FORT DETRICK, MARYLAND
SITE MANAGEMENT PLAN
FY 2024 ANNUAL UPDATE

November 2024

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ACRONYMS AND ABBREVIATIONS

List of Acronyms and Abbreviations

AEDB-R	Army Environmental Database – Restoration
AOC	Area of Concern
ARCADIS	ARCADIS U.S., Inc.
Army	United States Department of the Army
bgs	Below ground surface
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
D.C.	District of Columbia
DD	Decision Document
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
EE/CA	Engineering Evaluation / Cost Analysis
EEQ	Environmental Effects Quotients
ERD	Enhanced Reductive Dechlorination
ERMs	Environmental Restoration Managers
ESI	Expanded Site Inspection
FFA	Federal Facilities Agreement
FS	Feasibility Study
ft	Feet
FTD	Fort Detrick

List of Acronyms and Abbreviations

FTD-72	Fort Detrick Area B Groundwater
FY	Fiscal Year
HHRA	Human Health Risk Assessment
HI	Hazard Index
IRP	Installation Restoration Program
LOAEL	Lowest-Observed-Adverse-Effect Level
LTM	Long Term Monitoring
LUCs	Land Use Controls
MDE	Maryland Department of the Environment
MCL	Maximum Contaminant Level
mg/kg	Milligram per kilogram
MMRP	Military Munitions Response Program
msl	Mean Sea Level
µg/kg	micrograms per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAEL	No-Observed-Adverse-Effect Level
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PIKA	PIKA International, Inc.

List of Acronyms and Abbreviations

PP	Proposed Plan
ppm	parts per million
RA	Remedial Action
RAB	Restoration Advisory Board
RBC	Risk Based Concentration
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RIP	Remedy In Place
ROD	Record of Decision
RPM	Remedial Project Manager
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SMP	Site Management Plan
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TNT	Trinitrotoluene
UCL	Upper Confidence Limit
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command

List of Acronyms and Abbreviations

USAEHA	United States Army Environmental Hygiene Agency
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
WDA	Western Disposal Area
XRF	X-Ray Fluorescence

1. Introduction

This document presents the Fiscal Year (FY) 2024 Site Management Plan (SMP) annual update for Fort Detrick Area B Groundwater (FTD-72), in Frederick County, Maryland completed in compliance with the Federal Facilities Agreement (FFA) between the United States Environmental Protection Agency (USEPA), and the U.S. Department of the Army (Army) and enacted on 5 August 2011. The SMP is intended to be a working document and will be updated annually to reflect additional information as it becomes available.

1.1. FFA Background and Purpose

Fort Detrick Area B Groundwater (FTD-72) was added to the National Priorities List (NPL) on 9 April 2009, based on a Hazard Ranking Score of 49.52 (NPL Final Rule #46 [74 Federal Register 16126, 40 CFR Part 300]). A FFA between the Army and USEPA was signed on 17 Dec 2010 and was finalized 5 August 2011 after public comment. The Maryland Department of the Environment (MDE) is not a party to the FFA.

The purpose of the FFA is to:

- Ensure that the environmental impacts associated with past and present activities at the Site are thoroughly investigated and appropriate remedial action (RA) is taken as necessary to protect the public health, welfare and the environment;
- Establish a procedural framework and Schedule for developing, implementing, and monitoring appropriate response actions at the Site in accordance with guidance and policy from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Resource Conservation and Recovery Act (RCRA), and applicable State law; and
- Facilitate cooperation, exchange of information and participation of the Parties in such actions.

A key component of the FFA is a SMP (Appendix F in the FFA). The SMP contains timetables, plans, or schedules that indicate the times and sequences of events. The SMP will be used as a management tool in planning, reviewing, and setting priorities for all response activities at the facility. The prioritization of activities, proposed schedules, and work descriptions are jointly developed by the Army and USEPA based on goals agreed to by all parties. Deadlines listed in the SMP are subject to stipulated penalties in accordance with Section XI of the FFA.

1.2. Overview of the SMP

The FFA Findings of Fact identified an initial list of 14 operable units (OU) or sites that require a Remedial Investigation / Feasibility Study (RI/FS). Table 1-1 provides an overview of these sites.

Table 11: FTD Area B Operable Units

OU #	*AEDB-R* ID*	*Site Name*	*Status***
1	FTD 49	Area B-11 Chemical Waste Disposal Pits	Decision Document (DD) issued December 2007. Remedy in Place (RIP) for waste material and soil. MDE concurred with Decision March 2008
2	FTD 50	Area B-2 Landfill	DD issued December 2007. RIP for waste material and soil. MDE concurred with Decision March 2008
3	FTD 05	Area B-Grid	DD issued February 2008. MDE concurred with No Further Action (NFA) decision in March 2008
4	FTD 43	Area B-20 South	DD issued February 2008. MDE concurred with NFA decision in March 2008
5	FTD 07	Area B Ammunition Areas	DD issued February 2008. MDE concurred with NFA decision in March 2008
6	FTD 48	Area B-1	Army, USEPA and MDE signed memorandum after Preliminary Assessment/Site Inspection to close out site because no release was found. MDE concurred with NFA decision in January 2005
7	FTD 51	Area B-3	DD issued March 2009. RIP for waste material and soil. MDE concurred with Decision May 2009
8	FTD 69	Area B-6	DD issued March 2009. RIP for waste material and soil. MDE concurred with Decision May 2009
9	FTD 70	Area B-8	DD issued March 2009. RIP for waste material and soil. MDE concurred with Decision May 2009
10	FTD 70	Area B - 8 (Trenches North of Area B-8)	DD issued December 2007. RIP for waste material and soil. MDE concurred with Decision March 2008
11	FTD 71	Area B-10	DD issued March 2009. RIP for waste material and soil. MDE concurred with Decision May 2009
12	FTD 70	Area B-18	DD issued December 2007. RIP for waste material and soil. MDE concurred with Decision March 2008

OU #	AEDB-R* ID	Site Name	Status**
13	FTD 43	Area B-20 North	DD issued February 2008. MDE concurred with NFA decision in March 2008
14	FTD 72	Area B Groundwater, including potential impacts of source areas to groundwater contamination	Extensive groundwater RI is currently underway.

* AEDB-R = Army Environmental Database – Restoration

**These decisions were made by the Army prior to the FTD 72 NPL listing and are subject to review by the USEPA in accordance with the FFA.

The Army has final remedies in place for 13 of the 14 sites (OUs 1 to 13) identified in Appendix A of the FFA. Eight of the 13 sites have a Decision Document (DD) and a Remedy in Place (RIP); a No Further Action (NFA) determination has been made for five of the 13 sites. These decisions were issued with the Army's full CERCLA authority delegated by the President to the Department of Defense (DoD) under Executive Order 12580 and with MDE concurrence, prior to the Area B Groundwater (FTD-72) NPL listing. In accordance with the FFA, the Army is not necessarily required to reopen the CERCLA RA DDs. However, all the actions and determinations made for these sites were made before the NPL listing and are subject to USEPA review. In accordance with CERCLA and the NCP, and under the terms of Section IX, Work To Be Performed of the FFA, USEPA has agreed to review documentation previously developed and work performed by the Army at these sites, as well as any new information available, to determine whether additional work is necessary.

The remaining site, Area B Groundwater (FTD-72), is the Area B Groundwater investigation work, including potential impacts from source areas to that groundwater contamination. The Army is in the process of implementing an approved RI work plan for Area B Groundwater.

The schedule in this FY2024 SMP annual update is shown on Table 3-14. The SMP will be revised, as needed, to address USEPA's review of the Army's final RA decisions.

2. Site Background and Regulatory Framework

This section provides a brief overview of the site location, history, hydrogeologic setting and an overview of the environmental program at Fort Detrick.

2.1. Site Location

Fort Detrick, located in Frederick County, Maryland, is an active Army installation. Fort Detrick is located within the City limits of Frederick, approximately 47 miles west of Baltimore and 45 miles northwest of Washington, District of Columbia (D.C.), and is surrounded by residential and commercial areas and county-owned lands. Fort Detrick Area B, the focus of this SMP, is presented in Figure 2-1.

2.2. Site History

Fort Detrick is an active Army installation that houses over 35 tenant organizations, including some non-DoD tenants. These tenants are primarily involved in medical research and development, medical logistics and acquisitions, secure worldwide telecommunications, and reserve activities.

Fort Detrick began in 1929, when Frederick County purchased 90 acres of farmland for use as a municipal airport. In 1930 this tract of land was leased to the Maryland National Guard for use as a summer training camp for the 104th Observation Squadron. This was the first military presence at this site.

Detrick Field was used as a summer training camp until 1940 when, by joint agreement of Frederick County and the Maryland National Guard, the field was leased to the U.S. Civil Aeronautics Administration. The U.S. Civil Aeronautics Administration used the field as a pilot training center until the outbreak of World War II.

In 1941, President Roosevelt ordered the establishment of the U.S. Biological Warfare program and in 1943 Camp Detrick was assigned to the Army Chemical Warfare Service for the development of a biological warfare research center. The original 90-acre tracts, plus an adjoining 53 acres, were purchased in 1944. By that time, Camp Detrick was well established as an installation for the research and development of offensive and defensive biological warfare techniques and agents.

Camp Detrick was designated a permanent installation shortly after the end of World War II. In 1946, 399 acres, now designated as Area B, were acquired to provide an outdoor test area, commonly called the "grid test area." In 1955 and 1956, the Flair U.S. Army Reserve Center was constructed as a separate entity in the northeast corner of Area B. Subsequently, the land transfer reverted to Fort Detrick, and in 1958 the facility became an on-post tenant.

After biological warfare activities were discontinued on April 1, 1972, the control of Fort Detrick was transferred from the U.S. Army Materiel Command to the Office of the Surgeon General, Department of the Army, and was further assigned as a subordinate installation of the U.S. Army Medical Department. In 1973, Fort Detrick was reassigned from the U.S. Army Surgeon General to the newly created U.S. Army Health Services Command now known as U.S. Army Medical Command. On September 30, 2011, the Fort Detrick U.S. Army Garrison was realigned under the Installation Management Command.

Today, Fort Detrick is a growing installation with the addition of a national interagency bio-defense campus. This is the result of executive branch and Congressional direction that addresses leveraging and expanding key competencies to achieve productive and efficient interagency cooperation in support of homeland security bio-defense.

2.3. Hydrogeologic Setting

2.3.1. Karst Development

Area B is underlain by two distinct bedrock units:

- Cambrian-aged limestone of Frederick Formation underlies the southern part of Area B.
- Triassic-aged conglomerate of the New Oxford Formation underlies the northern part of Area B.

While much younger than the limestone, the conglomerate consists largely of limestone pebbles derived from the older New Oxford Formation. Both units, therefore, consist of rock that is susceptible to karst weathering, the process by which soluble rock such as limestone is preferentially weathered by circulating groundwater. In karst aquifers, groundwater gradually enlarges the most favorable groundwater pathways, and alters the way in which groundwater moves through the aquifer. Groundwater in karst aquifers follows complex pathways though integrated networks of conduits, often at velocities many times greater than are possible in non-karst aquifers. Karst conduits have been encountered in many wells completed within Area B, in both the limestone and conglomerate bedrock. Surface features such as the small sinkholes and springs that have been observed at Area B and the immediate vicinity are also the result of karst processes.

2.3.2. Groundwater

In Area B, the water table averages approximately 20 feet (ft) below ground surface (bgs). There are currently 113 monitoring wells (including 29 monitoring wells installed in 2011-2012) located on Area B. Over 30 sets of synoptic water level measurements have been collected from Area B monitoring wells over a 14-year period from 1998 to 2012, covering all seasons and a drought in 2001-2002. Groundwater tracer studies were also conducted in 1995 and 2013/14 to help understand patterns of groundwater flow through the karst conduit network.

The majority of groundwater flow that occurs beneath Area B is interpreted to move through a complex network of karst conduits. Water-level data and the tracer study both provide evidence showing that this groundwater flows generally eastward across Area B and discharges at springs located along Carroll Creek on the eastern side of Area B, and just off-site.

2.3.3. Surface Water

Area B is located within the drainage basin of Carroll Creek, one of many sub-basins that drain into the Monocacy River (see Figure 2-2). Surface water runoff follows the topography of Area B. The upper Carroll Creek basin includes all of Area B and covers approximately 4,620 acres.

Carroll Creek and several of its tributaries originate at the higher elevations of Catoctin Mountain in the west and flow to the east into the Frederick Valley. Stream 1 is an ephemeral stream that enters the west side of Area B and terminates at a sinkhole. Streams 3 and 4 are wet weather surface water features located within the eastern half of Area B that emanate from ephemeral springs. Streams 3 and

4 flow south, discharging into Stream 2. Stream 2 located along the southern boundary of Area B and Stream 6 to the north of Area B are unnamed tributaries to Carroll Creek that originate west of Area B in the Catoctin Mountains. Flow through the City of Frederick is largely controlled by engineered drainage ways. The Monocacy River is the principal drainage feature of Frederick County and flows in a southerly direction through the Frederick Valley and discharges to the Potomac River.

Wetland delineation was performed by the United States Army Corps of Engineers (USACE), Baltimore District in March 2004 to investigate the freshwater wetlands and waterways at Area B (USACE, 2004). The delineation identified the limits of five wet meadows that comprise a total 6.65 acres and two ponds (0.15 and 0.36 acres) that were possible transitory features. In addition, it was determined that the wetlands drain into a perennial tributary of Carroll Creek that extends along the southern boundaries.

2.4. Status of Environmental Restoration Program for Fort Detrick

Numerous environmental investigations and remediation activities have been performed at Fort Detrick since the 1980s. Detection of volatile organic compounds (VOCs) contamination in domestic wells off Fort Detrick property adjacent to Area B in 1992 and 1993 prompted the placement of some residents on bottled water with subsequent connection of affected residents to the City of Frederick water system. In response to a spike in VOC concentrations detected in 1997 and 1998, the Army conducted a hot spot removal action at Area B-11 (a former waste disposal area) from 2001 to 2004 to remove potential intact drums of tetrachloroethene (PCE) and trichloroethene (TCE) thereby preventing further groundwater contamination. While the majority of the suspected source material was removed, some waste remains in place. Ongoing periodic groundwater monitoring of the solute plume has documented significant declines in constituent concentrations in several wells since 1998. In 2006, bottled water was provided to five residences along Kemp Lane due to low level detections (below the Maximum Contaminant Level [MCL]) for PCE and TCE. These residents were ultimately connected to the municipal water supply. This was a proactive measure to ensure that human health was protected. In May 2010, all of Area B's disposal areas were capped with geosynthetic impervious caps.

Area B Groundwater was listed on the NPL in April 2009. Environmental restoration activities on Area B Groundwater are being conducted in accordance with CERCLA and funded under the Army's Installation Restoration Program (IRP). The Army is the lead agency with USEPA as the lead regulatory agency with the cooperation of the MDE.

2.5. The CERCLA Process

The following sections provide an overview of the CERCLA process. The objectives of the CERCLA process are to evaluate the nature and extent of contamination at a site, and to identify, develop, and implement appropriate RAs to protect human health and the environment. The major elements of the CERCLA process are identified below and described in greater detail in Table 2-1:

- Preliminary Assessment (PA)
- Site Inspection (SI)
- RI/ FS
- Treatability Study
- Engineering Evaluation/Cost Analysis (EE/CA) and Removal Action (may be implemented at any time in the CERCLA process)
- Proposed Plan (PP) and Record of Decision (ROD)
- Remedial Design (RD) and RA
- RIP / Response Complete (RC)
- Five Year Reviews, if applicable

Table 2-1: Major Elements of the CERCLA Process

Table 2-1: Major Elements of the CERCLA Process

Phase	Description of Phase
Preliminary Assessment (PA)	Initiation of concern about a site, area, or potential contaminant source. The PA is a limited-scope assessment designed to distinguish between sites that clearly pose little or no threat to human health or the environment and sites that may pose a threat and require further investigation. Environmental samples are rarely collected during a PA. The PA also identifies sites requiring assessment for possible response actions. If the PA results in a recommendation for further investigation, an SI is conducted.
Site Inspection\(SI)	Some sites warrant preliminary or interim investigations, studies, or removal/remedial actions. If it is unclear as to whether a site should be included in the CERCLA RI/FS process, an SI is sometimes conducted to make a general determination if activities at the site have impacted environmental media. SIs typically include the collection of environmental and waste samples to determine which hazardous substances are present at a site and to determine if these substances have been released to the environment.
Remedial Investigation (RI)	During an RI, data is collected to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and, if necessary, conduct treatability testing to evaluate the potential performance and cost of the treatment technologies being considered.
Treatability Study	Treatability studies may be conducted at any time during the CERCLA process. The need for a treatability study generally is identified during the FS. Treatability studies may be classified as either bench-scale (laboratory study) or pilot-scale (field studies). For technologies that are well-developed and tested, bench-scale studies are often sufficient to evaluate performance. For innovative technologies, pilot tests may be required to obtain the desired information. Pilot tests simulate the physical and chemical parameters of the full-scale process, and are designed to bridge the gap between bench-scale and full-scale operations. Treatability studies are performed to assist in the evaluation of a potentially promising remedial technology. The primary objectives of treatability testing are to provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the FS and support the remedial design of a selected alternative.
Engineering Evaluation /Cost Analysis (EE/CA) and Interim Removal Action (IRA)	Removal actions are implemented to clean up or remove hazardous substances from the environment at a specific site in order to mitigate the spread of contamination. Removal actions may be implemented at any time during the CERCLA process. Removal actions are classified as either time-critical or non-time-critical actions. Actions taken immediately to mitigate an imminent threat to human health or the environment, such as the removal of corroded or leaking drums, are classified as time-critical removal actions. Removal actions that may be delayed for 6 months or more without significant additional harm to human health or the environment are classified as non-time-critical removal actions (NTCRA). For an NTCRA, an EE/CA is prepared rather than the more extensive FS. An EE/CA focuses only on the substances to be removed rather than on all contaminated substances at the site.
Feasibility Study (FS)	The FS is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions. The RI and FS can be conducted concurrently; data collected in the RI influences the development of remedial alternatives in the FS, which in turn affect the data needs and scope of treatability studies and additional field investigations. This phased approach encourages the continual scoping of the site characterization effort, which minimizes the collection of unnecessary data and maximizes data
Proposed Plan (PP)	A PP presents the remedial alternatives developed in the FS and recommends a preferred remedial alternative. The public has an opportunity to comment on the PP during an announced formal public comment period. Site information is compiled in an administrative record and placed in the general IR program information repositories established at local libraries for public review. The public comments are reviewed and the responses are recorded in a document called a Responsiveness Summary. At the end of the public comment period, an appropriate remedial alternative is chosen to protect human health and the environment. All parties directly involved in the restoration program (Army, USEPA, and MDE) must agree on the selected alternative.
Record of Decision (ROD)	The ROD document is issued to explain the selected remedial action. Public comments received during the PP are addressed as part of the responsiveness summary in the ROD. A notice to the public is issued when the ROD is signed by Army and USEPA following State concurrence.
Remedial Design (RD) / Removal Action (RA)	The final stage in the process is the RD/RA. The technical specifications for cleanup remedies and technologies are designed in the RD phase. If land use controls are a component of the remedy, the Land Use Control Remedial Design is generated during this phase. The RA is the actual construction or implementation phase of the cleanup process.
Remedy In Place (RIP)	For long-term remedies where it is anticipated that remedial action objectives will be achieved over a long period, the RIP milestone signifies the completion of the remedial action construction phase, and that the remedy has been implemented and has been demonstrated to be functioning as designed (i.e., all testing has been accomplished and the remedy will function properly). Once all RCs and RIPs have been documented for every site at the facility and the terms of the FFA have been met, site closeout and NPL deletion is completed.
Response Complete (RC)	Within the CERCLA process there are multiple points at which a decision can be made that no further response action is required; properly documented (necessary regulatory notification or application for concurrence has occurred) these decisions constitute response complete and/or site closeout. RC is the point at which the remedy has achieved the required reduction in risk to human health and the environment (cleanup goals have been met). Response complete is followed by site closeout.
Five Year Reviews	Five-year reviews generally are required by CERCLA or program policy when hazardous substances remain on site above levels that permit unrestricted use and unlimited exposure. Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. Generally, reviews are performed 5 years after the initiation of a CERCLA response action, and are conducted every 5 years as long as future uses remain restricted. Five-year reviews for FTD are performed by the Army, the lead agency for the site, but USEPA retains responsibility for determining the protectiveness of the remedy.

2.5.1. Community Participation

2.5.1.1. Restoration Advisory Board

As stated in the FFA, "the 'members of the public interested in this action 'may be represented by inclusion of a Restoration Advisory Board (RAB) or technical review committee, if they exist for Fort Detrick, or by other appropriate means." A RAB exists at Fort Detrick and is comprised of members of the community, local environment group members, and state and federal officials, who meet quarterly to keep the community informed on environmental issues at the Installation.

2.5.1.2. Community Involvement Plan

The Fort Detrick Environmental Restoration Program Community Involvement Plan was released in July 2000 with the goal of establishing effective and comprehensive mechanisms for communication and exchange of information about the environmental investigation and restoration program with all interested stakeholders. In an effort to incorporate additional needs and requirements, following Fort Detrick's addition to USEPA's NPL, to incorporate the Superfund Community Involvement Handbook (published by USEPA in April 2005), and address concerns and information gaps identified at RAB meetings, the 2000 version was updated resulting in an updated publication of the same title that was finalized in July 2012. The CIP was updated again in 2017 and 2024.

The 2024 version of the Community Involvement Plan (CIP) contains the following sections:

1. Overview of Community Involvement Plans
2. Installation and Installation Restoration Program Background
3. Active Cleanup Sites at Fort Detrick
4. Community Profile

   This includes information on Environmental Justice, History of Community Involvement, Community Feedback, and a Summary of Communication Needs
5. Community Involvement Activities

   This includes information on Fort Detrick Points of Contact for the Public, the Information Repository, Developing Outreach Materials, Site Information on the Internet, Work with the Restoration Advisory Board, and Conducting Broader Community Engagement to Share Information

2.5.2. Information Repositories

Fort Detrick has established an Administrative Record, which contains various documents available for the public's review at the following location:

C. Burr Artz Central Library, Maryland Room

110 E Patrick St, Frederick,

Frederick, MD 21701

301-600-1368

Maryland Room Hours

Hours:

Monday - Closed

Tues - Thu: 10am - 7pm

Fri - 10am-5pm

Sat - 12pm to 5 PM

Sunday - Closed

2.5.3. Roles and responsibilities

2.5.3.1. USEPA

USEPA is responsible for overseeing the Superfund remedial activities at NPL federal facility sites. USEPA's oversight is shaped by a variety of factors including statutory requirements, regulations, guidance, FFA, SMP, and common practice. USEPA's oversight at federal facilities consists of ensuring that the federal facilities comply with CERCLA, the NCP, the signed FFA and other agreements; and other statutes, as appropriate (e.g., RCRA). USEPA's oversight also includes assisting in the determination of cleanup remedies or potentially selecting the remedies, concurring that there is consistency with all relevant guidance and policies determined by USEPA to be appropriate for the facility, and determining that decisions protect human health and the environment and are technically sound.

Additional USEPA activities include promoting community involvement through the community advisory boards, providing Technical Assistance Grants, providing technical advice and assistance (e.g., assisting in identifying and implementing the sampling strategies and analytical requirements), identifying cleanup actions that are not justified based on risk, reviewing design documents and federal agency pollution abatement plans, and resolving disputes regarding noncompliance.

The USEPA Remedial Project Manager (RPM) should assume the responsibility to serve as liaison between RCRA and CERCLA and assure that CERCLA actions will satisfy RCRA concerns and that

fundamental RCRA requirements are integrated into the FFA process and schedules and vice-versa. In non-authorized states, the RPM can be granted RCRA corrective action and decision-making authority.

2.5.3.2. Maryland Department of the Environment

The MDE Federal Facilities Division oversees the investigation and remediation of sites that are either listed on the NPL, or sites where the DoD is a responsible party to the contamination at sites. The Federal Facilities Section participates with the USEPA and DoD in the decision-making in all phases of environmental investigations and oversight of cleanups of hazardous waste at the DoD sites. The Section ensures that state requirements are considered, and public health and the environment are protected at sites. Through partnering efforts with these facilities and the USEPA, the Section can expedite assessment, evaluation and, where necessary, remediation of environmental conditions at these sites.

2.5.3.3. U.S. Army

The Defense Environmental Restoration Program (DERP) was formally established by Congress in 1986 and is codified at Title 10 United States Code 2701 – 2710. The program provides for the cleanup of DoD sites. The DoD has delegated execution of the DERP to the DoD components (Army, Navy, Air Force, and Defense Agencies). The Army's environmental restoration program under the DERP at active/operating Army installations is the Active IRP and the Military Munitions Response Program (MMRP).

The U.S. Army Environmental Command (USAEC) is the program execution manager for the Active and Excess IRP and MMRP. The USAEC oversees the execution of the DERP at active/operating and excess installations and has assigned Environmental Restoration Managers (ERMs) to serve as the technical environmental link to installation or garrison environmental offices. The ERMs are responsible for monitoring the execution of the Army DERP for assigned installations. The ERM assists the installation with the prioritization of Army DERP requirements, monitors project execution for obligation and reporting, and provides technical and financial guidance and support to assigned installations.

The Garrison Commander is responsible for executing the installation's environmental programs, including the IRP and MMRP. The Garrison Commander is responsible for tasking the installation's DERP executors, coordinating regulatory and community involvement, and for ensuring compliance with DoD policies, to include explosive safety policies, and applicable federal and state laws and regulations. The RPM is the installation coordinator of the restoration activities among the Army, the USEPA, state agencies, and the local community. The RPM position is assigned to the Garrison Commander and has overall responsibility for the DERP execution at the installation. The DERP executor conducts remedial responses (identification, investigation, and cleanup of contamination) at active installations at the direction of the RPM. Army installations may execute projects or use the USACE or the U.S. Army Institute of Public Health (formerly U.S. Army Center for Health Promotion and Preventive Medicine) to execute specific projects for the DERP.

The FFA for Fort Detrick was issued by the USEPA and projects under the FFA for Fort Detrick are carried out in consultation with the USEPA and MDE.

Figure 2-1: Site Location Map

Note: FTD72 (Area B Groundwater) encompasses all of the groundwater beneath Area B

Site Management Plan
Fort Detrick
Frederick, MD

PIKA INTERNATIONAL, INC. ARCADIS

Figure 2-1
Site Location

Legend

- Operable Unit Boundary
- Area B Boundary
- Stream

Data Source: ESRI, ArcGISOnline, Aerial Photo

Coordinate System: Maryland State Plane
Datum: NAD 1983
Units: Feet

Figure 2-2: Area B Streams

Site Management Plan
Fort Detrick
Frederick, MD

PIKA INTERNATIONAL, INC. ARCADIS

Figure 2-2
Area B Streams

Legend

- Fort Detrick Boundary
- Stream

Data Source: ESRI, ArcGISOnline, Aerial Photo

Coordinate System: Maryland State Plane
Datum: NAD 1983
Units: Feet

3. Fort Detrick Site Descriptions

This section provides a summary of base-wide investigations as well as a brief history of CERCLA activities (chronology of significant CERCLA documents and milestones), a summary of the nature and extent of potential contamination, potential unacceptable risks, RAs, and the CERCLA path forward for each of the sites.

3.1. Base Wide Studies

3.1.1. Contamination Assessment Overview

The Army used Area B as the primary location for Fort Detrick's waste management activities. Prior to the 1970s, the Army used Area B for testing simulant biological materials. Although a list of live materials used in Area B is not available, the Army did use *Bacillus globigii, Serratia marcescens,* and *Escherichia coli* among its simulant materials. The Army buried test animals in trenches or pits in Area B after autoclave sterilization. Area B served as a disposal area for chemical, biological, and radiological material. Sterilized *Bacillus anthracis* was buried in Area B, and radiological tracer materials (including radioactive carbon, sulfur, and phosphorous) and two cylinders marked "Phosgene" were reportedly buried in Area B. Documentation shows that the pits were unlined, that they were not systematically numbered, that their locations were not accurately documented, and that individual pits were used for several different waste disposal purposes. Area B is also the location of a lined and permitted active municipal landfill, a research animal farm used by the Army Medical Research Institute of Infectious Diseases, a former skeet range, and a former explosives storage area.

Anticrop research was conducted at Fort Detrick Area B, some of which included biological agents as well as chemical herbicides and defoliants. Of particular concern was an agent identified as 2, 4, 5-T (trichlorophenoxyacetic acid). This is one of the major components of what became known as Agent Orange. The waste residuals of the demilitarization process were eventually placed in a landfill at Area B.

In 1970 and 1971, after the U.S. outlawed biological research for offensive operations, the Army began a decontamination and certification program at Fort Detrick's Area A laboratories. The Army used autoclave steam sterilization and incineration among its decontamination procedures. The entire biological (rice blast) anticrop stockpile was destroyed as part of the biological warfare demilitarization program completed in February 1973. Incineration ash from the decontamination process was tilled into the soil in the northwestern corner of Area B.

In 1977, severe soil erosion exposed buried scrap materials in several disposal areas and created several deep cavities in Area B; the Army subsequently covered these areas with soil. Contamination assessments at Fort Detrick started in 1977 when the U.S. Department of the Army Office of the Project Manager for Chemical Demilitarization and Installation Restoration directed an initial installation assessment at the site. The assessment indicated that activities at the installation could have resulted in releases of chemicals to the environment. Additionally, visible evidence of buried waste materials was observed. No unexploded ordnance has ever been found in the ensuing site investigations.

In 1981, the USEPA completed a Field Investigation of Uncontrolled Hazardous Waste Sites (Preliminary Assessment) that surmised that Area B may have been the disposal area for biological, chemical, radioactive, industrial, and munitions waste. The report surmised that despite the Army's efforts to decontaminate its facilities associated with biological research, there was a potential for *Bacillus*

anthracis contamination in some areas. USEPA recommended that the State and USEPA monitor the Army's investigations to address the potential for off-site migration of toxic materials and to delineate the potential hazards related to the possible presence of *Bacillus anthracis* cysts in the soil.

In February 1992, TCE concentrations above the MCL and elevated levels of trichloroflouromethane were detected in an Area B monitoring well sampled as part of Fort Detrick's state landfill permit requirements. In March 1992, Fort Detrick met with the U.S. Army Environmental Hygiene Agency (USAEHA) to discuss the elevated levels. Based on this meeting, the USAEHA began a study of the active landfill and Area B that included installation and sampling of monitoring wells. In February 1993 the report was published.

In October 1992, MDE sampled 21 residential wells in the vicinity of Fort Detrick Area B and found TCE concentrations above the MCL in four wells, all located along Shookstown Road / Montevue Lane, an east-west roadway outside of Area B's southeastern edge. Affected residents along Shookstown Road / Montevue Lane were supplied bottled water with subsequent connection of the homes to the City of Frederick water system.

From 1992 through 1993, various investigations were performed to evaluate conditions in Area B to locate potential burial sites, and determine the contamination present at the various Areas of Concern (AOC). Reports included geologic studies, soil gas surveys, geohydrologic studies, a preliminary SI, and various groundwater assessments.

From 1994 to the present, RIs were performed to assess the nature and extent of contamination and associated potential human health and ecological risks. The RI was conducted in two parts. Field activities associated with the Phase I RI occurred during 1994 and 1995. Sampling and monitoring operations associated with the phase II RI occurred in 1997, July 1998 and October 2000.

Since 1999, groundwater sampling has been conducted along the southern boundary of the facility and south of Area B-11. The samples show that the VOCs TCE and PCE are the major constituents. Data from groundwater sampling in 2005 map the TCE and PCE plume as extending from Area B's western boundary to its eastern boundary. However, because TCE was detected in an inactive/unused-residential well located on the southeastern portion of Shookstown Road near Carroll Creek, the plume may extend as far south as the location of this well.

In March 2001, a post-operation cleanup was performed at the former Area B skeet range (FTD-29) to excavate, remove, and dispose of lead shot and clay pigeon debris that was dispersed over an area approximately 565,487 square ft. In August 2005 an additional area by the firing line and pigeon throwers was scraped to remove clay pigeon debris missed during the first cleanup action.

The Army had previously used one portion of Area B, called Area B-11, as a chemical disposal area. From 2001 to 2004, the installation performed an interim removal action at Area B-11 (FTD-49) to remove potential intact drums of tetrachloroethene (PCE) and trichloroethene (TCE) thereby preventing further groundwater contamination. During this removal action, viable biological material was discovered commingled with the excavated hazardous waste. Because of this, Fort Detrick and the Army have decided to limit future intrusive activities into Area B disposal areas due to concerns regarding the safety of the onsite workers and other potential receptors and the associated costs. However, the project was

completed after the implementation of significant processes to ensure worker and public safety. While the removal action was completed, there is still some waste in place below the cap.

In September 2005, two groundwater samples collected from residential wells along Kemp Lane contained TCE or PCE at concentrations meeting the criteria for documenting Level I actual contamination under the Hazard Ranking System. The detected levels for TCE and PCE were below the MCL drinking water standard. In January 2006, bottled water was provided to five residences along Kemp Lane as proactive measure to ensure that human health was protected. These residences were ultimately connected to municipal water.

In February 2008 a NFA DD for five sites in Area B was signed. Sites Area B-Grid (FTD-05), Area B-Ammo (FTD-07), Area B-Skeet (FTD-29) and Area B-20 North/South (FTD-43) were closed out under the restoration program with no additional funding requirements.

In December 2007 and March 2009, DDs were signed selecting capping with land use controls (LUCs) for six restoration sites encompassing eight disposal areas. These areas include Area B-11 (FTD-49); Area B-2 (FTD-50); Area B-3 (FTD-51); Area B-6 (FTD-69); Areas B-8, Trenches N of B-8, and B-18 (FTD-70); and Area B-10 (FTD-71). Capping of the wastes is judged by the Army and regulating agencies to be the most protective measure in both the long and short-term.

Area B-11 (FTD-49); Area B-2 (FTD-50); Area B-3 (FTD-51); Area B-6 (FTD-69); Areas B-8, Trenches N of B-8, and B-18 (FTD-70); and Area B-10 (FTD-71) were capped with a geosynthetic impervious cap in January 2010; soil cover and seeding of the sites was finished in May 2010. The remedy was completed in June 2010. Long term monitoring (LTM) and maintenance of the cap are underway.

In April 2009, Area B Groundwater was added to the NPL. A FFA was signed by the USEPA on 17 December 2010 to address Area B Groundwater. In July 2010, a comprehensive Area B Groundwater RI Work Plan (Phase 3 RI) was approved by both USEPA and MDE. Work under the 2010 work plan was completed and the results were documented in a draft Conceptual Site Model (CSM). Based on comments received from USEPA additional data gaps were identified leading to the need for additional site investigation activities. A Phase 4 RI Work Plan Addendum was drafted and approved by USEPA and MDE in 2016 (ARCADIS 2016). Activities under the addendum were completed during spring and early summer 2017, and the results were presented in a draft Final RI Report, which was submitted in December 2019. Based on comments received from USEPA additional data gaps were identified leading to the need for additional RI activities (Phase 5). A contract has been awarded to address EPA comments on the Draft Final RI report, draft a Phase 5 RI Work Plan Addendum, complete associated field investigation activities, and incorporate additional investigative findings into the RI Report. This anticipated to be completed before the close of FY2024. This is described further in Section 3.2.12.4.

The Army has completed site inspections (SI) on seven sites across Area B. These sites included two herbicide sites, an inclined test shed, a test chamber, a toxic gas storage building, a rice blast disposal area, and a solvent storage area. The SI recommended further action for Field B and New Area 1 herbicide sites due to concentrations of arsenic and thallium (Field B only) exceeding USEPA Risk Based Screening Levels and site-specific background concentrations. A contract to complete additional investigation, in the form of an Expanded Site Inspection (ESI), has been awarded. The first phase of the ESI includes conducting an analysis of background concentrations of inorganics, as well as other contaminants associated with sites on Area A. The goal of the background analysis is to aid in

determining if the elevated concentrations observed are naturally occurring or are a result of a release. ESI field investigation activities will occur following the background investigation.

3.2. Site Descriptions

As listed previously in Table 1-1 in Section 1.2, a total of fourteen OUs have been identified on Area B. Nine of these OUs are associated with former waste disposal activities. Eight of the nine were capped based on the results of investigations conducted. During the capping effort six of the disposal areas were grouped and informally labeled the Western Disposal Area (WDA). Four non-contiguous caps make up the Western Disposal Area, which are described in more detail in the following sections. The remaining three disposal areas were not grouped. The descriptions below have been organized based on site type and the nine waste sites are listed first.

3.2.1. Area B-11 Chemical Waste Pits (FTD-49 / OU #1)

3.2.1.1. Site Description

This site currently addresses soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72).

Area B-11 is located on the southwest side of Area B within the WDA and consists of numerous disposal pits. This site is an open field bordered by a stand of trees to the north, Area B-8 to the east, and B-10/B-10 Grove to the southeast. This landfill is a 5.2-acre section of a larger 19.6-acre landfill complex. For administrative purposes, sections of this complex were broken out into three other AEDB-R sites: FTD 69 (Area B-6), FTD 70 (Area B-8), and FTD 71 (Area B-10).

Area B-11 is composed of a variety of disposal sites created from the early 1950s through approximately 1972. The individual disposal sites include general refuse trenches, a sludge pit, and acid and chemical disposal pits. Wastes buried in Area B-11 have been identified as the primary source of TCE and PCE contamination in Area B groundwater and surface water. A hot spot removal action was performed from 2001 to 2004 to remove potential intact drums of tetrachloroethene (PCE) and trichloroethene (TCE) thereby preventing further groundwater contamination. Approximately 3,494 tons of contaminated soil and waste material was removed that included chemical containers, approximately 59 intact and 35 perforated compressed gas cylinders, biological and medical waste including vials containing live pathogenic bacteria, and miscellaneous scrap material. All contaminated waste was disposed of properly off-site. A summary of relevant documents is presented in Table 3-1.

Table 3-1: Area B-11 Chemical Waste Pits (FTD 49 / OU #1)

Document	Author, Date	Administrative Record Number
Engineering Evaluation and Cost Analysis for the Area B-11 Disposal Pits, Fort Detrick, Frederick, Maryland. Final Document.	USACE. 2000	#00-05
Remedial Investigation for Area B, Fort Detrick, Frederick, Maryland. Draft Document.	USACE. 1998	#98-01
Fort Detrick Interim Removal Action, Area B-11 Disposal Pits, Technical Closure Report.	USACE. 2004	#04-06
Western Disposal Areas (FTDs 70, 71, 49) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2008	#08-05
Proposed Plan for Area B-3 Inactive (FTD 51), Area B-6 (FTD 69), and the Western Disposal Areas (FTDs 70, 71, 49), Fort Detrick, Maryland.	U.S. Army. 2009	#09-01
Decision Document for Area B-3 Inactive (FTD 51), Area B-6 (FTD 69), and the Western Disposal Areas (FTDs 70, 71, 49).	Shaw Environmental 2009	#09-03
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

Topography: The topography at Area B-11 slopes gently to the northeast, towards Area B-8.

Surface Water Hydrology: No streams or wetlands are present at the site.

Groundwater: Static water level measurements recorded during Area B periodic groundwater sampling events indicate that groundwater underlying Area B likely flows to the east-southeast towards the springs that drain into Carroll Creek, and ultimately, the Monocacy River.

3.2.1.2. Nature and Extent of Potential Contamination

The following metals and their associated maximum concentrations were selected as contaminants of potential concern (COPCs) in subsurface soil following excavation activities at Area B-11: arsenic (44.3 milligrams per kilogram [mg/kg]), chromium (105 mg/kg), iron (51,000 mg/kg), lead (895 mg/kg), thallium (4.2 mg/kg), and vanadium (1,950 mg/kg). Organic compounds and their associated maximum concentrations selected as COPCs in post-excavation subsurface soil at Area B-11 include: 1,1,2,2-tetrachloroethane (4.2 micrograms per kilogram [µg/kg]), 1,1,2-trichloroethane (3.4 µg/kg), 1,2-

dibromo-3-chloropropane (3.7 µg/kg), EDB (8.3 µg/kg), 1,2-dichloroethane (10.3 µg/kg), benzene (255 µg/kg), bromomethane (590 µg/kg), carbon tetrachloride (129 µg/kg), chloroform (730 µg/kg), methylene chloride (397 µg/kg), PCE (175,000 µg/kg), TCE (153,000 µg/kg), xylenes (total) (73,100 µg/kg), 1,2,4-trichlorobenzene (532,000 µg/kg), 3,3'-dichlorobenzidine (46.2 µg/kg), bis(2-chloroethyl)ether (5,540 µg/kg), hexachlorobenzene (872 µg/kg), naphthalene (281 µg/kg), nitrobenzene (735 µg/kg), N-nitrosodi-n-propylamine (238 µg/kg), N-nitrosodiphenylamine (3,1204 µg/kg), 4,4'-DDD (2,780,000 µg/kg), 4,4'-DDE (11,600,000 µg/kg), 4,4'-DDT (6,178 µg/kg), aldrin (5,486 µg/kg), delta-BHC (682 µg/kg), dieldrin (3,830 µg/kg), endrin (524,000 µg/kg), heptachlor epoxide (10,873 µg/kg), heptachlor (1,098 µg/kg), and lindane (113 µg/kg).

3.2.1.3. Potential Risks

Risk assessments are a critical part of the RI step in the CERCLA process. Human and Ecological Health risk assessments are performed to characterize how threatening a hazardous waste site is to human health and the environment. Once the risks are characterized, the risks are used to develop cleanup goals that are used to evaluate and select appropriate remedial alternatives for the site. Risk assessments are done before any cleanup or remedial actions have been taken and therefore represent pre-remedial action conditions.

Human Health Risk Assessment (HHRA):

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. A solar farm project was completed in FY15 in areas adjacent to disposal Areas B-2, B-8, and B-18. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers. In the future, land use in the disposal sites is expected to remain open space.

A streamlined Human Health Risk Assessment (HHRA) was conducted that identified the following hypothetical exposure pathways for the site:

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

Ecological Risk:

A Screening Level Ecological Risk Assessment (SLERA) was conducted to assess the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.1.4. Activities Completed / Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in March 2009 which selected capping with LUCs as the preferred remedy. MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cover (the remedy) was in place in January 2010. Soil cover and seeding was completed in May 2010. Long-term operation and maintenance of the cap and LUCs with annual monitoring and five-year reviews will remain in place indefinitely. Area B-11 was capped under a common contiguous cap with Area B-8 and the Trenches North of Area B-8. The Area B landfill caps are depicted on Figure 3-1.

The initial operation and maintenance (O&M) activities consisted of monthly inspections and maintenance activities until the sufficient vegetative cover was established. O&M activities under this plan consisted of semi-annual cap inspections, after the first mowing of the vegetative cover each year during late spring and again after the last cut in fall. This plan included the monitoring of the vegetative cover establishment during O&M inspections. Percent vegetative coverage in each cap area, including adjoining areas, was estimated and noted on cap area drawings. Reseeding of cap areas took place on a yearly basis as necessary.

In addition to the initial O&M activities the caps are also inspected for any visually detectable erosion including but not limited to small rills, cracks, or sloughing and displacement of final cover soils. Erosion, visible settlement, depressions, evidence of animal burrowing, such as holes in the final cover layer, are documented on area drawings, photographed, and marked in the field for further assessment and, if needed, repaired on a yearly basis. In addition, exposed and damaged geosynthetics are identified, documented on area drawings, photographed, and flagged or otherwise marked in the field for further assessment and repair by a qualified geosynthetics installer. Gas vents and signage are also inspected.

In June 2016 the Army finalized a Cap Inspection and Monitoring Work Plan for the landfill caps on Area B. This expanded work plan includes all the previously described physical inspection, maintenance /repair activities and added semi-annual groundwater monitoring. The monitoring activities under the Cap Inspection and Monitoring Work Plan are reported on a semi-annual basis. As part of the Cap Inspection and Monitoring Plan a groundwater monitoring well network was established for each capped disposal area. The groundwater monitoring network was expanded in partnership with the USEPA and includes an additional sixteen new groundwater monitoring wells across Area B. The installation of the wells was completed in April of FY 2018. The O&M/LTM began in May of 2016 and included only the currently existing groundwater monitoring wells. The Area B landfill caps are depicted on Figure 3-1. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.2. Areas B-8, Trenches North of B-8 and B-18 (FTD-70 / OU #9, #10, #12)

These sites currently address soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72). Areas B-8, Trenches North of B-8, and B-18 are near each other and combined make up the Western Disposal Area (WDA).

3.2.2.1. Site Descriptions

Area B-8

Area B-8 is located approximately in the center of the WDA. Area B-8 is a grass-covered field bounded by Area B-10 Grove to the southeast and Area B-11 to the southwest. Based on an analysis of historical maps, aerial photos, geophysical surveys, and soil borings, the limits of Area B-8 waste has been defined as a 2.4-acre area.

Waste burial activities were conducted in Area B-8 from 1948 until 1972. Based on historical records of waste disposal and analysis of soil and waste samples collected from the site, the types of material present are expected to include metal, wood, and general debris from laboratory remodeling and building demolition, possibly including decontaminated (sterilized) materials from Fort Detrick laboratories dismantled in the early 1950s. Area B-8 also may have received radioactive carbon, sulfur, and phosphorus compounds, as well as sludge from the decontaminating plant that had been found to contain *Bacillus anthracis*. Hypochlorite was mixed with the sludge as it was removed from the holding tanks to sterilize it prior to burial.

Trenches North of Area B-8

The Trenches North of Area B-8 are located north of Area B-8 and make up the northern portion of the WDA. The site encompasses a 0.97-acre area and consists of three parallel, north-south trending, elongated depressions located to the north of Area B-8. The depressions range from approximately 250 to 350 ft in length, are 10 ft wide, 30 to 45 ft apart, 2 ft deep and are in a grassy field that borders a wooded area to the west-northwest.

The Trenches North of Area B-8 were not annotated on historical drawings and therefore disposal activities at these locations are unknown. Historical aerial photographs suggest that the trenches were created around 1958. Based on field observations, geophysical data, and visual subsurface observations, it is likely that the three elongated depressions north of Area B-8 represent trenches that were used to bury animal bedding material.

Area B-18

Area B-18 is a former sinkhole that is no longer active and located within a small patch of trees northeast of the Trenches North of Area B-8. The site encompasses approximately 0.4 acres and was a former waste disposal site reportedly used by the Army until 1950 to dispose of various types of waste materials. Although surface debris was evident at the site, it was uncertain whether subsurface disposal activity by the Army occurred. Recent efforts to remove the surface debris have confirmed that subsurface waste is also present. Therefore, this site was capped with the rest of the WDA.

An investigation in 1995 was conducted by collecting soil samples from five soil borings located in an area of apparently disturbed soils observed in a 1963 aerial photograph that was not attributed to another environmental site. No waste material was encountered in any of the borings.

Topography : Area B-8 lies north of Area B-10 Grove and northeast of Area B-11. The topography is relatively flat and slopes gently to the northeast. The Trenches North of Area B-8, as the name implies, are located to the north of Area B-8.

Surface Water Hydrology: No streams or wetlands lie within the WDA. Surface water runoff follows topography.

Soil Types: Most of Area B-8 and the Trenches North of Area B-8 are located within the Augusta soil type, while the remainder of the WDA is located within the Duffield and Frankstown soil types.

Groundwater: Groundwater typically flows south and east in this area with groundwater flow ranges from 79-246 ft per day with a mean value of 151 ft per day, based on the 1995 dye trace study.

A summary of relevant documents is presented in Table 3-2.

Table 3-2: Areas B-8, Trenches North of B-8 and B-18 (FTD 70 / OU #9)

Document	*Author, Date*	*Admin Record Number*
Area B-18 (FTD-70) Data Report, Fort Detrick, Maryland.	U.S. Army. 2008	#08-14
Western Disposal Areas (FTDs-70, -71, -49) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2008	#08-05
Proposed Plan for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49), Fort Detrick, Maryland.	U.S. Army. 2009	#09-01
Decision Document for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49).	Shaw Environmental. 2009	#09-03
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

3.2.2.2. Nature and Extent of Potential Contamination Area B-8

Analytical sampling of soil identified COPCs above screening levels; however, there were no indications of hot spots where gross contamination was evident. COPCs and their associated maximum concentrations were: arsenic (22 mg/kg), chromium (46.9 mg/kg), iron (98,000 mg/kg), vanadium (210 mg/kg), benz(a)anthracene (2,000 µg/kg), alpha-BHC (47.9 µg/kg), and delta- BHC (1.15 µg/kg).

Trenches North of Area B-8

Analytical sampling of soil identified COPCs above screening levels; however, there were no indications of hot spots where gross contamination was evident. COPCs and their associated maximum concentrations were: arsenic (45.1 mg/kg), chromium (70.1 mg/kg), iron (100,000 mg/kg), thallium (9.02 mg/kg), and chloroform (5.4 µg/kg).

Area B-18

Analytical results from the soil samples indicated that only one VOC (acetone) and six SVOCs were detected at concentrations well below residential screening levels. One pesticide (dieldrin) was detected at an estimated concentration below the certified reporting limit. PCBs and herbicides were not detected. Metals detected above alluvial soil background and current residential screening levels included: aluminum, iron, thallium, and vanadium. These metals each only exceeded screening levels in two samples. Manganese was detected above alluvial soil background and current industrial screening levels in one soil sample.

3.2.2.3. Potential Risks

Human Health Risk Assessment:

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. In the future, land use in the disposal sites is expected to remain open space. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers.

A streamlined HHRA was conducted that identified the following hypothetical exposure pathways for the site:

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to

conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

Ecological Risk:

A SLERA was conducted to assess the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.2.4. Activities Completed Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in March 2009 which selected capping with LUCs as the preferred remedy. The MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cap (the remedy) was in place in January 2010. Soil cover and seeding was completed in May 2010. Areas B-8 and the Trenches North of B-8 were capped under one common contiguous cap with Area B-11. Area B-18 is capped under a non-contiguous, standalone cap. Areas B-8, B-18 and Trenches North of B-8 caps underwent the initial O&M activities and are subject to the O&M/LTM Plan described in Section 3.2.1.4. The Area B landfill caps are depicted on Figure 3-1. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.3. Area B-10 and B-Grove (FTD-71 / OU #11)

3.2.3.1. Site Description

This site currently addresses soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72).

Area B-10

Area B-10 is in the southern portion of the WDA. The site is a sparsely wooded, open area surrounded by a grove of trees, which is referred to as B-10 Grove. Based on an analysis of historical maps, aerial photos, geophysical surveys, and soil borings, the limits of Area B-10 waste has been defined as a 1.2-acre area.

Waste burial activities were reportedly conducted in Area B-10 from 1965 to 1970, and included refuse, primarily bedding from normal animal farm operations. Area B-10 may have also received animal carcasses and special operations materials. Animal burial reportedly occurred when a laboratory incinerator was overloaded or down for repairs. The carcasses were reportedly sterilized by autoclave prior to burial.

Area B-10 Grove

Area B-10 Grove is a grove of trees surrounding Area-B-10. The grove of trees has been present for as long as the Army has owned the property, so there is no record of subsurface burial in the aerial photographic record. Analysis of historical maps, aerial photos, and geophysical surveys indicate that subsurface burial has not occurred at the site.

Surface debris has been found in the area. In March 2002, a reconnaissance of Area B-10 Grove found a variety of items on the surface including two empty 1-gallon metal chlordane containers, various broken glass debris (pipettes, test tubes, syringes without needles, and bottles), mouse traps, a half buried crumpled drum and garbage can, and a plastic industrial syringe with no measurement markings.

Topography: Area B-10 is located to the southeast, and includes a relatively flat clearing surrounded by trees. Area B-10 Grove is a stand of trees that lies to the north and east of Area B-10. Topography for Area B-10 and B-10 Grove slopes gently to the north and east.

Surface Water Hydrology: No streams or wetlands lie within the WDA. Surface water runoff follows topography.

Soil Types: Most of Areas B-8 and the Trenches North of Area B-8, are located within the Augusta soil type, while the remainder of the WDA is located within the Duffield and Frankstown soil types.

Groundwater: Groundwater typically flows south and east in this area with groundwater flow ranges from 79-246 ft per day with a mean value of 151 ft per day, based on the 1995 dye trace study.

A summary of relevant documents is presented in Table 3-3.

Table 3-3: Area B-10 and B-10 Grove (FTD 71 / OU #11)

Document	*Author. Date*	*Admin Record Number*
Area B-18 (FTD-70) Data Report, Fort Detrick, Maryland.	U.S. Army. 2008	#08-14
Western Disposal Areas (FTDs-70, -71, -49) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2008	#08-05
Proposed Plan for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49), Fort Detrick, Maryland.	U.S. Army. 2009	#09-01
Decision Document for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49).	Shaw Environmental. 2009	#09-03
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01

Document	*Author. Date*	*Admin Record Number*
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

3.2.3.2. Nature and Extent of Potential Contamination

Analytical sampling of soil identified COPCs above screening levels at Area B-10; however, there were no indications of hot spots where gross contamination was evident. COPCs and their associated maximum concentrations were: arsenic (21 mg/kg), iron (84,000 mg/kg), manganese (4,700 mg/kg), and vanadium (240 mg/kg). No hazardous materials were found at Area B-10 Grove. The items were generally found on the margins of B-10 Grove rather than the interior.

3.2.3.3. Potential Risks

Human Health Risk Assessment:

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. In the future, land use in the disposal sites is expected to remain open space. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers.

A streamlined HHRA was conducted that identified the following hypothetical exposure pathways for the site.

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

Ecological Risk:

A SLERA was conducted to assess the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.3.4. Activities Completed Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. Containment was selected in accordance with the USEPA Presumptive Remedy for CERCLA Municipal Landfills. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in March 2009 which selected capping with LUCs as the preferred remedy. The MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cap (the remedy) was in place in January 2010. Soil cover and seeding was completed in May 2010. As stated previously, no hazardous materials were found at Area B-10 Grove therefore this area was not capped. Area B-10

was capped under two non-contiguous caps. The Area B-10 caps underwent the initial O&M activities and are subject to the O&M/LTM Plan described in Section 3.2.1.4. The Area B landfill caps are depicted on Figure 3-1. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.4. Area B-6 (FTD-69 / OU #8)

3.2.4.1. Site Description

This site currently addresses soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72).

Area B-6 is located in the southwest portion of Area B. A dirt access road essentially defines the northern border of Area B-6. Area B-6 was operational during the 1950s. Based on historical records of waste disposal and analysis of soil and waste samples collected from the site, the types of material present are expected to include metal, wood, and general debris from laboratory remodeling and building demolition, possibly including decontaminated (sterilized) materials from Fort Detrick laboratories dismantled in the early 1950s. This area also received autoclaved carcasses of animals ranging from mice to horses. Animals used in special operations, involving live biological agents, were routinely incinerated before burial. Some carcasses may not have been incinerated prior to disposal, but all were reportedly disinfected by autoclave prior to leaving the laboratory. Based on an analysis of historical maps, aerial photos, geophysical surveys, and soil borings, the limits of Area B-6 waste has been defined as a 2.6-acre area. A summary of relevant documents is presented in Table 3-4.

Table 3-4: Area B-6 (FTD 69 / OU #8)

Document	*Author. Date*	*Admin Record Number*
Area B-6 (FTD-69) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2007	#07-03
Proposed Plan for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49), Fort Detrick, Maryland.	U.S. Army. 2009	#09-01
Decision Document for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49).	Shaw Environmental. 2009.	#09-03
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

Topography: Elevations at the site range from 355 to 385 ft above msl, and topography slopes to the south and southeast at up to 10%.

Surface Water Hydrology: No streams lie within Area B-6. However, a small stream referred to as Stream 2 flows just south of Area B-6 and the Area B installation boundary. Portions of Area B-6 lie within the 5-year floodplain of Stream 2 and minor wetlands are also present at the site. Surface water runoff follows topography.

Soil Types and Geology: A review of soil boring logs, well installation logs, and geotechnical data collected from Area B-6 indicates that the undisturbed soils within the footprint of Area B-6 most likely represent Augusta series and Duffield series soils. Although groundwater flow generally follows topography which is to the south and southeast; static water level measurements indicate that groundwater flow is to the east and northeast.

3.2.4.2. Nature and Extent of Potential Contamination

Analytical sampling of soil identified COPCs above screening levels; however, there were no indications of hot spots where gross contamination was evident. COPCs and their associated maximum concentrations were: arsenic (17 mg/kg), chromium (80.57 mg/kg), iron (88,000 mg/kg), vanadium (260 mg/kg), 2-methylnaphthalene (10,000 µg/kg), 3,3'-dichlorobenzidine (41 µg/kg), benzo(a)pyrene (10,000 µg/kg), chloroform (12 µg/kg), naphthalene (30,000 µg/kg), PCE (17 µg/kg), and TCE (500 µg/kg) in soil. No COPCs were identified for surface water or sediment.

3.2.4.3. Potential Risks

Human Health Risk Assessment:

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. In the future, land use in the disposal sites is expected to remain open space. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers.

A streamlined HHRA was conducted that identified the following hypothetical exposure pathways for the site:

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially

pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

Ecological Risk:

A SLERA was conducted to assess the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.4.4. Activities Completed Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. Containment was selected in accordance with the USEPA Presumptive Remedy for CERCLA Municipal Landfills. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in March 2009 which selected capping with LUCs as the preferred remedy. MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cap (the remedy) was in place in January 2010. Soil cover and seeding was completed in May 2010. The Area B landfill caps are depicted on Figure 3-1. The Area B-6 cap underwent the initial O&M activities and are subject to the O&M/LTM Plan described in Section 3.2.1.4. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.5. Landfill B-2 (FTD-50 / OU #2)

3.2.5.1. Site Description

This site currently addresses soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72).

Area B-2 is located on the east side of a grassy mound within the animal farm pastures of United States Army Medical Research Institute of Infectious Diseases. A series of animal fences currently encloses the site. Based on an analysis of historical maps, aerial photos, geophysical surveys, and soil borings, the limits of buried waste were delineated as a 0.9-acre area. A summary of relevant documents is presented in Table 3-5.

Table 3-5: Area B-2 landfill (FTD 50 / OU #2)

Document	*Author. Date*	*Admin Record Number*
Area B-2 (FTD 50) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2006	#06-06
Proposed Plan for Area B-2 (FTD 50), Fort Detrick, Maryland.	U.S. Army. 2007	#07-07
Decision Document for Area B-2 (FTD 50).	Shaw Environmental. 2007	#08-04
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

Topography: Elevations at the site range from 365 to 390 feet above mean sea level (msl), and topography slopes primarily to the east at an average grade of approximately 8 percent.

Surface Water Hydrology: No streams, storm sewer systems, or wetlands lie within 1,000 ft of the site. Surface water runoff follows topography.

Soil Types and Geology: Area B-2 is located within the silts and sands of the Penn series soil, which forms in place from decomposition of the underlying shale, siltstone, and sandstone bedrock of the Triassic New Oxford Formation.

Groundwater: Groundwater in the bedrock flows primarily to the east through bedding plane partings.

3.2.5.2. Nature and Extent of Potential Contamination

Based on historical records of waste disposal and analysis of soil and waste samples collected from the site, the types of material present are expected to include metal, wood, and general waste, possibly including decontaminated (sterilized) materials from Fort Detrick laboratories dismantled in the early 1950s. Although analytical sampling of soil identified COPCs above screening levels, there were no indications of hot spots where gross contamination was evident.

Contaminants of potential concern and their associated maximum concentrations were: arsenic (18 mg/kg), chromium (70.7 mg/kg), iron (71000 mg/kg), manganese (6400 mg/kg), thallium (10 mg/kg), vanadium (260 mg/kg), aldrin (160 µg/kg), Aroclor-1254 (1.29 mg/kg), benz(a)anthracene (6000 µg/kg), benzo(a)pyrene (5000 µg/kg), enzo(b)fluoranthene (5000 µg/kg), and heptachlor epoxide (82 µg/kg).

3.2.5.3. Potential Risks

Human Health Risk Assessment:

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. In the future, land use in Area B-2 is expected to remain agricultural fields. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers.

A streamlined HHRA was conducted that identified the following hypothetical exposure pathways for the site:

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the site and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. The following chemicals were present at the site at concentrations that exceeded screening values: arsenic, chromium, iron, manganese, thallium, vanadium, aldrin, Aroclor-1254, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and heptachlor epoxide.

Ecological Risk:

A SLERA was conducted for Area B-2, which assessed the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.5.4. Activities Completed Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. Containment was selected in accordance with the USEPA Presumptive Remedy for CERCLA Municipal Landfills. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in February 2008 which selected capping with LUCs as the preferred remedy. The MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cap (the remedy)

was in place in January 2010. Soil cover and seeding was completed in May 2010. Long-term operation and maintenance of the cap and LUCs with annual monitoring and five-year reviews will remain in place. The Area B landfill caps are depicted on Figure 3-1. The Area B-2 cap underwent the initial O&M activities and are subject to the O&M/LTM Plan described in Section 3.2.1.4. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.6. Landfill B-3 (FTD-51 / OU #7)

3.2.6.1. Site Description

This site currently addresses soil contamination only. Because of the complexity of the Area B disposal sites, the groundwater component for this site and all other Area B sites was broken out as a separate site called Area B Groundwater (FTD 72).

Area B-3 Inactive consists of two separate areas, referred to as B-3 West and B-3 East. B-3 West is immediately adjacent to the operating landfill, with its northern border defined by the southern edge of the active landfill liner. This area operated as Fort Detrick's sanitary landfill from the 1970s through 1990 and received various types of waste. When the current, active landfill liner was installed in 1990, it effectively capped a portion of the older landfill, leaving B-3 West un-capped. The actual limits of B-3 West waste have been defined as a 2.8-acre area.

Area B-3 East is the older disposal area, located on the north side of a grassy slope near the active landfill gate. B-3 East is physically separated from B-3 West and the active landfill by an access road and fence. This site is believed to have been in operation during the late 1950s or early 1960s. Wastes reportedly included metal and general debris, and decontaminated (sterilized) materials from Area A laboratories. The actual limits of B-3 East waste have been defined as a 0.4-acre area.

A summary of relevant documents is presented in Table 3-6.

Table 3-6: Landfill B-3 (FTD 51 / OU #7)

Document	*Author. Date*	*Admin Record Number*
Area B-3 Inactive (FTD-51) Remedial Investigation/Feasibility Study, Fort Detrick, Maryland.	U.S. Army. 2008	#08-06
Proposed Plan for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49), Fort Detrick, Maryland.	U.S. Army. 2009	#09-01
Decision Document for Area B-3 Inactive (FTD-51), Area B-6 (FTD-69), and the Western Disposal Areas (FTDs-70, -71, -49).	Shaw Environmental. 2009	#09-03
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland	ARCADIS U.S., Inc. 2016	#16-01

Document	Author. Date	Admin Record Number
Fort Detrick Area B Landfills (FTD-49,50,51, 69, 70, 71) 2014 Five Year Review	USACE. 2017	#17-01

Topography: Elevations range from 376 to 404 ft above msl at Area B-3 Inactive, which represents a topographic high for all of Area B.

Surface Water Hydrology: No streams or wetlands lie within Area B-3 Inactive. Surface water runoff follows topography. There are artificially engineered storm water management ditches associated with the active landfill. The closest natural stream to Area B-3 Inactive is approximately 1,000 ft to the north.

Soil Types and Geology: Area B-3 Inactive is predominantly located within the silts and sands of the Penn series soil, which forms in place from decomposition of the underlying shale, siltstone, and sandstone bedrock of the Triassic New Oxford Formation.

Groundwater: Groundwater in the bedrock flows primarily to the east through bedding plane partings.

3.2.6.2. Nature and Extent of Potential Contamination

Analytical sampling of soil identified COPCs above screening levels; however, there were no indications of hot spots where gross contamination was evident. COPCs and their associated maximum concentrations were: arsenic (18 mg/kg), chromium (89 mg/kg), iron (63,000 mg/kg), manganese (1,660 mg/kg), vanadium (240 mg/kg), and 4,4'- DDT (1,700 µg/kg).

3.2.6.3. Potential Risks

Human Health Risk Assessment:

Currently, land use in Area B is industrial. Workers, including caretakers performing mowing or maintenance activities, and personnel conducting maintenance activities in Area B buildings, have the greatest potential for frequent exposure to environmental media at Fort Detrick. In the future, land use in the disposal sites is expected to remain open space. An upgraded Area B fence has been installed and a planned controlled gate facility is likely to reduce the potential for trespassers.

A streamlined HHRA was conducted that identified the following hypothetical exposure pathways for the site:

- Site workers and visitors potentially ingesting, contacting, and inhaling contaminants at the site
- Off-site residents potentially inhaling airborne contaminants
- Site workers, visitors, and off-site residents potentially ingesting, contacting, and inhaling contaminants that have migrated via runoff and surface water
- Off-site residents potentially ingesting, contacting, and inhaling contaminants migrated via groundwater

The streamlined risk assessment identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

The streamlined risk assessments identified COPCs based on soil/waste samples collected from the sites and analyzed for a variety of contaminants. Concentrations detected in the samples were compared to conservative screening values to identify which chemicals are present at concentrations that potentially pose a health concern. Chemicals are present at the site in soil and groundwater at concentrations that exceed screening values.

Ecological Risk:

A SLERA was conducted to assess the potential for adverse effects to non-human receptors resulting from exposure to site chemicals. Chemicals of potential ecological concern were identified.

3.2.6.4. Activities Completed Path Forward

A response action was deemed necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants or contaminants from the sites that may present an imminent and substantial endangerment to public health or welfare. The remedy selected was capping with (LUCs and LTM. The selected remedy utilizes containment as a principal element, which does not satisfy the statutory preference for treatment as a principal element of the remedy. Containment was selected in accordance with the USEPA Presumptive Remedy for CERCLA Municipal Landfills. The selected remedy interrupts exposure pathways that result from direct contact with the soil and waste material at the site. Risks from contaminated groundwater are not addressed. Groundwater and surface water for all of Area B is currently being investigated as a separate study site under Site FTD 72 and will be addressed under a separate DD.

A DD was signed in March 2009 which selected capping with LUCs as the preferred remedy. The MDE approved capping design plans on June 23, 2009. Cap construction activities began June 25, 2009. Weather events caused significant delays in construction activities. The impervious cap (the remedy) was in place in January 2010. Soil cover and seeding was completed in May 2010. As mentioned previously Area B-3 consists of two non-continuous areas, which were capped separately. The Area B landfill caps are depicted on Figure 3-1. The Area 3 caps underwent the initial O&M activities and are subject to the O&M/LTM Plan described in Section 3.2.1.4. Semi-annual O&M, LTM and five-year reviews will remain in place indefinitely.

3.2.7. Area B-Grid (FTD-05 / OU #3)

3.2.7.1. Site Description

Area B-Grid is located in the center of Area B and was previously used as a test grid in the late 1940s to observe the dissemination of biological stimulants that were either airdropped or dispersed as aerosols with detonation using compressed gas or a small explosive charge. The biological stimulants included *Serratia marcesens* and *Bacillus globigii*, which are non-pathogenic microorganisms that are easily detected. Metal residue of explosive containers/casings was the main source of concern for the surface and subsurface soils in the area.

Area B-Grid (FTD-05) was identified in the USEPA Aerial Photographic Analysis for the years 1952, 1958, 1964, and 1970. Review of the aerial photographs reveal that other than the concentric air monitoring stations observed in the photos, no other activities are observed in the Environmental Protection Information Center study.

Area B-Grid (FTD-05) was investigated during a 1995 Phase I RI and a 2004 Environmental Investigation. Both surface and near surface soil samples were collected during the 1995 Phase I RI and during the 2004 investigation. A RI was performed in September 2006, which consisted of a HHRA and a SLERA, and indicated that there are no unacceptable human and ecological risks for Area B-Grid (FTD-05) attributable to a CERCLA release. A summary of relevant documents is presented in Table 3-7.

Table 3-7: Area B Grid (FTD 05 A / OU #3)

Document	*Author. Date*	*Admin Record Number*
Areas B-Ammo Original and Outside, B Grid, B-20 North and B-20 South Installation Restoration Program Site Close-Out Document.	USACE. 2005	N/A
Area B-Skeet (IRP Site 29) Installation Restoration Program Site Close-Out Document. Draft	USACE. 2005	N/A
Fort Detrick Remedial Investigation of Five Sites in Area B.	USACE. 2006	#06-07
Fort Detrick Proposed Plan of Five Sites in Area B.	USACE. 2007	#07-08
Decision Document of Five Sites in Area B Areas B-Ammo, B-Grid, B-20 North and B-20 South, and B-Skeet (AEDB-R Sites FTD-07, FTD-05, FTD-43, and FTD-29).	USACE. 2008	#08-03

Physiography and Topography: Area B-Grid (FTD-05) is a circular area located in the center of Area B. The grid was laid out as a series of seven concentric circles with measurement devices from 50 to 1,000 ft from the center. The relic outline of this grid is still discernible, and the area is currently used as open land and for the animal farm. Elevations at the site range from approximately 340 to 380 ft above msl. The topography at the site slopes from the northwest to the southeast.

Surface Water Hydrology: Surface water runoff at the site is to the south/southeast towards an intermittent stream that flows from west to east across the southern portion of the site to Carroll Creek.

Soil Types: Soils in Area B-Grid (FTD-05) consist of four main soil types: Athol Gravelly Loam, Penn Shaly Loam, Augusta Gravelly Loam, and Lindside Silt Loam. The Athol and Penn series on the northern portion of the site were derived from Triassic-age bedrock, while the Augusta and Lindside present on the southern portion of the site developed from recent alluvial deposits.

Geology: Area B-Grid (FTD-05) is underlain by the Triassic-age shale of the New Oxford Formation throughout much of the site. The Cambrian-age limestone of the Frederick Formation is present in the northern and southern portions of the site. Depth to bedrock at the site ranges from 21 to 32 ft bgs.

Groundwater: Groundwater flow at the site is towards the southeast. Depth to groundwater ranges from 30 ft bgs in the northern portion of the site to 4 ft bgs in the southern portion of the site.

3.2.7.2. Nature and Extent of Potential Contamination

Based on previous studies, surface soil samples collected from Area B-Grid surface soil were analyzed for arsenic during the 2004 RI. Analytical results were compared to USEPA Region III Residential Risk Based Concentrations (RBC) and the 95 percent (%) Upper Confidence Limit (UCL) for background samples collected from the Triassic Conglomerate surface soil. Arsenic was detected at concentrations ranging from 2.7 to 5.7 mg/kg. Although these concentrations exceed the Residential RBC (0.43 mg/kg) and the Industrial RBC (1.9 mg/kg), all concentrations are below the background 95% UCL (5.77 mg/kg) for arsenic. This indicates that arsenic is naturally occurring in surface soil at Area B-Grid and is not the result of a CERCLA release.

Groundwater contamination is addressed under Area B Groundwater (FTD-72) to evaluate Area B groundwater as a whole.

3.2.7.3. Potential Risks

Adult Resident:

For the future adult resident, upper-bound excess lifetime cancer risks are within USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-Grid (FTD-05). Risks were primarily due to the ingestion of arsenic. Arsenic has been determined to be within Fort Detrick background levels. The total Hazard Index (HI) for the adult resident's exposure to total soil was less than 1.

Child Resident:

For the future child resident, upper-bound excess lifetime cancer risks are within USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-Grid (FTD-05). Risks were primarily due to the ingestion of arsenic in total soil. Arsenic has been determined to be within Fort Detrick background levels. The total HI for the child resident's exposure to total soil was greater than 1 (HI = 5.7). This exceedance was primarily due to iron, manganese, and vanadium in total soil. Iron and vanadium have been determined to be within background.

The concentration of manganese was above Fort Detrick background levels; however, there are no known sources of this inorganic at the site, as only the inorganics aluminum, antimony, barium, boron, calcium, copper, iron, lead, magnesium, nickel, potassium, sodium, tin, and zinc are associated with fuses, primers/detonators, bulk explosives, propellants, and propellant charges. This suggests that manganese is naturally occurring and not the result of a CERCLA release.

Ecological Risk:

A SLERA was performed to determine if there were any unacceptable ecological risks at this site. Based on the findings of the SLERA, NFA for ecological receptors is recommended for Area B-Grid. Because there are no elevated human health and ecological risks attributable to a CERCLA release associated with Area B-Grid (FTD-05), this site was eliminated from further investigation and was recommended for NFA.

3.2.7.4. Activities Completed Path Forward

As described in Section 3.1.1, a DD was issued in February 2008 and MDE concurred with the NFA decision in March 2008.

3.2.8. Area B-20 South (FTD-43 / OU #4)

3.2.8.1. Site Description

Area B-20 South (FTD-43) consists of an earthen-berm. The berm likely represents a mixture of soils derived locally. The bermed area was a former control burn area, for the destruction of explosives, located in the western portion of Area B within the B-Skeet Area (FTD-29). According to historical records, small quantities of explosives materials were placed in cardboard boxes and burned in the area surrounded by the earthen berm. The location was investigated to determine if the residue of the burned material may have affected the local soils.

Area B-20 South (FTD-43) surface and subsurface soil was investigated during a 1995 Phase I RI and a 1998 Phase II RI. A RI was performed in September 2006, which consisted of an HHRA and a SLERA, and indicated there are no unacceptable human and ecological risks for Area B-20 South (FTD-43) attributable to a CERCLA release.

Physiography: and Topography: Area B-20 South (FTD-43) consists of an approximately 10 ft high horseshoe-shaped earthen-berm which ranges in elevation from approximately 370 to 380 ft above msl. The berm itself is covered with trees and the area inside the berm is grass covered.

Surface Water Hydrology: Surface water runoff at the site is towards the east. There are no surface water bodies present on the site.

Soil Types: Soils in Area B-20 South (FTD-43) consist of alluvial derived soils that are clayey silts with trace quartz gravel.

Geology: Area B-20 South (FTD-43) is underlain by the Frederick Formation (Cambrian Limestone).

Groundwater: Groundwater at the site flows to the southeast. Depth to groundwater at the site is approximately 23 ft bgs.

A summary of relevant documents for these sites is presented in Table 3-8.

Table 3-8: Area B-20 South (FTD 43 / OU #4)

Document	*Author. Date*	*Admin Record Number*
Areas B-Ammo Original and Outside, B Grid, B-20 North and B-20 South Installation Restoration Program Site Close-Out Document.	USACE. 2005	N/A
Area B-Skeet (IRP Site 29) Installation Restoration Program Site Close-Out Document. Draft Final Document.	USACE. 2005	N/A
Fort Detrick Remedial Investigation of Five Sites in Area B.	USACE. 2006	#06-07
Fort Detrick Proposed Plan of Five Sites in Area B.	USACE. 2007	#07-08

Document	Author. Date	Admin Record Number
Decision Document of Five Sites in Area B Areas B-Ammo, B-Grid, B-20 North and B-20 South, and B-Skeet (AEDB-R Sites FTD-07, FTD-05, FTD-43, and FTD-29).	USACE. 2008	#08-03

3.2.8.2. Nature and Extent of Potential Contamination

Phase I Soil Investigation:

A sampling grid was established, and fifteen sampling points were selected using a random number generator. At each sampling point, samples were collected using trowels and hand augers. Two samples were collected from each location. One sample was collected from under the vegetative mat from 0-0.5 ft bgs and the second was collected from 0.5-1.5 ft bgs. All samples were field screened for Research Department Explosive using the USAEC colorimetric method and sent to the on-site laboratory for Target Compound List (TCL) semi-volatile organic compounds (SVOCs) and metals analyses using x-ray fluorescence (XRF). Analysis was conducted for the same parameters, the complete Target Analyte List (TAL) metals list, cyanide, and explosives.

Phase II Soil Investigation:

Phase II field activities consisted of the completion of two soil borings (RISB23 and RISB24) in Area B-20 South. Samples were collected from the borings to examine the main burn area within the berm. Three samples were collected from each boring and analyzed for TCL, VOCs, SVOCs, explosives, TAL metals, and cyanide. It should be noted that no debris or disposed materials were identified in any sample at Area B-20 South.

Surface Soil Results:

Surface soil samples were analyzed for VOCs, SVOCs, explosives, and metals. Analytical results were compared to USEPA Region III residential screening levels and the 95% UCL for background samples collected from Alluvial soil. A summary of the surface soil results from the 1995 and 1998 Phase I and II RI are summarized below.

VOCs, SVOCs, and Explosives:

- VOCs, SVOCs, and explosives were not detected at concentrations exceeding USEPA Region III Residential or Industrial screening levels in surface soil samples collected from Area B-20 South.

Metals:

- Arsenic was detected in eight samples at concentrations ranging from 5.55 to 17.9 mg/kg. One sample (RISB23AD – 17.9 mg/kg) exceeds the background screening value (13.0 mg/kg), the residential screening level (0.43 mg/kg), and the industrial screening level (1.9 mg/kg).
- Cadmium was detected in eight samples at concentrations ranging from 0.121 to 8.57 mg/kg. One sample (RISB24A – 8.7 mg/kg) exceeds the background screening value (0.088 mg/kg), the

residential screening level (3.9 mg/kg), but did not exceed the industrial screening level (51 mg/kg).

- Chromium was detected in nine samples at concentrations ranging from 19.3 to 37.6 mg/kg. Eight samples exceed the background screening value (19.9 mg/kg), and the residential screening level (23 mg/kg). No samples exceed the industrial screening level (310 mg/kg).
- Iron was detected in nine samples at concentrations ranging from 21,400 to 64,000 mg/kg. One sample (HAB20S4-B – 64,000 mg/kg) exceeds the background screening value (44,622 mg/kg) and the residential screening level (2,300 mg/kg) and the industrial screening level (31,000 mg/kg).
- Manganese was detected in nine samples at concentrations ranging from 1,300 to 14,000 mg/kg. One sample (HAB20S3-B – 14,000 mg/kg) exceeds the background industrial screening level (2,000 mg/kg).
- Nickel was detected in nine samples at concentrations ranging from 14.9 to 269 mg/kg. Four samples exceed the background screening value (19.9 mg/kg), and one sample (HAB20S3-B) exceeds the residential screening level (160 mg/kg). No samples exceed the industrial screening level (2,000 mg/kg).
- Thallium was detected in four samples at concentrations ranging from 1.14 to 1.51 mg/kg. Four samples exceed the background screening value (0.15 mg/kg) and residential screening level (0.55 mg/kg). No samples exceed the industrial screening level (7.2 mg/kg).
- Vanadium was detected in nine samples at concentrations ranging from 28.6 to 54.5 mg/kg. Two samples (HAB20S3-B, HAB20S4-B) exceed the background screening value (48.1 mg/kg) and residential screening level (7.8 mg/kg). No samples exceed the industrial screening level (102 mg/kg).

Subsurface Soil Results:

Subsurface soil samples were analyzed for VOCs, SVOCs, explosives and metals. Analytical results were compared to USEPA Region III residential screening levels and the 95% UCL for background samples collected from Alluvial soil. A summary of the subsurface soil results from the 1995 and 1998 Phase I and II RI are summarized below.

VOCs, SVOCs, and Explosives:

- VOCs, SVOCs, and explosives were not detected at concentrations exceeding USEPA Region III residential or industrial screening levels in subsurface soil samples collected from Area B-20 South.

Metals:

- Arsenic was detected in three samples at concentrations ranging from 10.5 to 21.6 mg/kg. Two samples (RISB23C, RISB24B) exceed the background screening value (13.0 mg/kg), the residential screening level (0.43 mg/kg), and the industrial screening level (1.9 mg/kg).
- Chromium was detected in four samples at concentrations ranging from 25.5 to 55.6 mg/kg. Four samples exceed the background screening value (19.9 mg/kg), and the residential screening level (23 mg/kg). No samples exceed the industrial screening level (310 mg/kg).
- Iron was detected in four samples at concentrations ranging from 38,100 to 75,000 mg/kg. Three samples exceed the background screening value (44,622 mg/kg) and the residential screening level (2,300 mg/kg) and the industrial screening level (31,000 mg/kg).
- Vanadium was detected in four samples at concentrations ranging from 49.6 to 67.5 mg/kg. Four samples exceed the background screening value (48.1 mg/kg) and residential screening level (7.8 mg/kg). No samples exceed the industrial screening level (102 mg/kg).

In 2015, soil from the existing berm on site was removed and used as daily cover on the Fort Detrick active sanitary landfill.

3.2.8.3. Potential Risks

Adult Resident:

For the future adult resident, upper-bound excess lifetime cancer risks are within the USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-20 South (FTD-43). Risks were primarily due to the ingestion and dermal absorption of arsenic. Arsenic has been determined to be within background. The total HI for the adult resident's exposure to total soil was greater than 1 (HI = 1.6), although no individual COPC was greater than 1. All these COPCs have been determined to be within background.

Child Resident:

For the future child resident, upper-bound excess lifetime cancer risks are within the USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-20 South (FTD-43). Risks were primarily due to the ingestion and dermal absorption of arsenic in total soil. Arsenic has been determined to be within background. The total HI for the child resident's exposure to total soil was greater than 1 (HI = 13.0). This exceedance was primarily due to iron, manganese, and vanadium in total soil, which have all been determined to be within background.

Ecological Risk:

A SLERA was performed to determine if there were any unacceptable ecological risks at this site. Based on the findings, NFA for ecological receptors is recommended for Area B-20 South (FTD-43). Because there are no elevated human health and ecological risks attributable to a CERCLA release associated

with Area B-20 South (FTD-43), this site was eliminated from further investigation and is recommended for NFA.

3.2.8.4. Activities Completed Path Forward

As described in Section 3.1.1, a DD was issued in February 2008 and MDE concurred with the NFA decision in March 2008.

3.2.9. Area B-20 North (FTD 43 / OU #13

3.2.9.1. Site Description

Area B-20 North (FTD-43) is a grass-covered area of approximately one acre located east of the active landfill. Historical use information indicates that this area was used as a controlled burn area for the destruction of explosives. In addition, explosives were placed in cardboard boxes and burned. This area is also indicated as a small arms firing range on a Fort Detrick historical map ("Area B Disposal Areas Detail Site Map," Drawing Number SK-5009). This area appears to have been operated from prior to 1952 through 1973.

Area B-20 North (FTD-43) was investigated during a Phase I RI in 1995, and a 2004 Environmental Investigation. During the 2004 Environmental Investigation, an EM-61 and EM-31 geophysical survey was conducted at this site. No electromagnetic anomalies potentially indicative of historically buried waste disposal structures were identified at Area B-20 North (FTD-43).

An RI was performed in September 2006, which consisted of an HHRA and a SLERA, and indicated that there are no unacceptable human and ecological risks for Area B-20 North (FTD-43) attributable to a CERCLA release.

Topography: Elevations at the site range from approximately 390 to 370 ft above msl. The topography at the site slopes from the west to the east.

Surface Water Hydrology: Surface water runoff at the site is to the northeast towards the northern tributary of Carroll Creek. There are no surface water bodies present on the site.

Soil Types: The soil in Area B-20 North (FTD-43) is described as a reddish-brown silt, with occasional gravel consisting of quartz or siltstone. This soil was derived from the weathering of the underlying Triassic shale bedrock. The depth to bedrock is uncertain; however, drilling logs for well BMW5D, located north of Area B-20 North (FTD-43), indicates an overburden thickness of approximately 13 ft. Thicknesses of at least this amount are expected in Area B-20 North (FTD-43).

Geology: Area B-20 North (FTD-43) is underlain predominantly by a calcium carbonate-rich Triassic-age shale of the New Oxford Formation. The Triassic sedimentary units are characteristically red or maroon in color.

Groundwater: Groundwater flow in the area is most likely towards the east and northeast. Depth to groundwater at the site is approximately 50 ft bgs.

A summary of relevant documents for these sites is presented in Table 3-9.

Table 3-9: Area B-20 North (FTD 43 / OU #13)

Document	*Author. Date*	*Admin Record Number*
Areas B-Ammo Original and Outside, B Grid, B-20 North and B-20 South Installation Restoration Program Site Close-Out Document.	USACE. 2005	N/A
Area B-Skeet (IRP Site 29) Installation Restoration Program Site Close-Out Document. Draft Final Document.	USACE. 2005	N/A
Fort Detrick Remedial Investigation of Five Sites in Area B.	USACE. 2006	#06-07
Fort Detrick Proposed Plan of Five Sites in Area B.	USACE. 2007	#07-08
Decision Document of Five Sites in Area B Areas B-Ammo, B-Grid, B-20 North and B-20 South, and B-Skeet (AEDB-R Sites FTD-07, FTD-05, FTD-43, and FTD-29).	USACE. 2008	#08-03

3.2.9.2. Nature and Extent of Potential Contamination

To assess the potential for buried waste material and lead debris in the revetment, an EM-61 and EM-31 geophysical survey was conducted over the target areas located both inside and outside the formerly fenced revetment area. Soil samples were to be collected from areas where anomalies were detected during the geophysical survey. As no anomalies were detected, four surface and subsurface soil samples were collected in the former revetment (two samples from the floor of the former revetment area and two samples from the area of the former face). Two samples were also collected from former bunker areas and two samples were collected from the bottom of the septic drain field that emanated from the vicinity of Building 1222.

Possible Bunker Storage Area (Samples 20N1 and 20N2)

Surface soil samples 20N1 and 20N2 were collected from this area and analyzed for explosives. Explosives were not detected in either of the samples.

Drain Field Area (Samples 20N3 and 20N4)

Subsurface soil samples were collected from the Drain Field Area and were analyzed only for TAL metals. Four metals (chromium, iron, manganese, and thallium) were detected at concentrations exceeding their background 95% UCLs and residential screening levels in the two samples. Iron was the only metal that also exceeded its industrial screening level in the samples. A more detailed discussion of the results is presented below.

Revetment Area (Samples 20N5A/B – 20N8A/B)

Surface Soil:

Surface soil samples (20N5A through 20N8A) were collected from the Revetment Area and were analyzed for TAL metals and explosives. Explosives were not detected in either of the two samples. Chromium, thallium, and vanadium concentrations exceeded their background 95% UCLs and residential screening levels in each of four samples, while iron exceeded its background 95% UCL and residential screening level in sample 20N8A. Arsenic exceeded its background 95% UCL and industrial screening level in sample 20N5A and iron exceeded its background 95% UCL and industrial screening level in samples 20N5A, 20N6A, and 207A.

Subsurface Soil:

Subsurface soil samples (20N5B through 20N8B and duplicate sample 20N7BD) were collected from the Revetment Area and were analyzed for TAL metals and explosives. Explosives were not detected in any of the samples. Chromium and vanadium concentrations exceeded their background 95% UCLs and residential screening levels in all the samples. Background 95% UCLs and residential screening levels were exceeded in two samples for manganese and three samples for thallium. Iron exceeded industrial screening levels in four out of five samples.

In 2015, soil from the existing berm on site was removed and used as daily cover on the Fort Detrick active sanitary landfill.

3.2.9.3. Potential Risks

Adult Resident:

For the future adult resident, upper-bound excess lifetime cancer risks are within USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-20 North (FTD-43). Risks were primarily due to the ingestion and dermal absorption of arsenic. Arsenic has been determined to be within background. The total HI for the adult resident's exposure to total soil was less than 1.

Child Resident:

For the future child resident, upper-bound excess lifetime cancer risks are within USEPA's target risk range ($1x10^{-6}$ to $1.0x10^{-4}$) for total soil at Area B-20 North (FTD-43). Risks were primarily due to the ingestion and dermal absorption of arsenic in total soil. Arsenic has been determined to be within background. The total HI for the child resident's exposure to total soil was greater than 1 (HI = 5.3). This exceedance was primarily due to iron, manganese, and vanadium in total soil. Iron and manganese have been determined to be within background. Vanadium was above background; however, there are no known sources of vanadium at Area B-20 North (FTD-43). This suggests that vanadium is naturally occurring and not the result of a CERCLA release.

Ecological Risk:

The results of the SLERA suggest some potential hazards due to chromium, thallium, and vanadium which were above background. It should be noted that even though concentrations of chromium, thallium, and vanadium were above background, there are no known sources of these three inorganics at the site, as only the inorganics aluminum, antimony, barium, boron, calcium, copper, iron, lead,

magnesium, nickel, potassium, sodium, tin, and zinc are associated with small arms ammunition, fuses, primers/detonators, bulk explosives, propellants, and propellant charges. This suggests that the levels of these three inorganics are naturally occurring and not the result of a CERCLA release.

One food-chain driver (chromium) was associated with estimated No-Observed-Adverse-Effect Level (NOAEL) and Lowest-Observed-Adverse-Effect Level (LOAEL) Environmental Effects Quotients (EEQs), respectively, of 10.6 and 2.1 for the American robin. Although estimated hazards were above 10 for one of the evaluated wildlife receptors (i.e., 10.6 for potential American robin exposure to chromium), and this inorganic was not determined to be background related, the small size of the site indicates there will likely be no adverse effects to the wildlife population based on direct contact exposure and a reduction in food supply, as less than one breeding pair of American robins would be expected on site. The basis for these estimated hazards used in the SLERA is an unpublished reproductive toxicity study using the black duck.

The original study was unpublished and there is considerable associated uncertainty. In addition, an uncertainty factor of 8 for the robin was used in these EEQ estimations, to account for potential differences in robin sensitivities, compared with the black duck test species. It is unknown if American robins are more sensitive to chromium than the black duck. If no uncertainty factor was used, the estimated Tier 2 LOAEL EEQ would be less than 1 and the Tier 2 NOAEL would be 1.3. Since it is unknown if American robins are more sensitive to chromium than the black duck, it is reasonable that an uncertainty factor of 8 for the robin is not necessary for calculating the LOAEL EEQ and the NOAEL.

Therefore, no further investigation is recommended for ecological receptors at this site. Because there are no elevated human health and ecological risks attributable to a CERCLA release associated with Area B-20 North (FTD-43), this site was eliminated from further investigation and is recommended for NFA.

3.2.9.4. Activities Completed / Path Forward

As described in Section 3.1.1, a DD was issued in February 2008 and MDE concurred with the NFA decision in March 2008.

3.2.10. Area B Ammunition Areas (FTD-07 / OU #5)

3.2.10.1. Site Description

Area B-Ammo (FTD-07) consists of two areas ("Original" and "Outside"). These areas are located in the eastern portion of Area B. B-Ammo Original (FTD-07) was used for munitions storage in bunkers. The explosives that were reportedly stored include: tetryl, black powder, rocket motors, and "trinitrotoluene (TNT) bursters" (TNT plus nitroglycerin). The magazines were decontaminated and dismantled in 1971. The only remaining original structure in B-Ammo Outside (FTD-07) is the munitions loading building (Building 1221). B-Ammo Outside (FTD-07) is located outside the munitions storage area (B-Ammo Original) and was used for munitions loading. Area B-Ammo Outside (FTD-07) was as an area where possible debris was placed. Most of the area is now used as either animal pastures or for storage by the U.S. Army Medical Research Institute of Infectious Diseases Animal Farm facility.

Several environmental investigations have been performed at Area B-Ammo (FTD-07). Area B Ammo (FTD-07) Original soil was investigated during a 1995 RI and 1998 environmental investigation. In 2004, an environmental investigation was conducted for both surface and subsurface soil at Area B Ammo (FTD-07) Outside. An RI was performed in September 2006, which consisted of an HHRA and a SLERA,

and indicated that there are no unacceptable human and ecological risks for Area B-Ammo (FTD-07) attributable to a CERCLA release. A summary of relevant documents is presented in Table 3-10.

Table 3-10: Area B Ammunition Areas (FTD 07 / OU #5)

Document	Author. Date	Admin Record Number
Areas B-Ammo Original and Outside, B Grid, B-20 North and B-20 South Installation Restoration Program Site Close-Out Document.	USACE. 2005	N/A
Area B-Skeet (IRP Site 29) Installation Restoration Program Site Close-Out Document. Draft Final Document.	USACE. 2005	N/A
Fort Detrick Remedial Investigation of Five Sites in Area B.	USACE. 2006	#06-07
Fort Detrick Proposed Plan of Five Sites in Area B.	USACE. 2007	#07-08
Decision Document of Five Sites in Area B Areas B-Ammo, B-Grid, B-20 North and B-20 South, and B-Skeet (AEDB-R Sites FTD-07, FTD-05, FTD-43, and FTD-29).	USACE. 2008	#08-03

Topography: Elevations at the site range from approximately 334 to 356 ft above msl. The topography slopes towards the east in the northern and central portions of the site, and to the south in the southern portion of the site.

Surface Water Hydrology: Surface water runoff in the northern and central portions of the site is to the east to Carroll Creek. Surface water runoff in the southern portion of the site is to the south to an intermittent stream that feeds into Carroll Creek. There are no surface water bodies present on the site.

Soil Types. Soil in Area B-Ammo (FTD-07) is primarily the Hagerstown Rocky Loam, as identified by the United States Department of Agriculture, composed of silty and clayey loams. Background data has been collected for this soil type to support analysis of Area B Ammo.

Geology. Area B-Ammo (FTD-07) is underlain by the Triassic-age limestone pebble conglomerate of the New Oxford Formation. Depth to bedrock in this area is approximately 21 ft bgs. Outcrop of the New Oxford Formation is observed in the area.

Groundwater: Groundwater flow at the site is generally to the east-southeast. Depth to groundwater at the site ranges from approximately 11 to 23 ft bgs.

3.2.10.2. Nature and Extent of Potential Contamination

In 2004, one surface (0-6 inches) and one subsurface (2-4 ft bgs) soil sample (plus a duplicate subsurface soil sample at one location) were collected from each of the five locations for a total of 11 samples. The samples were intended to correlate to the USEPA Region III definition of surface and subsurface soil.

Three of the sampling locations were placed in areas where potential debris to the northeast and east of Building 1221 was identified in 1952, 1958, 1964, and 1970 aerial photography. To evaluate potential releases from possible storage areas, the other two samples were placed between three former buildings identified as B9, B10, and B11 on the 1958 to 1970 aerial photography. Sample locations were selected away from roads and buildings constructed at a later date, due to the potential for grading and fill. Each sample was analyzed for explosives and metals and screened against USEPA Region III screening levels for residential and industrial soil.

Surface Soil Results:

Surface soil samples were analyzed for explosives and metals in Area B-Ammo Outside. Analytical results were compared to USEPA Region III residential screening levels and the 95% UCL for background samples collected from the Triassic Conglomerate surface soil. A summary of the results from the 2004 environmental investigation for surface soil at Area B-Ammo Outside follows:

- Explosives were not detected in any of the samples.
- Arsenic was detected at concentrations ranging from 6.1 to 8.9 mg/kg, which exceed the 95% UCL for background (5.77 mg/kg), the residential RBC (0.43 mg/kg), and the industrial RBC (1.9 mg/kg).
- Iron was detected at concentrations ranging from 21,300 to 41,900 mg/kg. Three samples contained concentrations which exceed the 95% UCL for background (29,700 mg/kg), the residential screening level (2,300 mg/kg), and the industrial screening level (31,000 mg/kg).
- Manganese was detected at concentrations ranging from 918 to 2,100 mg/kg. One sample contained concentrations which exceed the 95% UCL for background (1,880 mg/kg), the residential screening level (160 mg/kg), and the industrial screening level (2,000 mg/kg).
- Vanadium was detected at concentrations ranging from 33.7 to 57.40 mg/kg. Three samples contained concentrations which exceed the 95% UCL for background (36.3 mg/kg), the residential screening level (7.8 mg/kg), but below the industrial screening level (102 mg/kg).

Subsurface Soil Results:

Subsurface soil samples were analyzed for explosives and metals. Analytical results were compared to USEPA Region III residential screening levels and the 95% UCL for background samples collected from the Triassic Conglomerate subsurface soil. A summary of the results from the 2004 environmental investigation for subsurface soil at Area B Ammo Outside follows:

- One explosive (nitrobenzene) was detected in samples AMMO3B (0.038 mg/kg) and AMMO5B (0.041 mg/kg), at concentrations below the residential screening level of 3.9 mg/kg. No other explosives were detected in any of the samples.
- Manganese was detected at concentrations ranging from 635 mg/kg to 1,610 mg/kg. All six samples contained concentrations which exceed the 95% UCL for background (620 mg/kg), the residential screening level (160 mg/kg), but below the industrial screening level (2,000 mg/kg).
- Thallium was detected in one subsurface soil sample at a concentration of 1.2 mg/kg, which is above the residential screening level (0.55 mg/kg), but is below the industrial screening level (7.2 mg/kg). There is no established 95% UCL background value for thallium. This single elevated

detection is isolated and is not characteristic of the area. Therefore, thallium is not considered a concern and no further investigation for thallium is required.

Groundwater contamination is addressed as Area B Groundwater (FTD-72) to evaluate Area B groundwater as a whole.

3.2.10.3. Potential Risks

Adult Resident:

For the future adult resident, upper-bound excess lifetime cancer risks are within the USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-Ammo (FTD-07). Risks were primarily due to the ingestion and dermal absorption of arsenic. Arsenic has been determined to be within background which suggests there was not a CERCLA release of compounds. The total HI for the adult resident's exposure to total soil was less than 1.

Child Resident:

For the future child resident, showed upper-bound excess lifetime cancer risks are within the USEPA's target risk range ($1x10^{-6}$ to $1x10^{-4}$) for total soil at Area B-Ammo (FTD-07). Risks were primarily due to the ingestion and dermal absorption of arsenic in total soil. Arsenic has been determined to be within background. The total HI for the child resident's exposure to total soil was greater than 1 (HI = 6.6). This exceedance was primarily due to iron, manganese, and vanadium in total soil. Iron and manganese have been determined to be within background.

The concentration of vanadium was above background; however, there are no known sources of vanadium at Area B-Ammo (FTD-07). Only the inorganics aluminum, barium, boron, calcium, copper, lead, magnesium, potassium, silver, sodium, and tin are associated with rockets, propellants, and propellant charges. This suggests that vanadium is naturally occurring and not the result of a CERCLA release.

Ecological Risk:

A SLERA was performed using total soil from both Area B-Ammo (FTD-07) Original and Outside to determine if there were any unacceptable ecological risks attributable to a CERCLA release at these sites. Based on the findings, NFA for ecological receptors is recommended for Area B-Ammo (FTD-07).

Because there are no elevated human health and ecological risks attributable to a CERCLA release associated with Areas B-Ammo (FTD-07) Original and Outside, these sites were eliminated from further investigation and are recommended for NFA.

3.2.10.4. Activities Completed Path Forward

As described in Section 3.1.1, a DD was issued in February 2008 and MDE concurred with the NFA decision in March 2008.

3.2.11. Area B-1 (FTD-48 / OU #6)

3.2.11.1. Site Description

A historical map titled "Area B Disposal Areas Site Detail Map" indicated that Area B-1 was a landfill ("Pit 1") that received metal, wood, and general refuse before 1950. Other information reported by the USAEHA indicates that Area B-1 reportedly operated from 1948 until approximately the mid-1970s. The

USAEHA report indicates the fill material reportedly consisted of metals, wood, and general refuse from laboratory remodeling and building demolition, and that all material was decontaminated before disposal. A summary of relevant documents is presented in Table 3-11.

Table 3-11: Area B-1 (FTD 48 / OU #6)

Document	*Author. Date*	*Admin Record Number*
Fort Detrick Area B1 IRP Site Close Out Document	Shaw. 2004	#05-02

Physiography and Topography: Area B-1 was reportedly an area measuring approximately 60 by 190 feet and is located in a grass covered field in the eastern portion of Area B, northeast of Area B-Ammo. Elevations at the site range from 340 to 344 feet above msl. The topography of Area B slopes from the northwest to the southeast.

Surface Water Hydrology: Surface water runoff at the site is to the south-southeast towards Carroll Creek. There are no surface water bodies present on the site.

Soil Types: Drilling logs for borings completed in Area B-1 describe the soil as stiff silt.

Geology: Area B-1 is underlain by the Cambrian limestone Frederick Formation.

Groundwater: Groundwater flow at the site is from the northwest to the southeast. Depth to groundwater was approximately 11 feet bgs, as measured in well MW-45 in the spring of 1997.

3.2.11.2. Nature and Extent of Potential Contamination

In 1995, soil samples were collected for analysis. Five borings were completed in Area B-1. All samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides / polychlorinated biphenyls (PCBs), TCL herbicides and XRF metals by the on-site laboratory. Splits of 25 % of the samples were submitted to DataChem Laboratory for confirmatory analysis of the same parameters, the complete TAL metals, and cyanide. The results of this analysis are listed below:

VOCs: The only VOC detected was acetone at estimated concentrations below the reporting limit. Acetone was also detected in associated quality control blank samples.

SVOCs: The following SVOCs were detected at estimated concentrations below the reporting limit in one or more samples: di-n-butylphthalate, 2,4-dimethylphenol, bis(2-ethylhexyl)phthalate, and naphthalene. Di-n-butylphthalate was also detected in associated quality control blank samples.

Pesticides: Endosulfan sulfate and 4,4'-DDT were detected in samples as well as quality control blanks. No other pesticides were detected.

Herbicides: No herbicides were detected.

PCBs: No PCBs were detected.

Inorganics: Inorganics were positively detected in all samples without any obvious outlying values to indicate hot spot contamination. It should be noted that the majority of inorganic analyses were performed using the XRF field method, with only two samples also quantified via the more stringent laboratory methods. Comparisons of XRF field results to laboratory results indicate that the XRF method consistently yielded numerically higher values for most analytes.

Since only two of the samples were analyzed using lab-based methods, it is not possible to do a rigorous statistical comparison of lab-based Area B-1 data to background.

Tentatively Identified Compounds: A total of 37 Tentatively Identified Compounds were reported in soil samples collected from Area B-1 at concentrations ranging from 0.1 to 1.0 µg/g.

3.2.11.3. Potential Risks

Human Health Risk Assessment:

Even though four metals were reported at levels above screening levels, the lack of debris/disposal materials in the borings indicates that these samples were not collected from a "disposal area". Based on the consensus of the Army, USEPA, MDE, USAEC, U.S. Army Public Health Command (formerly U.S. Army Center for Health Promotion and Preventive Medicine), and the USACE, there has been no disposal activity at the area identified as Area B-1 on the Fort Detrick "Area B Disposal Areas Site Detail Map". Therefore, there are no CERCLA releases in the investigation area and consequently no risk to human receptors as a result of disposal activity regulated under CERCLA. Notable site-related contamination does not exist and no source areas exist at this site.

Ecological Risk:

There are several analytes that were reported above Biological Technical Assistance Group (BTAG) screening levels. These include aluminum, barium, beryllium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, silver, thallium, vanadium, zinc, and cyanide. Although these detections exceed BTAG levels, they are not associated with a known disposal area regulated under CERCLA.

3.2.11.4. Activities Completed Path Forward

The Army, USEPA, and MDE signed a memorandum after the PA/SI to close out the site, because no release was found. MDE concurred with the NFA decision in January 2005.

3.2.12. Area B Groundwater (FTD-72 / OU #14)

3.2.12.1. Site Description

All groundwater in Area B was included in this site. In February 1992, TCE concentrations above the MCL and elevated levels of trichlorofluoromethane were detected in an Area B monitoring wells sampled as part of Fort Detrick's State Landfill permit requirements. As a result, the Army began an investigation of an active landfill and other areas within Area B. The report was published in 1993.

In October 1992, MDE sampled 21 off-post residential wells adjacent to Area B. TCE concentrations above MCL levels were identified in four of the tested wells. Following the discovery of TCE in the domestic wells, the Army provided bottled water and subsequently connected affected residences on Shookstown Road and Montevue Lane to public water. One residence was connected to Fort Detrick's drinking water system.

Since discovery of the groundwater contamination, the Army has completed numerous studies to locate the source of the groundwater contamination, and to understand the extent of the migration. The investigations have included the installation of numerous monitoring wells and completion of groundwater tracer studies. These studies are described in the sections below.

In February 2008, the Army met with MDE and USEPA to present a Groundwater Conceptual Site Model (CSM) (Shaw 2008). The model included 16 years of groundwater data and numerous geological and geophysical studies. Several key data gaps were identified. The Army worked with MDE and USEPA to identify additional fieldwork that is needed to further define the nature and extent of the groundwater contamination beneath Area B and to complete the RI. The Work Plan (Shaw 2010) was finalized on 29 June 2010 after review by USEPA and MDE. The Work Plan was amended with the Field Sampling Plan (ARCADIS/Pirnie 2011b) and the Quality Assurance Project Plan (ARCADIS/Pirnie 2011c) in 2011. Work under the 2010 work plan was completed the results were documented in a draft Conceptual Site Model (CSM), which was submitted in early 2013. Based on comments received from USEPA additional data gaps were identified leading to the need for additional site investigation activities. A Phase 4 RI Work Plan Addendum was drafted and approved by USEPA and MDE in 2016 (ARCADIS 2016). Activities under the addendum were completed during spring and early summer 2017 and were followed by the Draft RI Report, which was submitted in April 2019. This effort and a follow-on investigation is described in Sections 3.2.12.4. and 3.2.12.5.

The scope of the RI field investigation was intended to address all potential source areas that may be contributing to the groundwater contamination. A summary of historical documents relevant to Area B Groundwater is presented in Table 3-12.

Table 3-12: Area B Groundwater Historical Investigations (FTD 72 / OU #14)

Document	*Author. Date*	*Admin Record Number*
Fort Detrick Remedial Investigation, Area B (IRP Site 72) Water Sampling Data Report July 2007 Sampling Event, Final Document September 2008	Shaw Environmental. 2008	#08-07
Fort Detrick Remedial Investigation, Area B (IRP Site 72) Water Sampling Data Report September 2007 Sampling Event, Final Document September 2008	Shaw Environmental. 2008	#08-08
Fort Detrick Remedial Investigation, Area B (IRP Site 72) Water Sampling Data Report January 2008 Sampling Event.	Shaw Environmental. 2008	#08-10
Fort Detrick Remedial Investigation, Area B (IRP Site 72) Water Sampling Data Report March 2008 Sampling Event.	Shaw Environmental. 2008.	#08-12

Document	*Author. Date*	*Admin Record Number*
Fort Detrick Remedial Investigation, Area B (IRP Site 72) Water Sampling Data Report June 2008 Sampling Event.	Shaw Environmental. 2008	#08-13
Area B Groundwater (FTD-72) Remedial Investigation Work Plan.	Shaw Environmental 2010	#10-01
Area B Groundwater (FTD-72) Remedial Investigation Quality Assurance Project Plan.	ARCADIS/Malcolm Pirnie. 2011	#11-04
Area B Groundwater (FTD-72) Remedial Investigation Sampling and Analysis Plan.	ARCADIS/Malcolm Pirnie. 2011	#11-05
Area B Groundwater (FTD-72) Remedial Investigation Waste Minimization Plan.	ARCADIS/Malcolm Pirnie. 2011	#11-05
Engineering Evaluation / Cost Analysis, Provision of a Safe Potable Water Source for Five Kemp Lane Residences	PIKA-ARCADIS 2013	#13-01
Area B Groundwater Conceptual Site Model (Technical Reports Attached: Existing Well Reconnaissance and Survey Report; Surface Water and Spring Survey Report; Shallow Groundwater DPT Sampling and Piezometer Installation Report; New Well Drilling, Testing, and Installation; Synoptic Water Level Monitoring, Groundwater and Surface Water/Sediment Sampling - Round 1 Report)	ARCADIS. 2014	#14-12
Action Memorandum, Provision of a Safe Potable Water Source for Five Kemp Lane Residences	PIKA-ARCADIS/. 2014	#14-25
Off Post Well Investigation Report	PIKA-ARCADIS/. 2014	#14-26
Draft 2013 Groundwater Tracer Study Report Area B Groundwater (FTD-72), Fort Detrick, Frederick, Maryland	ARCADIS. 2014	N/A
Round 2 Synoptic Groundwater and Surface Water Sampling Report, Rounds 2/3 Synoptic Water Levels Rounds for Area B, Fort Detrick, Maryland	ARCADIS. 2015	#15-02
Round 2 Shallow Groundwater DPT Sampling and Piezometer Installation Report, Fort Detrick Area B Groundwater (FTD-72)	ARCADIS. 2015	#15-03
Vapor Intrusion Data Report for Area B, Fort Detrick, Maryland	ARCADIS. 2015	#15-04

Document	Author. Date	Admin Record Number
Final Remedial Investigation, Work Plan Addendum. Area B Groundwater (FTD-72) Remedial Investigation, Fort Detrick	ARCADIS. 2016	#16-02
Cap Inspection and Monitoring Work Plan, Fort Detrick Area B Landfill Caps, Fort Detrick, Maryland,	ARCADIS. 2016	#16-01

3.2.12.2. Nature and Extent of Potential Contamination

VOCs are present in the karst aquifer that underlies Fort Detrick's Area B. The most notable VOCs are PCE and TCE that emanate in a dissolved plume from Area B-11, a former waste disposal area located in the western portion of Area B. The Army performed a hot spot removal action at the B-11 site from 2001 to 2004, to remove potential intact drums of tetrachloroethene (PCE) and trichloroethene (TCE) thereby preventing further groundwater contamination. On-going periodic monitoring of the solute plume has documented significant declines in PCE and TCE concentrations by up to several orders of magnitude. The goal of the on-going RI at Area B Groundwater is to determine the nature and extent of these PCE and TCE plumes.

3.2.12.3. Potential Risks

The 2008 CSM was developed to describe the site-specific pathways that contaminants may follow from the original (primary) source to receptors, including release mechanisms, secondary sources, migration pathways, and exposure routes (Shaw 2008). Results of the ongoing Area B Groundwater RI investigation will be used to update the CSM.

3.2.12.4. Activities Completed Path Forward

Area B Groundwater RI

The Army has completed Phase 3 RI activities under a Work Plan approved by USEPA and MDE in 2010 (Shaw 2010), as well as the approved Field Sampling Plan (ARCADIS/Pirnie 2011b) and Quality Assurance Project Plan (2011c). The following activities were completed under this work plan:

- Well inspection and repair of 81 existing Area B monitoring wells (completed in April 2011)
- Horizontal flow meter study of 38 existing Area B monitoring wells (completed in July 2011)
- Phase one monitoring well installation, which included the installation of 29 monitoring wells on Area B (completed in March 2012)
- Phase two monitoring well installation, which included:
    - The installation of one deep monitoring well (500 ft below ground surface) on Area B east of B-11 to improve vertical and lateral delineation of groundwater contamination emanating from the B-11 Area (completed in January 2015).

- The installation of 5 monitoring wells off Area B south of B-11 to improve vertical and lateral delineation of groundwater contamination emanating from the B-11 Area (completed in October 2014).
- The installation of 2 monitoring wells on Frederick County property to enhance the down gradient vertical delineation east of Carroll Creek (completed in June 2014).
- The installation of 11 shallow/first water wells off post along the boundary of Area B south of B-11 to evaluate impacts to shallow groundwater west of Area B (completed in July 2014).

- Testing of all newly installed monitoring wells including geophysical logging and packer testing of open boreholes prior to well installation (phase one wells completed in March 2012 and phase two wells in January 2015).
- Direct push drilling of 39 piezometers and 24 borings (completed in March 2012)
- Seep and spring survey of 13,000 ft of stream bed with the identification of 40 seeps and springs (completed in April 2012)
- Round 1 groundwater, surface water, and sediment sampling (completed in May 2012).
- Round 2 groundwater and surface water sampling (completed in September 2012).
- Phase 2 monitoring well sampling (completed August 2014, November 2014, and March 2015).
- Round 1 vapor intrusion sampling at five locations including one building on Area B and four private properties (completed in January 2013)
- Four rounds of synoptic water level measurements (completed in February 2013)
- Additional direct push drilling of seven piezometers and seven borings (completed in August 2013)
- Round 2 vapor intrusion sampling at five locations including one building on Area B and four private properties (completed in September 2013)
- Focused dye trace study with monitoring conducted at 95 locations (completed January 2014)

All tasks under the 2010 work plan (Shaw, 2010) have been completed. Data collected between April 2011 and May 2012 was integrated into an updated Area B groundwater CSM (ARCADIS, 2013). The updated Draft CSM included a series of technical reports covering the field activities completed during this time period. The CSM provided a refined understanding of the groundwater flow system beneath Area B and the impacts of the former dump sites on the environment.

A review of the draft RI data to date reveals the following:

- Preliminary data review shows minor or no impacts from SVOCs, PCBs, metals, herbicides, or pesticides in groundwater, surface water, or sediment;
- Preliminary data review shows VOCs are the main contaminant and are present in groundwater and low concentrations in surface water and sediment;
- Deep groundwater from monitoring wells: VOCs were detected in deep groundwater at part per million (ppm) concentrations (as high as 15 ppm) on Area B in the vicinity of B-11;

- Shallow groundwater from piezometers: VOCs were detected at concentrations exceeding drinking water standards in shallow groundwater at three locations off-site to the east of Area B, though groundwater is not used for potable purposes in this area;
- Seeps/springs samples at emergence point: VOCs were detected at concentrations exceeding drinking water standards and Human Health Criteria for human consumption in eight seeps/springs locations off-site to the east of Area B; though seeps and springs are not used for potable purposes in this area;
- Surface water: VOCs were detected above drinking water criteria and the human health screening criteria for consumption at one location off-site to the east of Area B (a pond less than 500 ft from the Area B boundary); and
- Surface water: VOCs (TCE, PCE, and Chloroform) were detected in Carroll Creek at points as far as approximately 3,500 ft downstream of Area B at levels below Human Health Screening Criteria [i.e., recreational use, fish ingestion and consumption (hypothetical comparison)].Vapor Intrusion:
- Data Gaps Identified: The CSM summarized the results of the Phase 3 RI activities and provided a condensed, descriptive interpretation of Area B's environmental conditions. The CSM concluded that the Phase 3 RI field activities completed had largely met the objectives; however, the need for supplemental investigations to further refine the CSM and complete the RI were revealed. These data needs were identified and documented in a Phase 4 RI Work Plan discussed below. Additionally, the need for additional groundwater flow data was identified as a result of stakeholder review of the Focused dye trace study.

Phase 4 RI Work Plan

Based on comments received from USEPA on the CSM, additional data gaps were identified and led to the need for additional site investigation activities. To close these additional data gaps a Phase 4 RI Work Plan Addendum was drafted and approved by USEPA and MDE in 2016 (ARCADIS 2016). Activities under the addendum were completed during spring and early summer 2017 and included the following:

- Sampling of all existing piezometers located off Area B,
- Seep and spring survey of the one-mile stretch of Carroll Creek extending from Route 15 upstream north of the confluence with the Robinson Pond outfall,
- Additional surface water sampling,
- Stream modeling contaminant transport of the one-mile stretch of Carroll Creek extending from Route 15 upstream north of the confluence with the Robinson Pond outfall to assist in understanding of persistent TCE concentrations, and
- An investigation of shallow groundwater PCE contamination of the Frederick County Parcel (including a maintenance building inventory/inspection; soil gas study, and isotopic finger printing of PCE).

Data collected from all RI phases was incorporated into a comprehensive Draft RI report, which was submitted in draft in April 2019. The draft final (most recent version) was submitted to EPA and MDE in December 2019. EPA comments on the Draft Final RI were received on 29 April 2020. The comments

generated the need for another contract, awarded in September 2021 to close data gaps and complete the RI report.

In the interim, the Army has been granted access to the off-Post Gambrill View (formerly Waverley View) property directly adjacent to the Western Disposal Area and engaged USACE to perform investigation tasks prior to the award of the contract to complete the RI. These tasks included the installation of 33 shallow groundwater monitoring points and 4 soil gas monitoring points. Quarterly sampling and analysis for VOCs will be conducted on the shallow groundwater monitoring points for a period of two years to ensure seasonal variability in groundwater concentrations are captured. Both shallow groundwater analytical results and soil gas analytical results will be used to estimate the potential for vapor intrusion for future residential buildings and estimate the potential for risk for future human receptors from vapor intrusion. The shallow groundwater data will also be used to assess the nature and extent of groundwater contamination off-Post along the southern boundary of Area B. A follow-on investigation completed under RI contract included the installation of deep bedrock wells in this area. In addition to assessing the potential for future risk, this data will be used to close data gaps in Remedial Investigation / Conceptual Site Model.

Additional Phase 5 RI efforts include:

- Installation of up to 12 new monitoring points in the vicinity of well BMW-77
- Surface water/sediment sampling along Carroll Creek
- Replace damaged wells
- Quarterly sampling of new points
- Update CSM by incorporating new points and USGS findings, conduct comprehensive human health and ecological risk assessments
- Finalize the RI report

Area B Groundwater Future Actions

Upon the finalization of the RI Report an FS, a PP and final ROD will be prepared that will identify the remedy for Area B Groundwater. The anticipated future actions for the Area B Groundwater investigation include:

- FS
- PP
- ROD
- RD/RA
- RIP
- RC

- LTM

Concurrently with the CERCLA activities listed above the Army executed two additional data collection efforts to further refine the CSM for Area B Groundwater and expedite the selection of remedial alternatives for the site. These activities are described in the following subsection.

Pilot Testing of Pump and Treat, Enhanced Reductive Dechlorination, and Surface Water Aeration

The primary objective of the pilot testing is to collect data needed to evaluate the effectiveness and feasibility of each proposed remedial technology for potential full-scale implementation at the site. The data collected from the pilot tests will be used to support the selection of remedial strategies. The results of these pilot testing activities will aid in the selection of remedial alternatives for detailed evaluation during the CERCLA FS Phase. The goals of each technology included in the Pilot Testing include:

Pump and Treat: The overall goal of the pump and treat test is to evaluate the feasibility of pumping and treating groundwater to reduce VOC concentrations in the karst bedrock groundwater near the WDA source at Area B, while mitigating the risk of land subsidence and sinkhole formation. Activities completed to date include but are not limited to the installation of pilot study groundwater wells, baseline groundwater sampling and analysis, site utility preparations and system design.

Enhanced Reductive Dechlorination (ERD): The goals of the enhanced reductive dechlorination test are to evaluate the short-term efficiency of the technology, to refine the existing CSM, and to evaluate the feasibility of ERD as a potential full-scale remedy for the site. Activities completed to date include the installation of injection points. This test has been deferred indefinitely until regulator concerns regarding the possible presence of biological agents in the aquifer have been addressed. The Army's Chemical Biological Application & Risk Reduction (CBARR) unit at Aberdeen Proving Ground, MD, has been identified to analyze groundwater samples for the biological agents of concern.

Surface Water Aeration: The goals of the surface water aeration test are to evaluate performance and optimize configuration of two aeration systems to reduce VOC concentrations in Robinson Pond water and ultimately in Carroll Creek to refine the existing CSM, and to evaluate the feasibility of surface water aeration as a potential full-scale remedy to reduce off site migration of VOCs. Activities completed to date include: baseline surface water sampling and analysis; the operation of the aeration fountains test; and the operation of the air diffusion system. Additional testing of the aeration fountain system was conducted, and all results will be evaluated in a completion report at the completion of the pilot study effort.

The report on the completed pilot study efforts was finalized in March 2024.

Additional Groundwater Studies – United States Geological Survey (USGS)

The USGS performed a series of independent studies designed to characterize temporal variability of the groundwater-surface water system and evaluate the proposed conceptual site model, better define the processes controlling the fate and transport of known groundwater contaminants and describe the potential for natural attenuation and designed bioremediation of groundwater contaminants in Area B Groundwater. This study was designed to refine the CSM and support future remediation feasibility study. This project intended to meet the following objectives:

1) Independently evaluate the CSM to assist interpretation of the fate and transport of groundwater contaminants.
    a. Compute water budgets for watersheds containing Area B using continuous data collected at USGS-monitored wells and stream gages in conjunction with simulated recharge using a soil-water-balance model. The water budget will be used to evaluate if significant inter-basin groundwater flow leaves the Carroll Creek watershed.
    b. Perform a synoptic groundwater-age tracer study.

2) Characterize the biogeochemistry of the groundwater system to inform potential future remedial decision-making.
    a. Quantify the flux of VOCs to Carroll Creek, focusing on contributions via diffuse flow through the stream bed. Assess redox and microbial conditions at those locations to better define fate of groundwater contaminants.
    b. Quantify storage of contamination within the rock matrix and to evaluate the longevity of groundwater contamination.
    c. Assess biodegradation mechanisms and potential for biodegradation prior to and following ERD Pilot Test injection, to evaluate ability of microbial communities present at the site to degrade contaminants with and without redox manipulation.
    d. Assess viability of natural attenuation and biodegradation throughout Area B groundwater.

The collection of new data and evaluation of existing datasets began in 2018 and is complete.

Area B Groundwater Monitoring

Fort Detrick has performed periodic groundwater monitoring at Area B since 1999. In addition to the RI groundwater sampling discussed above, Fort Detrick is also conducting quarterly monitoring of 15 strategically located groundwater monitoring wells (sentinel wells along the Area B boundary and wells with elevated concentrations), and one down gradient spring.

3.2.12.5. Activities on the Gambrill View Property

The purpose of the shallow groundwater investigation on Gambrill View (formerly Waverley View) was to:

a) Determine the presence/absence of VOCs in shallow groundwater beneath the Waverley View property,

b) Determine the concentrations and lateral extent of VOCs in shallow groundwater beneath the Waverley View property, and

c) Determine if the concentrations of VOCs in shallow groundwater beneath Waverley View create a potential for vapor intrusion risk and potential risk to human receptors who may inhabit future dwellings proposed to be built on the property. The USEPA Vapor Intrusion Screening Level (VISL) calculator was used to assess risk from potential vapor intrusion.

The goal of the shallow VOC groundwater investigation was to determine potential vapor intrusion risk for the planned dwellings on the Waverley View property (prior to construction), in order for the Army to determine if an interim action should be implemented during construction to mitigate potential unacceptable risks.

Using the CERCLA risk action level of a hazard index (HI) of 1, the VISL results indicate exceedances of the HI in 9 wells, when using the default attenuation factor (AF) of 0.001. Based on these results, if residences are constructed above these wells, there may be unacceptable risk to future residents from inhalation of vapors. For this reason, the Army Corps of Engineers performed an Engineering Evaluation / Cost Analysis (EE/CA) of several possible interim actions that could be pursued.

3.2.13. EE/CA Provision of a Safe Potable Water Source for Five Kemp Lane Residences

As stated in Sections 2.4 and 3.1, in September 2005, low level concentrations (below the MCL) of PCE and TCE were detected in the drinking water wells at two residences along Kemp Lane. Since January 2006, bottled water has been provided to five residences along Kemp Lane as a proactive measure to ensure that human health was protected. Fort Detrick has initiated this EE/CA to evaluate alternatives to provide a permanent solution to mitigate potential human health hazards associated with VOCs present in the karst aquifer underlying Area B. The EE/CA presents three removal action alternatives: Alternative 1 – NFA; Alternative 2 – provide bottled water service and groundwater monitoring; and Alternative 3 – connect residences to the City Water Supply. Each of the alternatives were evaluated based on the merits of the individual and comparative analyses regarding implementability, effectiveness, and cost. Based on this evaluation, the recommended alternative to provide long term protection of human health to residents/receptors along Kemp Lane presented in the Final EE/CA (February 2013) is Alternative 3 – connect residences to the City Water Supply.

A 45-day public comment period was held from August 29, 2013, through October 13, 2013. During this time the EE/CA was made available on Fort Detrick's website (https://home.army.mil/detrick/index.php/about/Garrison/directorate-public-works/environmental-management-division) and copies were placed in Fort Detrick's administrative record (see section 2.5.2 Information Repositories for location). Additionally, a public information session was held on September 18, 2013, to provide the public the opportunity to learn more about the EE/CA and provide comments in person. No public comments were received during the 45-day public comment period.

An Action Memorandum was drafted following the close of the 45-day public comment period. The purpose of the Action Memorandum is to document the decision to provide an alternative, safe source of potable water to the Kemp Lane residences and to document Alternative 3 – connect residences to the City Water Supply as the selected action. The Action Memorandum was signed on 25 September 2014

EE/CA Future Actions

The final quarterly monitoring event of the five drinking water wells on Kemp Lane was completed in March 2015. The work plan for the connection of Kemp Lane residences to the City Water Supply has been developed and finalized. The residences were connected to the City Water Supply in spring 2017.

3.2.14. Off Post Private Well Investigation

Fort Detrick conducted a study to identify and sample all active drinking water wells surrounding Area B to ensure residents were not consuming groundwater that contains contaminants migrating from Area B. The study includes researching drinking-water sources, a door-to-door survey, various public outreach activities, drinking water sampling and reporting. The study was completed in September 2013 and the Draft Off Post Private Well Investigation was submitted for regulatory review in July 2014. Results were communicated to the public at the August 2014 RAB meeting. The Off Post Private Well Investigation Report was finalized in July 2015. No additional actions are expected.

3.2.15. Site Inspection of Area B New Archive Search Report Sites

The Army has performed archival research to determine if there have been historical releases to the environment at Fort Detrick that were not previously addressed. A report on the use/testing of 2,4,5-trichlorophenoxyacetic acid (herbicide/defoliate used in agriculture and an ingredient in Agent Orange) on all areas of Fort Detrick was completed and released. An additional Archive Search Report, focused on historical activities associated with the use, storage, and/or disposal of potentially hazardous materials at Fort Detrick was submitted for regulatory review in June 2014. The research revealed six previously unidentified sites on Area B that warranted investigation in the form of a CERCLA SI. The SI for Area B evaluated the sites listed below and organized by category based on historical use. The SI documented one of two conditions: site evaluation was accomplished with a NFA recommendation, or documentation of environmental impacts above relevant screening criteria with a recommendation to advance the site to RI phase. The SI was performed in consultation with USEPA, MDE and the local community. The Final SI report was submitted to EPA and MDE in February 2018 with recommendations by site:

Table 3-13: Area B Site Inspection Sites and Recommendations

Group / Site Name	*Recommendation*
Group 1: Herbicide Test Areas	
New Area 1: possible herbicide test plot	Further Investigation for inorganics in soil (arsenic and thallium)
Field B	Further Investigation for inorganics in soil (arsenic and thallium)
Group 8: General Disposal, Storage, and Other Sites	
T-1235 Inclined Test Shed and T-1236 Test Chamber	Site evaluation accomplished NFA based on no observed release
Chemical Warfare Materiel Toxic Gas Storage Building 1217	Site evaluation accomplished NFA based on no observed release

Group / Site Name	*Recommendation*
Rice Blast Disposal Area	Site evaluation accomplished NFA based on no observed release
Former solvent and flammables storage area	Site evaluation accomplished NFA based on no observed release

In August 2019 the Army awarded a contract to conduct an Expanded Site Inspection (ESI) and additional tasks to address further investigation needs at the New Area 1: possible herbicide test plot and Field B. In addition to ESI a background study was completed to establish existing concentrations of inorganic and other compounds in Area B soil. This background information will not be used for risk assessment purposes, but only for comparison to the investigated sites. The work plan to complete the ESI efforts is expected in August 2024.

3.3. Schedule

The schedule for Area B Groundwater (FTD-72) is provided as Table 3-14. Table 3-14 lists the anticipated submittal schedule for documents requiring technical review. This list is meant to aid in determining document prioritization; however, this schedule is estimated and subject to change.

Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
Area B Groundwater (FTD-72) Fort Detrick (This task does not include investigations or responses for PFAS and is tracked separately)			
RI Field Investigation Planning (completion date)	**6/30/2011**	**3**	**2011**
Quality Assurance Project Plan, Sampling and Analysis Plan and Waste Minimization Plan	6/30/2011	3	2011
RI Field Investigation (completion date)	**11/22/2013**	**1**	**2014**
Well Recon and Repair	4/11/2012	3	2012
Horizontal Flow Meter Survey	12/13/2011	1	2012
Seep and Spring Survey	3/16/2012	2	2012
Perform VI Sampling - Round 1	3/11/2013	2	2013
Perform VI Sampling - Round 2	10/29/2014	1	2015
Perform VI Sampling - Round 3	2/1/2016	2	2016
Draft VI/Risk Assessment RI Data Report	7/17/2017	4	2017
Draft Final VI/Risk Assessment RI Data Report	5/8/2019	3	2019
Final VI/Risk Assessment RI Data Report	9/5/2019	4	2019
Well Installation	2/14/2012	2	2012
Direct Push Drilling	3/22/2012	2	2012
Borehole Logging	10/25/2011	1	2012
Groundwater Sampling / Monitor Water Levels Round 1	4/13/2012	3	2012
SW and SD Sampling Round 1	4/20/2012	3	2012
Groundwater Sampling / Monitor Water Levels Round 2	9/28/2013	4	2013
SW Sampling Round 2	11/8/2013	1	2014
Expanded DPT Investigation	8/12/2013	4	2013
SW Sampling Round 3	11/8/2013	1	2014
Focused Dye Tracer Study	1/24/2014	2	2014
Installation of Additional Wells (On and Off Post)	1/19/2015	2	2015
CSM Update (Includes technical reports from RI field investigation activities)	**3/31/2014**	**2**	**2014**
Draft CSM Update	2/18/2013	2	2013
Draft Final CSM Update	4/19/2013	3	2013
Final CSM Update	3/31/2014	2	2014
Dye Trace Study Report		**2**	**2018**
Draft Dye Trace Study Report	10/29/2014	1	2015
Final Dye Trace Study Close-Out-Report	3/7/2018	2	2018
USGS - Independent Groundwater Studies			
Groundwater Studies Begin	4/16/2018	**3**	**2018**
Groundwater Studies End	9/30/2021	**4**	**2021**
Draft Follow on Dye Trace Study Work Plan	5/18/2022	3	2022
Draft Final Follow on Dye Trace Study Work Plan	8/26/2022	4	2022
Final Follow on Dye Trace Study Work Plan	11/11/2022	1	2023
Dye Trace Field Work Start (dye injection and begin monitoring)	11/21/2022	1	2023
Pilot Study			
Draft Pilot Study Work Plan	5/29/2018	**3**	**2018**
Draft Final Pilot Study Work Plan	9/10/2018	**4**	**2018**
Final Pilot Study Work Plan	11/1/2018	**1**	**2019**
Technology Construction (Drilling) Phase Initiation	6/1/2019	**3**	**2019**
Technology Construction (Drilling) Phase Completion	9/10/2019	**4**	**2019**
Surface Water Aeration Operation Phase Initiation	6/10/2019	**3**	**2019**
Surface Water Aeration Operation Phase Completion	1/30/2020	**2**	**2020**
Pump and Treat Operation Phase Initiation	9/7/2021	**4**	**2021**

Notes:
* Some projected dates are presented only as Fiscal Year Quarters
Green / Gray shaded cells are updates from the last SMP submission
Yellow shaded cells are projected
dates in the current fiscal year

Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
Pump and Treat Operation Phase Completion	5/6/2022	3	2022
Enhanced reductive Dichlorination Operation Phase Initiation	deferred	3	2027
Enhanced reductive Dichlorination Operation Phase Completion	deferred		
Draft Pilot Study Evaluation Report	11/17/2023	1	2024
Draft Final Pilot Study Evaluation Report	3/8/2024	2	2024
Final Pilot Study Evaluation Report	3/21/2024	2	2024
Remedial Investigation Work Plan Addendum 1	**11/18/2016**	1	2017
Draft Remedial Investigation Work Plan	6/5/2015	3	2015
Draft Final Remedial Investigation Work Plan (March 2016)	3/17/2016	2	2016
Revised Draft Final Remedial Investigation Work Plan (April 2016)	4/13/2016	3	2016
Final Remedial Investigation Work Plan	11/18/2016	1	2017
Remedial Investigation Addendum Field Work Complete	8/11/2017	4	2017
Safe Potable Water for Five Kemp Lane Residents IRA (completion date)	**2/14/2017**	2	2017
Draft EE/CA Provision of a Safe Potable Water for Five Kemp Lane Residents	8/8/2012	4	2012
Draft Final EE/CA Provision of a Safe Potable Water for Five Kemp Lane Residents	1/10/2013	2	2013
Final EE/CA Provision of a Safe Potable Water for Five Kemp Lane Residents	2/8/2013	2	2013
Revised Final EE/CA Provision of a Safe Potable Water for Five Kemp Lane Residents	6/7/2013	3	2013
Draft Action Memorandum Provision of a Safe Potable Water for Five Kemp Lane Residents	1/15/2014	2	2014
Draft Final Action Memorandum Provision of a Safe Potable Water for Five Kemp Lane Residents	3/16/2014	2	2014
Final Action Memorandum Provision of a Safe Potable Water for Five Kemp Lane Residents	9/25/2014	4	2014
Draft Connection of Five Kemp Lane Residents to the City of Frederick Public Water Supply Work Plan	11/13/2014	1	2015
Draft Final Connection of Five Kemp Lane Residents to the City of Frederick Public Water Supply Work Plan	2/12/2015	2	2015
Final Connection of Five Kemp Lane Residents to the City of Frederick Public Water Supply Work Plan	2/12/2015	2	2015
Connection of Five Kemp Lane Residents to the City of Frederick Public Water Supply	2/14/2017	2	2017
Gambrill View (Waverly) Investigation and Response			
Draft Vapor Intrusion Study Report	7/9/2023	4	2023
Final Vapor Intrusion Study Report	4/19/2024	3	2024
Draft EE/CA - Provision of Vapor Barriers	10/16/2024	1	2025
Draft Final EE/CA Provision of Vapor Barriers	12/15/2024	1	2025
Final EE/CA - Provision of Vapor Barriers	2/1/2025	2	2025
RI Reporting			
Draft RI Report	6/1/2025	3	2025
Draft Final RI Report	12/1/2025	1	2026
Final RI Report	3/1/2026	2	2026
FS Reporting	**12/6/2026**	1	2027
Draft FS Report	5/30/2026	3	2026
Draft Final FS Report	9/27/2026	4	2026
Final FS Report	12/6/2026	1	2027
Proposed Plan	**6/19/2027**	3	2027
Draft Proposed Plan	1/20/2027	2	2027
Draft Final Proposed Plan	5/20/2027	3	2027
Final Proposed Plan	7/29/2027	4	2027
Proposed Plan Public Meeting	6/19/2027	3	2027
Record of Decision	**3/20/2028**	2	2028
Draft Record of Decision	9/12/2027	4	2027
Draft Final Record of Decision	1/10/2028	2	2028

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Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
Final Record of Decision	3/20/2028	**2**	**2028**
Remedial Design	**1/24/2029**	**2**	**2029**
Draft Remedial Design	7/18/2028	**4**	**2028**
Draft Final Remedial Design	11/15/2028	**1**	**2029**
Final Remedial Design	1/24/2029	**2**	**2029**
Remedial Action-Construction	**2/23/2032**	**2**	**2032**
Implement Remedial Action (Construction Begins)	2/23/2029	**2**	**2029**
Implement Remedial Action (Construction Complete)	2/23/2032	**2**	**2032**
Remedial Action-Operations and Maintenance	**2/23/2032**	**2**	**2032**
Implement Remedial Action (Operations and Maintenance Begins)	2/23/2032	**2**	**2032**
Area B Landfill Cap Inspection and Quarterly Groundwater Monitoring Work Plan	**6/9/2018**	**3**	**2018**
Draft Area B Landfill Cap Inspection and Quarterly Groundwater Monitoring Work Plan	6/5/2015	**3**	**2015**
Draft Final Area B Landfill Cap Inspection and Quarterly Groundwater Monitoring Work Plan	2/11/2016	**2**	**2016**
Final Area B Landfill Cap Inspection and Quarterly Groundwater Monitoring Work Plan	7/27/2016	**4**	**2016**
Complete Expansion of Monitoring Network (Install Shallow Monitoring Wells and Lysimeters)	6/9/2018	**3**	**2018**
Area B Waste Pit Caps Semi-Annual Monitoring (Groundwater Monitoring / Inspections / Maintenance)			
FY2016 - Semi-Annual Monitoring (completion date)	**3/1/2021**	**2**	**2021**
2016 1st Semi-Annual Monitoring Field Event	5/2/2016	**3**	**2016**
2016 2nd Semi-Annual Monitoring Field Event	11/14/2016	**1**	**2017**
2016 Draft 1st Semi-Annual Monitoring Report	8/10/2017	**4**	**2017**
2016 Draft Final 1st Semi-Annual Monitoring Report	10/1/2020	**1**	**2021**
2016 Final 1st Semi-Annual Monitoring Report	2/1/2021	**2**	**2021**
2016 Draft 2nd Semi-Annual Monitoring Report	3/20/2017	**2**	**2017**
2016 Draft Final 2nd Semi-Annual Monitoring Report	1/8/2021	**2**	**2021**
2016 Final 2nd Semi-Annual Monitoring Report	3/1/2021	**2**	**2021**
FY2017 - Semi-Annual Monitoring (completion date)	**3/1/2021**	**2**	**2021**
2017 1st Semi-Annual Monitoring Field Event	5/1/2017	**3**	**2017**
2017 2nd Semi-Annual Monitoring Field Event	11/1/2017	**1**	**2018**
2017 Draft 1st Semi-Annual Monitoring Report	9/21/2018	**4**	**2018**
2017 Draft Final 1st Semi-Annual Monitoring Report	1/8/2021	**2**	**2021**
2017 Final 1st Semi-Annual Monitoring Report	3/1/2021	**2**	**2021**
2017 Draft 2nd Semi-Annual Monitoring Report	6/14/2019	**3**	**2019**
2017 Draft Final 2nd Semi-Annual Monitoring Report	1/8/2021	**2**	**2021**
2017 Final 2nd Semi-Annual Monitoring Report	3/1/2021	**2**	**2021**
FY2018 - Semi-Annual Monitoring	**3/4/2022**	**2**	**2022**
2018 1st Semi-Annual Monitoring Field Event	5/1/2018	**3**	**2018**
2018 2nd Semi-Annual Monitoring Field Event	11/1/2018	**1**	**2019**
2018 Draft 1st Semi-Annual Monitoring Report	1/7/2020	**2**	**2020**
2018 Draft Final 1st Semi-Annual Monitoring Report	8/20/2021	**4**	**2021**
2018 Final 1st Semi-Annual Monitoring Report	3/4/2022	**2**	**2022**
2018 Draft 2nd Semi-Annual Monitoring Report	1/31/2021	**2**	**2021**
2018 Draft Final 2nd Semi-Annual Monitoring Report	8/20/2021	**4**	**2021**
2018 Final 2nd Semi-Annual Monitoring Report	3/4/2022	**2**	**2022**
FY2019 - Semi-Annual Monitoring		**2**	**2022**
2019 1st Semi-Annual Monitoring Field Event	5/1/2019	**3**	**2019**
2019 2nd Semi-Annual Monitoring Field Event	11/1/2019	**1**	**2020**

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Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
2019 Draft 1st Semi-Annual Monitoring Report	8/1/2021	**4**	**2021**
2019 Draft Final 1st Semi-Annual Monitoring Report	8/31/2021	**4**	**2021**
2019 Final 1st Semi-Annual Monitoring Report	3/4/2022	**2**	**2022**
2019 Draft 2nd Semi-Annual Monitoring Report	2/1/2021	**2**	**2021**
2019 Draft Final 2nd Semi-Annual Monitoring Report	3/3/2021	**2**	**2021**
2019 Final 2nd Semi-Annual Monitoring Report	3/4/2022	**2**	**2022**
FY2020 - Semi-Annual Monitoring		**1**	**2023**
2020 1st Semi-Annual Monitoring Field Event	5/1/2020	**3**	**2020**
2020 2nd Semi-Annual Monitoring Field Event	11/1/2020	**1**	**2021**
2020 Draft 1st Semi-Annual Monitoring Report	8/1/2020	**4**	**2020**
2020 Draft Final 1st Semi-Annual Monitoring Report	1/8/2021	**2**	**2021**
2020 Final 1st Semi-Annual Monitoring Report	10/12/2022	**1**	**2023**
2020 Draft 2nd Semi-Annual Monitoring Report	12/15/2020	**1**	**2021**
2020 Draft Final 2nd Semi-Annual Monitoring Report	1/8/2021	**2**	**2021**
2020 Final 2nd Semi-Annual Monitoring Report	10/12/2022	**1**	**2023**
FY2021 - Semi-Annual Monitoring		**4**	**2022**
2021 1st Semi-Annual Monitoring Field Event	5/1/2021	**3**	**2021**
2021 2nd Semi-Annual Monitoring Field Event	10/18/2021	**1**	**2022**
2021 Draft 1st Semi-Annual Monitoring Report	1/24/2022	**2**	**2022**
2021 Draft Final 1st Semi-Annual Monitoring Report	5/23/2022	**3**	**2022**
2021 Final 1st Semi-Annual Monitoring Report	5/23/2022	**3**	**2022**
2021 Draft Final 1st Semi-Annual Monitoring Report	5/23/2022	**3**	**2022**
2021 Final 1st Semi-Annual Monitoring Report	5/23/2022	**3**	**2022**
2021 Draft 2nd Semi-Annual Monitoring Report	5/24/2022	**3**	**2022**
2021 Draft Final 2nd Semi-Annual Monitoring Report	8/10/2022	**4**	**2022**
2021 Final 2nd Semi-Annual Monitoring Report	8/10/2022	**4**	**2022**
FY2022 - Semi-Annual Monitoring		**4**	**2023**
2022 1st Semi-Annual Monitoring Field Event	5/23/2022	**3**	**2022**
2022 2nd Semi-Annual Monitoring Field Event	10/17/2022	**1**	**2023**
2022 Draft 1st Semi-Annual Monitoring Report	1/17/2023	**2**	**2023**
2022 Draft Final 1st Semi-Annual Monitoring Report	4/7/2023	**3**	**2023**
2022 Final 1st Semi-Annual Monitoring Report	6/6/2023	**3**	**2023**
2022 Draft 2nd Semi-Annual Monitoring Report	3/22/2023	**2**	**2023**
2022 Draft Final 2nd Semi-Annual Monitoring Report	6/10/2023	**3**	**2023**
2022 Final 2nd Semi-Annual Monitoring Report	8/9/2023	**4**	**2023**
FY2023 - Annual Monitoring Summary Report	12/15/2023	**1**	**2024**
Five Year Reviews			**1900**
FY14 - Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy (completion date)	**6/6/2017**	**3**	**2017**
FY19 - Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy (completion date)	**5/26/2020**	**3**	**2020**
Draft Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	4/22/2019	**3**	**2019**
Draft Final Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	6/1/2019	**3**	**2019**
Final Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	5/26/2020	**3**	**2020**
FY24 - Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	12/24/2024	**1**	**2025**
FY29 - Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	6/24/2029	**3**	**2029**
FY34 - Five Year Reviews for Area B Groundwater and Areas B-2, B-3, B-6, B-8, Trenches North of B-8, B-18, B-10 and B-11 Landfill Capping Remedy	6/24/2034	**3**	**2034**
Off Post Private Well Investigation (completion date)	**7/14/2015**	**4**	**2015**
Research and Initial Outreach (public meetings, door to door survey and data collection/review)	10/26/2012	**1**	**2013**
Private Well Sampling	12/21/2012	**1**	**2013**

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Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
Draft Private Well Investigation Report	7/24/2014	4	2014
Draft Final Private Well Investigation Report	1/8/2015	2	2015
Final Private Well Investigation Report	7/14/2015	4	2015
Public Meeting Results Reporting	8/6/2014	4	2014
Area B Groundwater (FTD-72) Fort Detrick Quarterly Groundwater Monitoring			1900
2017 Quarter Groundwater Sampling (completion date)	**1/29/2021**	2	2021
2017 1st Quarterly Groundwater Monitoring Field Event	4/3/2017	3	2017
2017 2nd Quarter Groundwater Monitoring Field Event	6/26/2017	3	2017
2017 3rd Quarterly Groundwater Monitoring Field Event	10/18/2017	1	2018
2017 4th Quarter Groundwater Monitoring Field Event	12/18/2017	1	2018
Draft Quarterly Groundwater Monitoring Report	5/31/2018	3	2018
Draft Final Quarterly Groundwater Monitoring Report	1/8/2021	2	2021
Final Quarterly Groundwater Monitoring Report	1/29/2021	2	2021
2018 Quarter Groundwater Sampling (completion date)	**3/5/2021**	2	2021
2018 1st Quarterly Groundwater Monitoring Field Event	3/5/2018	2	2018
2018 2nd Quarter Groundwater Monitoring Field Event	6/4/2018	3	2018
2018 3rd Quarterly Groundwater Monitoring Field Event	9/10/2018	4	2018
2018 4th 1st Quarter Groundwater Monitoring Field Event	12/3/2018	1	2019
Draft Quarterly Quarter Groundwater Monitoring Report	5/17/2019	3	2019
Draft Final Quarterly Groundwater Monitoring Report	1/8/2021	2	2021
Final Quarterly Groundwater Monitoring Report	3/5/2021	2	2021
2019 Quarter Groundwater Sampling	**8/30/2021**	4	2021
2019 1st Quarterly Groundwater Monitoring Field Event	3/1/2019	2	2019
2019 2nd Quarter Groundwater Monitoring Field Event	6/1/2019	3	2019
2019 3rd Quarterly Groundwater Monitoring Field Event	9/1/2019	4	2019
2019 4th Quarter Groundwater Monitoring Field Event	12/1/2019	1	2020
Draft Quarterly Quarter Groundwater Monitoring Report	2/8/2021	2	2021
Draft Final Quarterly Groundwater Monitoring Report	8/2/2021	4	2021
Final Quarterly Groundwater Monitoring Report	8/30/2021	4	2021
2020 Quarter Groundwater Sampling		2	2022
2020 1st Quarterly Groundwater Monitoring Field Event	3/1/2020	2	2020
2020 2nd Quarter Groundwater Monitoring Field Event	6/1/2020	3	2020
2020 3rd Quarterly Groundwater Monitoring Field Event	9/1/2020	4	2020
2020 4th Quarterly Groundwater Monitoring Field Event	2/1/2021	2	2021
Draft Quarterly Quarter Groundwater Monitoring Report	8/1/2021	4	2021
Draft Final Quarterly Groundwater Monitoring Report	9/30/2021	4	2021
Final Quarterly Groundwater Monitoring Report	1/21/2022	2	2022
2021 Quarter Groundwater Sampling		4	2022
2021 1st Quarterly Groundwater Monitoring Field Event	3/2/2021	2	2021
2021 2nd Quarter Groundwater Monitoring Field Event	6/7/2021	3	2021
2021 3rd Quarterly Groundwater Monitoring Field Event	8/23/2021	4	2021
2021 4th Quarterly Groundwater Monitoring Field Event	10/18/2021	1	2022
Draft Quarterly Quarter Groundwater Monitoring Report	3/31/2022	2	2022
Draft Final Quarterly Groundwater Monitoring Report	8/10/2022	4	2022
Final Quarterly Groundwater Monitoring Report	8/10/2022	4	2022
2022 Quarter Groundwater Sampling			

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Table 3-14: Area B Groundwater (FTD-72 / OU #14) Schedule

Task Name	Completion Dates*	Completion / Estimated Completion	
		Quarter	Fiscal Year
2022 1st Quarterly Groundwater Monitoring Field Event	3/14/2022	2	2022
2022 2nd Quarter Groundwater Monitoring Field Event	5/23/2022	3	2022
2022 3rd Quarterly Groundwater Monitoring Field Event	8/22/2022	4	2022
2022 4th Quarterly Groundwater Monitoring Field Event	10/18/2022	1	2023
Draft Quarterly Quarter Groundwater Monitoring Report	6/14/2023	3	2023
Draft Final Quarterly Groundwater Monitoring Report	12/14/2023	1	2024
Final Quarterly Groundwater Monitoring Report	pending		2024
2023 Quarterly Groundwater Sampling - Annual Report			
Draft Annual Groundwater Monitoring Report	8/20/2024		2024
Draft Final Annual Groundwater Monitoring Report	12/20/2024	1	2025
Final Annual Groundwater Monitoring Report	4/30/2025	3	2025
2024 Quarterly Groundwater Sampling - Annual Report			
Draft Annual Groundwater Monitoring Report	8/30/2025		2025
Draft Final Annual Groundwater Monitoring Report	12/30/2025	1	2026
Final Annual Groundwater Monitoring Report	4/30/2026	2	2026
Site Inspection of Area B New Archive Search Report Sites (completion date)	**3/9/2018**	**2**	**2018**
SI Work Plan Development	8/5/2016	4	2016
Draft SI Work Plan	8/29/2014	4	2014
Draft Final SI Work Plan	6/26/2015	3	2015
Revised Final SI Work Plan	5/26/2016	3	2016
SI Field Work	8/5/2016	4	2016
SI Report Development		2	2018
Draft SI Report	6/10/2017	3	2017
Draft Final SI Report	11/9/2017	1	2018
Final SI Report	3/9/2018	2	2018
Expanded Site Inspection (ESI) of Area B Herbicide Test Areas			2027
Area B Soil Statistical Background Study			
Draft Area B Soil Statistical Background Report	8/19/2021	4	2021
Draft Final Area B Soil Statistical Background Report	10/2/2022	1	2023
Final Area B Soil Statistical Background Report	8/12/2024	4	2024
ESI Work Plan Development		4	2025
Draft ESI Work Plan			

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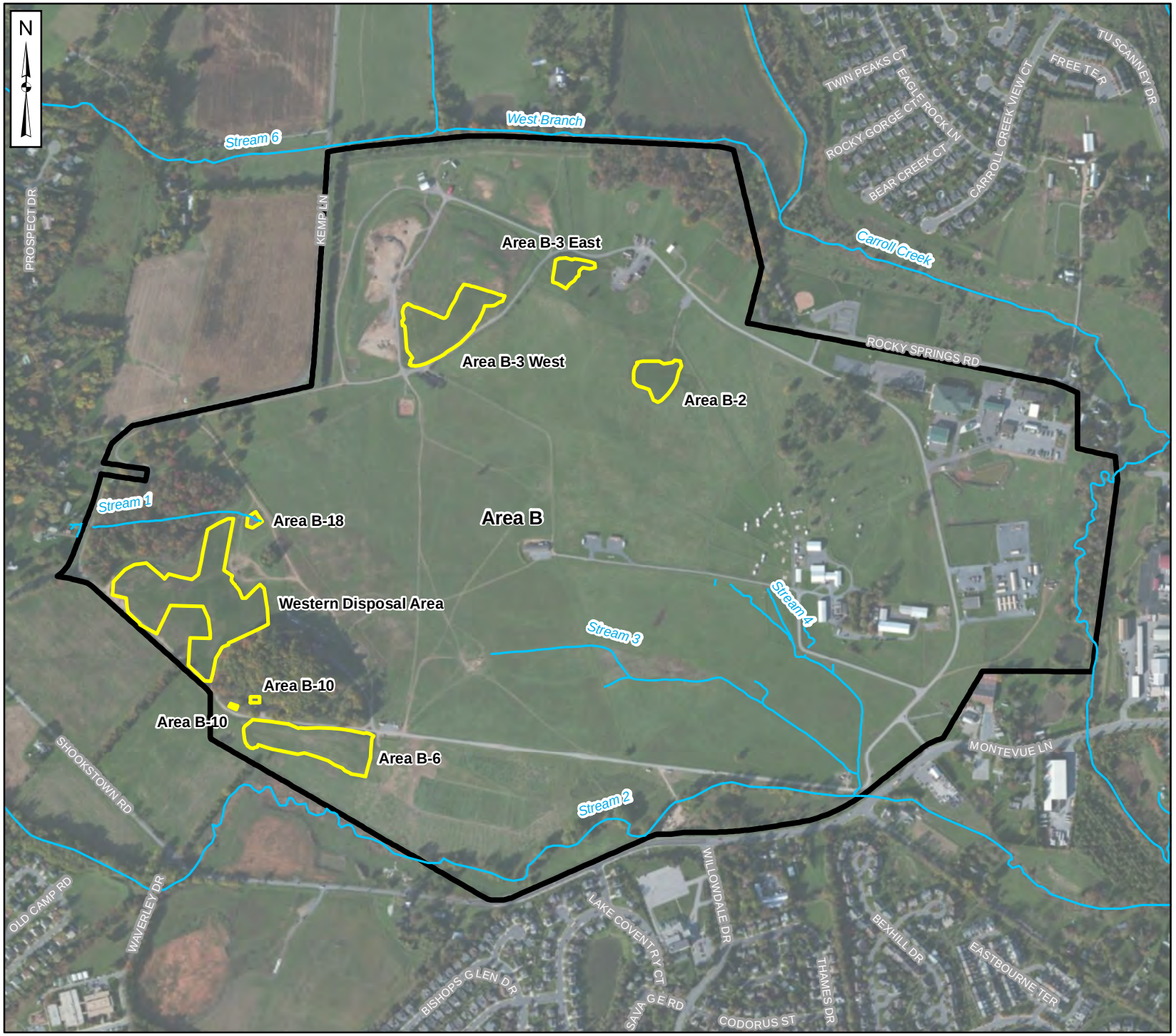
Figure 3-1: Area B Landfill Caps



Site Management Plan
Fort Detrick
Frederick, MD

PIKA INTERNATIONAL, INC. ARCADIS

Figure 3-1
Area B Landfill Caps

Legend

- Fort Detrick Boundary
- Landfill Cap
- Stream

Western Disposal Area:
B-8, B-10, trenches north of B-10, B-11, B-18

Data Source: ESRI, ArcGISOnline, Aerial Photo

Coordinate System: Maryland State Plane
Datum: NAD 1983
Units: Feet

4. Land Use Planning

4.1. Land Use Controls

The types of LUCs in place at Fort Detrick are described below.

Area B Landfill Caps— Chemical Waste Pits B-11 (FTD-49), Landfill B-2 (FTD-50), Landfill B-3 (FTD-51), Area B-6 (FTD-69), Areas B-8, B-18, and Trenches North of B-8 (*FTD-70), and Area B-10 and B-Grove (FTD-71)*

- Land Use Restrictions:
    - Prohibit activities that would impact the landfill cap (or cover system) and drainage system
    - Prohibit excavation on landfill cap or cover system
    - Prohibit installation of utility system lines through the site
    - Restrict construction of buildings that may interfere with the landfill cap or cover system
    - Restrict planting that interferes with the landfill cap or cover system (roots that penetrate the cap or cover system)
    - Restrict vehicular traffic
- Types of Engineering Controls: Markers, Signs
- Types of Institutional Controls: Dig Permits, Notations in Master Plan, Restrictions on land use
- LUC Enforcement: Annual Inspections, 5 Year Reviews, Markers, Other

4.2. Future Land Use

In October 2009, the US Army Garrison Fort Detrick and the City of Frederick established a Memorandum of Understanding (MOU) for the consideration of a proposed granting of a right-of-way (ROW) through Area B, for a section of Christopher's Crossing roadway. Considerations included reviewing and providing comments on documents such as environmental assessments, engineering documents, landfill cap information, grading plans, historical photos, and historical maps. The MOU ensured the coordination and communication required for the consideration of the ROW but did not grant permission or approval of the ROW. Furthermore, the goal of the MOU was to complete all relevant matters associated with granting of the ROW by May 1st, 2010. To date this goal has not been met and the Garrison subsequently terminated the MOU.

Because the planned roadway is adjacent to capped disposal areas and is near the primary source area of the Area B groundwater contamination, the City of Frederick will be responsible to assure that the design of the roadway does not impact the landfill caps nor changes the hydrology of the site. The roadway design will need Army, U.S. Environmental Protection Agency and the Maryland Department of the Environment approval prior to construction. As the roadway is a City of Frederick project, the Army has no control over the funding, design or schedule associated with the project.

5. References

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