

**Revised Final**

**Engineering Evaluation /  
Cost Analysis**

**Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences**

**Fort Detrick, Maryland**

June 2013

United States Army Corps of Engineers  
Baltimore, Maryland

Contract Number / Delivery Order Number:  
W912DR-11-D-0001 / 0003

*Shelly K Morris*

---

Shelly Morris, PMP  
ARCADIS U.S., Inc.  
Project Manager

*B.A. Full*

---

Brian Stockwell  
PIKA International, Inc.  
Program Manager

*Heather Polinsky*

---

Heather Polinsky, PMP  
ARCADIS U.S., Inc.  
Quality Assurance / Quality Control Manager

**Revised Final  
Engineering Evaluation /  
Cost Analysis**

**Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences**

Fort Detrick, Maryland

Prepared for:

United States Army Corps of Engineers  
Baltimore District

Contract Number / Delivery Order:

W912DR-11-D-0001 / 0003

Prepared by:

PIKA International, Inc. and  
ARCADIS U.S., Inc.  
8451 State Route 5  
Building 1038  
Ravenna, OH 44266

Date:

June 2013

*This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.*

## Table of Contents

<b>Executive Summary</b>	<b>1</b>
<b>1. Introduction</b>	<b>1-1</b>
1.1 Purpose of Report	1-2
1.2 Report Organization	1-3
<b>2. Site Characterization</b>	<b>2-1</b>
2.1 Site Description and Background	2-1
2.2 Previous Investigations	2-2
<b>3. Identification of Removal Action Objectives</b>	<b>3-1</b>
3.1 Identification of Applicable or Relevant and Appropriate Requirements	3-1
3.1.1 Chemical-Specific ARARs and TBC Guidance	3-1
3.1.2 Location-Specific ARARs and TBC Guidance	3-2
3.1.3 Action-Specific ARARs and TBC Guidance	3-2
3.2 Identification of Health Hazards	3-3
3.3 Removal Action Objective	3-3
3.3.1 Statutory Limits on Removal Actions	3-4
3.3.2 Determination of Removal Scope	3-4
3.3.3 Determination of Removal Schedule	3-4
3.3.4 Planned Remedial Activities	3-4
<b>4. Identification and Analysis of Removal Action Alternatives</b>	<b>4-1</b>
4.1 Identification of Possible Removal Action Alternatives	4-1
4.1.1 Alternative 1: No Further Action	4-1
4.1.2 Alternative 2: Provide Bottled Water Service and Groundwater Monitoring	4-1
4.1.3 Alternative 3: Connect Residences to the City Water Supply	4-2
4.2 Evaluation Criteria of Potential Removal Action Alternatives	4-2
4.2.1 Effectiveness	4-2
4.2.2 Implementability	4-2
4.2.3 Cost	4-3

## Table of Contents

4.3	Individual Analysis of Possible Removal Action Alternatives	4-3
4.3.1	Alternative 1- No Further Action	4-3
4.3.1.1	Effectiveness	4-3
4.3.1.2	Implementability	4-4
4.3.1.3	Cost	4-4
4.3.2	Alternative 2 – Provide Bottled Water Service and Groundwater Sampling	4-4
4.3.2.1	Effectiveness	4-5
4.3.2.2	Implementability	4-5
4.3.2.3	Cost	4-6
4.3.3	Alternative 3 – Connect Residences to City Water Supply	4-6
4.3.3.1	Effectiveness	4-7
4.3.3.2	Implementability	4-7
4.3.3.3	Cost	4-8
<b>5.</b>	<b>Comparative Analysis of Removal Action Alternatives</b>	<b>5-1</b>
5.1	Effectiveness	5-1
5.2	Implementability	5-1
5.3	Cost	5-2
<b>6.</b>	<b>Recommended Removal Action Alternative</b>	<b>6-1</b>
<b>7.</b>	<b>Plan for Public Participation</b>	<b>7-1</b>
<b>8.</b>	<b>References</b>	<b>8-1</b>

### Tables

Table 4-1	Alternative 2 Costs
Table 4-2	Alternative 3 Costs
Table 5-1	Comparison of Effectiveness of Alternatives
Table 5-2	Comparison of the Implementability of Alternatives
Table 5-3	Cost Summary of Alternatives

## Table of Contents

### Figures

Figure 2-1 Fort Detrick Area B - Site Location Map

Figure 2-2 Monitoring Well Sampling Concentrations (June 2012)

### Appendix

Appendix A Project Schedule

Appendix B Cost Estimating Backup

Appendix C Comments and Responses

**List of Acronyms and Abbreviations**

ARAR	Applicable or Relevant and Appropriate Requirement
ARCADIS	ARCADIS U.S., Inc.
Army	United States Department of the Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COMAR	Code of Maryland Regulations
DERP	Defense Environmental Restoration Program
EE/CA	Engineering Evaluation / Cost Analysis
FFA	Federal Facility Agreement
FTD	Fort Detrick
FTD-72	Fort Detrick Area B Groundwater
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
PCE	tetrachloroethene
PIKA	PIKA International, Inc.
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
TBC	To-Be-Considered
TCE	trichloroethene
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

## **Executive Summary**

This Engineering Evaluation / Cost Analysis (EE/CA) addresses the investigation of proposed public water connection for five residences along Kemp Lane in Frederick, Maryland, adjacent to Fort Detrick Area B. This EE/CA evaluates three alternatives to mitigate potential human health hazards associated with Volatile Organic Compounds (VOCs) concentrations in residential water supply wells.

This EE/CA addresses a specific scope of work associated with five residences within Frederick, Maryland (the Site) and does not address the entire Fort Detrick Area B. These five residences are located on Kemp Lane; Kemp Lane forms the western boundary to Fort Detrick Area B. The purpose of this EE/CA is to evaluate potential alternatives that would mitigate potential health risks associated with VOCs in the plume underlying Area B. The contaminants of concern for Area B and the residential supply wells are VOCs, primarily tetrachloroethene (PCE), trichloroethene (TCE), and related compounds. Each of these five residences has a drinking water well that may be at risk due to the Area B solvent plume during extreme drought conditions.

Currently, VOCs are present in the karst aquifer that underlies Fort Detrick's Area B. The most predominant 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. Numerous environmental investigations and remediation activities have been performed at Fort Detrick Area B since the 1980s. Periodic groundwater monitoring of the solvent plume has been conducted since 1998 and has documented significant declines in constituent concentrations. Several drinking water wells at the residences along Kemp Lane have had detections of TCE and PCE below the Maximum Contaminant Level (MCL). Currently five residences, including the residences that had detections of TCE and PCE, are receiving bottled water as a precautionary measure by Fort Detrick to ensure a safe drinking supply for these residents. Periodic monitoring of constituents of concern in the residential wells is on-going, and there have been no detections of VOCs at or above the MCLs since the early 1990s. The previous investigations were conducted consistent with Section 300.430 (a)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The basis for the EE/CA and associated removal action is primarily the NCP coupled with guidance from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980<sup>1</sup> and the Defense Environmental Restoration Program

---

<sup>1</sup> The law has subsequently been amended, by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the Small Business Liability Relief and Brownfields Revitalization Act of 2002.

(DERP). Specifically, Section 300.415(b)(1) of the NCP states that “any release, regardless of whether the site is included on the National Priorities List (NPL), where the lead agency makes the determination, based on the factors in Section 300.415(b)(2), that there is a threat to public health or welfare of the United States or the environment, the lead agency may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release.” Section 300.415(b)(2) of the NCP lists eight criteria to determine whether a removal action is appropriate. The two factors most applicable to current site conditions are as follows:

- Section 300.415(b)(2)(i) - Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.
- Section 300.415(b)(2)(ii) - Actual or potential contamination of drinking water supplies or sensitive ecosystems.

Historical VOC monitoring at the five residences along Kemp Lane indicate that there have been levels of VOCs detected below their respective MCLs. These concentrations have warranted the provision of bottled water as a precautionary measure to these residences. PCE and TCE are listed by the Agency for Toxic Substances and Disease Registry as part of their Substance Priority List, deeming these two compounds significant potential threats to human health due to their known toxicity and potential for human exposure at NPL sites. The Army is required to respond in cooperation with DERP and Section 104(a)(1) of the Comprehensive Environmental Response, Compensation and Liability Act, and has developed and evaluated the following three removal action alternatives:

1. Alternative 1 – No Further Action
2. Alternative 2 – Provide Bottled Water Service and Groundwater Monitoring
3. Alternative 3 – Connect Residences to the City Water Supply

Each of the alternatives was evaluated based on the merits of the individual and comparative analyses in regards to 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 is Alternative 3: Connect Residences to the City Water Supply. Alternative 3 was selected because it will most effectively attain the following removal action objective:

**Engineering Evaluation /  
Cost Analysis**

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

*To provide long-term protection to human receptors at five homes along Kemp Lane by eliminating access to the hazard posed by exposure to VOCs at concentrations above their MCLs in the solvent plume under Fort Detrick Area B.*

## 1. Introduction

This document presents the Engineering Evaluation / Cost Analysis (EE/CA) of mitigating human health hazards associated with the Volatile Organic Compounds (VOCs) that are present in the karst aquifer that underlies Fort Detrick's Area B (FTD-72), in Frederick County, Maryland. This EE/CA has been completed in compliance with the Federal Facility Agreement (FFA) between the United States (U.S.) Environmental Protection Agency (USEPA), and the U.S. Department of the Army (Army), and signed on 5 August 2011. This EE/CA was prepared by ARCADIS U.S., Inc (ARCADIS) under contract with PIKA International, Inc. (PIKA). The Project Management Plan was prepared in accordance with the Performance Work Statement included in Contract W912DR-11-D-0001; Delivery Order 0001 (issued 10 June 2011), by the U.S. Army Corps of Engineers (USACE), Baltimore District to PIKA.

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 1626]). An FFA between the Army and USEPA was signed on 17 December 10 and was finalized 5 August 2011 after public comment. The Maryland Department of the Environment (MDE) is not a party to the FFA.

Area B Groundwater was listed on the NPL in April 2009. Environmental restoration activities on Area B Groundwater are being conducted in accordance with Comprehensive Environmental Response, Compensation and Liability Act (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. The IRP activities at Fort Detrick operate principally under the CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300] as well as the Defense Environmental Restoration Program (DERP) (Department of Defense Manual [DoDM] 4715.20, 2012).

This EE/CA has been prepared to evaluate potential alternatives that would mitigate health hazards associated with volatile organic compounds (VOCs) in the plume underlying Fort Detrick Area B. The VOC concentrations in the drinking water wells at the residences along Kemp Lane have never exceeded their respective Maximum Contaminant Levels (MCL) in the past; however during drought conditions in 2005, PCE and TCE were detected in two residential wells below the MCLs. During the same period, a Fort Detrick boundary monitoring well along Kemp Lane had a detection of PCE over the MCL. Because of these detections, as a proactive/precautionary measure to insure the protection of human health, five residential properties along the border have been provided bottled water by Fort

Detrick. Therefore, this EE/CA has been prepared to address this portion of the site in accordance to 40 CFR 300.415(b)(4)(i).

## **1.1 Purpose of Report**

This EE/CA evaluates alternatives to mitigate potential human health risks associated with VOCs concentrations in the residential water supply obtained through groundwater supply wells. The EE/CA identifies removal action objectives for the five residences along Kemp Lane; develops three removal action alternatives to address the health hazard, analyzes effectiveness, implementability, and cost of the three alternatives; and recommends the best-suited removal action alternative. This proposed action will provide long-term protection to human receptors consuming the groundwater at five residences along Kemp Lane from the VOC plume underlying Fort Detrick Area B.

The purpose of this EE/CA is to evaluate alternatives for providing five residences along Kemp Lane an alternative, safe source of potable water. The contaminants of concern for this site are VOCs in groundwater, specifically tetrachloroethene (PCE) and trichloroethene (TCE) and related compounds.

The basis for drafting this report and proceeding with an alternative potable water source is the NCP. Section 300.415(b)(2) of the NCP lists eight criteria to determine whether a removal action is appropriate. The two factors most applicable to current Site conditions are as follows:

- Section 300.415(b)(2)(i) - Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.
- Section 300.415(b)(2)(ii) - Actual or potential contamination of drinking water supplies or sensitive ecosystems.

Historical VOC monitoring at the five residences along Kemp Lane indicate that there have been levels of VOCs detected below their respective MCLs. These concentrations have warranted the provision of bottled water to these residences, as an on-going interim response action. PCE and TCE are listed by the Agency for Toxic Substances and Disease Registry as part of their Substance Priority List, deeming these two compounds significant potential threats to human health due to their known toxicity and potential for human exposure at NPL sites.

Thus, the Army is required to take a response action under CERCLA and this EE/CA has been prepared with the guidance set forth in the NCP (40 CFR 300.415, Removal Action).

## **1.2 Report Organization**

In addition to this Section 1 Introduction, the report is divided into seven sections as follows:

- Section 2 – Site Characterization: This section presents information pertaining to Site characteristics, description, and history. An overview of the environmental program at Fort Detrick’s Area B is also presented in this section.
- Section 3 – Identification of Removal Action Objectives: The removal action objective is identified and Applicable or Relevant and Appropriate Requirements (ARARs) are identified. Furthermore, this section provides information regarding health hazards posed by the site as well as the removal action scope, goals, objective and schedule.
- Section 4 – Identification and Analysis of Removal Action Alternatives: Removal Action Alternatives are developed and described based on effectiveness, implementability, and cost.
- Section 5 – Comparative Analysis of Removal Action Alternatives: The Removal Action Alternatives are compared against each other based on effectiveness, implementability, and cost.
- Section 6 – Recommended Removal Action Alternative: Based on the evaluation presented in the EE/CA, a recommended alternative to address the VOC human health hazard at five residences along Kemp Lane is identified.
- Section 7– Plan for Public Participation: Describes the degree and responsibilities of stakeholder involvement during the removal action process.
- Section 8 – References: The references used to develop this report are presented.

## **2. Site Characterization**

This section provides a brief overview of the site location, history, hydrogeologic setting and an overview of the environmental program at Fort Detrick's Area B, Maryland as it pertains to the adjacent residences on Kemp Lane.

### **2.1 Site Description and Background**

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, D.C., and is surrounded by residential and commercial areas and county-owned lands. Fort Detrick Area B, the focus of this EE/CA, is presented in Figure 2-1.

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

Fort Detrick, Frederick Campus, consists of four non-contiguous tracts of land designated as Area A, Area B, Area C Water Treatment Plant, and Area C Waste Water Treatment Plant. These areas cover a total of approximately 1,212 acres. Fort Detrick's active municipal landfill, animal farm, former skeet range, former explosives storage, and former waste disposal / test areas associated with former research activities are all located within Area B. Area B is approximately 399 acres in size and is located 0.5 miles west of the center of Fort Detrick activity, otherwise known as Area A. Area B is the focus of this investigation. Area C is two separate tracts that contain the Fort Detrick Water Treatment Plant and Waste Water Treatment Plant.

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 104<sup>th</sup> Observation Squadron. This was the first military presence at this site.

From 1943 through 1969, Fort Detrick served as the nation's center for biological warfare research. Early research (i.e., prior to 1945) was conducted in temporary buildings and facilities. These temporary buildings were gradually replaced with permanent structures, and by 1945 approximately 245 permanent structures had been built, most of which have subsequently been demolished (Shaw 2010).

Area B was purchased in 1946, to provide an outdoor test area, and has been the main location of waste disposal activities for Fort Detrick. After the enactment of the

Resource Conservation and Recovery Act hazardous waste regulations in 1976, hazardous wastes were shipped offsite for disposal at an approved treatment and disposal facility. In 1989, a permitted municipal landfill was constructed in the Northeast corner of Area B. Historical waste disposal practices at Area B (i.e., prior to 1976) have resulted in groundwater contamination in Area B and adjacent areas.

The focus of this EE/CA is five residences located on Kemp Lane, directly adjacent to the known primary source of groundwater contamination on Fort Detrick Area B. Kemp Lane forms the western boundary of Fort Detrick with Frederick County, Maryland.

## **2.2 Previous Investigations**

Currently, VOCs (primarily PCE and TCE) are present in the karst aquifer that underlies Fort Detrick's Area B. These VOCs emanate in a solvent plume from Area B-11, a former waste disposal area located in the western portion of Area B. Numerous environmental investigations and remediation activities have been performed at Fort Detrick Area B since the 1980s. Detection of VOCs contamination in domestic wells off Fort Detrick property adjacent to Area B in 1992 and 1993 prompted the placement of several residents on Shookstown Road and Montevue Lane on bottled water with subsequent connection of affected residences to the City of Frederick water system. In response to a spike in groundwater 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 the presumed primary source of PCE and TCE migrating to groundwater. In May 2010, all of Area B's disposal areas were capped with a low-permeability cover, following the presumptive remedy process for CERCLA landfills.

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

Periodic groundwater monitoring of the solvent plume has been conducted since 1998 and has documented significant declines in constituent concentrations. Bottled water has been provided to five residences along Kemp Lane due to a low level detection (below MCL) of PCE and TCE in the early 1990s. This was a proactive measure to ensure that human health was protected. Periodic monitoring is on-going; there have been no detections of VOCs above the MCLs at these properties to date.

A Phase I Remedial Investigation (RI) of the Area B Groundwater, both on- and off-post, has been ongoing since 2011. The goal of the RI is to establish the groundwater flow direction and to determine the depth of contamination through groundwater,

## **Engineering Evaluation/ Cost Analysis**

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

surface water, and spring sampling. This investigation is establishing and expanding an appropriate groundwater monitoring network through the installation and sampling of additional monitoring wells and piezometers (Shaw 2010).

The results of the June 2012 sampling event are shown in Figure 2-2.

### **3. Identification of Removal Action Objectives**

The scope of this removal action is to mitigate health hazards associated with the VOCs plume underlying Fort Detrick Area B. The main objective is to provide long-term protection of human health to residents/receptors along Kemp Lane by identifying and implementing an alternative safe drinking water supply.

#### **3.1 Identification of Applicable or Relevant and Appropriate Requirements**

This section describes the regulatory standards and guidance that may be applied to this site. Regulatory standards and guidance (ARARS) are divided into three categories: chemical specific, location specific, and action specific requirements.

In order to be classified as an ARAR, the NCP states that federal and/or state laws must meet one of the following two requirements: (1) applicability or (2) relevance and appropriateness. Applicable requirements are “those cleanups standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at CERCLA site” [40 CFR 300.5]. Relevant and appropriate requirements are “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not ‘applicable’ to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site” [40 CFR 300.5].

The NCP identifies a third category, termed “information to-be-considered” (TBC). TBCs are guidelines or advisories that are issued by the federal or state government, but which are neither legally binding nor promulgated 40 CFR 300.400(g)(3). However, these guidelines may be used when they are necessary to ensure protection of public health and the environment If ARARs do not address a particular circumstance at a CERCLA site, then TBCs can be used to establish remedial guidelines or targets although their use is discretionary rather than mandatory. Even when TBCs are used, the requirements imposed on the removal action, including cost-effectiveness, still apply [55 Federal Register 8745, March 9, 1990, 202-204].

##### **3.1.1 Chemical-Specific ARARs and TBC Guidance**

Chemical-specific requirements establish health-based concentration limits, risk based criteria limits, or ranges for specific hazardous substances in different environmental

media. These standards provide media cleanup levels or a basis for calculating cleanup levels. Chemical-specific standards are also used to indicate an acceptable level of discharge, to determine treatment and disposal requirements for a particular remedial activity, and to assess the effectiveness of a removal action.

Potential chemical-specific ARARs and TBC guidance identified as a basis for the decision to employ this removal action to protect human health from VOC contaminated groundwater include:

#### ARAR

- **Safe Drinking Water Act 42 U.S.C.A. §§ 300f to 300j-26():** The main federal law that ensures the quality of Americans' drinking water. Any water provided will meet all federal standards. Specifically related to this EE/CA include a MCL of 5.0 micrograms per liter ( $\mu\text{g/L}$ ) for both PCE and TCE.
- **Maryland Water Supply Program – Code of Maryland Regulations (COMAR) Maryland Public Drinking Water Regulations [26.04.01](#):** The mission of the Water Supply Program is to ensure that public drinking water systems provide safe and adequate water to all present and future users in Maryland, and that appropriate usage, planning and conservation policies are implemented for Maryland's water resources.

#### 3.1.2 Location-Specific ARARs and TBC Guidance

Location-specific requirements set restrictions on the types of remedial activities that can be performed based on specific site characteristics or location. Location-specific standards provide a basis for assessing restrictions during the formulation and evaluation of site specific remedies. Removal actions may be restricted or precluded based on citing laws for hazardous waste facilities and based on proximity to wetlands, floodplains, or man-made features such as landfill, disposal area, and/or local historic buildings.

No potential location-specific ARARs and TBC guidance were identified for the removal actions evaluated in this EE/CA.

#### 3.1.3 Action-Specific ARARs and TBC Guidance

Action-specific requirements set controls or restrictions on the design, implementation, and performance of waste management actions. These standards specify performance levels, actions, or technologies and specific levels for discharge of residual chemicals. They also provide a basis for assessing the feasibility and effectiveness of the removal alternatives.

Potential action-specific standards identified for the removal actions evaluated for this EE/CA include:

*ARAR*

- **Erosion and Sediment Control (COMAR 26.17.01.07):** This regulation is applicable when excavation or on-site storage of contaminated soil and waste is contemplated. It sets criteria and procedures to protect the lands and waters comprising the watersheds of the state and prohibits discharge of raw sewage or waste into these watersheds.
- **Frederick County Plumbing Codes (COMAR 05.02.07 and Frederick County, Maryland Code of Ordinances, 2004, Chapter 1-14):** Plumbing codes are required to provide practical plumbing regulations for the safeguarding of person and property from hazards arising from unsanitary and unhealthy plumbing conditions.
- **Frederick County Well Abandonment Procedures (COMAR 26.04.04.11):** The specifications for well abandonment in the state of Maryland have been delegated to the counties by the Maryland Department of the Environment. Unused wells shall be abandoned and sealed. A well abandonment form would be prepared by the licensed driller at the time of the abandonment in conjunction with the Fredrick County Health Department.

### **3.2 Identification of Health Hazards**

VOCs in drinking water above their respective MCLs present health hazards to human receptors. As discussed in Section 2, the solvent plume underlying Fort Detrick Area B may present a health hazard to the five residences along Kemp Lane, located to the west of the installation. These residences are currently on well water. Connecting these houses to public water and abandoning the private wells would eliminate the exposure to VOCs in groundwater.

### **3.3 Removal Action Objective**

The removal action objective for connection to public water is based on the potential for elevated levels of VOCs in the five homes along Kemp Lane from the groundwater plume under Fort Detrick Area B. The removal action objective was developed based on the criteria outlined in Section 300.430(e)(2) of the NCP with the objective to protect human health. The removal action objective for this project is as follows:

*To provide long-term protection to human receptors at five homes along Kemp Lane by eliminating access to the hazard posed by exposure to VOCs at concentrations above their MCLs in the solvent plume under Fort Detrick Area B.*

### 3.3.1 Statutory Limits on Removal Actions

There is a \$2 million and 12-month statutory limits for Fund-financed removal actions. The Planned Remedial Activities (presented in Section 4) were developed to meet the statutory limits on removal actions.

### 3.3.2 Determination of Removal Scope

The Removal Action Scope for this project is to eliminate the exposure pathways for VOCs in drinking water in the most effective, implementable, and cost effective manner. These exposure pathways include ingestion, inhalation, and dermal contact by human receptors. The Removal Action Scope will provide the basis for evaluation of the removal action alternatives and recommendations of the preferred alternative for the residences along Kemp Lane, presented in Sections 5 and 6

### 3.3.3 Determination of Removal Schedule

The removal action schedule has not yet been established. The removal action is not time critical, as the bottled water supply minimizes the potential receptors health risk.

### 3.3.4 Planned Remedial Activities

Relevant and viable removal alternatives were chosen for evaluation and comparison. Removal alternatives were analyzed for their effectiveness, implementability, and cost. Effectiveness was evaluated in terms of protectiveness and ability to achieve removal objectives. The protectiveness of the alternatives was assessed in terms of how well they protect public health and the community, protect workers during implementation, protect the environment, and comply with ARARs. The implementability of the alternatives depends on their technical feasibility, the availability of necessary resources to support the alternatives, and their administrative feasibility. The cost of the alternatives was determined by looking at capital costs, costs for post-removal site control, and present worth cost. A comparative analysis was conducted to evaluate the relative performance of each alternative in relation to each of the criteria. This process identified key trade-offs that would affect the remedy selection. Based on this analysis, a recommended action was determined. The planned remedial activities were developed to meet the removal action objective presented above (presented in Section 4, Section 5, and Section 6).

## **4. Identification and Analysis of Removal Action Alternatives**

The removal action alternatives identified in this section were developed to meet the removal action objective identified in Section 3. The alternatives are based on eliminating access to the source of VOCs in groundwater at the five residences along Kemp Lane. Three removal action alternatives are described and evaluated in this section based on the following criteria: implementability, effectiveness, and cost. The alternative determined to be the most effective to achieve the removal action objective is identified in Section 6.

### **4.1 Identification of Possible Removal Action Alternatives**

This section presents three removal action alternatives for addressing the health hazards posed by the VOCs in the solvent plume under Fort Detrick Area B.

#### **4.1.1 Alternative 1: No Further Action**

Under Alternative 1, no further corrective action will be employed. Furthermore, the bottled water service and quarterly groundwater monitoring program currently operating at the residences will be discontinued. This alternative will not mitigate the threat posed by the VOCs in the solvent plume under Fort Detrick Area B. However, under the NCP, the no further action alternative must be evaluated to establish a baseline of comparison regarding future performance for the remaining alternatives, even though this alternative is not a viable option itself.

#### **4.1.2 Alternative 2: Provide Bottled Water Service and Groundwater Monitoring**

Under Alternative 2, the current bottled water service will continue to be provided indefinitely. A commercial water distributor will continue to deliver bottled water to the residences on a monthly basis. The bottled water would substitute groundwater as the source of potable water and would mitigate the ingestion hazard posed by VOCs at concentrations above the MCL in the solvent plume, if used as directed. However, this would not reduce any exposure to VOCs through inhalation or dermal contact. Because Alternative 2 entails leaving the groundwater wells operational for non-potable uses (e.g., irrigation, bathing, domestic cleaning), long-term monitoring activities would be necessary. The current groundwater monitoring program would continue to ensure protectiveness is maintained. The monitoring program would include quarterly sampling at each residence with analysis of VOCs by USEPA Method 8260. The groundwater monitoring program duration would be established in a Removal Action Work Plan.

#### 4.1.3 Alternative 3: Connect Residences to the City Water Supply

Alternative 3 includes abandoning the groundwater wells at each residence and connecting each home to the City of Frederick water supply. A 16-inch waterline has recently been installed along Kemp Lane and was operational in summer 2012. Steps for connecting the homes to the waterline would include the following:

- The City of Frederick would tap into the 16-inch line and run service lines from the tap to the property line of each of the five homes, where a water meter would be installed.
- A contractor would install a minimum of a 1-inch distribution line from the meter to the home to complete the connection to the city water supply.
- A contractor would abandon the groundwater wells in accordance with COMAR 26.04.04
- Prior to establishing full connection to the city water supply, a contractor would flush all pipes within each residence with chlorine. Flushing the line with chlorine is a precautionary measure required by the City of Frederick to ensure any existing water within the residential pipes cannot backflow into the city's water supply.
- A contractor would install a backflow preventer as a secondary precaution to prevent backflow from the residential lines to the city's water supply.

## 4.2 Evaluation Criteria of Potential Removal Action Alternatives

The NCP [40 CFR 300.430(e)(7)] cites the general evaluation criteria of effectiveness, implementability, and cost. Each of these criteria is considered in the evaluation of alternatives. The types of specific considerations within each of these general criteria are listed below.

### 4.2.1 Effectiveness

Effectiveness may be evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health during the implementation period. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time.

### 4.2.2 Implementability

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or

impractical at a site; and administrative feasibility, which reviews the ability to obtain permits; and the availability of necessary services, equipment, and skilled workers to implement the removal action alternative for the site. The implementability evaluation criteria are defined in the NCP [40 CFR 300 (e)(7)(ii)].

#### 4.2.3 Cost

Cost involves developing the level of engineering detail and preparing a sufficiently accurate cost estimate for each alternative so that a relative and appropriate cost comparison can be made between competing alternatives. For purposes of this EE/CA, the cost estimates for construction were based on fiscal year 2012 costs. Other considerations in the evaluation of remedy selection include capital and annual Operations and Maintenance (O&M) costs as presented in the NCP [(40 CFR 300 (e)(7)(iii)]. It was assumed that the annual costs would be carried out for a period of ten years for each alternative.

### 4.3 Individual Analysis of Possible Removal Action Alternatives

#### 4.3.1 Alternative 1- No Further Action

The declaration of the No Action Alternative on a property or project is a programmatic decision that indicates it has been determined that No Further Action is required to address unsafe conditions or hazardous substances, pollutants, or contaminants that may affect future land uses. Under this alternative, “no action” would be taken to eliminate exposure to potential VOCs in groundwater at the five residences along Kemp Lane. The groundwater wells would remain operational and would function as the primary water source for each residence. No administrative controls would be put into place to limit potential exposure to current or future groundwater users at the residences. As no action is associated with this alternative, implementation would be immediate upon its acceptance. Implementation of Alternative 1 would not meet the removal action objective and does not remove or reduce the risks present at the residences.

##### 4.3.1.1 Effectiveness

This alternative would not be an effective method of addressing access to potential VOCs in groundwater at the five residences along Kemp Lane. With the no further action alternative, the bottled water service and groundwater monitoring program would cease and there would be no controls to ensure current use remains protective of human health. This alternative would not provide controls for monitoring reduction of VOC concentrations over time, reduction of exposure, or long-term management measures.

All current and potential future risks would remain the same under this alternative.

- **Protection of Public Safety and the Environment.** This alternative would not eliminate or reduce the volume of contaminated media at the five residences, nor would it limit the potential exposure pathways for current or potential future receptors to the contaminants.
- **Compliance with ARARs.** This alternative would not be compliant with the ARARs.
- **Effectiveness.** Since the only action taken under Alternative 1 would be to discontinue the ongoing bottled water service this alternative would provide no long- or short-term effectiveness.

#### 4.3.1.2 Implementability

This alternative would be implementable because it requires no action on part of Fort Detrick.

- **Technical Feasibility.** This alternative has no technical requirements.
- **Administrative Feasibility.** This alternative would be administratively feasible because no action is required.
- **Availability of Services and Materials.** This alternative would require no services or materials.
- **Local Agency Acceptance.** This alternative would not be acceptable to the local regulatory agencies because site risks are not reduced or controlled.
- **Community Acceptance.** This alternative would not be acceptable to the local community because site risks are not reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would not be acceptable to USEPA, MDE, or local government agencies because site risks are not reduced or controlled.

#### 4.3.1.3 Cost

There would be no capital costs associated with this project.

#### 4.3.2 Alternative 2 – Provide Bottled Water Service and Groundwater Sampling

Alternative 2 includes continuing to provide bottled water to each home as a replacement source of potable water. This service would reduce the potential ingestion exposure to potential VOCs in the solvent plume at, or above, the MCL.

However, this would not reduce any exposure to potential VOCs through inhalation or dermal contact. Under this alternative the groundwater monitoring program would continue on a quarterly basis to ensure protectiveness is maintained. The groundwater wells will remain in-place as a source of non-potable water under this alternative. Implementation of this Alternative would be rapid, because both groundwater monitoring and bottled water service delivery are currently in place at these five properties.

#### 4.3.2.1 Effectiveness

This alternative would reduce the potential ingestion exposure to VOCs in the solvent plume below, at, or above, the MCL. However, this would not reduce any exposure to VOCs through inhalation or dermal contact. Since this alternative would not eliminate all exposure pathways the effectiveness of this alternative is limited.

- **Protection of Public Safety and the Environment.** This alternative provides a minimum level of long-term effectiveness and permanence. While the bottled water service is intended to provide a substitute source for potable water, the homes will remain connected to groundwater. Residents could be exposed to and will have full access to groundwater. The usage of bottled water as a replacement potable water source will be dependent on the daily decisions of the individuals within each residence. It is difficult to improve reliability and long-term effectiveness. This alternative would not eliminate or reduce the volume of contaminated media at the five residences. It would limit, but not fully eliminate, the potential exposure pathways for current or potential future receptors to the contaminants.
- **Compliance with ARARs.** This alternative would not be compliant with the ARARs. This alternative does not prevent access to the solvent plume. Because access to the source of VOCs is not addressed, Alternative 2 fails to be a permanent solution to the mitigation of the hazards posed by VOCs in the solvent plume in Area B of Fort Detrick.
- **Short-Term Effectiveness.** Implementation of this alternative does not pose any additional short-term risks to the community, the workers, or the environment because the bottled water service and groundwater monitoring program are in-place and operating now. This alternative would therefore have good short-term effectiveness.

#### 4.3.2.2 Implementability

Alternative 2 does not require implementation because the bottled water service and groundwater monitoring program are already in place.

- **Technical Feasibility.** This alternative has no technical requirements.
- **Administrative Feasibility.** This alternative would be administratively feasible because the bottled water service and groundwater monitoring program are already in place.
- **Availability of Services and Materials.** This alternative would require no additional service or materials.
- **Local Agency Acceptance.** This alternative would not be acceptable to the local regulatory agencies because site risks are not reduced or controlled.
- **Community Acceptance.** This alternative would not be acceptable to the local community because site risks are not reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would not be acceptable to USEPA, MDE, or local government agencies because site risks are not reduced or controlled.

#### 4.3.2.3 Cost

The cost estimate for Alternative 2 includes monthly bottled water delivery with an average consumption of six 5-gallon bottles per home per month and one water cooler rental per home per month. Quarterly groundwater monitoring events include the collection of groundwater and Quality Assurance / Quality Control samples, analysis for VOCs using USEPA method 8260, and Region 3 MIII data validation. Sampling costs assume the wells will be purged but not redeveloped during each sampling event. Costs also include transporting drums of purge water to Fort Detrick for storage or disposal.

This alternative would have no capital cost and a total O&M cost of \$337,194 (total for the first 10 years). The total net present value of Alternative 2 is \$287,630. Table 4-1 contains a detailed cost estimate for Alternative 2.

#### 4.3.3 Alternative 3 – Connect Residences to City Water Supply

The third alternative incorporates removal of groundwater wells to mitigate exposure to the VOCs in the solvent plume. The residences would each be connected to the City of Frederick Water Supply. This alternative would eliminate human exposure pathways to potential VOCs in groundwater at the five residences along Kemp Lane. This alternative would not require additional monitoring following completion of the removal action.

#### 4.3.3.1 Effectiveness

This alternative would not be an effective method for reducing the volume of contamination onsite, but it would be an effective method for removing access and restricting all potential pathways for human receptors to be exposed to the contamination. In Alternative 3, access to the source of the VOCs, which drives the health hazard, is removed from each residence. The advantage of removing access to the source of the VOCs is that long-term monitoring will not be required once the wells are abandoned.

- **Protection of Public Safety and the Environment.** This alternative would not eliminate or reduce the volume of potentially contaminated media at the five residences, but it would eliminate the potential exposure pathways for current or potential future human receptors to the contaminants. Removal of access to the potential source of VOCs provides a long-term and permanent solution to mitigate exposure at each residence.
- **Compliance with ARARs.** This alternative would be compliant with the ARARs.
- **Short-Term Effectiveness.** This alternative poses some short-term risks to the community and site workers during the construction required to connect the residences to the City of Frederick water supply and the well removal process. Short-term risks would most likely be attributed to typical safety hazards associated with construction. The potential for exposure and safety during construction would be reduced through the use of suitable protective clothing and equipment and implementation of safe construction practices.

#### 4.3.3.2 Implementability

Alternative 3 can be implemented within a reasonable time frame. A water distribution main was recently installed along Kemp Lane and is expected to be operational in summer 2012.

- **Technical Feasibility.** A water distribution main was recently installed along Kemp Lane and was operational in summer 2012. This alternative would be technically feasible because it would require the use of standard construction methods to connect the five residences to the existing water supply.
- **Administrative Feasibility.** This alternative would be administratively feasible and has no long-term administrative burden.

- **Availability of Services and Materials.** The five homes are located in Frederick County and would have to petition the City of Frederick to provide water service. The City of Frederick provides water to county residents, and it is expected that the five homes would be allowed to connect to the city water supply. The services and materials to complete this alternative would be easily acquired.
- **Local Agency Acceptance.** This alternative would be acceptable to the local regulatory agencies because site risks are mitigated through elimination of access to potentially contaminated groundwater.
- **Community Acceptance.** This alternative would be acceptable to the local community because site risks are reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would likely be found acceptable to USEPA, MDE, and local government agencies because site risks are reduced or controlled.

#### 4.3.3.3 Cost

The estimated cost for Alternative 3 includes the City of Frederick costs to tap the distribution line and install a water meter at the property line of each home, contractor costs for continuing a 1-inch distribution line between the meters and each residence, and contractor costs for well abandonment and line chlorination within each residence prior to full connection to the city water supply. This cost also includes a one-time City of Frederick Impact Fee. Annual/quarterly water costs are not included as part of the EE/CA.

This alternative would have an estimated capital cost of \$122,200 with no annual O&M costs. The total current net present value of costs for Alternative 3 (total for the first 10 years), is \$122,200. The detailed cost estimate is included as Table 4-2.

## **5. Comparative Analysis of Removal Action Alternatives**

This section compares the alternatives against each other by ranking them based on effectiveness, implementability, and cost. Each of the five alternatives outlined in Section 3.0 were analyzed and compared against each other.

Alternative 1 – No Further Action

Alternative 2 – Provide Bottled Water Service and Groundwater Monitoring

Alternative 3 – Connect Residences to the City Water Supply

### **5.1 Effectiveness**

Effectiveness is evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health after implementation. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time.

Alternative 3 is the most effective in the long-term because it meets the removal action objective by permanently removing direct access to the source of VOCs causing the potential health hazards at the site. Thus, Alternative 3 is a permanent solution that will not require additional long-term monitoring or maintenance. Although Alternative 3 would pose short-term risks to the community and site workers during the construction activities; these short-term risks can be effectively mitigated using standard administrative and engineering controls during the construction period. Alternative 2 has no short-term risk but is only likely to be moderately effective in the long-term. As such, there is some doubt as to whether this alternative will be effective in the long-term. Alternative 1 is not effective and does not meet the removal action objective.

Table 5-1 presents a comparison of the effectiveness of the alternatives.

### **5.2 Implementability**

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or unworkable at a site, and administrative feasibility, which reviews the ability to obtain permits, and the availability of necessary services, equipment, and skilled workers to implement the technology.

While there are no technical implementation challenges with Alternative 1, it is not implementable because it is administratively an untenable alternative as no action will be unacceptable to the regulatory agencies and the community. There are

uncertainties associated with the implementability of Alternative 2 because, although an alternative source of potable water will be provided, it is not possible to implement or control the usage of bottled water at each residence. Alternative 3 is the most intrusive alternative requiring substantial construction and well abandonment. As such it presents the greatest technical implementation challenges.

Table 5-2 presents a comparison of the implementability of the alternatives.

### **5.3 Cost**

Cost estimates are reviewed as capital (first year) costs, O&M costs, and Net Present Value (NPV) costs. The backup documentation used to generate the cost estimates presented in Tables 4-1 and 4-2 are provided in Appendix B.

Alternative 1 has no associated costs and thus is least expensive. Alternative 2 has no associated capital costs because bottled water service and groundwater monitoring are already being provided at each residence. The O&M costs include continuing bottled water service and groundwater monitoring for a period of 10 years, and the total cost of Alternative 2 is \$287,630. The capital cost of Alternative 3 includes construction and fees associated with abandoning existing groundwater wells and connecting the five residences to the City of Frederick water supply. The O&M cost for Alternative 3 includes the cost of water consumption for a period of 10 years. The total cost of Alternative 3 is \$122,200. The cost summary for the alternatives is shown in Table 5-3.

## **6. Recommended Removal Action Alternative**

A comparative analysis of alternatives was conducted using the evaluation criteria of effectiveness, implementability, and cost based upon the objectives presented earlier in this EE/CA. Based on this comparison, the recommended alternative for mitigating the VOC hazards to the five residences along Kemp Lane in the solvent plume at Area B of Fort Detrick is **Alternative 3: Connect Residences to the City Water Supply**. Alternative 3 was selected because it removes access to groundwater at the site and thus removes access to the VOCs in the solvent plume below Area B. Alternative 3 provides the best permanence and long-term effectiveness in meeting the removal action objective. The long-term effectiveness of Alternative 3 surmounts its short-term risks, greater capital cost (Alternative 2 has \$0 capital costs), and its greater implementability challenges; which results in selection of Alternative 3.

A detailed description of the selected removal action will be provided in a Removal Action Work Plan. However, a brief summary of components likely to be included as part of Alternative 3 includes the following:

- Abandonment of existing groundwater wells;
- Tapping into the City of Frederick water distribution line along Kemp Lane;
- Installing water distribution lines from the water distribution line along Kemp Lane to each of the five homes; and
- Chlorinating the pipes and installing backflow preventers in each home to prevent potential backflow of existing water from within the residential pipes to the city water supply.

Once established the project schedule will be provided as Appendix A.

## **7. Plan for Public Participation**

Pursuant to Section 300.415(n) and 300.820 of the NCP the following actions will be initiated for public participation:

- Publish notice of availability for the administrative record file and availability of the EE/CA – Upon completion of the EE/CA, a public notice will be posted within the local newspapers attesting to the availability of the EE/CA for public review and comment. The notice will be posted within a local newspaper prior to the anticipated public comment period. An affidavit of publication will be included as part of the Removal Action Report 30-day, public comment period. The Final EE/CA will be reproduced in full and placed within the Fort Detrick Post Library, Building 1520, Community Support Center, 1520 Freedman Drive, Fort Detrick, Maryland. This document will be available for public review for a minimum of 30 days.
- Written Response to Significant Comments – Following the 30-day public comment period, written responses to significant comments will be prepared and included within the administrative record.
- Restoration Advisory Board – Periodic Restoration Advisory Board meetings are held at Fort Detrick. During these meetings, an announcement will be made that the administrative record (specifically the EE/CA) will be available for review and public comment, and will be summarized in a presentation to the Board. Significant comments generated during the Restoration Advisory Board meetings will also be documented and addressed within the written response to public comments.

## **8. References**

- Amendments to the Safe Drinking Water Act. Pub. L. no.104-182 104<sup>th</sup> Congress (1996).
- ARCADIS/Malcolm Pirnie, Inc. (2011). Sampling and Analysis Plan, Fort Detrick Area B (FTD-72) Groundwater remedial Investigation.
- Code of Maryland Regulations\_05.02.07.
- Code of Maryland Regulation [26.04.01](#).
- Code of Maryland Regulations 26.04.04.11.
- Code of Maryland Regulations 26.17.01.07.
- Frederick County, Maryland Code of Ordinances, 2004, Chapter 1-14.
- National Oil and Hazardous Substances Pollution Contingency Plan. Title 40 Code of Federal Regulations, Pt 300. 1990 ed.
- United States of America, Department of Defense (DoD). (2012). Department of Defense Manual (DoDM) 4715.20. Defense Environmental Restoration Program (DERP) Management.
- Safe Drinking Water Act 42 U.S.C.A. §§ 300f to 300j-26.
- Shaw Environmental, Inc. 2010. Area B Groundwater (FTD-72) Remedial Investigation Work Plan. Fort Detrick, Maryland.
- U.S. Army, 2009. FY 2009 Fort Detrick Army Defense Environmental Restoration Program Installation Action Plan.

## Tables

**Table 4-1: Alternative 2 Costs**

<b>Inputs and Assumptions</b>	<b>First Year</b>	2012
	<b>Years of Implementation</b>	10
	<b>i =</b>	3.00%

<b>Alternative 2 Costs</b>	<b>Unit</b>	<b>Unit Cost per Home</b>	<b>Monthly Cost per Home</b>	<b>Monthly Cost for 5 Homes</b>	<b>10-year Cost for 5 Homes</b>	<b>Net Present Value (NPV)</b>
<b><u>Bottled Water Service</u></b>						
Average Monthly Water Consumption: 6 bottles per home	per bottle	\$ 9	\$ 51.00	\$ 255.00	\$ 30,600	\$ 26,110
Monthly Water Cooler Rental: 1 per home	per cooler	\$ 11	\$ 11	\$ 54.95	\$ 6,594	\$ 5,630
<b><u>Groundwater Monitoring</u></b>						
Quarterly Sampling Event with VOC Analysis	per quarter	\$ 1,500	\$ 500	\$2,500.00	\$ 300,000	\$ 255,910
<b>Total</b>		<b>\$ 1,519</b>	<b>\$ 551</b>	<b>2,810</b>	<b>\$ 337,194</b>	<b>\$ 287,630</b>

**Table 4-2: Alternative 3 Costs**

<b>Inputs and Assumptions</b>	
First Year	2012
Years Water Service Provided	10
i =	3.00%

<b>Alternative 3 Costs</b>	<b>Unit</b>	<b>Unit Cost per Home</b>	<b>Annual Cost per Home</b>	<b>Annual Cost for 5 Homes</b>	<b>10-year Cost for 5 Homes</b>	<b>Net Present Value (NPV)</b>
<b><u>Connection to Water Distribution System</u></b>						
City of Frederick Impact Fee	per home	\$ 6,684	N/A	N/A	\$ 33,422	\$ 33,422
Plumbing Permit Fees	per home	\$ 189	N/A	N/A	\$ 944	\$ 944
Tap into City of Frederick waterline	per home	\$ 7,883	N/A	N/A	\$ 39,416	\$ 39,416
Install water meter	per home	\$ 743	N/A	N/A	\$ 3,714	\$ 3,714
Install 1-inch water line from property boundary to home, abandon existing wells, chlorinate lines prior to connection	per home	\$ 8,941	N/A	N/A	\$ 44,704	\$ 44,704
<b>Total</b>		<b>\$ 24,440</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 122,200</b>	<b>\$ 122,200</b>

**Table 5–1: Comparison of Effectiveness of Alternatives**

Effectiveness	Alternative 1	Alternative 2	Alternative 3
	No Action	Provide Bottled Water Service and Groundwater Monitoring	Connect Residences to the City Water Supply
Protection of public safety and the environment	NC	3	2
Compliance with ARARs	NC	4	1
Long-term effectiveness	NC	3	1
Short-term effectiveness	NC	2	1
Total	NC	12	5
Rank	NC	2	1
<p><i>Note:</i>                      Scoring: 1=most desirable, 2=more desirable than undesirable, 3=more undesirable than desirable, 4=undesirable; NC=not considered</p>			

**Table 5–2: Comparison of the Implementability of Alternatives**

Implementability	Alternative 1	Alternative 2	Alternative 3
	No Action	Provide Bottled Water Service and Groundwater Monitoring	Connect Residences to the City Water Supply
Technical feasibility	NC	1	1
Administrative feasibility	NC	1	2
Availability of services and materials	NC	1	2
Local agency acceptance	NC	3	1
Community acceptance	NC	3	1
Regulatory and governmental acceptances	NC	3	1
Total	NC	12	8
Rank	NC	2	1
<p><i>Note:</i>            Scoring: 1=most desirable, 2=more desirable than undesirable, 3=more undesirable than desirable, 4=undesirable; NC=not considered</p>			

**Table 5–3: Cost Summary of Alternatives**

<b>Implementability</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
	No Action	Provide Bottled Water Service and Groundwater Monitoring	Connect Residences to the City Water Supply
Capital Cost	\$0	\$0	\$122,200
Annual Operating Costs	\$0	\$33,719	\$0
O&M Years	NA	10	10
Net Present Value	\$0	\$287,630	\$122,200
Rank	NC	2	1
<p><i>Note:</i>            A 10-year period with a 3.0% discount rate is used for economic projections. Scoring: Alternatives are ranked 1 (lowest cost) through 2 (highest cost); NA=not applicable; NC=not considered</p>			

## Figures



**Engineering Evaluation /  
Cost Analysis**

**Off-Post Connection to  
Public Water Supply**

**Fort Detrick  
Frederick, MD**



**Figure 2-1  
Site Location**

**Legend**

- Installation Boundary
- Kemp Lane
- Stream

Data Source: ESRI, ArcGISOnline, Aerial Photo

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

# Engineering Evaluation / Cost Analysis

## Off-Post Connection to Public Water Supply

Fort Detrick  
Frederick, MD



**Figure 2-2**  
**Monitoring Well and Spring**  
**Results Above MCL**

### Legend

- Installation Boundary
- Frederick City Boundary
- ~ Stream
- ▲ Spring
- Monitoring Well
- Private Well Sampling Area
- Spring Location



Data Source: ESRI, ArcGISOnline, Aerial Photo

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



## **Appendix A**

Project Schedule  
(to be provided once established)

## **Appendix B**

Cost Estimating Backup

Vendor Quotes

Vendor	Contact	Item	Cost	Unit	Total Cost	Comments
Castaway Plumbing, Inc. 9210 Reichs Ford Road Frederick, MD. 21704 Ph: 240-674-5652 fax: 301-695-4051 <a href="mailto:Castawayplumbing@live.com">Castawayplumbing@live.com</a> <a href="http://www.castawayplumbing.com">http://www.castawayplumbing.com</a>	Scott Graczowski President/CEO	Materials and installation for installing check valve, pressure reducing valve, and expansion tank on water heater in existing home. Materials and labor also included for chlorinating lines prior to connection to city line.	\$ 850.00	per home		
		Installation of distribution line between residential property line and home. Trenching, returning trench to original grade with seed and straw, and planting new grass included in price	\$ 10.75	per foot of trench	\$ 12,366.25	Total Cost of installing 755ft of drinking water lines and chlorinating lines prior to city connection.
Jiffy Plumbing & Heating 4623 Baltimore Avenue Hyattsville, MD 20781 Ph: 301-277-9111 <a href="http://www.calljiffy.com/">http://www.calljiffy.com/</a>	Bill	Estimate of the cost of materials and labor to install a distribution line from the residential property line to the home. Costs vary based on pipe size and material. Includes cost of filling well casings with concrete but not total abandonment.	\$4,000-\$60	per home	\$ 21,500.00	Total Low Cost of installing 755ft of drinking water lines, chlorinating lines prior to city connection, and filling wells.
		Cost and materials to chlorinate lines in home prior to connection to city line.	\$300	per home	\$ 31,500.00	Total High Cost of installing 755ft of drinking water lines and chlorinating lines prior to city connection, and filling wells.
Charles F. Murphy, Inc. Maryland Master Plumber #21410 301-662-6344 (F)  <a href="http://www.cfmurphy.com">www.cfmurphy.com</a>  301-662-1759 (O)	John Murphy	1" Type K Copper pipe	\$ 6.74	per foot		Total Cost of installing 755ft of 1" Type K Copper drinking water lines, chlorinating lines in home prior to city connection, and abandoning wells.
		1" Polyethylene pipe and #18 tracer wire	\$ 1.53	per foot		
		Excavation: operator, equipment, laborer, backfilling, and compaction	\$ 9.80	per foot		
		Lawn refurbishment: grading, grass seed, stabilization straw application.	\$ 125.00	per home		
		Pipe Installation: pipefitter and pipe layer	\$ 2.90	per foot	\$ 24,608.45	
Residential Materials and Labor: curb stop connection pack joint fitting, house interior transition pack joint fitting, house interior shut off valve, pressure reducing valve, containment Double Check Valve, secondary isolation shut off valve, water heater expansion tank.	\$ 759.70	per home		Total Cost of installing 755ft of 1" Polyethylene drinking water lines, chlorinating lines in home prior to city connection, and abandoning wells.		
Well Abandonment	\$ 711.55	per home				
Chlorination	\$ 360.00	per home				
Frederick City Plumbing Permit	\$ 30.00	per home	\$ 20,674.90			
All Around Plumbing, Inc 301-829-6745 301-829-6746 fax <a href="mailto:Brendan@allaroundplumbingmd.com">Brendan@allaroundplumbingmd.com</a>	J. Brendan Madden President	Labor and materials for installing 1" soft copper water line from property line to home (\$3700 to \$4100 per 100	\$4,100.00	per 100ft	\$ 33,935.00	Total Low Cost of installing 755ft of 1" soft copper water lines and chlorinating lines prior to city connection.
		Labor and materials for installing 1" PSI polyethylene water line from property line to home (\$2300 to \$2700 pe	\$2,700.00	per 100ft	\$ 36,955.00	Total High Cost of installing 755ft of 1" soft copper water lines and chlorinating lines prior to city connection.
					\$ 23,365.00	Total Low Cost of installing 755ft of 1" polyethylene water lines and chlorinating lines prior to city connection.
		chlorination (sub-contracted)	\$1,200.00	per home	\$ 26,385.00	Total High Cost of installing 755ft of 1" polyethylene water lines and chlorinating lines prior to city connection.
Point To Point Land Surveyors 305 S. Main Street Mount Airy, Maryland 21771 410-689-9093 cell 301-703-8319 phone 301-703-8324 fax	Dave Miller Owner, Vice President	Cost of surveying property boundaries for all 5 homes.	\$2,200.00	lump sum	\$ 2,200.00	Total cost of surveying 5 homes on Kemps Lane
3140 West Ward Road; Suite 103 Dunkirk, Maryland 20754 410-286-9712 - Phone 410-286-9716 - Fax <a href="http://www.advancedsurveysinc.com">www.advancedsurveysinc.com</a>	Glenn Swanso Vice President	Survey of first acre of a property to establish property boundary Survey of every acre thereafter to establish property boundary	\$ 260.00 \$ 200.00	first acre per acre, prorated	\$ 1,525.40	Total cost to survey 5 properties that are 2.18, 0.8, 0.68, 1.1, and 2.56 acres each.

## Plumbing Fees

First 100 feet of water main	\$	75.00
Each additional 100ft or portion thereof	\$	50.00
Backflow preventer installation by licensed plumber	\$	30.00

	Feet of Water Main	Total Cost
Kemp Lane A	100-120ft	\$ 155.00
Kemp Lane B	100ft	\$ 105.00
Kemp Lane C	<100ft	\$ 105.00
Kemp Lane D	135-220ft	\$ 205.00
Kemp Lane E	190-215ft	\$ 205.00
	Plumbing Fee Total	<u>\$ 775.00</u>

Water Connection Cost Estimate

Estimated by Angela Nolan, PE  
Designed by Angela Nolan, PE  
Prepared by Angela Nolan, PE

Preparation Date 3/12/2012  
Effective Date of Pricing 3/12/2012  
Estimated Construction Time 180 Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

<u>Date</u>	<u>Author</u>	<u>Note</u>
3/22/2012	Angela Nolan, PE	Escalation was calculated using Table A-2 of EM 1110-2-1304 Civil Works Construction Cost Index System, dated 31 March 2000 with tables revised as of 30 September 2011. Beginning of escalation was March 2012 with end date projected as December 2013. Mid-point of construction was assumed to be February 2012. Used "Buildings, Grounds & Utilities" feature codes to determine the yearly cost indexes.

<u>Description</u>	<u>Quantity</u>	<u>UOM</u>	<u>ContractCost</u>	<u>Escalation</u>	<u>Contingency</u>	<u>SIOH</u>	<u>ProjectCost</u>
<b>Project Cost Summary Report</b>			<b>94,139</b>	<b>18,497</b>	<b>9,565</b>	<b>0</b>	<b>122,200</b>
			<i>94,139.00</i>				<i>122,200.45</i>
<b>02 County Supply</b>	<b>1.00</b>	<b>EA</b>	<b>94,139</b>	<b>18,497</b>	<b>9,565</b>	<b>0</b>	<b>122,200</b>
			<i>63,389.00</i>				<i>87,834.25</i>
<b>02a Water Distribution</b>	<b>1.00</b>	<b>EA</b>	<b>63,389</b>	<b>18,005</b>	<b>6,440</b>	<b>0</b>	<b>87,834</b>
			<i>30,750.00</i>				<i>34,366.20</i>
<b>02b Fees</b>	<b>1.00</b>	<b>EA</b>	<b>30,750</b>	<b>492</b>	<b>3,124</b>	<b>0</b>	<b>34,366</b>

<u>Description</u>	<u>Quantity</u>	<u>UOM</u>	<u>Contractor</u>	<u>DirectCost</u>	<u>SubCMU</u>	<u>CostToPrime</u>	<u>PrimeCMU</u>	<u>ContractCost</u>
<b>Contract Cost Summary Report</b>				<b>94,139</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>94,139</b>
				<i>94,139.00</i>		<i>0.00</i>		<i>94,139.00</i>
<b>02 County Supply</b>	<b>1.00</b>	<b>EA</b>		<b>94,139</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>94,139</b>
				<i>63,389.00</i>		<i>0.00</i>		<i>63,389.00</i>
<b>02a Water Distribution</b>	<b>1.00</b>	<b>EA</b>		<b>63,389</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>63,389</b>
				<i>30,750.00</i>		<i>0.00</i>		<i>30,750.00</i>
<b>02b Fees</b>	<b>1.00</b>	<b>EA</b>		<b>30,750</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30,750</b>

<u>Description</u>	<u>Quantity</u>	<u>UOM</u>	<u>Contractor</u>	<u>DirectLabor</u>	<u>DirectEQ</u>	<u>DirectMatl</u>	<u>DirectSubBid</u>	<u>DirectUserCost</u>	<u>DirectCost</u>
<b>Project Direct Costs Report</b>				<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>94,139</b>	<b>94,139</b>
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>94,139.00</i>
<b>02 County Supply</b>	<b>1.00</b>	<b>EA</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>94,139</b>	<b>94,139</b>
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>63,389.00</i>
<b>02a Water Distribution</b>	<b>1.00</b>	<b>EA</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>63,389</b>	<b>63,389</b>
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>4,275.00</i>
USR Distribution Line Tap	5.00	EA		0	0	0	0	21,375	21,375
(Note: Cost includes materials and installation for the City of Frederick to tap into distribution line along Kemps Lane and run a 1-inch water line to the property line of each home. 50% markup added for benefits. 10% markup added for administration fees. Cost and markups provided by the City of Frederick.)									
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>402.80</i>
USR Water Meter	5.00	EA		0	0	0	0	2,014	2,014
(Note: Price includes materials and installation by City of Frederick. 50% markup added for benefits. 10% markup added for administration fees. Cost and markups provided by the City of Frederick.)									
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>8,000.00</i>
USR Service Line to Home	5.00	EA		0	0	0	0	40,000	40,000
(Note: Cost includes labor and materials for installation of a 1-inch distribution line from the property line to the home. Trenching, pipe, grading, chlorination of lines prior to city connection, and well abandonment included in price. Cost is based on the higher average cost from vendor quotes received.)									
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>30,750.00</i>
<b>02b Fees</b>	<b>1.00</b>	<b>EA</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30,750</b>	<b>30,750</b>
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>5,981.00</i>
USR City Impact Fee	5.00	EA		0	0	0	0	29,905	29,905
(Note: City of Frederick Water Impact Fee)									
				<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>		<i>169.00</i>
USR Frederick County Plumbing Permit	5.00	EA		0	0	0	0	845	845
(Note: Cost of Residential Utility Permit, per home)									

## **Appendix C**

Comments and Responses

Response to Comments Table							
Provision of a Safe Potable Water Source for Five Kemp Lane Residences, Fort Detrick, Maryland							
Draft Final EE/CA							
August 2012							
Response Code: A = Agree with comment D = Disagree with comment C = Comment requires clarification N = Comment noted, no action required or taken							
Comment Number	Commenter	Page(s)	Section	Line(s)	Comment	Response Code	Response
1	RT/EPA	ES-1	Paragraph 2		Change text to "that would mitigate potential health risks associated with..."	A	Text will be changed as requested.
2	RT/EPA	Global			Replace "solute plume" with "solvent plume" as we have never referred to the plume as a sloute plume in the past.	A	All instances of "solute plume" will be replaced with "solvent plume" as requested.
3	RT/EPA	1-2			Change text to "This EE/CA evaluates alternatives to mitigate potential human health risks associated with..."	A	Text will be changed as requested.
4	RT/EPA	1-2			Change text if appropriate to "Section 300.415(b)(2)(i) - Actual or Potential exposure of chlorinated solvents to near by..."	D	The text of Section 300.415(b)(2)(i) is a direct quote from the NCP and "exposure to chlorinated solvents" is not specified in the NCP text.
5	RT/EPA	4-2	heading		Residents is spelled wrong	A	The miss-spelling has been corrected and not reads: "4.1.3 Alternative 3: Connect Residences to the City Water Supply"
6	RT/EPA	4-2, 4-7			Change the date of water main was operational "from summer of 2012" to date the line was ready or update to a new projected date if it is not ready yet.	A	The text was changed from "is expected to be operational in summer 2012" to "was operational in summer of 2012".
7	EG/MDE	5-2	5.3	Second paragraph	The text incorrectly states that the total cost of Alternative 3 is \$171,980. Please update the text to reflect the correct cost of Alternative 3, \$122,200.	A	Cost was revised.

**Final**

**Engineering Evaluation / Cost  
Analysis**

**Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences**

**Fort Detrick, Maryland**

February 2013

U.S. Army Corps of Engineers

Baltimore, Maryland

Contract Number / Delivery Order Number:

W912DR-11-D-000/ 0003



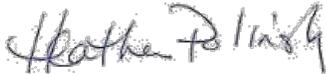
---

Shelly Morris, PMP  
ARCADIS/Malcolm Pirnie  
Project Manager



---

Brian Stockwell  
PIKA International, Inc.  
Program Manager



---

Heather Polinsky, PMP  
ARCADIS/Malcolm Pirnie  
Quality Assurance / Quality Control Manager

## Final Engineering Evaluation / Cost Analysis

### Provision of a Safe Potable Water Source for Five Kemp Lane Residences

Fort Detrick, Maryland

Prepared for:  
United States Army Corps of Engineers  
Baltimore District

Contract Number / Delivery Order:  
W912DR-11-D-0001 / 0003

Prepared by:  
PIKA International, Inc. and  
ARCADIS / Malcolm Pirnie  
8451 State Route 5  
Building 1038  
Ravenna, OH 44266

Date:  
February 2013

*This document is intended only for the use of  
the individual or entity for which it was prepared  
and may contain information that is privileged,  
confidential and exempt from disclosure under  
applicable law. Any dissemination, distribution  
or copying of this document is strictly prohibited.*

## Table of Contents

<b>Executive Summary</b>	<b>1</b>
<b>1. Introduction</b>	<b>1-1</b>
1.1 Purpose of Report	1-2
1.2 Report Organization	1-3
<b>2. Site Characterization</b>	<b>2-1</b>
2.1 Site Description and Background	2-1
2.2 Previous Investigations	2-2
<b>3. Identification of Removal Action Objectives</b>	<b>3-1</b>
3.1 Identification of Applicable or Relevant and Appropriate Requirements	3-1
3.1.1 Chemical-Specific ARARs and TBC Guidance	3-2
3.1.2 Location-Specific ARARs and TBC Guidance	3-2
3.1.3 Action-Specific ARARs and TBC Guidance	3-2
3.2 Identification of Health Hazards	3-4
3.3 Removal Action Objective	3-4
3.4 Identification of Removal Action Goals	3-4
3.5 Determination of Removal Action Schedule	3-4
<b>4. Identification and Analysis of Removal Action Alternatives</b>	<b>4-1</b>
4.1 Identification of Possible Removal Action Alternatives	4-1
4.1.1 Alternative 1: No Further Action	4-1
4.1.2 Alternative 2: Provide Bottled Water Service and Groundwater Monitoring	4-1
4.1.3 Alternative 3: Connect Residences to the City Water Supply	4-2
4.2 Evaluation Criteria of Potential Removal Action Alternatives	4-2
4.2.1 Effectiveness	4-2
4.2.2 Implementability	4-2
4.2.3 Cost	4-3
4.3 Individual Analysis of Possible Removal Action Alternatives	4-3
4.3.1 Alternative 1- No Further Action	4-3
4.3.1.1 Effectiveness	4-3
4.3.1.2 Implementability	4-4
4.3.1.3 Cost	4-4
4.3.2 Alternative 2 – Provide Bottled Water Service and Groundwater Sampling	4-4
4.3.2.1 Effectiveness	4-5

## Table of Contents

4.3.2.2	Implementability	4-5
4.3.2.3	Cost	4-6
4.3.3	Alternative 3 – Connect Residences to City Water Supply	4-6
4.3.3.1	Effectiveness	4-6
4.3.3.2	Implementability	4-7
4.3.3.3	Cost	4-8
<b>5.</b>	<b>Comparative Analysis of Removal Action Alternatives</b>	<b>5-1</b>
5.1	Effectiveness	5-1
5.2	Implementability	5-1
5.3	Cost	5-2
<b>6.</b>	<b>Recommended Removal Action Alternative</b>	<b>6-1</b>
<b>7.</b>	<b>Plan for Public Participation</b>	<b>7-1</b>
<b>8.</b>	<b>References</b>	<b>8-1</b>

### Tables

Table 4-1	Alternative 2 Costs
Table 4-2	Alternative 3 Costs
Table 5-1	Comparison of Effectiveness of Alternatives
Table 5-2	Comparison of the Implementability of Alternatives
Table 5-3	Cost Summary of Alternatives

### Figures

Figure 2-1	Fort Detrick Area B - Site Location Map
Figure 2-2	Monitoring Well Sampling Concentrations (June 2012)

### Appendix

Appendix A	Project Schedule
Appendix B	Cost Estimating Backup
Appendix C	Comments and Responses

## List of Acronyms and Abbreviations

### List of Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
ARCADIS/Pirnie	ARCADIS/Malcolm Pirnie
Army	United States Department of the Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EE/CA	Engineering Evaluation / Cost Analysis
FFA	Federal Facility <del>ties</del> Agreement
FTD	Fort Detrick
FTD-72	Fort Detrick Area B Groundwater
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
NCP	National Oil and Hazardous Substances <u>Pollution</u> Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
PCE	tetrachloroethene
PIKA	PIKA International, Inc.
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
TBC	To-Be-Considered
TCE	trichloroethene
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile Organic Compounds

## Engineering Evaluation / Cost Analysis

Provision of a Safe Potable Water Source for Five Kemp Lane Residences Fort Detrick, Maryland

### Executive Summary

This Engineering Evaluation / Cost Analysis (EE/CA) addresses the investigation of proposed public water connection for five residences along Kemp Lane in Frederick, Maryland, adjacent to Fort Detrick Area B. This EE/CA evaluates three alternatives to mitigate potential human health hazards associated with Volatile Organic Compounds (VOCs) concentrations in residential water supply wells.

This EE/CA addresses a specific scope of work associated with five residences within Frederick, Maryland (the Site) and does not address the entire Fort Detrick Area B. These five residences are located on Kemp Lane; Kemp Lane forms the western boundary to Fort Detrick Area B. The purpose of this EE/CA is to evaluate potential alternatives that would mitigate potential health risks associated with VOCs in the plume underlying Area B. The contaminants of concern for Area B and the residential supply wells are VOCs, primarily tetrachloroethene (PCE), trichloroethene (TCE), and related compounds. Each of these five residences has a drinking water well that may be at risk due to the Area B solvent plume during extreme drought conditions.

Currently, VOCs are present in the karst aquifer that underlies Fort Detrick's Area B. The most predominant 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. Numerous environmental investigations and remediation activities have been performed at Fort Detrick Area B since the 1980s. Periodic groundwater monitoring of the solvent plume has been conducted since 1998 and has documented significant declines in constituent concentrations. Several drinking water wells at the residences along Kemp Lane have had detections of TCE and PCE below the Maximum Contaminant Level (MCL). Currently five residences, including the residences that had detections of TCE and PCE, are receiving bottled water as a precautionary measure by Fort Detrick to ensure a safe drinking supply for these residents. Periodic monitoring of constituents of concern in the residential wells is on-going, and there have been no detections of VOCs at or above the MCLs since the early 1990s. The previous investigations were conducted consistent with Section 300.415 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The basis for the EE/CA and associated removal action is the NCP. Specifically, Section 300.415(b)(1) of the NCP states that "any release, regardless of whether the site is included on the National Priorities List (NPL), where the lead agency makes the determination, based on the factors in Section 300.415(b)(2), that there is a threat to public health or welfare of the United States or the environment, the lead agency may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release." Section 300.415(b)(2) of the NCP lists

**Comment [SMR1]:** This section of the NCP is about removal actions not remedial investigations

**Comment [SMR2]:** And CERCLA and responsibilities under DERP

## Engineering Evaluation / Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

eight criteria to determine whether a removal action is appropriate. The two factors most applicable to current site conditions are as follows:

- Section 300.415(b)(2)(i) - Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.
- Section 300.415(b)(2)(ii) - Actual or potential contamination of drinking water supplies or sensitive ecosystems.

Historical VOC monitoring at the five residences along Kemp Lane indicate that there have been levels of VOCs detected below their respective MCLs. These concentrations have warranted the provision of bottled water to these residences. PCE and TCE are listed by the Agency for Toxic Substances and Disease Registry as part of their Substance Priority List, deeming these two compounds significant potential threats to human health due to their known toxicity and potential for human exposure at NPL sites. Thus, the residences along Kemp Lane are eligible for response under Section 104(a)(1) of the Comprehensive Environmental Response, Compensation and Liability Act and the three removal action alternatives were developed and selected for evaluation are:

1. Alternative 1 – No Further Action
2. Alternative 2 – Provide Bottled Water Service and Groundwater Monitoring
3. Alternative 3 – Connect Residences to the City Water Supply

Each of the alternatives was evaluated based on the merits of the individual and comparative analyses in regards to 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 is Alternative 3: Connect Residences to the City Water Supply. Alternative 3 was selected because it will most effectively attain the following removal action objective:

*To provide long-term protection to human receptors at five homes along Kemp Lane by eliminating access to the hazard posed by exposure to VOCs at concentrations above their MCLs in the solvent plume under Fort Detrick Area B.*

**Comment [SMR3]:** This isn't worded quite right. We have a release and are required to respond in cooperation with DERP and CERCLA, there is no need to discuss the "eligibility" of the site

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 1. Introduction

This document presents the Engineering Evaluation / Cost Analysis (EE/CA) of mitigating human health hazards associated with the Volatile Organic Compounds (VOCs) that are present in the karst aquifer that underlies Fort Detrick's Area B (FTD-72), in Frederick County, Maryland. This EE/CA has been completed in compliance with the Federal Facility ies Agreement (FFA) between the United States (U.S.) Environmental Protection Agency (USEPA), and the U.S. Department of the Army (Army), and enacted-signed on 5 August 2011. This EE/CA was prepared by ARCADIS/Malcolm Pirnie (ARCADIS/Pirnie) under contract with PIKA International, Inc. (PIKA). The Project Management Plan was prepared in accordance with the Performance Work Statement included in Contract W912DR-11-D-0001; Delivery Order 0001 (issued 10 June 2011), by the U.S. Army Corps of Engineers (USACE), Baltimore District to PIKA.

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 1626]). An FFA between the Army and USEPA was signed on 17 December 10 and was finalized 5 August 2011 after public comment. The Maryland Department of the Environment (MDE) is not a party to the FFA.

Area B Groundwater was listed on the NPL in April 2009. Environmental restoration activities on Area B Groundwater are being conducted in accordance with Comprehensive Environmental Response, Compensation and Liability Act (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. The IRP activities at Fort Detrick operate principally under the CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300] and the Defense Environmental Restoration Program (DERP).

This EE/CA has been prepared to evaluate potential alternatives that would mitigate health hazards associated with volatile organic compounds (VOCs) in the plume underlying Fort Detrick Area B. The VOC concentrations in the drinking water wells at the residences along Kemp Lane have never exceeded their respective Maximum Contaminant Levels (MCL) in the past; however during drought conditions in 2005, PCE and TCE were detected in two residential wells below the MCLs. During the same period, a Fort Detrick boundary monitoring well along Kemp Lane had a detection of PCE over the MCL. Because of these detections, as a proactive measure to insure the protection of human health, five residential properties along the border

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

have been provided bottled water by Fort Detrick. Therefore, this EE/CA has been prepared to address this portion of the site in accordance to 40 CFR 300.415(b)(4)(i).

### 1.1 Purpose of Report

This EE/CA evaluates alternatives to mitigate potential human health risks associated with VOCs concentrations in the residential water supply obtained through groundwater supply wells. The EE/CA identifies removal action objectives for the five residences along Kemp Lane; develops three removal action alternatives to address the health hazard, analyzes effectiveness, implementability, and cost of the three alternatives; and recommends the best-suited removal action alternative. This proposed action will provide long-term protection to human receptors consuming the groundwater at five residences along Kemp Lane from the VOC plume underlying Fort Detrick Area B.

The purpose of this EE/CA is to evaluate alternatives for providing five residences along Kemp Lane an alternative, safe source of potable water. The contaminants of concern for this site are VOCs in groundwater, specifically tetrachloroethene (PCE) and trichloroethene (TCE) and related compounds.

The basis for drafting this report and proceeding with an alternative potable water source is the NCP. Section 300.415(b)(2) of the NCP lists eight criteria to determine whether a removal action is appropriate. The two factors most applicable to current Site conditions are as follows:

- Section 300.415(b)(2)(i) - Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.
- Section 300.415(b)(2)(ii) - Actual or potential contamination of drinking water supplies or sensitive ecosystems.

Historical VOC monitoring at the five residences along Kemp Lane indicate that there have been levels of VOCs detected below their respective MCLs. These concentrations have warranted the provision of bottled water to these residences, as an on-going interim response action. PCE and TCE are listed by the Agency for Toxic Substances and Disease Registry as part of their Substance Priority List, deeming these two compounds significant potential threats to human health due to their known toxicity and potential for human exposure at NPL sites.

Thus, ~~the Army is required to take a response action under the residences along Kemp Lane are eligible for response under Section 104(a)(1) of CERCLA~~ and this

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

EE/CA has been prepared with the guidance set forth in the NCP (40 CFR 300.415, Removal Action).

### 1.2 Report Organization

In addition to this Section 1 Introduction, the report is divided into seven sections as follows:

- Section 2 – Site Characterization: This section presents information pertaining to Site characteristics, description, and history. An overview of the environmental program at Fort Detrick's Area B is also presented in this section.
- Section 3 – Identification of Removal Action Objectives: The removal action objective is identified and Applicable or Relevant and Appropriate Requirements (ARARs) are identified. Furthermore, this section provides information regarding health hazards posed by the site as well as the removal action scope, goals, objective and schedule.
- Section 4 – Identification and Analysis of Removal Action Alternatives: Removal Action Alternatives are developed and described based on effectiveness, implementability, and cost.
- Section 5 – Comparative Analysis of Removal Action Alternatives: The Removal Action Alternatives are compared against each other based on effectiveness, implementability, and cost.
- Section 6 – Recommended Removal Action Alternative: Based on the evaluation presented in the EE/CA, a recommended alternative to address the VOC human health hazard at five residences along Kemp Lane is identified.
- Section 7– Plan for Public Participation: Describes the degree and responsibilities of stakeholder involvement during the removal action process.
- Section 8 – References: The references used to develop this report are presented.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

## 2. Site Characterization

This section provides a brief overview of the site location, history, hydrogeologic setting and an overview of the environmental program at Fort Detrick's Area B, Maryland as it pertains to the adjacent residences on Kemp Lane.

### 2.1 Site Description and Background

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, D.C., and is surrounded by residential and commercial areas and county-owned lands. Fort Detrick Area B, the focus of this EE/CA, is presented in **Figure 2-1**.

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

Fort Detrick, Frederick Campus, consists of four non-contiguous tracts of land designated as Area A, Area B, Area C Water Treatment Plant, and Area C Waste Water Treatment Plant. These areas cover a total of approximately 1,212 acres. Fort Detrick's active municipal landfill, animal farm, former skeet range, former explosives storage, and former waste disposal / test areas associated with former research activities are all located within Area B. Area B is approximately 399 acres in size and is located 0.5 miles west of the center of Fort Detrick activity, otherwise known as Area A. Area B is the focus of this investigation. Area C is two separate tracts that contain the Fort Detrick Water Treatment Plant and Waste Water Treatment Plant.

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 104<sup>th</sup> Observation Squadron. This was the first military presence at this site.

From 1943 through 1969, Fort Detrick served as the nation's center for biological warfare research. Early research (i.e., prior to 1945) was conducted in temporary buildings and facilities. These temporary buildings were gradually replaced with permanent structures, and by 1945 approximately 245 permanent structures had been built, most of which have subsequently been demolished (Shaw 2010).

Area B was purchased in 1946, to provide an outdoor test area, and has been the main location of waste disposal activities for Fort Detrick. After the enactment of the

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

Resource Conservation and Recovery Act hazardous waste regulations in 1976, hazardous wastes were shipped offsite for disposal at a treatment and disposal facility. In 1989, a permitted municipal landfill was constructed in the Northeast corner of Area B. Historical waste disposal practices at Area B (i.e., prior to 1976) have resulted in groundwater contamination in Area B and adjacent areas.

The focus of this EE/CA is five residences located on Kemp Lane, directly adjacent to the known primary source of groundwater contamination on Fort Detrick Area B. Kemp Lane forms the western boundary of Fort Detrick with Frederick County, Maryland.

### 2.2 Previous Investigations

Currently, VOCs (primarily PCE and TCE) are present in the karst aquifer that underlies Fort Detrick's Area B. These VOCs emanate in a solvent plume from Area B-11, a former waste disposal area located in the western portion of Area B. Numerous environmental investigations and remediation activities have been performed at Fort Detrick Area B since the 1980s. Detection of VOCs contamination in domestic wells off Fort Detrick property adjacent to Area B in 1992 and 1993 prompted the placement of several residents on Shookstown Road and Montevue Lane on bottled water with subsequent connection of affected residences to the City of Frederick water system. In response to a spike in groundwater 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 the presumed primary source of PCE and TCE migrating to groundwater. In May 2010, all of Area B's disposal areas were capped with a low-permeability cover, following the presumptive remedy process for CERCLA landfills.

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

Periodic groundwater monitoring of the solvent plume has been conducted since 1998 and has documented significant declines in constituent concentrations. Bottled water has been provided to five residences along Kemp Lane due to a low level detection (below MCL) of PCE and TCE in the early 1990s. This was a proactive measure to ensure that human health was protected. Periodic monitoring is on-going; there have been no detections of VOCs above the MCLs at these properties.

A Phase I Remedial Investigation (RI) of the Area B Groundwater, both on- and off-post, has been ongoing since 2011. The goal of the RI is to establish the groundwater flow direction and to determine the depth of contamination and groundwater flow

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

through groundwater, surface water, and spring sampling. This investigation is establishing and expanding an appropriate groundwater monitoring network through the installation and sampling of additional monitoring wells and piezometers (Shaw 2010).

The results of the June 2012 sampling event are shown in **Figure 2-2**.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 3. Identification of Removal Action Objectives

The scope of this removal action is to mitigate health hazards associated with the VOCs plume underlying Fort Detrick Area B. The main objective is to provide long-term protection of human health to residents/receptors along Kemp Lane by identifying and implementing an alternative safe water supply.

#### 3.1 Identification of Applicable or Relevant and Appropriate Requirements

This section describes the regulatory standards and guidance that may be applied to this site. Regulatory standards and guidance are divided into three categories: chemical specific, location specific, and action specific requirements.

In order to be classified as an ARAR, the NCP states that federal and/or state laws must meet one of the following two requirements: (1) applicability or (2) relevance and appropriateness. Applicable requirements are “those cleanups standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at CERCLA site” [40 CFR 300.5]. Relevant and appropriate requirements are “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not ‘applicable’ to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site” [40 CFR 300.5].

The NCP identifies a third category, termed “information to-be-considered” (TBC). TBCs are guidelines or advisories that are issued by the federal or state government, but which are neither legally binding nor promulgated (~~USEPA, 1990~~). ~~40 CFR 300.400(g)(3)~~. However, these guidelines may be used when they are necessary to ensure protection of public health and the environment (~~USEPA, 1990~~). If ARARs do not address a particular circumstance at a CERCLA site, then TBCs can be used to establish remedial guidelines or targets although their use is discretionary rather than mandatory. Even when TBCs are used, the requirements imposed on the removal action, including cost-effectiveness, still apply [55 Federal Register 8745, March 9, 1990].

Comment [SMR4]: This citation is missing a page number

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 3.1.1 Chemical-Specific ARARs and TBC Guidance

Chemical-specific requirements establish health-based concentration limits, risk based criteria limits, or ranges for specific hazardous substances in different environmental media. These standards provide media cleanup levels or a basis for calculating cleanup levels. Chemical-specific standards are also used to indicate an acceptable level of discharge, to determine treatment and disposal requirements for a particular remedial activity, and to assess the effectiveness of a removal action.

Potential chemical-specific ARARs and TBC guidance identified as a basis for the decision to employ this removal action to protect human health from VOC contaminated groundwater include:

#### ARAR

- **Safe Drinking Water Act** ~~40 CFR 141-149-42 U.S.C.A. §§ 300f to 300j-26~~ ~~(USEPA Amended 1996)~~: The main federal law that ensures the quality of Americans' drinking water. Any water provided will meet all federal standards.
- **Maryland Water Supply Program**: The mission of the Water Supply Program is to ensure that public drinking water systems provide safe and adequate water to all present and future users in Maryland, and that appropriate usage, planning and conservation policies are implemented for Maryland's water resources.

Comment [SMR5]: Shouldn't the specific MCL be listed?

Comment [SMR6]: To be an ARAR it must be promulgated so there needs to be a citation to the COMAR

### 3.1.2 Location-Specific ARARs and TBC Guidance

Location-specific requirements set restrictions on the types of remedial activities that can be performed based on specific site characteristics or location. Location-specific standards provide a basis for assessing restrictions during the formulation and evaluation of site specific remedies. Removal actions may be restricted or precluded based on citing laws for hazardous waste facilities and based on proximity to wetlands, floodplains, or man-made features such as landfill, disposal area, and/or local historic buildings.

No potential location-specific ARARs and TBC guidance were identified for the removal actions evaluated in this EE/CA.

### 3.1.3 Action-Specific ARARs and TBC Guidance

Action-specific requirements set controls or restrictions on the design, implementation, and performance of waste management actions. These standards specify

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

performance levels, actions, or technologies and specific levels for discharge of residual chemicals. They also provide a basis for assessing the feasibility and effectiveness of the removal alternatives.

Potential action-specific standards identified for the removal actions evaluated for this EE/CA include:

### ARAR

- **Erosion and Sediment Control (Code of Maryland Regulations 26.17.01.07):** This regulation is applicable when excavation or on-site storage of contaminated soil and waste is contemplated. It sets criteria and procedures to protect the lands and waters comprising the watersheds of the state and prohibits discharge of raw sewage or waste into these watersheds.
- **Frederick County Plumbing Codes** Plumbing codes are required to provide practical plumbing regulations for the safeguarding of person and property from hazards arising from unsanitary and unhealthy plumbing conditions.
- **Maryland Building Performance Standards (COMAR 05.02.07) / Frederick County Building Codes** Building codes are required to provide reasonable protection to the public against hazards to life, health, and property during construction activities.
- **Frederick County Well Abandonment Procedures (COMAR 26.04.04.11)** The specifications for well abandonment in the state of Maryland have been delegated to the counties by the Maryland Department of the Environment. Unused wells shall be abandoned and sealed. A well abandonment form would be prepared by the licensed driller at the time of the abandonment in conjunction with the Frederick County Health Department.

**Comment [SMR7]:** Needs to have a citation

**Comment [SMR8]:** ARARs are federal or state ENVIRONMENTAL or facility citing laws. This is neither, however that does not mean it is not legally applicable, it just means it does not set a standard that controls the remedial action

**Comment [SMR9]:** Just curious, is this our responsibility or that of the well owner? How does the abandonment impact the remedial action?

### TBC

- **Work Zone Lane Closure Guidance (Maryland State Highway Administration, 2006)** Maryland State Highway Administration's guidelines take a statewide approach to establishing lane closure restrictions. Restrictions are dictated by the type of roadway, with the guidelines broken down into three categories: freeways, arterials, and signalized intersections. Maryland State Highway Administration has also defined a process for conducting traffic analyses to determine the impacts of work zone lane closures.

**Comment [SMR10]:** This is not a standard that affects the remedial action. It is also not environmental in nature.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 3.2 Identification of Health Hazards

VOCs in drinking water above their respective MCLs present health hazards to human receptors. As discussed in Section 2, the solvent plume underlying Fort Detrick Area B may present a health hazard to the five residences along Kemp Lane, located to the west of the installation. These residences are currently on well water. Connecting these houses to public water and abandoning the private wells would eliminate the exposure to VOCs in groundwater.

### 3.3 Removal Action Objective

The removal action objective for connection to public water is based on the potential for elevated levels of VOCs in the five homes along Kemp Lane from the groundwater plume under Fort Detrick Area B. The removal action objective was developed based on the criteria outlined in Section 300.430(e)(2) of the NCP with the objective to protect human health. The removal action objective for this project is as follows:

*To provide long-term protection to human receptors at five homes along Kemp Lane by eliminating access to the hazard posed by exposure to VOCs at concentrations above their MCLs in the solvent plume under Fort Detrick Area B.*

### 3.4 Identification of Removal Action Goals

The Removal Action Goal for this project is to eliminate the exposure pathways for VOCs in drinking water in the most effective, implementable, and cost effective manner. These exposure pathways include ingestion, inhalation, and dermal contact by human receptors. The Removal Action Goal will provide the basis for evaluation of the removal action alternatives and recommendations of the preferred alternative for the residences along Kemp Lane, presented in Sections 5 and 6.

### 3.5 Determination of Removal Action Schedule

The removal action schedule has not yet been established. The removal action is not time critical, as the bottled water supply minimizes the potential receptors health risk.

**Comment [SMR11]:** This section should include statutory limits on removal actions; determination of removal scope; determination of removal schedule; planned remedial activities. OSWER 9360.0-32FS

#### **4. Identification and Analysis of Removal Action Alternatives**

The removal action alternatives identified in this section were developed to meet the removal action objective identified in Section 3. The alternatives are based on eliminating access to the source of VOCs in groundwater at the five residences along Kemp Lane. Three removal action alternatives are described and evaluated in this section based on the following criteria: implementability, effectiveness, and cost. The alternative determined to be the most effective to achieve the removal action objective is identified in Section 6.

##### **4.1 Identification of Possible Removal Action Alternatives**

This section presents three removal action alternatives for addressing the health hazards posed by the VOCs in the solvent plume under Fort Detrick Area B.

###### **4.1.1 Alternative 1: No Further Action**

Under Alternative 1, no further corrective action will be employed. Furthermore, the bottled water service and quarterly groundwater monitoring program currently operating at the residences will be discontinued. This alternative will not mitigate the threat posed by the VOCs in the solvent plume under Fort Detrick Area B. However, under the NCP, the no further action alternative must be evaluated to establish a baseline of comparison regarding future performance for the remaining alternatives, even though this alternative is not a viable option itself.

###### **4.1.2 Alternative 2: Provide Bottled Water Service and Groundwater Monitoring**

Under Alternative 2, the current bottled water service will continue to be provided indefinitely. A commercial water distributor will continue to deliver bottled water to the residences on a monthly basis. The bottled water would substitute groundwater as the source of potable water and would mitigate the ingestion hazard posed by VOCs at concentrations above the MCL in the solvent plume, if used as directed. However, this would not reduce any exposure to VOCs through inhalation or dermal contact. Because Alternative 2 entails leaving the groundwater wells operational for non-potable uses (e.g., irrigation, bathing, domestic cleaning), long-term monitoring activities would be necessary. The current groundwater monitoring program would continue to ensure protectiveness is maintained. The monitoring program would include quarterly sampling at each residence with analysis of VOCs by USEPA Method 8260. The groundwater monitoring program duration would be established in a Removal Action Work Plan.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 4.1.3 Alternative 3: Connect Residences to the City Water Supply

Alternative 3 includes abandoning the groundwater wells at each residence and connecting each home to the City of Frederick water supply. A 16-inch waterline has recently been installed along Kemp Lane and was operational in summer 2012. Steps for connecting the homes to the waterline would include the following:

- The City of Frederick would tap into the 16-inch line and run service lines from the tap to the property line of each of the five homes, where a water meter would be installed.
- A contractor would install a minimum of a 1-inch distribution line from the meter to the home to complete the connection to the city water supply.
- A contractor would abandon the groundwater wells in accordance with COMAR 26.04.04
- Prior to establishing full connection to the city water supply, a contractor would flush all pipes within each residence with chlorine. Flushing the line with chlorine is a precautionary measure required by the City of Frederick to ensure any existing water within the residential pipes cannot backflow into the city's water supply.
- A contractor would install a backflow preventer as a secondary precaution to prevent backflow from the residential lines to the city's water supply.

## 4.2 Evaluation Criteria of Potential Removal Action Alternatives

The NCP [40 CFR 300.430-(e)(7)] cites the general evaluation criteria of effectiveness, implementability, and cost. Each of these criteria is considered in the evaluation of alternatives. The types of specific considerations within each of these general criteria are listed below.

### 4.2.1 Effectiveness

Effectiveness may be evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health during the implementation period. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time.

### 4.2.2 Implementability

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or impractical at a site; and administrative feasibility, which reviews the ability to obtain permits; and the availability of necessary services, equipment, and skilled workers to

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

implement the removal action alternative for the site. The implementability evaluation criteria are defined in the NCP [40 CFR 300 (e)(7)(ii)].

### 4.2.3 Cost

Cost involves developing the level of engineering detail and preparing a sufficiently accurate cost estimate for each alternative so that a relative and appropriate cost comparison can be made between competing alternatives. For purposes of this EE/CA, the cost estimates for construction were based on fiscal year 2012 costs. Other considerations in the evaluation of remedy selection include capital and annual Operations and Maintenance (O&M) costs as presented in the NCP [(40 CFR 300 (e)(7)(iii)]. It was assumed that the annual costs would be carried out for a period of ten years for each alternative.

## 4.3 Individual Analysis of Possible Removal Action Alternatives

### 4.3.1 Alternative 1- No Further Action

The declaration of the No Action Alternative on a property or project is a programmatic decision that indicates it has been determined that No Further Action is required to address unsafe conditions or hazardous substances, pollutants, or contaminants that may affect future land uses. Under this alternative, "no action" would be taken to eliminate exposure to potential VOCs in groundwater at the five residences along Kemp Lane. The groundwater wells would remain operational and would function as the primary water source for each residence. No administrative controls would be put into place to limit potential exposure to current or future groundwater users at the residences. As no action is associated with this alternative, implementation would be immediate upon its acceptance. Implementation of Alternative 1 would not meet the removal action objective and does not remove or reduce the risks present at the residences.

#### 4.3.1.1 Effectiveness

This alternative would not be an effective method of addressing access to potential VOCs in groundwater at the five residences along Kemp Lane. With the no further action alternative, the bottled water service and groundwater monitoring program would cease and there would be no controls to ensure current use remains protective of human health. This alternative would not provide controls for monitoring reduction of VOC concentrations over time, reduction of exposure, or long-term management measures.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

All current and potential future risks would remain the same under this alternative.

- **Protection of Public Safety and the Environment.** This alternative would not eliminate or reduce the volume of contaminated media at the five residences, nor would it limit the potential exposure pathways for current or potential future receptors to the contaminants.
- **Compliance with ARARs.** This alternative would not be compliant with the ARARs.
- **Effectiveness.** Since the only action taken under Alternative 1 would be to discontinue the ongoing bottled water service this alternative would provide no long- or short-term effectiveness.

### 4.3.1.2 Implementability

This alternative would be implementable because it requires no action on part of Fort Detrick.

- **Technical Feasibility.** This alternative has no technical requirements.
- **Administrative Feasibility.** This alternative would be administratively feasible because no action is required.
- **Availability of Services and Materials.** This alternative would require no services or materials.
- **Local Agency Acceptance.** This alternative would not be acceptable to the local regulatory agencies because site risks are not reduced or controlled.
- **Community Acceptance.** This alternative would not be acceptable to the local community because site risks are not reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would not be acceptable to USEPA, MDE, or local government agencies because site risks are not reduced or controlled.

### 4.3.1.3 Cost

There would be no capital costs associated with this project.

## 4.3.2 Alternative 2 – Provide Bottled Water Service and Groundwater Sampling

Alternative 2 includes continuing to provide bottled water to each home as a replacement source of potable water. This service would reduce the potential ingestion exposure to potential VOCs in the solvent plume at, or above, the MCL. However, this would not reduce any exposure to potential VOCs through inhalation or dermal contact. Under this alternative the groundwater monitoring program would continue on a quarterly basis to ensure protectiveness is maintained. The groundwater

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

wells will remain in-place as a source of non-potable water under this alternative. Implementation of this Alternative would be rapid, because both groundwater monitoring and bottled water service delivery are currently in place at these five properties.

### 4.3.2.1 Effectiveness

This alternative would reduce the potential ingestion exposure to VOCs in the solvent plume below, at, or above, the MCL. However, this would not reduce any exposure to VOCs through inhalation or dermal contact. Since this alternative would not eliminate all exposure pathways the effectiveness of this alternative is limited.

- **Protection of Public Safety and the Environment.** This alternative provides a minimum level of long-term effectiveness and permanence. While the bottled water service is intended to provide a substitute source for potable water, the homes will remain connected to groundwater. Residents could be exposed to and will have full access to groundwater. The usage of bottled water as a replacement potable water source will be dependent on the daily decisions of the individuals within each residence. It is difficult to improve reliability and long-term effectiveness. This alternative would not eliminate or reduce the volume of contaminated media at the five residences. It would limit, but not fully eliminate, the potential exposure pathways for current or potential future receptors to the contaminants.
- **Compliance with ARARs.** This alternative would not be compliant with the ARARs. This alternative does not prevent access to the solvent plume. Because access to the source of VOCs is not addressed, Alternative 2 fails to be a permanent solution to the mitigation of the hazards posed by VOCs in the solvent plume in Area B of Fort Detrick.
- **Short-Term Effectiveness.** Implementation of this alternative does not pose any additional short-term risks to the community, the workers, or the environment because the bottled water service and groundwater monitoring program are in-place and operating now. This alternative would therefore have good short-term effectiveness.

### 4.3.2.2 Implementability

Alternative 2 does not require implementation because the bottled water service and groundwater monitoring program are already in place.

- **Technical Feasibility.** This alternative has no technical requirements.
- **Administrative Feasibility.** This alternative would be administratively feasible because the bottled water service and groundwater monitoring program are already in place.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

- **Availability of Services and Materials.** This alternative would require no additional service or materials.
- **Local Agency Acceptance.** This alternative would not be acceptable to the local regulatory agencies because site risks are not reduced or controlled.
- **Community Acceptance.** This alternative would not be acceptable to the local community because site risks are not reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would not be acceptable to USEPA, MDE, or local government agencies because site risks are not reduced or controlled.

### 4.3.2.3 Cost

The cost estimate for Alternative 2 includes monthly bottled water delivery with an average consumption of six 5-gallon bottles per home per month and one water cooler rental per home per month. Quarterly groundwater monitoring events include the collection of groundwater and Quality Assurance / Quality Control samples, analysis for VOCs using USEPA method 8260, and Region 3 MIII data validation. Sampling costs assume the wells will be purged but not redeveloped during each sampling event. Costs also include transporting drums of purge water to Fort Detrick for storage or disposal.

This alternative would have no capital cost and a total O&M cost of \$337,194 (total for the first 10 years). The total net present value of Alternative 2 is \$287,630. **Table 4-1** contains a detailed cost estimate for Alternative 2.

### 4.3.3 Alternative 3 – Connect Residences to City Water Supply

The third alternative incorporates removal of groundwater wells to mitigate exposure to the VOCs in the solvent plume. The residences would each be connected to the City of Frederick Water Supply. This alternative would eliminate human exposure pathways to potential VOCs in groundwater at the five residences along Kemp Lane. This alternative would not require additional monitoring following completion of the removal action.

#### 4.3.3.1 Effectiveness

This alternative would not be an effective method for reducing the volume of contamination onsite, but it would be an effective method for removing access and restricting potential pathways for human receptors to be exposed to the contamination. In Alternative 3, access to the source of the VOCs, which drives the health hazard, is removed from each residence. The advantage of removing access to the source of the VOCs is that long-term monitoring will not be required once the wells are abandoned.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

- **Protection of Public Safety and the Environment.** This alternative would not eliminate or reduce the volume of potentially contaminated media at the five residences, but it would eliminate the potential exposure pathways for current or potential future human receptors to the contaminants. Removal of access to the potential source of VOCs provides a long-term and permanent solution to mitigate exposure at each residence.
- **Compliance with ARARs.** This alternative would be compliant with the ARARs.
- **Short-Term Effectiveness.** This alternative poses some short-term risks to the community and site workers during the construction required to connect the residences to the City of Frederick water supply and the well removal process. Short-term risks would most likely be attributed to typical safety hazards associated with construction. The potential for exposure and safety during construction would be reduced through the use of suitable protective clothing and equipment and implementation of safe construction practices.

### 4.3.3.2 Implementability

Alternative 3 can be implemented within a reasonable time frame. A water distribution main was recently installed along Kemps Lane and is expected to be operational in summer 2012.

- **Technical Feasibility.** A water distribution main was recently installed along Kemps Lane and was operational in summer 2012. This alternative would be technically feasible because it would require the use of standard construction methods to connect the five residences to the existing water supply.
- **Administrative Feasibility.** This alternative would be administratively feasible and has no long-term administrative burden.
- **Availability of Services and Materials.** The five homes are located in Frederick County and would have to petition the City of Frederick to provide water service. The City of Frederick provides water to county residents, and it is expected that the five homes would be allowed to connect to the city water supply. The services and materials to complete this alternative would be easily acquired.
- **Local Agency Acceptance.** This alternative would be acceptable to the local regulatory agencies because site risks are mitigated through elimination of access to potentially contaminated groundwater.
- **Community Acceptance.** This alternative would be acceptable to the local community because site risks are reduced or controlled.
- **Regulatory and Governmental Acceptances.** This alternative would likely be found acceptable to USEPA, MDE, and local government agencies because site risks are reduced or controlled.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 4.3.3.3 Cost

The estimated cost for Alternative 3 includes the City of Frederick costs to tap the distribution line and install a water meter at the property line of each home, contractor costs for continuing a 1-inch distribution line between the meters and each residence, and contractor costs for well abandonment and line chlorination within each residence prior to full connection to the city water supply. This cost also includes a one-time City of Frederick Impact Fee. Annual/quarterly water costs are not included as part of the EE/CA.

This alternative would have an estimated capital cost of \$122,200 with no annual O&M costs. The total current net present value of costs for Alternative 3 (total for the first 10 years), is \$122,200. The detailed cost estimate is included as **Table 4-2**.

## **5. Comparative Analysis of Removal Action Alternatives**

This section compares the alternatives against each other by ranking them based on effectiveness, implementability, and cost. Each of the five alternatives outlined in Section 3.0 were analyzed and compared against each other.

Alternative 1 – No Further Action

Alternative 2 – Provide Bottled Water Service and Groundwater Monitoring

Alternative 3 – Connect Residences to the City Water Supply

### **5.1 Effectiveness**

Effectiveness is evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health after implementation. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time.

Alternative 3 is the most effective in the long-term because it meets the removal action objective by permanently removing direct access to the source of VOCs causing the potential health hazards at the site. Thus, Alternative 3 is a permanent solution that will not require additional long-term monitoring or maintenance. Although Alternative 3 would pose short-term risks to the community and site workers during the construction activities; these short-term risks can be effectively mitigated using standard administrative and engineering controls during the construction period. Alternative 2 has no short-term risk but is only likely to be moderately effective in the long-term. As such, there is some doubt as to whether this alternative will be effective in the long-term. Alternative 1 is not effective and does not meet the removal action objective.

Table 5-1 presents a comparison of the effectiveness of the alternatives.

### **5.2 Implementability**

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or unworkable at a site, and administrative feasibility, which reviews the ability to obtain permits, and the availability of necessary services, equipment, and skilled workers to implement the technology.

While there are no technical implementation challenges with Alternative 1, it is not implementable because it is administratively an untenable alternative as no action will be unacceptable to the regulatory agencies and the community. There are

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

uncertainties associated with the implementability of Alternative 2 because, although an alternative source of potable water will be provided, it is not possible to implement or control the usage of bottled water at each residence. Alternative 3 is the most intrusive alternative requiring substantial construction and well abandonment. As such it presents the greatest technical implementation challenges.

Table 5-2 presents a comparison of the implementability of the alternatives.

### 5.3 Cost

Cost estimates are reviewed as capital (first year) costs, O&M costs, and Net Present Value (NPV) costs. The backup documentation used to generate the cost estimates presented in Tables 4-1 and 4-2 are provided in Appendix B.

Alternative 1 has no associated costs and thus is least expensive. Alternative 2 has no associated capital costs because bottled water service and groundwater monitoring are already being provided at each residence. The O&M costs include continuing bottled water service and groundwater monitoring for a period of 10 years, and the total cost of Alternative 2 is \$287,630. The capital cost of Alternative 3 includes construction and fees associated with abandoning existing groundwater wells and connecting the five residences to the City of Frederick water supply. The O&M cost for Alternative 3 includes the cost of water consumption for a period of 10 years. The total cost of Alternative 3 is \$122,200. The cost summary for the alternatives is shown in Table 5-3.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 6. Recommended Removal Action Alternative

A comparative analysis of alternatives was conducted using the evaluation criteria of effectiveness, implementability, and cost based upon the objectives presented earlier in this EE/CA. Based on this comparison, the recommended alternative for mitigating the VOC hazards to the five residences along Kemp Lane in the solvent plume at Area B of Fort Detrick is **Alternative 3: Connect Residences to the City Water Supply**. Alternative 3 was selected because it removes access to groundwater at the site and thus removes access to the VOCs in the solvent plume below Area B. Alternative 3 provides the best permanence and long-term effectiveness in meeting the removal action objective. The long-term effectiveness of Alternative 3 surmounts its short-term risks, greater capital cost (Alternative 2 has \$0 capital costs), and its greater implementability challenges; which results in selection of Alternative 3.

A detailed description of the selected removal action will be provided in a Removal Action Work Plan. However, a brief summary of components likely to be included as part of Alternative 3 includes the following:

- Abandonment of existing groundwater wells;
- Tapping into the City of Frederick water distribution line along Kemp Lane;
- Installing water distribution lines from the water distribution line along Kemp Lane to each of the five homes; and
- Chlorinating the pipes and installing backflow preventers in each home to prevent potential backflow of existing water from within the residential pipes to the city water supply.

Once established the project schedule will be provided as **Appendix A**.

## **Engineering Evaluation/ Cost Analysis**

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### **7. Plan for Public Participation**

Pursuant to Section 300.415(n) and 300.820 of the NCP the following actions will be initiated for public participation:

- Publish notice of availability for the administrative record file and availability of the EE/CA – Upon completion of the EE/CA, a public notice will be posted within the local newspapers attesting to the availability of the EE/CA for public review and comment. The notice will be posted within a local newspaper prior to the anticipated public comment period. An affidavit of publication will be included as part of the Removal Action Report 30-day, public comment period. The Final EE/CA will be reproduced in full and placed within the Fort Detrick Post Library, Building 1520, Community Support Center, 1520 Freedman Drive, Fort Detrick, Maryland. This document will be available for public review for a minimum of 30 days.
- Written Response to Significant Comments – Following the 30-day public comment period, written responses to significant comments will be prepared and included within the administrative record.
- Restoration Advisory Board – Periodic Restoration Advisory Board meetings are held at Fort Detrick. During these meetings, an announcement will be made that the administrative record (specifically the EE/CA) will be available for review and public comment, and will be summarized in a presentation to the Board. Significant comments generated during the Restoration Advisory Board meetings will also be documented and addressed within the written response to public comments.

## Engineering Evaluation/ Cost Analysis

Provision of a Safe Potable  
Water Source for Five Kemp  
Lane Residences  
Fort Detrick, Maryland

### 8. References

ARCADIS/Malcolm Pirnie (2011). Sampling and Analysis Plan, Fort Detrick Area B (FTD-72) Groundwater remedial Investigation.

Shaw Environmental, Inc. 2010. Area B Groundwater (FTD-72) Remedial Investigation Work Plan. Fort Detrick, Maryland.

U.S. Army, 2009. FY 2009 Fort Detrick Army Defense Environmental Restoration Program Installation Action Plan.

~~U.S. Environmental Protection Agency (USEPA), 1990.~~ National Oil and Hazardous Substances Pollution Contingency Plan. Final Rule. 40 CFR Part 300.

~~U.S. Environmental Protection Agency (USEPA), 1996.~~ Amendments to the Safe Drinking Water Act. Public Law 104-182 104<sup>th</sup> Congress.

**Comment [SMR12]:** This not how to cite to a federal law.

**Tables**

Figures

**Appendix A**

Project Schedule  
(to be provided once established)

**Appendix B**

Cost Estimating Backup

**Appendix C**

Comments and Responses