduced the calculated 1996 mortality rate from 1,000 to 655 ducks. Therefore, to meet the short-term RAO, the allowable number of duck deaths attributable to white phosphorus needed to be less than 327 deaths by 2003. Duck mortality rates since 1999 have been less than this target number. Based on the mortality data, the short-term RAO has been successfully met.

The latest Draft RA summary report for ERF (USACE 2011a) also states that the estimated ranges for the 2010 and 2011 mortality data (0.3 percent to 0.8 percent, and 0.4 percent to 0.9 percent) are less than the long-term RAO. The significant drop in mortality rates has been directly attributed to the full-scale active remediation of the white phosphorus-contaminated areas at ERF. A slight increase in mortality rates was observed in 2009; however, the increase has been attributed to unusually dry conditions during the first half of the 2009 fall migration season. Water levels returned to normal during the subsequent migrations seasons (2010 and 2011) and mortality rates continued to decrease. Despite the 2009 increase in mortalities, the mortality rate has been below the long-term RAO for the last six years.

System Operations/O&M: System maintenance continues to be routinely performed. During system operation, equipment is monitored through on-site inspections.

Opportunities for Optimization: Due to the achievement of the short-term RAO and the accelerated achievement of the long-term RAO, there are no current opportunities for optimization.

Early Indicators of Potential Issues: Waterfowl mortalities at the ERF may be skewed due to unintentional hazing of the waterfowl population during yearly field activities.

Implementation of LUCs and Other Measures: ERF is an active range and subject to U.S. Army regulations. The LUCs for ERF are functioning as intended and continue to be protective of human health and the environment. Figure 3-3 depicts the OUC ERF area subject to restricted use under the LUC Policy (i.e., the OUC site boundary).

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Answer: Yes

Changes in Standards and TBCs: There are no changes in standards identified as ARARs, newly promulgated standards, and/or changes in TBCs identified in the ROD, that could call into question the protectiveness of the remedy.

Changes in Exposure Pathways: There are no changes in land use or the anticipated land use on or near the site; no new human health or ecological exposure pathways, receptors, or populations at risk have been identified; no new contaminants or contaminant sources have been identified; and no changes in the physical site conditions have been observed.

Changes in Toxicity and Other Contaminant Characteristics: White phosphorus is the only COC identified in the OUB ROD and does not have any matrix specific RAOs. No changes to toxicity or other characteristics for white phosphorus have occurred since the 2008 Five-Year Review.

Changes in Risk Assessment Methods: None

Expected Progress Towards Meeting RAOs: The remedy is progressing at a rate faster than originally anticipated in the ROD.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Answer: No

7.3 OUE TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended in the decision documents?

Answer: Yes

Remedial Action Performance: The PCE plume at OUE appears to be stable and contained with concentrations of contaminants in downgradient wells being either nondetect or well below the MCL. Although it is early in the remedy performance period (seven years since the OUE ROD was signed), natural attenuation, a selected remedy in the ROD, has been found to be limited at the site as evidenced by the results of biodegradation parameters and the near-absence of PCE breakdown products. Dilution appears to be the primary process of natural attenuation at the site.

System Operations/O&M: Implemented operating procedures (in this case, monitoring) will maintain the effectiveness of response actions. There are no large variances in O&M costs that would indicate potential remedy problems or remedy issues.

Opportunities for Optimization: None

Early Indicators of Potential Issues: According to Section 11.4 of the OUE ROD, it is expected that the selected remedy (natural attenuation) will meet the RAOs for the AVMA site and that groundwater contamination will be reduced to levels less than the MCLs within a 30-year time period. Although it is early in the remedy performance period (seven years since the OUE ROD was signed), natural attenuation has been found to be limited at the AVMA site and no significant increasing or decreasing trends are statistically apparent. In addition, several manned facilities are located within the estimated PCE plume boundaries at the AVMA site, indicating a potential for a completed vapor-intrusion exposure pathway at these facilities.

Implementation of LUCs and Other Measures: The LUCs at the AVMA are functioning as intended and continue to be protective of human health and the environment. Excavation in the area is restricted and requires a permit. Groundwater intrusion is also restricted. At Building 35-752, LUCs have prevented unauthorized exposure by restricting the land and groundwater use at the site. Additionally, an Excavation Clearance Request is required prior to the commencement of any excavation activities, which limits the likelihood of exposure to contaminants.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Answer: No

Changes in Standards and TBCs: There have been no MCL changes to the chemical-specific ARARs (40 CFR 141, 40 CFR 143, 18 AAC 75 and 18 AAC 80) listed in the 2005 OUE ROD that affect site COCs. The 2012 update to the chemical-specific ARAR 18 AAC 75 did affect the screening value used to eliminate dioxins as a soil chemical of concern at the time of the ROD. However, this does not affect the outcome of the screening process, as the maximum detected OUE dioxin concentration remains below the updated direct contact and migration to groundwater cleanup levels.

Changes in Exposure Pathways: The risk assessment conducted to support the remedy selection outlined in the OUE ROD did not evaluate the potential vapor intrusion pathway for the manned buildings at the site. The vapor intrusion pathway is considered a change to the exposure assumptions made for the site. No changes in land use or the anticipated land use on or near the site have been identified; no new contaminants or contaminant sources have been identified; and no changes in the physical site conditions have been observed.

Changes in Toxicity and Other Contaminant Characteristics: Toxicity information has been updated since the risk assessment used to support the ROD was completed. The updated toxicity information does not affect the protectiveness of the remedy because the RAOs listed in the ROD do not yield an unacceptable risk (carcinogenic or non-carcinogenic) for OUE when updated toxicity information is considered.

Changes in Risk Assessment Methods: None

<u>Expected Progress Towards Meeting RAOs</u>: Although it is early in the remedy performance period (seven years since the OUE ROD was signed), natural attenuation has been found to be limited at the AVMA site based on evaluation of historical site data. In order to meet the 30 year time frame stated in the OUE ROD, a pilot study of an enhanced natural attenuation technology (Emulsified Vegetable Oil, Aerobic Biodegradation, etc.) should be considered.

<u>Question C</u>: Has any other information come to light that could call into question the protectiveness of the remedy?

<u>Answer</u>: No

7.4 TECHNICAL ASSESSMENT SUMMARY

As described above, all remedies at JBER-R are functioning as intended in the RODs for OUs B, C, and E. However, changes in toxicity data and exposure pathways at OUB and OUE, may affect the protectiveness of the selected remedies.

In 1999, HVE and SPSH were effectively used to remediate a hot spot at OUB. Contaminant levels continue to decrease, and LUCs remain effective in preventing exposure to any residual contamination. Because the plume boundary beyond Monitoring Well AP-3747 has not been defined, the augmentation of the monitoring well network is recommended to define the downgradient limit of the PRDA Plume. Although some evidence of ATV use has been identified at OUB, activities do not appear to have disturbed the soil or groundwater at the site. Concrete barriers were installed at the site in 2011 to assist in the prevention of unauthorized access to the site; during site inspection activities performed in 2012, no evidence of trespassing was noted. Although five post-ROD to-be-watched contaminants have been identified for OUB, they are likely breakdown products from the originally identified COCs at OUB and monitoring data shows that the concentrations of these compounds are relatively stable. Therefore, the selected remedy at OUB remains protective in the short term. The remedy at OUB currently protects human health and the environment because the LUCs are preventing exposure to contaminated groundwater, soil, and potential UXO hazards. However, in order for the remedy to be protective in the long-term, the COC RAOs established in the ROD will need to be re-evaluated to consider current COC toxicity information. Changes in toxicity values for some COCs currently result in and unacceptable risk (Hazard Index > 1) when the residential exposure scenario is considered.

The short-term RAO for decreased duck mortality rates has been met for this Five-Year Review period at OUC. This significant drop in mortality rates has been directly attributed to the full-scale active remediation of the white phosphorus-contaminated areas at ERF. Under current estimates, the long-term RAO for decreased duck mortality is anticipated to be reached faster than originally anticipated in the ROD for OUC.

Although it is early in the remedy performance period (seven years since the OUE ROD was signed), the selected remedy in the OUE ROD, natural attenuation, has been found to be limited at the site as evidenced by the results of biodegradation parameters, the near-absence of PCE breakdown products, and no statistically apparent downward trend in PCE concentration. Under current estimates, achievement of the RAOs at for groundwater contamination reduction is unlikely within the 30-year timeframe originally predicted. Additionally, the risk assessment conducted to support the remedy selection outlined in the OUE ROD did not evaluate the potential vapor intrusion pathway for the manned buildings at the site. Therefore, the protectiveness of the selected remedy at OUE cannot be determined until the vapor intrusion pathway has been properly evaluated.

8.0 ISSUES

This section details issues related to current site operations, conditions, or activities, and evaluates whether the issues affect current or future protectiveness of the associated remedy. The issues identified during this Five-Year Review that affect protectiveness are presented in Table 8-1. The issues identified during this Five-Year Review that do not affect protectiveness are presented in Table 8-2.

Table 8-1
Issues Identified During the Five-Year Review (2013) that Affect Protectiveness

OU	Site	Issue	Affects Current Protectiveness? (Y/N)	Affects Future Protectiveness? (Y/N)
B	PRDA	**Downgradient Plume Boundary:** The downgradient margin of the OUB plume at Poleline Road Disposal Area is not defined. A downgradient monitoring well (AP-3747), is located to the north-northeast of the "hot spot". However, the plume boundary appears to extend beyond this well.	N	Y
B	PRDA	**Cleanup Standard:** Chemical-specific toxicity updates affect the OUB RAOs for 1,1,2,2 PCA (groundwater and soil) and PCE (soil) because they were risk based at the time of the ROD (no regulatory MCL). The toxicity changes result in an unacceptable exposure (Hazard Index > 1) when the residential exposure assumption, used to support the OUB ROD, and the ROD RAOs are considered.	N	Y
E	AVMA	**Vapor Intrusion:** Manned facilities are present in the vicinity of the PCE plume associated with the AVMA site indicating a potential for vapor intrusion to occur at those facilities.	Y	Y

Note:
For additional definitions, see the Acronyms and Abbreviations section.

Table 8-2
Issues Identified During the Five-Year Review (2013) that Do Not Affect Protectiveness

OU	Site	Issue	Affects Current Protectiveness? (Y/N)	Affects Future Protectiveness? (Y/N)
B	PRDA	**Land-Use Controls:** Evidence of limited ATV access was identified at the Poleline Road Disposal Area during site inspection activities.	N	N
B	PRDA	**Monitoring:** Groundwater samples from sentinel wells to be monitored prior to each Five-Year Review were not collected in time for data to be reviewed at the time this report was prepared.	N	N
B	PRDA	**Land Use Controls:** During site inspection activities, monitoring wells AP-3985, AP-3986, and AP-4551 were found to be unlocked.	N	N
C	ERF	**Waterfowl Mortality:** Waterfowl populations may be biased slightly low due to unintentional hazing during seasonal field activities.	N	N
E	AVMA	**Natural Attenuation**: Although it is early in the remedy performance period (seven years since the OUE ROD was signed), natural attenuation at the AVMA site has been limited, resulting in no significant decreasing trends in contaminant concentrations in the groundwater according to statistical analysis (Mann-Kendall) of historical contaminant concentrations.	N	N

Notes:
ATV = all-terrain vehicle
For additional definitions, see the Acronyms and Abbreviations section.

As stated above in Tables 8-1 and 8-2, LUCs at the OUB site have been historically ineffective, as evidence of trespassing has been noted at the site. In 2011, concrete barriers were installed at OUB to prevent unauthorized access and damage to onsite monitoring wells. During the latest site inspection, performed in 2012, no evidence of trespassing was noted at the site. However a single set of ATV tracks was observed. Additionally, the downgradient boundary of the contaminant plume beyond monitoring well (AP-3747) at OUB has yet to be defined. However, because of the LUCs in place, the age of the plume, and the lack of downgradient receptors, this data gap does not negatively impact the current protectiveness at the site. The data gap may negatively impact the future protectiveness at OUB.

Sampling of sentinel wells at OUB is also required prior to the Five-Year Review to assist in the data review process; however, the data were not available prior to this Five-Year Review.

Additionally, monitoring wells AP-3985, AP-3986, and AP-4551 were found to be unlocked during the 2012 site inspection.

The chemical-specific toxicity updates affect the OUB RAOs for 1,1,2,2-PCA (groundwater and soil) and PCE (soil) because they were risk-based at the time of the ROD (no regulatory MCL). The toxicity changes result in an unacceptable exposure level (Hazard Index > 1) when the residential exposure assumption, used to support the OUB ROD, and the ROD RAOs are considered. The current protectiveness of the remedy is not affected because there are no residential structures or other downgradient receptors located within the vicinity of OUB. However, the future protectiveness at the site is affected based on the potential for unacceptable exposure (Hazard Index > 1).

Waterfowl populations during surveys at the OUC site may be biased slightly low due to unintentional hazing during field activities. However, the RAO for OUC is based upon the percentage of deceased waterfowl at the site.

Although it is early in the remedy performance period (seven years since the OUE ROD was signed), statistical analysis (Mann-Kendall) performed for the AVMA site has not shown a significant decreasing or increasing trend for contaminant constituents in the groundwater. For this reason, and because natural attenuation has been determined to be limited, the anticipated timeframe for cleanup (30 years) as stipulated in the ROD may not be met. Additionally, PCE contamination has been identified in the groundwater at the AVMA site. PCE has the potential to volatilize and negatively impact the indoor air quality of any structures located within the plume boundaries through vapor intrusion. The potential for vapor intrusion at the AVMA site affects the current and future protectiveness at the site.

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9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for issues identified in this review that affect protectiveness are presented in Table 9-1. Recommendations and follow-up actions for issues identified in this review that do not affect protectiveness are presented in Table 9-2.

Table 9-1
Recommendations and Follow-up Actions for Issues Identified in the Five-Year Review (2013) that Affect Protectiveness

OU	Site	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Current Protectiveness? (Y/N)	Follow-up Actions: Affects Future Protectiveness? (Y/N)
B	Poleline Road	**Downgradient Plume Boundary**: Augment the monitoring well network in the shallow aquifer at OUB to define the downgradient limit of the plume.	USAF	ADEC, EPA	2015	N	Y
		Cleanup Standard: Update the OUB COC RAOs to provide future protectiveness of human health.	USAF	ADEC, EPA	2015	N	Y
E	AVMA	**Vapor Intrusion:** The potential vapor-intrusion exposure pathway should be assessed at the AVMA site.	USAF	ADEC, EPA	2014	Y	Y

Notes:
For additional definitions, see the Acronyms and Abbreviations section.

Table 9-2
Recommendations and Follow-up Actions for Issues identified in the Five-Year Review (2013) that Do Not Affect Protectiveness)

OU	Site	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Current Protectiveness? (Y/N)	Follow-up Actions: Affects Future Protectiveness? (Y/N)
B	Poleline Road	**Land-Use Controls:** Although concrete barriers are installed in the vicinity of the site, signage should be added at the barriers and along the nearby recreational trail to identify that unauthorized access is not permitted.	USAF	ADEC, EPA	2013	N	N
		Monitoring: Groundwater samples from sentinel wells to be monitored prior to each Five-Year Review should be collected in the year preceding the beginning of the Five-Year Review.	USAF	ADEC, EPA	2016	N	N
		Monitoring: Maintenance activities should be conducted at OUB to secure monitoring wells AP-3985, AP-3986, and AP-4551.	USAF	ADEC, EPA	2013	N	N
C	Eagle River Flats	**Waterfowl Mortality:** Waterfowl populations should be re-addressed upon completion of seasonal field activities at the site to ensure that no bias is represented.	USAF	ADEC, EPA	2016	N	N
E	AVMA	**Natural Attenuation**: Although it is early in the remedy performance period (seven years since the OUE ROD was signed), natural attenuation has been shown to be limited at the AVMA site. In order to meet the 30 year time frame stated in the OUE ROD, a pilot study of an enhanced natural attenuation technology (Emulsified Vegetable Oil, Aerobic Biodegradation, etc.) should be considered.	USAF	ADEC, EPA	2014	N	N

Notes:
ATV = all-terrain vehicle
For additional definitions, see the Acronyms and Abbreviations section.

The site-specific recommendations and follow-up actions are explained below:

- The concrete barriers installed at OUB should be incorporated into the annual JBER LUC inspections to ensure that they are functioning as intended. During the site inspection performed for this Five-Year Review, no evidence of unauthorized site access was noted. The downgradient contaminant plume boundary in the shallow aquifer has yet to be defined at OUB; therefore, it is recommended that the monitoring well network at OUB be augmented to assist in defining the downgradient extent the plume. To ensure that the latest data are available during the Five-Year Review process, the sentinel wells at OUB should be sampled in the year prior to the Five-Year Review. Additionally, it is recommended that the OUB COC RAOs be updated to provide future protectiveness of human health at OUB. It is also recommended that locks be provided for monitoring wells AP-3985, AP-3986, and AP-4551 to protect the integrity of the wells.

- The waterfowl population numbers at OUC may be biased slightly low due to unintentional hazing during field activities; therefore, it is recommended that the waterfowl population at OUC be re-addressed upon completion of field activities for the site and the numbers be compared with previous survey events to evaluate for any bias. As stated previously, this issue will not affect current or future protectiveness as the RAOs for OUC are based upon percentages of deceased waterfowl.
- Although it is early in the remedy performance period (seven years since the OUE ROD was signed), statistical analysis performed for the AVMA site has shown no significant increasing or decreasing trends in concentrations of contaminant constituents. In order to meet the 30-year time frame stated in the OUE ROD, a pilot study of an enhanced natural attenuation technology (Emulsified Vegetable Oil, Aerobic Biodegradation, etc.) should be considered. Additionally, concentrations of PCE have been identified at the AVMA site. While the depth to groundwater is relatively deep at the site, there is still a potential for exposure to volatilized PCE through vapor intrusion, especially in manned facilities that may be located within the contaminant plume boundary. It is therefore recommended that the vapor-intrusion pathway be evaluated to determine whether volatilized contaminants are negatively affecting the indoor/outdoor air at the site.

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10.0 PROTECTIVENESS STATEMENT(S)

Table 10-1 was developed based on the EPA Comprehensive Five-Year Review Guidance (June 2001) and summarizes OU and source area information from the preceding sections used to formulate protectiveness statements. Only OUs B, C, and E source areas are included in this section since all OUA and OUD source areas were either NFA or transferred.

10.1 OUB – POLELINE ROAD DISPOSAL AREA

The remedy at OUB currently protects human health and the environment because the LUCs are preventing exposure to contaminated groundwater, soil, and potential UXO hazards. However, in order for the remedy to be protective in the long term, the COC RAOs established in the ROD will need to be re-evaluated to consider current COC toxicity information and the recommendation for defining the downgradient extent of the plume will need to be addressed. Changes in toxicity values for some COCs currently result in an unacceptable risk (Hazard Index > 1) when the residential exposure scenario is considered.

10.2 OUC – EAGLE RIVER FLATS

The remedy at OUC is protective of human health and the environment.

10.3 OUE – ARMORED VEHICLE MAINTENANCE AREA

Protectiveness determination of the remedy at OUE is deferred until the potential impacts associated with the vapor intrusion pathway at the site are evaluated. The vapor intrusion assessment is expected to be performed in 2014.

Table 10-1
Protectiveness Statement Basis

OU	Source Area	**Question A** Is the remedy functioning as intended in the decision documents?	**Question B** Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives still valid?	**Question C** Has any other information come to light that could call into question the protectiveness of the remedy?	Is the remedy protective in the short term?	Is the remedy protective in the long term?
B	PRDA	Yes	No	No	Yes	No
C	ERF	Yes	Yes	No	Yes	Yes
E	AVMA	Yes	No	No	Deferred	Deferred

Note:
For definitions, see the Acronyms and Abbreviations section.

11.0 NEXT REVIEW

Future Five-Year Reviews for OUs B, C, and E are necessary because COC concentrations remain above levels that allow for unlimited use of the site and unrestricted exposure to the air, soil, and water. The next JBER-R Five-Year Review will be scheduled for completion five years from the final signature date of this review. The next JBER-R Five-Year Review is expected to be completed in 2018.

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APPENDIX A

Public Announcement and Third Five-Year Review Factsheet

US Air Force Announces Start of Five-Year Review

The 673d Air Base Wing at Joint Base Elmendorf-Richardson (JBER) announces the beginning of the Five-Year Review of cleanup remedies implemented at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites.

The purpose of the Five-Year Review is to evaluate whether the remedies selected to clean up contaminated sites are operating as designed and continue to remain protective of human health and the environment. The U.S. Environmental Protection Agency and Alaska Department of Environmental Conservation also are participating in this review.

Reviews are conducted at least once every five years until contaminant levels allow unlimited use of the site and unrestricted exposure to the air, soil and water. Detailed information concerning JBER cleanup efforts is available in the information repository at:

Alaska Resources Library & Information Services
University of Alaska, Anchorage Consortium Library
3211 Providence Drive
(907) 786-1871

The findings of the Five-Year Review will be placed in the information repository in July 2013.

Interested persons can participate in the Five-Year Review process through September 2012 by responding to a questionnaire available from:

Kevin Maher, Jacobs Engineering
4300 B Street, Suite 600
Anchorage, AK 99508
kevin.maher@jacobs.com (907) 563-3322

Information on the cleanup process is distributed to interested persons through periodic JBER Environmental Restoration Program Fact Sheets. If you want to be added to the mailing list, contact Cynthia Tomlinson at (907) 552-3230 or cynthia.tomlinson@us.af.mil.

August 2012

OVERVIEW: FIVE-YEAR REVIEW
ENVIRONMENTAL RESTORATION PROGRAM
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

August 2012

INTRODUCTION

Elmendorf Air Force Base (AFB), located just north of Anchorage, Alaska, and the Army's Fort Richardson, located east of the base, merged under the joint base initiative to form Joint Base Elmendorf-Richardson (JBER). While U.S. Air Force (USAF) and Army unit missions remain separate, JBER is consolidating service-specific programs and installation support functions, such as environmental services. The USAF, as the supporting component of JBER, is now responsible for management of all Environmental Restoration Programs.

FIVE-YEAR REVIEW

The USAF, lead agency for environmental cleanup at JBER, announces the Five-Year Review. This review is a detailed evaluation of the environmental cleanup work being performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The objective of the evaluation is to determine if a selected remedy is functioning as intended and continues to remain protective of human health and the environment. If a remedy is found not to be protective of human health and the environment, recommendations for additional activities are documented in the Five-Year Review. The U.S. Environmental Protection Agency and the Alaska Department of Environmental Conservation will provide oversight of this process.

Two Five-Year Reviews will be conducted: one for JBER-Richardson (scheduled for completion in December 2012) and one for JBER-Elmendorf (scheduled for completion in May 2013). This is the third Five-Year Review for JBER-Richardson and the fourth Five-Year Review for JBER-Elmendorf. The most recent Five-Year Reviews for former Elmendorf AFB and former Fort Richardson were completed in 2008. CERCLA requires that a review is conducted at least once every five years after a remedy is selected until hazardous substances, pollutants, or contaminants no longer remain on site above levels that allow for unlimited use and unrestricted exposure.

These reviews will evaluate whether the selected remedies documented in records of decision (ROD) remain protective of human health and the environment. The reviews will also determine if cleanup levels initially mandated remain protective. Periodic reviews are required because conditions on the site could have changed over time, a remedy may not be operating as designed or intended, or there could be new, more stringent cleanup requirements.

The community is encouraged to participate in the review process. Background information and RODs for JBER are on file in the Information Repository at the Alaska Resources Library and Information Services. Interviews are being conducted by Jacobs Engineering through August 2012. A report summarizing the results of the Five-Year Review will be placed in the Information Repository.

ACRONYMS

AFB	Air Force Base
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
JBER	Joint Base Elmendorf-Richardson
LUC	land use control
MNA	monitored natural attenuation
NFA	no further action
OB/OD	open burning/open detonation
OU	operable unit
PCB	polychlorinated biphenyl
ROD	record of decision
TCE	trichloroethylene
USAF	U.S. Air Force

OPERABLE UNIT SUMMARIES

CERCLA sites on JBER are grouped into operable units (OU) based on similarities in one of the following: contaminant types (fuels, solvents, etc.), contaminant sources (leaking tanks, spills, etc.), or geographical location.

JBER-Elmendorf – RODs have been signed for six OUs and one site

Operable Unit 1

- Site: LF59
- Contaminant: trichloroethylene (TCE) in groundwater
- Remedy: groundwater monitoring to track contamination levels and land use controls (LUC) such as access and use restrictions to prevent contact with contamination

Operable Unit 2

- Site: ST41
- Contaminant: fuel in groundwater
- Remedy: monitored natural attenuation (MNA) to ensure contaminant reduction through natural biological and physical processes; LUCs

Operable Unit 3

- Cleanup is complete, so OU3 is not included in this Five-Year Review; the last Five-Year Review for OU3 was in 1998.

Operable Unit 4

- Sites: FT23, SD24, SD25, SD28, and SD29
- Contaminants: fuel and solvents in groundwater
- Remedy: MNA and LUCs

Operable Unit 5

- Site: ST37
- Contaminants: fuel and TCE in groundwater and seep water
- Remedy: MNA and LUCs for groundwater, plus treatment in natural and engineered wetlands for seep water

Operable Unit 6

- Sites: LF02, LF03, LF04, WP14, and SD15
- Contaminants: fuel and solvents in groundwater and soil
- Remedy: MNA and LUCs for groundwater, plus high-vacuum extraction for soil and groundwater at SD15. Additionally, landfill debris that erodes out of LF04 is removed from the beach annually.

Site DP98

- Contaminant: TCE in soil and groundwater
- Remedy: excavation/off-site disposal of contaminated soil; treatability study, groundwater modeling, MNA and LUCs for groundwater

JBER-Richardson – RODs have been signed for five OUs

Operable Unit A

- Sites: Building 986 POL Laboratory Dry Well, Ruff Road Fire Training Area, Roosevelt Road Transmitter Site Leachfield
- Contaminants: fuels in soil
- Remedy: NFA under CERCLA

Operable Unit B

- Site: Poleline Road Disposal Area
- Contaminant: solvents in soil and groundwater
- Remedy: high vacuum extraction, treatability studies, MNA and LUCs

Operable Unit C

- Sites: Eagle River Flats Impact Area, Open Burn/Open Detonation (OB/OD) Pad
- Contaminants: white phosphorus in sediment
- Remedy: pond and watercourse pumping and drying to oxidize white phosphorus, gravel capping of watercourses too small to drain/dry; LUCs; OB/OD Pad NFA under CERCLA

Operable Unit D

- Sites: Building 45-590 (Auto Hobby Shop), Circle Road Drum Site, Building 726 (Laundry Facility), Dust Palliative, Storm water Outfall to Ship Creek, Grease Pits, Landfill Fire Training Area, Building 700/718 (Former Drum Storage Area), Building 704 (Drum Storage Area)
- Contaminants: fuel and/or solvents in soil and groundwater
- Remedy: NFA under CERCLA

Operable Unit E

- Sites: Armored Vehicle Maintenance Area, Building 796 (Battery Shop), Building 955 (former Sludge Bin), Building 35-752 (High Frequency Transmitter Site)
- Contaminants: solvents and/or fuel in soil and/or groundwater
- Remedy: MNA and LUCs; NFA under CERCLA (2 sites)

Steps in the Five-Year Review Process	
Document Review	A review of the records of decision (ROD) and updates to the RODs since the last Five-Year Review. This includes review of the cleanup objectives and operation, monitoring, and optimization records.
Site Inspection & Interviews	To document if land use or site conditions have changed in ways that impact the protectiveness of the remedy, each site will be inspected and interviews will be conducted with operations personnel, community members, and regulators.
Assessment of Remedy Protectiveness	A comparison of cleanup standards in the ROD to current regulatory standards, site conditions, and remedy performance to determine if the ROD cleanup standards and actions are protective of human health and the environment.
Final Report	The report presents the purpose of the review, applicable regulations, site chronology and background, remedial actions and basis for remedial actions, progress since the last Five-Year Review, technical assessment of remedy protectiveness, and recommendations for any required or suggested improvements or follow-up actions. If the remedy for a site is deemed protective, a "certification of protectiveness" will be signed by an Air Force official that the site remains protective of human health and the environment. If the findings show that it is not protective, the report will state what steps are required to achieve protectiveness. The report also discusses when the next review is due and what areas will be included or excluded and why.

DEFINITIONS

LUC A land use control is an administrative or physical measure that limits human exposure by restricting activity, use, and/or access to properties with residual contamination.

MNA Monitored natural attenuation is a technique used to test for or measure the breakdown of contaminants in soil and groundwater by natural physical, chemical, and biological processes.

NFA No further action is a term used to indicate that there are no contaminants present, or that any contaminants that were present have been remediated to applicable cleanup levels.

PCB A group of toxic, persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant.

ROD Public document that explains which cleanup alternative has been selected and specifies the cleanup objectives.

TCE A solvent that was routinely used to remove grease from equipment and parts.

For More Information

Kevin Maher
Jacobs Engineering
4300 B Street, Suite 600
Anchorage, Alaska 99503
(907) 563-3322
kevin.maher@jacobs.com

Information Repository

Alaska Resources Library & Information Services (ARLIS)
University of Alaska Anchorage Consortium Library
3211 Providence Drive
Anchorage, Alaska
Reference Desk: (907) 272-7547

APPENDIX B

OUB Risk Evaluation of Cleanup Levels

JBER-Richardson Third Five-Year Review Resource Documents

OUB COC Cleanup Level Risk Evaluation

			Current Toxicity Values[1]				Risk-Based Screening Level[1]						
Water	Concentration	Units	Cancer Slope Factor	Reference Dose	Inhalation Unit Risk	Reference Concentration	Residential Soil RBSL[2]	Industrial Soil RBSL[2]	Groundwater RBSL[2] (mg/L)	MCL	RBSL Basis[3]	Is Concentration greater than RBSL	Is Concentration greater than MCL
Carbon tetrachloride	0.005	mg/L	0.07	0.004	0.000006	0.1			0.00039	0.005	c	Yes	No
cis-1,2-dichloroethene	0.07	mg/L		0.002					0.028	0.07	n	Yes	No
trans-1,2-Dichloroethene	0.1	mg/L		0.02	0.06				0.086	0.1	n	Yes	No
PCE (Tetrachloroethylene)	0.005	mg/L	0.0021	0.006	0.00000026	0.04	22	110	0.0097	0.005	c**	No	No
TCE (Trichloroethylene)	0.005	mg/L	0.046	0.0005	0.0000041	0.002			0.000441	0.005	c**	Yes	No
1,1,2,2-tetrachloroethane	0.052	mg/L	0.2	0.02	0.000058		0.56	2.8	0.000066	0.052	c	Yes	No

Soil	Concentration	Units	Cancer Slope Factor	Reference Dose	Inhalation Unit Risk	Reference Concentration	Residential Soil RBSL[2]	Industrial Soil RBSL[2]	Groundwater RBSL[2]	MCL	RBSL Basis[3]	Is Concentration greater than Residential RBSL	Is Concentration greater than MCL
PCE	4	mg/kg	0.0021	0.006	0.00000026	0.04	22	110	9.7	4	c**	No	No
1,1,2,2-tetrachloroethane	0.1	mg/kg	0.2	0.02	0.000058		0.56	2.8	0.066	0.1	c	No	No

1 Toxicity values and Risk Based Screening Levels were obtained from the Regional Risk-Based Screening Levels Table (master_sl_table_run_NOV2012).

2 RBSL are based on an Incremential Lifetime Cancer Risk of 10^{-6} or a Hazard Index of 1.

3 I = c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer

RME INTAKE EXPOSURE FACTORS												
MEDIA, EXPOSURE ROUTE,	**CONTACT RATE**	**SOIL ADHERENCE FACTOR**	**SOIL CONVERSION FACTOR**	**PARTICULATE EMISSION FACTOR**	**EXPOSURE TIME**	**EXPOSURE TIME**	**EXPOSURE FREQUENCY**	**EXPOSURE DURATION**	**BODY WEIGHT**	**AVERAGING TIME**		**INTAKE RATE**
RECEPTOR					**CONVERSION FACTOR**					**NONCANCER**	**CANCER**	
UNIT	(mass or vol/time)	(mg/cm^2)		1/(kg/m3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)	(years)	(mg/kg)/day)
CHEMICAL EXPOSURES												
INDUSTRIAL SOIL												
Soil Ingestion Worker	50		1.0E-06		1	1	250	25	70	25		**4.89E-07**
(Noncarcinogenic)	(mg/day)		($1 kg/10^6 mg$)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_IG_S												
Soil Ingestion Worker	50		1.0E-06		1	1	250	25	70		70	**1.75E-07**
(Carcinogenic)	(mg/day)		($1 kg/10^6 mg$)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_W_IG_S												
Soil Dermal Worker	3300	0.2	1.0E-06		1	1	250	25	70	25		**6.46E-06**
(Noncarcinogenic)	(cm^2/day)	(mg/cm^2)	($1 kg/10^6 mg$)		(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_DR_S												
Soil Dermal Worker	3300	0.2	1.0E-06		1	1	250	25	70		70	**2.31E-06**
(Carcinogenic)	(cm^2/day)	(mg/cm^2)	($1 kg/10^6 mg$)		(hours/day)	(hours/day)	(days/year)	(years)	(kg)			**(mg/kg-day)**
IC_W_DR_S												
									1/BW			
Soil Inhalation Worker				4.15E-10	1	1	250	25		25		**2.84E-10**
(Noncarcinogenic)	(mg^3/day)			1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_IH_S												
Soil Inhalation Worker			1.0E+03	4.15E-10	1	1	250	25			70	**1.02E-07**
(Carcinogenic)	(mg^3/day)		$1 ug/10^{-3} mg$	1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_W_IH_S												
INDUSTRIAL GROUNDWATER												
Groundwater Ingestion Worker	1				1	1	250	25	70	25		**9.78E-03**
(Noncarcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_IG_GW												
Groundwater Ingestion Worker	1				1	1	250	25	70		70	**3.49E-03**
(Carcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_W_IG_GW												
Groundwater Dermal Worker	3300	1	1.0E-03		1	0.25	250	25	70	25		**8.07E-03**
(Noncarcinogenic)	(cm^2/day)	(mg/cm^2)	($1 L/10^3 cm3$)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_DR_GW												
Groundwater Dermal Worker	3300	1	1.0E-03		1	0.25	250	25	70		70	**2.88E-03**
(Carcinogenic)	(cm^2/day)	(mg/cm^2)	($1 L/10^3 cm3$)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_W_DR_GW												
Groundwater Inhalation Worker	0				1	1	250	25	70	25		**0.00E+00**
(Noncarcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_W_IH_GW												
Groundwater Inhalation Worker	0				1	1	250	25	70		70	**0.00E+00**
(Carcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_W_IH_GW												

MEDIA, EXPOSURE ROUTE,	CONTACT RATE	SOIL ADHERENCE FACTOR	SOIL CONVERSION FACTOR	PARTICULATE EMISSION FACTOR	EXPOSURE TIME	EXPOSURE TIME	EXPOSURE FREQUENCY	EXPOSURE DURATION	BODY WEIGHT	AVERAGING TIME		INTAKE RATE
RECEPTOR					CONVERSION FACTOR					NONCANCER	CANCER	
UNIT	(mass or vol/time)	(mg/cm^2)		1/(kg/m3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)	(years)	(mg/kg)/day)
CHEMICAL EXPOSURES												
RESIDENTIAL SOIL												
Soil Ingestion Adult	100		1.0E-06		1	1	350	24	70	24		**1.37E-06**
(Noncarcinogenic)	(mg/day)		(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_IG_S												
Soil Ingestion Adult	100		1.0E-06		1	1	350	24	70		70	**4.70E-07**
(Carcinogenic)	(mg/day)		(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)			**(mg/kg-day)**
IC_RA_IG_S												
Soil Dermal Adult	5700	0.2	1.0E-06		1	1	350	24	70	24		**1.56E-05**
(Noncarcinogenic)	((cm^2/day)	(mg/cm^2)	(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_DR_S												
Soil Dermal Adult	5700	0.2	1.0E-06		1	1	350	24	70		70	**5.35E-06**
(Carcinogenic)	((cm^2/day)	(mg/cm^2)	(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)			**(mg/kg-day)**
IC_RA_DR_S												
Soil Inhalation Adult				4.15E-10	1	1	350	24		24		**3.98E-10**
(Noncarcinogenic)	(m^3/day)			1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_IH_S												
Soil Inhalation Adult			1.0E+03	4.15E-10	1	1	350	24			70	**1.36E-07**
(Carcinogenic)	(m^3/day)		1 $ug/10^{-3}$ mg	1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)			**(mg/kg-day)**
IC_RA_IH_S												
Soil Inhalation Adult				6.62E-10	1	1	350	24		24		**6.35E-10**
(Noncarcinogenic)	(m^3/day)			1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_IH_S_F												
Soil Inhalation Adult			1.0E+03	6.62E-10	1	1	350	24			70	**2.18E-07**
(Carcinogenic)	(m^3/day)		1 $ug/10^{-3}$ mg	1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)			**(mg/kg-day)**
IC_RA_IH_S_F												
Soil Ingestion Child	200		1.0E-06		1	1	350	6	15	6		**1.28E-05**
(Noncarcinogenic)	(mg/day)		(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_IG_S												
Soil Ingestion Child	200		1.0E-06		1	1	350	6	15		70	**1.10E-06**
(Carcinogenic)	(mg/day)		(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_IG_S												
Soil Dermal Child	2800	0.2	1.0E-06		1	1	350	6	15	6		**3.58E-05**
(Noncarcinogenic)	((cm^2/day)	(mg/cm^2)	(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_DR_S												
Soil Dermal Child	2800	0.2	1.0E-06		1	1	350	6	15		70	**3.07E-06**
(Carcinogenic)	((cm^2/day)	(mg/cm^2)	(1 $kg/10^6$ mg)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_DR_S												
Soil Inhalation Child				6.62E-10	1	1	350	6		6		**6.35E-10**
(Noncarcinogenic)	(m^3/day)			1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_IH_S_F												
Soil Inhalation Child			1.0E+03	6.62E-10	1	1	350	6			70	**5.44E-08**
(Carcinogenic)	(m^3/day)		1 $ug/10^{-3}$ mg	1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_IH_S_F												

MEDIA, EXPOSURE ROUTE,	CONTACT RATE	SOIL ADHERENCE FACTOR	SOIL CONVERSION FACTOR	PARTICULATE EMISSION FACTOR	EXPOSURE TIME	EXPOSURE TIME	EXPOSURE FREQUENCY	EXPOSURE DURATION	BODY WEIGHT	AVERAGING TIME		INTAKE RATE
RECEPTOR					CONVERSION FACTOR					NONCANCER	CANCER	
UNIT	(mass or vol/time)	(mg/cm^2)		1/(kg/m3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)	(years)	(mg/kg)/day)
CHEMICAL EXPOSURES												
Soil Inhalation Child				4.15E-10	1	1	350	6		6		**3.98E-10**
(Noncarcinogenic)	(m^3/day)			1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_IH_S												
Soil Inhalation Child			1.0E+03	4.15E-10	1	1	350	6			70	**3.41E-08**
(Carcinogenic)	(m^3/day)		1 ug/10^{-3} mg	1/(kg/m^3)	1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_IH_S												
RESIDENTIAL GROUNDWATER												
Groundwater Ingestion Adult	2				1	1	350	24	70	24		**2.74E-02**
(Noncarcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_IG_GW												
Groundwater Ingestion Adult	2				1	1	350	24	70		70	**9.39E-03**
(Carcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RA_IG_GW												
Groundwater Dermal Adult	18000	1	1.0E-03		1	0.58	350	24	70	24		**1.43E-01**
(Noncarcinogenic)	((cm^2/day)	(mg/cm^2)	(1 L/10^3 cm3)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_DR_GW												
Groundwater Dermal Adult	18000	1	1.0E-03		1	0.58	350	24	70		70	**4.90E-02**
(Carcinogenic)	((cm^2/day)	(mg/cm^2)	(1 L/10^3 cm3)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RA_DR_GW												
Groundwater Inhalation Adult	0.833				1	1	350	24	70	24		**5.71E-03**
(Noncarcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RA_IH_GW												
Groundwater Inhalation Adult	0.833				1	1	350	24	70		70	**1.96E-03**
(Carcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RA_IH_GW												
Groundwater Ingestion Child	1				1	1	350	6	15	6		**6.39E-02**
(Noncarcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_IG_GW												
Groundwater Ingestion Child	1				1	1	350	6	15		70	**5.48E-03**
(Carcinogenic)	(liters/day)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_IG_GW												
Groundwater Dermal Child	6600	1	1.0E-03		1	0.333	350	6	15	6		**1.40E-01**
(Noncarcinogenic)	((cm^2/day)	(mg/cm^2)	(1 L/10^3 cm3)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_DR_GW												
Groundwater Dermal Child	6600	1	1.0E-03		1	0.333	350	6	15		70	**1.20E-02**
(Carcinogenic)	((cm^2/day)	(mg/cm^2)	(1 L/10^3 cm3)		1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_DR_GW												
Groundwater Inhalation Child	0.416				1	1	350	6	15	6		**1.33E-02**
(Noncarcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)	(years)		**(mg/kg-day)**
IN_RC_IH_GW												
Groundwater Inhalation Child	0.416				1	1	350	6	15		70	**1.14E-03**
(Carcinogenic)	(m^3/hr)				1/(hours/day)	(hours/day)	(days/year)	(years)	(kg)		(years)	**(mg/kg-day)**
IC_RC_IH_GW												
IN = Intake factor for considering noncarcinogenic health effects												
IC = Intake factor for considering carcinogenic health effects												

OUB

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	Future
Receptor Population:	Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	On-Site	Ingestion	PCE (Tetrachloroethylene)	4	mg/kg	6.99E-07	mg/kg-day	2.1E-03	(mg/kg-day)$^{-1}$	1.E-09	1.96E-06	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.0003
				1,1,2,2-tetrachloroethane	0.1	mg/kg	1.75E-08	mg/kg-day	2.0E-01	(mg/kg-day)$^{-1}$	3.E-09	4.89E-08	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.000002
			Exp. Route Total								5.E-09					0.0003
			Dermal	PCE (Tetrachloroethylene)	4	mg/kg	ND	mg/kg-day	2.1E-03	(mg/kg-day)-1	NA	ND	mg/kg-day	6.0E-03	1/(mg/kg-day)	NA
				1,1,2,2-tetrachloroethane	0.1	mg/kg	2.31E-08	mg/kg-day	2.0E-01	(mg/kg-day)-1	5.E-09	6.46E-08	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.000003
			Exp. Route Total								5.E-09					0.000003
		Exposure Point Total									1.E-08					0.0003
	Exposure Medium Total										1.E-08					0.0003
	Air	Inhalation of Fugitive Dust	Inhalation	PCE (Tetrachloroethylene)	4	mg/kg	4.06E-07	ug/m^3	2.6E-07	(ug/m^3)$^{-1}$	1.E-13	1.14E-09	mg/m^3	4.0E-02	mg/m^3	0.00000003
				1,1,2,2-tetrachloroethane	0.1	mg/Kg	1.02E-08	ug/m^3	5.8E-05	(ug/m^3)$^{-1}$	6.E-13	2.84E-11	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								7.E-13					0.00000003
		Exposure Point Total									7.E-13					0.00000003
	Exposure Medium Total										7.E-13					0.00000003
Medium Total											1.E-08					0.0003
Bedrock Groundwater	Bedrock Groundwater	Bedrock Groundwater	Ingestion	Carbon tetrachloride	5.00E-03	mg/L	1.75E-05	mg/kg-day	7.0E-02	(mg/kg-day)-1	1.E-06	4.89E-05	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.01
				cis-1,2-dichloroethene	7.00E-02	mg/L	2.45E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	6.85E-04	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.3
				trans-1,2-Dichloroethene	1.00E-01	mg/L	3.49E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	9.78E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.05
				PCE (Tetrachloroethylene)	5.00E-03	mg/L	1.75E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	4.E-08	4.89E-05	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.008
				TCE (Trichloroethylene)	5.00E-03	mg/L	1.75E-05	mg/kg-day	4.6E-02	(mg/kg-day)-1	8.E-07	4.89E-05	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.1
				1,1,2,2-tetrachloroethane	5.20E-02	mg/L	1.82E-04	mg/kg-day	2.0E-01	(mg/kg-day)-1	4.E-05	5.09E-04		2.0E-02	1/(mg/kg-day)	0.03
			Exp. Route Total								4.E-05					0.5
		Exposure Point Total									4.E-05					0.5
			Dermal	Carbon tetrachloride	5.00E-03	mg/L	2.29E-06	mg/kg-day	7.0E-02	(mg/kg-day)-1	2.E-07	6.41E-06	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.002
				cis-1,2-dichloroethene	7.00E-02	mg/L	1.08E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	3.03E-05	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.02
				trans-1,2-Dichloroethene	1.00E-01	mg/L	1.55E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	4.33E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.002
				PCE (Tetrachloroethylene)	5.00E-03	mg/L	5.07E-06	mg/kg-day	2.1E-03	(mg/kg-day)-1	1.E-08	1.42E-05	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.002
				TCE (Trichloroethylene)	5.00E-03	mg/L	1.41E-06	mg/kg-day	4.6E-02	(mg/kg-day)-1	7.E-08	3.96E-06	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.01
				1,1,2,2-tetrachloroethane	5.20E-02	mg/L	1.11E-05	mg/kg-day	2.0E-01	(mg/kg-day)-1	2.E-06	3.11E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.002
			Exp. Route Total								2.E-06					0.03
		Exposure Point Total									4.E-05					0.6
	Exposure Medium Total										4.E-05					0.6
Medium Total											4.E-05					0.6
										Total of Receptor Risks Across All Media	4.E-05		Total of Receptor Hazards Across All Media			1

OUB

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	On-Site	Ingestion	PCE (Tetrachloroethylene)	4	mg/kg	1.88E-06	mg/kg-day	2.1E-03	$(mg/kg\text{-}day)^{-1}$	4.E-09	5.48E-06	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.0009
				1,1,2,2-tetrachloroethane	0.1	mg/kg	4.70E-08	mg/kg-day	2.0E-01	(mg/kg-day)-1	9.E-09	1.37E-07	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.000007
			Exp. Route Total								1.E-08					0.0009
			Dermal	PCE (Tetrachloroethylene)	4	mg/kg	ND	mg/kg-day	2.1E-03	(mg/kg-day)-1	NA	ND	mg/kg-day	6.0E-03	1/(mg/kg-day)	NA
				1,1,2,2-tetrachloroethane	0.1	mg/kg	5.35E-08	mg/kg-day	2.0E-01	(mg/kg-day)-1	1.E-08	1.56E-07	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.000008
			Exp. Route Total								1.E-08					0.000008
		Exposure Point Total									2.E-08					0.0009
	Exposure Medium Total										2.E-08					0.0009
	Air	Inhalation of Fugitive Dust	Inhalation	PCE (Tetrachloroethylene)	4	mg/kg	8.71E-07	ug/m^3	2.6E-07	$(ug/m^3)^{-1}$	2.E-13	2.54E-09	mg/m^3	4.0E-02	mg/m^3	0.00000006
				1,1,2,2-tetrachloroethane	0.1	mg/kg	2.18E-08	ug/m^3	5.8E-05	$(ug/m^3)^{-1}$	1.E-12	6.35E-11	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								1.E-12					0.00000006
		Exposure Point Total									1.E-12					0.00000006
	Exposure Medium Total										1.E-12					0.00000006
Medium Total											2.E-08					0.0009
Bedrock Groundwater	Bedrock Groundwater	Bedrock Groundwater	Ingestion	Carbon tetrachloride	5.00E-03	mg/L	4.70E-05	mg/kg-day	7.0E-02	(mg/kg-day)-1	3.E-06	1.37E-04	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.03
				cis-1,2-dichloroethene	7.00E-02	mg/L	6.58E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	1.92E-03	mg/kg-day	2.0E-03	1/(mg/kg-day)	1
				trans-1,2-Dichloroethene	1.00E-01	mg/L	9.39E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	2.74E-03	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.1
				PCE (Tetrachloroethylene)	5.00E-03	mg/L	4.70E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	1.E-07	1.37E-04	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.02
				TCE (Trichloroethylene)	5.00E-03	mg/L	4.70E-05	mg/kg-day	4.6E-02	(mg/kg-day)-1	2.E-06	1.37E-04	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.3
				1,1,2,2-tetrachloroethane	5.20E-02	mg/L	4.88E-04	mg/kg-day	2.0E-01	(mg/kg-day)-1	1.E-04	1.42E-03	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.07
			Exp. Route Total								1.E-04					1
		Exposure Point Total									1.E-04					1
		Bedrock Groundwater	Dermal	Carbon tetrachloride	5.00E-03	mg/L	8.35E-06	mg/kg-day	7.0E-02	(mg/kg-day)-1	6.E-07	2.43E-05	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.006
				cis-1,2-dichloroethene	7.00E-02	mg/L	3.82E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	1.12E-04	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.06
				trans-1,2-Dichloroethene	1.00E-01	mg/L	5.46E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	1.59E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.008
				PCE (Tetrachloroethylene)	5.00E-03	mg/L	1.85E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	4.E-08	5.39E-05	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.009
				TCE (Trichloroethylene)	5.00E-03	mg/L	5.15E-06	mg/kg-day	4.6E-02	(mg/kg-day)-1	2.E-07	1.50E-05	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.03
				1,1,2,2-tetrachloroethane	5.20E-02	mg/L	4.04E-05	mg/kg-day	2.0E-01	(mg/kg-day)-1	8.E-06	1.18E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.006
			Exp. Route Total								9.E-06					0.1
		Exposure Point Total									1.E-04					2
	Exposure Medium Total										1.E-04					2
Medium Total											1.E-04					2
										Total of Receptor Risks Across All Media	1.E-04			Total of Receptor Hazards Across All Media		2

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CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	On-Site	Ingestion	PCE (Tetrachloroethylene)	4	mg/kg	4.38E-06	mg/kg-day	2.1E-03	$(mg/kg-day)^{-1}$	9.E-09	5.11E-05	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.009
				1,1,2,2-tetrachloroethane	0.1	mg/kg	1.10E-07	mg/kg-day	2.0E-01	(mg/kg-day)-1	2.E-08	1.28E-06	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.00006
			Exp. Route Total								3.E-08					0.009
			Dermal	PCE (Tetrachloroethylene)	4	mg/kg	ND	mg/kg-day	2.1E-03	(mg/kg-day)-1	NA	ND	mg/kg-day	6.0E-03	1/(mg/kg-day)	NA
				1,1,2,2-tetrachloroethane	0.1	mg/kg	3.07E-08	mg/kg-day	2.0E-01	(mg/kg-day)-1	6.E-09	3.58E-07	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.00002
			Exp. Route Total								6.E-09					0.00002
		Exposure Point Total									4.E-08					0.009
	Exposure Medium Total										4.E-08					0.009
	Air	Inhalation of Fugitive Dust	Inhalation	PCE (Tetrachloroethylene)	4	mg/kg	2.18E-07	ug/m^3	2.6E-07	$(ug/m^3)^{-1}$	6.E-14	2.54E-09	mg/m^3	4.0E-02	mg/m^3	0.00000006
				1,1,2,2-tetrachloroethane	0.1	mg/kg	5.44E-09	ug/m^3	5.8E-05	$(ug/m^3)^{-1}$	3.E-13	6.35E-11	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								4.E-13					0.00000006
		Exposure Point Total									4.E-13					0.00000006
	Exposure Medium Total										4.E-13					0.00000006
Medium Total											4.E-08					0.009
Bedrock Groundwater	Bedrock Groundwater	Bedrock Groundwater	Ingestion	Carbon tetrachloride	5.00E-03	0.00E+00	2.74E-05	mg/kg-day	7.0E-02	$(mg/kg-day)^{-1}$	2.E-06	3.20E-04	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.08
				cis-1,2-dichloroethene	7.00E-02	0.00E+00	3.84E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	4.47E-03	mg/kg-day	2.0E-03	1/(mg/kg-day)	2
				trans-1,2-Dichloroethene	1.00E-01	0.00E+00	5.48E-04	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	6.39E-03	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.3
				PCE (Tetrachloroethylene)	5.00E-03	0.00E+00	2.74E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	6.E-08	3.20E-04	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.05
				TCE (Trichloroethylene)	5.00E-03	0.00E+00	2.74E-05	mg/kg-day	4.6E-02	(mg/kg-day)-1	1.E-06	3.20E-04	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.6
				1,1,2,2-tetrachloroethane	5.20E-02	0.00E+00	2.85E-04	mg/kg-day	2.0E-01	(mg/kg-day)-1	6.E-05	3.32E-03	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.2
			Exp. Route Total								6.E-05					3
		Exposure Point Total									6.E-05					3
		Unconsolidated Groundwater	Dermal	Carbon tetrachloride	5.00E-03	0.00E+00	4.15E-06	mg/kg-day	7.0E-02	$(mg/kg-day)^{-1}$	3.E-07	4.84E-05	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.01
				cis-1,2-dichloroethene	7.00E-02	0.00E+00	1.90E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	2.22E-04	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.1
				trans-1,2-Dichloroethene	1.00E-01	0.00E+00	2.71E-05	mg/kg-day	No toxicity value	(mg/kg-day)-1	NA	3.17E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.02
				PCE (Tetrachloroethylene)	5.00E-03	0.00E+00	9.18E-06	mg/kg-day	2.1E-03	(mg/kg-day)-1	2.E-08	1.07E-04	mg/kg-day	6.0E-03	1/(mg/kg-day)	0.02
				TCE (Trichloroethylene)	5.00E-03	0.00E+00	2.56E-06	mg/kg-day	4.6E-02	(mg/kg-day)-1	1.E-07	2.99E-05	mg/kg-day	5.0E-04	1/(mg/kg-day)	0.06
				1,1,2,2-tetrachloroethane	5.20E-02	0.00E+00	2.01E-05	mg/kg-day	2.0E-01	(mg/kg-day)-1	4.E-06	2.34E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.01
			Exp. Route Total								4.E-06					0.2
		Exposure Point Total									6.E-05					4
	Exposure Medium Total										6.E-05					4
Medium Total											6.E-05					4
									Total of Receptor Risks Across All Media		6.E-05			Total of Receptor Hazards Across All Media		4

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OU	Key Document	Document	Issuance Date
A/B	X	Record of Decision for OUA and OUB, Fort Richardson, Alaska	Aug-97
C	X	Record of Decision for OUC, Fort Richardson Anchorage, Alaska	Sep-98
D		Record of Decision, Operable Unit D, Fort Richardson, Alaska	Jun-00
E	X	Record of Decision, Operable Unit E, Fort Richardson, Alaska	Sep-05
All		Notice of Noncompliance, Compliance Schedule, and Notice of Necessity for Conference, In the Matter of the Environmental Protection Agency	Jun-90
All		Draft Site Screening Inspection Report for FRA	Nov-92
All		ODPC Plan, Oil Discharge Prevention and Contingency Plan, Fort Richardson, Alaska	Sep-93
All		Sampling Report for Groundwater Monitoring Network at Fort Richardson, Alaska	Jan-94
All		Geotechnical Report for Groundwater Monitoring Network, Fort Richardson, Alaska	Apr-94
All	X	Federal Facilities Agreement for Fort Richardson, Alaska	Dec-94
All		Areawide Community Relations Plan, Fort Richardson, Alaska	Jun-98
All		Subsurface Geologic Investigations of the Fort Richardson Contonment Area, Alaska	Apr-99
All		Installation Action Plan for Fort Richardson, Alaska	Mar-99
All		Glacial Geology and Stratigraphy of Fort Richardson, Alaska, A Review of Available Data on the Hydrogeology	Apr-00
All		Technical Memorandum, Land Use Evaluation, Environmental Noise Management Plan, Fort Richardson, Alaska	May-00
All		Installation Action Plan For Fort Richardson, Alaska	Aug-00
All		Draft Environmental Staging Facility Standard Operating Procedures	Sep-00
All		Pollution Prevention Plan Fort Richardson Alaska	Dec-00
All		Final Environmental Staging Facility Standard Operating Procedures	Mar-01
All		Fort Richardson Groundwater Sampling Program Health and Safety Plan	Aug-01
All		Fort Richardson Groundwater Sampling and Analysis Plan	Aug-01
All		Final Installation Environmental Noise Management Plan	Oct-01
All	X	First Five-Year Review Report	Feb-03
All	X	Second Five-Year Review Report	Feb-08
A		REMEDIAL DESIGN	
		Management Plan, Remedial Investigation/Feasibility Study, OUA	Feb-95
		Remedial Investigation Report, OUA (Volume 2: Appendix H, Analytical Data)	Mar-96
		Final, Baseline Human Health and Ecological Risk Assessments, OUA	Aug-96
		Final Feasibility Study, OUA, Ruff Road Fire Training Area	Nov-96
		Final Work Plan, Final Site Safety and Health Plan, Treatment System Demonstrations and Design	Mar-98

OU	Key Document	Document	Issuance Date
		Verification Study, Ruff and Roosevelt Road	
		Investigation of the Roosevelt Road Transmitter Site Using Ground-Penetrating Radar, Draft Report	May-98
		CRREL Report 99-4, Investigation of the Roosevelt Road Transmitter Site Using Ground-Penetrating Radar	Mar-99
		Final Environmental Baseline Survey Existing and Proposed Railroad Right-of-Way	Feb-01
A		REMEDIAL ACTION REPORT(S)	
		Proposed Plan for Final Remedial Action at OUA and OUB, Public Comment Period and Information Exchange	Jan-97
		Delivery Order, Request for Proposal, Indefinite Delivery Type (IDT), Remedial Action (RA), OUA, POL Laboratory (Building 986) Dry Well	Apr-97
A		DRAWINGS/AS-BUILTS	
		95% Design Analysis, OUA, POL Laboratory (Building 986) Dry Well	Apr-97
A		SAMPLING/MONITORING PLANS, REPORTS, DATA	
		Draft 1998 System Monitoring Report Treatment System Demonstrations and Design Verification Study Ruff & Roosevelt Road	Jan-99
		Memorandum, Subject: 1998 Summary Report, Treatment System Demonstration & Design Verification Study, Ruff and Roosevelt Road	Dec-99
		Final 1998 System Monitoring Report, Treatment System Demonstrations and Design Verification Study, Ruff & Roosevelt Road	Dec-99
		Final 1999 System Monitoring Report, Treatment System Demonstrations and Design Verification Study, Ruff Road	Aug-00
		Confirmation Soil Sampling Report Ruff Road Fire Training Area, Fort Richardson, AK	Dec-00
		Draft Design Verification Study Report for the Treatment System Demonstrations and Design Verification Study, Ruff Road, Fort Richardson, AK	Apr-01
		Final Design Verification Study Report for the Treatment System Demonstrations and Design Verification Study Ruff Road, Fort Richardson	Jul-01
B		REMEDIAL DESIGN	
		Surface Geophysical Investigation, U.S. Army Fort Richardson Facility, Anchorage, Alaska	Aug-90
		Final Poleline Road Disposal Area, Expanded Site Investigation, Fort Richardson, Alaska	Feb-91
		Final Poleline Road Disposal Area, Remedial Investigation Technical Plan	Aug-91
		Poleline Road Disposal Area, Remedial Investigation Technical Plan	Sep-91
		Pumping Test Work Plan for the Poleline Road Disposal Area, Fort Richardson, Alaska	Dec-90
		Final Project Work Plan, Phase 2 - Continuation of the Removal Action, Poleline Road Disposal Area, Fort Richardson, Alaska	May-94
		Reconnaissance Ground-Penetrating Radar, Electromagnetic Induction Surveys of the Poleline Road Site, Fort Richardson, AK, Draft Final Report	May-94
		Draft Final Report, Phases I & II, Poleline Road Disposal Area Project, Fort Richardson, Alaska	Dec-94
		Final Report Appendices (A-1 to A-4, and D-8 to D-11)	Dec-94

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OU	Key Document	Document	Issuance Date
		Phase II Sampling & Analysis Report (Binder 1: Instruction Sheet for Appendix J, and Binder 2: Instruction Sheet for Appendix L)	Dec-93
		Phase I HSP Appendices	Dec-93
		Phase II HSP Appendices (Appendices HS-1 to HS-3, Appendices HS-4 to HS-8, Appendices HS-9B to HS-18, and Appendices HS-19 to HS-28)	Dec-93
		Phase I SAP Appendices	Dec-93
		Phase I SAP Appendices (Appendices A - E, Appendix F, Appendix F (cont.), and Appendices G - M)	Dec-93
		Final Remedial Investigation Management Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Mar-95
		Ecological Risk Approach Document, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Aug-95
	X	Final Remedial Investigation Report, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska (Volume I: Report & Appendix I, Volume II - 1 of 2, Appendices II - XIV (Except VII), and Volume II - 2 of 2, Appendix VII)	Sep-96
	X	Final Risk Assessment Report, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Sep-96
		Final Feasibility Study Report, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Jan-97
		Final Treatability Study Report, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Mar-97
		Final Site Work Plan, Soil Stockpile Remediation, Poleline Road Disposal Area, Fort Richardson, Alaska	Apr-97
		Final Environmental Protection Plan, Soil Stockpile Remediation, Poleline Road Disposal Area, Fort Richardson, Alaska	Apr-97
		Final Contractor Quality Control Plan, Soil Stockpile Remediation, Poleline Road Disposal Area, Fort Richardson, Alaska	Apr-97
		Final Work Plan Technical Memorandum, Groundwater Characterization and Design Verification Study, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	May-97
		Draft Final, Engineering Evaluation/Cost Analysis, Treatment & Disposal of Chemical Agent Identification Sets (CAIS), Poleline Road Disposal Area, Fort Richardson, Alaska	May-97
		Final Long-Term Groundwater Monitoring Work Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Sep-97
		CRREL Report 97-4, Geophysical Investigations at a Buried Disposal Site on Fort Richardson, Alaska	Sep-97
		Preliminary Remedial Design Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Dec-97
		Final Remedial Design Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Apr-98
		Draft, Work Plan Technical Memorandum, Design Verification Study - Array 4, Operable Unit B, Poleline Disposal Area, Fort Richardson, AK	Jun-98
		Final Remedial Design Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Jun-98
		Final Long-Term Groundwater Monitoring Work Plan, June 1998 Sampling, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, AK	Sep-98
		Draft, High Vacuum Extraction Treatability Study, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Feb-99

OU	Key Document	Document	Issuance Date
		Final Work Plan Technical Memorandum, Design Verification Study, Arrays 4, 5, and 6, Operable Unit B, Poleline Disposal Area, Fort Richardson, Alaska	Aug-99
		Draft Report, Design Verification Study, Arrays 4, 5, and 6, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Mar-00
B		REMEDIAL ACTION REPORT(S)	
		Operable Unit B Remedial Design/Remedial Action, Statement of Work, December 5, 1997	Dec-97
		DRAFT Remedial Action Work Plan Operable Unit B Poleline Road Disposal Area, Fort Richardson, AK	Dec-00
		DRAFT Interim Remedial Action Report Operable Unit B Poleline Road Disposal Area, Fort Richardson, AK	Jan-03
B		REMEDIAL DESIGN	
		Design Verification Study Arrays 4, 5, and 6	Dec-00
		Building 762, 786, OUB and OUE Health and Safety Plan SSHP	Aug-04
	X	CLOSES Evaluation for OUB	Sep-04
B		O&M MANUALS	
		Final Operation, Maintenance and Monitoring Manual: OUB Soil Vapor Extraction Treatment System Fort Richardson, Alaska	Oct-05
B		SAMPLING/MONITORING PLANS, REPORTS, DATA	
		Long-Term Groundwater Monitoring November 1997 Sampling Operable Unit B Poleline Road Disposal Area	Nov-97
		Long-Term Groundwater Monitoring November 1997 Sampling Poleline Road Disposal Area	Jan-98
		Draft Design Verification Study, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Feb-98
		Long-Term Groundwater Monitoring Technical Memorandum June 1998 Sampling, Operable Unit B	Jun-98
		Technical Memorandum OUB Poleline Road Disposal Area	Jul-98
		Chemical Quality Assurance Report, Operable Unit B, Fort Richardson, Alaska, Draft	Jul-98
		Final Chemical Quality Assurance Report OUB	Sep-98
		Long-Term Groundwater Monitoring Technical Memorandum June 1998 Sampling, Operable Unit B	Sep-98
		Analytical Results of Post Treatment Surface Samples Collected at Poleline Road Disposal Area, Fort Richardson, AK	Nov-98
		Final Long-Term Groundwater Monitoring, October 1998 Sampling, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Jan-99
		Technical Memorandum for Batch Treatment Cell No. 3, Soil Stockpile Remediation, Poleline Road Disposal Area, Fort Richardson, Alaska	Apr-99
		Final Long-Term Groundwater Monitoring, March 1999 Sampling, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Jun-99
		Technical Memorandum, OU-B, Poleline Road, Fort Richardson	Sep-99
		Final System Evaluation, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska	Sep-99

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OU	Key Document	Document	Issuance Date
		Technical Memorandum, OU-B, Poleline Road, Ft. Richardson, Alaska, Installation of Array 5 and Associated Soil Sampling, May 1999	Sep-99
		Final Report, Operable Unit B, Poleline Road Disposal Area, Long-Term Groundwater Monitoring Report	May-00
		Poleline Road Disposal Area Long-Term Groundwater Monitoring	Oct-00
		Final Report Operable Unit B Poleline Road Disposal Area October 2000 Long-Term Groundwater Monitoring Report	Nov-00
		Revised Final Report Design Verification Study Arrays 4, 5, and 6, Operable Unit B Poleline Road Disposal Area, Fort Richardson, Alaska	Mar-01
		July 2001 Long-Term Groundwater Monitoring Report	Jul-01
		Final Technical Memorandum Updating Long-Term Groundwater Monitoring Results Volume I	Dec-01
		OUB Groundwater Sampling at Operable Unit B Poleline Road March 2002 Volume I	May-02
		OUB Groundwater Sampling at Operable Unit B Poleline Road March 2002 Volume II	May-02
		OUB Groundwater Sampling at Operable Unit B Poleline Road March 2002 Volume III	May-02
		Historical Aerial Photographic Analysis Of The Poleline Road Disposal Area, OUB	Oct-02
		OUB U.S. Army Program Manager for Chemical Demilitarization EE/CA	Feb-03
		CRREL Geological Update: Hydro-Geological and Glaciological Interpretations of New Wells Drilled at Poleline Road, Poleline Road Disposal Area	Apr-03
		Operable Unit B Final Report for Decommissioning of SVE Wells, Thermocouples, and Electrodes	Apr-03
		Field Sampling Plan OUB Poleline Disposal Area 2003 GWM	Apr-03
		OUB Poleline Road Groundwater Monitoring Program Report, Spring 2003	Jul-03
		Exploration and Monitoring Well Logs OUB Poleline Road Disposal Area	Aug-03
		Fort Richardson, Operable Unit B, Poleline Road Disposal Area, Groundwater Monitoring Report	Jan-04
		OUB Final Fall 2003 Groundwater Sampling Report	Mar-04
		SAP Building 762, 786, OUB (Poleline Road), OUE (Armoured Vehicle Maintenance Area)	Aug-04
		Final Fort Richardson, OUB Poleline Road Disposal Area, Groundwater Monitoring Report Fort Richardson, Alaska	?2004
		Maps of Poleline Road Plumes and Groundwater Table, 1997-2003, Operable Unit B, Fort Richardson, Alaska	Oct-04
		Refined 3D Geologic Model of the Poleline, Road Disposal Area, Operable Unit B, Fort Richardson, Alaska	Mar-05
		Final Operation, Maintenance and Monitoring Manual: OUB Soil Vapor Extraction Treatment System Fort Richardson, Alaska	Oct-05
		Final Summary Report: OUB Soil Vapor Extraction Treatment System, Fort Richardson, Alaska	Nov-06
		Final Report Fort Richardson OUB Poleline Road Disposal Area Groundwater Monitoring Report	Jun-06
		Final Fort Richardson Operable Unit B Poleline Road Disposal Area September 2006 Groundwater Monitoring Report	Dec-07
		Revised Final Fort Richardson Operable Unit B Poleline Road Disposal Area Groundwater Monitoring Report October 2007	Aug-08

OU	Key Document	Document	Issuance Date
	X	Fort Richardson Operable Unit B Poleline Road Disposal Area Groundwater Monitoring Report Spring and Fall 2009	Dec-10
	X	Memorandum to the Site File for Long Term Monitoring at the Poleline Road Disposal Area, Operable Unit B, JBER Richardson, Alaska	Mar-11
	X	Final JBER-Richardson Operable Unit B Poleline Road Disposal Area Fall 2010 Groundwater Monitoring Report	Jan-12
	X	Draft United States Air Force Joint Base Elmendorf-Richardson Alaska Environmental Restoration Program 2011 Groundwater Monitoring and Borehole Sampling Three-Party Agreement Sites: OUB Poleline Road Disposal Area and OUE Armored Vehicle Design Maintenance Area	Jul-12
C		REMEDIAL DESIGN	
		Eagle River Flats, Expanded Site Investigation, Fort Richardson, Alaska, Final Technical Report, Data Item A011	Jun-90
		CRREL Report 92-5, Waterfowl Mortality in Eagle River Flats, Alaska, The Role of Munitions Residues	May-92
		FY 92 Final, Phase II. Remedial Investigation Report: White Phosphorus Contamination of Salt Marsh Sediments at Eagle River Flats, Alaska	Jun-93
		CRREL Report 93-23, Preliminary Assessment of Sedimentation and Erosion in Eagle River Flats, South-Central Alaska	Dec-93
		Interagency Expanded Site Investigation, Evaluation of White Phosphorus Contamination and Potential Treatability at Eagle River Flats, Alaska	May-94
		Eagle River Flats, Comprehensive Evaluation Report, Fort Richardson, Alaska	Jul-94
		Interagency Expanded Site Investigation, Evaluation of White Phosphorus Contamination and Potential Treatability at Eagle River Flats, Alaska, FY 94 Final Report (Volumes 1 and 2)	May-95
		Eagle River Flats, Final 1995 Work Plan, Fort Richardson, Alaska	Jun-95
		Eagle River Flats, Final Quality Assurance Program Plan, Fort Richardson, Alaska	Jun-95
		CRREL Report 96-9, Physical System Dynamics and White Phosphorus Fate and Transport, 1994, Eagle River Flats, Fort Richardson, Alaska	Aug-96
		Operable Unit C, OB/OD Pad, Fort Richardson, Alaska, Site Investigation Work Plan	Sep-96
		CRREL Report 96-13, Physical Processes and Natural Attenuation Alternatives for Remediation of White Phosphorus Contamination, Eagle River Flats, Fort Richardson, Alaska	Dec-96
		Site Safety and Health Plan for Site Visit to Eagle River Study Area	Apr-97
		Scope of Work for Treatability Study of Pond Pumping for Enhancement of In-Situ White Phosphorus Attenuation in Eagle River Flats	Apr-98
		Technical Memorandum: Spill Prevention and Control for Eagle River Flats Pumping Treatability Study	Jun-98
		OB/OD Pad Interim Closure Plan Approach Document	Dec-98
		Field Work and Pond Drainage Eagle River Flats, Safety and Health Plan	Dec-98
		Draft OB/OD PAD Interim Closure Plan	Mar-99
		1999 Field Work Plan for Eagle River Flats	Jun-99
		Remediating and Monitoring White Phosphorus Contamination at Eagle River Flats	Jul-00
		OUC 2002 Remediation & Monitoring Work Plan Eagle River Flats	May-02

OU	Key Document	Document	Issuance Date
		2003 Remedial and Monitoring Work Plan, Operable Unit C, Eagle River Flats, Fort Richardson, Alaska	Mar-03
		2004 Long-Term Monitoring Work Plan, Operable Unit C, Eagle River Flats, Fort Richardson, Alaska	Apr-04
		CLOSES Evaluation Draft Final Report, OUC-Eagle River Flats White phosphorus	Jun-04
		2005 Long-Term Monitoring Work Plan, Operable Unit C - Eagle River Flats	Apr-05
		Final (MEC) Work Plan For Unexploded Ordnance and O&M Support For HTRW Area Sampling Eagle River Flats - Operable Unit C, Fort Richardson, Alaska	May-05
		Draft Fort Richardson CERLCA Federal Facility Agreement, Recommended Action, Interim Decision Summary for Eagle River Flats	May-05
		2006 Long-Term Monitoring and Remediation Work Plan Operable Unit C, Eagle River Flats, Fort Richardson, Alaska	Apr-06
		Final Letter Report For Soil Excavation, Assessment, and Treatment, Eagle River Flats, Fort Richardson, Alaska	Jun-06
		2007 Long-Term Monitoring and Remediation Work Plan Operable Unit C (Eagle River Flats), Fort Richardson, Alaska	Apr-07
	X	2009 Long Term Monitoring Work Plan Operable Unit C - Eagle River Flats	Apr-09
	X	Memorandum to the Site File, Operable Unit C - Eagle River Flats	Nov-11
C		REMEDIAL ACTION REPORT(S)	
		DRAFT Interim Remedial Action Report Operable Unit C Eagle River Flats, Fort Richardson, AK	Jul-02
		OUC Field Work & Pond Drainage Eagle River Flats Safety & Health Plan Field Year #3	Jan-02
		OUC Remediating & Monitoring White phosphorus Contamination at ERF FY 01 Draft Report	Apr-02
		OUC Field Summary Report 2001 Work Season Field Work & Pond Drainage Eagle River Flats	Jun-02
		OUC 2001 Remedial Progress Report Operable Unit C Eagle River Flats FY 01 Report	Jul-02
		Interim Remedial Action Report, Operable Unit C, Eagle River Flats, Fort Richardson, Alaska	May-03
		2003 Draft Remedial Progress Report, Operable Unit C, Eagle River Flats, Fort Richardson, Alaska	Apr-04
		Remediating and Monitoring White phosphorus Contamination at Eagle River Flats, Operable Unit C, Fort Richardson, Alaska FY04 Data Report	Aug-05
		Remediating and Monitoring White phosphorus Contamination at Eagle River Flats, Operable Unit C, Fort Richardson, Alaska FY05 Data Report	Apr-06
		Remediating and Monitoring White phosphorus Contamination at Eagle River Flats, Operable Unit C, Fort Richardson, Alaska FY06 Data Report	May-07
		Remediating and Monitoring White phosphorus Contamination at Eagle River Flats, Operable Unit C, Fort Richardson, Alaska FY07 Data Report	May-08
		Waterbird Use of Eagle River Flats from Aerial Surveys, April - October 2007	Dec-07
	X	Remediating and Monitoring White Phosphorus Contamination at Eagle River Flats (Operable Unit C), Fort Richardson, Alaska FY10 Data Report	Jul-11
	X	United States Air Force Joint Base Elmendorf-Richardson Alaska Environmental Restoration Program 2010-2011 Remedial Action Summary Report Operable Unit C - Eagle River Flats	Jan-12

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OU	Key Document	Document	Issuance Date
C		SAMPLING, MONITORING PLANS, REPORTS, DATA	
		Fort Richardson RAB Field Trip Summary Report	Apr-04
		Interim Waterfowl Mortality Monitoring Report OUC-Eagle River Flats Impact Area	Jul-04
		2005 Annual Summary Report, Operable Unit C - Eagle River Flats	Aug-04
D		REMEDIAL DESIGN	
		Fort Richardson, Operable Unit D, Preliminary Source Evaluation 2, Site-Specific Safety and Heath Plan, Final	Sep-94
		Analytical Data for Preliminary Source Evaluation 2, Operable Unit D (Volume II of III: Building 796, Building 955, Dust Palliative Roadways, Fire Training Pit) Fort Richardson, Alaska	Apr-95
		Analytical Data for Preliminary Source Evaluation 2, Operable Unit D (Volume III of III: Grease Pits, Background, Decontamination Water) Fort Richardson, Alaska	Apr-95
		Fort Richardson, Alaska, Preliminary Source Evaluation 2 Operable Unit D Draft	Apr-95
		Preliminary Source Evaluation 2, Operable Unit D, Fort Richardson, Alaska	Jun-96
		OUD, Field Sampling Plan, Addendum 1, Final, Fort Richardson, Alaska	Jul-97
		OUD, Field Sampling Plan, Addendum 2, Final, Fort Richardson, Alaska	Sep-97
		Field Sampling Plan OUD Modification 3 DRAFT	Nov-97
		Feasibility of Using Resistivity Geophysical Surveys for Mapping the Confining Layer on Fort Richardson: Preliminary Results	Dec-97
		Subject: Overview Letter and Schedule for Operable Unit D, Feasibility Study, Fort Richardson, Alaska	Dec-97
		Final RI/FS, Operable Unit D, Fort Richardson, Alaska (Volume Ia - Remedial Investigation Report, Volume Ib - Remedial Investigation Report Appendices, Volume IIa - Risk Assessment, and Volume IIb - Postwide Risk Assessment)	Nov-98
		Final RI/FS, Operable Unit D, Fort Richardson, Alaska (Volume III - Feasibility Study)	Jan-99
		Revised Proposal for OUD Sampling, Fort Richardson, Alaska	Jul-00
D		REMEDIAL ACTION REPORT(S)	
		Re: Draft Remedial Design/Remedial Action Report - Building 35-752, Building 45-590, and Building 796	No Date
		Draft Remedial Design/Remedial Action Report - Building 35-752, Building 45-590, and Building 796	Aug-99
D		O&M MANUALS	
		Operation and Maintenance Manual, Building 796, Install/Replace Oil Water Separators, Fort Richardson, Alaska	Jan-98
D		SAMPLING/MONITORING PLANS, REPORTS, AND DATA	
		Delivery of Draft Sampling Memos, 2000 Sampling	Sep-00
		OUD Groundwater B 796 9000-219	Feb-01
		Draft Post RI Sampling Report - Buildings 796 and 955, Fort Richardson	Mar-01
E		REMDIAL DESIGN	
		Fort Richardson, Analysis of Existing Facilities/Environmental Assessment Report	Feb-83

OU	Key Document	Document	Issuance Date
		Site Safety and Health Plan, Site 4, Building 35-752, High Frequency Transmitter Site, Fort Richardson, Alaska	Aug-93
		Release Investigation Report And Corrective Action Plan Building 45-590 Fort Richardson, Alaska	Sep-94
		Release Investigation Report Underground Storage Tank Sites Fort Richardson, Alaska	Jan-94
		Draft Quarterly Ground Water Monitoring Report March 1995 Sampling Event Building 45-590 Fort Richardson, AK	May-95
		Decision Document For Building 45-590, Underground Storage Tank 59A Fort Richardson, Alaska	Sep-96
		Draft Remedial Design/Remedial Action Report - Building 35-752, Building 45-590, and Building 796	Nov-96
		OUE Revised Final Management Plan Remedial Investigation/Feasibility Study	May-02
		OUE FRA Environmental Staging Facility Work Plan FRA	Jun-02
		OUE Environmental Staging Facility Work Plan and Quality Program Plan	Jun-02
		Circle Drive Stockpiles and Building 47-220 Excavation, Assessment, and Treatment - Fort Richardson, Alaska	Aug-02
		Circle Drive Stockpile Assessment, Fort Richardson, Alaska	Sep-02
		OUE Revised Final Management Plan Remedial Investigation/Feasibility Study	Nov-02
	X	Operable Unit E Remedial Investigation Report	Apr-04
	X	Operable Unit E Risk Assessment Report	Apr-04
		OUE RI Chemical Quality Assurance Report	May-04
		Final OUE FS	Sep-04
		Final OUE RI/FS	Sep-04
		Final OUE Proposed Plan	Oct-04
		RCRA Closure Evaluation and Respone For Building 755 - Auto Hobby and Crafts Center, Building 955 - DEH Preventative Maintenance Oil/Water Separator Sludge Bin, Building 986 - Tanks and Containers, Building 35-752, January 2006	Jan-06
E		SAMPLING/MONITORING PLANS, REPORTS, AND DATA	
		Groundwater sampling @ OUE March 2002 Volume 1	Apr-02
		Groundwater sampling @ OUE March 2002 Volume 2	Apr-02
		Groundwater sampling @ OUE March 2002 Volume 3	Apr-02
		Groundwater sampling @ OUE March 2002 Volume 4	Apr-02
		OUE Environmental Staging Facility Progress Status & Management Report	May-02
		OUE Environmental Staging Facility Progress Status & Management Report	Jul-02
		OUE Environmental Staging Facility Progress Status & Management Report	Jan-03
		OUE Environmental Staging Facility Progress Status & Management Report	Jan-03
		Groundwater Sampling at OUE August 2002	Apr-03
		Groundwater Sampling at OUE August 2002	Nov-02

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OU	Key Document	Document	Issuance Date
		OUE Groundwater Monitoring Program Report, Spring 2003	Sep-03
		OUE Final Fall 2003 Groundwater Sampling Report	May-04
		Annual Reports, OUB, OUE AVMA, Bldg 786 and 762, Ft Richardson Groundwater Sampling Program DERA	Nov-05
		OUB, OUE AVMA, Bldg 786 and 762 Fall Groundwater Monitoring Reports	Jun-06
		OUE Armored Vehicle Maintenance Area - Groundwater Monitoring Report	Dec-06
		OUE Armored Vehicle Maintenance Area October 2007 Groundwater Monitoring Report	Jan-08
	X	Report of Chemical Findings, Building 35-750, Fort Richardson, AK (08-057)	Jul-08
	X	Fort Richardson Operable Unit E Armored Vehicle Maintenance Area Groundwater Monitoring Report December 2008	Dec-10
	X	Fort Richardson Operable Unit E Armored Vehicle Maintenance Area Groundwater Monitoring Report May and September 2009	Dec-10
	X	United States Air Force Joint Base Elmendorf-Richardson Alaska Environmental Restoration Program Fall 2010 Groundwater Monitoring Report JBER-Richardson Operable Unit E Armored Vehicle Maintenance Area	Jan-12
	X	Report of Chemical Findings, Building 35-752, Fort Richardson, AK (12-073	Aug-12

Note: Key references are included electronically for reference.

APPENDIX C

Site Inspection Checklists

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: POLELINE ROAD	**Date of inspection:** 6/27/12
Location and Region: OU8	**EPA ID:** AK6214522157
Agency, office, or company leading the five-year review: JEG	**Weather/temperature:** SUNNY, COOL ~ 55°F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls (circled)
- Institutional controls (circled)
- Groundwater pump and treatment
- Surface water collection and treatment
- Other__________
- Monitored natural attenuation (circled)
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A ______ ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** N/A ______ ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ADEC
Contact LOUIS HOWARD — ENV'T'L SPECIALIST — 8/13/12 — (907) 269-7552
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency USACE
Contact BETH ASTLEY — PROJECT MANAGER — 9/21/12 — (907) 753-5782
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency US EPA
Contact SANDRA HALSTEAD + BILL ADAMS — REMEDIAL PROJECT MANAGER — 8/28/12 — (907) 271-1218
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency
Contact
Name — Title — Date — Phone no.
Problems; suggestions; Report attached

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A
Remarks			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks			
4. **Permits and Service Agreements**			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits	Readily available	Up to date	N/A
Remarks			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks ERPIMS			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks			

IV. O&M COSTS

1. **O&M Organization**
State in-house
PRP in-house
Federal Facility in-house
Other____
Contractor for State
Contractor for PRP
Contractor for Federal Facility
N/A

2. **O&M Cost Records**
Readily available
Up to date
Funding mechanism/agreement in place
Original O&M cost estimate_________________ Breakdown attached
N/A

Total annual cost by year for review period if available

From	To		
______ Date	______ Date	______ Total cost	Breakdown attached
______ Date	______ Date	______ Total cost	Breakdown attached
______ Date	______ Date	______ Total cost	Breakdown attached
______ Date	______ Date	______ Total cost	Breakdown attached
______ Date	______ Date	______ Total cost	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS (Applicable) N/A

A. Fencing

1. **Fencing damaged** Location shown on site map (Gates secured) N/A
Remarks____

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
Remarks SEE PHOTOS, SIGNAGE

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ______

Frequency ______

Responsible party/agency ______

Contact ______

Name ______ Title ______ Date ______ Phone no. ______

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A

Remarks ______

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident

Remarks ______

2. **Land use changes on site** N/A

Remarks ______

3. **Land use changes off site** N/A

Remarks ______

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A

Remarks ______

B. Other Site Conditions

Remarks____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent______________ Depth____________
   Remarks____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths____________ Widths____________ Depths__________
   Remarks____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent______________ Depth____________
   Remarks____

4. **Holes** Location shown on site map Holes not evident
   Areal extent______________ Depth____________
   Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent______________ Height____________
   Remarks____

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent______________
	Ponding	Location shown on site map	Areal extent______________
	Seeps	Location shown on site map	Areal extent______________
	Soft subgrade	Location shown on site map	Areal extent______________
	Remarks______________________________		

9. **Slope Instability** Slides Location shown on site map No evidence of slope instability
Areal extent______________
Remarks______________________________

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
Remarks______________________________

2. **Bench Breached** Location shown on site map N/A or okay
Remarks______________________________

3. **Bench Overtopped** Location shown on site map N/A or okay
Remarks______________________________

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
Areal extent______________ Depth____________
Remarks______________________________

2. **Material Degradation** Location shown on site map No evidence of degradation
Material type______________ Areal extent____________
Remarks______________________________

3. **Erosion** Location shown on site map No evidence of erosion
Areal extent______________ Depth____________
Remarks______________________________

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type____________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type____________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____
____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____
____

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring / Thermal destruction / Collection for reuse Good condition / Needs Maintenance Remarks______		
2. **Gas Collection Wells, Manifolds and Piping** Good condition / Needs Maintenance Remarks______		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition / Needs Maintenance / N/A Remarks______		

F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks______	Functioning	N/A
2. **Outlet Rock Inspected** Remarks______	Functioning	N/A

G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent______ Depth______ N/A Siltation not evident Remarks______		
2. **Erosion** Areal extent______ Depth______ Erosion not evident Remarks______		
3. **Outlet Works** Remarks______	Functioning	N/A
4. **Dam** Remarks______	Functioning	N/A

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Horizontal displacement___________ Rotational displacement___________ Remarks___________	Location shown on site map Vertical displacement___________	Deformation not evident
2.	**Degradation** Remarks___________	Location shown on site map	Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Siltation not evident
2.	**Vegetative Growth** Vegetation does not impede flow Areal extent___________ Remarks___________	Location shown on site map Type___________	N/A
3.	**Erosion** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Erosion not evident
4.	**Discharge Structure** Remarks___________	Functioning	N/A
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1.	**Settlement** Areal extent___________ Remarks___________	Location shown on site map Depth___________	Settlement not evident
2.	**Performance Monitoring** Performance not monitored Frequency___________ Head differential___________ Remarks___________	Type of monitoring___________	Evidence of breaching

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks________________
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks________________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks________________
B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks________________
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks________________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks________________

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters______
   Additive (*e.g.*, chelation agent, flocculent)______
   Others______
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually______
   Quantity of surface water treated annually______
   Remarks______

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks______

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks______

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks______

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks______

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks______

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

Properly secured/locked   Functioning   Routinely sampled   Good condition
All required wells located   Needs Maintenance   N/A

Remarks AP-43B – MISSING OUTER CASING; AP-~~4348~~ 3985, 3986 & 4551 – UNLOCKED.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

THE REMEDY INCLUDES NATURAL ATTENUATION OF CONTAMINANTS IN GROUNDWATER. GW MONITORING RESULTS SHOW DECREASING TREND IN CONTAMINANT CONCENTRATIONS & A STABLE PLUME.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

NO VARIANCES IN O&M COSTS THAT WOULD INDICATE POTENTIAL REMEDY PROBLEMS/ISSUES.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. THE SHALLOW AQUIFER CONTAMINATION PLUME IS NOT FULLY DEFINED DOWNGRADIENT OF THE "HOT SPOT". ATV USE HAS BEEN NOTICED AT THE SITE. CONCRETE BARRIERS WERE INSTALLED TO PREVENT ACCESS.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. NONE

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: EAGLE RIVER FLATS	**Date of inspection:** 6/27/12
Location and Region: OUC	**EPA ID:** AK6214522157
Agency, office, or company leading the five-year review: JEG	**Weather/temperature:** CLEAR, SUNNY ~60°F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls (circled)
- Institutional controls (circled)
- Groundwater pump and treatment
- Surface water collection and treatment
- Other______________________________
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A __________ __________ __________
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. __________
   Problems, suggestions;   Report attached ____________________

2. **O&M staff** N/A __________ __________ __________
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. __________
   Problems, suggestions;   Report attached ____________________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ADEC
Contact LOUIS HOWARD — ENVT'L SPECIALIST — 8/13/12 — (907) 269-7552
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency USACE
Contact BETH ASTLEY — PROJECT MANAGER — 9/21/12 — (907) 753-5782
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW LIST

Agency EPA
Contact SANDRA HALSTEAD + BILL ADAMS — REMEDIAL PROJECT MANAGER — 8/23/12 — (907) 271-1218
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW LIST.

Agency ____________
Contact ____________ ____________ ______ ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ____________

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A
Remarks____________________			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks____________________			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks____________________			
4. **Permits and Service Agreements**			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits__________	Readily available	Up to date	N/A
Remarks____________________			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks____________________			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks____________________			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks____________________			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks____________________			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks____________________			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks____________________			

IV. O&M COSTS

1. **O&M Organization**
   State in-house — Contractor for State
   PRP in-house — Contractor for PRP
   Federal Facility in-house — Contractor for Federal Facility
   N/A
   Other

2. **O&M Cost Records**
   Readily available — Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate — Breakdown attached — N/A

   Total annual cost by year for review period if available

From ______ (Date)	To ______ (Date)	______ Total cost	Breakdown attached
From ______ (Date)	To ______ (Date)	______ Total cost	Breakdown attached
From ______ (Date)	To ______ (Date)	______ Total cost	Breakdown attached
From ______ (Date)	To ______ (Date)	______ Total cost	Breakdown attached
From ______ (Date)	To ______ (Date)	______ Total cost	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable (circled) — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured (circled) — N/A
   Remarks

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A
   Remarks CONTROLLED AREA SIGNS IN PLACE TO PREVENT ACCESS. RANGE CONTROL NOTIFICATION PRIOR TO ENTERING SITE

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ______

Frequency ______

Responsible party/agency ______

Contact ______ ______ ______ ______

Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A

Remarks ______

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident

Remarks ______

2. **Land use changes on site** N/A

Remarks ______

3. **Land use changes off site** N/A

Remarks ______

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A

Remarks ______

B. Other Site Conditions

Remarks______________________________

____

____

____

____

____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent____________ Depth____________
Remarks______________________________
____

2. **Cracks** Location shown on site map Cracking not evident
Lengths____________ Widths____________ Depths____________
Remarks______________________________
____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent____________ Depth____________
Remarks______________________________
____

4. **Holes** Location shown on site map Holes not evident
Areal extent____________ Depth____________
Remarks______________________________
____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks______________________________
____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks______________________________
____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent____________ Height____________
Remarks______________________________
____

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent______________
	Ponding	Location shown on site map	Areal extent______________
	Seeps	Location shown on site map	Areal extent______________
	Soft subgrade	Location shown on site map	Areal extent______________
	Remarks____		
9.	**Slope Instability** Slides	Location shown on site map	No evidence of slope instability
	Areal extent______________		
	Remarks____		

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______________	Depth______________	
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______________	Areal extent______________	
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______________	Depth______________	
	Remarks____		

4.	**Undercutting**	Location shown on site map	No evidence of undercutting	
	Areal extent__________	Depth__________		
	Remarks____________________			
5.	**Obstructions** Type__________		No obstructions	
	Location shown on site map	Areal extent__________		
	Size__________			
	Remarks____________________			
6.	**Excessive Vegetative Growth**	Type__________		
	No evidence of excessive growth			
	Vegetation in channels does not obstruct flow			
	Location shown on site map	Areal extent__________		
	Remarks____________________			
D.	**Cover Penetrations**	Applicable	N/A	
1.	**Gas Vents**	Active	Passive	
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	
	N/A			
	Remarks____________________			
2.	**Gas Monitoring Probes**			
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks____________________			
3.	**Monitoring Wells** (within surface area of landfill)			
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks____________________			
4.	**Leachate Extraction Wells**			
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks____________________			
5.	**Settlement Monuments**	Located	Routinely surveyed	N/A
	Remarks____________________			

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring / Thermal destruction / Collection for reuse Good condition / Needs Maintenance Remarks______		
2. **Gas Collection Wells, Manifolds and Piping** Good condition / Needs Maintenance Remarks______		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition / Needs Maintenance / N/A Remarks______		
F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks______	Functioning	N/A
2. **Outlet Rock Inspected** Remarks______	Functioning	N/A
G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent______ Depth______ N/A Siltation not evident Remarks______		
2. **Erosion** Areal extent______ Depth______ Erosion not evident Remarks______		
3. **Outlet Works** Functioning N/A Remarks______		
4. **Dam** Functioning N/A Remarks______		

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
Horizontal displacement________ Vertical displacement________
Rotational displacement________
Remarks____________________________

2. **Degradation** Location shown on site map Degradation not evident
Remarks____________________________

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
Areal extent________ Depth________
Remarks____________________________

2. **Vegetative Growth** Location shown on site map N/A
Vegetation does not impede flow
Areal extent________ Type________
Remarks____________________________

3. **Erosion** Location shown on site map Erosion not evident
Areal extent________ Depth________
Remarks____________________________

4. **Discharge Structure** Functioning N/A
Remarks____________________________

VIII. VERTICAL BARRIER WALLS Applicable N/A

1. **Settlement** Location shown on site map Settlement not evident
Areal extent________ Depth________
Remarks____________________________

2. **Performance Monitoring** Type of monitoring________
Performance not monitored
Frequency________ Evidence of breaching
Head differential________
Remarks____________________________

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks______		
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______		
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______		
B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable	N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks______		
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks______		
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks______		

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal — Oil/water separation — Bioremediation
   Air stripping — Carbon adsorbers
   Filters____________________
   Additive (*e.g.*, chelation agent, flocculent)____________________
   Others____________________
   Good condition — Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually____________________
   Quantity of surface water treated annually____________________
   Remarks____________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A — Good condition — Needs Maintenance
   Remarks____________________

3. **Tanks, Vaults, Storage Vessels**
   N/A — Good condition — Proper secondary containment — Needs Maintenance
   Remarks____________________

4. **Discharge Structure and Appurtenances**
   N/A — Good condition — Needs Maintenance
   Remarks____________________

5. **Treatment Building(s)**
   N/A — Good condition (esp. roof and doorways) — Needs repair
   Chemicals and equipment properly stored
   Remarks____________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked — Functioning — Routinely sampled — Good condition
   All required wells located — Needs Maintenance — N/A
   Remarks____________________

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time — Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained — Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

REMEDIATION ACTIVITIES COMPLETE; SITE WILL ONLY BE MONITORED/SAMPLED PRIOR TO 5-YEAR REVIEW (2016). WATERFOWL MORTALITY RATES ARE BELOW RAOS. REMEDY HAS BEEN EFFECTIVE.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

NONE.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. WATERFOWL MORTALITY RATES MAY BE BIASED SLIGHTLY LOW DUE TO UNINTENTIONAL HAZING DURING FIELD ACTIVITIES.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. NONE, REMEDY HAS BEEN EFFECTIVE.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: AVMA	**Date of inspection:** 6/27/12
Location and Region: OUE	**EPA ID:** AK6214522157
Agency, office, or company leading the five-year review: JEG	**Weather/temperature:** PARTLY CLOUDY ~ 60°F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- Institutional controls (circled)
- Groundwater pump and treatment
- Surface water collection and treatment
- Other ______
- Monitored natural attenuation (circled)
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A ______ ______
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ______
   Problems, suggestions;   Report attached ______

2. **O&M staff** N/A ______ ______
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ______
   Problems, suggestions;   Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ADEC
Contact LOUIS HOWARD (Name) — ENVT'L SPECIALIST (Title) — 8/13/12 (Date) — (907)269-7552 (Phone no.)
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency USACE
Contact BETH ASTLEY (Name) — PROJECT MANAGER (Title) — 9/21/12 (Date) — (907)753-5782 (Phone no.)
Problems; suggestions; Report attached See Interview List

Agency EPA
Contact SANDRA HALSTEAD + BILL ADAMS (Name) — REMEDIAL PROJECT MANAGER (Title) — 8/23/12 (Date) — (907) 271-1218 (Phone no.)
Problems; suggestions; Report attached See Interview List

Agency
Contact (Name) — (Title) — (Date) — (Phone no.)
Problems; suggestions; Report attached

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A
Remarks			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks			
4. **Permits and Service Agreements**			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits	Readily available	Up to date	N/A
Remarks			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks			

IV. O&M COSTS

1. O&M Organization

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other____________________

N/A

2. O&M Cost Records

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate____________ Breakdown attached

N/A

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable (circled) N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A (circled)
Remarks____________________

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A (circled)
Remarks____________________

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented   Yes   No   N/A
Site conditions imply ICs not being fully enforced   Yes   No   N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ____________
Frequency ____________
Responsible party/agency ____________
Contact ____________ ____________ ______ ______
Name   Title   Date   Phone no.

Reporting is up-to-date   Yes   No   N/A
Reports are verified by the lead agency   Yes   No   N/A

Specific requirements in deed or decision documents have been met   Yes   No   N/A
Violations have been reported   Yes   No   N/A
Other problems or suggestions: Report attached

2. **Adequacy**   ICs are adequate   ICs are inadequate   N/A
Remarks ____________

D. General

1. **Vandalism/trespassing**   Location shown on site map   No vandalism evident
Remarks ____________

2. **Land use changes on site**   N/A
Remarks ____________

3. **Land use changes off site**   N/A
Remarks ____________

VI. GENERAL SITE CONDITIONS

A. Roads   Applicable   N/A

1. **Roads damaged**   Location shown on site map   Roads adequate   N/A
Remarks ____________

B. Other Site Conditions
Remarks____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent______________ Depth___________
   Remarks____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths___________ Widths___________ Depths__________
   Remarks____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent______________ Depth___________
   Remarks____

4. **Holes** Location shown on site map Holes not evident
   Areal extent______________ Depth___________
   Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent______________ Height___________
   Remarks____

8. **Wet Areas/Water Damage**		Wet areas/water damage not evident	
Wet areas		Location shown on site map	Areal extent______________
Ponding		Location shown on site map	Areal extent______________
Seeps		Location shown on site map	Areal extent______________
Soft subgrade		Location shown on site map	Areal extent______________
Remarks______________________________________			
9. **Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
Areal extent______________			
Remarks______________________________________			

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
   Remarks______________________________________

2. **Bench Breached** Location shown on site map N/A or okay
   Remarks______________________________________

3. **Bench Overtopped** Location shown on site map N/A or okay
   Remarks______________________________________

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
   Areal extent______________ Depth______________
   Remarks______________________________________

2. **Material Degradation** Location shown on site map No evidence of degradation
   Material type______________ Areal extent______________
   Remarks______________________________________

3. **Erosion** Location shown on site map No evidence of erosion
   Areal extent______________ Depth______________
   Remarks______________________________________

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______ Depth______
Remarks____

5. **Obstructions** Type______ No obstructions
Location shown on site map Areal extent______
Size______
Remarks____

6. **Excessive Vegetative Growth** Type______
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______
Remarks____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring Thermal destruction Collection for reuse Good condition Needs Maintenance Remarks___		
2. **Gas Collection Wells, Manifolds and Piping** Good condition Needs Maintenance Remarks___		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Needs Maintenance N/A Remarks___		
F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks___	Functioning	N/A
2. **Outlet Rock Inspected** Remarks___	Functioning	N/A
G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent___ Depth___ N/A Siltation not evident Remarks___		
2. **Erosion** Areal extent___ Depth___ Erosion not evident Remarks___		
3. **Outlet Works** Functioning N/A Remarks___		
4. **Dam** Functioning N/A Remarks___		

H. Retaining Walls	Applicable	N/A
1. **Deformations** Location shown on site map Deformation not evident Horizontal displacement______ Vertical displacement______ Rotational displacement______ Remarks______		
2. **Degradation** Location shown on site map Degradation not evident Remarks______		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A
1. **Siltation** Location shown on site map Siltation not evident Areal extent______ Depth______ Remarks______		
2. **Vegetative Growth** Location shown on site map N/A Vegetation does not impede flow Areal extent______ Type______ Remarks______		
3. **Erosion** Location shown on site map Erosion not evident Areal extent______ Depth______ Remarks______		
4. **Discharge Structure** Functioning N/A Remarks______		
VIII. VERTICAL BARRIER WALLS	Applicable	N/A
1. **Settlement** Location shown on site map Settlement not evident Areal extent______ Depth______ Remarks______		
2. **Performance Monitoring** Type of monitoring______ Performance not monitored Frequency______ Evidence of breaching Head differential______ Remarks______		

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	N/A

1. Pumps, Wellhead Plumbing, and Electrical
Good condition All required wells properly operating Needs Maintenance N/A
Remarks____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances
Good condition Needs Maintenance
Remarks____

3. Spare Parts and Equipment
Readily available Good condition Requires upgrade Needs to be provided
Remarks____

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. Collection Structures, Pumps, and Electrical
Good condition Needs Maintenance
Remarks____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances
Good condition Needs Maintenance
Remarks____

3. Spare Parts and Equipment
Readily available Good condition Requires upgrade Needs to be provided
Remarks____

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters____________________
   Additive (*e.g.*, chelation agent, flocculent)____________________
   Others____________________
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually____________________
   Quantity of surface water treated annually____________________
   Remarks____________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks____________________

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks____________________

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks____________________

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks____________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks____________________

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells (natural attenuation remedy)**
Properly secured/locked Functioning Routinely sampled Good condition
All required wells located Needs Maintenance N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

NO SIGNIFICANT DECREASING TRENDS HAVE BEEN IDENTIFIED AT THE SITE; HOWEVER, GW PLUME IS REPORTABLE STABLE. NATURAL ATTENUATION IS LIMITED.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: 35-752	**Date of inspection:** 6/27/12
Location and Region: OUE	**EPA ID:** AK6214522157
Agency, office, or company leading the five-year review: JEG	**Weather/temperature:** PARTLY CLOUDY ~60°F

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls (circled)
- Institutional controls (circled)
- Groundwater pump and treatment
- Surface water collection and treatment
- Other ______
- Monitored natural attenuation (circled)
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A ______ ______ ______
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ______
   Problems, suggestions;   Report attached ______

2. **O&M staff** N/A ______ ______ ______
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ______
   Problems, suggestions;   Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ADEC
Contact Louis Howard — ENVT'L SPECIALIST — 8/13/12 — (907)269-7552
Name — Title — Date — Phone no.
Problems; suggestions; Report attached SEE INTERVIEW SHEET

Agency USACE
Contact BETH ASTLEY — PROJECT MANAGER — 9/21/12 — (907)753-5782
Name — Title — Date — Phone no.
Problems; suggestions; Report attached See Interview List

Agency EPA
Contact Sandra Halstead + Bill Adams — REMEDIAL PROJECT MANAGER — 8/23/12 — (907)271-1218
Name — Title — Date — Phone no.
Problems; suggestions; Report attached See Interview List

Agency ______
Contact ______ ______ ______ ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ______

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**
   State in-house | Contractor for State
   PRP in-house | Contractor for PRP
   Federal Facility in-house | Contractor for Federal Facility
   Other________________________
   N/A

2. **O&M Cost Records**
   Readily available | Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate__________ Breakdown attached N/A

   Total annual cost by year for review period if available

   From_______ (Date) To_______ (Date) _______ (Total cost) Breakdown attached
   From_______ (Date) To_______ (Date) _______ (Total cost) Breakdown attached
   From_______ (Date) To_______ (Date) _______ (Total cost) Breakdown attached
   From_______ (Date) To_______ (Date) _______ (Total cost) Breakdown attached
   From_______ (Date) To_______ (Date) _______ (Total cost) Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map Gates secured N/A
   Remarks________________________

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
   Remarks WARNING SIGNAGE IN PLACE

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ____________________
Frequency ____________________
Responsible party/agency ____________________
Contact ____________ ____________ ________ ________
Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks ____________________

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks ____________________

2. **Land use changes on site** N/A
Remarks ____________________

3. **Land use changes off site** N/A
Remarks ____________________

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks ____________________

B. Other Site Conditions			
Remarks______			
VII. LANDFILL COVERS Applicable N/A			
A. Landfill Surface			
1. **Settlement** (Low spots) Areal extent______ Remarks______	Location shown on site map Depth______	Settlement not evident	
2. **Cracks** Lengths______ Remarks______	Widths______	Location shown on site map Depths______	Cracking not evident
3. **Erosion** Areal extent______ Remarks______	Location shown on site map Depth______	Erosion not evident	
4. **Holes** Areal extent______ Remarks______	Location shown on site map Depth______	Holes not evident	
5. **Vegetative Cover** Trees/Shrubs (indicate size and locations on a diagram) Remarks______	Grass	Cover properly established	No signs of stress
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks______	N/A		
7. **Bulges** Areal extent______ Remarks______	Location shown on site map Height______	Bulges not evident	

8. **Wet Areas/Water Damage**		Wet areas/water damage not evident	
Wet areas		Location shown on site map	Areal extent________
Ponding		Location shown on site map	Areal extent________
Seeps		Location shown on site map	Areal extent________
Soft subgrade		Location shown on site map	Areal extent________
Remarks________			
9. **Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
Areal extent________			
Remarks________			
B. Benches	Applicable	N/A	
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1. **Flows Bypass Bench**		Location shown on site map	N/A or okay
Remarks________			
2. **Bench Breached**		Location shown on site map	N/A or okay
Remarks________			
3. **Bench Overtopped**		Location shown on site map	N/A or okay
Remarks________			
C. Letdown Channels	Applicable	N/A	
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1. **Settlement**		Location shown on site map	No evidence of settlement
Areal extent________		Depth________	
Remarks________			
2. **Material Degradation**		Location shown on site map	No evidence of degradation
Material type________		Areal extent________	
Remarks________			
3. **Erosion**		Location shown on site map	No evidence of erosion
Areal extent________		Depth________	
Remarks________			

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____

5. **Obstructions** Type____________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____

6. **Excessive Vegetative Growth** Type____________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring Good condition Remarks____________	Thermal destruction Needs Maintenance	Collection for reuse
2. **Gas Collection Wells, Manifolds and Piping** Good condition Remarks____________	Needs Maintenance	
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Remarks____________	Needs Maintenance	N/A
F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks____________	Functioning	N/A
2. **Outlet Rock Inspected** Remarks____________	Functioning	N/A
G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent________ Siltation not evident Remarks____________	Depth________	N/A
2. **Erosion** Areal extent________ Erosion not evident Remarks____________	Depth________	
3. **Outlet Works** Remarks____________	Functioning	N/A
4. **Dam** Remarks____________	Functioning	N/A

H. Retaining Walls	Applicable	N/A
1. **Deformations** Horizontal displacement_______ Rotational displacement_______ Remarks_______	Location shown on site map Vertical displacement_______	Deformation not evident
2. **Degradation** Remarks_______	Location shown on site map	Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A
1. **Siltation** Areal extent_______ Remarks_______	Location shown on site map Depth_______	Siltation not evident
2. **Vegetative Growth** Vegetation does not impede flow Areal extent_______ Remarks_______	Location shown on site map Type_______	N/A
3. **Erosion** Areal extent_______ Remarks_______	Location shown on site map Depth_______	Erosion not evident
4. **Discharge Structure** Remarks_______	Functioning	N/A
VIII. VERTICAL BARRIER WALLS	Applicable	N/A
1. **Settlement** Areal extent_______ Remarks_______	Location shown on site map Depth_______	Settlement not evident
2. **Performance Monitoring** Performance not monitored Frequency_______ Head differential_______ Remarks_______	Type of monitoring_______	Evidence of breaching

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks____

B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable	N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks____

C. Treatment System	Applicable	N/A

1. Treatment Train (Check components that apply)
- Metals removal
- Oil/water separation
- Bioremediation
- Air stripping
- Carbon adsorbers
- Filters___
- Additive (*e.g.*, chelation agent, flocculent)___
- Others___
- Good condition
- Needs Maintenance
- Sampling ports properly marked and functional
- Sampling/maintenance log displayed and up to date
- Equipment properly identified
- Quantity of groundwater treated annually___
- Quantity of surface water treated annually___

Remarks___

2. Electrical Enclosures and Panels (properly rated and functional)
N/A Good condition Needs Maintenance
Remarks___

3. Tanks, Vaults, Storage Vessels
N/A Good condition Proper secondary containment Needs Maintenance
Remarks___

4. Discharge Structure and Appurtenances
N/A Good condition Needs Maintenance
Remarks___

5. Treatment Building(s)
N/A Good condition (esp. roof and doorways) Needs repair
Chemicals and equipment properly stored
Remarks___

6. Monitoring Wells (pump and treatment remedy)
Properly secured/locked Functioning Routinely sampled Good condition
All required wells located Needs Maintenance N/A
Remarks___

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time   Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained   Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

DURING MOST RECENT GW SAMPLING EVENT (JUNE 2012) ALL WATER SAMPLES EXHIBITED CONCENTRATIONS OF CONTAMINANTS BELOW CLEANUP CRITERIA.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. NONE

APPENDIX D

Photograph Log

Photo No. 1 – 27 June 2012
The secured access gate to the OUB Poleline Road Disposal Area site (facing southeast).

Photo No. 2 – 27 June 2012
Signage on boundary fencing of the OUB Poleline Road Disposal Area site (facing southeast).

Photo No. 3 – 27 June 2012
Security fencing at the OUB Poleline Road Disposal Area site (facing northeast).

Photo No. 4 – 27 June 2012
Typical monitoring well with a newly-installed concrete barrier at the OUB Poleline Road Disposal Area site (facing east).

Photo No. 5 – 27 June 2012
Exterior casing from Monitoring Well AP-4348 had been removed at the OUB Poleline Road Disposal Area site (facing east).

Photo No. 6 – 27 June 2012
Secured exterior gate at the OUC Eagle River Flats site (facing north).

Photo No. 7 – 27 June 2012
General view of the OUC Eagle River Flats site (facing west).

Photo No. 8 – 20 August 2009
Aerial image of coastal east bank monitored for ordinance in May of 2010 at OUC Eagle River Flats (Aero-Metric [2009]). Digital Orthophoto.

Photo No. 9 – June 2008
Gravel Cap at 03DIS38 in OUC Eagle River Flats.

Photo No. 10 – 27 June 2012
U.S. Army 6th Engineer Battalion Class IV Yard located within the OUE AVMA site area (facing south-southwest).

Photo No. 11 – 27 June 2012
Building 733 and associated grounds, located within the OUE AVMA site area (facing southeast).

Photo No. 12 – 27 June 2012
Building 732 and associated storage yard, located within the OUE AVMA site area (facing southwest).

Photo No. 13 – 27 June 2012
U.S. Army Consolidated Storage Yard located within the OUE AVMA site area (facing north).

Photo No. 14 – 27 June 2012
Monitoring Wells AP-3468 and AP-3534 at the OUE AVMA site (facing north-northwest).

APPENDIX E

Interview Responses

Interview Record

Name: Beth Astley	Date: September 21, 2012
Organization: USACE	Phone Number: 907-753-5782
Title: Project Manager	Email: Beth.N.Astley@usace.army.mil
Interview Type: ☒ Mail/Email	☐ Phone/In Person

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

MNA is the only realistic solution to sites with DNAPL such as OUB (Poleline Road), and OUE due to complex geology with multiple fine grained layers.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

I am not aware of any effects on the surrounding community.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

Over the past 5 years there have been problems at OUB, Poleline road with people driving ATV's and snow machines onto the site. Two wells were damaged by vehicles. Signs were erected and the trails were blocked but people removed the signs and unblocked the trails.

4. Do you feel well informed about site activities and cleanup progress?

NA

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Monthly site visits were conducted from October 2005- January 2011. Issues were reported to DPW Environmental staff (now JBER staff).

Groundwater data results were reported in ERDC-CRREL Report 12-06 "Hydrologic Assessment and water level records for the Poleline Road Disposal Area 1995-2011". An updated conceptual site model based on hydrogeologic and chemical plume models were reported in ERDC-CRREL Report 11-10 "Poleline Road Disposal Area Hydrologic Analysis and Modeling Summary Report".

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

CRREL staff performed monthly site inspections of the wells including collection of groundwater level data. Monthly groundwater level elevation measurements were ceased in January 2011. Since that time, inspections have not been conducted by CRREL.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

The monitoring network was optimized in 2011. The number of wells was reduced to key wells within each aquifer to monitor natural attenuation without affecting protectiveness. Several of the wells were determined to be screened within perched water tables that were not representative of the aquifers and were removed from the monitoring network. Wells determined to be upgradient with consistent ND results were also removed. The new network focuses on the down-gradient area within the regional aquifer because it is the pathway for groundwater contaminants to migrate away from Poleline Road. Because contaminant concentrations have been shown to be affected by seasonal changes in the water table, sampling was recommended annually in the fall in order to better evaluate chemical data trends. The groundwater optimization will reduce long term monitoring costs and fall sampling will provide more consistent results for

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

No

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2008) that you feel may impact the protectiveness or effectiveness of the remedy?

None known.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

None known.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Yes. See #7 above.

The updated conceptual site model and recommended monitoring well network is presented in:
ERDC-CRREL Report 11-10 "Poleline Road Disposal Area Hydrologic Analysis and Modeling Summary Report"

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

Interview Record

Name: Tyler Ellingboe	Date: August 16, 2012
Organization: Bristol Environmental Remediatio	Phone Number: (907) 563-0013
Title: Project Manager/Senior Waste Specialist	Email: tellingboe@bristol-companies.co
Interview Type: ☒ Mail/Email	☐ Phone/In Person

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

My general sentiment regarding the restoration effort at JBER, Alaska is that it is progressing in a positive direction. Attempts are being made to address and close known contaminated sites and to properly monitor the former Fort Richardson Landfill.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

I do not believe that site operations have had a negative effect on the surrounding community. I am not aware of how much communication occurs between the environmental department and the general community. I am not aware of any community concerns or complaints regarding any site or its operations.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

I am not aware of any problems.

4. Do you feel well informed about site activities and cleanup progress?

I am well informed about the site activities and cleanup progress on only the sites that Bristol Environmental Remediation Services is currently or has recently performed work on (Ft. Rich UST Corrective Action Hot Tanks, Ft Rich Landfill Monitroing, and the Ft. Rich UIC Closure at Building 772 (Old Power Plant). I am not aware or well informed about other cleanup projects that are occurring on JBER.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes, for my three projects:
Ft Rich UST Corrective Action Hot Tanks (soil excavation , soil boring activities, and GW well installation. Currently working on reporting)
Ft. Rich Landfill Monitoring (Quarterly and annual gas and GW monitoring activities and report preparation and submittals)
Ft Rich UIC Closure Bldg 772 (excavated an old septic/cess pool and associated soil and submitted UIC Closure Report)

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The former Ft Rich Landfill site has gas probes and groundwater assessment and detection monitoring wells installed. Bristol has been performing quarterly and annual gas probe monitoring and annual groundwater sampling of wells at the site over the past year.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

The Ft Rich Landfill site is scheduled to install a couple additional (upgradient and downgradient) groundwater detection wells. The site is also scheduled to have sections of fencing repaired, access gates replaced, and sections of the landfil cap re-graded and re-seeded. Also, a section of ditch is scheduled to be cleaned out and re-graded. Impacts of the changes should increase security of the site and improve visual aesthetics.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

I believe that a couple of the detection wells had exceedances and that is what is driving the installation of additional upgradient and downgradient detection wells.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2008) that you feel may impact the protectiveness or effectiveness of the remedy?

I am not aware of any.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

I am not aware of any.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

I am not aware of any.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

I have no additional comments.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
ALASKA OPERATIONS OFFICE
Room 537, Federal Building
222 West 7th Avenue, #19
Anchorage, Alaska 99513-7588

August 31, 2012

673 CES/CEANR
6326 Arctic Warrior Drive
JBER, AK 99506-3240
Attn: Cynthia Tomlinson

Re: EPA responses on the Interview Record, Fort Richardson Five Year Review, August 2012.

EPA Region 10 has completed the Interview Record form, Fort Richardson Five Year Review, Joint Base Elmendorf-Richardson, Alaska, which was received on 10 August 2012.

A pdf version of the Interview Record is attached via electronic mail.

EPA's responses are the combined interview of Bill Adams, the EPA remedial project manager for Fort Richardson during the majority of the period covered under the review, and Sandra Halstead, the current EPA remedial project manager for Fort Richardson.

Please feel free to contact me if you have questions.

Best Regards,

Sandy Halstead

Remedial Project Manager, Federal Facilities.
907-271-1218
Halstead.sandra@epa.gov

Interview Record

Name: Sandra Halstead and Bill Adams	Date: August 23, 2012
Organization: US EPA Region 10	Phone Number: 907-271-1218
Title: Remedial Project Manager, Federal Sites	Email: halstead.sandra@epa.gov
Interview Type: ☒ Mail/Email	☐ Phone/In Person

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

The responses from US EPA R10 include those of Bill Adams, who was the US EPA Remedial Project Manager for Fort Richardson sites during the period of this review (200802102). This question does not distinguish between the two military bases on the JBER installation. Comments provided are specific to Fort Richardson sites.

Overall the cleanup and restoration efforts at Fort Richardson are good, and there is a continued large effort to address contaminated sites on the base. The joint base transition may have posed some uncertainty and challenges for staff, but overall the cleanup is progressing smoothly.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

US EPA is unaware of any community concerns or complaints regarding cleanup at Fort Richardson. The community meetings are not well attended, including a meeting which discussed the re-establishment of a live firing range at Eagle River Flats. The importance of the military to the local economy, as well as the culture of the military, may contribute to acceptance of site activities on base.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

EPA is not aware of any issues.

4. Do you feel well informed about site activities and cleanup progress?

Yes, EPA is a federal partner and by statute is involved in site activities and the cleanup process. There are sometimes challenges with communication about issues that come up with short notice or are new discoveries. The partnership would be strengthened by instituting a better method for communication around new issues.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes, EPA has federal oversight responsibility for cleanup of CERCLA sites at Fort Richardson. The EPA RPMs participate in planning meetings and review and comment on documents throughout the process.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

None of the Fort Richardson remedies contain active treatment which requires O & M. However, groundwater well maintenance is routinely done to ensure well integrity and sample quality assurance. The Army/ Air Force contractors also conduct a checklist of the Institutional controls at sites (fencing, barriers, etc...)

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

There have been changes to maintenance and sampling schedules but these have likely not affected the effectiveness of the remedy since many are based on annual monitoring and inspections. The change in contractors has impacted sampling schedules, sometimes resulting in gaps in the sampling frequency. During much of this five year review period, USACE CRRL could respond for short term or unanticipated sampling activities. The scope of current contracts may not allow for such flexibility.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

With a site of this size, there have been frequent and widely distributed problems across all the Operating Units (OUs) over time. New information gained in sampling may prompt changes. Specific examples include the treatment at Eagle River Flats, and the evolving conseptual site model and monitoring well locations and frequencies at Poleline Road Disposal Area (PRDA). At PRDA, a removal was conducted on contaminant hot spots, and the monitoring wells suggested stability of the plume. Years later, one of the monitoring wells began picking up increased contaminant concentrations (perhaps triggered by shifting after a seismic event?). It is important to keep in mind the long term goals of the sites since cleanup levels may not be achieved.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2008) that you feel may impact the protectiveness or effectiveness of the remedy?

Development of a Land Use Control atlas, as well as formalizing and instituting an installation-wide LUC policy from the Air Wing commander level, should help with ensuring protectiveness in preventing human health exposures.

At Eagle River Flats, the change in land use to resume the area as a live fire range could impact the protectiveness/effectiveness of the remedy. As military construction occurs on the base, these changes in land use often result in discovery of new areas for possible remediation.

Seismic activity/ earthquakes in the area during this period may contribute to changes in site stability.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

Costs are always an issue, especially with contracting changes and flexibility to acquire funding for priority sites on a yearly basis.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

O & M doesn't apply to most of the remedies for Fort Richardson sites. Groundwater monitoring optimization was conducted at a few key sites, especially at Poleline Road Disposal Area to track the best locations for data collection to understand plume dynamics. EPA encourages continued use of tools like the MAROS process to statistically analyze groundwater monitoring well networks.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

Encourage a continued attention to remediation of contaminated sites, and if possible, continue to add staff and funding to address the issues. It will be critical to identify where the new contract has flexibility to help prioritize work that may not be anticipated in the current scope.

Interview Record

Name: Louis Howard	Date: August 13, 2012
Organization: DEC	Phone Number: (907) 269-7552
Title:	Email: louis.howard@alaska.gov
Interview Type: ☒ Mail/Email	☐ Phone/In Person

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

The IRP program at JBER is a well run organization. While current federal hiring freezes prevent backfilling of environmental management and key staff positions with new personnel, they are doing the best they can with what they have and should be commended for it.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

The site operations have had an overall positive effect on the surrounding community. I am not aware of any community concerns or complaints regarding any site or its operations.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No.

4. Do you feel well informed about site activities and cleanup progress?

JBER's IRP program is the most responsive and open federal facility program I have dealt with.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes. The regular site visits are those that might occur during a federal facility agreement meeting, inspections of investigations or cleanups during the field seasons or CEB tour.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The Air Force has a continuous presence for O&M activities for long-term monitoring and Land Use Controls management.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

O&M changes occur regularly and can be due to cleanup complete at a site, removing equipment used for cleanup, additional removal actions due to new sources being found or new information. The Air Force has gone to a Performance Based Contract approach for most of its sites on JBER (aka Elmendorf/Richardson). The 8 year contract for this approach should not affect the protectiveness or effectiveness of any remedies. Optimization and innovation are possible under the contract which could change the remedies.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

See the semi-annual reports and last Five-Year Review for Elmendorf Air Force Base and Fort Richardson.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2008) that you feel may impact the protectiveness or effectiveness of the remedy?

No.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

No.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

See the semi-annual reports and last Five-Year Review for Elmendorf Air Force Base and Fort Richardson.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

No.

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By____________

Interview Record

Name: Joe Levesque	Date: 9-12-2012
Organization: JBER	Phone Number: (907) 230-8126
Title: Public Interest	Email: joe@levesquelawgroup.com
Interview Type: Mail/Email (circled)	Phone/In Person

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Over-all impression is good, although too much is often left for natural attenuation.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

Any effort to make environmental assessment and cleanup is positive. I'm not aware of specific complaints.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No

4. Do you feel well informed about site activities and cleanup progress?

Yes, I attend meetings with the cleanup folks and follow their activities and progress.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

We do have summer site visits.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

I believe there is – by the Environmental Restoration folks.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Not that I'm aware of.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

This depends upon which site. I believe new sites have been discovered, while some has received complete remediation and others are ongoing remediation.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2008) that you feel may impact the protectiveness or effectiveness of the remedy?

No

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

Not aware

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Not aware.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

APPENDIX F

Original FFA Source Areas and Their Current Statuses

Current Disposition of Source Areas Identified at JBER-Richardson Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
2pty	986	POL Laboratory Drywell	Waste oil, lubricants, aviation fuels, solvents, acid, alcohol, reagents, POL soils	2pty, currently NFA, with ICs	CLOSES evalutation conducted in 2004.	W020	60	USATHAMA 1991 property report and RCRA facility assessment (1990 RFA)
A	67630	Roosevelt Road Transmitter Site Leachfield	PCBs in transformer oil	2pty, currently NFA -with ICs	Contaminated soil was excavated prior to ROD and site was NFA in ROD. Site has since been sampled and capped with 6 feet of soil.	W010	118	USATHAMA 1991 property report and 1990 RFA
A	Fmr Lndfil#9 (Ruff Road)	Ruff Road Former Fire Training Area	Construction rubble, jp-4, chlorinated & nonchlor. Solvents	2pty, currently NFA -with ICs	Site underwent SVE treatment as part of 2pty agreement and has since been NFRAP with ICs.	W040	97	USATHAMA 1991 property report and 1990 RFA
B	Poleline Road Disposal Area	Poleline Road Disposal Area	Decon. Solvents, smoke cannisters, cw training material	Ltm with ICs	Currently performing groundwater monitoring and examining contamination trends to ensure ROD objectives will be met.	N087		None
C	Eagle River Flats	Eagle River Flats Impact Area	White phosphorus	Short term and long-term RAO objectives met.	Completed remediation activites. Continued monitoring to occur prior to Five-Year Review.	W006	117	USATHAMA 1991 property report and 1990 RFA
C	Eagle River Flats	Open Burn/Open Demo Area	Powder bags, fuzes, tnt, grenades,rocket motors, projectiles, ash	RCRA closure	NFA under CERCLA and referred to RCRA for closure.	W025	99	USATHAMA 1991 property report and 1990 RFA
D	700	Former Drum/PCB Storage Area	POL	NFA under CERCLA and 2pty	NFA in OUD ROD. Groundwater sampling indicated that site was clean and NFRAP under 2pty.	W009	1, 91	USATHAMA 1991 property report and 1990 RFA
D	704	Former Roads And Grounds Drum Storage & Waste Accumulation Area	Waste solvent	NFA under CERCLA and 2pty	NFA in OUD ROD. Sampling indicated that site was clean and NFRAP under 2pty.	R053	3, 4	1990 RFA

Current Disposition of Source Areas Identified at JBER-Richardson
Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
D	726	Former Laundry & Drycleaning USTs	Perchlorethylene, sludge	NFA	NFA in OUD ROD. Low level contamination at depth not considered a risk.	W016	9, 10, 11, 12, 13, 14, 15, 120	USATHAMA 1991 property report and 1990 RFA
D	796	Dol Maint, Area -- Former Battery Acid Disposal Site	Neutralized btry acid, heavy metals	NFA in OUE ROD	Groundwater at the site was sampled post OUD ROD. No contaminants exceeded mcls.	R059	37	1990 RFA
2pty	955	Used Oil Transfer Area (Sludge Bin)	pesticides, used oil/fuel	NFA in OUE ROD with RCRA closure	Contaminated soil disposed of at permitted disposal facility. Soil samples collected post OUD ROD. No contaminants exceeded cleanup levels or rbcs so site was be closed under the OUE ROD.	R060	41	1990 RFA
2pty	45590	Motor Pool	Waste oil, lubricants, antifreeze, acid, solv.	NFA under CERCLA with RCRA closure	NFA under CERCLA. No evidence of contaminant release that poses an unacceptable risk. Groundwater is monitored as part of closure plan for JBER-Richardson landfill.	W002	83	USATHAMA 1991 property report and 1990 RFA
D	Fra Landfill (East Side)	Landfill Former Fire Training Area	Oil, solvent, transm./brake/hydraulic fluid, water contam. Diesel, jp-4	NFA	NFA under CERCLA. No evidence of contaminant release that poses an unacceptable risk. Groundwater is monitored as part of closure plan for JBER-Richardson landfill.	W015	98	USATHAMA 1991 property report and 1990 RFA
D	Fra Landfill (East Side), Approx. 1000' SW Of Ff Pit #2	Grease Pit #1	Cooking grease, petroleum, grease/oil, o/w sediment separator bottoms, fuel tank water, ethyl glycol	NFA	NFA under CERCLA. No evidence of contaminant release that poses an unacceptable risk. Groundwater is monitored as part of closure plan for JBER-Richardson landfill.	R072	92	1990 RFA

Current Disposition of Source Areas Identified at JBER-Richardson Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
D	Fra Landfill (East Side), Approx. 1000' SW Of Ff Pit #2	Grease Pit #2	Cooking grease, petroleum, grease/oil, o/w sediment separator bottoms, fuel tank water, ethyl glycol	NFA	NFA under CERCLA. No evidence of contaminant release that poses an unacceptable risk. Groundwater is monitored as part of closure plan for JBER-Richardson landfill.	R073	93	1990 RFA
D	Circle Road Drum Site	Circle Road Drum Site	POL	NFA with RCRA closure	Contamination removed from site and confirmation sampling indicated no evidence of contamination remaining at the site that posed unacceptable risk.	N090		None
D	Fra	Storm Drainage Outfall To Ship Creek	Oils, fuels, solvents	NFA	NFA under CERCLA. No evidence of contaminant release that poses an unacceptable risk. Groundwater is monitored as part of closure plan for JBER-Richardson landfill.	R075	115	1990 RFA
D	Fra Roads	DUST Palliative	Waste oil, solvent	NFA	Sampling indicated no evidence of contamination that poses unacceptable risk.	W028		USATHAMA 1991 property report
E	35-752	PCB Site/UST (Antenna Bldg)	PCBs, POL,	RCRA closure (inside bldg), CERCLA ri/fs outside	NFA under OUE ROD. GW monitoring to occur prior to Five-Year Review.	W023	90	USATHAMA 1991 property report and 1990 RFA
E	Avma	Groundwater Plume Upgradient Of 45590 Site	Carbon tetrachloride, pce	CERCLA ri/fs	Site is part of OUE ROD. Groundwater monitoring and examination of contaminant concentration trends occuring at the site.			
	604	Medical Lab	Fixative w/silver, methyl methacrylate, reagents	NFA	No reported spills. Waste generated inside bldg. Medical lab reagent discharges into sanitary sewer system.	W004		USATHAMA 1991 property report

Current Disposition of Source Areas Identified at JBER-Richardson
Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
	700	Paint Shop Spray Booth	Waste paint	NFA	Releases to soil, suRFAce water, or ground water unlikely; unit located indoors on third floor; filters capture air releases.	R051	2	1990 RFA
2pty	704	Roads And Grounds Wash Rack Sump And Oil/Water Separator	Washwater w/oil, grease, dirt	NFA	Soil sampling indicatd that no release had occurred.	R054	5, 6	1990 RFA
	706	Self-Help Shop	POL, waste paint, solvents	NFA	No reported releases to soil, air, or ground water.	N082		None
2pty	710	Aafes Service Station	Waste oil	NFA	Unit in good condition with low potential for releases.	R056	7	1990 RFA
	721	Pesticide Storage Area	Insecticides, herbicides, avicides, RODenticides, paint, ddt, rinsate	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W007	8	USATHAMA 1991 property report and 1990 RFA
2pty	732	Motor Pool	Waste oil, lubricants, antifreeze, acid, solv.	NFA	UST two-party site; no other reported releases to air, soil, or ground water.	W002	16, 71	USATHAMA 1991 property report and 1990 RFA
	740	Former Paint Booth	Waste paints, solvents	NFA	No reported releases to soil, air, or ground water.	N095		Draft ecar, dec '93
2pty	740	Maintenance Shop, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	17, 18, 19	USATHAMA 1991 property report and 1990 RFA
2pty	750	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	20, 21, 22, 23, 24	USATHAMA 1991 property report and 1990 RFA
2pty	750	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	20, 21, 22, 23, 24	USATHAMA 1991 property report and 1990 RFA
	754	O/W Separator	Wash water w/oil, grease, fuel	NFA	Unit in good condition with low potential for releases.	R093	25	1990 RFA

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Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
2pty	755	Auto & Craft Shop	Waste paints, grease, mineral spirits, oil	NFA	Petroleum contamination at depth not leaching to groundwater. Site closed with NFRAP and ICs .	R057	27, 72	1990 RFA
2pty	756	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	28, 29, 73	USATHAMA 1991 property report and 1990 RFA
	764	Motor Pool	Waste oil, lubricants, antifreeze, acid, solv.	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	N084		None
2pty	770	Motor Pool	Waste oil, lubricants, antifreeze, acid, solv.	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W002	75	
	772	In-Service Transform.	PCB's in transfmr oil	NFA	Transformer inside secure building. Sufficient concrete curbing around transformer to contain spills. No floor drain.	W008		USATHAMA 1991 property report
2pty	778	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	31, 76	USATHAMA 1991 property report and 1990 RFA
2pty	782	Veh. Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air. 2pty status closed.	W018		USATHAMA 1991 property report
2pty	784	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	32, 77	USATHAMA 1991 property report and 1990 RFA
	789	Ds/Gs Maintenance Facility	Tce, waste solvent/oil, grease, paint, acid	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W001	78	USATHAMA 1991 property report and 1990 RFA
2pty	794	Cannibilization Yard	POL, solvents	NFA	Sampling indicated that contaminants are not present above risk levels.	N096		Draft ecar, dec '93

Current Disposition of Source Areas Identified at JBER-Richardson
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OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
2pty	796	Veh.Washrack & O/W Sep.	Oil/grease from wash	NFA	Unit in good condition with low potential for releases.	W018	34	USATHAMA 1991 property report and 1990 RFA
	796	Spray Paint Booth And Vehicle & Weapons Shop	Enamel/carc paint fume	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	R058	36	1990 RFA
	798	Ds/Gs Maintenance	Tce, waste solvent/oil, grease, paint, acid	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W001	79	USATHAMA 1991 property report and 1990 RFA
	802	Supply Warehouse	Solvents,waste oil, reagents, photo fixative, waste paint/lithium batteries, hvy metals	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W011		USATHAMA 1991 property report
	802	Rad. Matrl. Storage	Pdr-27, krypton-85, promethium-147, tritium, radium	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W012		USATHAMA 1991 property report
	804	Supply Warehouse	Solvents,waste oil, reagents, photo fixative, waste paint/lithium batteries, hvy metals	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W011		USATHAMA 1991 property report
	804	Rad. Matrl. Storage	Pdr-27, krypton-85, promethium-147, tritium, radium	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W012		USATHAMA 1991 property report
	812	Motor Pool, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	40, 80	USATHAMA 1991 property report and 1990 RFA
	908	Print Shop/Photo Lab	Grease,mineral spirits, oil, solv, ink, silver, rags	NFA	No reported spills. Waste generated inside bldg. Waste water discharges into sanitary sewer system.	W003		USATHAMA 1991 property report

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OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
	974	Sper Shop -- Waste Solvent (Tce) Accumulation Area	Tca	NFA	No evidence of release to soil, air, or ground water.	R062	45	1990 RFA
	974	Sper Shop	Used oil/solvents, chlorinated solv, antifreeze, grease, potassium hydroxide, waste water, trichloroethane, brake fluid, contam. Oil/diesel	NFA	No evidence of release to soil, air, or ground water.	R061	44	1990 RFA
2pty	974	Veh.Washrack & O/W Sep.	Oil/grease from wash	NFA	Unit in good condition with low potential for releases.	W018	49	USATHAMA 1991 property report and 1990 RFA
	974	Fuel Blivet Clng Area	Washwater w/fuel, deterg.	NFA	No evidence of release to soil, air, or ground water; suRFAce of cleaning area is coated concrete w/curb.	R091	46, 47	1990 RFA
2pty	975	ElectronICs Maintenance Shop, Veh.Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	50, 51, 52	USATHAMA 1991 property report and 1990 RFA
	976	Maint Shop,Acid Bath/Tk	Waste acids	NFA	Unit located inside building; no reported releases to soil, air, or ground water; unit inactive since 1974; unit has been removed.	R065	56	1990 RFA
	976	Maint Shop, Fib.Glas Filt.	Fiberglass particles	NFA	Filters located inside aluminum box inside building; no reported releases soil, air, or ground water.	R066	57	1990 RFA
	978	Photo Lab, Silver Recov.	Hypo solution	NFA	Self-enclosed unit inside building; no reported releases to soil, air, or ground water.	R067	58	1990 RFA

Current Disposition of Source Areas Identified at JBER-Richardson
Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
	978	Tasc Paint Spray Booth	Waste paints	NFA	Unit located inside building; no reported releases to soil, air, or ground water.	R068	59	1990 RFA
	988	Retail Fuel Storage Yd	Diesel fuel, gasoline	NFA	No evidence of release to soil, air, or ground water;	W031		USATHAMA 1991 property report
	27006	Moose Run Golf Crse	Grease, oil	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	R078	81	1990 RFA
	28002	Water Treatment Plant	Filter backwash water., settled sludge, fuel oil	NFA	Subject to npdes permit monitoring	W046		USATHAMA 1991 property report
	36012	Cent.Heat & Pwr Plant/Waste Accum. Area	Diesel fuel, coal, fly ash	NFA	Since unit is covered, paved, and handled small quantities of waste, release to ground water or suRFAce water unlikely.	W026	62, 104-114	USATHAMA 1991 property report and 1990 RFA
	36013	Classified Waste Incin.	Classified waste, ash	NFA	Due to absence of hazardous constituents in wastes, no potential for harmful releases.	W027	103	USATHAMA 1991 property report and 1990 RFA
2pty	39600	Former Nike Missile Site (Upper Site Summit), & Lower Site Summit	Water w/residual solv, fuels, radioactive material, asbestos	Active 2pty site	Site will undergo additional investigation starting in fy05	W048		USATHAMA 1991 property report
	45040	Boat Shop	Antifreeze, dryclean solvent, oil, paint thinner	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	R079	82	1990 RFA
	45125	Haz Waste Storage Fac.	Waste solvent/oil/paint fuel, PCB-contam. Material	NFA	Investigate iaw RCRA permitting process	W022	88	USATHAMA 1991 property report and 1990 RFA
	45133	Haz Waste Storage Area	Contam. Soils (oil/fuel)	NFA	Investigate iaw RCRA permitting process	R071	89	1990 RFA
	45703	176 Eod Maint Fac		NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	N081		None

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OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
2pty	45726	23 En Co Maintenance Facility, Washrack & O/W Sep.	Oil/grease from wash	NFA	Due to sufficient controls & small quantities generated, unlikely for releases to GW, SW, or air.	W018	64, 65	USATHAMA 1991 property report and 1990 RFA
2pty	47203	AiRCRAft Maintenance Facility	Waste jp-4, jet fuel, oil, hydraulic fluid, petrol. Naptha, heavy metals	NFA	Acls for dro contamination at site. NFRAP with ICs.	N095		None
	47427	AiRCRAft Maintenance Facility	Waste jp-4, jet fuel, oil, hydraulic fluid, petrol. Naptha, heavy metals	NFA	No evidence of release to soil, air, or ground water.	W021	86, (1990 RFA mistakenly lists as bldg 47727 -- no such building on record)	USATHAMA 1991 property report, 1990 RFA
	47430	AiRCRAft Maintenance Facility	Waste jp-4, jet fuel, oil, hydraulic fluid, petrol. Naptha, heavy metals	NFA	No evidence of release to soil, air, or ground water.	W021		USATHAMA 1991 property report
	47430	A/C Washrack & O/W Sep.	Oil/grease from wash	NFA	No evidence of release to soil, air, or ground water;	W019		USATHAMA 1991 property report
	47431	AiRCRAft Maintenance Facility	Dryclean solv, grease, hydraulic fluid, methyl ethyl ketone, naptha, waste fuels/oil	NFA under ffa	No evidence of contaminant release and site was NFA in the ffa.	W021	67	USATHAMA 1991 property report
	47432	AiRCRAft Maintenance Facility	Waste jp-4, jet fuel, oil, hydraulic fluid, petrol. Naptha, heavy metals	NFA	No evidence of release to soil, air, or ground water;	R070	84	
	47433	AiRCRAft Maintenance Facility	Waste jp-4, jet fuel, oil, hydraulic fluid, petrol. Naptha, heavy metals	NFA	No evidence of release to soil, air, or ground water;	W021		USATHAMA 1991 property report
2pty	47641	AiRCRAft Maintenance Facility	Waste fuel, grease, oil	NFA	No evidence of release to soil, air, or ground water.	R094	85	1990 RFA

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OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
2pty	47811	Veteranary Incin.	Animal carcasses, infectious waste, ash	NFA	Due to nature of hazardous wastes and unit construction, little potential for harmful releases.	W027	102	USATHAMA 1991 property report and 1990 RFA
	55295	Ammo Deactiv. Furnace	Waste small cal. Ammo, cartridges, ash, hvy metals, propellant, primers, fuzes	NFA under CERCLA	Pending permit application.	W024	101	USATHAMA 1991 property report and 1990 RFA
2pty	59000	Ak Arng Veh Maint Fac	Waste fuel, grease, oil, solvents, antifreeze; oil/grease from wash	NFA	State of the art unit located inside building; no reported releases to soil, air, or ground water.	N086		None
	Ammo Area C	Rad. Matrl. Disposal	Radioactive wastes	NFA	Inactive site with no known releases.	W013		USATHAMA 1991 property report
	Ammo Holding Area	Ammo Supply Point	Ammunition	NFA	Ammo secured inside concrete bunkers. No known releases within asp compound.	W029		USATHAMA 1991 property report
	Field Loc	Septic Tanks/Leach Flds	San. Waste water, indUSTrial wastewater	NFA	No evidence of past releases	W017		USATHAMA 1991 property report
	Field Loc	Spill Areas	Diesel, mogas, jp-4	NFA	all known spill sites remediated.	W049		USATHAMA 1991 property report
	Fra	Above Gnd Storage Tnks	Diesel, gasoline, htng oil	NFA	Sufficient controls in place; no evidence of past releases	W041		USATHAMA 1991 property report
	Fra	Above Gnd Storage Tnks	Diesel, gasoline, htng oil	NFA	Sufficient controls in place; no evidence of past releases	W042		USATHAMA 1991 property report
	Fra	Underground Stor.Tnks	Diesel, mogas, waste oil,	NFA	Subject to UST two-party agreement	W043	7, 16, 19, 23, 24, 26, 29, 30, 35, 38, 39, 42, 43, 48, 53, 61, 63, 66, 68, 69, 70, 119, and 120	USATHAMA 1991 property report and 1990 RFA
	Fra	Former USTs	Diesel, mogas, fuel oil,	NFA	Subject to UST two-party agreement	W044		USATHAMA 1991 property report

Current Disposition of Source Areas Identified at JBER-Richardson Identified in the Original FFA

OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
	Fra	Former USTs	Waste oil, fuel oil	NFA	Subject to UST two-party agreement	W045		USATHAMA 1991 property report
	Fra	Sanitary Sewer System	Sanitary/indUSTrial wastewater w/oils, grease	NFA	Subject to npdes permit monitoring	R076	116	1990 RFA
	Landfill #1, East Sector Of Fra Lf, 400 Acres	Landfill	Sanitary waste, waste oil/brake fluid, pesticides	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W032	94, 95	USATHAMA 1991 property report and 1990 RFA
	Landfill #2, North-Central Sector Of Fra Lf; 338 Acres	Landfill	San. Waste, unknown	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W033		USATHAMA 1991 property report
	Landfill #3, South-Central Sector Of Fra Lf; 60 Acres	Landfill	San. Waste, unknown	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W034		USATHAMA 1991 property report
	Landfill #4, Southwest Sector Of Fra Lf; 3 Acres	Landfill	Construction debris	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W035		USATHAMA 1991 property report
	Landfill #5, Northwest Sector Fra Lf; 3 Acres	Landfill	Constr. Debris, sanitary waste, metal, wood, asbestos, explosives, infectious waste	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W036		USATHAMA 1991 property report
	Landfill #6, West Edge Of Fra Lf; Unk. Size	Landfill	Unknown	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W037		USATHAMA 1991 property report
	Landfill #7, Adjacent To Old Davis Highway (Vic. Anchorage Lf)	Landfill	Sanitary waste	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W038		USATHAMA 1991 property report

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OU	Building/ Location	Site Description	Potential COCs	Status	Comments	Wc report site #	1990 RFA SWM	Notes & References
	Landfill #8, Adj. To Old Davis/Glenn Highways, Approx 3 Km South Of The Eagle River; 3 Acres	Landfill	Cars w/waste oil, junk	NFA under CERCLA	Closed under solid waste regs with long-term GW monitoring	W039		USATHAMA 1991 property report
	Uc553983	Rt Bravo Transformer Site (Vic. GWen Lake)	PCBs, metals	NFA	Contaminants below epa action levels.	N089		Usapacehea report, 31 jan 94
	Various Field Locations	Open Burning Sites And Firing Ranges/Impact Areas	Lead, munitions waste from mortar, small arms, grenades, rockets	NFA	Active training facilities for marksmanship/gunnery training with no evidence of adverse environmental effects.	W005	100	USATHAMA 1991 property report and 1990 RFA
	Vic. Uc577959	Transfer Station	Fra solid waste, asbestos	NFA	No reported releases to soil, air, or ground water.	R074	96	1990 RFA

APPENDIX G

JBER LUC Management Policy &

JBER-Richardson Base Civil Engineer Work Clearance Request

BY ORDER OF THE COMMANDER
673D AIR BASE WING (PACAF)

673D AIR BASE WING INSTRUCTION 32-7003

19 MAY 2011

Civil Engineering

LAND USE CONTROL MANAGEMENT

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Certified by: 673 CEG/CC (Col Russell R. Hula)

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This instruction implements AFPD 32-70, *Environmental* Quality, and is used in conjunction with AFIs 32-7020, *The Environmental Restoration Program*, 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, and 673ABWI 32-1007, *Safeguarding Utilities From Damage*. It prescribes the processes and responsibilities for the management of and compliance with land use controls on Joint Base Elmendorf-Richardson (JBER) and applies to all military and civilian organizations that occupy facilities, or conduct business, on the installation. This publication does not apply to the US Air Force Reserve or Air National Guard units and members. The current land use control areas can be found on the Environmental Restoration map located on the GeoBase webpage. Refer recommended changes and questions about this publication to the office of primary responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*, and route the AF Form 847 through the appropriate chain of command. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS) located at **ttps://www.my.af.mil/gcss-af61a/afrims/afrims.cfm**. See **Attachment 1**

SUMMARY OF CHANGES

This publication has been substantially revised and must be completely reviewed. The instruction was updated to reflect changes as a result of the joint base establishment, including the scope of the program, as well as the establishment or redesignation of units.

1. General:

1.1. Land use controls (LUC), such as limitations on access, water use, excavations, and property transfers, will supplement engineering controls as appropriate for short-term and long-term management to prevent or limit human and environmental exposure to hazardous substances, pollutants, or contaminants. Examples include limitations on the depth and location of excavations, prohibition of or restrictions on well drilling and use of ground water, management of excavated soils, and prohibition of certain land uses. LUCs, often used interchangeably with institutional controls (IC), are administrative, procedural, engineering, and regulatory measures to control human access to and use of property.

1.2. LUCs were established at JBER to prevent exposure to contaminated soil and water, based on agreements between the military services and the US Environmental Protection Agency (USEPA) and the Alaska Department of Environmental Conservation (ADEC). LUCs are used to reduce the potential for exposure to hazardous substances or to enhance the protectiveness of a soil and/or water cleanup remedy. They include restrictions on the use of portions of the shallow aquifer south of the Elmendorf Moraine, limitations on the types of buildings allowed in certain areas – primarily occupancy limitations, and land use designations for certain areas as recreational use only. The LUCs have been implemented at several sites and operable units (OU) as part of the Environmental Restoration Program. LUCs were established for DP98 and OUs 1, 2, 4, 5, and 6 on former Elmendorf AFB property in their respective records of decision (ROD), as a component of the selected cleanup remedy. LUCs were also established for restoration and compliance sites formerly part of Fort Richardson in their respective RODs or Decision Documents. LUCs must be in place as long as a property is not available for unrestricted use or unlimited exposure and may include temporary or permanent restrictions or requirements. When all cleanup goals have been achieved for a given site, temporary controls, such as groundwater use restrictions, may be removed.

2. Responsibilities:

2.1. JBER personnel, tenants, or contractors whose projects or activities require excavation in areas where site-specific LUCs are in effect will comply with all LUCs, 673ABWI 32-1007, and applicable Air Force instructions. Base contractors and tenant organizations will have LUC compliance requirements incorporated into their contracts and interagency agreements, as will be necessary. Failure to comply with LUCs will be grounds for penalty, in accordance with provisions specified in applicable contract documents. At project completion, the JBER organization or contractor will sign a certification of LUC compliance and return the compliance statement to 673 CES/CEANR.

2.2. The 673d Civil Engineer Squadron (673 CES):

2.2.1. Asset Management Flight (673 CES/CEA):

2.2.1.1. Natural Resources Management (673 CES/CEAN):

2.2.1.1.1. Environmental Restoration (673 CES/CEANR):

2.2.1.1.1.1. Will provide groundwater and site-specific LUC requirements throughout the installation and identify any known soil contaminated sites and monitoring wells for the area of the proposed project.

2.2.1.1.1.2. Will conduct annual site visits to ensure compliance with LUCs during project implementation.

2.2.1.1.1.3. Will conduct 5-year reviews, at 5-year intervals, or as required by any subsequent RODs.

2.2.1.1.1.4. Will prepare annual LUC compliance reports and submit reports to ADEC and USEPA by 1 February each year.

2.2.1.1.1.5. Will disseminate LUC information to personnel involved in LUC management, including real property and 673 CES/CEPT for inclusion into GeoBase.

2.2.1.1.1.6. Will operate an active educational program that includes disseminating updated fact sheets and LUC information, providing notices through the installation intranet and the *Arctic Warrior* newspaper, and by briefing LUC management at project kick-off meetings; Environmental, Safety and Occupational Health Council meetings, and Community Environmental Board meetings.

2.2.1.1.1.7. Will coordinate any changes in the base general plan (BGP), or real estate transactions, with USEPA and ADEC.

2.2.1.1.1.8. Will maintain copies of signed certificates of compliance, indicating requestor's adherence to LUCs during project execution.

2.2.1.2. Asset Optimization (673 CES/CEAO):

2.2.1.2.1. Will incorporate LUCs into the BGP, which is available to all base organizations, consultants, and site activation task forces to aid in the facility planning process. The BGP will be consulted prior to facility siting or proposing changes in land use.

2.2.1.2.2. Will coordinate any changes to the BGP which could affect LUCs with 673 CES/ CEANR, to ensure USEPA and ADEC have 30 days to review the proposed changes.

2.2.1.2.3. Will require an AF Form 332, *Base Civil Engineer Work Request*, at the initial planning or siting phase of all projects, including those initiated by tenant organizations. If the project is in an area with LUCs, 673 CES/CEAO will coordinate with 673 CES/CEAN to include specific information about the LUCs in the project location. The 673 CES/CEAO will ensure a project siting review is conducted and that 673 CES/CEAN coordinates on the review.

2.2.1.3. Real Property (673 CES/CEAOR):

2.2.1.3.1. Will ensure LUCs are incorporated into all real estate instruments such as leases, transfers, tenant support agreements, easements, and rights-of-way. In accordance with AFI 32-7066 land use and groundwater use restrictions identified in Environmental Baseline Surveys (EBS) will be incorporated into real estate instruments. A written waiver must be prepared to document any transaction that is exempt. The EBS or waiver will be included in the real estate transaction administrative record.

2.2.1.3.2. Will notify 673 CES/CEANR at least 6 months prior to any lease, transfer, or sale of Air Force land so that USEPA and ADEC can be involved in discussions to ensure appropriate provisions are included in the lease, transfer, or sale terms. Review and comment opportunities afforded to USEPA and ADEC as to federal-to-federal transfers will be in accordance with all applicable federal laws.

2.2.2. Programs Flight (673 CES/CEP) and SABER (673 CES/CEPMS):

2.2.2.1. Will ensure compliance with LUCs by incorporating general LUC language, provided by 673 CES/CEANR, in technical provisions (Section 01010) and environmental constraints/ protection measures (Section 01120) of construction contract documents.

2.2.2.2. As the Contracting Officer's Technical Representative, will inspect and ensure contractors are complying with this Wing Instruction.

2.2.2.3. Geo Integration Office GeoBase Program (673 CES/CEPT):

2.2.2.3.1. Will post a LUC map layer to the interactive map on the installation local area network, allowing all installation organizations access to LUC data on their desktop computers.

2.2.2.3.2. Will incorporate LUCs into the Constraints and Opportunities Map, the Record Drawing Set used for initial siting of new facilities.

2.3. The 773d Civil Engineer Squadron (773 CES):

2.3.1. Operations (773 CES/CEO):

2.3.1.1. Will ensure compliance with LUCs by confirming the appropriate signature and concurrence is completed on 673 ABW Form 3, *Base Civil Engineer Work Clearance Request*, prior to the 773 CES/CEO signature which validates the request.

2.3.1.2. Will maintain approved and completed 673 ABW Form 3, log and file in 773 CES/ CEOSC (CE Customer Service) and make available these work requests and supporting documents for duplication by 673 CES/CEAN, as needed.

2.3.1.3. Infrastructure (773 CES/CEOI):

2.3.1.3.1. Will ensure compliance with 3WGI 32-1007 by preparing and coordinating a 673 ABW Form 3.

2.3.1.3.2. Will revise and coordinate 673 ABW Form 3 for uniform use on all projects executed on JBER in which mechanized equipment penetrates or disturbs the ground, or hand digging that penetrates more than 4 inches below the ground surface.

2.4. The 673d Contracting Squadron (673 CONS) and other service centers, such as the US Army Corps of Engineers (COE) and the Air Force Center for Engineering and the Environment (AFCEE), will ensure compliance with LUCs by incorporating general LUC language, provided by 673 CES/CEANR, in technical provisions (Section 01010) and environmental constraints/protection measures (Section 01120) of construction contract documents. These agencies will ensure contractors are complying with this Wing Instruction.

3. Existing LUCs at JBER:

3.1. LUCs in effect at JBER include site-specific LUCs and restrictions on groundwater use. The LUCs will be terminated as specified in the ROD when the sites or operable units have met required cleanup goals. The military services will seek prior concurrence from USEPA and ADEC to terminate LUCs or modify current land uses. In addition, the military services will seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs, or any action that may alter or is inconsistent with the land use assumptions or land uses described in the respective ROD.

3.2. Site-specific LUCs are specified in the governing ROD or Decision Document. These documents are located in the information repository.

3.3. The installation has implemented an administrative groundwater restriction on the use of groundwater from the shallow aquifer in the area that was formerly Elmendorf AFB. Use of the shallow aquifer within the groundwater control boundary for any purpose including, but not limited to, drinking, irrigation, fire control, dust control, or any other activity is strictly prohibited. Portions of the shallow aquifer are contaminated and may pose a health risk. The shallow aquifer is defined as any unconfined, saturated, water-bearing zone below the ground surface. The current groundwater control boundary can be found on the Environmental Restoration map located on the GeoBase webpage.

ROBERT D. EVANS, Colonel, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPD 32-70, *Environmental Quality*, 20 July 1994.

AFI 32-7020, *The Environmental Restoration Program*, 7 February 2001.

AFI 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, 1 June 2004.

3WGI 32-1007, *Safeguarding Utilities From Damage*, 17 August 2006.

AFMAN 33-363, *Management of Records*, 8 March 2008.

Forms Prescribed

No forms were prescribed by this publication.

Forms Adopted

AF Form 332, *Base Civil Engineer Work Request*, AF Form 847, *Recommendation for Change of Publication*, and 673 ABW Form 3, *Base Civil Engineer Work Clearance Request*.

Acronyms and Abbreviations

ADEC—- Alaska Department of Environmental Conservation.

AFCEE—- Air Force Center for Engineering and the Environment.

AFRIMS—- Air Force Records Information Management System.

BGP—- Base General Plan.

COE—Army Corps of Engineers.

EBS—- Environmental Baseline Surveys.

IC—- Institutional Controls.

JBER—Joint Base Elmendorf-Richardson.

LUC—- Land Use Controls.

OPR—Office of Primary Responsibility.

OU—- Operable Units.

RDS—- Air Force Disposition Schedule.

ROD—- Records of Decision.

USEPA—- US Environmental Protection Agency.

BASE CIVIL ENGINEER WORK CLEARANCE REQUEST	Permit Number:

1. Clearance is requested to proceed with work at ______________________ on Work Order No. ______________________

Contract No. ______________________ involving excavation or utility disturbance per attached sketch.

2. Description of Work: (Particularly describe in detail all ground penetrations. Provide length, width, and depth of all excavations and clearly indicate location on attached drawing.

A map showing the location of the proposed work, building numbers, and street names must be submitted with the work request. Coordination of this form is the requestor's responsibility. Initial / final coordination can be obtained at Bldg 700, 0800 to 1100 and 1300 to 1600 Mon-Fri (except federal holidays). Individual coordinations are made using the contact information listed below.

3. **INSTRUCTIONS:**

This BCE Work Clearance Request is required for any work that may disrupt aircraft or vehicular traffic flow base utility services, fire protection, intrusion alarm systems, air quality, water quality, stormwater flow, biovents/monitoring wells, recreations trails/activities, wetlands, vegitation or routing activities of the installation. Work must be coordinated to minimize customer inconvenience and ensure the safety of contract workers and base personnel. This request must be processed prior to start of work. If work is not started within 30 days of the approval date or it is suspected that job site conditions have changed, this request must be reprocessed by all shops and validated by the approving officer. Further guidance concerning utilities can be found in 673 ABWI 32-1007.

4. Requester's Name:	5. Phone No.	6. Organization:

	JBER-R (RICHARDSON) ORGANIZATION LOCATION/PHONE NUMBER	**Utilities in Area**		**Locate Date**	**Printed Name and Signature**	**Notes: Use Block 16 for Remarks**
		Yes	**No**			
7.	A. Water Sewer, Primary Electric Cable TV (GCI),Natural Gas (ENSTAR),Commerical Telephone (ACS),ALASCOM Alaska Dig Line 278-3121				LOCATE NUMBER: LOCATE DATE:	Annotate Dig Line Locate Number and Date
	B. Service Contracts (SHAW) HVAC-Steam Distr, Storm Drainage Secondary Elec, Water & Sewer, Fire Alarms BLDG 977, 384-0532/3060					Locate Date Assigned by 773 CES Service Contract Section Bldg 700
	C. Security Alarm Shop (JBER_R) Bldg 5337 748-0149/552-4046					
	D. Storm Drainage/Railroad-(JBER-R) Bldg 704 384-1717					
	E. Power Pro (Generators) Bldg 700 Door 12 384-2426/552-2715					
	F. POL (LFM) - Cathodic Protection Bldg 8306 JBER-E 552-3334/4433					
	G. GEO Base (JBER-R) Bldg 724 1st Floor 384-2322					Coordination Only (No Locate Required)
	H. Environmental (JBER-E) Bldg 6326 Rm 212 552-3099					
	I. Contact Fire Department at JBER-E Station #2 Bldg 5126 552-2620/8108					Coordination Only (No Locate Required)
	J. Constr. Management (JBER-E) Bldg 6326 Rm 134A 552-1601				Last Signature before Block 19	Coordination Only (No Locate Required)

RICHARDSON ORGANIZATION LOCATION/PHONE NUMBER		Utilities in Area		Locate Date	Printed Name and Signatures	Remarks Use Block 16 for additional
		Yes	No			
8.	Security Forces - SFO (JBER-R) Bldg 656 384-0825/1128/2204					Coordination Only (No Locate Required)
9.	Official Comm Cable Maint. Bldg 7265 (JBER-E) 552-8541					
10.	Bryant Airfield Manager HANGAR 1 Bryant Field 428-7252/7241					: **Only required if within close proximity of airfield boundry
11.	Privatized Housing Bldg 600 (JBER-R) 344-6006					N/A if North of Richardson Drive or East of Glenn Hwy
12.	DOYON UTILITIES Bldg 36010 (JBER-R) 428-0002					Must be signed by Doyon in addition to Alaska Dig Line (Block 7A) prior to
13.	Safety - Weapons/ Ground Bldg 600 Rm 49 (Basement) 384-2383/2437 (JBER-R)					Coordination Only (No Locate Required)
14.						
15.						

16. Additional Remarks:

17. Clearance request ☐ Approved ☐ Disapproved

18. Work Must Start Prior To:

19. Signature of Approving Official: *(Chief, Operations Chief, Engineering)*

20. Approval Date:

Work Clearance is not valid until a permit is signed by the approving official and a permit numbers is assigned in the 773d CES/CEOSC office (Bldg 700, Door 12). Approved work is limited to that described in Block 2 and on any attached drawings.