**DEPARTMENT OF THE ARMY**
**US ARMY INSTALLATION MANAGEMENT COMMAND**
**HEADQUARTERS, UNITED STATES ARMY GARRISON**
**4551 LLEWELLYN AVENUE, SUITE 5000**
**FORT GEORGE G. MEADE, MARYLAND 20755-5000**

**REPLY TO ATTENTION OF:**

August 14, 2013

Environmental Division

Ms. Elisabeth Green
Federal Facilities Division
Maryland Department of the Environment
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230

Dear Ms. Green:

Enclosed please find the August 2013 *Final Proposed Plan (Plan), Phoenix Military Reservation*. The Maryland Department of the Environment approved the Draft Final Plan on August 13, 2013. Copies of the Final Plan have been furnished to Mick Butler (Fort George G. Meade), Francis Coulters (U.S. Army Environmental Command), John Burchette (U.S. Environmental Protection Agency), Kevin Koepenick (Baltimore County), and the Cockeysville Branch Library.

If you have any questions, please feel free to contact Ms. Denise Tegtmeyer at (301) 677-9559 or me at (301) 677-9365.

Sincerely,

Paul V. Fluck, PG, REP
Program Manager, Installation Restoration Program
Directorate of Public Works-Environmental Division

Enclosure

ARCADIS

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# Final Proposed Plan

# Phoenix Military Reservation, Jacksonville, Maryland

**August 2013**

# FINAL PROPOSED PLAN FOR PHOENIX MILITARY RESERVATION JACKSONVILLE, MARYLAND

**August 2013**

## INTRODUCTION AND PURPOSE

This Proposed Plan (PP) provides information necessary to allow the public to participate with the U.S. Department of the Army (Army), the Lead Agency, in selecting the appropriate Remedial Alternative (RA) for the Phoenix Military Reservation (PMR), a sub-installation to Fort George G. Meade (FGGM), Maryland. The PMR Fire Control Area (FCA) ("the Site") is located approximately one-half mile west of Jacksonville, Maryland, in northeastern Baltimore County. **Figure 1** illustrates the location of the Site. Throughout this document, figure and table references are bolded. In addition, bolded terms are defined in the Glossary Section.

This PP summarizes information found in detail in the ***Remedial Investigation*** (RI) and the ***Focused Feasibility Study*** (FFS) as well as other reports that are available for review as part of the ***Administrative Record*** file for this Site. Although there are currently no unacceptable human health risks posed by the Site, groundwater has been impacted and could present health risks in the future if Site use changes. This PP highlights the preferred RA for the remediation of groundwater that would control and prevent these future health risks at the Site and outlines the four RAs identified during the FFS (ARCADIS, 2013).

The Army and the Maryland Department of the Environment (MDE) will finalize and present the selected RA for the Site in the Decision Document. It should be noted that PMR is not on the ***National Priorities List*** (NPL) and the MDE is the lead regulatory agency. The final selection will not take place until after the public comment period. During the public comment period, all comments will be taken into consideration as appropriate. The public is encouraged to comment on the preferred RA presented in this PP as well as the other RAs considered. Information about how to submit comments may be found in the "Community Participation" section of this PP.

The Army at FGGM and MDE jointly issue this PP in order to fulfill the public participation requirements under Section 117(a) of the ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980*** (CERCLA), as amended by the ***Superfund Amendments and Reauthorization Act of 1986*** (SARA) and the ***National Oil and Hazardous Substances Pollution Contingency Plan*** (NCP) Section 300.430(f)(2). The Army and MDE encourage the public to review all of the documents relevant to activities conducted at the Site in order to assist in the selection of an appropriate RA for the Site. Pertinent information regarding the public meeting and comment period is provided.

### IMPORTANT DATES AND LOCATIONS

**Public Meeting: August 29, 2013**
The Army will hold a public meeting to explain the PP and all Response Actions presented in the FFS. Oral and written comments will also be accepted at the meeting. The meeting will be held at the Holiday Inn Express, 11200 York Road, Hunt Valley, Maryland at 7:00 PM.

**Public Comment Period:**
**August 15 – September 13, 2013**
The Army will accept written comments on the PP during the public comment period.

**The Administrative Record, containing information used in selecting the preferred Response Action, is available for public review at the following location:**

*Cockeysville Branch Library*
*9833 Greenside Drive,*
Cockeysville, MD, 21030

**Additional information is maintained at the following location:**

Fort Meade Environmental Division Office
4215 Roberts Avenue, Room 320
Fort Meade, Maryland 20755

### Remedial Alternatives

**Remedial Alternative 1**: No Action.

**Remedial Alternative 2**: Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs).

**Remedial Alternative 3**: In-Situ Chemical Oxidation, MNA, and LUCs.

**Remedial Alternative 4**: Directed Groundwater Recirculation, MNA, and LUCs.

Relevant documents used in the preparation of this PP are listed in the "References" section found at the end of this document.

Based on the RI and FFS, the Army's preferred RA is:

- Remedial Alternative 4 – Direct Groundwater Recirculation, Monitored Natural Attenuation (MNA), and Land Use Controls (LUCs).

This RA addresses potential risks posed from groundwater under possible future land use scenarios at the Site. The results of the RI and ***Human Health Risk Assessment (HHRA)*** (ARCADIS, 2012) indicate that surface / sub-surface soil (0 to 10 feet [ft] below ground surface [bgs]) and surface water at PMR do not present unacceptable risk to human receptors on- and off-site under current and future land use scenarios. While there

are no current unacceptable human health risks from the Site, hypothetical future risks have been calculated for future residential use of the Site should it occur. Only these future risks presented from groundwater need be addressed through selection of this remedial alternative.

The results of the HHRA indicate the potential for adverse health effects for adult and child residents at PMR under the hypothetical future residential land use scenario from exposure to trichloroethene (TCE) in on-site groundwater. TCE was identified in groundwater samples above the Maximum Contaminant Level (MCL) of 5 micrograms per liter (5 µg/L) during RI activities. TCE exceedances in groundwater will be addressed as part of the preferred RA.

Estimated reasonable maximum exposure (RME) cancer risks for other future land use scenarios including construction workers, off-site residents, and adolescent recreational users are within the acceptable risk range and adverse non-cancer health effects are not expected to occur.

The preferred RA presented in this PP addresses the current MCL exceedances of TCE in groundwater. The preferred RA meets the CERCLA threshold criteria, and provides the best combination of balancing criteria when evaluated against the CERCLA requirements.

### Phoenix Military Reservation History

The PMR was originally developed in 1954 as a Nike Ajax missile site. In 1958, the Site was modified to use the Nike Hercules missiles. Active-duty Army personnel under the command of the Army Air Defense Command manned the Site until 1962, when the Maryland Army National Guard (MDARNG) assumed command. In 1966, the Nike missile program was terminated, and the Site remained relatively inactive until 1974 (Environmental Science and Engineering, Inc. [ESE], 1983).

In 1974, the Army granted the MDARNG a five-year lease of the FCA and its improvements. The MDARNG used the facility as a year-round training ground for its Military Police Company. In 1979, the MDARNG requested and was granted a five-year extension. The MDARNG ceased active operations in 1982, with the buildings being demolished shortly thereafter; the Site has been unoccupied since that time.

Historical photographs indicate that the area was farmed prior to the installation of the FCA and more recently maintained as lawn to facilitate site access and visibility. Since the cessation of Army activities on the Site, lawn maintenance has been suspended over most of the Site. Adjacent landowners maintain their properties as extensive lawn areas and pastureland for horses. The area is no longer being commercially farmed (ARCADIS, 2013).

### Current and Future Use

The PMR is currently vacant and surrounded by a fence. All permanent structures have been demolished and removed. The future use of the property is undetermined.

### Historical Investigations

A summary of the historical investigations and remedial actions conducted at the Site and a summary of past activities, including the implementation of the 1999 groundwater sampling and analysis, are presented in the RI/FFS Report (Malcolm Pirnie/Berger, 1999). To address data gaps identified within the RI/FFS, five additional phases of investigations were conducted between 2003 and 2012. These investigations include the following:

- Phase I – Investigated on-site source areas to determine constituent concentrations in the groundwater between the Site and the Greene Branch.
- Phase II – Delineated the identified dissolved phase TCE plume and total petroleum hydrocarbon (TPHC) groundwater plume and assessed impacts to discharge points (surface water or springs).
- Phase III – Conducted additional surface water sampling to document contaminant concentrations at plume discharge points.
- Supplemental Remedial Investigation – Initiated to further characterize volatile organic compound (VOC) contamination at PMR and address concerns that PMR constituents have migrated off-site and affected residential wells located southwest (Mollie Court) and east (Sunnybrook Road) of the Site.
- Groundwater Sampling – Completed in December 2012 to further evaluate attenuation mechanisms for constituents in on-site groundwater.

A summary of each of these investigations, as well as associated findings, are provided in the RI Report (ARCADIS, 2012) and FFS (ARCADIS, 2013).

## SITE CHARACTERISTICS

### Phoenix Military Reservation Description

The PMR is a former Nike missile battery site located approximately one-half mile west of Jacksonville, Maryland, in northeastern Baltimore County. The PMR formerly consisted of two parcels of land: the FCA and the Launch Control Area (LCA). The FCA and LCA each occupy approximately 17 acres of land and are approximately one-half mile apart. They occupy two adjacent hilltops separated by a valley through which the Greene Branch flows (ESE, 1983). The LCA was divested by the Army prior to this investigation and is no longer considered to be part of the PMR.

The Site is located within a residential area that is characterized by large single family homes situated on lots that are greater than one acre. The Site and the majority of the surrounding area include mature mixed hardwood forests with isolated open lawns and fields. To the east, there is a large contiguous wooded area composed of mature mixed hardwoods. Areas of steep slope adjacent to the Site are wooded with mature hardwoods and understory. There are no records from the United States Fish and Wildlife Service or Baltimore County indicating any threatened or endangered species in this area.

## Nature and Extent of Contamination

As discussed above, in addition to investigations detailed in the 1999 RI/FFS Report, five additional phases of investigation have since been completed at the Site. Results from these most recent investigations indicate TCE as the contaminant of concern (COC) at the PMR. Investigations identified a former septic system (including a tank, three leaching wells, and a leaching trench) as the likely source of TCE contamination (ARCADIS, 2013). After being discharged into the septic system, the TCE likely migrated into both the septic wells and the leaching trench. From these points, the TCE migrated through the soil column to the water table via gravity drainage and precipitation infiltration. The concentrations were low enough that the TCE was dissolved and moved with the flow of groundwater as opposed to being pure dense non-aqueous phase liquid. As the contaminants encountered the groundwater, they were dispersed both horizontally and vertically due to local variances in the hydraulic gradient (ARCADIS, 2013). During the historical investigations, a TPHC groundwater plume was identified at the Site. Based on groundwater sampling conducted during these investigations, TPHC is no longer present at the Site and is not discussed further in this report.

Soil, groundwater, air, surface water, and sediment were investigated during the RI. Assessments of each of these media are provided below.

### Extent of Contamination in Soil

Soil sampling has been conducted at the Site in an attempt to identify the source of the dissolved phase TCE plume. The on-site Phase I activities included a membrane interface probe (MIP) investigation and the collection of soil samples from borings. Although two locations were identified during the MIP investigation as having potentially chlorinated solvent-like detections, soil borings advanced at these and other locations did not show evidence of soil contamination. As outlined in the 1999 RI/FFS Report (Malcolm Pirnie / Berger, 1999), it appears likely that the TCE source contaminants dissolved and migrated directly down to the water table.

### Extent of Contamination in Groundwater

The various groundwater investigations at PMR included the installation of 24 monitoring wells and multiple comprehensive rounds of groundwater sampling, with the most recent comprehensive groundwater sampling completed in 2011 and a supplemental sampling event completed in 2012.

Of the 13 shallow wells sampled in 2011, no groundwater samples from monitoring wells exhibited TCE concentrations above the MCL of 5 µg/L. For the deep portion of the aquifer, three of 11 wells sampled in 2011 exhibited concentrations of TCE above its MCL of 5 µg/L. TCE was detected at monitoring wells FCA-1, FCA-3, and FCA-7 at concentrations of 250 µg/L, 25 µg/L, and 7.4 µg/L, respectively.

Groundwater sampling was completed in December 2012 in order to supplement the 2011 sampling data. In 2012, TCE concentrations were lower in all five groundwater samples than observed during the previous event. TCE MCL exceedances were observed in samples from monitoring wells FCA-1 (200 µg/L), FCA-3 (24 µg/L), and FCA-7 (7.1 µg/L). TCE concentrations in samples from FCA-5 (3.8 µg/L) and FCA-9 (0.64 µg/L) were below the MCL.

*Shallow Groundwater Delineation*

Based on a review of samples collected during the 2011 sampling event, contaminants in the shallow portions of the aquifer have decreased to levels below regulatory criteria. Based on this finding and the sampling results of other nearby shallow monitoring wells, the shallow dissolved phase TCE plume is considered to be delineated.

*Deep Groundwater Delineation*

Upon review of the results of the groundwater sampling completed in 2011, deep groundwater at the PMR and Mollie Court off-site residential well sampling results, the deep dissolved phase TCE plume has been delineated. No chlorinated compounds were detected above MCLs in samples from the off-site residential wells.

### Extent of Contamination in Air

There has been no air sampling conducted at the Site. However, with the absence of TCE soil contamination, the absence of surface spills (Weston, 1992), and the relatively deep groundwater table, there is little to no potential of air serving as a pathway for contamination. Photo ionization detector readings during previous drilling and sampling activities have not detected any organic vapors above background.

### Extent of Contamination in Surface Water and Sediment

Analysis of the surface water samples identified only one sample location (SW-6) where analytes were detected (benzo[a]anthracene and chrysene). However, as neither of these contaminants has been observed in

nearby or on-site monitoring wells, these occurrences do not appear to be related to the PMR. Furthermore, these compounds were detected at relatively low concentrations, and there are no applicable United States Environmental Protection Agency (USEPA) comparison criteria for them.

Although some VOCs and semi-volatile organic compounds (SVOCs) were detected in RI sediment samples, none of those compounds were detected on-site (recently or historically) and are believed to be attributable to off-site sources, including paving operations (e.g., driveway in the vicinity of SED-4) and roadway runoff.

Additional surface water sampling was conducted along the topographic lineament feature that traverses from south to north immediately east-northeast of the Site, effectively between the existing groundwater monitoring wells FCA-13 and FCA-17 (where TCE had previously been observed) and the residential private wells to the east-northeast. No compounds were detected above MCLs, and no site-related compounds were detected.

## SCOPE AND ROLE OF THE RESPONSE ACTION

This response action represents the overall strategy for remediation at the PMR. The Site is one of many sites under FGGM jurisdiction that are in the CERCLA process. The Site Management Plan (URS Group, Inc., 2013) provides details on other sites at Fort Meade that will be addressed in separate response actions from this one. The anticipated schedule for each of those sites in also provided in the Site Management Plan.

Based on historical investigations, unacceptable risks were identified under future land use scenarios due to exposure to TCE in groundwater at the Site. These risks must be eliminated or controlled.

This PP provides a summary of the RAs considered for impacted groundwater at the Site and recommends the preferred RA (Remedial Alternative 4 – Direct Groundwater Recirculation, MNA, and LUCs.

## SUMMARY OF THE SITE RISKS

As presented in the RI Report (ARCADIS, 2012), baseline risk assessments were conducted to determine the current and future effects of contaminants on human health and the environment in accordance with CFR 300.430(d)(4) and USEPA guidance.

The baseline risk assessments estimate the level of risk the Site poses to human health and the environment if no action were taken to address on-site contamination. As part of the baseline risk assessment, an HHRA was performed to identify constituents of potential concern (COPCs) at or from the Site to be evaluated as part of a hazard evaluation. Because there is no current use of FCA, there were no current potential exposures identified for the HHRA. Potential future exposures were evaluated for ingestion, inhalation, and direct contact to surface/subsurface soils (0 to 10 ft bgs) and groundwater and for direct contact to surface water.

For the purposes of the screening evaluation, constituents were identified as COPCs when: soil and sediment maximum concentrations exceeded the USEPA Regional screening levels (RSLs) for residential soil (USEPA, 2012a), groundwater maximum concentrations exceeded the USEPA RSLs for 'Tap water' which are protective of potable uses of groundwater and MCLs (USEPA, 2012b) to evaluate the potential for vapor intrusion, and surface water maximum concentrations exceeded the MDE Ambient Water Quality Criteria. Those RSLs based on non-cancer endpoints were divided by 10 to adjust from a target hazard quotient of 1 to 0.1 for identification of COPCs. If a constituent's maximum concentration did not exceed its screening value, then that constituent was excluded from the risk assessment. Details of the HHRA methodology are presented in the RI Report (ARCADIS, 2012).

A Screening-Level Ecological Risk Assessment (SLERA) was also performed as part of the baseline risk assessment to identify chemicals of potential ecological concern (COPECs). For the purposes of the screening evaluation, constituents were identified as COPECs in soil, surface water, and sediment based on the comparison of maximum detected constituent concentrations to media- and constituent-specific ecological screening values. Details of the SLERA methodology are presented in the RI Report (ARCADIS, 2012).

The risk assessments have been conducted in accordance with guidance developed by the USEPA, supplemented as necessary with related guidance developed by the MDE (the lead regulatory agency). Results of the baseline risk assessment are discussed in further detail below.

### Human Health Risk Assessment

As presented in the RI Report (ARCADIS, 2012), an HHRA was completed to identify COPCs at or from the Site to be quantitatively evaluated as part of a HHRA and hazard evaluation. Potential risks associated with exposure to chemicals in soil, groundwater, and surface water were evaluated for populations including:

- Current receptors
- Future on-site and off-site construction workers
- Future on-site adult and child residents
- Future off-site adult and child residents (North of PMR)
- Future off-site adult and child residents (South of PMR)
- Future adolescent recreational user

Details of the HHRA methodology are presented in the RI Report and results of the assessment are summarized below.

## WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

*Hazard Identification:* In this step, the contaminants of concern at the site in various media (i.e., soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

*Exposure Assessment:* In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a RME scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

*Toxicity Assessment:* In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

*Risk Characterization:* This step summarizes and combines exposure information and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a $10^{-4}$ cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of $10^{-4}$ to $10^{-6}$ (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk). For non-cancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected.

**Results of the HHRA**

A summary of unacceptable risks identified during the HHRA is provided below:

- *Future Hypothetical On-Site Residents*: The total incremental estimated lifetime cancer risk for a future residential receptor hypothetically residing at the PMR exceeds USEPA's acceptable cancer risk range for two exposure scenarios. The first is exposure to groundwater blended from all on-site bedrock monitoring wells at PMR. The second is exposure to groundwater drawn exclusively from a single bedrock monitoring well, FCA-1 which has the highest concentration of TCE and was assumed to be used as a source of drinking water. These estimated lifetime cancer risks represent combined hypothetical lifetime exposures as a child and as an adult.

  For noncarcinogenic health effects associated with potential exposures to groundwater at PMR used as a source of drinking water, the total endpoint HIs associated with TCE toxicity exceed the acceptable hazard limit for the hypothetical future adult and child resident.

## Screening-Level Ecological Risk Assessment

A SLERA was performed to determine the potential for adverse health effects in ecological receptors from exposure to constituents originating at the PMR. The SLERA was based on observations of the potential ecological habitat and receptor populations at the Site and on detected constituent concentrations in environmental media sampled during recent RIs. An ecological conceptual site model was developed to outline the potential exposure pathways between constituents in environmental media and the identified ecological receptors.

Given depth to groundwater at the PMR, it is not expected that ecological receptors would come into direct contact with constituents in groundwater. Based on the nature of contamination and the potential habitat present on and in the immediate vicinity of the PMR, the focus of the SLERA was on:

- Direct contact exposure to constituents in soil of the grass and early successional areas on the PMR, and

- Off-site exposure to constituents in surface water and sediment at the springs, the intermittent streams, and in the Greene Branch.

COPECs were initially identified in soil, surface water, and sediment based on the comparison of maximum detected constituent concentrations to media- and constituent-specific ecological screening values. Twelve metals were initially selected as COPECs in soil. However, because concentrations of metals in soil cannot be traced to former activities at the PMR and the metals concentrations are generally comparable to

published background soil concentrations, soil pathways were not evaluated further. Initially, four SVOCs were selected as COPECs in surface water and one VOC was selected as a COPEC in sediment in the southern intermittent stream. However, the southern intermittent stream is extremely localized, open water may only be found in a very small pool year-round, and it is not likely to sustain aquatic communities in either the small pool near the spring or in the seasonally dry channel down gradient of the spring. Therefore, surface water and sediment pathways were not evaluated further.

Based on the site characterization and data evaluation, adverse health effects in ecological receptors from exposure to site-related constituents in sampled environmental media at the PMR are unlikely. Therefore, further study or ecological evaluation is not necessary.

## REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are based on human health and environmental factors, which are considered in the formulation and development of RAs. Such objectives are developed based on the criteria outlined in 40 CFR 300.68(e)(2) and CERCLA Sec. 121(b).

The RAOs for the Site have been developed in such a way that attainment of these goals will result in the protection of human health and achievement of identified ***Applicable or Relevant and Appropriate Requirements*** (ARARs) 40 CFR 300.400(g).

The RAOs for COCs at the Site are:

- Prevent human exposure to groundwater that would cause unacceptable risk over the duration of the response action.
- Achieve the MCL for the identified COC in groundwater in a reasonable timeframe thereby restoring groundwater to its potential beneficial use.

### Basis for the Establishment of Remedial Action Objectives

A statutory goal of the ***Defense Environmental Restoration Program*** is for the Army to take appropriate actions to investigate and, where necessary, address releases of hazardous substances or pollutants that create an imminent and substantial endangerment to the public health or welfare and/or to the environment. The Army is required to select remedies that attain a degree of cleanup that assures protection of human health and the environment.

It is the Army's current judgment that the preferred RA identified in this PP will address potential health risks in the future and continue to provide protection to human health and the environment from actual or threatened releases of hazardous substances into the environment.

### Identification of Constituents of Concern and Site Cleanup Levels

As presented in the RI Report (ARCADIS, 2012), the HHRA determined that there are no risks to human health associated with soil and surface water media at the Site. Therefore, this PP focuses solely on risks associated with groundwater contamination; soil and surface water will not be included in further discussion.

As part of the FFS for PMR (ARCADIS, 2013), the contaminants detected in groundwater were screened to identify COCs. Details of the screening process are presented in the HHRA and Sections 3 and 4 of the FFS (ARCADIS, 2013). In summary, COCs are defined as constituents that contribute to site-specific cancer risk or non-cancer hazards to human health based on the HHRA.

Through the RI it has been determined that a remedial action is necessary to address risks presented by groundwater contamination at the Site under hypothetical future land use scenarios.

#### Groundwater

COCs were established during the HHRA. No COCs were identified for groundwater under current use scenarios as there is no current groundwater use at the Site and therefore no health risks. There are no health risks to current off-site groundwater users. For the future hypothetical on-site resident receptor, risks above the upper end of the acceptable risk range were identified, and TCE is present at concentrations greater than its MCL on-site. The COC identified for groundwater for the future hypothetical resident receptor was TCE, which is the primary risk driver.

The risk and hazard estimates for all other receptor groups and exposure scenarios are either within or below USEPA risk management levels, including potential use of groundwater as a source of drinking water off the PMR property by current and future residents, soil exposures by future construction worker and hypothetical resident receptors, and dermal exposures by recreational users of the southern intermittent stream.

For groundwater, ARARs are USEPA MCLs. A detailed discussion of ARAR evaluation and analysis is provided in the FFS (ARCADIS, 2013).

#### Summary of Site Cleanup Levels

Site Cleanup Levels (SCLs) for groundwater will be MCLs or non-zero MCLs in accordance with the requirements of CERCLA. Groundwater SCLs were identified only for COCs that exceeded MCLs. The groundwater SCLs are as follows:

- TCE: 5 µg/L

## SUMMARY OF REMEDIAL ALTERNATIVES

RAs for groundwater contamination at the Site were developed and evaluated in the FFS (ARCADIS, 2013)

based upon the results of a preliminary technology evaluation and screening. The remedial measures considered for groundwater remediation during the evaluation presented in the FFS included:

- No Action
- MNA and LUCs
- In-Site Chemical Oxidation, MNA, and LUCs
- Directed Groundwater Recirculation, MNA, and LUCs

These measures, retained during the preliminary technology evaluation and screening phase (detailed in Section 5 of the FFS), were then further refined into the four RAs listed below. The RAs are described below with their respective estimated ***Capital Costs***, estimated cost for ***Operation and Maintenance*** (O&M) activities, and an estimate of the ***Present Worth Costs*** for the RA.

**Remedial Alternative 1: No Action**

***Estimated Capital Cost: $0***
***Estimated O&M Cost Over 30 Years: $0***
***Estimated Present Worth Cost: $0***

CERCLA and the NCP require that a No Action alternative be evaluated at every site to establish a baseline for the comparison of other RAs 40 CFR 300.430€(9). Under this alternative, no remedial action would take place.

**Remedial Alternative 2: MNA and LUCs**

***Estimated Capital Cost: $15,000***
***Estimated O&M Cost Over 50 Years: $28,200***
***Estimated Present Worth Cost: $532,000***

Alternative 2 includes MNA and LUCs. Based on the review of available data (ARCADIS, 2012), natural attenuation processes are controlling migration and steadily reducing COC concentrations in groundwater. Groundwater monitoring to support the MNA remedy would be performed annually to confirm the effectiveness of natural attenuation. Groundwater samples would be collected from a network of monitoring wells throughout the plume for VOCs, including parent compounds (TCE) and degradation products (cis-1,2-dichloroethene, vinyl chloride, and ethene), biogeochemical indicators, and water quality parameters.

Data indicate the location of the plume is stable and that the areal extent of the plume is decreasing. Based on the linear regression trend analysis presented in the RI Report (ARCADIS, 2012), it is estimated that natural attenuation will achieve cleanup goals within 10 years at the perimeter of the plume (wells FCA-3 and FCA-7) and within 50 years at the center of the plume (well FCA-1). Based on these trends, the monitoring network would be able to be reduced over time. These timeframes would be confirmed through ongoing groundwater monitoring.

Land Use Controls

The existing LUCs already in place at the PMR, specifically institutional controls (ICs), will be maintained and enhanced and engineering controls (ECs) such as additional signage will be added. ICs are administrative measures put in place to affect human activity in order to control current and future land use. The four general categories of ICs evaluated or already in use at the PMR, and which provide layers of protection, are as follows: governmental controls, proprietary controls, enforcement and permitting, and informational devices, which assist with the management and implementation of LUCs. Most of these measures are already in place.

ECs, including signage (warning signs) describing restrictions of site use at key locations of the Site, will be installed. An existing perimeter fence surrounds the Site. Annual inspections of the Site will be performed to establish that all on-site LUCs (for example, fencing and signage) are in good condition, to confirm that the land use of the Site has not changed, and that through visual inspection that onsite groundwater is not in use.

The 5-year review process and the annual land use certifications/inspections will be used to document that the remedy remains protective. Additionally, the remedial design will specify notification requirements to the MDE should land use change occur, or be planned. The Baltimore County Department of Environmental Protection and Sustainability will also be copied on required notifications to MDE. LUCs will be implemented using the Department of Navy Guidance as agreed programmatically between the Army and the USEPA.

The specifics regarding the implementation of LUCs at the Site will be detailed in a separate document titled *Land Use Control and Implementation Plan* (LUCIP). The LUC mechanisms identified in this PP are potentially applicable based on current or future land uses at the Site. However, actual LUC mechanisms to be implemented at the Site will be determined during the preparation of the LUCIP.

**Remedial Alternative 3: In-Situ Chemical Oxidation, MNA, and LUCs**

***Estimated Capital Cost: $181,000***
***Estimated O&M Cost Over 15 Years: $133,400***
***Estimated Present Worth Cost: $859,000***

Alternative 3 consists of in-situ chemical oxidation, MNA, and LUCs. Under this alternative, two lines of three to four injection wells each would be installed to target TCE detected at concentrations greater than 100 µg/L. This area is centered at monitoring well FCA-1 (**Figure 2**). The impacted areas outside of the chemical oxidation treatment area would achieve SCLs through natural attenuation processes within 10 years or less. The injection wells which are located within the general vicinity of monitoring well FCA-1 are assumed to be screened in the fractured schist bedrock from approximately 65 to 75 ft bgs. Routine injection of sodium persulfate solution would be used to chemically degrade TCE.

For the purposes of this PP, the injected sodium persulfate solution is assumed to be at a 2% concentration. Based on a 10 ft screened interval and a radius of influence of 15 ft, approximately 5,000 gallons is required for each of the six to eight injection wells. An injection rate of 0.6 gallons/minute/well results in a duration of 4 to 5 weeks assuming 8 hour injections/day. It is assumed that one injection event would be required per year for two years to reduce concentrations to a level to ultimately allow natural attenuation processes to achieve cleanup goals at the Site. Because of the reduced concentrations within the core of the plume, it is assumed that this remedy would require 10 to 15 years to achieve SCLs.

Data collected from monitoring wells located within the injection radius of influence will be used to evaluate the adequate concentration and distribution of the chemical reagent. Performance and operational data will be collected to satisfy the following criteria:

- Evaluation progress of the chemical oxidation process occurring within the reactive zone
- Trends in molar concentrations of TCE will be assessed over time within and downgradient of the reactive zone to evaluate system performance

It is estimated that approximately two years would be required to reduce TCE concentrations via chemical oxidation in the center of the plume to concentrations similar to those on the periphery of the plume. When TCE concentrations in the center of the plume are reduced, natural attenuation would reduce the remaining concentrations at a rate similar to the surrounding plume. This timeframe would be confirmed through ongoing groundwater monitoring, completing the transition from chemical oxidation to MNA. The estimated timeframe to achieve cleanup goals for the entire Site under this alternative is 10 to 15 years.

Land Use Controls

The same LUC components would be implemented under this Alternative as discussed above for Alternative 2.

**Remedial Alternative 4: Directed Groundwater Recirculation, MNA, and LUCs**

***Estimated Capital Cost: $170,500***
***Estimated O&M Cost Over 15 Years: $73,600***
***Estimated Present Worth Cost: $837,000***

Alternative 4 consists of Directed Groundwater Recirculation, MNA, and LUCs. Under this alternative, a single extraction well would be installed approximately 30 ft to the east of monitoring well FCA-1 (**Figure 3**) and three wells to the southwest, south, and east to be used to re-inject the extracted water following treatment. Installation for the wells (extraction and injection) would be assumed to a depth of 100 ft bgs, with screened intervals in the fractured schist bedrock from approximately 50 to 100 ft bgs. Based on the available information, it is assumed that the extraction well would yield within a range of 1 to 5 gallons per minute. The extracted groundwater would be treated ex-situ via granular activated carbon vessels. At least two granular activated carbon units would be used in parallel to allow for continuous operation during carbon change out or other maintenance. The treated groundwater would be sampled monthly prior to reinjection to ensure cleanup goals have been achieved.

The Directed Groundwater Recirculation system is assumed to operate for 5 years under this alternative. The Directed Groundwater Recirculation system would operate through any potential change in the future use of the property. Following system shutdown, natural attenuation would reduce remaining concentrations to achieve cleanup goals for the Site within a total time of 10 to 15 years from initiation of the remedial action.

Data collected from monitoring wells located within the radius of influence of the extraction well will be used to evaluate the recirculation rates and contaminant trends. Performance and operational data will be collected to satisfy the following criteria:

- Collect water level data to assess the recirculation system and ensure contraction of the groundwater plume
- Trends in molar concentrations of TCE will be assessed over time to ensure cleanup goals will be achieved in the anticipated timeframes.
- Confirm that Site COCs in groundwater are not migrating off-site towards residential dwellings in the future.

Land Use Controls

The same LUC components would be implemented under this Alternative as discussed above for Alternative 2.

## EVALUATION OF REMEDIAL ALTERNATIVES

The NCP requires nine balancing criteria to evaluate the different RAs individually, and against one another in order to select a remedy (40 Code of Federal Regulation 300.430(e)(9)). These criteria are as follows:

Threshold Criteria – Must be met for the RA to be eligible for selection as a remedial option.

1. Overall Protection of Human Health and the Environment – Determines whether an RA eliminates, reduces, or controls threats to public health and the environment through ICs, ECs, or treatment.
2. Compliance with ARARs – Evaluates whether the RA meets the requirements set forth in Federal and State environmental or facility siting statutes, or whether a waiver is justified. Identification of ARARs is dependent on Site risks and the hazardous substances present at

the Site, site characteristics, the Site location, and the actions selected to remediate the Site. Thus, requirements may be chemical-, location-, or action-specific. Please refer to Section 4.2 of the FFS (ARCADIS, 2013) for a more detailed discussion of ARARs.

Primary Balancing Criteria – Used to weigh major trade-offs among RAs.

3. Long-term Effectiveness and Permanence – Considers the ability of an RA to maintain protection of human health and the environment over time.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment – Evaluates an RA's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. Short-term Effectiveness – Considers the length of time needed to implement an RA and the risks the RA poses to workers, residents, and the environment during implementation.
6. Implementability – Considers the technical and administrative feasibility of implementing the RA, including factors such as the relative availability of goods and services.
7. Cost – Includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an RA over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of –30 to +50 percent.

Modifying Criteria – May be considered to the extent that information is available during the FFS, but can be fully considered only after public comment is received on this PP.

8. State/Support Agency Acceptance – Considers whether the State agrees with the Army's analysis and recommendations, as described in the RI, FFS and PP.
9. Community Acceptance – Considers whether the local community agrees with the Army's analysis and preferred RA. Comments received on the PP are an important indicator of community acceptance.

## Comparative Analysis of Remedial Alternatives

This section summarizes the comparative analysis of RAs for PMR that were presented in the FFS (ARCADIS, 2013). A chart summarizing this comparative analysis is included as **Table 1**. Each alternative is ranked 1 (being the best) through 4 (being the worst) for each of the criteria. The rankings are then averaged for each alternative.

### Overall Protection of Human Health and the Environment

Under current land use, all alternatives provide protection to human health and the environment as there are no current unacceptable risks. However, future land use scenarios at the Site present unacceptable risks. Alternatives 2, 3, and 4 either remove or control possible future exposure to COCs in impacted groundwater. Alternative 4 provides the highest level of overall protection because of the treatment and hydraulic control aspects of the alternative as well as the shortened timeframe. Alternative 3 provides the next highest level of overall protection because of in-situ treatment and reduced timeframe aspects of the alternative. Alternative 2 ranks lower than Alternatives 3 and 4 on overall protection because it lacks active treatment, and the timeframe to achieve cleanup goals at on-site monitoring well FCA-1 is greater than the other two alternatives. It is noted that the plume has been demonstrated to be shrinking in size with declining concentrations and ultimately Alternative 2 would meet the RAOs.

### Compliance with ARARs

Alternatives 2, 3, and 4 comply with chemical-specific ARARs. All alternatives except Alternative 1 control exposure to site COCs through monitoring and LUCs while action-specific ARARs would be met by Alternatives 2, 3 and 4. They would not be met by Alternative 1, No Action.

### Long-Term Effectiveness and Permanence

Under Alternative 1, no monitoring would be conducted to assess COC declines. Alternatives 2, 3, and 4 are all effective and permanent in the long-term because they would reduce future risk to human health by controlling or removing pathways of exposure to COCs in groundwater. All alternatives except Alternative 1 use LUCs to restrict land use and remove potential future pathways of exposure. Alternative 3 includes in-situ treatment to more quickly achieve cleanup goals as compared to Alternative 2. Alternative 4 includes Direct Groundwater Recirculation to achieve cleanup goals in a timeframe similar to Alternative 3, but also provides certainty through hydraulic control and maintains the natural subsurface geochemistry.

Of these four alternatives, Alternative 4 would be most effective and permanent in the long-term because it achieves cleanup goals in a reduced timeframe, maintains hydraulic control, and does not alter subsurface geochemistry. Alternative 3 is the next most effective and permanent alternative because it achieves the cleanup goals in a reduced timeframe. Alternative 2 ranks lower on this criterion because the timeframe to reach permanence and demonstrate effectiveness for monitoring well FCA-1 is longer than Alternatives 3 and 4. However, the plume has been demonstrated to be shrinking, and all wells besides monitoring well FCA-1

are expected to achieve cleanup goals in less than 10 years. Alternative 1 ranks lowest on this criterion.

**Reduction of Toxicity, Mobility, and Volume through Treatment**

Alternatives 1 and 2 would not reduce the toxicity, mobility, and volume of COCs through treatment of impacted groundwater at the Site other than through natural attenuation processes. Alternatives 3 and 4 would reduce the toxicity, mobility, and volume of COCs through treatment. Additionally, Alternative 4 provides hydraulic control to the core of the shrinking plume to further reduce mobility of COCs. Therefore, Alternative 4 ranks highest on this criterion.

**Short-Term Effectiveness**

Alternative 1 is considered effective in the short-term as there are no risks to human health under the current land use. However, Alternative 1 is ineffective overall because there is no action taken to address risk to human health under future land use scenarios. Alternative 2 is the most effective of the remaining alternatives for this criterion because the remedial components are already installed, so there would be almost no risk to the community and site workers. Alternatives 3 and 4 include additional risk in the short term because of the installation of wells and the construction of the remediation systems; however, these additional risks can be controlled and mitigated.

**Implementability**

Alternative 1 is not administratively feasible due to lack of monitoring to ensure protection of human health and the environment. Alternative 2 is the most readily implementable (technically and administratively) because the monitoring network is already in place and has proven effective. Alternatives 3 and 4 would require additional permitting for well installation, reagent injections, recirculation/reinjection of treated groundwater, and additional monitoring to ensure secondary water quality impacts. There is additional uncertainty to Alternative 3 and 4 as compared to Alternative 2 as to the performance of chemical oxidation and Directed Groundwater Recirculation with the Site geology.

**Cost**

Based on the present worth estimates of probable costs for the action alternatives, Alternative 2 has the lowest projected present worth cost ($532,000). Alternative 4 ($837,000) and Alternative 3 ($859,000) are the next most costly, respectively. Although there is no cost associated with Alternative 1, it does not adequately protect human health and the environment and does not comply with ARARs.

**State/Support Agency Acceptance**

Approval of the preferred RA presented in this PP is expected. Regulatory approval will be further evaluated in the Decision Document following the public comment period.

The actions implemented under the chosen RA will comply with substantive provisions of State of Maryland permitting requirements.

**Community Acceptance**

The U.S. Army has approved the release of this Plan to the public. Community acceptance of the preferred RA will be evaluated at the conclusion of the public comment period. Community acceptance will be addressed in the ***Responsiveness Summary*** prepared for the Decision Document.

**Table 1: Comparative Analysis Chart**

| | Remedial Alternative 1 - No Action | Remedial Alternative 2 – MNA and LUCs | Remedial Alternative 3 – In-Situ Chemical Oxidation, MNA, and LUCs | Remedial Alternative 4 – Direct Groundwater Recirculation, MNA, and LUCs |
|---|---|---|---|---|
| **Evaluation Criteria** | **Rank** | **Rank** | **Rank** | **Rank** |
| Overall Protection of Human Health and the Environment | 4 | 3 | 2 | 1 |
| Compliance with ARARs | 2 | 1 | 1 | 1 |
| Long-term Effectiveness and Permanence | 4 | 3 | 2 | 1 |
| Reduction of Toxicity, Mobility, and Volume through Treatment | 4 | 3 | 2 | 1 |
| Short-term Effectiveness | 1 | 1 | 1 | 1 |
| Implementability | 1 | 2 | 3 | 4 |
| Cost | 1 | 2 | 4 | 3 |
| State/Support Agency Acceptance | | | | |
| Community Acceptance | | | | |
| Averaged ranking | 2.42 | 2.14 | 2.14 | 1.71 |
| Overall rank | 3 | 2 | 2 | 1 |

## SUMMARY OF THE PREFERRED REMEDIAL ALTERNATIVE FOR PMR

The results of the HHRA, as presented in the RI Report (ARCADIS, 2012), indicate that while there are no current adverse health effects associated with contamination present in groundwater beneath the site, under hypothetical future residential use unacceptable health risks have been calculated. Therefore, the preferred RA was recommended based on the best balance among the selection criteria for treatment groundwater contamination at the Site.

The preferred RA is:

- Remedial Alternative 4 – Directed Groundwater Recirculation, MNA, and LUCs

Based on the results of the comparative analysis and detailed evaluation presented in the FFS, the Army recommends that Remedial Alternative 4 (Directed Groundwater Recirculation, MNA, and LUCs) be implemented as the preferred alternative for remediation of contaminants in groundwater at PMR. Alternative 4 is the most appropriate remedy for groundwater contamination at PMR because it achieves the threshold criteria and provides the best balance of tradeoffs relative to the five primary balancing criteria described in the Evaluation of Remedial Alternatives section above.

According to the HHRA, cumulative cancer risks for hypothetical future on-site adult and child residents exposure to groundwater exceed the USEPA target risk range of $1x10^{-6}$ to $1x10^{-4}$ for health protectiveness and the cumulative non-cancer hazard indices are greater than 1, indicating that adverse noncarcinogenic effects could potentially occur. Under Alternative 4, operation of the Direct Groundwater Recirculation system would actively treat COCs in groundwater and installation and maintenance of LUCs to restrict future land use and implement a restriction on groundwater use would limit uncontrolled exposure to groundwater until it is returned to its beneficial use, thereby controlling potential future unacceptable risks to human health under future land use scenarios.

It should be noted that the RA recommended can be changed in light of new information or in response to public comment. Public comment will be received through the activities discussed in the next section.

Based on information currently available, the U.S. Army believes the preferred RA meets the threshold criteria and provides the best balance of tradeoffs among the other RAs with respect to the balancing and modifying criteria. The Army expects the preferred RA to satisfy the following statutory requirements of CERCLA 121(b): 1) to be protective of human health and the environment; 2) to comply with ARARs; 3) to be cost-effective; 4) to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and, 5) to satisfy the preference for treatment as a principal element.

## COMMUNITY PARTICIPATION

Public participation is an important component of remedy selection. The Army and MDE are soliciting input from the community on the preferred RA. The comment period extends from **August 15, 2013 to September 13, 2013** (30 days). This period includes a public meeting at which the Army will present the PP as agreed to by the MDE. The Army will accept both oral and written comments at this meeting and written comments following the meeting through September 13, 2013

### Public Comment Period

The Army is providing a 30-day comment period from **August 15, 2013 to September 13, 2013** to provide an opportunity for public involvement in the decision-making process for the proposed action. The public is encouraged to review and comment on this PP. During the public comment period, the public is encouraged to review the following reports and other documents pertinent to PMR and the Superfund process: *Draft Remedial Investigation/Focused Feasibility Study Report (Malcolm Pirnie / Berger, 1999), Final Remedial Investigation Report (ARCADIS, 2012), and the Focused Feasibility Study (ARCADIS, 2013)*. This information is available at the Cockeysville Branch Library located at 9833 Greenside Drive, Cockeysville, MD, 21030 and the Fort George G. Meade Environmental Division Office, located at 4215 Roberts Avenue, Room 320 at Fort George G. Meade. To obtain further information, the following representatives may be contacted:

**Ms. Mary Doyle**
**U.S. Army Garrison Fort George G. Meade**
**Public Affairs Office**
**4409 Llewellyn Avenue**
**Fort Meade, MD 20755**
**(301) 677-1361**

**Ms. Elisabeth Green, Ph.D.**
**Maryland Department of the Environment**
**Federal Facilities Division**
**1800 Washington Blvd. Suite 625**
**Baltimore, MD 21230-1719**
**(410) 537-3346**

### Written Comments

If the public would like to comment in writing on the PP or other relevant issues, comments should be delivered to the Army at the public meeting or mailed (postmarked no later than **September 13, 2013**) to Ms. Mary Doyle at the address provided.

### Public Meeting

The Army will hold a public meeting to accept comments on this PP on **August 29, 2013**, at the Holiday Inn Express, Hunt Valley, Maryland. This meeting will provide an opportunity for the public to comment on the proposed action. Comments made at the meeting will be transcribed. A copy of the transcript will be included in the Decision Document Responsiveness Summary

and will be added to the FGGM Administrative Record file and information repositories.

**Army's Review of Public Comment**

The Army will review the public's comments as part of the process in reaching a final decision on the most appropriate action to be taken. The Army's final choice of action will be issued in the Decision Document. A Responsiveness Summary, documenting and responding to written and oral comments received from the public, will be issued with the Decision Document. Once community response and input are received and the Army and MDE sign the Decision Document, it will become part of the Administrative Record.

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg/L | micrograms per liter |
| ARARs | Applicable or Relevant and Appropriate Requirements |
| Army | U.S. Department of the Army |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| COC | Constituent of Concern |
| COPC | Constituent of Potential Concern |
| COPEC | Constituent of Potential Ecological Concern |
| EC | Engineering Control |
| ESE | Environmental Science and Engineering, Inc. |
| FCA | Fire Control Area |
| FFS | Focused Feasibility Study |
| FGGM | Fort George G. Meade |
| ft | feet |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| IC | Institutional Control |
| LCA | Launch Control Area |
| LUC | Land Use Control |
| LUCIP | Land Use Control Implementation Plan |
| MCL | Maximum Contaminant Level |
| MDARNG | Maryland Army National Guard |
| MDE | Maryland Department of the Environment |
| MIP | Membrane Interface Probe |
| MNA | Monitored Natural Attenuation |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPL | National Priority List |
| O&M | Operation and Maintenance |
| PMR | Phoenix Military Range |
| PP | Proposed Plan |
| RA | Remedial Alternative |
| RAO | Remedial Action Objective |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| RSL | Regional Screening Level |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SCL | Site Cleanup Level |
| SLERA | Screening-Level Ecological Risk Assessment |
| SVOC | Semi-Volatile Organic Compound |
| TCE | trichloroethene |
| TPHC | total petroleum hydrocarbon |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compound |

## GLOSSARY OF TERMS

**Administrative Record:** This is a collection of documents (including plans, correspondence and reports) generated during site investigation and remedial activities. Information in the Administrative Record is used to select the preferred Response Action and is available for public review. 40 CFR 300.800

**Applicable or Relevant and Appropriate Requirements (ARARs):** The federal and State requirements that a selected remedy must attain. These requirements may vary among sites and RAs. 40 CFR 300.5

**Capital Costs:** This includes costs associated with construction, treatment equipment, site preparation, services, transportation, disposal, health and safety, installation and start-up, administration, legal support, engineering, and design associated with Response Actions.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):** This federal law was passed in 1980 and is commonly referred to as the Superfund Program. It provides for liability, compensation, cleanup, and emergency response in connection with the cleanup of inactive hazardous waste disposal sites that endanger public health and safety or the environment.

**Focused Feasibility Study (FFS):** This CERCLA document reviews the chemicals of concern at a site, and evaluates multiple remedial technologies for use at the site. Finally, it identifies the most feasible Remedial Alternative.

**Human Health Risk Assessment (HHRA):** This assessment describes the formal step-by-step scientific process for quantifying health risks to human receptors (residents, workers, recreationalists), thereby estimating the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media under current or future scenarios. A risk assessment uses standardized tools, formats, and scientifically accepted assumptions.

**National Oil and Hazardous Substances Contingency Plan (NCP):** CERCLA codification that governs the response to the problems of abandoned or uncontrolled hazardous waste disposal sites as well as to certain incidents involving hazardous wastes (e.g., spills).

**National Priorities List (NPL):** A list compiled by EPA pursuant to CERCLA Sec. 105, of uncontrolled hazardous substance releases in the US that are priorities for long-term remedial evaluation and response.

**Operation and Maintenance (O&M):** Annual post-construction cost necessary to ensure the continued effectiveness of a Response Action.

**Present Worth Costs:** Used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year. This allows the cost of the Response Actions to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover capital and O&M costs associated with each Response Action over its planned life.

**Remedial Investigation (RI):** An investigation under CERCLA that involves sampling environmental media such as air, soil, and water to determine the nature and extent of contamination and human health and environmental risks that result from the contamination.

**Responsiveness Summary:** A part of the Decision Document in which the Army documents and responds to written and oral comments received regarding the remedial alternatives presented in the PP.

**Superfund Amendments and Reauthorization Act (SARA):** A Congressional act that modified CERCLA. SARA was enacted in 1986.

## REFERENCES


ARCADIS. 2012. Final Remedial Investigation Report. Phoenix Military Reservation. Jacksonville, Maryland. October 2012.

ARCADIS. 2013. Focused Feasibility Study, Phoenix Military Reservation, Jacksonville, Maryland. Final. June.

Environmental Science and Engineering, Inc (ESE). 1983. Assessment of Contamination - Phoenix Military Reservation.

Malcolm Pirnie / Berger. 1999. Draft Remedial Investigation/Focused Feasibility Study Report. Prepared for the United States Army Corps of Engineers, Baltimore District. Contract Number DACA31-94-D-0017.

Roy F. Weston, Inc. (Weston). 1992. Preliminary Assessment Report Addendum for Phoenix Military Reservation, MD. Prepared for the U.S. Army Toxic and Hazardous Materials Agency. Contract Number DAA15-90-D-0009.

URS Group Inc. 2013. Site Management Plan 2013 Annual Update Fort George G Meade, Maryland. September.

USEPA. 2012a. Regional Screening Level (RSL) Resident Soil Table. Updated November 2012.

USEPA. 2012b. Regional Screening Level (RSL) Tapwater Supporting Table. Updated November 2012.

Weston. See Roy F. Weston, Inc.

# Figures

CITY: MPLS DIV/GROUP: IM DB: MG LD: PIC: PM: TM: TR:
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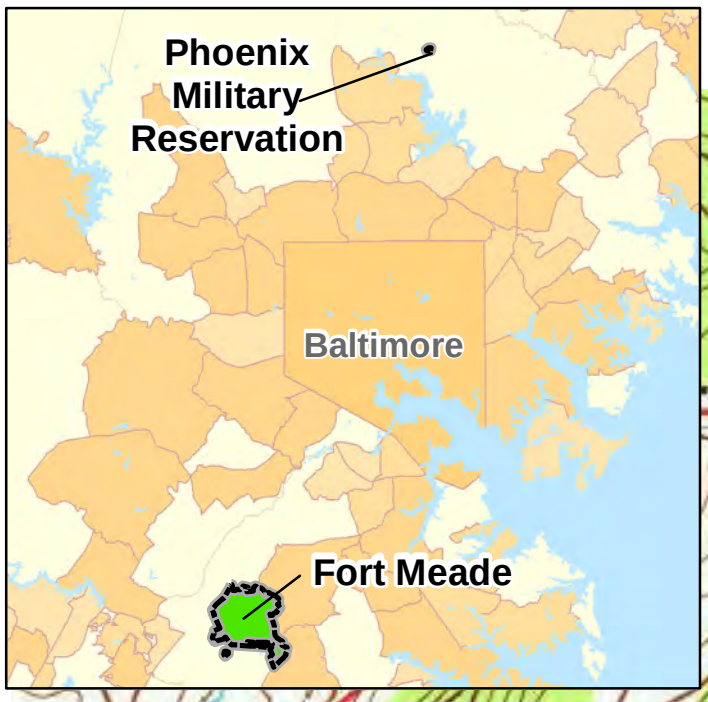


JACKSONVILLE

GREENE BRANCH

PHOENIX MILITARY RESERVATION

LOCH RAVEN
RESERVOIR


0 0.25 0.5
APPROXIMATE SCALE IN MILES

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

**SITE LOCATION**

ARCADIS

FIGURE
**1**

CITY: MPLS DIV/GROUP: IM DB: MG LD: KS
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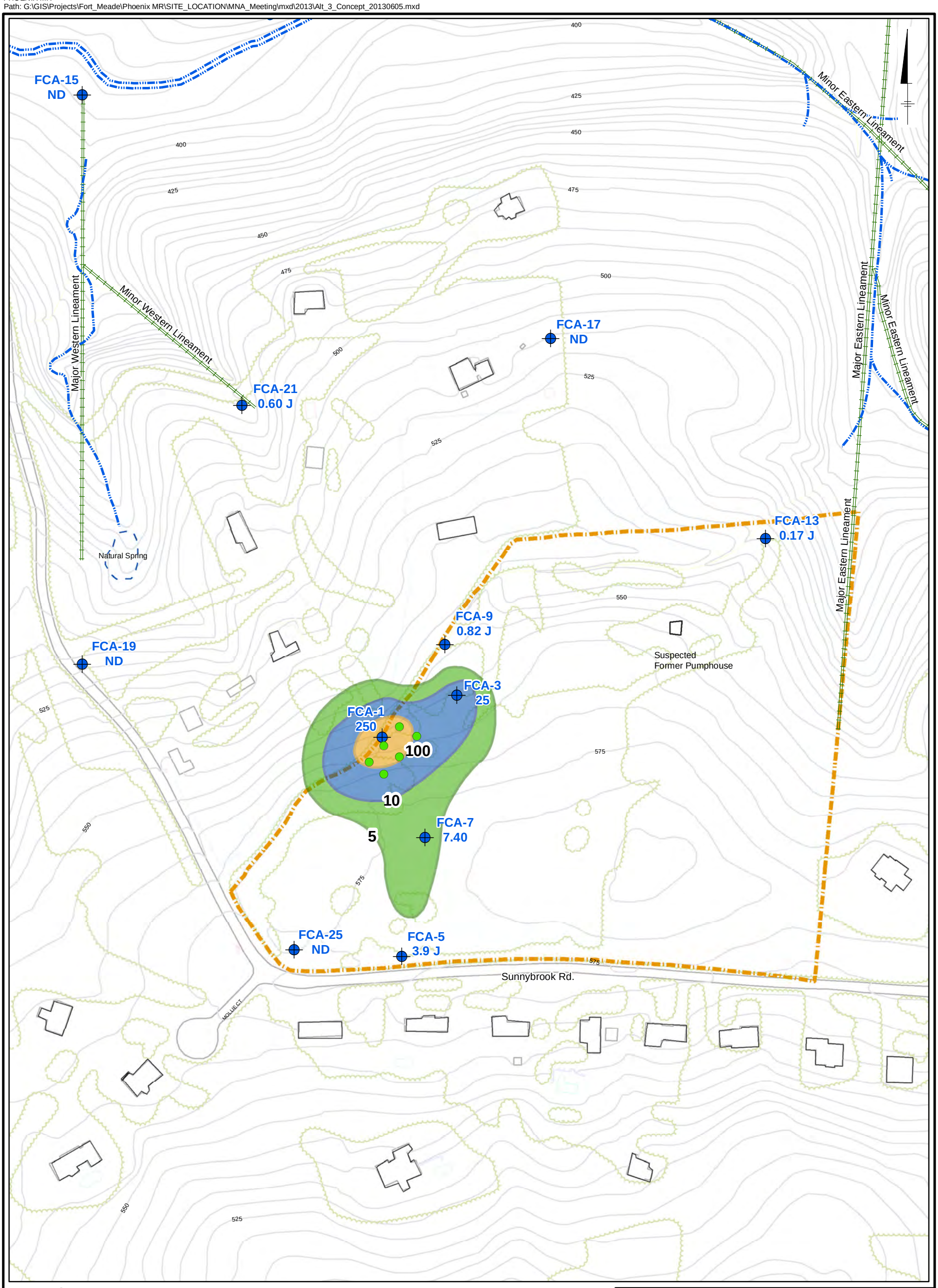


## Legend

**May 2011 Trichloroethene Concentration**

- 5 µg/L
- 10 µg/L
- 100 µg/L

**5** TCE concentration in µg/L

- Deep Well Location
- Lineament
- Stream
- Proposed Injection Well
- Natural Spring
- House
- Approximate Site Boundary

Note:
ND = Non-Detect
J = estimated concentration
µg/L = micrograms per liter

0 200 400
SCALE IN FEET

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

**ALTERNATIVE 3 CONCEPTUAL LAYOUT:
IN-SITU CHEMICAL OXIDATION, MONITORED
NATURAL ATTENUATION, AND LAND USE CONTROLS**

ARCADIS

FIGURE
**2**

CITY: MPLS DIV/GROUP: IM DB: MG LD: KS
PHOENIX MR
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## Legend

**May 2011 Trichloroethene Concentration**

- 5 µg/L
- 10 µg/L
- 100 µg/L

**5** TCE concentration in µg/L

- Deep Well Location
- Lineament
- Stream
- Natural Spring
- Extraction Well
- Recirculation Well
- House
- Approximate Site Boundary

Note:
ND = Non-Detect
J = estimated concentration
µg/L = micrograms per liter

0 200 400
SCALE IN FEET

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

**ALTERNATIVE 4 CONCEPTUAL LAYOUT: DIRECTED GROUNDWATER RECIRCULATION, MONITORED NATURAL ATTENUATION, AND LAND USE CONTROLS**

ARCADIS

FIGURE
3

**Appendix A**

Responses to MDE Comments

## Response to Comments Table

## Draft Proposed Plan, Phoenix Military Reservation, Jacksonville, Maryland

## July 2013

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 | Date of Comment | Page(s) | Section | Line(s) | Comment | Response Code | Response |
|---|---|---|---|---|---|---|---|---|
| 1 | MDE | 7/31/2013 | | General Comment | | For non-National Priority List sites in Maryland, the Maryland Department of the Environment (MDE) does not typically sign the Decision Document. Instead, the MDE provides concurrence in letter form | N | Comment Noted. |
| 2 | MDE | 7/31/2013 | | General Comment | | This document is quite detailed and long a Proposed Plan. Several sections could be shortened considerably, which would enhance the "readability" of the document for public. Two sections in particular that could be shortened without reducing the level of detail presented in the document: "Summary of Site Risks," (consider consolidating much of the "Results of the HHRA" subsection by grouping populations based on whether there is unacceptable risk or not, and directing the to the HHRA if more detail is needed), and Table 1 (consider removing all text and just present ranks). | A | The Human Health Risk Assessment Section was consolidated and only presents/discusses unacceptable risks to the respective receptors. The remedial alternative descriptions in Table 1 were removed and only scoring ranks are presented. |
| 3 | MDE | 7/31/2013 | 5 | | Column 2, "Results of the HHRA," Bullet 1 | The text in this bullet is confusing. It could be interpreted to read that there are no residents at properties adjacent to PMR property, which is incorrect. Please consider re-writing this bullet. | A | This bullet was deleted as part of the text consolidation in the Human Health Risk Assessment Section (see response to Comment #2). |
| 4 | MDE | 7/31/2013 | 7 | | Column 2, Last Sentence ("Annual inspections of…) | The text states that annual inspections will be conducted to ensure that "no unauthorized excavations were performed." Does this refer to unauthorized excavations for installation of wells, or will any type excavation be prohibited? The remedial action objectives for the site only mention preventing human exposure to groundwater, not to soil. Please clarify. | A | The referenced sentence was revised to clarify the annual inspections will be performed to confirm land use has not changed and onsite groundwater is not in use, see below:<br><br>"Annual inspections of the Site will be performed to establish that all on-site LUCs (for example, fencing and signage) are in good condition, to confirm that the land use of the Site has not changed, and that through visual inspection that onsite groundwater is not in use." |
| 5 | MDE | 7/31/2013 | 5 | (informal comment) | 3rd Bullet bullet ("Future hypothetical on-site residents") | - sentence 3: verb missing: "The second to groundwater drawn exclusively..." I think this should instead read: "The second is exposure to groundwater drawn exclusively..."<br>- last sentence: noun/pronoun agreement: "This estimated lifetime cancer risks.." should instead be "These estimated lifetime cancer risks"<br>- second paragraph: verb agreement: "... the total endpoint HIs associated with TCE toxicity exceed ..." (not exceeds) | A | All three sentences were revised as requested. |
| 6 | MDE | 7/31/2013 | 6 | (informal comment) | 2nd column, 2nd bullet for RAO | - plural agreement: "Achieve MCLs for the ..." should be changed to "Achieve (the) MCL for the ..." Since there is only one COC, there is only one MCL | A | The sentence was revised as requested. |
| 7 | MDE | 7/31/2013 | 8 | (informal comment) | 1st column, 1st paragraph of "Remedial Alternative 3" section | - 2nd sentence: word missing: "... four injection wells would be installed to target ..." | A | The sentence was revised as requested. |
| 8 | MDE | 7/31/2013 | 8 | (informal comment) | 2nd column, 1st paragraph of "Remedial Alternative 4" section | - 3rd sentence: word(s?) missing: "Installation for these wells would be assumed to a depth of 100 ft bgs..." I think it should be something like this instead: "Installation for the wells would be assumed to be at a depth of 100 ft bgs" | A | The sentence was revised as requested. |
| 9 | MDE | 7/31/2013 | 13 | (informal comment) | 1st column, 1st sentence | - weird formatting. There's an extra period and a few extra spaces at the end of this sentence | A | Formatting was revised as requested. |
| | | | | | | | | |