Joint Base Andrews
Air Force Civil Engineer Center

Proposed Plan
Spill Site 01 Remedial Action

U.S. Air Force Announces Proposed Remedial Action Plan for Spill Site 01, Brandywine, MD

Joint Base Andrews
November 2016

Introduction

The United States Air Force (USAF) is proposing “Alternative 4 –In Situ Thermal Treatment and **Land Use Controls (LUCs)**” as its preferred groundwater cleanup remedy at Environmental Restoration Program Spill Site 01 (SS-01), also referred to as the “Brandywine DRMO site,” located in Brandywine, Prince George’s County (PGC), Maryland. The Proposed Plan presents proposed cleanup activities intended to protect people from groundwater contamination at the site. In addition, USAF is recommending no further action for the soils at SS-01.

USAF, the lead agency for site activities, in consultation with the U.S. Environmental Protection Agency (EPA) Region 3 and the **Maryland Department of the Environment (MDE)**, is issuing this **Proposed Plan** as part of the public participation activities required under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)**[1] and Title 40 of the Code of Federal Regulations (CFR), Section 300.430(f)(2). Title 40 CFR 300 is known as the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**. This Proposed Plan describes SS-01, summarizes detailed technical information in the Supplemental **Remedial Investigation (RI)** and **Feasibility Study (FS)** reports, describes the various cleanup alternatives considered, and discusses opportunities for the public to participate in the decision-making process for the site.

The Brandywine DRMO site was proposed for the **National Priorities List (NPL)** on July 28, 1998, and was formally placed on the NPL on June 9, 1999. The Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS) identification number for the site is MD9570024803. To remediate contaminated sites at JBA, the Department of Defense and EPA entered into a **Federal Facility Agreement** (**FFA**) effective March 30, 2010. The FFA established two **operable units (OUs)** for the site: OU-1 to address **groundwater** impacts and OU-2 to address surface soil and **sediment** impacts. The FFA also established a procedural framework for developing and implementing response actions for these OUs as required by CERCLA. The FFA is designed to facilitate cooperation and communication between USAF and EPA regarding the response actions.

Mark Your Calendar for the Public Comment Period

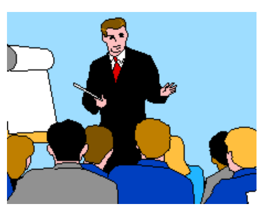
Public Comment Period

December 1, 2016, to January 9, 2017

Submit Written Comments

Questions and comments on the four alternatives for OU-1 and the no further action recommendation for OU-2 can be provided at the public meeting or in writing during the **public comment period**. New information provided during the public comment period could result in the selection of a final **remedial action** that differs from the preferred alternative.

USAF, in consultation with EPA, MDE, and the **Prince George’s County Health Department (PGCHD)**, will review public comments on the Proposed Plan submitted during the public comment period. To submit comments or obtain further information, please refer to the insert page.



Attend the Public Meeting

December 12, 2016
7:30 PM to 8:30 PM

USAF will hold a public meeting to explain its preferred **remedial alternative** for OU-1 and the no further action recommendation for OU-2 and answer questions. Oral and written comments will be accepted at the meeting.

Brandywine Fire Department
14201 Brandywine Road
Brandywine, Maryland

If you need special consideration to attend this meeting, please contact Kara-Beth Dambaugh of HydroGeoLogic, Inc. (USAF contractor) by telephone at (518) 877-0390 or by email at kdambaugh@hgl.com at least 1 week before the meeting.

[1] A glossary of specialized terms used in this Proposed Plan begins on page 29. Terms included in the glossary appear in **bold print** the first time that they are used in this document.

Location of Administrative Record

This Proposed Plan is part of the **administrative record** for the site. An administrative record is a collection of technical documents that forms the basis for the selection of a cleanup remedy. The administrative record is available for public review at the **information repository** for the site, which is located at the Prince George's County Memorial Library, Surratts-Clinton Branch. The address and hours for the library are listed in the "Community Participation" section on page 28. The administrative record is also available online at http://afcec.publicadmin-record.us.af.mil.

The following four cleanup alternatives were evaluated for OU-1:

- Alternative 1 – No Action
- Alternative 2 – **Excavation, In Situ Enhanced Reduction**, and LUCs
- Alternative 3 – **Excavation**, **In Situ Chemical Oxidation (ISCO)** Using **Potassium Permanganate**, and LUCs
- Alternative 4 – **In Situ Thermal Treatment** and LUCs

The alternatives are described in the "Summary of Remedial Alternatives" section on page 15.

This Proposed Plan is required by Section 117(a) of CERCLA and Section 300.430(f)(2) of the NCP. CERCLA and the NCP require public participation in the process of selecting a cleanup remedy. USAF and EPA, in consultation with MDE and PGCHD, will make a final decision on the remedy for the site after reviewing and considering all information submitted during the public comment period for this Proposed Plan. The final decision on the remedial approach may be modified, or another remedial action may be selected based on new information or public comments received. The selected final response action will be documented in the ROD for the site.

Site Background

SS-01 Location

SS-01 includes the former Brandywine Defense Reutilization and Marketing Office (DRMO) yard and its surroundings, which are located in Brandywine within PGC, Maryland. Brandywine is located approximately 18 miles southeast of Washington, D.C. The Brandywine DRMO is located at 14180 Brandywine Road, Brandywine, Maryland. The Brandywine **groundwater extraction and treatment system (GWETS**) is located at 13709 Cherry Tree Crossing Road in Brandywine, Maryland.

SS-01 Description and History

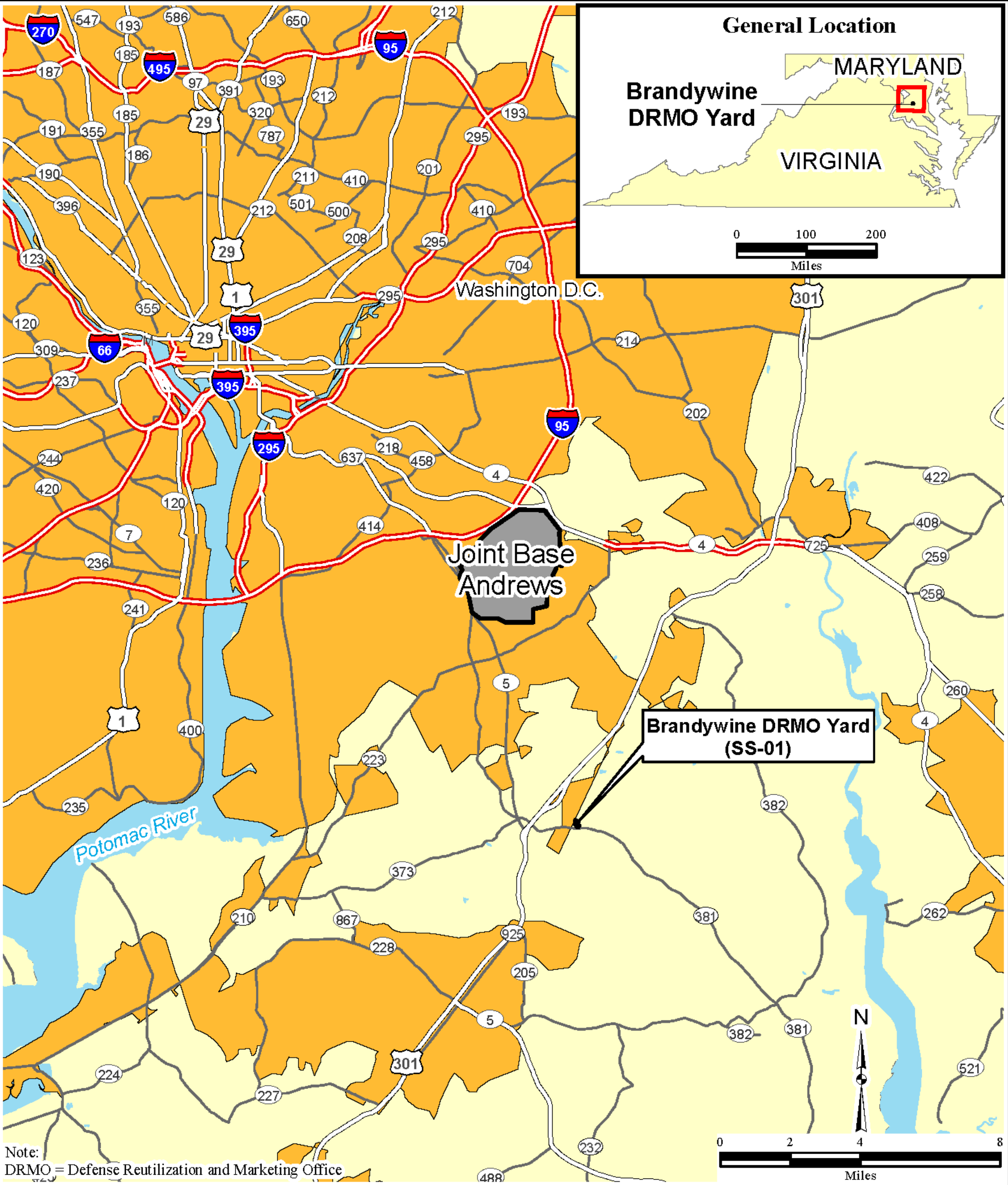
The former Brandywine DRMO yard is an inactive facility administratively controlled by Joint Base Andrews (JBA). The site is located in Brandywine, Maryland, approximately 8 miles southeast of JBA (Figure 1).

The site was constructed in 1943 and used by the Department of Defense as a storage and recycling facility. Before 1980, hazardous wastes, oil and solvents were stored at the DRMO. Several buildings, concrete bins and above ground storage tanks were located within the site. Past operational activities at the former Brandywine DRMO have resulted in releases of hazardous substances, pollutants, and **contaminants** to soil, sediment, surface water, and groundwater at the Brandywine DRMO site. Environmental investigations began in 1985 and are being pursued under USAF's Environmental Restoration Program. This comprehensive program is designed to address restoration of the environment affected by USAF activities.

The former Brandywine DRMO yard, which occupies approximately 8 acres, is bound to the west and south by an active railroad track and to the east and north by wooded areas (Figure 2). Residential areas are located east, south, and west of the former DRMO yard.

According to USAF records, hazardous materials and wastes have not been stored at the DRMO yard since 1980. The former DRMO yard warehouse was destroyed by fire in January 1987. Prior to 1980, drums of waste **solvent**s were stored at the DRMO yard, and several concrete bins located in the northeast area of the yard were used to store capacitors and transformers, some of which contained **polychlorinated biphenyls (PCBs)** (Dames & Moore, 1991). PCB contamination detected in the soil at the former DRMO yard may have leaked from the capacitors and transformers stored at the yard. Detailed information on where solvent drums were stored and how wastes were handled at the former DRMO yard is not available. There are no records of spills, leakage, or burial of wastes or PCBs at the yard (Dames & Moore, 1996). However, the results of soil and groundwater **sampling** indicate that releases of hazardous substances, pollutants, or contaminants have occurred at the former Brandywine DRMO yard.

The primary **contaminant of concern (COC)** in surface and near surface soils (0 to 4 feet below ground surface) at the Brandywine DRMO site was PCB-1260. The first soil removal occurred in 1988 (USAF, 2010). PCB-contaminated soils were removed from the former DRMO yard in 1993 and 1994 during a removal action conducted under Air Force Center for Environmental Excellence guidance (Halliburton NUS Corp, 1995). However, the results of the soil sampling indicated that contaminants (primarily PCB-1260 and lesser quantities of an insecticide [dieldrin] and metals) had spread beyond the former DRMO yard through the erosion of contaminated soil by surface water runoff (URS, 2006b). The runoff transported the PCB-contaminated DRMO



Note:
DRMO = Defense Reutilization and Marketing Office

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3/10/2014 JG
Map Source: HGL, ESRI

Legend
- Major Road
- Highway
- Limited Access Highway
- Joint Base Andrews and Brandywine DRMO Yard
- Surface Water Body
- Urban Area

Figure 1
Site Location

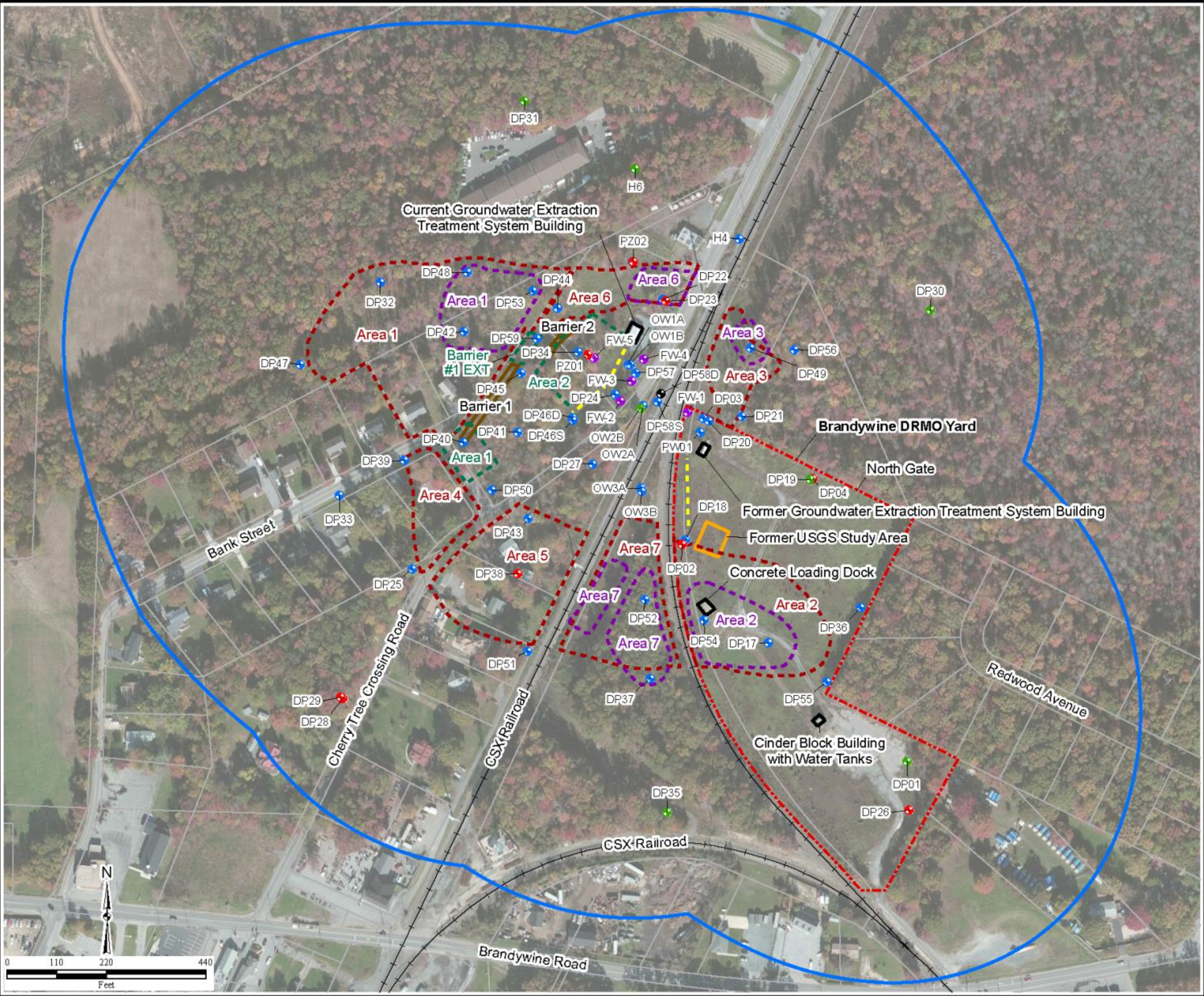

Figure 2.0
Site Layout

Legend

- Brandywine Formation Monitoring Well (part of Monitoring Well Network)
- Brandywine Formation Monitoring Well (not part of Monitoring Well Network)
- Deeper Formation Monitoring Well
- Abandoned Monitoring Well
- Flux Monitoring Well
- DP01 Monitoring Well Identification
- Brandywine DRMO Property Boundary
- Railroad
- Parcel Boundary
- Land Use Control Boundary (500 feet from maximum plume extent in 2007)
- Groundwater Extraction Trench
- Barrier
- Existing Structure
- Former USGS Study Area
- Area Injection Area, 2013/2014
- Area Injection Area, 2010
- Area Injection Area, 2008

Notes:
DRMO=Defense Reutilization and Marketing Office
USGS=U.S. Geological Survey

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Map Source: HGL, URS, ArcGIS Online Imagery

soil into a drainage ditch along the CSX railroad north of the former DRMO yard and into a wetland to the west of the former DRMO yard. The USAF performed a removal action in this area between 2006 and 2007, successfully removing the soil and sediments containing PCB contamination along the CSX railroad and the wetlands to the west of the DRMO, disposing of them off site. Following the removal, the USAF undertook site restoration activities including planting of native trees and shrubs in the wetland, as well as additional maintenance of some trees in this area. The cleanup criterion was one part per million (1 ppm) for PCBs in soil and sediment outside of the DRMO Yard, which is protective of human health and ecological receptors. The cleanup criterion was 10 ppm in soil within the DRMO property (which is not quality ecological habitat), because that level is protective of residential receptors. Between September 2006 and December 2007, 6,362.5 tons of impacted soil, sediments, and debris were excavated and removed from the site for proper disposal. Final Inspection occurred on October 17, 2007. The total cost of the removal action implementation was $1,857,468 (Cape, 2008).

According to the groundwater data presented in the Brandywine RI report (URS, 2006a), the releases of CERCLA-regulated contaminants at the former Brandywine DRMO resulted in three distinct **plumes** of dissolved **chlorinated solvents** in the groundwater totaling approximately 21 acres in size (HGL, 2009b).

The chlorinated solvents **trichloroethene (TCE)** and **tetrachloroethene (PCE)** were the most prevalent COCs in groundwater (HGL, 2014). The area of highest contaminant concentrations was located northwest of the DRMO yard and extended westward under the nearby residential area.

For management of CERCLA activities, the Brandywine DRMO site is divided into two OUs. OU-1 is contaminated groundwater, and OU-2 is contaminated surface soil and sediment. Historically soil/sediment and groundwater impacts were managed independently under separate actions. This Proposed Plan addresses both OU-1 and OU-2.

Previous Actions

Numerous investigations and remedial measures have been conducted at the Brandywine DRMO site. A complete history of past investigations and remedial activities can be found in the Brandywine Supplemental RI report (HGL, 2013b). This document, among others discussed below, is part of the administrative record available for review at the locations identified in the "Community Participation" section on page 28. The primary activities are listed below.

Year	Document
1985	Phase 1 Installation Restoration Program Records Search (Engineering-Science Inc., 1985)
1988–1990	U.S. Geological Survey (USGS) Groundwater and Soil Investigations (USGS, 1991)
1991	Hazardous Waste Remedial Action Program TCE Plume Delineation Study (Dames & Moore, 1992a)
1993–1994	Soil and Tank Removal Action (Halliburton NUS Corp, 1995)
1999	Groundwater Treatment System Operations and Emission Test (IT Corporation, 1999)
2002–2003	RI (URS, 2006a)
2006	Engineering Evaluation/Cost Analysis (Soil Contamination) (URS, 2006b)
2006	Focused FS (Groundwater Contamination) (URS, 2006c)
2006	Interim ROD (USAF, 2006)
2007	Action Memo – Soil Removal (USAF, 2007)
2006–2007	Interim Remedial Action Completion Report - Soil (IRACR) (Cape, 2008)
2010	FFA (USAF, 2010)
2010–2011	Supplemental RI (HGL, 2013b)
2013	Interim Remedial Action Completion Report - Groundwater (IRACR) (HGL, 2013a)
2013–2014	Summary of Third Injection Event (HGL, 2014a)
2015	FS (HGL, 2015)
2016	Revised FS (HGL, 2016)

Soil and Tank 1993-1994 Removal Action

PCB-contaminated soils were removed from the former DRMO yard between 1993 and 1994. Three underground storage tanks (USTs) and three aboveground storage tanks (ASTs) also were removed. In addition, a deep burn pit was identified in the northwest portion of the yard, and burned debris and soil from the pit were excavated and disposed of.

During the removal action, approximately 14,000 cubic yards of PCB-contaminated soil were removed from the former DRMO yard. Based on the results from the sampling of remaining soil at the site, all soil or other surface materials with PCB concentrations above 10 milligrams per kilogram (mg/kg) were removed from the former DRMO yard (Halliburton NUS Corp, 1995). Later soil removal actions are discussed in the "IRACR- Soil" section.

Groundwater Treatment System

In September 1996 a groundwater treatment system that used air stripping and carbon adsorption to remove **volatile organic compounds (VOCs)** was constructed at the northwest corner of the former DRMO as part of the Hazardous Waste Remedial Action Program (HAZWRAP) (Dames & Moore, 1996). This system operated on a part-time basis. The capture zone for this system was limited and did not capture the leading edge of the groundwater contamination. The groundwater contamination observed in the residential area was not captured or treated by this system (USAF, 2006). Operations ceased in 2008 because this system was ineffective at stopping the **migration** of the groundwater plume westward.

Remedial Investigation

URS completed an RI report entitled *Final Remedial Investigation Report, Site SS-01, Brandywine DRMO, Andrews Air Force Base, August 2006* (URS, 2006a) that summarized all past groundwater sampling and remedial activities at the site.

The RI evaluated groundwater, surface water, drinking water, sediment, surface soil, and subsurface soil. In addition, the RI also included a baseline human health **risk assessment** (HHRA) and an ecological risk assessment (ERA). The HHRA and ERA determined whether there were risks at the site that warranted cleanup action and are discussed in the "Summary of Site Risks" section.

The RI identified the most significant groundwater contaminants as PCE, TCE, **cis-1,2-dichloroethene** (**cis-1,2-DCE)**, **vinyl chloride (VC)**, **1,4-dichlorobenzene (1,4-DCB)**, and **2-methylnaphthalene**. Additionally, the RI identified PCBs, one pesticide, and several metals in soil and sediment at the site.

Soil Removal Action

Engineering Evaluation/Cost Analysis and Action Memo

In 2006 an Engineering Evaluation/Cost Analysis (EE/CA) was prepared for OU-2 and developed the removal action goals (URS, 2006b). Based on both the HHRA and the ERA, excavation of the PCB-contaminated surface soil and sediments was recommended. Excavation activities occurred between September 2006 and December 2007, and approximately 6,362.5 tons of contaminated soil, sediment, and other debris were removed from the site and properly disposed of. Afterward the site was restored. The removal action goals were documented in the 2007 Action Memo (USAF, 2007).

IRACR – Soil

Between September 2006 and December 2007, PCB-contaminated soil was excavated, and post-excavation verification sampling confirmed that cleanup goals had been met (Cape, 2008). A final inspection of the removal event was conducted on October 17, 2007, and JBA and EPA approved the final Interim Remedial Action Completion Report (IRACR) dated November 2008, indicating that the removal action selected by USAF had been implemented successfully. As documented in the IRACR, cleanup goals were achieved and no long-term operation, monitoring, or maintenance activities, and no **institutional controls (ICs),** were required (Cape, 2008).

Interim Remedial Action for Groundwater

Focused Feasibility Study

In 2006 a Focused Feasibility Study (FFS) was completed that evaluated alternatives for addressing groundwater contamination at the Brandywine DRMO site and identified the preferred remedial alternative (URS, 2006c). The FFS identified the preferred remedial action, which was successfully implemented and is described further in the following sections.

Interim ROD

The **Interim ROD (IROD)**, completed in 2006, pertains to an interim remedial action to address the groundwater contamination outside of the source area while hydraulically containing groundwater in the source area. The selected interim remedial action for the site was carbon **substrate injections** with **bioaugmentation** for groundwater outside of the source area, and groundwater extraction and treatment (GWETS) for groundwater in the source area, as well as LUCs to prevent exposure.

Groundwater Treatment System

A new GWETS was constructed at 13709 Cherry Tree Crossing Road in 2008. This GWETS was designed and constructed to control the groundwater **hydraulic gradient** in the **Brandywine Formation** within a suspected **dense nonaqueous phase liquid (DNAPL) source area** and to function in concert with substrate injections/bioaugmentation. The GWETS operated from December 2008 through May 2013, treated 12.5 million gallons of water, and removed 89.4 pounds of VOCs.

Substrate Injections

In 2008, 2010, and 2013/2014 substrate injections occurred at nearly 2,000 locations to support the **IROD** for the site. These carbon substrate injections with bioaugmentation enhanced bioremediation to provide additional support for anaerobic **dechlorination**.

Site-specific approaches were designed using Anaerobic BioChem® (ABC®) (developed by Redox Tech, LLC) and EHC® (developed by Adventus) as the **organic substrates**. Based on the lack of evidence of a suitable microbial population, bioaugmentation was performed by injecting KB-1® (**Dehalococcoides [DHC]**) (produced by SiREM). Sodium bicarbonate was injected with the ABC to increase the pH of the groundwater. Vitamin B12 was added during the third injection to support remediation.

IRACR – Groundwater

The final IRACR – Groundwater summarizes the remedial action and certifies that the **remedial action objectives (RAOs)** for the site had been attained (HGL, 2013a). The IROD RAOs were met through the construction and operation of the GWETS, the implementation of ICs, and the 2008, 2010, and 2013/2014 injections and barriers (HGL, 2014a). The GWETS described in the IRACR replaced the GWETS that had been installed in 1996 in the northwest corner of the DRMO and had operated sporadically for approximately 10 years. Figure 2 identifies the locations of these two GWETS. The new GWETS is located west of Cherry Tree Crossing Road.

Groundwater Monitoring

Between 2008 and 2015, 14 post-injection groundwater monitoring sampling events were conducted (HGL, 2014b). In accordance with the IROD, groundwater monitoring occurred quarterly in 2008 and 2009, semiannually in 2010 and 2011, and annually from 2012 through 2014 (USAF, 2006). The results from these sampling events indicate that the groundwater remedy has been very effective and that the groundwater plume has been reduced by 92 percent (20.7 acres to 1.5 acres), with the source area remaining as the focus for the final remedy (HGL, 2016).

Final Remedial Action

Supplemental Remedial Investigation

A Supplemental RI completed between 2010 and 2011 confirmed that TCE contained in the **Calvert Formation** and 1,4-DCB, **naphthalene**, and 2-methylnaphthalene concentrations in the **smear zone** (the area in the subsurface where contamination was smeared across the. soil when the water table fluctuated between historic high and low water table elevations) of the northwest corner of the DRMO yard were acting as ongoing sources of contamination to the Brandywine Formation (HGL, 2013b). The Supplemental RI concluded, with regulatory stakeholder concurrence, that the risk assessment completed as part of the 2006 RI would not require reanalysis given that the groundwater COCs had remained the same. 1,4-DCB was added as a groundwater COC because it had been omitted from the COC list in the IROD although it had exceeded federal **Maximum Contaminant Levels (MCLs)** (HGL, 2016). The following table lists all COCs at the site, along with the current maximum concentration detected and the cleanup level for each contaminant.

Maximum Contaminant Concentrations Above MCLs or RSLs		
Contaminant	Maximum Concentration* (µg/L)	MCL or Regional Screening Level (µg/L)
TCE	19,400	5
Cis-1,2-DCE	963	70
PCE	below detection limits	5
VC	11.5	2
Naphthalene	732	0.17
2-Methylnapthelene	479	36
Iron	96,100	14,000
Manganese	6,540	430
1,4-DCB	647	75

Data is from groundwater samples collected in March 2015 presented in the 14th Post Injection Groundwater Monitoring Report.

Final Feasibility Study

In 2016, the final FS entitled Revised *Final Feasibility Study, Brandywine DRMO Yard: Site SS-01, Joint Base Andrews, Maryland (HGL, 2016)*, was completed. This final FS discusses the remaining risks at the site for both OU-1 (groundwater) and OU-2 (surface soil and sediment), and evaluates alternatives to address those risks. For OU-2, the final FS documents that no **unacceptable risks** to human health or the environment remain from contaminants in surface soil or sediment, and that **unlimited use and unrestricted exposure (UU/UE)** conditions have been met for this medium. Therefore, no further action is recommended for OU-2.

For OU-1, the final FS identifies remaining COCs in groundwater and discusses RAOs for addressing those contaminants. The smear zone is included in the groundwater remedy to ensure that residual constituents in the smear zone do not leach to groundwater. Four remedial alternatives were developed for OU-1, and each alternative was evaluated against the nine criteria as required by CERCLA to determine the most favorable alternative. The four alternatives are described in the "Summary of Remedial Alternatives" section on page 15 of this Proposed Plan. The nine criteria are described on page 25 in the box entitled "NCP Criteria for Evaluation of Remedial Alternatives."

Site Characteristics

This section summarizes the information presented in the FS for SS-01 concerning the habitat, geology, hydrogeology, and surface water hydrology at SS-01. Additional details can be obtained from the following technical reports: *Final Supplemental Remedial Investigation Report*, (HGL, 2013b), *Interim Removal Action Completion Report for PCB Soil Removal* (Cape, 2008), and *Final Interim Removal Action Completion Report - Groundwater* (HGL, 2013a). Copies of these documents are part of the administrative record.

Wildlife Habitat

The Brandywine DRMO site is relatively flat and is near a topographic high for the area. Surface elevations range from 228 to 235 feet above mean sea level across the former DRMO area. Areas that constitute favorable habitat for wildlife are present in the vicinity of the former DRMO yard. Large tracts of predominantly hardwood forest bound the DRMO to the north and east.

This forested area is likely to support a variety of species of terrestrial wildlife. Additional forest, interspersed with marsh areas, is located across the railroad tracks and Cherry Tree Crossing Road to the west of the former DRMO yard. This area, which receives surface drainage from the former DRMO yard, appears capable of supporting a variety of forest and wetland species. The intermittent nature of water flow through the small interconnected drainage channels that are separated by small areas of higher sediment deposition (i.e., islands) limits the viability of the area as an **aquatic** habitat, although it may support amphibious **organisms** when water is present. No rare, threatened, or endangered species were identified in the vicinity of the former DRMO yard (URS, 2006a). During the 2006 through 2007 removal action, contaminated soil and sediments were removed from the habitat area located adjacent to the CSX railroad tracks and west of the GWETS. The habitat in this area was restored, and a summary of the removal action is described in the IRACR - Soil (Cape, 2008).

Geology

The geologic formations encountered at the Brandywine DRMO site during the RI and Supplemental RI include, in descending order, the Brandywine and Calvert Formations. The **Upland Deposits** (Brandywine Formation) are 22 to 30 feet thick and are composed of four distinct layers containing clay, **silt**, sand, and gravel and are heterogeneous laterally and vertically across the site (HGL, 2013b).

The Miocene Deposits (Calvert Formation) underlie the Brandywine Formation, are composed of three distinct layers (**Upper Calvert**, **Oxidized Calvert**, and **Green Calvert)**, and were determined during the RI to be approximately 100 feet thick (URS, 2006a). The Calvert Formation is located at a depth of approximately 25 to 35 feet below ground surface. The Calvert Formation consists of relatively impermeable silt and clays and serves as an **aquitard**.

Hydrogeology

The **groundwater table** at the Brandywine Formation varies across the site but is typically less than 10 feet below ground surface, depending on surface topography and season. Generally, groundwater flows in a west-northwesterly direction. The groundwater flows an average of 35 feet per year through the Brandywine Formation (URS, 2006a). The Calvert Formation aquitard restricts the vertical (downward) flow of shallow groundwater in the Brandywine Formation at the site. The shallow groundwater at the site comes from rain and melting snow that has infiltrated the soil.

Surface Water Hydrology

Rainwater runoff flows across the undeveloped DRMO yard toward perimeter drains that funnel the runoff to the northwest corner of the property (Dames & Moore, 1996). Most of the drainage leaving the DRMO yard is directed northward along the east side of the CSX railroad tracks to two 16-inch culverts located north of the northwest corner of the DRMO yard (Figure 3). Due to the elevation of the tracks west of the site, the stormwater runoff tends to pool, leaving the culvert in backwater for long periods (Dames & Moore, 1996).

Regional surface water flow in the vicinity of the DRMO yard is toward the west/northwest. The two 16-inch culverts direct stormwater runoff to an unnamed intermittent drainage channel/forested wetland located south of the Gott facility on the west side of Cherry Tree Crossing Road (Figure 3). The drainage channel was reworked and the forested wetland restored following the removal of PCB-contaminated soils between 2006 and 2007. Surface flow eventually joins with a southern and northern drainage system to form a tributary of Timothy Branch (Dames & Moore, 1996). Timothy Branch is located approximately 3,000 feet south of the DRMO yard and flows south from the Brandywine area to join Mattawoman Creek, which is located approximately 3 miles south of the DRMO yard. Mattawoman Creek ultimately discharges to the Potomac River.

Site Contamination

Before 1980, drums of waste solvents were stored at the DRMO yard, and several concrete bins located in the northeast area of the yard were used to store capacitors and transformers, some of which contained PCBs. Past operational activities at the Brandywine DRMO site have resulted in releases of hazardous substances to soil, sediment, surface water, and groundwater.

For management of CERCLA activities, the Brandywine DRMO site is divided into two OUs. OU-1 is contaminated groundwater, and OU-2 is contaminated surface soil and sediment

Groundwater Contamination - OU-1

Prior to implementation of the interim remedial action for groundwater, a 20.7-acre groundwater plume containing multiple VOCs, semivolatile organic compounds (SVOCs), and metals was delineated using sampling data from the groundwater **monitoring wells** network. Figure 4 illustrates the delineated TCE plume.

The construction and operation of the GWETS and the implementation of the remedial actions in 2008, 2010, and 2013/2014, conducted in accordance with the IROD, resulted in plume reduction and gradient control. The results from the 13 post-injection groundwater monitoring events have shown that the groundwater remedy has reduced the groundwater VOC plume by 92 percent, with the source area remaining as the focus for the final remedy (HGL, 2014b). The changes in the footprint of the plume are illustrated on Figure 4 and provide an indication of the effectiveness of the interim remedy. The focus of this proposed plan is the remaining contamination in the source area. The source area includes the upper 10 feet of the Calvert Formation between the northwest corner of the DRMO yard and the GWETS; TCE that historically seeped into the Calvert Formation in this area is now diffusing back into the Brandywine Formation and continues to contaminate the groundwater in the aquifer to concentrations above MCLs. 1,4-DCB, naphthalene, and 2-methylnaphthalene concentrations in the smear zone continue to leach into the groundwater and cause exceedances of MCLs established under the Safe Drinking Water Act or risk-based cleanup levels for compounds without MCLs.

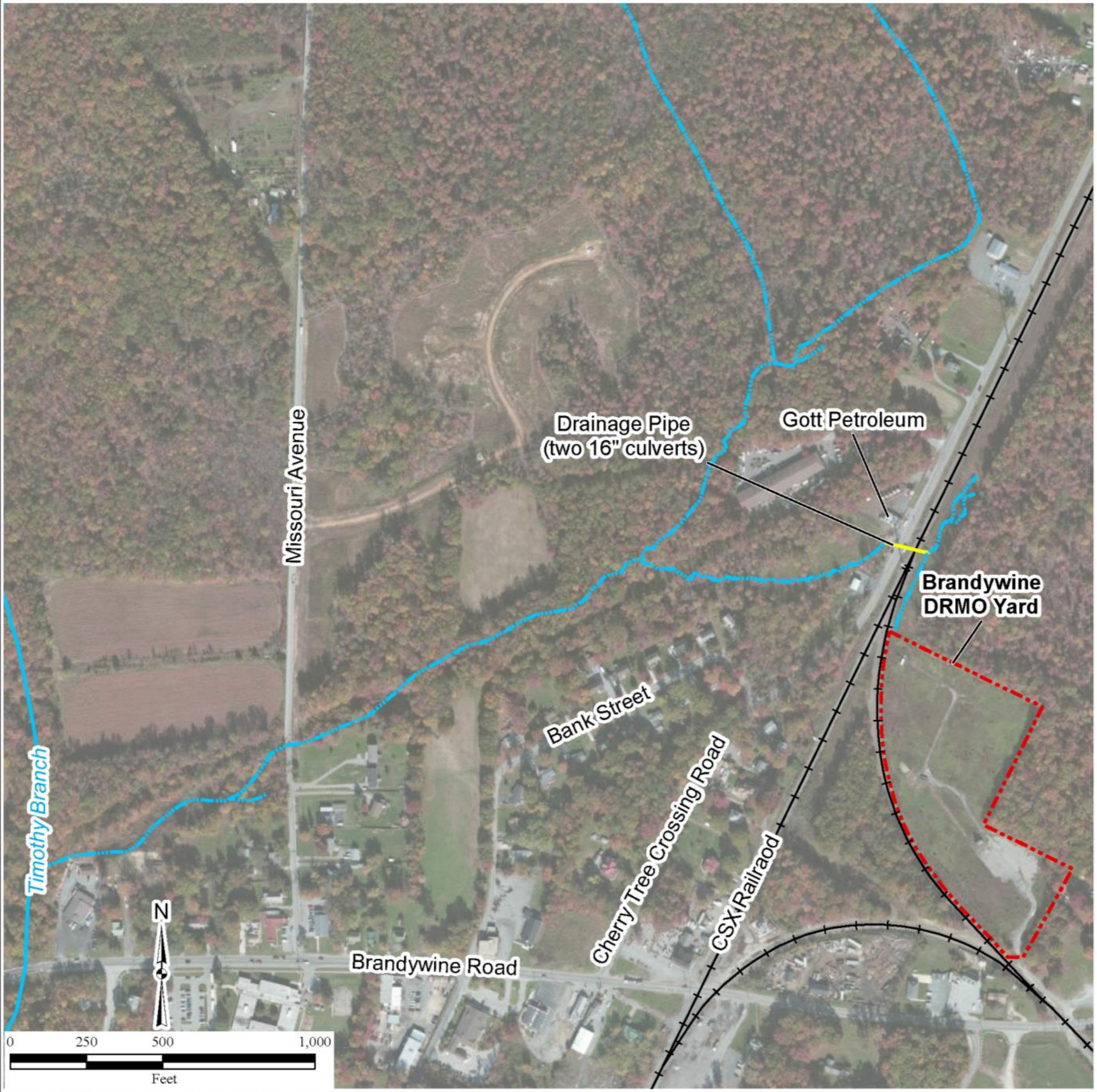

Figure 3
Brandywine DRMO Yard Surface Water Drainage Pathway

Legend

- Brandywine DRMO Property Boundary
- Railroad
- Timothy Branch
- Intermittent Stream
- Underground Drain Pipe

Note:
DRMO=Defense Reutilization and Marketing Office

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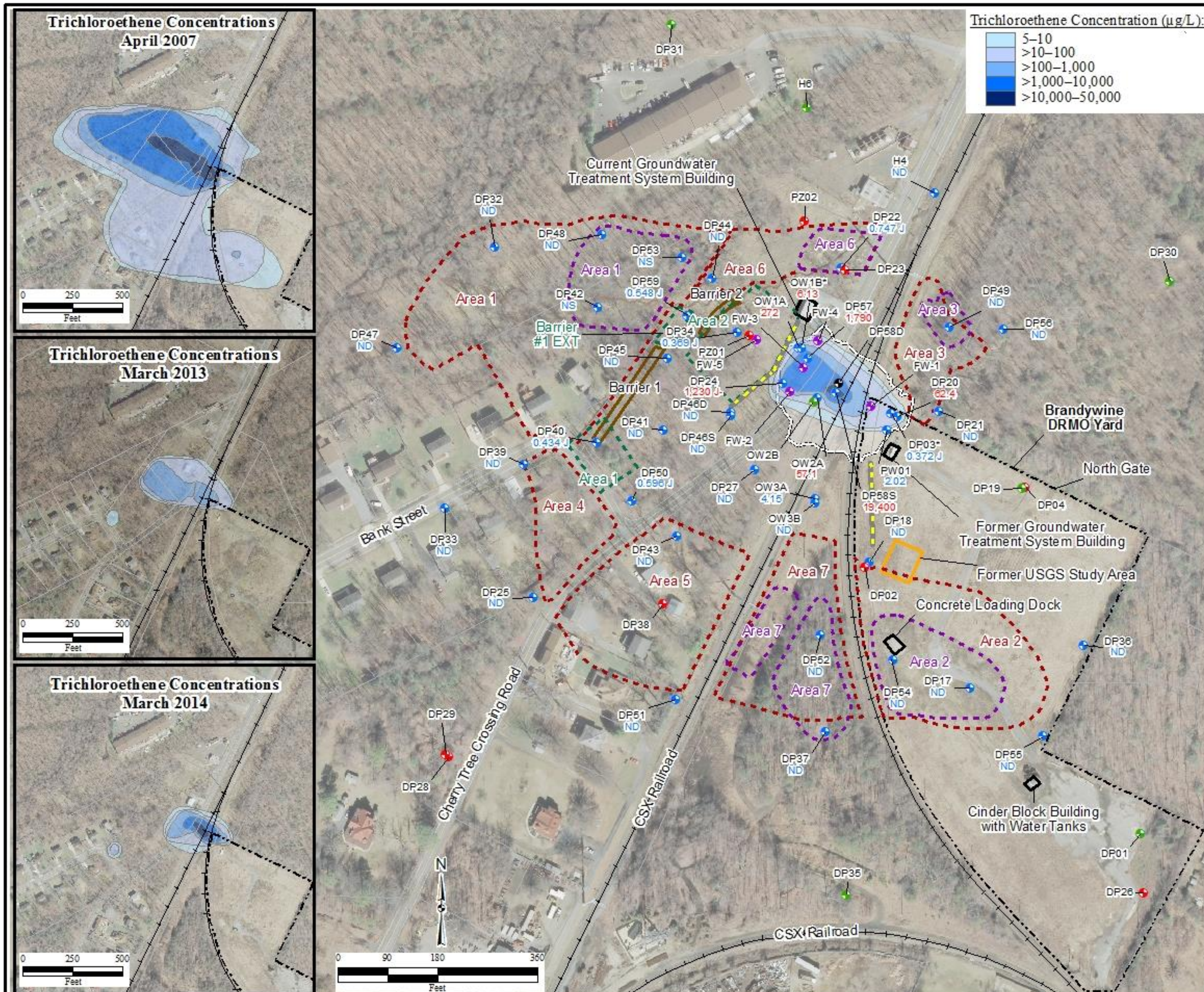
4/14/2014 AW
Map Source: HGL, URS, ESRI, ArcGIS Online Imagery

THE CHIEF'S OWN

HGL HydroGeoLogic, Inc

HGL—Proposed Plan, Brandywine DRMO Yard: Site SS-01—Joint Base Andrews, MD

Figure 4
Trichloroethene Concentration Levels March 2015



Legend

- Brandywine Formation Monitoring Well (part of Monitoring Well Network)
- Brandywine Formation Monitoring Well (not part of Monitoring Well Network)
- Deeper Formation Monitoring Well
- Abandoned Monitoring Well
- Flux Monitoring Well
- DP01 — Monitoring Well Identification
- 4.15 — Trichloroethene Concentration below MCL (<5 µg/L)
- 549 — Trichloroethene Concentration above MCL (>5 µg/L)
- Brandywine DRMO Property Boundary
- Railroad
- Parcel Boundary
- Groundwater Extraction Trench
- Barrier
- Existing Structure
- Former USGS Study Area
- Injection Area, 2013/2014
- Injection Area, 2010
- Injection Area, 2008
- Source Area

Notes:
For cluster wells, contour represents well screened in lower portion of Brandywine Formation.
For wells with a duplicate sample, the highest detected concentration is shown.
Analyte concentrations in micrograms per liter (µg/L).
Maryland State Imagery Acquisition Partnership, (MSIAP) 2011
*=Data not used in contouring
DRMO=Defense Reutilization and Marketing Office
J=positive detection, estimated value
J-=positive detection, estimated low value
MCL=maximum contaminant level
ND=not detected
NS=not sampled

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10/16/2015 JP
Map Source: HGL, URS, MSIAP, 2011

HGL HydroGeoLogic, Inc.

Soil Contamination - OU-2

PCBs, SVOCs, pesticides, and metals have been detected in site soils. Based on the risk assessments completed as part of the 2006 RI (URS, 2006a), PCBs (specifically Aroclors 1254 and 1260) were detected at concentrations that could potentially pose a risk to human and ecological receptors. Concentrations of dieldrin and some metals also indicated the potential for adverse ecological effects, but these constituents were co-located with the PCBs that warranted cleanup. The human health residential risk-based cleanup goal was a PCB concentration of 10 mg/kg within the former DRMO yard. An ecological risk-based cleanup goal of 1.0 mg/kg was established in the wetland and non-wetland forest areas and to the extent practicable in the right-of-way of the CSX railroad.

Three soil removal events, in 1988, 1993/1994, and 2006/2007, have been conducted at the site. Post-excavation **samples** have confirmed that through these excavations the PCB cleanup goals of 10 mg/kg in the DRMO yard (residential cleanup level) and 1 mg/kg outside of the DRMO yard (ecological cleanup level) have been achieved. Because the cleanup goals were attained, no additional action was required.

Questions regarding COC concentrations beneath the CSX railroad bed/ballast were raised by EPA because data for this area had not been collected and could prevent the site from reaching UU/UE. In December 2013 borings were advanced beneath both CSX railroad lines, and collected soil samples were analyzed for PCBs and total organic carbon. Analytical data indicated that PCBs beneath the CSX railroad bed/ballast were less than the 10 mg/kg cleanup goal for residential soils, indicating that no unacceptable risk to human health or the environment remained for OU-2 (HGL, 2016).

Scope and Role of Remedial Action

Contaminated groundwater and residual constituents in the smear zone that could act as a continuing source of groundwater contamination are present at the Brandywine DRMO site. USAF's overall strategy for remediating the site is to address unacceptable risks posed by the groundwater. The smear zone is being addressed as part of the groundwater remedy to ensure that residual constituents in the smear zone do not leach to groundwater. USAF prefers a cleanup plan that ideally can achieve site remediation goals in the shortest practical timeframe. A rapid and proven remediation technology, such as the preferred remedial alternative presented in this Proposed Plan, should meet remediation goals and not interfere with CSX operations.

Remedial actions have been conducted for both OU-1 and OU-2. The soil and sediment removal action for OU-2, described within the IRACR - Soil, achieved the RAOs. No long-term operation, monitoring, or maintenance activities, or ICs, were required for this aspect of the site remediation (Cape, 2008). The interim groundwater remedy for OU-1, described in the IRACR - Groundwater, achieved the IROD's RAOs. As a result of the 2008, 2010, and 2013/2014 injections completed under the groundwater interim remedial action in combination with the construction and operation of the GWETS, nearly the entire distal area of the PCE and TCE plumes has been remediated to levels below federal MCLs. The size of the groundwater plume has been reduced by 92 percent (from 20.7 acres to 1.5 acres), with the source area remaining as the focus for the final remedy. From December 2008 through May 2013 the GWETS treated 12.5 million gallons of water resulting in 89.4 pounds of VOCs being treated (HGL, 2016).

This Proposed Plan summarizes remedial alternatives evaluated for the continued cleanup of groundwater contaminated with VOCs and SVOCs and includes the LUC and monitoring elements of the Interim remedy as well as technologies to accelerate source area cleanup. Even though most of these technologies target VOCs and SVOCs contamination, the effect of these technologies on **iron** or manganese concentrations is evaluated when applicable. Iron and manganese are secondary contaminants resulting from geochemical changes associated with the site releases and treatments and are expected to return to natural levels as cleanup of the VOCs and SVOCs is accomplished.

The HHRA determined that current residents surrounding the DRMO and commercial workers are not exposed to unacceptable health risks due to the contamination at the Brandywine DRMO site. The contaminants in groundwater contribute to unacceptable health risks to **hypothetical** future residents, both children and adults, living on the site and future commercial workers working on the site (see the next section, "Summary of Site Risks"). The COCs are identified in the RAO section.

USAF and EPA will choose the final remedial alternative in consultation with MDE and PGCHD after considering information submitted during the public comment period for this Proposed Plan. The final remedy for SS-01 will be performed in accordance with the final ROD signed by USAF and EPA.

Summary of Site Risks

This section presents a summary of the risks associated with exposure to site-related contaminants at the Brandywine DRMO site. **Exposure pathways** based on current site conditions and conservative assumptions about future site uses were evaluated. A more detailed discussion of potential risks at the site and the risk evaluation process can be found in the FS report (HGL, 2016), RI report (URS, 2006a), and FFS (URS, 2006c).

Human Health Risk Assessment

A HHRA was conducted as part of the RI to assess the potential impact of exposure to site-related contaminants in environmental media (groundwater and soil) at the Brandywine DRMO site. The HHRA evaluated risk under current and future land use conditions and determined if actions were needed to protect human health. Risk estimates were conservative to prevent underestimating the health risks to humans. The HHRA process is described in the text box "What is Risk." The complete HHRA is provided in the *Final Remedial Investigation Report, Site SS-01, Brandywine DRMO, Andrews Air Force Base* (URS, 2006a).

The HHRA evaluated potential risks from exposure to soil and groundwater for the following receptors and exposure pathways:

- Maintenance worker (other worker): ingestion of and dermal contact with surface soil and inhalation of airborne dust and VOCs;
- Construction worker: ingestion of and dermal contact with surface and subsurface soil and inhalation of airborne dust and VOCs;
- Trespasser or visitor: ingestion of and dermal contact with surface soil at the site and inhalation of airborne dust and VOCs;
- Resident: ingestion of, dermal contact with, and inhalation of VOCs from groundwater obtained from wells finished in the Brandywine Formation and used as a source of water for drinking and showering (surface and subsurface soil at current residences are not contaminated);
- Future commercial worker: ingestion of and dermal contact with surface and subsurface soil and inhalation of airborne dust and VOCs; and
- Future resident: ingestion of and dermal contact with surface soil, subsurface soil, and groundwater used as a water supply; inhalation of airborne dust and VOCs; and inhalation of volatiles while showering with groundwater.

Soil

Current and future land use of the Brandywine DRMO site consists of both residential and commercial usage. Results of the 2006 HHRA indicated that contaminants in subsurface soil at the Brandywine DRMO site would not pose unacceptable health risks to any of the potential receptors evaluated. In addition, contaminants in surface soil would not pose unacceptable health risks for any of the potential receptors evaluated, except for future residents, who could face unacceptable health risks because of potential ingestion and dermal contact with the elevated concentrations of PCB-1260 and dieldrin. Human health and ecological risks associated with the surface soils and sediments (OU-2) have already been addressed via the 2006 through 2007 removal action (Cape, 2008). As documented in the final FS, no further action will be required for OU-2 (HGL, 2016).

What is Risk?

What is human health risk and how is it calculated?

A human health risk assessment estimates "baseline risk." This is an estimate of the likelihood of health problems occurring to people exposed to the site if no cleanup action were taken. USAF established a four-step process based on EPA guidance to estimate baseline risk at a site. The four-step process includes the following:

Step 1: Analyze Contamination

Step 2: Estimate Exposure

Step 3: Assess Potential Health Impacts

Step 4: Characterize Site Risk

In **Step 1**, USAF looks at the concentrations of contaminants found at a site as well as scientific studies on the effects that these contaminants have had on people (or on animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations established by EPA as generic screening levels protective of residential exposure help USAF determine which site-related contaminants are most likely to pose the greatest threat to human health. Contaminants detected at the site at levels greater than EPA screening levels are evaluated further in the risk assessment.

In **Step 2**, USAF considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, a "reasonable maximum exposure" scenario is calculated that portrays the highest level of human exposure reasonably expected to occur. A **central tendency exposure scenario** may also be considered to describe median, rather than upper limit, exposures.

In **Step 3**, USAF uses the information from Step 2, combined with information on the **toxicity** of each contaminant, to assess potential health risks from exposure. USAF considers two types of risk: cancer risk and noncancer hazard. The likelihood of any kind of cancer resulting from exposure to a site is generally expressed as an upper-bound probability, for example, a "1 in 10,000 probability." In other words, for every 10,000 people who could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other non-site-related causes. For noncancer health effects, USAF calculates a "**hazard index**." The key concept here is that a "threshold level" or dose (usually measured as a hazard index of less than 1) exists below which noncancer health effects are not expected to occur, even in sensitive receptors.

In **Step 4**, USAF determines whether exposure to site-related contaminants would be expected to cause health problems in sensitive receptors. The results of the three previous steps are combined, evaluated, and summarized. USAF adds the potential risks from the individual contaminants to determine the total risk resulting from exposure to site-related contaminants.

Groundwater

Groundwater use is not permitted in the vicinity of the Brandywine DRMO site because Maryland regulations forbid the installation of individual water supply systems when a community water supply system is available (COMAR 26.03.01.05.A). Public water is supplied to the area by the Washington Suburban Sanitary Commission (WSSC). Groundwater usage in the vicinity of the Brandywine DRMO site has been documented during surveys conducted by USAF and PGCHD to ensure that contaminated groundwater is not being used (2006a, URS). In addition, the groundwater does not discharge to surface water.

Because all current residences at the site receive water from the local municipal distribution system and PGC enforces the regulatory prohibition of drilling new wells for water supply in the Brandywine area, there are no current receptors that could potentially come into contact with contaminated groundwater at the Brandywine DRMO site. The HHRA concluded that there are no unacceptable health risks to current residents from contaminated groundwater at the site because current residents use water obtained from the WSSC for drinking and showering. Given that all residents in the vicinity of the Brandywine DRMO site are connected to a municipal water supply and drilling of new drinking water wells is prohibited, it is highly unlikely that groundwater at the Brandywine DRMO site would be used for drinking or showering in the future. Those residences or businesses currently using water from existing wells in the Brandywine area are located significantly beyond the extent of the groundwater plume.

The only potentially complete current exposure pathway for groundwater contaminants is inhalation of vapors emanating from groundwater that migrate into the ambient air or into basements of buildings. This phenomenon is known as **vapor intrusion**, and is described in the text box entitled "How VOCs in Soil or Groundwater Can Affect Indoor Air." Residents and commercial workers could be exposed to indoor vapor intrusion. To address this potential pathway, indoor air sampling was accomplished at several residences located over the groundwater plume, and vapor intrusion modeling was presented in the RI (URS, 2006a). The potential risks due to vapor intrusion were estimated based on the results of the sampling. The HHRA concluded that there are no unacceptable risks to current residents from the vapor intrusion pathway. However, there would be elevated human health risks associated with vapor intrusion for potential future residents and future commercial workers if buildings were to be constructed over the source area at the site.

In addition to the potential future risks from vapor intrusion, the results of the 2006 HHRA indicated that groundwater would pose unacceptable health risks to future residents if the contaminated groundwater were to be used as drinking water or for showering. The unacceptable risks would be due to ingestion of and dermal contact with all eight COCs in groundwater used as a drinking water supply and due to inhalation of TCE, PCE, and naphthalene vapors in groundwater used for showering.

The interim remedy addressed the identified risks in most of the plume, but risks associated with the source area remain. This Proposed Plan focuses on how USAF will address these risks.

Currently plans for residential development at SS-01 do not exist, and such future use of the site is highly unlikely in the vicinity of the source area. However, LUCs would be imposed on the site to ensure that it is not used for residential use until it meets UU/UE requirements or mitigation measures make it safe for residential occupancy.

How VOCs in Soil or Groundwater Can Affect Indoor Air

If VOCs contaminate soil or groundwater at a site, it is important to evaluate nearby buildings for possible impacts from vapor intrusion. Vapor intrusion occurs when fumes from the contaminated soil or groundwater seep through cracks and holes in the foundations or slabs of buildings and accumulate in basements, crawl spaces, or living areas, as shown in the diagram below.

A variety of factors can influence whether vapor intrusion will occur at a building located near soil or groundwater contaminated with VOCs. These include the concentration of the contaminants, the type of soil, the depth to groundwater, the construction of the building, and the condition of the foundation or slab. In addition, the existence of underground utilities can create pathways for vapors to travel. Short-term exposure to high levels of organic vapors can cause eye and respiratory irritation, headache, and/or nausea. Breathing low levels of organic vapors over a long period of time may increase an individual's risk for respiratory ailments, cancer, and other health problems.

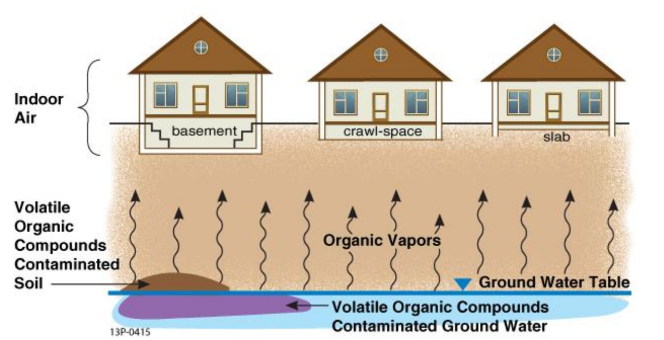


Diagram showing the volatilization of volatile organic compounds into indoor air

Adapted from EPA's *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Ground Water and Soils* (EPA, 2002).

Ecological Risk Assessment

An ERA was conducted as part of the RI to determine whether there were site contaminants that could cause adverse effects to plants and animals. The complete ERA is provided in the *Remedial Investigation Report, Site SS-01, Brandywine DRMO, Andrews Air Force Base* (URS, 2006a). Because of the differences in habitat quality and chemical migration potential, separate ERAs were performed for the former DRMO yard, the wetland forests (located in the drainage areas west of Cherry Tree Crossing Road), and the non-wetland forest.

Industrial activities and environmental remediation on the former DRMO yard has severely altered its habitat. It is a relatively low quality habitat with no unique species or terrestrial plants. The wetland forest and the non-wetland forest areas represent high quality habitats with significant diversity of plant species.

Potential ecological risks due to site-related contaminants in soil at the Brandywine DRMO site were updated with data from additional surface soil samples collected in August 2005 and summarized in the FFS (URS, 2006c). Groundwater does not reach the surface at the Brandywine DRMO site. Therefore, groundwater contaminants do not contribute to ecological risks.

The FFS concluded that the metals and PCB-1260 contamination spread from the former DRMO yard and were deposited in the wetlands through the erosion of contaminated soil by surface water runoff (URS, 2006c). Prior to the removal actions, the maximum concentrations of PCB-1260, total chromium, vanadium, and zinc in surface soils in high quality habitats (the wetland forest and non-wetland forested areas) posed a threat to ecological receptors. Human health and ecological risks associated with soils and sediments (OU-2) have already been addressed via the 2006 through 2007 removal action as documented in the IRACR-Soil (Cape, 2008). Following excavation activities and prior to backfilling operations, post-excavation samples were collected and confirmed that the excavation activities had achieved the residential cleanup criterion for PCBs of 10 mg/kg within the DRMO yard and the ecological cleanup criterion for PCBs of 1 mg/kg outside of the DRMO Yard (Cape, 2008). Metals co-located with the PCB contamination were also removed. Consequently, the final FS recommends no further action for OU-2 (HGL, 2016).

Conclusion

It is the judgment of USAF, the lead agency for the site, that the Preferred Alternative, or one of the other active measures identified in this Proposed Plan, is necessary as a remedial action to protect public health and the environment from actual or threatened releases of hazardous substances into the environment.

Remedial Action Objectives

Based upon the evaluation of site conditions, an understanding of the contaminants and their physical properties, the results of the risk assessments, and an analysis of **applicable or relevant and appropriate requirements (ARARs)**, the following RAOs are proposed for OU-1 at the Brandywine DRMO site:

- Reduce concentrations of VOCs (TCE, PCE, cis-1,2-DCE, and VC) in the Upper Calvert Formation and Oxidized Calvert Formation so that contaminant diffusion from the Calvert Formation back into the Brandywine Formation groundwater is arrested and COC concentrations in the Brandywine Formation groundwater are reduced to levels below MCLs.
- Reduce concentrations of 1,4-DCB, 2-methylnaphthalene, and naphthalene in smear zone soils in the northwest corner of the DRMO yard such that COC concentrations in the Brandywine Formation groundwater are reduced to levels below MCLs and risk-based levels for constituents without an MCL.
- Protect potential future human receptors from exposure to contaminated groundwater by dermal contact and ingestion, and to vapor emanating from the contaminated groundwater above unacceptable risk levels.
- Restrict exposure to vapors from vapor intrusion until there is no potential risk.
- Restrict exposure to groundwater for dermal contact, ingestion, and inhalation while showering/bathing until cleanup is achieved.
- Restrict the use of groundwater for drinking or showering purposes until **site remediation goals (SRG)s** for the COCs are achieved.
- Maintain land use controls to ensure that people are not exposed to contaminants in the groundwater until SRGs are achieved

The preliminary SRGs for the COCs are the federal MCLs established under the Safe Drinking Water Act, for those COCs with MCLs. For COCs without MCLs, the May 2016 EPA Regional Screening Levels are used herein to establish remedial goals. The site remediation goals are identified in the following tables. Reducing the concentrations of the COCs to the following SRGs will protect both human health and the environment.

The Air Force will monitor the plume (source area and the distal portions of the plume addressed during the interim remedy that have not met cleanup goals) and implement the LUCs described in the final ROD until RAOs are achieved.

Groundwater Preliminary SRGs	
Contaminant	Preliminary SRG (µg/L)
TCE	5*
Cis-1,2-DCE	70*
PCE	5*
VC	2*
Naphthalene	1.7+
2-Methylnaphthalene	36+
Iron	14,000+
Manganese	430+
1,4-DCB	75*
Derivation: * = MCL, + = RSL, and Δ = SSL/RSL	

Summary of Remedial Alternatives

The following four remedial alternatives for OU-1 were developed to address groundwater and smear zone soils in the *Revised Final Feasibility Study, Brandywine DRMO Yard: Site SS-01, Joint Base Andrews, Maryland, July 2016* (HGL, 2016):

- Alternative 1 – No Action
- Alternative 2 – Excavation, In Situ Enhanced Reduction, and LUCs
- Alternative 3 – Excavation, In Situ Chemical Oxidation (ISCO) Using Potassium Permanganate, and LUCs
- Alternative 4 – In Situ Thermal Treatment and LUCs

It should be noted that a decision of no further action is proposed for OU-2.

The USAF's preferred alternative for OU-1 is Alternative 4 –In Situ Thermal Treatment and LUCs. The four alternatives are briefly summarized in the following subsections. All costs are presented in **present worth costs**. Each alternative's remediation timeframe was determined by the time required to reach SRGs for the groundwater contamination in the source area. Each alternative was evaluated against the nine criteria required by CERCLA (see "NCP Criteria for Evaluation of Remedial Alternatives" in the box on page 24).

Land Use Controls

LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent exposure to contaminants above permissible levels. The established LUC boundary, illustrated as a blue line, is presented on Figure 2. The LUC boundary may be adjusted over time as new data are analyzed. Changes to the LUC boundary would require a ROD modification; because this would likely be a minor change to the remedy, the modification would entail regulator concurrence and a memorandum for the administrative record. The proposed LUCs are explained further under the Alternatives sections below.

Alternative 1 – No Action

Alternative 1 – Estimated Cleanup Costs	
Capital	$0
Operation and Maintenance	$0
Periodic Cost	$0
Total Present Worth	$0
Total Project Lifetime	60+ years

No costs would be associated with the no action alternative. The no action alternative is required by the NCP and serves as the baseline alternative. All remedial action alternatives are compared to the no action alternative.

Under this alternative, no controls or remedial technologies would be implemented. The current **pump and treat** system would be turned off. No LUCs or long term monitoring would be implemented. The time to reach SRGs is assumed to be 60 or more years for the purpose of this alternative.

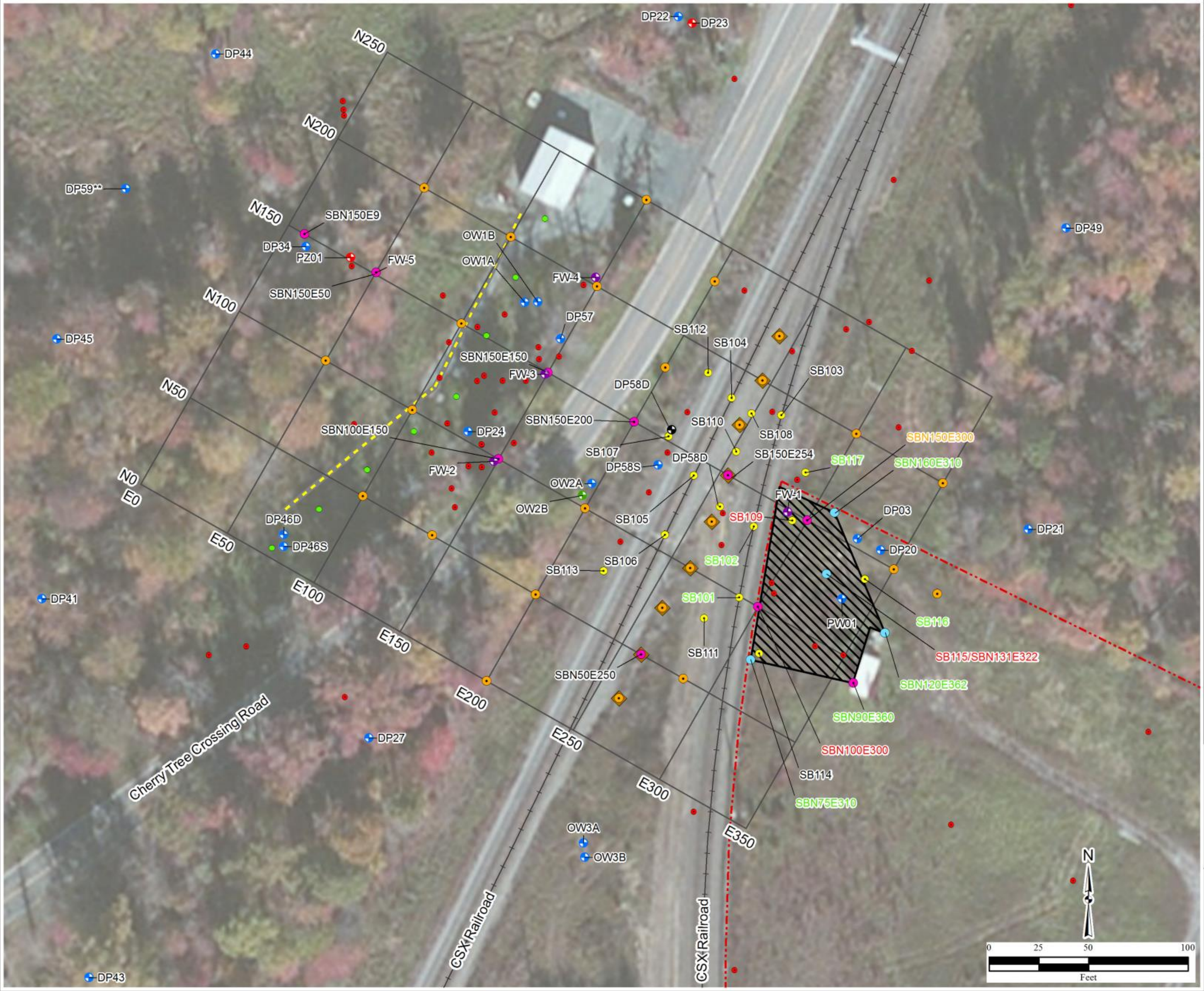
Alternative 2 – Excavation, In Situ Enhanced Reduction, and LUCs

Alternative 2 – Estimated Cleanup Costs	
Capital	$4,429,299
Operation and Maintenance	$414,674
Periodic Cost	$52,041
Total Present Worth	$4,896,014
Total Project Lifetime	9 years

Alternative 2 would involve excavating an area of the smear zone to reduce the levels of naphthalene, 2-methylnaphthalene, and 1,4-DCB and reduce the risk of these contaminants leaching from soil to groundwater. The excavation area is presented on Figure 5. The total volume of soil requiring excavation is approximately 1,900 cubic yards (HGL, 2016).

To address the source area, a substrate would be injected into the impacted portion, or upper 12 feet, of the Calvert Formation. The FS assumed that the substrate used would be either EHC® or Emulsified Zero-Valent Iron (EZVI). Both substrates are proprietary mixtures that combine fermentable organic material and **zero-valent iron** and can be delivered into the subsurface with a range of technologies. The EHC® accelerates the rate at which native microorganisms biodegrade VOCs into harmless substances. The EZVI causes chemical reactions that reduce the contaminants into harmless substances.

Figure 5
Area of 1,4-DCB and Naphthalene Remediation



Legend

- Brandywine Formation Monitoring Well (part of Monitoring Well Network)
- Brandywine Formation Monitoring Well (not part of Monitoring Well Network)
- Deeper Formation Monitoring Well
- Abandoned Monitoring Well
- Flux Monitoring Well
- Soil Boring, URS
- Soil Boring, HGL (2007)
- Soil Boring, HGL (2010)
- MIP Investigation Location
- MIP Investigation Location With Soil Samples
- 2012 Supplemental RI Soil Samples
- Tight Traverse
- SBN160E310 — 1,4-DCB and naphthalene concentrations non-detect or below cleanup levels
- SBN100E300 — 1,4-DCB and naphthalene concentrations exceed respective cleanup levels
- SBN150E300 — 1,4-DCB concentration exceeds cleanup level
- Brandywine DRMO Property Boundary
- Railroad
- Groundwater Extraction Trench
- 50' x 50' Grid
- Remediation Area

Notes:
Only borings with data discussed in the Supplemental RI are labeled.
*=Sample collected above the water table.
**=DP59 installed December 2013
DRMO=Defense Reutilization and Marketing Office
DCB=dichlorobenzene
MIP=membrane investigation probe
RI=remedial investigation

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1/5/2015 CNL
Source: HGL, URS, ESRI, ArcGIS Online Imagery

The total treatment area would be approximately 450,000 cubic feet (Figure 6). It is assumed that substrate injected into the upper portion of the Calvert Formation would migrate into the Brandywine Formation and effectively treat this area. Two injections would be planned. The second injection event would occur 3 years after the first injection event based on the typical amount of time these substrates remain in the ground.

Because the remedy would be expected to take 2 to 6 years to be completed, LUCs would be implemented to prevent exposure to contaminated groundwater until RAOs are achieved. Five-year reviews as required by CERCLA would serve to evaluate site conditions over time.

Groundwater Monitoring

Groundwater monitoring would be performed in the treatment area to evaluate remedy performance. Monitoring would provide information about changes in contaminant levels, the status of the injected substrates, and the potential need for additional injections. Monitoring data would be used to evaluate the effectiveness of each injection event and to confirm that RAOs have been met. The sampling frequency would be twice per year for the first 6 years following the initial injection, followed by 3 years of annual sampling. The frequency and the duration might need to be changed based upon site-specific conditions and performance of the remedy. Figure 7 illustrates the proposed performance monitoring network specific to the source area, which would be refined during the design. Additionally, the plume would be monitored, including the distal portions of the plume addressed during the interim remedy that have not yet achieved cleanup goals. The monitoring well network would continually be evaluated and optimized with respect to analytes, monitoring frequency, and location based upon trends and achievement of cleanup goals.

Land Use Controls

Alternatives 2 to 4 would include LUCs to restrict the use of, or limit access to, real property to prevent exposure to contaminants above permissible levels. The intent of using these controls is to protect human health and the environment by limiting the activities that may occur at the site to prevent exposure to COCs and to protect the remedy. The area for which the LUCs would be implemented is shown on Figure 2 and might be adjusted over time as new data are analyzed. Changes to the LUC boundary would require a ROD modification; because this would likely be a minor change to the remedy, the modification would entail regulator concurrence and a memorandum for the administrative record.

Groundwater use is not permitted in the vicinity of the Brandywine DRMO site because Maryland regulations forbid the installation of individual water supply systems when a community water supply system is available (COMAR 26.03.01.05.A.). Public water is supplied to the area by the WSSC. Implementation of LUCs on the use of the groundwater is needed due to potential risks to residents or workers from vapor intrusion, ingestion, or dermal contact with the COCs in groundwater. LUCs on the use of groundwater will be implemented at the Brandywine DRMO site by USAF and PGC. The Air Force would be ultimately responsible to ensure that all LUCs are implemented; LUC tasks for which the Air Force is primarily responsible would be administered by the Joint Base Andrews Environmental Restoration Program through the Air Force Civil Engineer Center, Operations Division-East Region (AFCEC/CZOE).

The LUC objectives would be as follows:

- Ensure no potable use of potentially impacted shallow groundwater at the site until SRGs are met in order to limit exposure of residents to groundwater contaminants;
- Ensure that activities occurring within the areas identified do not damage the monitoring wells, interfere with the ability to undertake required environmental monitoring or testing, or cause the plume to spread;
- Ensure that land use is consistent with RAOs;
- Ensure that any proposed construction activities near the site are evaluated with regard to risks posed by contaminants at the site and the potential for construction and dewatering activities to exacerbate site conditions; and
- Ensure that any affected groundwater that exceeds relevant regulatory criteria is appropriately managed and disposed of during construction activities.

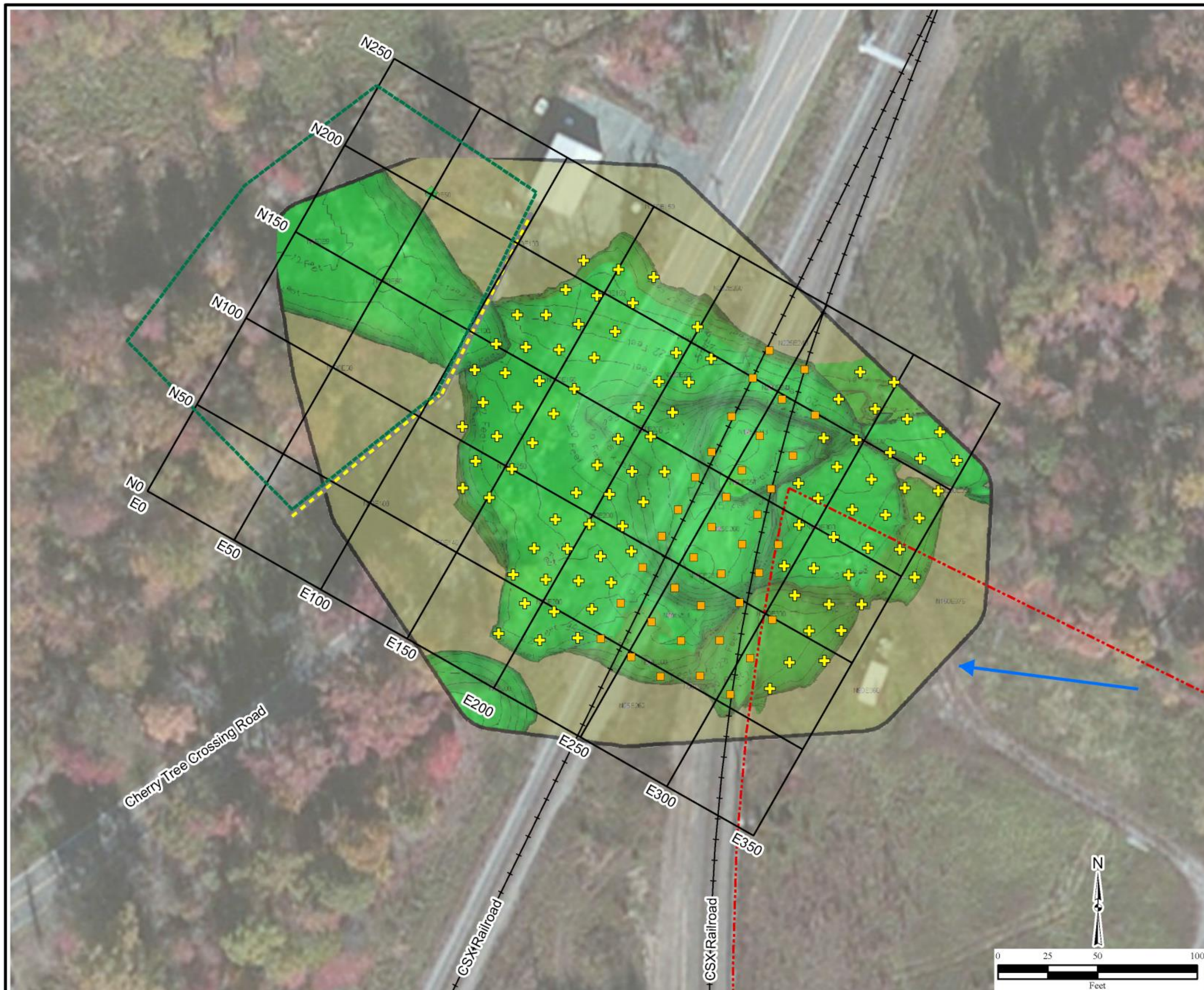
The LUCs described in the IROD will remain in place until the final ROD is signed and the LUCs set forth in the final remedy are implemented. Once implemented, the LUCs listed in the final ROD will remain in place until the concentrations of contaminants at the site allow for UU/UE, defined by attainment of the SRGs. LUCs will be implemented at the Brandywine DRMO site by USAF and PGC.

PGC has agreed to proceed in accordance with the following regulations and ordinances for the off-base portions of the SS-01 plume:

- Review groundwater well permit applications for conformance with Maryland regulations COMAR 26.04.01 and COMAR 26.04.04, and refuse to issue permits for private water supply wells in areas where public water is available, pursuant to COMAR 26.03.01.05A, and
- Review plans for developments, new construction, and building additions in accordance with the Prince George's County Code, Sections 32-124 through 32-166.

Figure 6

Proposed Injection Locations for Alternatives 2 and 3



Legend

- Hydraulic Fracturing Injection Locations*
- Injection Locations using the KAPSDIDS Technology†
- Brandywine DRMO Property Boundary
- Railroad
- Groundwater Extraction Trench
- General Groundwater Flow Direction
- Injection Area, 2013/2014
- 50' x 50' Grid
- ECD Result >4.0x10^5 µV, ~1-5 mg/kg TCE

Notes:
DRMO=Defense Reutilization and Marketing Office
ECD=electron capture detector, sensitive to TCE
MIP=membrane interface probe
mg/kg=milligram per kilogram
TCE=trichloroethene
µV=microvolt
*=Hydraulic fracturing injection locations have four 2.5 ft treatment depth intervals. Each injection is assumed to have a 10 ft radius of influence and the spacing between the locations is 15 ft.
†=Injection locations with the KAPSDIDS technology, each location has three 4 ft treatment depth intervals. Each injection is assumed to have a 10 ft radius of influence and the spacing between the locations is 20 ft.

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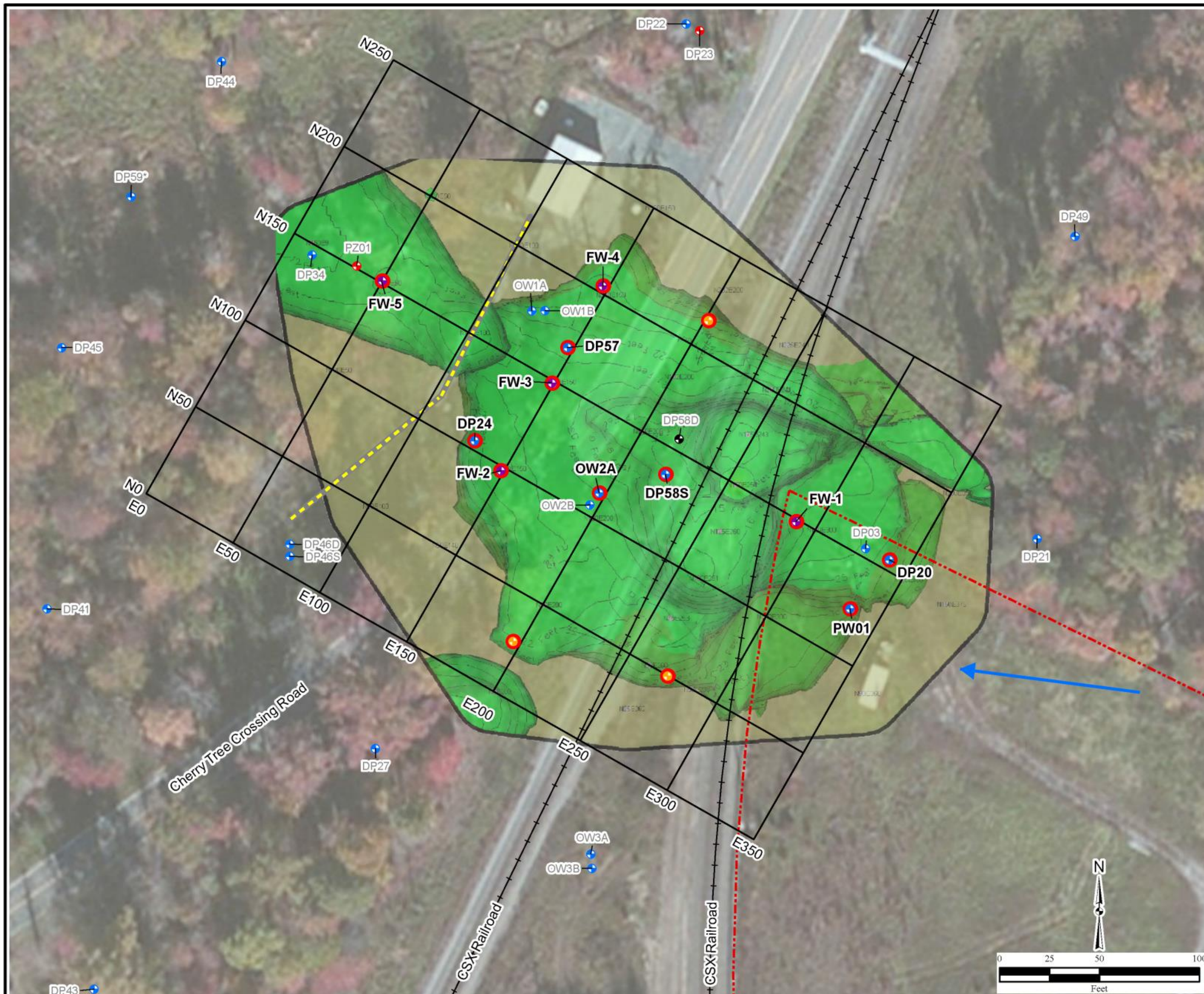
8/29/2014 JG
Source: HGL, URS, ArcGIS Online Imagery

HGL—Proposed Plan, Brandywine DRMO Yard: Site SS-01—Joint Base Andrews, MD

Figure 7
Proposed Performance Monitoring Network for Alternatives 2 and 3



Legend

- Proposed Performance Monitoring Well Network
- Brandywine Formation Monitoring Well
- Deeper Formation Monitoring Well
- Abandoned Monitoring Well
- Flux Monitoring Well
- Proposed Performance Monitoring Wells
- Brandywine DRMO Property Boundary
- Railroad
- Groundwater Extraction Trench
- General Groundwater Flow Direction
- 50' x 50' Grid
- ECD Result >$4.0x10^5$ µV, ~1-5 mg/kg TCE

Notes:
DRMO=Defense Reutilization and Marketing Office
ECD=electron capture detector, sensitive to TCE
MIP=membrane interface probe
mg/kg=milligram per kilogram
TCE=trichloroethene
µV=microvolt
Bold=Proposed Performance Monitoring Program

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10/8/2014 PDB
Source: HGL, URS, ArcGIS Online Imagery

It would be the responsibility of JBA to perform the following LUCs:

- All SS-01 ROD use limitations and exposure restrictions will be included in the Installation Development Plan. Records of groundwater contamination at the site and LUC area will be maintained in the Base geographic information system (GIS)/environmental database. SS-01 will be designated as a "land use control" area in the Land Management map layer of the Base GIS. This will be implemented by 11th Wing Civil Engineer Squadron Engineering Flight Execution Support (11 CES/CENME) with support and oversight by AFCEC/CZOE. This designation prohibits activities such as residential development and potable use of groundwater.
- Regular updates, no less frequently than once per year, will be provided to PGC and MDE regarding the extent of the plume and the required distance of wells and dewatering trenches from the edge of the plume for safe groundwater usage.
- The Base Environmental Impact Analysis Process will assess the potential environmental impact of any action proposed at the site. AFCEC/CZOE will review proposed construction activities as part of that process.
- AFCEC/CZOE will continue to maintain signs at the site identifying the area as a CERCLA site. The signs identify the nature of the contamination, state that no groundwater use or withdrawal is permitted without written authorization from JBA, and include contact information for both JBA and PGC.
- The Joint Base Andrews Facility Review Board, with support and oversight by AFCEC/CZOE, will review and approve of any proposed land use changes, including construction of new facilities or additions to existing facilities at SS-01.
- Review of work orders and dig permits by 11th Wing Civil Engineer Squadron Programs Flight (11 CES/CEPM) staff with responsibility and oversight by AFCEC/CZOE will ensure continued enforcement of the LUCs.
- The Air Force is responsible for implementing, maintaining, monitoring, reporting, and enforcing land use controls.
- The Air Force shall inform, monitor, enforce, and bind, where appropriate, authorized lessees, tenants, contractors and other authorized occupants of the site regarding the LUCs affecting the site.
- Although the Air Force may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Air Force shall retain ultimate responsibility for remedy integrity.
- Any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs will be addressed by the Air Force as soon as practicable, but in no case will the process be initiated later than 10 days after the Air Force becomes aware of the breach.
- The Air Force will notify EPA and MDE as soon as practicable but no longer than ten days after discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. The Air Force will notify EPA and MDE regarding how the Air Force has addressed or will address the breach within 10 days of sending EPA and MDE notification of the breach.
- The Air Force shall notify EPA and MDE 45 days in advance of any proposed land use changes that are inconsistent with land use control objectives or the selected remedy.
- The Air Force must provide notice to EPA and MDE at least six (6) months prior to any transfer or sale of property containing land use controls so that EPA and MDE can be involved in discussions to ensure that appropriate provisions are included in the transfer or conveyance documents to maintain effective land use controls. If it is not possible for the facility to notify EPA and MDE at least six months prior to any transfer or sale, then the facility will notify EPA and MDE as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to land use controls. The Air Force agrees to provide EPA and MDE with such notice, within the same time frames, for federal-to-federal transfer of property accountability. The Air Force shall provide either access to or a copy of the executed deed or transfer assembly to the EPA and MDE.
- JBA shall not modify or terminate LUCs, implementation actions, or land use that are associated with the selected remedy without approval by EPA and the opportunity for concurrence by the State. JBA shall seek prior concurrence of EPA and the State before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.
- Monitoring of the environmental use restrictions and controls will be conducted annually by the Air Force. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the USEPA and the MDE. The annual monitoring reports will be used in

preparation of the Five Year Review to evaluate the effectiveness of the remedy. The annual monitoring report, submitted to the regulatory agencies by the Air Force, will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed to such restrictions and controls.

Additional LUCs would be required if Alternative 4 is implemented. These LUCs are discussed with Alternative 4 on page 27.

The internal procedures that JBA would use to implement the LUCs include but are not limited to the following:

- Base Civil Engineer Work Requests – One tool for achieving the LUC performance objectives is the AF Form 332 (AF332) or Base Civil Engineer Work Request. This form must be submitted and approved before the start of any construction project at Joint Base Andrews. One step in the approval process for this form is a comparison of the construction site with all constraints that are described in the Installation Development Plan. The AF332 serves as the document for communicating any construction constraints to the appropriate offices. Any constraints at the site result in the disapproval of the form unless the requester makes appropriate modifications to the construction plans.
- Excavation Permits – Joint Base Andrews also uses the 11th Wing, Air Force District of Washington Form AF IMT 103 or Excavation Permit to enforce soil and sediment disturbance restrictions. The requester submits the permit to the Civil Engineer Squadron for any project that involves soil or sediment excavation. If constraints involving soil disturbance or worker safety exist at the excavation area, the permit describes the appropriate procedures that workers must implement before the start of excavation to prevent unknowing exposure to contamination.
- The Base Environmental Impact Analysis Process (EIAP) – EIAP is conducted pursuant to the National Environmental Policy Act, as promulgated for the AF in 32 CFR 989, to assess the potential environmental impact of any federal action initiated by or involving Joint Base Andrews. An AF Form 813 (AF813) initiates the EIAP. Both AF332s and excavation permits are subject to an evaluation under the EIAP. The proponent of a proposed action is required to submit the AF332 or excavation permit with AF813 so that the appropriate environmental analysis of the proposed action and alternatives to the proposed action is accomplished prior to any construction or excavation activities. The EIAP works to ensure proposed construction and excavation sites take into account the constraints that are described in the Installation Development Plan and known to the AFCEC Environmental Restoration Installation Support Team (IST). The EIAP also ensures that all environmental factors, such as LUCs, are considered in the selection of locations for construction projects.
- The Installation Development Plan, which replaced the Base General Plan, is a long-range planning tool that designates current and future land uses. It also provides a framework for selecting the locations of future facilities needed to carry out the Base mission. The 2016 Installation Development Plan describes the specific LUCs for each site, the reasons for the controls, and the areas where the controls are applied. To ensure that LUCs remain protective, base personnel must have access to information concerning its existence, purpose, and maintenance requirements. The Installation Development Plan provides the important information to ensure that LUC management takes place and that the LUC's presence is effectively communicated.

The Air Force would notify EPA in advance of any changes to internal procedures associated with the selected remedy that might affect the LUCs.

Alternative 3 – Excavation, In Situ Chemical Oxidation (ISCO) Using Potassium Permanganate, and LUCs

Alternative 3 – Estimated Cleanup Costs	
Capital	$6,462,264
Operation and Maintenance	$526,977
Periodic Cost	$48,472
Total Present Worth	$6,989,241
Total Project Lifetime	7 years

Alternative 3 involves the same excavation component described in Alternative 2.

To address the source area, potassium permanganate would be injected into the impacted portion, or upper 12 feet, of the Calvert Formation. It is assumed that substrate injected into the upper portion of the Calvert Formation will migrate into the Brandywine Formation and effectively treat this zone. Following the initial injection, up to three additional injection events with similar injection spacing but staggered locations would be conducted. The frequency of the injections is expected to be one per year. The total treatment area is similar to that for Alternative 2 and is illustrated in Figure 6.

Potassium permanganate causes chemical reactions that reduce the contaminants to harmless substances. In addition, the chemical changes caused by the potassium permanganate also decrease iron and manganese concentrations in groundwater.

Groundwater Monitoring

Similar to Alternative 2, performance monitoring would occur post-injection to evaluate remedy performance. Groundwater monitoring would be performed in the treatment area to evaluate remedy performance. Monitoring would provide information about changes in contaminant levels, the status of the injected substrates, and the potential need for additional injections. Monitoring data would be used to evaluate the effectiveness of each injection event and to confirm that RAOs have been met. The sampling frequency would be quarterly, following each injection event, followed by 3 years of annual sampling following the last quarterly event. The frequency and the duration may need to be changed based upon site-specific conditions and performance of the remedy.

Figure 7 illustrates the proposed performance monitoring network specific to the source area, which will be refined during the design. Additionally, the plume would be monitored, including the distal portions of the plume addressed during the interim remedy that have not yet achieved cleanup goals, to demonstrate RAOs have been met. The monitoring well network would continually be evaluated and optimized with respect to analytes, monitoring frequency, and location based upon trends and achievement of cleanup goals.

Land Use Controls

Similar to Alternative 2, LUCs would remain in place until the concentrations of contaminants at the site allow for UU/UE, defined by attainment of the SRGs. The LUCs for Alternative 3 are the same as those described for Alternative 2.

Alternative 4 – In Situ Thermal Treatment and LUCs

Alternative 4 – Estimated Cleanup Costs	
Capital	$8,323,208
Operation and Maintenance	$600,385
Periodic Cost	$49,639
Total Present Worth	$8,973,233
Total Project Lifetime	5 years

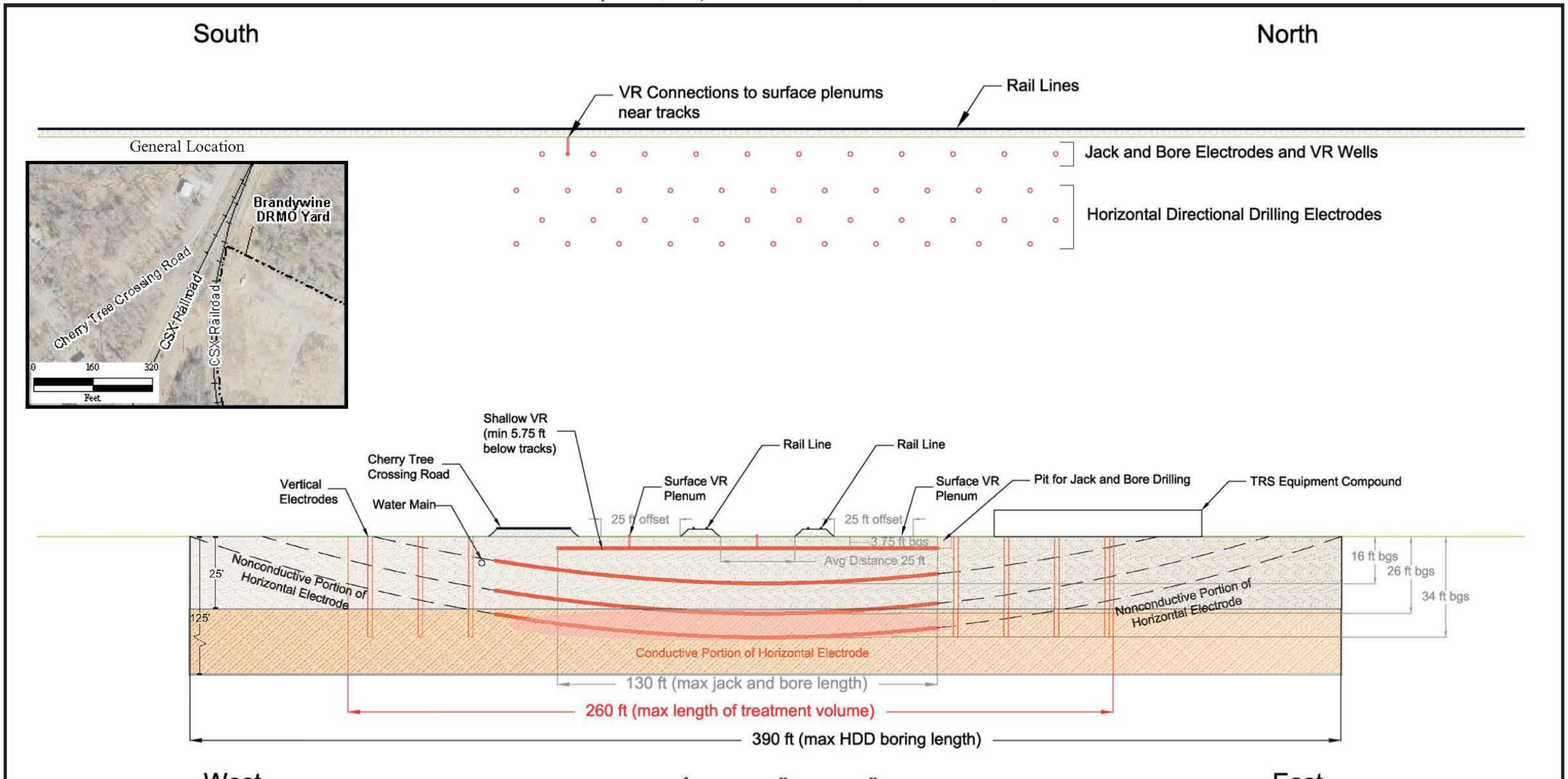
Alternative 4 is USAF's preferred alternative to address contaminated groundwater.

Alternative 4 involves the use of an **electrical resistance heating (ERH)** thermal treatment system to address the source areas. ERH would be installed beneath the CSX tracks, within the northwest corner of the DRMO yard, and between Cherry Tree Crossing Road and the GWETS (Figure 8, Figure 9). ERH would heat the subsurface (up to 100°C) to **volatilize** and increase the mobility of the contaminants, and vapor recovery wells would be used to extract the contaminants. Extracted vapors would be treated with vapor-phase granular activated carbon. Heating the subsurface is also anticipated to increase microbial activity and degrade contamination in situ.

ERH is particularly well suited for this site because the primary COCs are VOCs that are present in heterogeneous, low permeability materials. ERH is particularly effective at heating low permeability subsurface materials and remediating the specific areas requiring treatment.

A total of 44 horizontal electrodes arranged in 4 layers by depth would be installed in the treatment area, in accordance with CSX requirements. CSX requirements refer to the minimum distances and depths from the tracks that must be maintained during remediation activities. The Joint Base Andrews 11th Civil Engineer Squadron Real Estate Office has a formal agreement with CSX (NYC-042652). The agreement is amended periodically as remediation efforts progress to allow for right-of-entry. Installation of the electrodes would occur using directional drilling from U.S. Government-owned property to minimize impacts within the CSX right-of-way. The shallow electrodes will be collocated with the **vapor recovery (VR) well**.

The shallow electrode/VR well would be the principal method of VR under the tracks and road, with the **surface plenum** providing a backup method. In addition to providing a backup method of vapor capture near the tracks and road, the surface plenum would divert rainfall out of the thermal treatment region and reduce contaminant flux during the remediation. Even though the surface plenum would reduce rainfall flux, there could be times when the water table would rise to the level of the shallow VR wells at 5.75 feet below ground surface. These wells would be designed to extract any water that enters the well screen. This water along with condensate from the vapor treatment system could be treated in the existing groundwater treatment system (which is functional but not currently operating) and discharged under the existing discharge permit equivalency (HGL, 2008).



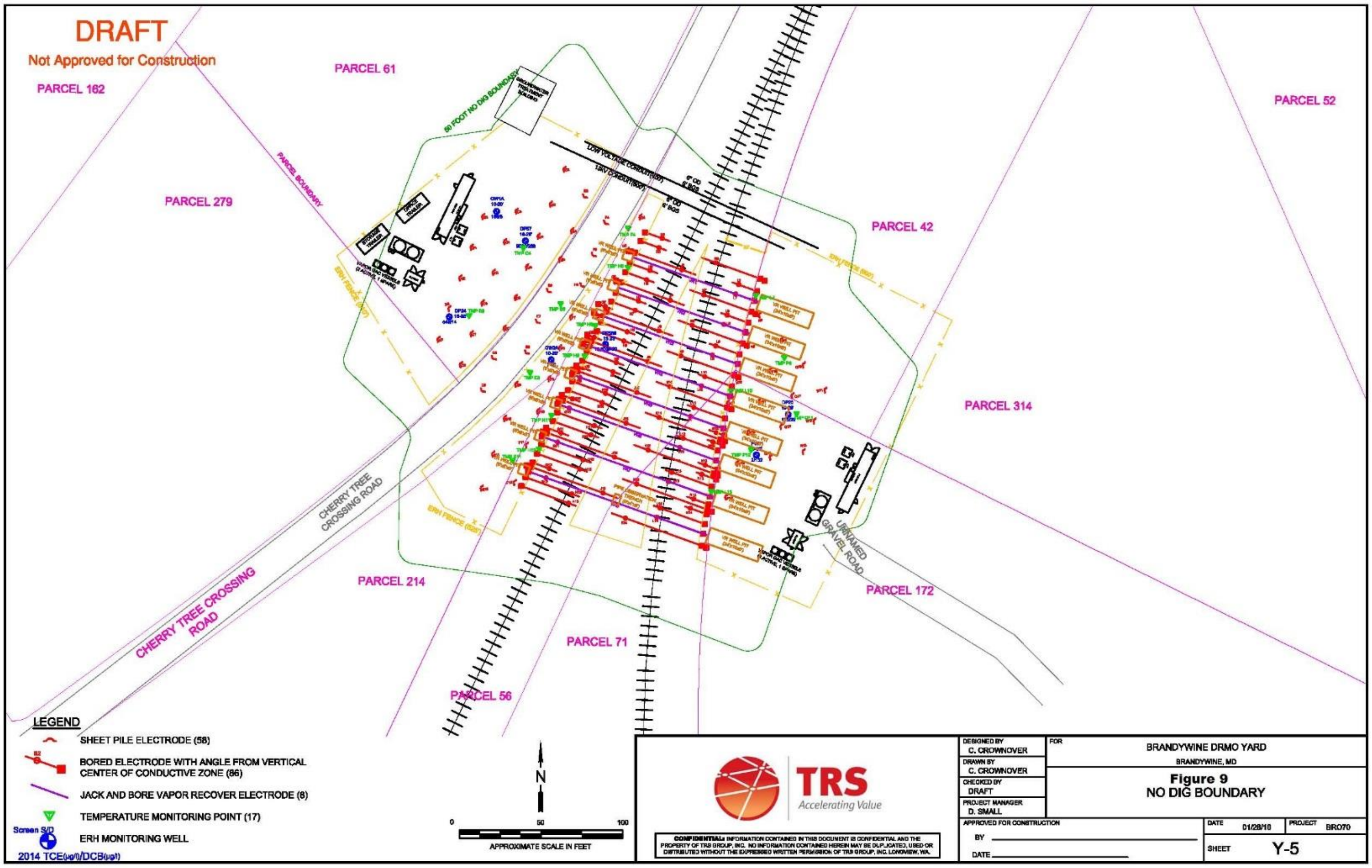
Notes:
'–feet
HDD–horizontal directional drilling
VR–vapor recovery

\\gst-srv-01\hglgis\Brandywine\DRMO Yard\FS SS01\2014-10-07\(4-03)Prop Thermal Treatment.cdr
6/5/2015 JAR
Source: HGL, TRS Group, Inc. 2014

Legend

- Source Area
- Brandywine Formation
- Calvert Formation

Figure 8
Proposed Thermal Treatment Layout for Alternative 4



Groundwater Monitoring

Because the electrodes would heat the subsurface to close to the boiling point of water (100°C), the **polyvinyl chloride (PVC) monitoring wells** would not be able to withstand the treatment. Therefore, approximately 17 monitoring wells would need to be fully removed. To track the removal of the VOCs from the subsurface, **stainless steel monitoring wells** would be installed. It is anticipated that up to 15 stainless steel monitoring wells would be installed. During installation, soil samples would be collected from the monitoring well boreholes for confirmation of VOC concentrations in the thermal treatment zone. The monitoring wells within the treatment area would be sampled before the start of thermal treatment. The data would be used to refine the length of time of treatment.

The 15 stainless steel monitoring wells installed in the treatment area would be sampled weekly for 4 to 6 weeks starting approximately 6 weeks after system startup and analyzed for VOCs. This delay in sampling will allow the subsurface to heat up to the required temperature, which is anticipated to take up to 8 weeks. The weekly sampling would allow portions of the treatment area to be turned off as cleanup criteria are met to save on electrical costs.

After the thermal treatment system has been shut down, post-remedial action groundwater sampling would occur quarterly for the first year, semiannually for the following 2 years, then annually for 1 year. This post-treatment monitoring would ensure that RAOs have been met. The frequency and the duration may need to be changed based upon site-specific conditions and performance of the remedy.

Monitoring is included for the plume, including distal portions of the plume addressed during the interim remedy, to demonstrate achievement of RAOs. A performance monitoring network would be established for the plume. The monitoring well network would be optimized and continually evaluated with respect to frequency and location based upon achievement of the RAOs.

Performance monitoring would include monitoring subsurface temperatures, VOCs recovered from the extracted vapors, and TCE, PCE, cis-1,2-DCE, VC, 1,4-DCB, naphthalene, 2-methylnaphthalene, iron, and manganese in monitoring wells.

Land Use Controls

Similar to Alternative 2, LUCs would remain in place until the concentrations of contaminants at the site allow for UU/UE, defined by attainment of the SRGs. The LUCs for Alternative 4 are the same as those described for Alternative 2, with three additional LUCs during actual operation of the ERH remedy. First, no digging will be allowed within 50 feet of the electrodes that will be used in the ERH remedy. This "no dig" boundary is marked on Figure 9. Second, no extension cord use would be allowed within 50 feet of the electrodes that will be used in the ERH remedy to prevent potential migration of current. This boundary is the same as the "no dig" boundary that is marked on Figure 9. Third, these prohibitions on digging and the use of electrical cords would be captured in license agreements that the Air Force would enter into with landowners on whose property the remediation will occur.

Evaluation of Alternatives

USAF evaluated the various cleanup alternatives against seven of the nine evaluation criteria (see the "Evaluation of Cleanup Alternatives" table below). More detailed information about the evaluation of each alternative can be found in Section 5.0, "Detailed Analysis of Remedial Alternatives," in the *Feasibility Study Brandywine DRMO Yard: Site SS-01, Joint Base Andrews, Maryland,* (HGL, 2016).

The following is a summary of the evaluation against the criteria through which USAF selected Alternative 4 –In Situ Thermal Treatment and LUCs as the preferred alternative for the cleanup of SS-01.

The four remedial alternatives were evaluated in relation to one another based on seven of the nine evaluation criteria (see "NCP Criteria for Evaluation of Remedial Alternatives" in the box on page 25). The criteria are divided into three categories: threshold, balancing, and modifying. Threshold criteria include the first two criteria: (1) overall protectiveness of human health and the environment and (2) compliance with ARARs.

The balancing criteria include the following criteria: (3) long-term effectiveness and permanence, (4) short-term effectiveness, (5) reduction of toxicity, mobility or volume of contaminants through treatment, (6) implementability, and (7) cost. The modifying criteria—(8) state regulator acceptance and (9) community acceptance—are evaluated after the public meeting and public comment period.

The following paragraphs provide the relative advantages and disadvantages of each alternative. The four alternatives are compared or ranked with respect to the degree to which each satisfies the criteria. In general, the distinguishing factors that result in ranking certain technologies more favorably than others are estimated timeframes to achieve site remediation goals and implementability and/or cost effectiveness. Because LUCs would be a component of

Evaluation of Cleanup Alternatives

Evaluation Criteria	Scores by Alternative			
	1	2	3	4
	No Action	Excavation, ISCO Using Enhanced Reduction, LUCs	Excavation, ISCO Using Potassium Permanganate, LUCs	In Situ Thermal Treatment, LUCs
Threshold				
1. Overall Protection of Human Health and the Environment.	0	2	2	2
2. Compliance with ARARs	0	2	2	2
Balancing				
3. Long-Term Effectiveness and Permanence.	N/A	2	1	3
4. Short-Term Effectiveness	N/A	1	2	3
5. Reduction of Toxicity, Mobility, or Volume Through Treatment.	N/A	1	2	3
6. Implementability	N/A	2	2	1
7. Cost	N/A ($0)	3 ($4,896,014)	2 ($6,989,241)	1 ($8,973,233)
Modifying				
8. State Regulator Acceptance	N/A	TBD	TBD	TBD
9. Community Acceptance	N/A	TBD	TBD	TBD
Time Until Response Complete	60+ years	9 years	7 years	5 years
Total Score:	0	13	13	15

0 - Does not satisfy criterion
1 - Satisfies criterion to a lower degree
2 - Satisfies criterion
3 – Satisfies criterion to a higher degree.
= Most Sustainable
Alternative 4 is shaded to indicate the USAF's preferred alternative.

each alternative, except the No Action Alternative, the alternatives provide a similar measure of protectiveness to human health while the remedy is being implemented. The LUCs would prohibit the use of groundwater for drinking water and bathing and otherwise limit contact with groundwater and breathing of soil vapor by residents. The LUCs also would require evaluation of proposed construction activities in the area regarding the risk posed by contaminants at the site and the potential for dewatering activities to exacerbate site conditions, until the site remediation goals are achieved.

Threshold Criteria

Alternative 1 (No Action) does not meet the threshold criteria of protectiveness and compliance with ARARs because it contains no provisions for reduction of COCs in groundwater to achieve ARARs and LUCs to prevent exposure to COCs until levels are reduced, and therefore does not address the unacceptable risks remaining at the site. Therefore, Alternative 1 was not retained for further consideration as a preferred alternative because of its inability to meet the threshold criteria of protectiveness. Alternatives 2, 3, and 4 are protective of human health and the environment and comply with ARARs. The estimated times for each alternative to achieve RAOs are 9 years, 7 years, and 5 years, respectively, with Alternative 4 expected to require the shortest amount of time to achieve cleanup objectives.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternatives 2, 3, and 4 have the potential to be equally effective over the long term because the VOC source area would be remediated and the smear zone source area will be removed or treated. The least amount of uncertainty with respect to treatment effectiveness and efficiency on TCE is associated with Alternative 4, while Alternative 3 contains the greatest amount of uncertainty with respect to TCE. Alternative 4 has the greatest uncertainty with respect to naphthalene and 2-methylnaphthalene, but this area of contamination is limited and the contaminants are susceptible to degradation.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 2, 3, and 4 would reduce the toxicity, mobility, and volume of the VOC source area through treatment. Alternative 2 would temporarily increase iron and manganese concentrations as substrate addition commonly leads to solubilization of metals, so it is ranked lower. Alternative 3 would decrease iron and manganese concentrations, but may temporarily change the **valence** state of chromium to a more toxic form. Alternative 4 is expected to have no net long-term effect on these inorganic COCs, but would achieve full reduction of the VOC source most quickly, resulting in a shorter timeframe for restoration of iron and manganese to background levels as the aquifer returns to less reducing conditions.

Alternative 4 is the only Alternative that would reduce the toxicity, mobility, and volume of the smear zone contamination through treatment.

NCP Criteria for Evaluation of Remedial Alternatives

The NCP specifies nine criteria for the evaluation and selection of remedial actions. The criteria are divided into three groups:

Threshold Criteria:

1. **Overall protection of human health and the environment**
2. **Compliance with applicable or relevant and appropriate requirements or justification of a waiver**

Primary Balancing Criteria:

3. **Long-term effectiveness and permanence**
4. **Reduction of toxicity, mobility, or volume through treatment**
5. **Short-term effectiveness**
6. **Implementability**
7. **Cost**

Modifying Criteria:

8. **State acceptance**
9. **Community acceptance**

The assessment of **overall protection of human health and the environment** describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

The assessment of compliance **with ARARs or justification of a waiver** describes how the alternative complies with the requirements, if a waiver (or a state variance) is required, how the waiver (or state variance) is justified, and addresses other information that lead and support agencies have agreed is to be considered.

The assessment of **long-term effectiveness and permanence** evaluates the effectiveness of the remedial alternative in maintaining protection of human health and the environment after response objectives have been met.

The assessment of **reduction of toxicity, mobility, and volume through treatment** evaluates the anticipated performance of specific treatment technologies employed in an alternative to reduce the toxicity or mobility of contaminants or reduce the volume of contaminated media.

The assessment of **short-term effectiveness** examines the effectiveness of the remedial alternative in protecting human health and the environment during the construction or implementation of the remedy until response objectives have been met. The criterion also addresses the time required to meet the response objectives.

The assessment of **implementability** evaluates the technical and administrative feasibility of the remedial alternative and the availability of goods and services.

The assessment of **cost** evaluates the capital, operations and maintenance, and long-term monitoring costs of each remedial alternative.

The assessment of **state acceptance** reflects the preferences or concerns of the state or support agency regarding the remedial alternative.

The assessment of **community acceptance** reflects the community's apparent preferences or concerns regarding the remedial alternative.

Short-Term Effectiveness

Alternatives 2, 3, and 4 pose short-term impacts to the surrounding community due to increased vehicle traffic and noise from treatment, as well as an increased presence of personnel in the area. Traffic control measures will be implemented to reduce hazards. Alternatives 2, 3, and 4 would involve coordination with CSX, but the injections within the CSX right-of-way associated with Alternatives 2 and 3 would likely be shorter term and easier to coordinate than the approximately 6-month continuous active remediation effort associated with Alternative 4. Alternative 3 uses harsher chemicals than Alternative 2 and would pose greater potential risk to on-site workers. Alternative 4 involves the application of power to the ground; fencing around the ERH treatment area and testing for stray voltage outside of this zone will ensure public safety. Alternatives 2 and 3 would require pilot studies to determine the actual delivery rate, delivery pressure for the injections, radius of influence, and appropriate injection technology.

To remediate TCE, the primary contaminant, Alternative 2 would take more than 9 years, Alternative 3 would take approximately 7 years, and Alternative 4 would take less than 5 years to achieve response complete.

Implementability

Alternatives 2 through 4 would be subject to CSX safety standards, and delays would be possible due to scheduling and train traffic. Alternative 2 is readily implementable based on previous experience at the site. Alternative 3 is also readily implementable, as it has been performed beneath CSX tracks at other sites and is very comparable in nature to Alternative 2. Alternative 4 is implementable beneath the CSX tracks and has the advantage over the other alternatives because it eliminates the risk associated with injections within an active rail road line, but requires the most significant construction and infrastructure. Alternatives 2 and 3 include an excavation component that will require coordination with CSX, dewatering, and shoring, which somewhat diminishes implementability for this portion of the work when compared to Alternative 4. Alternative 4 has been proven at over 100 sites throughout the United States. It is anticipated that the potential risks of mobilizing contaminants or damaging infrastructure are greater by implementing Alternative 4 than implementing Alternative 2 or Alternative 3. Alternative 4 has the shortest remedial timeframe of the 4 remedial alternatives.

Costs

Alternative 2 has the lowest cost, with a majority of the costs associated with the injection events. Alternative 3 is similar to Alternative 2, with the majority of costs associated with the injection events. The costs of Alternatives 2 and 3 could change based on the findings of the pilot studies regarding the actual radius of influence and substrate or **oxidant** demand. The costs for Alternative 4 are highest, but are the least subject to change because of the relative lack of uncertainty with respect to thermal treatment.

Modifying Criteria

This Proposed Plan has been developed by USAF with cooperation provided by EPA, MDE, and PGCHD. Community acceptance will be determined by consideration of comments on this Proposed Plan submitted by the public during the comment period. The state will provide feedback on the preferred alternative after consideration of public comments. The public comments and the USAF responses to the comments will be included in a **responsiveness summary** as part of a final ROD.

Green and Sustainable Practices

USAF and EPA also evaluated the remedial alternatives to ensure that green and **sustainable** practices are incorporated when appropriate and that any potential negative impacts related to the remedy are reduced or eliminated.

Of the active remedial alternatives, Alternatives 2 and 3 include smear zone excavation with off-site disposal. Alternative 2 enhances biological processes that occur naturally in the environment to degrade chemicals by using long lasting biodegradable compounds; however, this treatment requires multiple rounds of injections and years of monitoring.

Alternative 3 would also degrade the contaminants, but it would do so by using harsher chemicals that are not natural to the environment and, when incorrectly handled, could cause harm to workers; additionally, this treatment requires multiple rounds of injections and years of monitoring.

Alternative 4 would require energy to power the thermal treatment. A partnership would be established with Carbonfund.org to offset energy purchased from the grid, resulting in zero net carbon dioxide emissions. This partnership incorporates green and sustainable principles that provide additional benefit to the environment.

Alternatives 2 and 3 both cause changes in the groundwater geochemistry, require more than one round of treatment, and result in more vehicle emissions than Alternative 4. Alternative 2 temporarily increases iron and manganese concentrations in the groundwater. Alternative 3 has the capacity to temporarily transform the valence state of chromium in the groundwater. Alternative 4 has no impacts to groundwater and does not have the risk of incomplete **degradation** that the other alternatives do.

Alternative 4 will achieve TCE cleanup in the shortest remedial timeframe and minimize the need for future sampling. Therefore, Alternative 4 is the most sustainable.

Preferred Remedial Alternative

Based on the evaluation of the remedial alternatives in the *Revised Final Feasibility Study for SS-01* (HGL, 2016), USAF has selected Alternative 4 –In Situ Thermal Treatment and Land Use Controls as the recommended alternative for OU-1. Alternative 4 is preferred because it has the shortest remedial action timeframe, has the least amount of uncertainty with regard to treatment of chlorinated VOCs, and is the most sustainable.

Alternative 4 involves in situ thermal treatment to volatilize/increase the mobility of contaminants and extract them from the subsurface, and associated performance monitoring. Heating of the subsurface is also expected to increase microbial activity and contaminant degradation. This technology addresses both the smear zone and Calvert Formation contamination. LUCs are implemented to prevent exposure over the course of remediation.

MDE and PGCHD concur with the USAF's and EPA's selection of Alternative 4 as the preferred alternative. Based on information currently available, USAF and EPA believe that the preferred alternative meets the criteria and provides the best balance of tradeoffs among the other alternatives with respect to the criteria. USAF and EPA expect the preferred alternative to satisfy the following statutory requirements of CERCLA § 121(b):

1. Be protective of human health and the environment,
2. Comply with ARARs,
3. Be cost effective,
4. Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and
5. Satisfy the preference for treatment as a principal element, or explain why the preference for treatment would not be met.

Five-Year Reviews

The NCP requires five-year reviews of remedial actions in which hazardous substances or pollutants or contaminants remain at levels above those required for UU/UE. For each five-year review, the USAF will complete the following:

- Evaluate the effect of any newly promulgated or modified ARARs that are based on the protection of human health and the environment,
- Evaluate changes in the toxicity values or exposure assumptions affecting the protectiveness of the remedy originally selected in the ROD, and
- Review the validity of land use and exposure assumptions on a site-specific basis.

Five-year reviews would continue until UU/UE conditions are achieved at the site.

Community Participation

Administrative Record Address and Hours

USAF makes information regarding the cleanup of SS-01 available to the public by maintaining a copy of the administrative record at the site's information repository at the following location:

Prince George's County Memorial Library
Surratts-Clinton Branch
9400 Piscataway Road
Clinton, Maryland

Library Hours:
Monday–Wednesday: 10:00 a.m.–9:00 p.m.
Thursday–Friday: 10:00 a.m.–6:00 p.m.
Saturday: 10:00 a.m.–5:00 p.m.
Sunday: Closed
Telephone: (301) 868-9200

The administrative record is also available online at http://afcec.publicadmin-record.us.af.mil/.

Public Notice

In addition, site information is made available to the public by publishing announcements in local newspapers (*Prince George's County Gazette* and the *Andrews Gazette*).

JBA hosts a public interest website

(http://www.andrews.af.mil/library/environmental)

and generates a periodic newsletter informing the community about activities at JBA.

USAF encourages interested persons to use these resources to learn more about the site and the CERCLA activities that have been conducted at the site.

Public Meeting

USAF will hold a public meeting to explain its preferred remedial alternative and Proposed Plan and to answer questions. Oral and written comments will be accepted at the meeting.

Monday December 12, 2016
6:30 p.m.–8:00 p.m.
Brandywine Fire Department
14201 Brandywine Road
Brandywine, Maryland

If you need special accommodations to attend this meeting, please contact Kara-Beth Dambaugh of HydroGeoLogic, Inc. (USAF contractor) by telephone at (518) 877-0390 or by email at kdambaugh@hgl.com at least 1 week before the meeting. A transcript of the public meeting will be included in the administrative record.

Public Comment Period

The public comment period for this Proposed Plan begins on December 1, 2016, and ends on January 9, 2017. However, the comment period will be extended upon receipt of a timely request. All comments received at the public meeting and during the public comment period will be summarized, and responses will be provided in the responsiveness summary section of the ROD. The ROD is the document that presents the selected remedy and will also be included in the administrative record.

Written Comments

Written comments may be submitted up to midnight on January 9, 2017, via mail or email and should be directed to the following:

11th Wing Public Affairs Office
William A. Jones III Building
1500 West Perimeter Road, Room 2330
Joint Base Andrews, MD 20762

11th Wing Public Affairs Email:

community.relations@us.af.mil

If you have any questions about the public comment process, contact the 11th Wing Public Affairs Office.

The Next Step

USAF and EPA, in consultation with MDE, and PGCHD, will evaluate public reaction to the preferred alternative during the public comment period and the public meeting before deciding on the final remedy.

Based on new information or public comments, USAF may modify its proposed alternative or select another cleanup alternative outlined in this Proposed Plan. If there are significant changes to the Proposed Plan prior to finalization, it will be reissued for public comment.

When the ROD is finalized, USAF will announce the selected cleanup plan in a local newspaper advertisement and place a copy of the ROD in the administrative record at the Surratts-Clinton Branch Library.

References

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Glossary

1,4-dichlorobenzene (1,4-DCB) – An organic compound that is a colorless solid with a strong odor. It is used as a pesticide and a deodorant, as well as in mothballs. The chemical formula of 1,4-DCB is $C_6H_4Cl_2$.

2-methylnaphthalene – An organic compound that is a solid with a strong odor. It is used to make dyes, resins, and vitamin K. The chemical formula of 2-methylnaphthalene is $C_{11}H_{10}$.

Administrative record – A record or file made available to the public that includes all information considered and relied on in selecting a remedy for a site.

Applicable or relevant and appropriate requirement (ARAR) – Any state or federal statute or regulation that pertains to the assessment of specific conditions or the use of a particular cleanup technology at a **Superfund** site. The Safe Drinking Water Act, Clean Water Act, and Clean Air Act are examples of federal applicable or relevant and appropriate requirements.

Aquitard – A geological formation that may contain groundwater but is not capable of transmitting significant quantities of it under normal **hydraulic gradients**. May function as a confining bed, limiting the groundwater flow direction.

Installation Development Plan – The Installation Development Plan provides the commander and key decision-makers with a summary of Joint Base Andrews' current and future capability to support the assigned missions. The overall goal of the plan is to provide a framework for the planning and design of future construction and for effective resource management.

Bioaugmentation – Addition of microbes, possibly with a carbon substrate or other amendments, to augment (increase) the rate of biological degradation (biodegradation) of contaminants.

Brandywine Formation – A geologic formation consisting of Upland Deposits that are 22 to 30 feet thick. The formation is composed of four distinct layers containing clay, silt, sand, and gravel and is heterogeneous laterally and vertically across the site.

Calvert Formation – A geologic formation consisting of greenish-gray silt and sandy clay that underlies the Upland Deposits Formation and serves as an **aquitard**.

Capital – The expense or cost associated with the purchase of equipment and/or construction used during the remedial alternative.

Central tendency exposure – The risk assessment scenario and associated exposure assumptions considered to describe median, rather than upper limit, exposures.

Chlorinated solvent – An organic solvent with molecular structure that contains chlorine, such as t**richloroethene (TCE).**

Cis-1,2-dichloroethene (cis-1,2-DCE) – A highly flammable, colorless liquid with a sharp, harsh odor. It is the primary biodegradation product of TCE. Cis-1,2-DCE and trans-1,2-DCE are the two forms of 1,2-DCE.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) – Passed in 1980 and amended in 1986, CERCLA is commonly referred to as the Superfund Law. It provides for liability, compensation, cleanup, and emergency response in connection with the cleanup of inactive hazardous waste disposal sites that endanger public health and safety of the environment. CERCLA is codified at 42 U.S.C. §§ 9601 to 9675.

Contaminant – A compound or element that, upon exposure, will or may reasonably be anticipated to cause certain specified harmful health effects.

Contaminants of concern (COC) – COCs are the chemical substances found at the site determined to pose an unacceptable risk to human health or the environment. These are the substances that are addressed by cleanup actions at the site.

Dechlorination – The partial or complete reduction of a compound containing chlorine (i.e., removal of chlorine atoms) by any chemical or physical process.

Dense nonaqueous phase liquid (DNAPL) – One of a group of organic substances that are relatively insoluble in water and more dense than water. DNAPLs tend to sink vertically through sand and gravel aquifers to the underlying layer (Calvert Formation).

Degradation – A decline to a lower condition, quality, or level.

Dehalococcoides (DHC) – A group of bacteria that live in soil and groundwater that are capable of removing chlorine atoms from organic compounds to obtain energy.

Electrical resistance heating (ERH) – In situ environmental remediation method that uses the flow of alternating current electricity to heat soil and groundwater and remediate contaminants.

Excavation – The act of digging to remove something.

Exposure pathway – The route a substance takes from its source (where it began) to its endpoint where people can come into contact with (or be exposed to) it. An exposure pathway has five parts: (1) a source of contamination (such as a leaking oil tank); (2) an environmental media and transport mechanism (such as movement through groundwater); (3) a point of exposure (such as a private well); (4) a route of exposure (eating, drinking, breathing, or touching); and (5) a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure scenario – A set of facts, assumptions, and inferences about how exposure takes place that aids the risk assessor in evaluating, estimating, or quantifying exposure of a human to a hazardous substance.

Feasibility Study (FS) – Based on data collected during the RI, options for cleanup actions or remediation are developed and evaluated in an FS. The criteria for evaluating remedial alternatives include their short-term and long-term effectiveness, cost, and acceptance by the surrounding community and state.

Federal Facility Agreement (FFA) – Establishes a procedural framework for developing and implementing response actions as required by CERCLA.

Green Calvert – A subset of the Calvert Formation composed of clay identified by its dark greenish-gray color.

Groundwater – Water beneath the ground surface that fills spaces between materials such as sand, soil, or gravel to the point of saturation. In aquifers, groundwater occurs in quantities sufficient for drinking water, irrigation, and other uses. Groundwater may transport substances that have percolated downward from the ground surface as it flows towards its point of discharge.

Groundwater extraction and treatment system (GWETS) – An environmental remediation technique that removes groundwater from the subsurface using extraction wells and treats the groundwater through a treatment process in a treatment system in order to reduce contaminants to acceptable levels.

Groundwater table – The level below the ground surface where the soil or rock is completely saturated with water.

Hazard index – The ratio of the daily intake of chemicals from on-site exposure divided by the reference dose for those chemicals. The reference dose represents the daily intake of a chemical not expected to cause adverse health effects.

Hydraulic gradient – The direction and slope of groundwater flow due to changes in the depth of the water table.

Hypothetical – Existing only as an idea or concept.

Information repository – A single reference source for information about environmental restoration activities at an installation. It shall, at a minimum, contain items made available to the public, including documentation that is in the administrative record and all public documents associated with a Restoration Advisory Board (RAB), if a RAB has been formed.

Institutional controls (ICs) – Non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. ICs are a type of Land Use Control (LUC).

In situ – Latin term for “in place.” When used in discussions of groundwater remediation, in situ means that contaminants are destroyed or transformed into a less toxic form in the subsurface instead of being removed to the surface for treatment.

In situ chemical oxidation (ISCO) – A form of advanced oxidation processes and advanced oxidation technology, is an environmental remediation technique used for soil and/or groundwater remediation to reduce the concentrations of targeted environmental contaminants to acceptable levels.

In situ enhanced reduction - When used in discussions of groundwater remediation, in situ enhanced reduction is an environmental remediation technique to reduce contaminants to acceptable levels.

In situ thermal treatment – The injection of energy into the subsurface to mobilize and recover volatile and semivolatile organic contaminants. Steam-enhanced extraction, electrical-resistance heating, and thermal-conductive heating (which were first developed for enhanced oil recovery) are now commonly used to remediate contaminants from source areas.

Interim Record of Decision (IROD) – An official public document that explains which cleanup alternative(s) will be implemented at **National Priorities List** sites. The IROD is based on information and technical analyses generated by the RI and FS and considers public comments and community concerns. The IROD explains the interim remedy selection process and is issued by JBA in consultation with EPA and state and local regulatory agencies following the public comment period.

Iron – Iron is a heavy flexible magnetic metallic element that is silver-white in pure form but readily rusts. It is often detected in groundwater.

Land use control (LUC) – Any type of physical, legal, or administrative mechanism (often a combination of mechanisms) that restricts the use of or limits access to real property to prevent or reduce risks to human health and the environment.

Maryland Department of the Environment (MDE) – The State of Maryland regulatory agency that ensures that activities conducted at JBA are compliant with the state's environmental regulations.

Maximum Contaminant Level (MCL) – The maximum concentration of a chemical, established by the Safe Drinking Water Act, that is allowed in public drinking water systems. Currently there are fewer than 100 chemicals for which a maximum contaminant level has been established; however, these represent chemicals that are thought to pose the most serious risk.

micrograms per liter (µg/L) – Unit of measure for liquids. One µg/L is equivalent to one part per billion, meaning that out of one billion liters of water, one liter will consist of the compound being analyzed.

Migration – The movement of oil, gas, contaminants, water, or other liquids through porous and permeable rock.

Monitoring well – A well drilled at a hazardous waste site to collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the amounts, types, and distribution of contaminants in the groundwater beneath the site.

Naphthalene – An organic compound that is a white solid with a strong odor. It is used to make mothballs. The chemical formula of **Naphthalene** is $C_{10}H_8$.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The NCP is found at 40 CFR Part 300. The purpose of the NCP is to provide the organizational structure and procedures for preparing and responding to discharges of oil and releases of hazardous substances, pollutants, or contaminants.

National Priorities List (NPL) – The list, compiled by EPA pursuant to CERCLA Section 105, that identifies the uncontrolled or abandoned hazardous substances releases in the United States that are priorities for long-term remedial evaluation and response.

Nonaqueous phase liquid – Liquids such as chlorinated hydrocarbon solvents. Because these substances are only slightly soluble in water, they exist as separate liquids, similar to mixtures of oil and water.

Operation and maintenance – Activities conducted after a hazardous waste site action is started to ensure that the cleanup action continues to be effective.

Operable unit (OU) – A discrete action that compromises an incremental step toward comprehensively remediating a site. At Brandywine, OU-1 represents groundwater and OU-2 represents surface soil and sediments.

Organic Substrate – An organic material used by microorganisms for growth or other purposes.

Organism – Any form of animal or plant life.

Oxidant – A chemical that contains oxygen that is used to change another chemical compound's properties through oxidation. It can react and destroy contaminants in place. Examples include ozone, permanganates, persulfates, and hydrogen peroxide.

Oxidation – A chemical reaction in which oxygen is added to an element or compound changing the element or compound's chemical properties.

Oxidized Calvert – A subset of the Calvert Formation composed of clay identified by its orange color.

Periodic Cost – An expense that occurs on an irregular basis associated with the remedial alternative such as five-year reviews and well abandonment.

Plume – A relatively concentrated area of contaminants spreading in the air or groundwater.

Polychlorinated Biphenyl (PCB) – Are a synthetic organic chemical widely used in industry in electrical insulators and transformers to reduce the chance of electrical fires.

Polyvinyl chloride (PVC) monitoring well – A monitoring well constructed out of PVC pipe, which is the most common economical material used for well installation.

Potassium permanganate – A product used to clean up groundwater contamination, via **in situ chemical oxidation**. The chemical formula of potassium permanganate is $KMNO_4$.

Present worth costs – The total present worth assumes that the amount of money required for an action is invested today and the money accumulates interest over the time required to implement the action. Because the total present worth takes into consideration the interest rate and timeframe of each action, alternatives with longer life spans can have lower present worth costs than alternatives with shorter life spans.

Prince George's County Health Department (PGCHD) – The county organization that ensures that activities conducted by JBA within Prince George's County are compliant with the county's health and environmental ordinances.

Proposed Plan – A public participation requirement of CERCLA and the NCP, it is the document in which the lead agency summarizes and presents to the public the preferred cleanup strategy and rationale. The Proposed Plan also summarizes the alternatives presented in the detailed analysis of the FS. The Proposed Plan may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public review and comment on all alternatives under consideration.

Public comment period – A time for the public to review and comment on various documents and actions taken by JBA and regulatory agencies. A 30-day comment period is required by Title 40 CFR Section 300.430(f)(3)(C) to provide a sufficient opportunity for community members to review the administrative record file and comment on the Proposed Plan.

Pump and treat – A common technology for groundwater remediation. Contaminated groundwater is extracted from wells by pumping and the contaminated groundwater is treated or removed at an above ground treatment plant.

Record of Decision (ROD) – An official public document that explains which cleanup alternative(s) will be implemented at **National Priorities List** sites. The ROD is based on information and technical analyses generated by the RI and FS and considers public comments and community concerns. The ROD explains the remedy selection process and is issued by JBA in consultation with EPA and state and local regulatory agencies following the public comment period.

Remedial alternative – An option to clean up a hazardous waste site.

Remedial Investigation (RI) – An RI involves data collection and site characterization activities intended to identify the type and magnitude of contamination present at a site. The RI includes sampling, monitoring, and gathering sufficient information to evaluate potential risks to human health and the environment and to determine the necessity for remedial action.

Remedial action – The response action that stops or substantially reduces a release or threatened release of hazardous substances.

Remedial action objective (RAO) – RAOs are site-specific objectives developed based on an evaluation of the potential risks to public health and to the environment. The future protection of environmental resources and the means of minimizing long-term disruption to existing facility operations also are considered.

Responsiveness summary – A summary of oral and written public comments received by the lead agency during a comment period and its responses to these comments. The responsiveness summary is an important part of the ROD, highlighting community concerns for decision-makers.

Risk assessment – An evaluation and estimation of the current and future potential for adverse human health or environmental effects resulting from exposure to contaminants.

Sampling/samples – A sample is a portion, piece, or segment that is representative of a whole thing, group, or species. Sampling is the act of collecting a sample.

Sediment – Sediment is topsoil, sand, and minerals washed from the land into water, usually after rain or snow melt. Sediment collects in the bottom of creeks, rivers, reservoirs, and harbors.

Silt – Finely divided particles of soil or rock, often carried in cloudy suspension in water and eventually deposited as sediment. It is smaller than sand particles but larger than clay particles.

Site remediation goal (SRG) – Level established to measure attainment of cleanup.

Solvent – A liquid capable of dissolving or dispersing another substance; a degreaser.

Source area – A specific area in which contaminants are released.

Smear Zone - the area where contamination occurred in the soil and was then smeared across the soil when the water table fluctuated between historic high and low water table elevations.

Stainless steel monitoring well – A monitoring well-constructed out of stainless steel. These wells are very expensive compared to PVC wells but withstand elevated temperatures associated with ERH remediation.

Substrate – A material used by microorganisms for growth or other purposes.

Substrate Injection – A material injected into the ground used by microorganisms for growth or other purposes.

Superfund – The program operated under the authority of CERCLA, as amended, that funds and carries out emergency and long-term removal and remedial activities. These activities include investigating sites for inclusion on the National Priorities List, determining their priority, and conducting and/or supervising the cleanup and other remedial actions.

Surface plenum – a geomembrane layer placed on the ground surface that will cover approximately 30,000 square feet. It will cover the area of the shallow electrode/vapor recovery wells and serve two functions: 1) prevent rainfall infiltration and 2) contain gas releases and assist in vapor recovery.

Surface soil – the unconsolidated mineral or organic material on the immediate surface of the Earth

Sustainable – Capable of being continued with minimal long-term effect on the environment or future generations.

Tetrachloroethene (PCE) – A solvent, also referred to as perchloroethene or tetrachloroethylene, which was commonly used in dry cleaning to remove grease and dirt from clothing. The chemical formula of PCE is C_2Cl_4.

Toxicity – The quality or strength of a substance being poisonous or harmful to plant, animal, or human life.

Trichloroethene (TCE) – A solvent, also referred to as trichloroethylene, which is used to remove grease and dirt from metal parts. The chemical formula of TCE is C_2HCl_3.

Unacceptable risk – There is risk involved in many areas of life. Environmental risk means a potential for harm to human health and/or the environment. Unacceptable risk means that the potential for harm is too high.

Unlimited use/unrestricted exposure (UU/UE) – A term used to describe when contamination at a site has been reduced to a level that is safe for any land use, including residential land use.

Upland Deposits – A geologic formation, consisting of variable discontinuous layers of gravel, sand, silt, and clay that underlay the site.

Upper Calvert – A subset of the Calvert Formation located immediately below the Brandywine Formation.

Vadose zone – The unsaturated zone of the earth between the land surface and the groundwater table.

Valence- The combining capacity of atoms determined by the number of electrons it can add, lose, or share. Also known as oxidation state.

Vapor intrusion – Migration of volatile chemical vapors from contaminated groundwater or soil into an overlying building.

Vapor recovery (VR) well – A well designed to recover the migration of volatile vapors from contaminated groundwater or soil.

Vinyl chloride (VC) – A colorless liquid chemical with a faintly sweet odor primarily used in the manufacture of plastics. It is also formed during the degradation of chlorinated VOCs such as TCE and cis-1,2-DCE. Health risks from exposure to high levels of vinyl chloride include liver and nerve damage, immune reactions, and liver, lung and brain cancer.

Volatile organic compound (VOC) – A general term for organic compounds capable of a high degree of vaporization or evaporation at standard temperature and pressure (20°C and 1 atmosphere). These potentially toxic chemicals are used as solvents, degreasers, paint thinners, and fuels. PCE, TCE cis-1,2-DCE, and VC are VOCs.

Volatilize/volatilization – The process of changing or causing to change from a liquid to a vapor (gas); the process of evaporation.

Zero-Valent Iron – In chemical terms, zero-valent iron describes the elemental form of iron, and refers to the zero charge carried by each atom – a result of the outer valence level being filled with electrons. Zero-valent iron is a reactive material that can be used to strip contaminants out of groundwater.

Proposed Remedial Action Plan for Spill Site 01
Joint Base Andrews, Maryland

Use This Space to Write Your Comments

Your input on the Proposed Plan is important to USAF. Comments provided by the public are valuable in helping us select a final remedy for the site.

You may use the space below to write your comments to mail or fax. Use additional paper if needed. Comments must be postmarked, faxed, or emailed by midnight January 9, 2017. If you have any questions about the public comment process, contact the 11th Wing Public Affairs Office at community.relations@us.af.mil.

Mail your comments to:

11th Wing Public Affairs Office
William A. Jones III Building
1500 West Perimeter Road, Room 2330
Joint Base Andrews, MD 20762

Or e-mail your comments to:

community.relations@us.af.mil

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City, State, Zip

Spill Site 01, Joint Base Andrews, Maryland
Comment Sheet

Fold on the lines, secure open bottom edge with clear tape, place first class stamp, and mail.

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