Draft Final Proposed Plan

Trap and Skeet Range 17 Soil
Anne Arundel County, MD

Fort George G. Meade
Legacy Base Realignment and Closure Program

July 2014

Contract Number: W912DR-09-D-0017
Delivery Order: 0032

Prepared for:

US Army Corps of Engineers ®
Baltimore District

10 South Howard Street
Baltimore, MD 21201

Prepared by:

URS

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Germantown, MD 20876

DRAFT FINAL REPORT

PROPOSED PLAN

TRAP AND SKEET RANGE 17 SOIL PATUXENT RESEARCH REFUGE, LAUREL, MD

FORT GEORGE G. MEADE LEGACY BASE REALIGNMENT AND CLOSURE PROGRAM

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Appendix A: Glossary of Terms

ARAR	Applicable or Relevant and Appropriate Requirement
ALM	Adult Lead Methodology
BAF	bioaccumulation factor
bgs	below ground surface
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
DU	decision unit
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
FFA	Federal Facility Agreement
FS	Feasibility Study
FWS	U.S. Fish and Wildlife Service
HE	high explosive
HHRA	human health risk assessment
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic
IR/BRAC	Installation Restoration/Base Realignment and Closure
ISM	incremental sampling methodology
LUC	land use control
LOAEL	Lowest Observed Adverse Effect Level
MDE	Maryland Department of the Environment
µg/dL	micrograms per deciliter
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
mm	millimeter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NG	nitroglycerin
NOAEL	No Observable Adverse Effect Level
OU	operable unit

O&M	operation and maintenance
OHM	OHM Remediation Services Corporation
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PbB	blood lead concentration
PRG	preliminary remediation goal
PRR	Patuxent Research Refuge
PRR-NT	Patuxent Research Refuge – North Tract
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SI	Site Investigation
TCLP	toxicity characteristic leaching procedure
URS	URS, Group, Inc.
USACE	U.S. Army Corp of Engineers
UXO	unexploded ordnance

SECTION ONE INTRODUCTION

The U.S. Army (Army), as lead agency, is presenting this plan for the Trap and Skeet Range 17 Soils located within the north tract of the Patuxent Research Refuge (PRR-NT) in Anne Arundel County, Maryland. The PRR-NT is a part of 7,600 acres of former range and maneuver land that was transferred by the Army from Fort George G. Meade (Fort Meade) to the Department of the Interior and U.S. Fish and Wildlife Service (FWS) in 1991. The Trap and Skeet Range 17 (also referred to as "the Site" in this document) is a former trap and skeet range and is one of the areas on the PRR-NT where the Army is leading environmental restoration activities. Figure 1 shows the location of Fort Meade, the PRR-NT, and the Site in relation to the larger region, including the cities of Baltimore, Maryland, and Washington, D.C.

This **Proposed Plan**[1] presents the **Preferred Alternative** and the other remedial options considered to address site risks associated with soil contamination at the Trap and Skeet Range 17; it also summarizes Site conditions. The Army plans to further address the Site groundwater in a separate action at a later date. The Army together with the U.S. Environmental Protection Agency (EPA), and in consultation with the Maryland Department of the Environment (MDE), will select the most appropriate remedy for soils at the Site and will present the remedy in a **Record of Decision (ROD)**.

The Army is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** as amended, commonly known as "Superfund," and Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

This Proposed Plan summarizes information that can be found in greater detail in the June 2014 **Remedial Investigation (RI) and Feasibility Study (FS)** which is contained in the **Administrative Record** for the Site. The public is encouraged to review the RI/FS and related documents available in the Administrative Record to gain a more comprehensive understanding of the Superfund activities that have been conducted at the Site. Information on community participation, and the location of the Administrative Record, is provided in Section 10 of this document.

MARK YOUR CALENDARS!	
Public Comment Period	**Public Meeting**
Dates: August 8 – September 8 **Submit written comments via letter or email to (Post-marked no later than September 8th):** Bill Eaton, URS Corporation 12420 Milestone Center Dr, Suite 150 Germantown, MD 20876 Phone (301) 820-3454, Email: Bill.Eaton@urs.com.	**Date:** TBD **Time:** 7 to 9 pm **Place:** Holiday Inn Express Baltimore BWI Airport West 7481 Ridge Road Hanover, MD 21076

This document is the result of a Fort Meade Partnership Team effort. The Team is the decision-making body composed of representatives from EPA Region III, MDE, Fort Meade, and the U.S.

[1] Words and phrases that appear in **bold** in this document are defined in the glossary.

Army Corps of Engineers (USACE). The Army is publishing this Proposed Plan to provide an opportunity for public review and comment on all the alternatives considered for the Site.

The Army recommends Alternative 3, Excavation and Offsite Treatment and Disposal with **Land Use Controls (LUCs)**, as the Preferred Alternative. Alternative 3 involves removing soils that are contaminated with lead and polycyclic aromatic hydrocarbons (PAHs). The LUCs include 1) prohibit any excavation or other disturbance of surface or subsurface soils without appropriate **unexploded ordnance (UXO)** support and written approval of the Fort Meade Legacy Base Realignment and Closure (BRAC) Environmental Management Office and 2) prohibit residential development of the Trap and Skeet Range 17 without further evaluation of residential exposure risks. The preferred remedy addresses soil contamination, is protective of human health and the environment, is expected to achieve cleanup goals in a reasonable period of time, is easily implemented, and is relatively cost effective.

The Army plans to address the Site groundwater as a separate **Operable Unit (OU)** at a later date.

The Army invites public review and comment on the alternatives described in this Plan as described in Section 10 of this Plan. The Army will consider public comments as part of the final decision-making process for this Site. The Preferred Alternative can change as a result of public comments; therefore, the Army encourages the public's participation in this process.

SECTION TWO SITE BACKGROUND

The Army, EPA, Department of the Interior, and the Architect of the Capitol signed a **Federal Facility Agreement (FFA)** in October 2009 to direct the comprehensive remediation of Fort Meade. EPA has assigned Fort Meade the following Superfund identification number: MD0910020567. The Trap and Skeet Range 17 is OU 37 of Fort Meade.

The Trap and Skeet Range 17 is located on the BRAC parcel that was transferred from Fort Meade to the Department of the Interior and the FWS in the early 1990s, and is administered as the PRR-NT, a National Wildlife Refuge. The PRR-NT is located in Anne Arundel County, Maryland, approximately halfway between Washington, D.C., and Baltimore, Maryland, as shown on Figure 1. Figure 2 shows the Site location within the PRR-NT.

2.1 SITE HISTORY

In 1917, Congress authorized Fort Meade to be used as a training cantonment for troops during World War I. The original 4,000-acre installation, most of which was previously farm land, was named Camp Meade in honor of Major General George G. Meade. In January 1941, additional training areas were added to the installation, expanding the post to 13,596 acres. During the 1940s, the facility underwent widespread growth to accommodate several regiments who moved their base of operations to Fort Meade, including the Second U.S. Army and the Eleventh Cavalry.

In 1988, the Defense Authorization Amendments and BRAC mandated the closure and/or realignment of approximately 9,000 acres encompassing the southernmost two-thirds of the installation. In 1991, the Army transferred 7,600 of the 9,000 acres to the Department of the Interior and the FWS to be administered as the PRR-NT. A second land transfer to the Patuxent Research Refuge (PRR) of approximately 500 acres took place in January 1993.

Figure 2 shows the location of the 20-acre Trap and Skeet Range 17 within the PRR-NT. The Trap and Skeet Range 17 is in the central portion of the PRR-NT in an otherwise undeveloped wooded area next to Wildlife Loop Road. The Site features are presented in Figure 3.

The BRAC portion of Fort Meade was previously used as a firing range. As a result, the potential exists for **munitions and explosives of concern (MEC)** to be present. Activities that involve the disturbance of surface and/or subsurface soil will require the proper **ordnance avoidance** or UXO support at the Trap and Skeet Range 17.

The Trap and Skeet Range 17 opened in the mid-1970s. After the property transfer in 1991, the Trap and Skeet Range 17 was used one or two nights a week until its closure in 1999. The Site contained two **trap ranges** (each with one trap house) and one **skeet range** (with one high house and one low house). The former trap and skeet range activities have resulted in surface and subsurface soil contamination by metals (lead, lead shot, arsenic, and antimony) from spent munitions, polycyclic aromatic hydrocarbons (PAHs) from target clay pigeon fragments, and nitroglycerin (NG) at gun firing stations.

2.2 SITE INVESTIGATIONS

MEC unrelated to the practice shooting at the range are confirmed at the Trap and Skeet Range 17. OHM Remediation Services Corporation (OHM) completed an ordnance survey in 1995 of

the 7,600 acres of the PRR-NT (excluding about 200 acres that were inaccessible due to wetlands and water ways). All of the Trap and Skeet Range 17 was surveyed. **Magnetometer** contacts identified during the survey were intrusively investigated to a depth of 6 inches below ground surface (bgs). Ordnance items within this interval were described as UXO or suspect UXO and either destroyed in place or removed for proper management and disposal.

Removed UXO items at the Trap and Skeet Range 17 were:

- Projectile, 155 millimeter (mm), High Explosive (HE) (four removed)
- Projectile, 105mm, HE (two removed)
- Projectile, 75mm, HE (one removed)
- Projectile, 60mm, HE (two removed)

Eight contacts were identified deeper than 6 inches bgs and were not removed and may still be present; these contacts are likely to be one or more of the above types of removed UXO. The Army implemented an education program in 2002 for visitors, hunters, and refuge personnel; the program is designed to increase awareness of the MEC hazard, provide examples of what MEC may look like, and teach people what to do if suspected MEC is encountered.

In 2004, the FWS and EPA conducted an investigation of the Site. Relying primarily on **X-ray Fluorescence** and full suite of metals soil sampling, FWS and EPA measured the nature and extent of metals in surface soil. They also measured lead shot particles in a limited number of surface soil samples. FWS and EPA then conducted an ecological risk assessment and concluded that lead posed ecological risks. The study did not evaluate potential human health risks.

From October 2009 through March 2010, URS Group, Inc. (URS) collected **discrete soil samples** to characterize the nature and extent of metals contamination at the Site as part of the RI/FS. Figure 4 presents the radial grid of soil sample locations. The sample locations were established on a radial grid with 17 branches (numbered R1 through R17). Along each radius, up to 10 sample locations were collected (assigned letters A through J). To assess the vertical extent of contamination the following sample intervals were collected: 0 to 3, 3 to 6, 6 to 9, and 9 to 12 inches bgs.

A summary of the RI discrete soil sample results is provided below:

Sample Interval (inches bgs)	Lead (mg/kg)		Lead Shot (shot/feet^2)		Arsenic (mg/kg)		Antimony (mg/kg)	
	Range of Detections	Mean	Count Range	Mean	Range of Detections	Mean	Range of Detections	Mean
0 to 3	44 to 130,000	5,930	0 to 6,617	635	1.6 to 1,900	58	0.3 to 2,700	57
3 to 6	12 to 6,400	602	0 to 2,772	127	1.4 to 39	6	0.2 to 250	15
6 to 9	6 to 980	170	0 to 191	45	1.2 to 9	3	0.2 to 23	2
9 to 12	10 to 380	72	(a)	(a)	0.4 to 6	3	0.1 to 6	1

Notes:
bgs = below ground surface; mg/kg = milligrams per kilogram; shot/feet^2 = shot per square feet
(a) Lead shot counts are generally very low for depths below 9 inches.

The following Site features were further investigated and deeper discrete soil samples were collected and analyzed for lead shot, antimony, arsenic, and lead (Figure 5):

- **Soil Berm Samples:** Two samples (depth intervals 12 to 24 and 36 to 48 inches bgs) were collected from each of three locations (Berm 1 through Berm 3) along the soil berm. The purpose of these samples was to assess the possibility of deeper mixing of contamination along the berm.
- **Drainage Samples:** Two samples (depth intervals 0 to 3 and 9 to 12 inches bgs) were collected from each of three locations (Trib 1 through Trib 3) along the drainage. The purpose of these samples was to assess the possibility of contamination migration as a consequence of occasional surface water flow along the drainage.
- **Deep Soil Samples:** Two samples (depth intervals 12 to 24 and 36 to 48 inches bgs) were collected from each of three locations (R10E, R7E, and R8G) centrally located within the anticipated shot fall zone. The purpose of these samples was to assess the possibility of: 1) deeper antimony, arsenic, and lead contamination occurrence as a result of possible leaching from soil to groundwater, and 2) deeper lead shot occurrence as a result of deep soil mixing caused by any unanticipated soil mixing that might have occurred during earth movement activities (e.g., construction of the berm area).

A summary of the RI discrete soil sample results for metals detected in the Site features is provided below:

Results	Lead (mg/kg)	Lead Shot (shot/feet^2)	Arsenic (mg/kg)	Antimony (mg/kg)
BERM AND DEEP SOIL SAMPLES				
12 to 24-inch interval:	32 to 1,100	0 to 464	2.3 to 5.9	0.22 to 14
36 to 48-inch interval:	6.6 to 360	0 to 59	2.5 to 5.4	0.18 to 16
DRAINAGE SAMPLES				
0- to 3-inch interval:	1,500 to 14,000	2 to 206	7.7 to 63	9.3 to 120
9- to 12-inch interval:	26 to 400	0 to 35	3.6 to 5.2	0.48 to 16

Notes:
mg/kg = milligrams per kilogram; shot/feet^2 = shot per square feet

The results of the 2009-2010 RI discrete soil sampling indicated that the detections of the munition-related metals (arsenic, antimony, and lead) are co-located with the lead shot fallout areas. The highest concentrations of the metals are in the shallow 0-3 inch depth range; the concentrations decrease rapidly in the deeper sample depths. The drainage is not transporting contamination offsite. The berm area has detected metal concentrations in the deeper 36-48 inches bgs depth range, probably due to earth movement activities.

Four groundwater samples were collected during the 2009-2010 RI sampling event at the Trap and Skeet Range 17 and analyzed for metals. Antimony, arsenic, and lead were identified as **chemicals of potential concern (COPCs)** in groundwater and were carried forward into the human health risk assessment. However, further discussion of the Site groundwater will be addressed at a later date in a separate Proposed Plan and ROD.

The Army met with EPA in May 2012 to discuss using **incremental sampling (IS)** to assess PAHs and NG. EPA and MDE recommended further site investigation to characterize PAHs within the clay pigeon fragment fallout area and NG in the former firing station areas. The Army identified seven **Decision Units (DUs)** based on the relative likelihood of finding either elevated

PAHs (DUs 1 through 4), elevated NG (DUs 6 and 7), and background location not affected by Site-related activities. URS conducted the IS in 2013.

The Table below presents the number of increments and replicates (samples) collected at each DU. Figures 6 and 7 present the DU locations. Each soil sample consists of 50 increments; at each increment location, three replicates were collected (i.e., replicates A, B, and C). All "A" soil increments were combined into a single large soil sample (roughly 2 pounds of soil) that was then delivered to the laboratory for analysis. Clay fragments were not removed from the samples. The same procedure was followed for the "B" and "C" increments.

Decision Unit (DU)	COPC	DU Size (Acres)	Soil Depth (inches bgs)	Increments per Replicate	Total Replicates [(a)]	Total Increments
DU1	PAHs	3	0-6	50	3	150
			6-12	50	3	150
DU2	PAHs	0.75	0-6	50	3	150
DU3	PAHs	0.75	0-6	50	3	150
DU4	PAHs	0.75	0-6	50	3	150
DU5	PAHs	0.75	0-6	50	3	150
DU6	NG	0.25	0-6	50	1	150
DU7	NG	0.25	0-6	50	1	150

Notes:
bgs = below ground surface; COPC = chemical of potential concern; DU = Decision Unit; NG = Nitroglycerin; PAHs = polycyclic aromatic hydrocarbons
(a) Corresponds to the total number of samples to be shipped to the lab for analysis.

PAHs were monitored in DUs 1 through 5, which represent the following areas:

- DU1: Down-range area with suspected PAH impacts based on visual evidence of clay target fragments
- DUs 2 and 3: Bounding areas with no suspected PAH impacts based on no visual evidence of clay target fragments
- DU4: Area near the firing lines with suspected PAH impacts based on visual evidence of clay target fragments
- DU5: Reference (background) area with only naturally occurring PAH impacts

NG was monitored in DUs 6 and 7, which represent the following areas:

- DU6 and DU7: Areas near the two firing lines with the assumed greatest probability of impact by NG due to their proximities to the firing lines.

A summary of the RI incremental soil sample results for total PAHs and NG is provided below:

Decision Unit (DU) and COPC	Incremental Sample Interval	Range of Detections (mg/kg)
DU1 – PAHs	0 to 6 inches	91 to 380
	6 to 12 inches	27 to 54
DU2 – PAHs	0-to 6 inches	0.138 to 0.171
DU3 – PAHs	0-to 6 inches	0.187 to 0.403

Decision Unit (DU) and COPC	Incremental Sample Interval	Range of Detections (mg/kg)
DU4 – PAHs	0-to 6 inches	22 to 653
DU5 - PAHs	0-to 6 inches	0.204 to 0.276
DU6 – NG	0-to 6 inches	4.8
DU7 – NG	0-to 6 inches	3.8

Notes:
COPC = chemical of potential concern; mg/kg = milligrams per kilogram

The PAH concentrations in the bounding units (DUs 2 and 3) were similar to the background unit DU5, implying no Site-related PAH impacts. The PAH results for DUs 1 and 4 were roughly two to three orders of magnitude higher than the results observed at DU5, indicating Site-related PAH impacts at DUs 1 and 4. The RI results indicate that surface soil at DUs 6 and 7 is impacted with Site-related NG concentrations.

2.3 PUBLIC PARTICIPATION ACTIVITIES

Fort Meade holds Restoration Advisory Board (RAB) meetings every third Thursday of every other month. Fort Meade RAB information is found at the following website: http://www.ftmeade.army.mil/environment/rab/index.html.

The RAB meetings provide a forum for discussion and exchange of information about Fort Meade's environmental restoration program under the Installation Restoration/Base Realignment and Closure (IR/BRAC) or Formerly Used Defense Sites. The RAB is composed of representatives of the community, installation and regulatory agencies; both the installation and the community jointly chair the RAB. The Army provides status reports on the environmental investigation and restoration activities at the BRAC sites, including the Trap and Skeet Range 17.

The Army presented the RI/FS activities and findings for the Trap and Skeet Range 17 at the March 20, 2014 RAB meeting. Also, the Army posts BRAC site investigation and decision documents at http://www.ftmeade.army.mil/environment/bracLegacy/index.html.

SECTION THREE SITE CHARACTERISTICS

This section describes the Site features, nature and extent of contamination, and COPCs for the Trap and Skeet Range 17.

3.1 SITE FEATURES

Figure 8 shows an aerial photograph with the topographic contour lines of the Trap and Skeet Range 17. The ground surface elevations vary from about 43 to 49 meters (140 to 160 feet) above mean sea level. The ground surface slopes gently eastward from Wildlife Loop Road, then northeastward farther down-range from the former trap and skeet houses.

The Trap and Skeet Range 17 is mostly covered with young sweetgum trees and a thick understory of brush. The area is in the process of returning to its natural state after closing the range. The FWS intends for this area to return to its natural state (i.e., no future development).

No surface water bodies are in the immediate vicinity of the Trap and Skeet Range 17; however, the Little Patuxent River is located about 1 mile east of the range. FWS and EPA (2004) mapped a drainage channel (Figure 3) approximately 400 feet downrange from the former trap and skeet houses. Signs of storm water runoff were found during a site visit for the RI activities, suggesting that rain events cause soil and lead shot erosion and transport into the drainage. Lead shot was visible on the soil surface within this drain. Because the flow from the drainage channel discharges into an upland-woodland and not a stream, the channel is not considered a water of the United States. Also, a small, manmade berm crosses the Site (Figure 3).

No jurisdictional wetlands are located at the Trap and Skeet Range 17; however, two wetland areas were identified close to the former range. These areas will require protection from runoff and heavy equipment during any remediation efforts. Figure 9 shows the locations of the nearby wetlands.

3.2 NATURE AND EXTENT OF CONTAMINATION

A summary of the findings regarding the nature and extent of both horizontal and vertical contamination in soil at the Site is provided in the tables in Section 2.2, Site Investigations, and in narrative form, below:

- Potentially buried MEC and/or UXO is present in the subsurface. Contacts deeper than 6 inches bgs were not removed during the 1995 ordnance survey and may still be present.
- Detections of the munition-related metals (arsenic, antimony, and lead) are co-located within the lead shot fallout areas.
- The highest concentrations of the metals tended to be in the shallow 0-3 inch depth range; the concentrations decrease rapidly in the deeper sample depths. The highest concentrations found were: lead at 130,000 mg/kg; arsenic at 1,900 mg/kg; and antimony at 2,700 mg/kg.
- The drainage channel is not transporting contamination offsite.
- The berm area has detected metal concentrations in the deeper 36-48 inches bgs depth range, probably due to earth movement activities.

- PAH concentrations in the bounding units (DUs 2 and 3) were similar to the background unit DU5, implying no Site-related PAH impacts.
- PAH results for DUs 1 and 4 are roughly two to three orders of magnitude higher than the results observed at DU5, indicating Site-related PAH impacts at DUs 1 and 4. The highest concentrations of PAHs found in DUs 1 and 4 were 380 mg/kg and 653 mg/kg, respectively.
- PAHs were detected in subsurface at DU1 at a maximum concentration of 54 mg/kg; total PAH concentrations decrease by up to about one order of magnitude between the surface and subsurface intervals, indicating rapid vertical attenuation of total PAHs with increasing depth.
- NG was detected in surface soil at DUs 6 and 7. The highest concentrations of NG in DUs 6 and 7 were 4.8 mg/kg and 3.8 mg/kg, respectively.

3.3 CHEMICALS OF POTENTIAL CONCERN

The table below presents the soil COPCs and their respective health effects for the Trap and Skeet Range 17. These contaminants were carried forward into the human health and ecological risk assessments.

Principal threat wastes are present at the Site because of potential explosion hazard(s) from UXO and/or MEC that may be present in the subsurface soil. As described in Section 2.2, eight contacts were identified deeper than 6 inches bgs and were not removed and may still be present.

COPC	Potential Health Effects
Antimony	Antimony is a silvery white metal of medium hardness that breaks easily. It is often found in low levels in the earth's crust, breathing air, drinking water, and food. Antimony is also used in the manufacturing of ammunition. When exposed to large amounts of antimony, human health effects include eye and skin irritation, hair loss, lung damage, vomiting, and heart problems. In animals, it causes fertility problems, liver damage, and blood changes.
Arsenic	Arsenic is a naturally occurring element that is widely found in the earth's crust. It is a steel grey solid material that is usually combined with other elements such as oxygen, chlorine, and sulfur. Arsenic is also used in ammunition manufacturing. Non-cancer human health effects include nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet, and darkening of the skin. EPA has identified arsenic as a human carcinogen; arsenic exposure can cause increased risk of skin, liver, bladder, and lung cancer.
Lead	Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing (e.g., ammunition). Human health effects include nervous system problems (e.g., weakness in fingers, wrists, or ankles), small increases in blood pressure, and brain and kidney damage.
	Children are more vulnerable to lead poisoning when exposed to high levels; health effects include blood anemia, severe stomachache, muscle weakness, and brain damage. In pregnant women, high levels can cause miscarriage, premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children.

COPC	Potential Health Effects
Lead (Continued)	Ecosystems experience a wide range of adverse effects such as less diverse ecological communities, decreased growth and reproductive rates in plants and animals, and neurological effects in animals.
Lead Shot	The health effects are similar to lead (as described above). It also presents a choking hazard to small children if the child picks up the particles while playing at the Site. Birds may ingest the shot as possible food or grit (i.e., ingested particulates to help grind up difficult to digest items).
PAHs [(a)]	PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. PAHs generally exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar pitch that was used to create clay target pigeons for skeet ranges. In both humans and animals, PAHs can cause harmful effects on the skin, body fluids, and the body's system for fighting disease after both short and long-term exposure. Some PAHs can cause lung, stomach, and/or skin cancer.
NG	NG is used in the manufacturing of propellants. . It is used as a medicine to prevent attacks of chest pains (angina); it dilates (widens) blood vessels, making it easier for blood to flow through them and easier for the heart to pump. When exposed to large amounts, health effects include a prompt fall in blood pressure, a roaring sound in the ears; persistent and throbbing headache with vertigo; a generalized tingling sensation; palpitations; visual disturbances; and vomiting and nausea.
MEC and/or UXO	The Site was once used as a firing range; therefore, UXO may be present in the subsurface and is a potential explosion hazard. This health hazard occurs if the subsurface is exposed through digging activities.

COPCs = chemicals of potential concern; PAHs = Polycyclic aromatic hydrocarbons; MEC = munitions and explosives of concern; NG = nitroglycerin; UXO = unexploded ordnance

[(a)] The PAHs are as follows: 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

SECTION FOUR SCOPE AND ROLE OF RESPONSE ACTION

This Proposed Plan describes the proposed remedial alternative for addressing soil contamination at the Trap and Skeet Range 17. The Army plans to further address the Site groundwater as a separate OU at a later date. The 1991 Land Transfer Assembly prohibits the use of groundwater from the Site as a potable resource at the PRR-NT. The remedial actions evaluated for the Site are consistent with the Congressional mandate regarding the transfer of the Site property to the FWS as a wildlife sanctuary.

Principal threat wastes are present at the Site due to possible MEC in the subsurface soil. Therefore, LUCs are necessary to protect against possible explosion hazard(s) at the Trap and Skeet Range 17. The Army plans to implement the following LUCs as part of the soil remedy for the Site:

1) prohibit any excavation or other disturbance of surface or subsurface soils without appropriate UXO support and written approval of the Fort Meade Legacy BRAC Environmental Management Office
2) prohibit residential development of the Trap and Skeet Range 17 without further evaluation of residential exposure risks

The LUCs are part of a PRR-NT-wide initiative; the Army is preparing a separate Proposed Plan and ROD to address potential MEC exposure for the 7,600-acre PRR-NT (which includes the Trap and Skeet Range 17). These documents will further define the remedial actions and LUCs necessary to protect human health and the environment from MEC exposure. The LUCs will be further documented in a **Land Use Control Remedial Design (LUCRD)** that will clearly identify the responsibilities and measures needed to maintain and monitor the LUCs.

SECTION FIVE SUMMARY OF SITE RISKS

A **human health risk assessment (HHRA)** and an **ecological risk assessment (ERA)** were conducted as part of the RI/FS to evaluate current and anticipated future risks associated with exposure to COPCs at the Site.

5.1 HUMAN HEALTH RISK ASSESSMENT

The HHRA evaluated current and future wildlife refuge workers and recreational users of the Site, consistent with the Trap and Skeet Range 17's incorporation within a national wildlife refuge managed by the FWS. Other standard EPA receptors were evaluated (e.g., industrial worker, construction worker, and resident); it is not likely that these receptors will come into contact with the Site media unless the land use changes in the future.

Human health risks are based on a conservative estimate of the potential **carcinogenic risk** posed by Site contaminants and their potential to cause other health effects not related to cancer. Carcinogenic risks and non-carcinogenic health effects were evaluated considering the following three factors: 1) the nature and extent of contaminants at the Site, 2) the pathways through which receptors are or may be exposed to those contaminants at the Site, and 3) the potential toxic effects of those contaminants.

Cancer risks are expressed as numbers reflecting the increased chance that a person will develop cancer over a lifetime as a result of exposure to contaminants in site media (e.g., ingesting soil while residing at the site). For example, **EPA's acceptable cancer risk range** is 10^{-4} to 10^{-6}, meaning there is one additional chance in 10 thousand (1×10^{-4}) to one additional chance in 1 million (1×10^{-6}) that a person will develop cancer if exposed to COPCs at a site. The Army and EPA agreed upon an upper cancer risk threshold level of 1×10^{-4} for the discrete sampling evaluation and 5×10^{-5} for the incremental sampling evaluation. EPA recommended the lower threshold for the incremental sampling methodology (ISM) to account for potential hot spots of contamination that might be diluted by combining the increments.

The probability of developing non-carcinogenic adverse health effects is expressed as a **hazard index (HI)**, which is the ratio of the existing level of exposure to contaminants at a site to an acceptable level of exposure. At or below an HI of 1, adverse effects are not expected. The Army and EPA agreed upon using an HI of 1 for the discrete sampling evaluation and 0.5 for the incremental sampling evaluation.

Because most human health effects data for lead are correlated with concentrations in the blood rather than an external dose, the traditional approach for evaluating health effects cannot be applied to lead. Lead is therefore evaluated separately from carcinogens and noncarcinogens. EPA has developed two lead models, Adult Lead Methodology (ALM) and the Integrated Exposure Uptake Biokinetic (IEUBK) model, to address an adult pregnant female worker and child resident, respectively. Both models were used to address current and future exposure to soils at the Site. The lead "concern threshold" recommended by EPA is no more than a 5 percent chance of exceeding 10 micrograms per deciliter (µg/dL) for both models.

The risk-based screening results identified the following COPCs in soils: arsenic, antimony, lead, PAHs, and NG. Lead shot was not specifically addressed in the HHRA; it is assumed that the shot particles undergo weathering and contribute to the lead concentrations detected in the soil at the Site.

5.1.1 Human Health Receptors and Exposure Pathways

The table below summarizes the current and future land use scenario receptors, exposure media, and exposure pathways that were evaluated in the HHRA.

Receptor	Description	Exposure Media/ Exposure Pathways
Current/Future Land Use Receptors		
PRR Worker/Intern	An outdoor worker who conducts inspections or outdoor maintenance activities. The employee is assumed to work at the Site for 8 hours per visit, one visit per month, 12 months per year, for 25 years.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors
Adult Visitor/Hunter [(1)]	An adult who participates in PRR-sponsored programs such as bird watching, hiking, or hunting. The receptor visits the Site for 4 hours per visit, one visit per month, for 24 years.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors
Child Visitor/Hunter [(1)]	A child (ages 6 to 16 years) who participates in PRR-sponsored programs such as bird watching, hiking, or hunting. The receptor visits the Site for 4 hours per visit, one visit per month, for 10 years.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors
Future Land Use Receptors		
Industrial Worker	A worker who spends 8 hours a day, 250 days per year for 25 years working at the Site, assuming that the refuge is converted into a more public commercial/industrial area and requires daily grounds maintenance.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors Groundwater/ingestion and dermal contact (potable usage) [(2)]
Construction Worker	A worker who spends 8 hours per day for 125 days (i.e., one time, 6-month construction project) when the Site is cleared and redeveloped for a land use other than a refuge. This hypothetical scenario is used to address potential short-term, but intense exposure to soils at the Site.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors
Resident	A standard EPA child/adult scenario used to explore the potential for unrestricted land use. The hypothetical resident spends 24 hours per day, 350 days per year, for 30 years living at the Site.	Soils/Ingestion, dermal contact, inhalation of particulates/vapors Groundwater/ingestion and dermal contact (potable usage) [(2)]

Notes:

[(1)] The hunter has limited access to the PRR (only in designated hunting areas, and only during hunting season). Ingestion of wild game (e.g., wild turkey, deer, or mourning doves) was not evaluated for the visitor/hunter scenario because the prey is not likely to stay within Trap and Skeet Range 17 boundaries (i.e., home ranges and foraging areas are larger). The hunting activities are likely recreational (not subsistence) at the refuge; the frequency of kills and of eating prey from the Site is limited due to hunting season restrictions.

[(2)] The Army plans to further address the Site groundwater as a separate OU at a later date. The 1991 Land Transfer Assembly prohibits the use of groundwater from the Site as a potable resource at the PRR-NT. The HHRA provided the evaluation for information purposes only.

5.1.2 Human Health Risk Assessment Findings

Tables 1 through 5 present the cancer risk and non-cancer HI results for the current/future scenarios (i.e., PRR worker/intern and visitor/hunter) and future land use scenarios (i.e.,

industrial worker, construction worker, and resident). Tables 1 and 2 present the metals evaluation results, Tables 3 and 4 present the PAH evaluation results, and Table 5 presents the NG evaluation results. Tables 1 through 5 are presented in the Table Section at the end of this Plan.

Current/Future Land Use Scenario: Neither the cancer nor the non-cancer thresholds are exceeded for antimony, arsenic, PAHs or NG in soil, indicating no unacceptable threats to human health. For lead, the ALM and IEUBK models predicted blood lead concentrations (PbBs) for current PRR receptors to be below the threshold of no more than a 5 percent chance of exceeding 10 micrograms per deciliter (µg/dL).

Future Land Use Scenario: Both the cancer and non-cancer thresholds are exceeded because of exposure to arsenic, antimony, and PAHs in the soil. Exposure to NG in soil does not cause any cancer risk or non-cancer threshold exceedances. For lead, both the ALM and IEUBK models predict unacceptable PbBs for future child and adult receptors.

The following chemicals of concern in soil at the Trap and Skeet Range 17, assuming future land redevelopment (i.e., industrial worker, construction worker, and resident scenarios), are:

- Lead in surface and subsurface soil
- Antimony and arsenic in surface and subsurface soil
- Benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene in DU1 surface soil
- Benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene in DU1 subsurface soil
- benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, and dibenz(a,h)anthracene in DU4 soil.

However, the lead model results, cancer risk estimates, and/or non-cancer hazard estimates for the current/future scenarios (i.e., PRR worker/intern and visitor/hunter) are below EPA thresholds. The Site is to remain a wildlife refuge (i.e., return to its natural state) and future development is unlikely.

5.2 ECOLOGICAL RISK ASSESSMENT

As noted in Section 2.2, EPA and FWS conducted their own ERA of the Trap and Skeet Range 17 in 2004; the study results indicated that the concentrations of lead and antimony in soil samples were positively correlated. It was concluded that, although there may be a risk from antimony, it may be masked by the higher concentration of lead. Consequently, antimony was eliminated from further consideration, leaving lead as the only metal considered as an ecological COPC.

The 2014 ERA used the 2004 results and then evaluated the chemicals detected in each DU from the incremental sampling. The screening process involved comparing the maximum soil concentration of each detected chemical to soil screening values for invertebrates, mammals, and birds. The soil COPCs are as follows:

- Lead and lead shot, based on the site-wide discrete soil sampling and EPA and FWS (2004) site assessment

- PAHs for DUs 1 and 4, based on the incremental soil sampling
- NG for DUs 6 and 7, based on the incremental soil sampling

5.2.1 Assessment and Measurement Endpoints

The ERA evaluated the following terrestrial indicator species for the assessment and measurement endpoints:

- Terrestrial invertebrates (earthworm): Soil concentrations were compared directly to **No Observable Adverse Effect Level (NOAELs)** and **Lowest Observed Adverse Effect Levels (LOAELs)** that were developed from site-specific toxicity testing performed by FWS using *Eisenia foetida.* **Hazard Quotient (HQ)** values were calculated for the earthworm.
- Small insectivorous mammals (short-tailed shrew): A food-chain model was used to evaluate risk to small insectivorous mammals that utilize the Site. The proposed endpoint receptor species is the short-tailed shrew (*Blarina brevicauda*). Earthworms were identified as the primary food source for the shrew. A dietary dose was calculated on the basis of ingestion of earthworms. The concentration of COPCs in earthworms was based on a bioaccumulation factor (BAF) calculated by FWS using data from another trap and skeet range. The resulting total daily dose was compared to existing toxicity data (e.g., NOAEL and LOAEL) through the calculation of an HQ.
- Insectivorous birds (American robin): A food-chain model was used to evaluate risk to insectivorous birds that utilize the Site as a food source. The endpoint receptor species is the American robin (*Turdus migratorius*). Earthworms were identified as the primary food source for the robin. A dietary dose was calculated on the basis of ingestion of earthworms. The concentration of COPCs in earthworms was based on a BAF calculated by FWS using data from another trap and skeet range. The resulting total daily dose was compared to toxicity data (e.g., NOAEL and LOAEL) through the calculation of an HQ.
- Gallinaceous birds (mourning dove): An ingestion-based probability model was used to evaluate risk to gallinaceous birds that utilize the Site to forage for seeds or grit. The endpoint receptor species is the mourning dove (*Zenaida macroura*). The model uses the ratio of grit to lead shot to estimate the probability that a bird would ingest a lead shot. Risk to the bird is estimated based on this probability.

5.2.2 Ecological Risk Assessment Findings

Activities at the Trap and Skeet Range have resulted in the deposition of lead shot and lead over the entire shot fall zone. PAHs, resulting from clay targets, are also distributed through portions of the Site. The results of the ERA indicate that species that have a limited home range and could potentially spend all or most of their lives at the Site are most likely to be adversely affected by contaminants at the Site. The results also indicate that the mourning dove, which has a significantly greater home range than the other measurement endpoint species, may also be adversely affected.

The ERA findings are discussed below for lead, lead shot, NG, and PAHs:

- Lead: Site-wide NOAEL-based HQs ranged from 137 (terrestrial invertebrates) to 188 (insectivorous bird). LOAEL-based HQs range from 15 (small mammal) to 24 (terrestrial invertebrates). An HQ above 1 indicates a probable adverse health effect.
- Lead shot: The probability that a gallinaceous bird will ingest one lead shot during its lifetime is estimated at 92 percent.
- NG: There are no NOAEL or LOAEL threshold exceedances.
- PAHs: The results for each of the DUs are summarized below. NOAEL and LOAEL HQ values are mentioned only if they exceeded the threshold of 1:
    - DU1 (surface): NOAEL-based HQs range up to 75 and LOAEL-based HQs range up to 1.1
    - DU1 (subsurface): NOAEL-based HQs range up to 10
    - DU2: No HQ threshold exceedances
    - DU3: No HQ threshold exceedances
    - DU4: NOAEL-based HQs range up to 59
    - DU5: No HQ threshold exceedances

Concentrations of lead in soil resulting in LOAEL HQs of 1 were calculated for the terrestrial invertebrate (260 mg/kg), short-tailed shrew (420 mg/kg), and the American robin (336 mg/kg). The terrestrial invertebrate value was selected as most protective of all ecological receptors at the Site and recommended as the lead **preliminary remediation goal (PRG)**. The lead ecological PRG is also protective of the human receptors evaluated in the HHRA.

It is the Army's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment at the Site.

SECTION SIX REMEDIAL ACTION OBJECTIVES

Achievement of the **Remedial Action Objectives (RAOs)** for the soil contamination is the focus of this Proposed Plan. As stated previously, the Army plans to address the Site groundwater as a separate OU at a later date. The RAOs for Trap and Skeet Range 17 soils are:

- Control exposure of human and ecological receptors to contaminated Site soil that poses risks that exceed acceptable levels,
- Reduce the soil contaminant concentrations to levels that do not pose unacceptable risks to human and ecological receptors, and
- Prevent potential future offsite contaminant migration along the drainage channel.

Achievement of the RAOs is determined by attainment of PRGs during the implementation of a remedial alternative. The stakeholders for this project have agreed upon the lead PRG of 260 mg/kg, which is protective of ecological and human receptors. No PRGs were derived for arsenic, antimony, and lead shot because these are co-located with the lead contamination.

The HHRA results indicate that exposure to PAHs in soils presents an unacceptable risk to the future resident and industrial worker scenarios, but not to the current/future PRR worker/intern or visitor/hunter scenarios. The HHRA assumes an exposure frequency of 12 days per year for the PRR worker/intern and hunter/visitor; however, EPA expressed concern that it will be difficult to prove that the exposure frequency of 12 days per year will not be exceeded in the future (i.e., not feasible to monitor individual receptors). A fence was considered to limit access and the number of days of exposure; however, a fence was rejected as a LUC because it is not compatible with the operation of the property as an open-access wildlife refuge and would entail significant long-term monitoring and maintenance costs.

Therefore, the stakeholders agreed that soils within the DU1 and DU4 boundaries will be removed to a depth of 12-inches bgs. Figure 6 presents the DU1 and DU4 boundary areas.

SECTION SEVEN SUMMARY OF REMEDIAL ALTERNATIVES

The following remedial alternatives were evaluated:

Alternative 1—No Action

Alternative 2—In-Situ Stabilization and Cover with LUCs

Alternative 3—Excavation and Offsite Treatment and Disposal with LUCs

Alternative 4—Excavation, Ex-situ Stabilization, and Offsite Disposal with LUCs

Alternative 5—Excavation, Soil Washing, and Onsite Reuse with LUCs

7.1 COMMON ELEMENTS OF THE REMEDIAL ALTERNATIVES

This section discusses the common elements of the remedial alternatives. The common elements of the four active remedial alternatives under consideration include the excavation and/or treatment of soils either onsite or offsite, and offsite disposal, or reuse of the soil onsite, of the same volumes of contaminated soil. The soil with lead concentrations exceeding the PRG of 260 mg/kg is treated and/or excavated and the soil within the DU1 and DU4 boundaries are removed to a depth of 12-inches bgs to address PAHs. The following soil volumes are assumed for Alternatives 2, 3, 4, and 5:

Ground Surface Footprint Area (acres)			Soil Treatment Volume (cubic yards)		
Lead	**PAHs**	**TOTAL**	**Lead**	**PAHs**	**TOTAL**
11.13	4.10	15.23	9,950	6,619	16,569

Alternatives 2, 3, 4, and 5 incorporate the same soil LUCs which are as follows:

1) Prohibit any excavation or other disturbance of surface or subsurface soils without appropriate UXO support and written approval of the Fort Meade Legacy BRAC Environmental Management Office
2) Prohibit residential development of the Trap and Skeet Range 17 without further evaluation of residential exposure risks

7.2 DESCRIPTION OF THE REMEDIAL ALTERNATIVES

This section describes the five remedial alternatives for the Trap and Skeet Range 17. A table is provided for each alternative that presents the capital cost, operation and maintenance (O&M) cost, and present worth cost, as well as the timeframes needed to implement the alternative. The Army recommends Alternative 3, Excavation and Offsite Treatment and Disposal with LUCs, as the Preferred Alternative.

7.2.1 Alternative 1—No Action

Superfund regulations contained in the NCP at 40 CFR Section 300.430(e)(6) require that the "no action" alternative be evaluated to establish a baseline for comparison to the other alternatives and to establish the baseline risk. Under this alternative, no action would be

conducted at the Site to prevent exposure to soil contamination nor would LUCs be implemented to protect against MEC exposure. No soil samples would be collected and the length of time to achieve RAOs is unknown.

Alternative 1 – No Action			
Cost ($)		**Timeframe (Years)**	
Capital:	0	Design and Construction	0
O&M:	0	O&M	0
Present Worth:	**0**	Long-Term Monitoring	0
		Time Needed to Achieve RAOs:	**Unknown**

7.2.2 Alternative 2—In-Situ Stabilization and Cover with LUCs

This alternative would involve UXO removal, **in-situ** stabilization/solidification of soil exceeding PRGs, covering with a non-woven geo-synthetic liner, followed by covering with approximately 24 inches of clean fill to prevent direct contact exposure pathways to human and ecological receptors. The soil cover would be vegetated and would be maintained indefinitely (30 years assumed for costing purposes). In addition, LUCs that protect against potential MEC exposure and prohibit future residential development would be implemented (See Section 7.1).

This alternative would have the advantage of reduced up-front capital costs because contaminated soils are not removed or treated. However, long-term costs would be higher because of the prolonged operation and maintenance requirements, which include inspection and occasional removal of trees and shrubs that could disrupt the cover.

Alternative 2 – In-Situ Stabilization and Cover with LUCs			
Cost ($)		**Timeframe (Years)**	
Capital:	7.7 M	Design and Construction	2
O&M:	1.2 M	O&M [(a)]	30
Present Worth:	**8.9 M**	Long-Term Monitoring [(a)]	30
		Time Needed to Achieve RAOs:	**2**

(a) Timeframes occur simultaneously.
O&M = operation and maintenance; M = million

7.2.3 Alternative 3—Excavation and Offsite Treatment and Disposal with LUCs

This alternative would involve first removing UXO and then excavating and removing soil exceeding PRGs. The soil would be tested for hazardous characteristics using the **toxicity characteristic leaching procedure (TCLP)**. Soil identified as hazardous would be transported to a **Resource Conservation and Recovery Act (RCRA)** Subtitle C hazardous waste treatment facility where it would be treated to stabilize the lead and lead shot, followed by disposal in a landfill permitted to accept the treated waste. In addition, LUCs that protect against potential MEC exposure and prohibit future residential development would be implemented (See Section 7.1).

This alternative would have the advantage of removing contamination from the Site and eliminating long-term cover inspection and maintenance costs. However, the alternative would have the disadvantage of increased up-front capital costs associated with excavation, transportation, and offsite treatment and disposal fees.

Alternative 3 – Excavation and Offsite Treatment and Disposal with LUCs			
Cost ($)		**Timeframe (Years)**	
Capital:	6.1 M	Design and Construction	2
O&M:	0.07 M	O&M	NA
Present Worth:	**6.2 M**	Long-Term Monitoring	5
		Time Needed to Achieve RAOs:	**2**

O&M = operation and maintenance; M = million; NA = not applicable

7.2.4 Alternative 4—Excavation, Ex-situ Stabilization, and Offsite Disposal with LUCs

This alternative is the same as Alternative 3 except the excavated soil would be excavated and treated at the Site to render the soil non-hazardous prior to soil transport to a non-hazardous waste disposal facility permitted to accept treated waste. The onsite treatment would include delivery of stabilizing agents to the Site, onsite soil processing, testing, partial reprocessing, and then loading for offsite transport. In addition, LUCs that protect against potential MEC exposure and prohibit future residential development would be implemented (See Section 7.1).

The landfill disposal costs would be reduced compared to Alternative 3 because the landfill would not have to stabilize the soil; however, such savings would be offset by increased soil treatment and transportation costs. Increased soil treatment costs derive from uncertainties concerning soil treatability to affect lead stabilization; increased transportation costs are due to an increase in the waste volume as a result of adding the soil stabilizing agents, potential complications related to the presence of heavy site vegetation and root masses that would impact soil treatment, and potential delays to secure treatment permits.

Alternative 4 – Excavation, Ex-situ Stabilization, and Offsite Disposal with LUCs			
Cost ($)		**Timeframe (Years)**	
Capital:	7.54 M	Design and Construction	2
O&M:	0.07 M	O&M	NA
Present Worth:	**7.6 M**	Long-Term Monitoring	5
		Time Needed to Achieve RAOs:	**2**

O&M = operation and maintenance; M = million; NA = not applicable

7.2.5 Alternative 5—Excavation, Soil Washing, and Onsite Reuse with LUCs

This alternative would involve UXO removal, excavation of soil exceeding the lead PRG of 260 mg/kg, and then use of **ex-situ** water-based processes for mechanically screening, scrubbing, and leaching waste constituents from the soil exceeding PRGs for recovery and treatment. The process would remove contaminants from soils by dissolving or suspending them in the wash

solution or by concentrating them into a smaller volume of soil through simple particle size separation techniques. During this mechanical fine-screening step, lead shot and other metal fragments would be removed and containerized for disposal. The majority of the washed soil would then be placed back at the Site, while the filter cake (with lead shot) would be sent offsite for disposal as RCRA hazardous waste. No backfill from an offsite source would be necessary under this alternative. There is some uncertainty about the effectiveness of soil washing to achieve the PRGs; therefore, a pilot study would be necessary. In addition, LUCs that protect against potential MEC exposure and prohibit future residential development would be implemented (See Section 7.1).

Alternative 5 – Excavation, Soil Washing, and Onsite Reuse with LUCs			
Cost ($)		**Timeframe (Years)**	
Capital:	7.8 M	Design and Construction	2
O&M:	0.07 M	O&M	NA
Present Worth:	**7.9 M**	Long-Term Monitoring	5
		Time Needed to Achieve RAOs:	**2**

O&M = operation and maintenance; M = million; NA = not applicable

SECTION EIGHT EVALUATION OF ALTERNATIVES

The five remedial alternatives were evaluated against seven of the nine evaluation criteria required by the NCP to be considered in the selection of a remedial action at a Superfund site (40 CFR Section 300.430(e)(9)(iii)). The alternatives were evaluated on the basis of the following two threshold criteria and five balancing criteria:

Threshold Criteria:

- Overall protection of human health and the environment
- Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)**

Balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

The "threshold criteria" are the requirements that each alternative must meet to be eligible for selection. The "primary balancing criteria" are those used to weigh the major trade-offs among the alternatives.

Table 6 (see Table Section) compares the alternatives using a point scoring system. Alternative 3 received the highest score and was selected as the Preferred Alternative. The order of preference for each alternative is provided at the end of each subsection; the following symbols are used to describe their ranking relative to each other: equals (=) and better than (>).

Two "modifying criteria"—State and community acceptance of the Preferred Alternative—are mentioned here, but will be fully evaluated after the public comment period for this Proposed Plan and addressed in the subsequent ROD.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Contaminants present at the Site currently pose unacceptable risks to ecological receptors and would also pose unacceptable risks to potential future human receptors (including construction workers, industrial workers, and adult and child residents). Alternative 1 (no action) includes no means to reduce these risks, and would not meet the threshold criterion of protection of human health and the environment; therefore, Alternative 1 is removed from further consideration. Alternatives 2 through 5 are judged to be equivalent with regard to meeting this criterion by controlling or eliminating ecological or human exposure to Site chemicals of concern through containment of contaminated soil under a cover, or excavation and treatment, either onsite or offsite, and disposal offsite, or reuse onsite following soil washing. The LUCs protect against potential MEC exposure at the Site. In other words, Alternatives 2 through 5 are ranked as follows: Alt. 2 = Alt. 3 = Alt. 4 = Alt. 5. In Table 6, each alternative received an "Excellent" rating.

8.2 COMPLIANCE WITH ARARS

Table 7 (see Table Section) presents the potential federal and state ARARs for the Site. Alternatives 2 through 5 would need to address ARARs that pertain to the handling of any hazardous waste that is treated and/or removed from the Site. Also, the alternatives would need to address construction-related ARARs concerning soil erosion, stormwater management, and fugitive dust control while the alternative is being implemented. Alternatives 2 through 5 would comply with all potential action-specific ARARs. They are ranked as follows with regard to this criterion: Alt. 2 = Alt. 3 = Alt. 4 = Alt. 5. In Table 6, each alternative received an "Excellent" rating.

8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives 2 through 5 would provide long-term effectiveness by covering, removing, or treating the soil contaminants in areas exceeding the soil PRGs. The long-term effectiveness of Alternative 2 would be evaluated by 5-year reviews throughout the 30 year operation and maintenance (O&M) period. There is some uncertainty concerning the effectiveness of soil washing to achieve the PRGs; therefore, a pilot study would be necessary. The relative long-term effectiveness of Alternatives 2 through 5 is judged to be: Alt. 3 = Alt. 4 > Alt. 5 > Alt. 2.

In Table 6, Alternatives 3 and 4 received an "Excellent" rating. Alternative 5 received a "Good" rating due to the uncertainty associated with the effectiveness of the soil washing, and Alternative 2 received an "Adequate" rating due to the long O&M period and multiple review cycles.

8.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 2 would achieve reduction of contaminant mobility through treatment by in-situ stabilization and covering the treated soil. However, compared to Alternatives 3 and 4, which both involve treatment onsite or offsite and placement of the stabilized soil in an offsite permitted landfill, the degree of mobility reduction may be less for Alternative 2. Alternative 5 would reduce mobility by removing contamination from the soil prior to placement of the soil back at the Site. Under Alternative 5, the removed lead shot would be available for recycling, resulting in no treated lead contamination remaining onsite or offsite. Contaminant toxicity would not be significantly changed by any alternative, other than indirectly by reducing the potential for exposure. Some volume reduction is achieved by Alternative 5 because bulk lead would be removed from the soil and recycled. Overall, the relative reduction of toxicity, mobility, and volume for Alternatives 2 through 5 is judged to be Alt. 5 > Alt. 3 = Alt. 4 > Alt. 2.

In Table 6, Alternative 5 received an "Excellent" rating because no treated lead contamination would remain onsite or offsite, Alternatives 3 and 4 received a "Good" rating, and Alternative 2 received an "Adequate" rating because the reduction of mobility may be less.

8.5 SHORT-TERM EFFECTIVENESS

Alternatives 2 through 5 would all be effective in the short term within a very similar timeframe (i.e., 2 years to achieve RAOs), with each employing similar measures to ensure the safety of remedial workers, to achieve protection of human health and the environment. Overall, the

relative short-term effectiveness for Alternatives 2 through 5 is judged to be Alt. 2 = Alt. 3 = Alt. 4 = Alt. 5. In Table 6, all alternatives received an "Excellent" rating.

8.6 IMPLEMENTABILITY

Alternative 3 would be the easiest alternative to implement because its individual elements are rather simple and do not involve special soil treatment at the Site. Implementability decreases for Alternatives 2 and 4 because they both involve onsite stabilization. Alternative 5 would be the most difficult to implement because it involves extensive soil handling (washing) and a pilot study to assess soil washing effectiveness. Overall, the relative implementability of Alternatives 2 through 5 is judged to be Alt. 3 > Alt. 2 = Alt. 4 > Alt. 5.

In Table 6, Alternative 3 received an "Excellent" rating (i.e., easiest to implement), Alternatives 2 and 4 received a "Good" rating, and Alternative 5 received an "Adequate" rating due to the difficulty of implementing the soil washing and the need for a pilot study.

8.7 COST

The table below presents the capital, long-term O&M, and total present worth costs for Alternatives 2 through 5. Alternative 3 is the least expensive of the alternatives. Accordingly, the relative preference of Alternatives 2 through 5 is ranked as follows from the cost perspective: Alt. 3 > Alt. 4 = Alt. 5 > Alt. 2.

In Table 6, Alternative 3 received an "Excellent" rating (i.e., the least expensive), Alternatives 4 and 5 received a "Good" rating (i.e., similar costs), and Alternative 2 received an "Adequate" rating (i.e., most expensive).

Cost Category	Alternatives Costs ($)			
	Alt. 2 In-Situ Stabilization and Cover	**Alt. 3 Excavation and Offsite Treatment and Disposal**	**Alt. 4 Excavation, Ex-Situ Stabilization, and Offsite Disposal**	**Alt. 5 Excavation, Soil Washing, and Onsite Reuse**
Capital:	$7.7 M	$6.1 M	$7.5 M	$7.8 M
O&M:	$1.2 M	$0.1 M	$0.1 M	$0.1 M
Present Worth:	**$8.9 M**	**$6.2 M**	**$7.6 M**	**$7.9 M**

Notes:

M = million

8.8 STATE ACCEPTANCE

The State of Maryland through the MDE has reviewed the remedial alternatives presented in this Proposed Plan and supports the Army's Preferred Alternative for remedial action. However, State acceptance will not be final until after MDE has had the opportunity to review any comments received during the public comment period on the Proposed Plan. Regulatory approval will be further evaluated in the ROD following the public comment period.

8.9 COMMUNITY ACCEPTANCE

Community acceptance of the Preferred Alternative presented in this Proposed Plan will be determined following the close of the public comment period.

SECTION NINE PREFERRED ALTERNATIVE

The Army's Preferred Alternative is Alternative 3 - Excavation and Offsite Treatment and Disposal with LUCs. This Preferred Alternative is proposed for implementation pending receipt of public comments on the proposed remedy. This remedy would be protective of human health and the environment and would comply with ARARs. The Preferred Alternative is expected to achieve cleanup goals in an estimated 2 years, is easily implemented, utilizes permanent solutions (e.g., soil removal), and is relatively cost-effective. Therefore, it is judged to offer the best performance relative to the seven evaluation criteria.

9.1 SUMMARY OF THE PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 3 - Excavation and Offsite Treatment and Disposal with LUCs, involving these primary actions:

- Remove UXO from the planned lead and PAH excavation areas
- Excavate all soil with lead concentrations exceeding the lead PRG of 260 mg/kg and conduct confirmation sampling to confirm attainment of the PRG
- Test the soil for hazardous characteristics using TCLP procedure
- Excavate PAH impacted soil at DU1 and DU4 to a depth of 12-inches bgs (confirmation sampling not necessary)
- Offsite soil transport, treatment, and disposal at a permitted facility(ies)
- Place clean fill in excavated areas and seed with vegetation
- Implement the following LUCs: 1) prohibit any excavation or other disturbance of surface or subsurface soils without appropriate UXO support and written approval of the Fort Meade Legacy BRAC Environmental Management Office and 2) prohibit residential development of the Trap and Skeet Range 17 without further evaluation of residential exposure risks.

The soil LUCs are part of a PRR-NT-wide initiative; the Army is preparing a separate Proposed Plan, ROD, and LUCRD to address potential MEC exposure (e.g., restrict digging into subsurface) for the 7,600-acre PRR-NT (which includes the Site).

Total, capital, and O&M costs (present value) are estimated to be:

- Total: $6.2 Million
- Capital: $6.1 Million
- O&M: $0.1 Million

Based on the information currently available, the Army believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Army expects the Preferred Alternative to satisfy the following CERCLA §121(b) requirements: 1) to be protective of human health and the environment; 2) to comply with ARARs (or justify a waiver); 3) to be cost-effective; 4) to utilize permanent solutions and alternative treatment technologies or resource recovery

technologies to the maximum extent practicable; and 5) to satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met. However, the Preferred Alternative can change in response to public comment or new information.

SECTION TEN COMMUNITY PARTICIPATION

The Army solicits input from the community on the action proposed in this Proposed Plan. A 30-day comment period from August 8, 2014 to September 8, 2014 is established for public involvement in the decision-making process for the proposed action. During the comment period, the public is invited to review this Proposed Plan and the environmental investigation reports available in the Administrative Record.

The Administrative Record is the body of documents that forms the basis for the selection of a particular response at a site. The Administrative Record includes other documents that support the response decision, relevant documents that were relied on in selecting the preferred response action, and documents that were considered in the decision-making process. The Administrative Record is available to the public at the locations listed below.

Administrative Record Locations	
Anne Arundel County Library 2624 Annapolis Road Severn, MD 21144 Phone: (410) 222-6280 Mon through Thu: 9 am to 9 pm Fri and Sat: 9 am to 5 pm http://www.aacpl.net/	Fort Meade Legacy BRAC Environmental Management Office Attn: IMND-MEA-PWE 4215 Roberts Ave; Room 320 Fort George G. Meade, MD 20755-7068 Phone: (301) 677-9178 Mon through Fri: 7:30 am to 4 pm http://www.ftmeade.army.mil/environment/bracLegacy/index.html

The Army will hold a public meeting on this Proposed Plan on TBD from 7 to 9 pm at the Holiday Inn Express, Baltimore BWI Airport West hotel located at 7481 Ridge Road in Hanover, MD. 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 added to the Fort Meade Administrative Record.

Oral, written, or email comments regarding the Army's Proposed Plan or other relevant issues, may be given to the Army at the public meeting and/or sent via mail or email (postmarked no later than September 8, 2014) to the Army contact person (see Point of Contacts Table below).

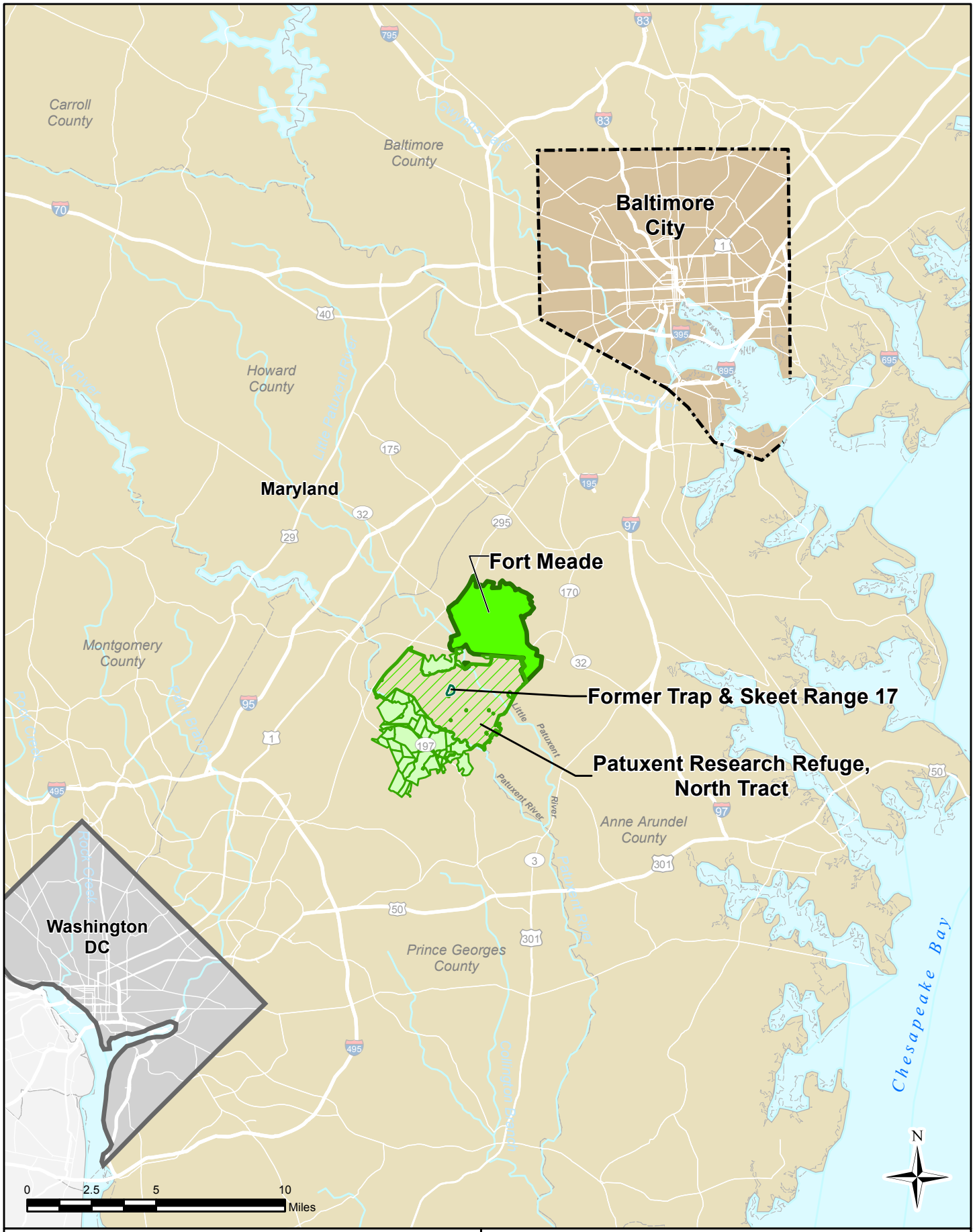
If any significant new information or public comments are received during the public comment period, the Army may modify the Preferred Alternative outlined in this Proposed Plan or select another response action.

The Army's final choice of action will be issued in a ROD. A Responsiveness Summary that documents the Army's responses to comments received during the public comment period will be issued with the ROD. Once community response and input are received and the ROD is signed by the Fort Meade Installation Commander, it will become part of the Administrative Record.

Any questions or requests for more information can be addressed to:

Point of Contacts	
Army, Lead Agency	
Andrea Graham Attn: CENAB-EN-HM, 10th Floor Department of the Army Corps of Engineers, Baltimore District 10 South Howard Street Baltimore, MD 21201 Phone: (443) 986-3444 Email: Andrea.A.Graham@usace.army.mil	
Regulatory Agencies	
John Burchette NPL/BRAC/Federal Facilities Branch USEPA Region III 1650 Arch Street Philadelphia, PA 19103-2029 Phone: (215) 814-3378 Email: Burchette.John@epa.gov	Dr. Elisabeth Green Project Manager, Federal Facilities Division Maryland Department of the Environment 1800 Washington Boulevard, Suite 625 Baltimore, MD 21230-1719 Phone: (410) 537-3346 Email: elisabeth.green@maryland.gov

FIGURES



CLIENT	USACE, Baltimore District			TITLE: Location Map
PROJ	Trap and Skeet Range 17, PP/ROD			
REVISION NO 1	GIS BY	JMW / AER	3/20/2014	URS 12420 Milestone Center Drive Germantown, MD 20876 — Figure 1
SCALE 1" = 5 miles	CHK BY	GW	3/20/2014	
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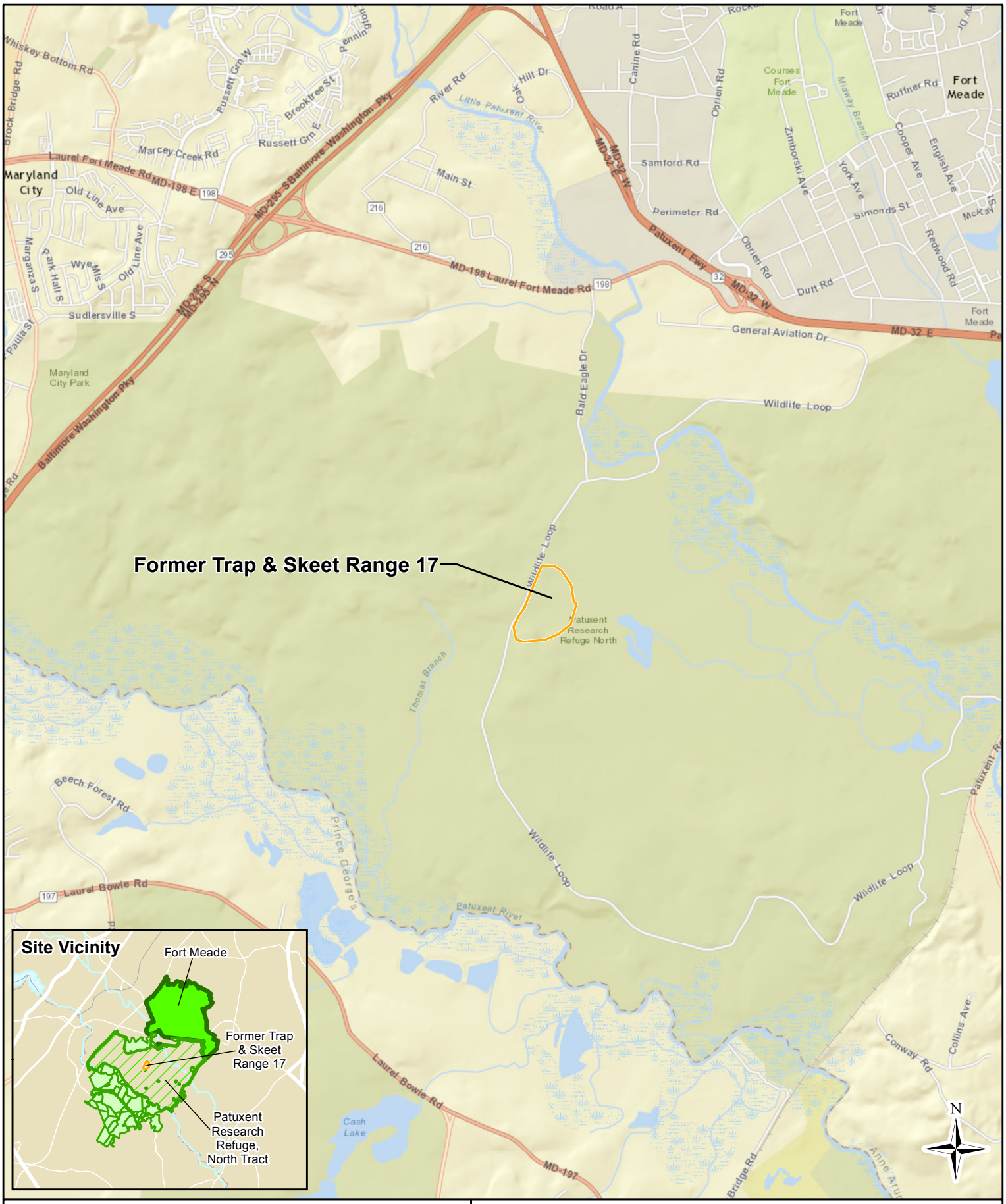

CLIENT	USACE, Baltimore District			TITLE: Site Location Map
PROJ	Trap and Skeet Range 17, PP/ROD			
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SCALE	1:40,000	CHK BY	GW	7/14/2014
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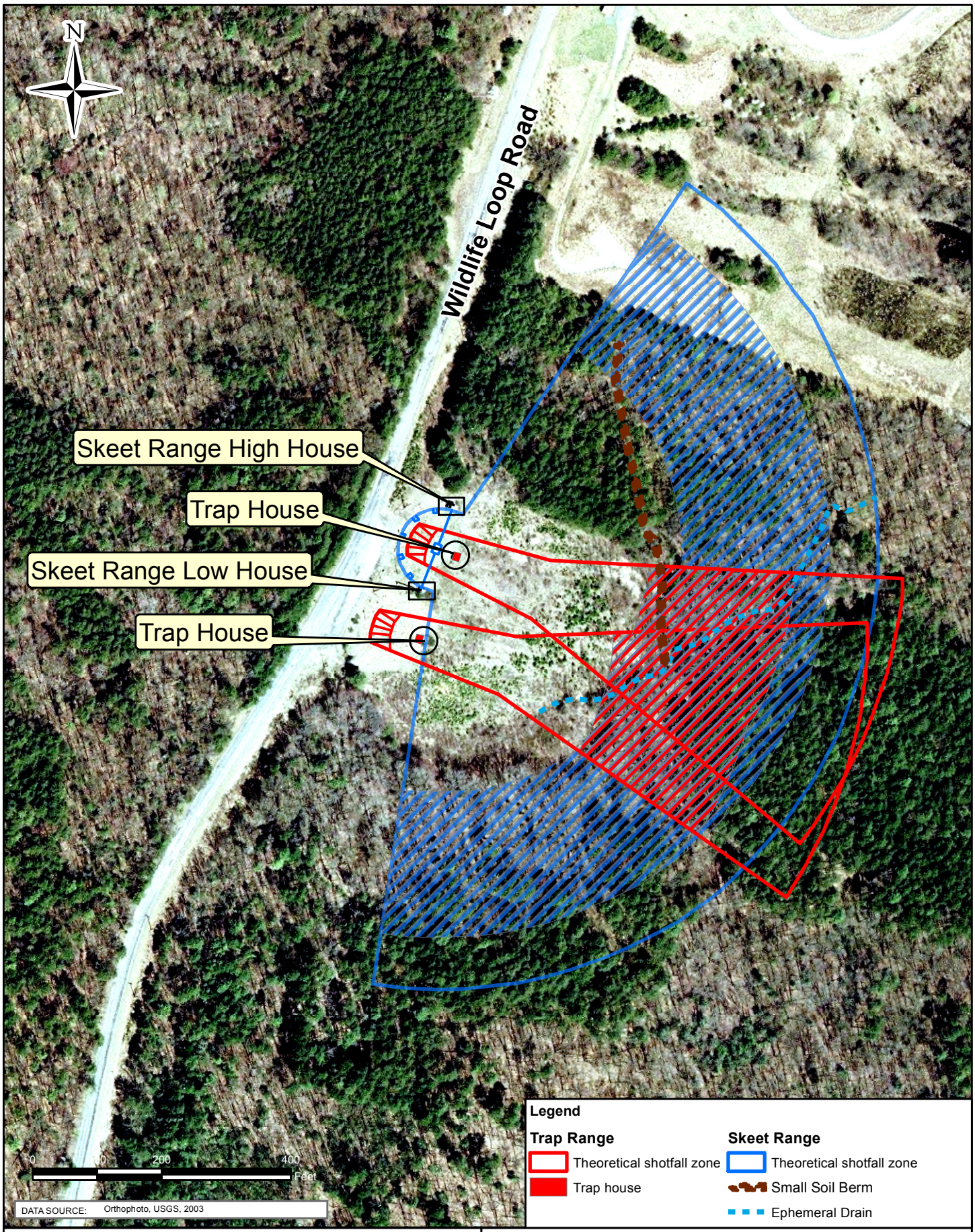
URS
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2



CLIENT	USACE, Baltimore District			TITLE	Trap and Skeet Range 17 Site Features
PROJ	Trap and Skeet Range 17, PP/ROD				
REVISION NO	0	GIS BY	AER	01/14/2014	URS 12420 Milestone Center Drive Germantown, MD 20876
SCALE	1:2,400	CHK BY	BE	01/14/2014	PROJ NO 15301086
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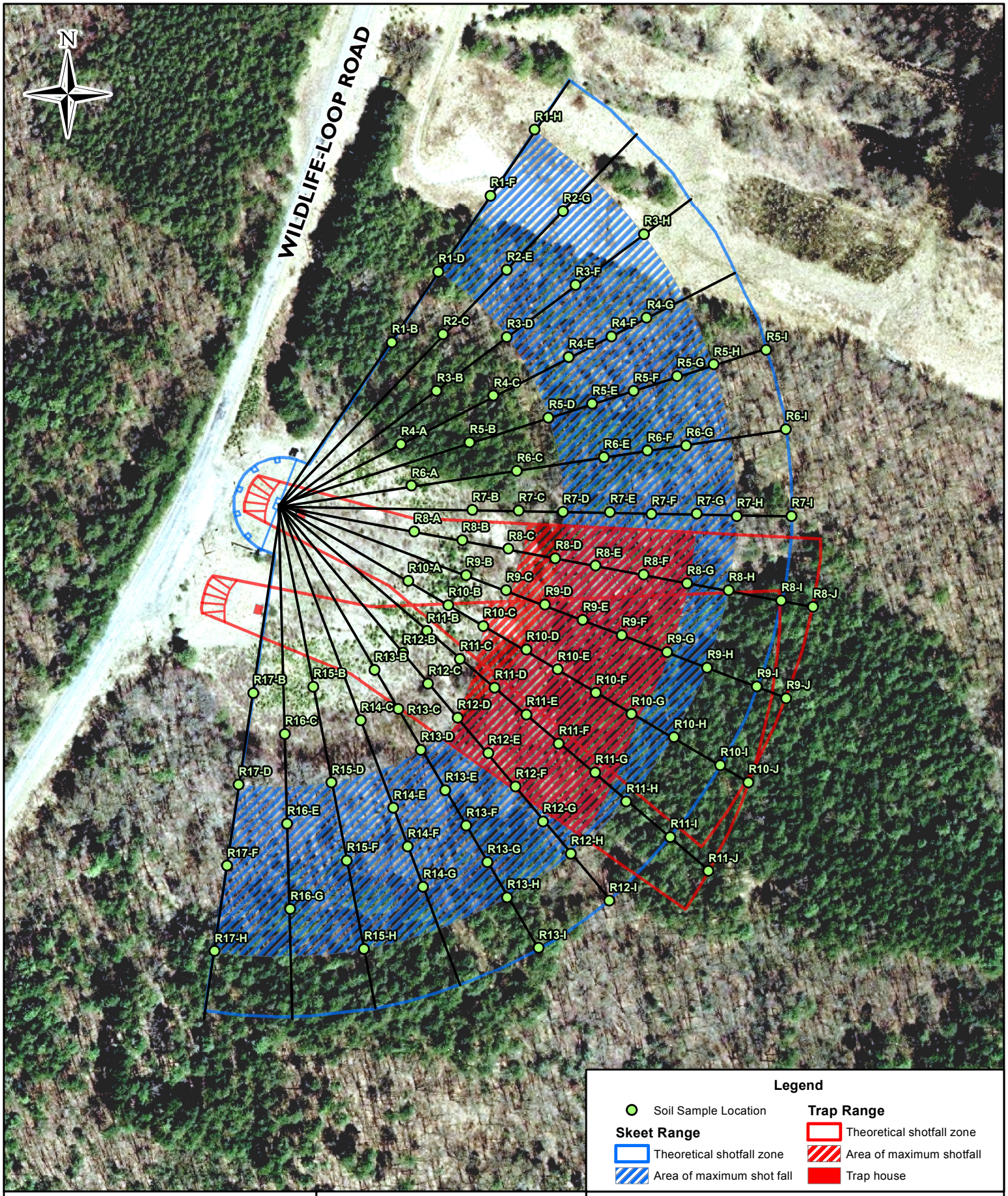


CLIENT	USACE, Baltimore District			
PROJ	Trap and Skeet Range 17, PP/ROD			
REVISION NO	1	GIS BY	AW	07/18/2014
ORIGINAL SCALE	1:2,000	CHK BY	GW	07/18/2014
Q:\Projects\TechSol\GIS\Projects\Fort_Meade\trap_and_skeet\R1_2008\Projects\Figure4_Soil_Interval_8.5x11.mxd		PROJ MGR	BE	07/18/2014

0 75 150 300 Feet

DATA SOURCE: Orthophoto, USGS, 2003

TITLE

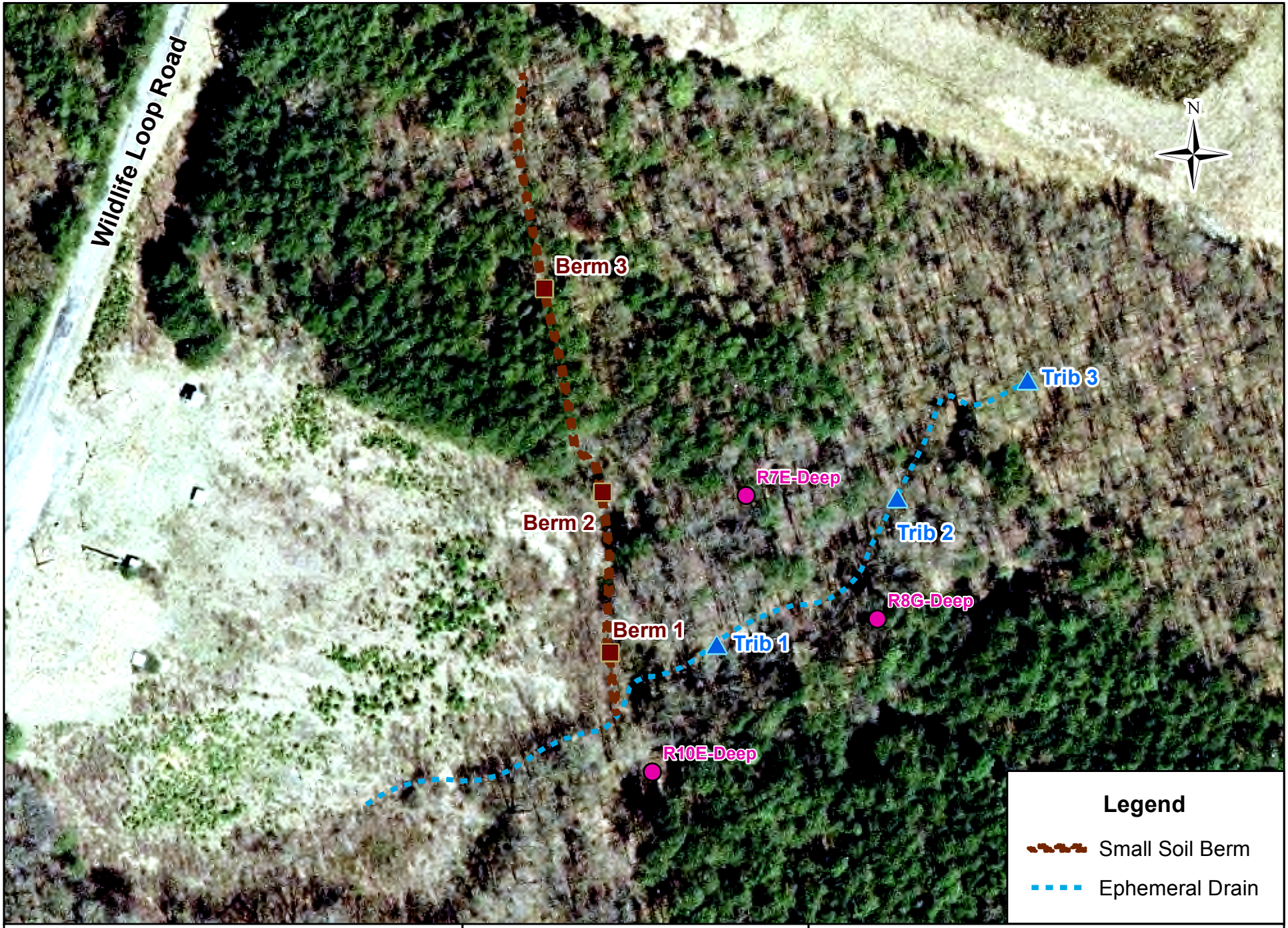
Discrete Soil Sampling Locations for Metals

URS

12420 Milestone Center Drive
Germantown, MD 20876

PROJ NO 15301086

Figure 4



CLIENT	USACE, Baltimore District			
PROJ	Trap and Skeet Range 17, PP/ROD			
REVISION NO	1	GIS BY	JK	01/14/2014
ORIGINAL SCALE	1:1,200	CHK BY	BE	01/14/2014
G:\Projects\Fort_Meade\trap_and_skeet\RI_2008\Projects\Figure5_Berm_Drain		PROJ MGR	BE	01/14/2014

0 37.5 75 150 Feet

DATA SOURCE: Orthophoto, USGS, 2003

TITLE

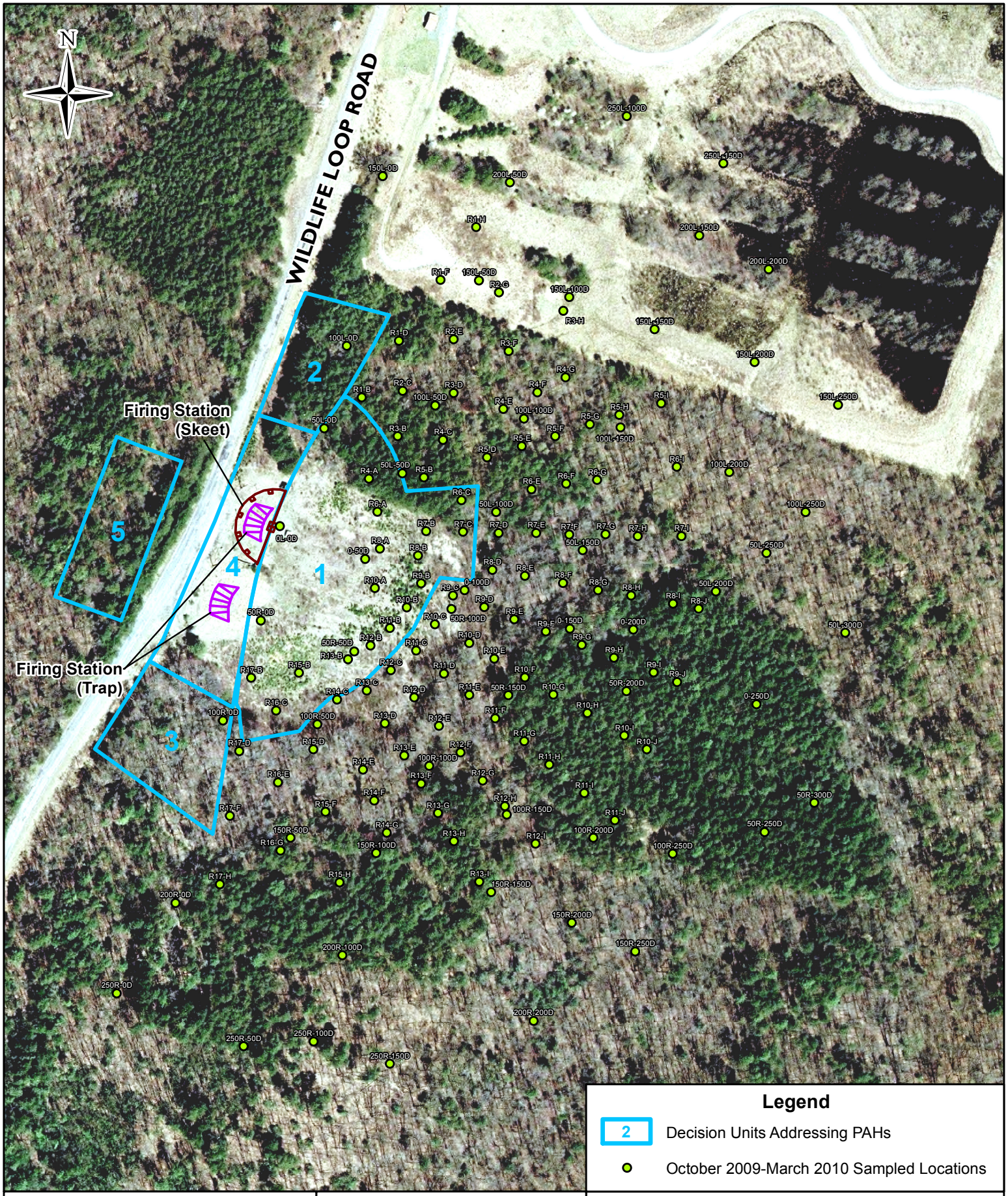
Berm, Deep and Ephemeral Drain Soil Sample Locations for As, Sb, Pb and Pb Shot Analyses

URS

12420 Milestone Center Drive
Germantown, MD 20876

PROJ NO 15301086

Figure 5



Legend

2 Decision Units Addressing PAHs

October 2009-March 2010 Sampled Locations

CLIENT	USACE, Baltimore District		
PROJ	Trap and Skeet Range 17, PP/ROD		
REVISION NO 1	GIS BY	AW	07/18/2014
ORIGINAL SCALE 1:2,500	CHK BY	GW	07/18/2014
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0 75 150 300 Feet

DATA SOURCE: Orthophoto, USGS, 2003

TITLE

Decision Units for PAH in Increment Soil Sample Investigation

URS

12420 Milestone Center Drive
Germantown, MD 20876

PROJ NO 15303180

Figure 6

Legend

6 Decision Units Addressing NG

October 2009-March 2010 Sampled Locations

CLIENT	USACE, Baltimore District		
PROJ	Trap and Skeet Range 17, PP/ROD		
REVISION NO	1	GIS BY	AW	07/18/2014
ORIGINAL SCALE	1:2,500	CHK BY	GW	07/18/2014
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0 75 150 300 Feet

DATA SOURCE: Orthophoto, USGS, 2003

TITLE

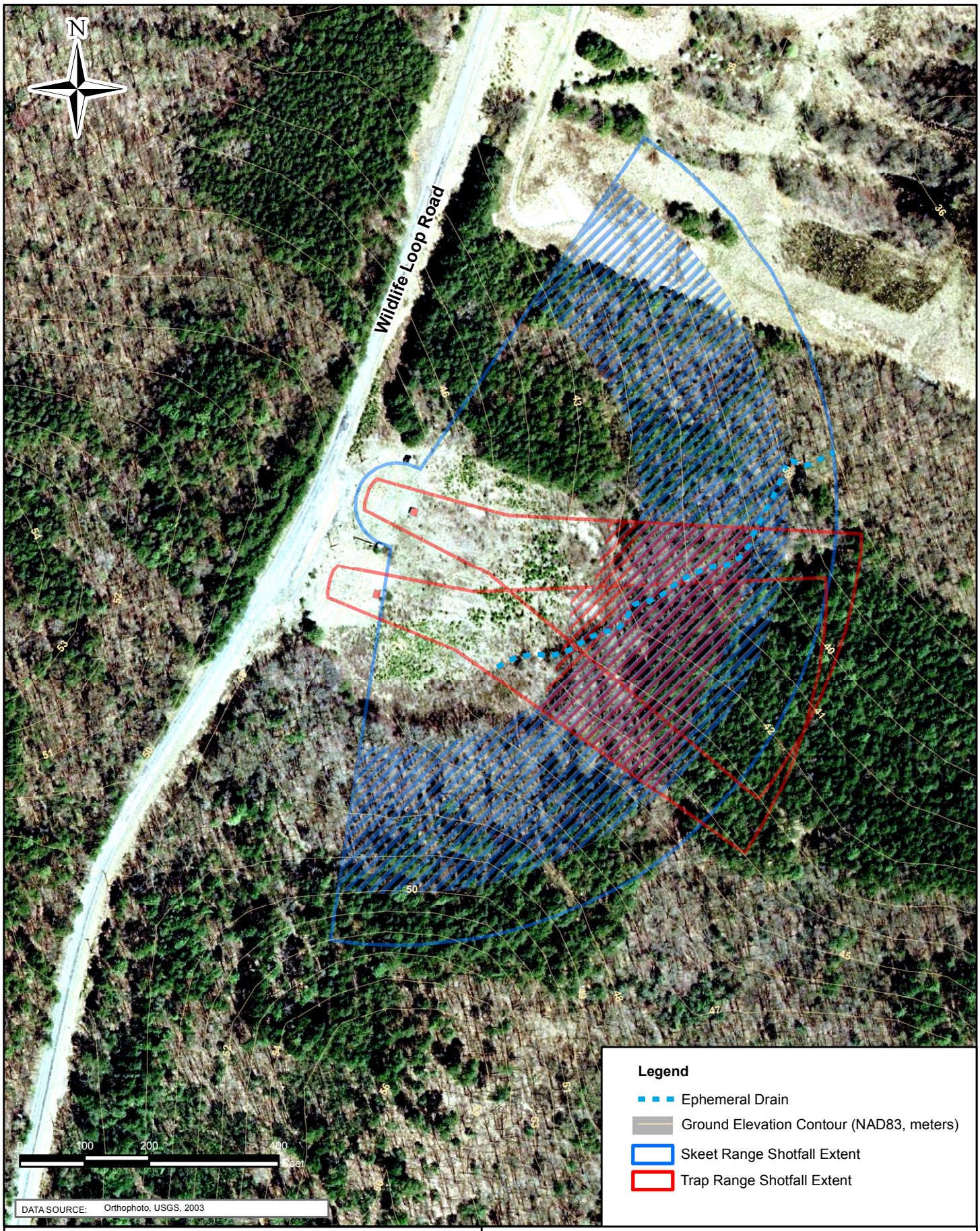
Decision Units for NG in Increment Soil Sample Investigation

URS

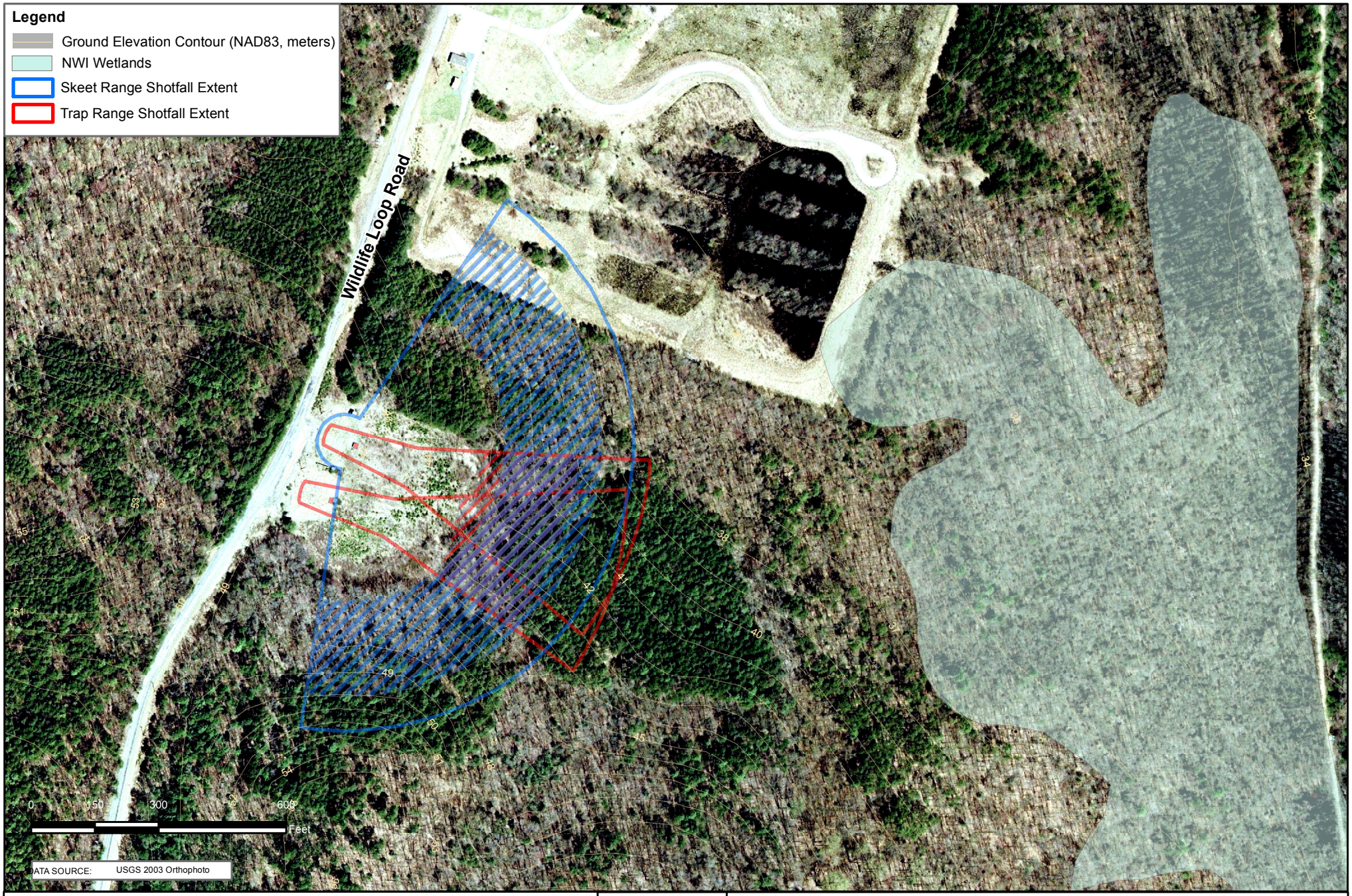
12420 Milestone Center Drive
Germantown, MD 20876

PROJ NO 15303180

Figure 7



CLIENT	USACE, Baltimore District			TITLE	Trap and Skeet Range 17 Topography and Ephemeral Drain
PROJ	Trap and Skeet Range 17, PP/ROD				
REVISION NO	0	GIS BY	AER/HAB	03/25/2014	URS 12420 Milestone Center Drive Germantown, MD 20876
SCALE		CHK BY	GW	03/25/2014	PROJ NO 15301080
G:\Projects\Fort_Meade\Trap_and_Skeet\RI_2008\Projects\Figure9_RangeTopoandStream.mxd		PROJ MGR	BE	03/25/2014	Figure 8



CLIENT	USACE, Baltimore District			
PROJ	Trap and Skeet Range 17, PP/ROD			
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G:\Projects\Fort_Meade\trap_and_skeet\R1_2008\Projects\Figure10_WetlandAreaEastofRange.mxd		PROJ MGR	BE	01/14/2014

N

TITLE

Wetland Area East of Range

URS

12420 Milestone Center Drive
Germantown, MD 20876

PROJ NO 15301086

Figure 9

TABLES

Table 1. Summary of Cancer Risk Results for the Metals Evaluation Human Health Discrete Sample Data Groups

Receptors	Exposure Media	Cancer Risk Soils [a]
Current/Future Scenarios		
PRR Worker/ Intern	Surface Soil	3×10^{-6}
	Mixed Soil	1×10^{-6}
Adult Visitor/Hunter	Surface Soil	2×10^{-6}
	Mixed Soil	7×10^{-7}
Child Visitor/Hunter	Surface Soil	1×10^{-6}
	Mixed Soil	6×10^{-7}
Future Scenarios with Groundwater (Total)		
Construction Worker	Surface Soil	4×10^{-6}
	Mixed Soil	2×10^{-6}
Industrial Worker	Surface Soil	7×10^{-5}
	Mixed Soil	3×10^{-5}
Resident (Lifetime)	Surface Soil	**3×10^{-4}**
	Mixed Soil	**1×10^{-4}**
Future Scenarios with Groundwater (Dissolved)		
Industrial Worker	Surface Soil	7×10^{-5}
	Mixed Soil	3×10^{-5}
Resident (Lifetime)	Surface Soil	**3×10^{-4}**
	Mixed Soil	**1×10^{-4}**

NA = Not applicable; Surface Soil = 0-3 inches; Mixed Soil = 0-48 inches

Shading indicates cumulative results greater than/equal to the cancer risk threshold of 1×10^{-4} for the discrete sample data group investigation

a) Groundwater at the Site will be further investigated and the risks will be analyzed and addressed in a separate action at a future date.

Table 2. Summary of Non-Cancer Hazard Results for the Metals Evaluation Human Health Discrete Sample Data Groups

Receptors	Exposure Media	Non-Cancer Hazard Soil [a]	Target Organ-Specific HI Analysis (HI is greater than or equal to1)
Current/Future Scenarios			
PRR Worker/ Intern	Surface Soil	0.06	NA
	Mixed Soil	0.03	NA
Adult Visitor/Hunter	Surface Soil	0.03	NA
	Mixed Soil	0.01	NA
Child Visitor/Hunter	Surface Soil	0.06	NA
	Mixed Soil	0.03	NA
Future Scenarios with Groundwater (Total)			
Construction Worker	Surface Soil	**2**	Antimony - blood (1)
	Mixed Soil	0.8	NA
Industrial Worker	Surface Soil	**1**	Chemical-specific HIs are below 1.
	Mixed Soil	0.5	NA
Adult Resident	Surface Soil	**2**	Antimony - blood (1); Arsenic - skin (1) and vascular system (1)
	Mixed Soil	0.7	NA
Child Resident	Surface Soil	**13**	Antimony - blood (9); Arsenic:- skin (6) and vascular system (6)
	Mixed Soil	**6**	Antimony - blood (4); Arsenic - skin (3) and vascular system (3)
Future Scenarios with Groundwater (Dissolved)			
Industrial Worker	Surface Soil	**1**	Chemical-specific HIs are below 1.
	Mixed Soil	0.5	NA
Adult Resident	Surface Soil	**2**	Antimony - blood (1)
	Mixed Soil	0.7	NA
Child Resident	Surface Soil	**13**	Antimony - blood (9); Arsenic – skin (5) and vascular system (5)
	Mixed Soil	**6**	Antimony - blood (4); Arsenic - skin (2) and vascular system (2)

Notes:

HI = hazard index; NA = Not applicable; Surface Soil = 0-3 inches; Mixed Soil = 0-48 inches

Shading indicates cumulative results greater than/equal to the hazard index (HI) threshold of 1 (discrete sample group).

a) Groundwater at the Site will be further investigated and the risks will be analyzed and addressed in a separate action at a future date.

Table 3. Summary of Cancer Risk Results for PAHs Evaluation Incremental Sample Data Groups, Human Health Decision Units 1 through 5

Receptors	Fall Out Area		Bounding Units		Firing Area	Background
	DU1 Surface Soil	DU1 Subsurface Soil	DU2 Surface Soil	DU3 Surface Soil	DU4 Surface Soil	DU5 Surface Soil
Current/Future Scenarios						
PRR Worker/Intern	2×10^{-5}	2×10^{-6}	4×10^{-9}	1×10^{-8}	3×10^{-5}	5×10^{-9}
Adult Visitor/Hunter	8×10^{-6}	1×10^{-6}	2×10^{-9}	6×10^{-9}	1×10^{-5}	2×10^{-9}
Child Visitor/Hunter	3×10^{-5}	3×10^{-6}	6×10^{-9}	2×10^{-8}	4×10^{-5}	8×10^{-9}
Future Scenarios						
Industrial Worker	**3×10^{-4}**	4×10^{-5}	7×10^{-8}	3×10^{-7}	**5×10^{-4}**	1×10^{-7}
Construction Worker	2×10^{-5}	2×10^{-6}	4×10^{-9}	1×10^{-8}	3×10^{-5}	5×10^{-9}
Resident (Lifetime)	**5×10^{-3}**	**6×10^{-4}**	1×10^{-6}	4×10^{-6}	**8×10^{-3}**	1×10^{-6}

Notes:

DU = Decision Unit; PAHs = polycyclic aromatic hydrocarbons; Surface Soil = 0-6 inches; Subsurface Soil = 6-12 inches
Shading indicates cumulative results greater than/equal to the cancer risk threshold of 5×10^{-5} for the incremental sample investigation.

Table 4. Summary of Non-Cancer Hazard Results for PAHs Evaluation Incremental Sample Data Groups, Human Health Decision Units 1 through 5

Receptors	Fall Out Area		Bounding Units		Firing Area	Background
	DU1 Surface Soil	DU1 Subsurface Soil	DU2 Surface Soil	DU3 Surface Soil	DU4 Surface Soil	DU1 Surface Soil
Current/Future Scenarios						
PRR Worker/Intern	0.0005	0.00007	0.000001	0.000002	0.0008	0.000002
Adult Visitor/Hunter	0.0002	0.00004	0.0000006	0.0000009	0.0004	0.000001
Child Visitor/Hunter	0.0005	0.00008	0.000001	0.000002	0.0009	0.000002
Future Scenarios						
Industrial Worker	0.01	0.001	0.00003	0.00004	0.02	0.00005
Construction Worker	0.02	0.003	0.0001	0.0002	0.03	0.0002
Adult Resident	0.02	0.003	0.00007	0.0001	0.03	0.0001
Child Resident	0.08	0.01	0.0002	0.0002	0.1	0.0003

Notes:

DU = Decision Unit; PAHs = polycyclic aromatic hydrocarbons; Surface Soil = 0-6 inches; Subsurface Soil = 6-12 inches

The cumulative results are lower than the hazard index threshold of 0.5 for the incremental sample investigation.

Table 5. Summary of Cancer Risk and Non-Cancer Hazard Results for NG Evaluation, Incremental Sample Data Groups, Human Health Decision Units 6 and 7

Receptors	DU6 and DU7, Firing Area		Target Organ-Specific HI Analysis
	Cancer Risk Surface Soil	Non-Cancer Hazard Surface Soil	
Current/Future Scenarios			
PRR Worker/ Intern	2×10^{-9}	0.004	NA
Adult Visitor/Hunter	1×10^{-9}	0.002	NA
Child Visitor/Hunter	1×10^{-9}	0.005	NA
Future Scenarios			
Industrial Worker	5×10^{-8}	0.08	NA
Construction Worker	2×10^{-9}	0.1	NA
Adult Resident	5×10^{-8}	0.09	NA
Child Resident	1×10^{-7}	0.8	NG - blood (0.8)
Resident (Lifetime)	2×10^{-7}	NA	NA

Notes:

DU = Decision Unit; HI = hazard index; NA = Not applicable; NG = nitroglycerin; Surface Soil = 0-6 inches

Shading indicates cumulative results greater than/equal to the cancer risk threshold of 5×10^{-5} and hazard index threshold of 0.5 for the incremental sample investigation.

Table 6. Summary of Comparative Analysis of Remedial Alternatives

Evaluation Criteria	Alternative 1 No Action	Alternative 2 In-Situ Stabilization and Cover with LUCs	Alternative 3 Excavation and Offsite Treatment and Disposal with LUCs	Alternative 4 Excavation, Ex-situ Stabilization, and Offsite Disposal with LUCs	Alternative 5 Excavation, Soil Washing, and Onsite Reuse with LUCs
THRESHOLD CRITERIA					
Overall Protection of Human Health and the Environment	FAIL	4	4	4	4
Compliance with ARARs	NA	4	4	4	4
PRIMARY BALANCING CRITERIA					
Long-Term Effectiveness and Permanence	NA	2	4	4	3
Reduction of Toxicity, Mobility, and Volume Through Treatment	NA	2	3	3	4
Short-Term Effectiveness	NA	4	4	4	4
Implementability	NA	3	4	3	2
Cost	NA	2	4	3	3
TOTAL SCORE:	**Not Evaluated**	**21**	**27**	**25**	**24**

Notes:
FAIL = Alternative 1 failed the threshold criterion and is therefore eliminated from further evaluation
NA = Not applicable

Relative Rating/Score:

Excellent =	4
Good =	3
Adequate =	2
Poor =	1

Table 7. Potential Federal and State ARARs
Note: these are the substantive requirements found in the following regulations:

Federal or State Statute, Regulation or Guidance	Summary of Requirement	Type of ARAR	ARAR Category
Hazardous Waste			
Hazardous Waste Land Disposal Restrictions, 40 CFR Section 268.1 through 268.3, 268.9, 268.40 through 268.46, 268.49, and 268.50.	Identifies hazardous wastes that are restricted from land disposal without prior treatment. Applies to excavated material which may qualify as hazardous waste.	Applicable	Action
Standards Applicable to Generators of Hazardous Waste, COMAR 26.13.03.02 thru .06	Standards applicable to generators of hazardous waste, including satellite accumulation procedures and storage time allowed before disposal off-site is required. Applies to hazardous waste stored on-site before shipment, including all excavated materials that are determined to be hazardous waste. Any waste media that are actively managed or shipped offsite must be tested to determine if they are RCRA characteristic wastes. Includes investigation-derived wastes.	Applicable	Action
Definition of and Criteria for Identifying Hazardous Wastes, COMAR 26.13.02.02 through .15, .18, and 22	Defines wastes that are subject to regulation as a RCRA hazardous waste. Applies to excavated material which may qualify as hazardous waste.	Applicable	Action
Water			
Maryland Erosion and Sediment Control, COMAR 26.17.01.01 (Definitions); 26.17.01.05; 26.17.01.07B (E&S Plans); 26.17.01.11 (Standards and Specifications)	Requires preparation of an erosion and sediment control plan for activities involving land clearing, grading, and other earth disturbances greater than 5,000 square feet. The remedial action will implement the erosion and sediment control criteria in relation to site activities. Applies to all remedy earth-moving components.	Applicable	Action
Maryland Stormwater Management, COMAR 26.17.02.02 (Definitions); 26.17.02.05; 26.17.02.06 (Min. Control Requirements); 26.17.02.08B, C, & E (Stormwater Management Measures); 26.17.02.09 (Stormwater Management Plans)	The primary goal of the state and local stormwater management programs is to maintain after development, as nearly as possible, the predevelopment runoff characteristics, and to reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding. The remedial action will implement stormwater management controls in relation to site activities.	Applicable	Action
Miscellaneous			
Executive Order (EO) 13514	Encourage the preferred remedial alternative to support sustainability.	Relevant and Appropriate	To Be Considered
COMAR 26.11.06.03 Control of Fugitive Particulate Matter	Applies to emission of particulates (dust) generated during excavation or other remedial construction activities.	Applicable	Action

Notes:
Action = Action-specific ARAR
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
COMAR = Code of Maryland Regulations
RCRA = Resource Conservation and Recovery Act

Appendix A

Glossary of Terms

Administrative Record: A collection of documents containing all the information and reports generated during the entire phase of investigation and cleanup at the Site and used to make a decision on the selection of a response action under CERCLA.

Applicable or Relevant and Appropriate Requirements (ARARs): Requirements set forth in federal and state environmental statutes and regulations that must be met in the implementation of remedial alternatives.

Carcinogenic Risk: A numerical estimation of the likelihood that an individual will contract cancer during his/her lifetime.

Chemicals of Potential Concern (COPCs): Chemicals, either present at the Site as a result of historical activities or of likely concern to human health and the environment, which are evaluated in the risk assessment.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A federal law, commonly referred to as the Superfund program, passed in 1980 that provides for cleanup and emergency response in connection with numerous existing inactive hazardous waste disposal sites that endanger public health and the safety of the environment.

Decision Unit (DU): The smallest volume of soil for which a decision will be made based on incremental sampling methodology.

Discrete Sampling: Soil samples collected along a grid pattern at a site.

Ecological Risk Assessment (ERA): An evaluation of the risk posed to the environment if response actions are not conducted.

EPA's Acceptable Cancer Risk Range: Cancer risks are expressed as numbers reflecting the increased chance that a person will develop cancer over a lifetime as a result of exposure to contaminants in site media. The acceptable cancer risk range is 10^{-4} to 10^{-6}, meaning there is one additional chance in 10 thousand (1×10^{-4}) to one additional chance in one million (1×10^{-6}) that a person will develop cancer.

Ex-Situ: Moved from its original place; excavated; removed or recovered from the subsurface.

Federal Facility Agreement (FFA): CERCLA requires federal agencies to investigate and clean up contamination at their facilities. Federal facilities that are significantly contaminated may be placed on the CERCLA NPL. For such facilities, CERCLA requires that EPA and the federal facility enter into an interagency agreement or FFA to govern the cleanup. For Fort Meade, these agencies include the Army, U.S. Environmental Protection Agency, Department of the Interior, and the Architect of the Capitol; these agencies signed an FFA in October 2009 to direct the comprehensive remediation of Fort Meade

Hazard Index (HI): A number indicative of non-carcinogenic health effects; it is the ratio of the existing level of exposure to an acceptable level of exposure. A value equal to or less than one indicates that the human population is not likely to experience adverse effects.

Hazard Quotient (HQ): The ratio of a contaminant exposure level (e.g., maximum concentration) to a screening value selected for the risk assessment for that substance and receptor (e.g. LOAEL or NOAEL). If the exposure level is higher than the toxicity value, then there is the potential for risk to the receptor**.**

Human Health Risk Assessment (HHRA): An evaluation of the risk posed to human health should remedial activities not be implemented.

Incremental Sampling (IS): A sampling method used to obtain a single sample for analysis that has a chemical concentration representative of a decision unit (DU). An incremental sample is obtained by collecting many (e.g., 50) increments in an unbiased manner from throughout the DU. Increments are combined into one sample (roughly 2 pounds or more) and sent to the laboratory for processing. This sampling method improves the reliability and defensibility of sampling data by reducing variability when compared to conventional discrete sampling strategies. A strong level of statistical confidence and the reduction of decision uncertainty that would require a large number of discrete analyses can often be obtained with a few incremental samples.

In-Situ Treatment: Treatment in its original place, unmoved; unexcavated; remaining in the subsurface.

Land Use Control Remedial Design (LUCRD): A design documents that outlines the roles and responsibilities of federal and state environmental regulators, local government officials, and private stakeholders in the long-term administration and management of LUCs at a site.

Land Use Controls (LUCs): Non-engineering measures intended to control human activities to prevent or reduce exposure to hazardous substances or conditions that pose a risk to human health or the environment. Controls, such as zoning and deed restrictions, are intended to restrict access and/or land use. LUCs also are used to protect the integrity of engineered elements of remediation measures (e.g., landfill caps and groundwater monitoring wells).

Lowest Observed Adverse Effect Level (LOAEL): The lowest level of a chemical stressor evaluated in a toxicity test that shows harmful effects on a plant or animal.

Magnetometer: sensitive equipment used to search for unexploded ordnance (UXO) which typically contains ferrous materials (i.e., containing magnetic metals such as iron and/or steel). Detections of ferrous materials ("contacts") are noted on a map and the results are studied to determine the UXO size, depth, and subsurface orientation.

Munitions and Explosives of Concern (MEC): Classification for military munitions that pose an explosive safety risk. This term, which distinguishes specific categories of military munitions that may pose unique explosive risks, means UXO, discarded military munitions (DMM), or munitions constituents (e.g., trinitrotoluene [TNT] or cyclotrimethylenetrinitramine [royal demolition explosive, or RDX]) present in high enough concentrations to pose an explosive hazard.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The federal regulation that implements the CERCLA response process. The NCP also provides information about the roles and responsibilities of EPA, other federal agencies, states, and private parties regarding releases of hazardous substances.

No Observable Adverse Effect Level (NOAEL): The highest level of a chemical stressor in a toxicity test that did not cause harmful effect in a plant or animal.

Operable Unit (OU): Term used to describe the site of a discrete cleanup action undertaken as part of a larger Superfund site cleanup. OUs may address different media within a single site (e.g., surface and subsurface soil, or groundwater), or separate geographic areas within a larger

site. In this instance, Fort Meade is the Superfund Site and the Trap and Skeet Range 17 is identified as OU 37.

Ordnance avoidance: Techniques employed on property known or suspected to contain UXO or other munitions that have experienced abnormal environments, in order to avoid contact with potential explosive or chemical agent hazards, or to allow entry to the area for the performance of required operations.

Preferred Alternative: The remedial alternative considered by the lead agency, the Army, and the lead and support regulatory agencies, EPA and MDE, to be the best alternative among the remedial alternatives considered during the Feasibility Study to address contaminants present at the Site. The preferred alternative is presented to the public in the proposed plan for public comment prior to selection of the final remedy in the Record of Decision (ROD).

Preliminary Remediation Goals (PRGs): Quantitative cleanup levels that are compliant with ARARs and result in residual risks that fully satisfy the NCP requirements for the protection of human health and the environment.

Principal Threat Wastes: The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 CFR Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

Proposed Plan: This is a document that presents a proposed cleanup alternative and requests public input regarding the remedial alternatives analyzed.

Record of Decision (ROD): A document that presents the final cleanup remedy selected for a Superfund site. The ROD includes a description of the site history and characteristics, a discussion of the contaminants present at the site and the human health and environmental risks presented by those contaminants, a description and comparative analysis of the remedial alternatives considered, and a discussion of how the final selected remedy will meet the remedial action objectives for the cleanup. Responses to public comments on the selected remedy and the other alternatives considered are provided in a Responsiveness Summary, which is a section of the ROD.

Remedial Action Objectives (RAOs): RAOs describe what the proposed site cleanup is expected to accomplish.

Remedial Investigation and Feasibility Study (RI/FS): The RI/FS is the step in the Superfund cleanup process that is conducted to gather sufficient information to support the selection of a site remedy that will reduce or eliminate the risks associated with contamination at the site. The RI involves site characterization (i.e., collection of data and information necessary to characterize the nature and extent of contamination at the site). The RI also determines whether

the contamination presents a significant risk to human health or the environment. The FS focuses on the development of specific response alternatives for addressing contamination at a site.

Resource Conservation and Recovery Act (RCRA): A comprehensive federal law enacted in 1976 that protects the environment by regulating the disposal of hazardous and nonhazardous solid wastes.

Skeet Range: A range that has typically eight shooting positions from which shooters fire at clay targets launched from both high and low houses. The targets are launched in the same pattern, but the angle of shot varies because the shooter moves to different shooting positions.

Toxicity Characteristic Leaching Procedure (TCLP): A testing procedure designed to determine whether a waste is hazardous or requires treatment to become less hazardous; Analytical test method used to measure compliance with metal treatment standards.

Trap Range: A range that has typically five shooting positions from which shooters fire at clay targets launched from three target launching machines in the center trap house. The targets are launched at different angles away from the trap house, and the shooter assumes various shooting positions behind the trap house.

Unexploded Ordnance (UXO): Military munitions that (a) have been primed, fused, armed, or otherwise prepared for action; (b) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (c) remain unexploded, whether by malfunction, design, or any other cause.

X-ray Fluorescence: Field-portable or handheld devices that are used for measuring metals and other elements in soils and sediment.

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