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ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) FOR FIVE SMALL ARMS/SKEET
RANGES AT STUMP NECK ANNEX NSWC INDIAN HEAD

6/1/2012
TETRA TECH

**Engineering Evaluation/
Cost Analysis (EE/CA)
for
Five Small Arms/Skeet Ranges
at Stump Neck Annex**

**Naval Support Facility Indian Head
Indian Head, Maryland**



**Naval Facilities Engineering Command
Washington**

**Contract Number N62467-04-D-0055
Contract Task Order 423**

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COST ANALYSIS (EE/CA)
FOR
FIVE SMALL ARMS/SKEET RANGES
AT STUMP NECK ANNEX**

**NAVAL SUPPORT FACILITY INDIAN HEAD
INDIAN HEAD, MARYLAND**

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:
Naval Facilities Engineering Command Washington
Washington Navy Yard, Building 212
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TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION.....	1-1
1.1 PURPOSE AND ORGANIZATION	1-1
1.2 REGULATORY FRAMEWORK	1-1
2.0 SITE CHARACTERIZATION.....	2-1
2.1 SITE DESCRIPTION AND BACKGROUND.....	2-1
2.1.1 Site Location and History	2-1
2.1.2 Topography and Vegetation.....	2-3
2.1.3 Hydrology	2-4
2.1.4 Geology and Hydrogeology	2-5
2.1.5 Current and Potential Future Land Use	2-7
2.1.6 Wetlands	2-8
2.1.7 Endangered and Special Status Species.....	2-9
2.1.8 Cultural and Archaeological Resources.....	2-9
2.1.9 Coastal Zones	2-11
2.2 PREVIOUS REMOVAL ACTIONS.....	2-12
2.3 PREVIOUS INVESTIGATIONS	2-12
2.3.1 Preliminary Assessment.....	2-12
2.3.2 Phase 1 Site Inspection	2-12
2.3.3 Phase 2 Site Inspection	2-13
2.4 SOURCE, NATURE, AND EXTENT OF CONTAMINATION.....	2-14
2.4.1 Marine Rifle Range - UXO 14	2-14
2.4.2 Old Skeet and Trap Range - UXO 15	2-16
2.4.3 Rum Point Skeet Range - UXO 16	2-17
2.4.4 Small Arms (Pistol) Range - UXO 17.....	2-18
2.4.5 Roach Road Rifle Range - UXO 25	2-19
2.5 STREAMLINED RISK EVALUATION	2-20
2.5.1 Human Health Risk Screening Evaluation.....	2-20
2.5.2 Ecological Risk Screening Evaluation.....	2-25
2.5.3 Conceptual Site Models	2-28
2.6 CONCLUSIONS.....	2-29
3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES	3-1
3.1 STATUTORY LIMITS ON REMOVAL ACTION.....	3-1
3.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.....	3-1
3.2.1 Chemical-Specific ARARs.....	3-3
3.2.2 Location-Specific ARARs.....	3-4

3.2.3	Action-Specific ARARs.....	3-5
3.3	REMOVAL ACTION OBJECTIVES	3-6
3.4	REMOVAL ACTION SCOPE	3-7
3.5	REMOVAL ACTION SCHEDULE	3-8
4.0	IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES	4-1
4.1	GENERAL RESPONSE ACTIONS.....	4-1
4.2	DEVELOPMENT OF ALTERNATIVES.....	4-1
4.2.1	Alternative 1 - No Action	4-2
4.2.2	Alternative 2 - Excavation and Off-Site Disposal	4-2
4.2.3	Alternative 3 - In-Situ Treatment, Excavation, and Off-Site Disposal	4-6
4.3	EVALUATION CRITERIA.....	4-8
4.4	DETAILED EVALUATION OF ALTERNATIVES	4-9
4.4.1	Alternative 1 - No Action	4-9
4.4.2	Alternative 2 - Excavation and Off-Site Disposal	4-9
4.4.3	Alternative 3 - In-Situ Treatment, Excavation, and Off-Site Disposal	4-11
5.0	COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES	5-1
5.1	EFFECTIVENESS.....	5-1
5.2	IMPLEMENTABILITY.....	5-2
5.3	COST	5-3
6.0	RECOMMENDED REMOVAL ACTION ALTERNATIVE.....	6-1
	REFERENCES.....	R-1

APPENDICES

- A SUMMARY OF FIELD SCREENING AND ANALYTICAL RESULTS**
- B SUPPORTING DOCUMENTATION FOR HUMAN HEALTH RISK EVALUATION**
- C SUPPORTING DOCUMENTATION FOR ECOLOGICAL RISK EVALUATION**
- D SOIL QUANTITY CALCULATIONS**
- E POST-REMOVAL ACTION ECOLOGICAL RISK EVALUATION**
- F COST ESTIMATES**

TABLES

NUMBER

- 2-1 Contaminants of Concern
- 3-1 Potential Chemical-Specific ARARs and TBCs
- 3-2 Potential Location-Specific ARARs and TBCs
- 3-3 Potential Action-Specific ARARs and TBCs
- 3-4 Cleanup Goals for Five Small Arms/Skeet Ranges
- 3-5 Summary of Proposed Soil Removal Quantities
- 4-1 Screening of Technologies and Process Options

FIGURES

NUMBER

- 2-1 Facility Location Map - Main Area and Stump Neck Annex
- 2-2 Facility Location Map - Valley Firing Fan
- 2-3 Small Arms/Skeet Range Location Map
- 2-4 Marine Rifle Range (UXO 14) - Lead Data and Extent of Soil Removal
- 2-5 Marine Rifle Range (UXO 14) - Firing Lines Metals Exceedances
- 2-6 Marine Rifle Range (UXO 14) - Target Berms and Hillside Impact Area Metals Exceedances
- 2-7 Old Skeet and Trap Range (UXO 15) - Lead Data and Extent of Soil Removal
- 2-8 Old Skeet and Trap Range (UXO 15) - Metals/PAH Exceedances and Extent of Soil Removal
- 2-9 Rum Point Skeet Range (UXO 16) - Lead Data and Extent of Soil Removal
- 2-10 Rum Point Skeet Range (UXO 16) - Metals/PAH Exceedances and Extent of Soil Removal
- 2-11 Small Arms (Pistol) Range (UXO 17) - Lead Data and Extent of Soil Removal
- 2-12 Small Arms Range (Pistol) (UXO 17) - Metals/Nitroglycerin Exceedance and Extent of Soil Removal
- 2-13 Roach Road Rifle Range (UXO 25) - Lead Data and Extent of Soil Removal
- 2-14 Roach Road Rifle Range (UXO 25) - Metals Exceedances and Extent of Soil Removal
- 2-15 Marine Rifle Range (UXO 14) - Hillside Impact Area Conceptual Site Model
- 2-16 Old Skeet and Trap Range (UXO 15) - Conceptual Site Model
- 2-17 Rum Point Skeet Range (UXO 16) - Conceptual Site Model for Groundwater
- 2-18 Small Arms (Pistol) Range (UXO 17) - Conceptual Site Model
- 2-19 Roach Road Rifle Range (UXO 25) - Conceptual Site Model

LIST OF ACRONYMS

AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
B(a)P	benzo(a)pyrene
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Cleanup Goal
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemical of Concern
COPC	Contaminant of Potential Concern
COMAR	Code of Maryland Regulations
CSM	Conceptual Site Model
CTO	Contract Task Order
CWAP	Comprehensive Work Approval Process
DPT	Direct Push Technology
EE/CA	Engineering Evaluation/Cost Analysis
EEQ	Ecological Effects Quotient
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ESCP	Erosion and Sedimentation Control Plan
FBL	fixed-base laboratory
FS	Feasibility Study
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HI	Hazard Index
ILCR	incremental lifetime cancer risk
LOAEL	Lowest Observed Adverse Effects Level
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRR	Marine Rifle Range
MRP	Munitions Response Program

LIST OF ACRONYMS (Continued)

msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	No Observed Adverse Effects Level
NOSSA	Naval Ordnance Safety and Security Activity
NPDES	National Pollutant Discharge Elimination System
NSF-IH	Naval Support Facility – Indian Head
NTCRA	Non-Time-Critical Removal Action
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSTR	Old Skeet and Trap Range
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PAL	Project Action Limit
PRG	Preliminary Remediation Goal
RAO	Removal Action Objective
RAWP	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RPSR	Rum Point Skeet Range
RRRR	Roach Road Rifle Range
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SAPR	Small Arms Pistol Range
SARA	Superfund Amendments and Reauthorization Act
SASR	Small Arms/Skeet Range
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SI	Site Inspection
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
Tetra Tech	Tetra Tech, Inc.
THQ	Target Hazard Quotient
TR	Target Risk

LIST OF ACRONYMS (Continued)

UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USDA	U.S. Department of Agriculture
UXO	Unexploded Ordnance
WMA	Wildlife Management Area
XRF	X-ray fluorescence

EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) presents the evaluation of alternatives for a removal action at five former Small Arms/Skeet Ranges (SASRs) located at Naval Support Facility Indian Head (NSF-IH) in Indian Head, Maryland. In coordination with the NSF-IH Partnering Team, the Navy is pursuing a non-time-critical removal action (NTCRA) at the five SASRs, which are located in the Stump Neck Annex portion of NSF-IH. The five sites, designated as Unexploded Ordnance (UXO) sites, include the Marine Rifle Range (UXO 14), Old Skeet and Trap Range (UXO 15), Rum Point Skeet Range (UXO 16), Small Arms (Pistol) Range (UXO 17), and Roach Road Rifle Range (UXO 25). This EE/CA has been prepared under the Navy's Munitions Response Program (MRP) for Naval Facilities Engineering Command (NAVFAC) Washington as part of Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-04-D-0055, Contract Task Order (CTO) 423.

This EE/CA addresses contaminated soil resulting from historical range operations at the five SASRs. Discrete areas of contamination are present at each of the five sites, which pose a potential risk to site receptors and must be managed appropriately. The evaluation of removal alternatives to address soil contaminated with lead, polycyclic aromatic hydrocarbons (PAHs), and nitroglycerin at the sites is necessary to mitigate risk and eliminate the potential for future contaminant migration.

The following Removal Action Objectives (RAOs) have been identified for this removal action:

- Mitigate potential human health risks due to direct exposure to lead, PAHs, and nitroglycerin contamination in soils;
- Mitigate the potential for erosion of contaminated soil, transport of contaminants, and subsequent exposure; and
- Ensure that post-removal action conditions provide an acceptable level of protection for ecological receptors against direct exposure and exposure via the food chain to lead, collocated metals, nitroglycerin, and PAHs in soil.

The three removal action alternatives developed and evaluated in this EE/CA are the following:

- Alternative 1 – No Action
- Alternative 2 – Excavation and Off-Site Disposal
- Alternative 3 – In-Situ Treatment, Excavation, and Off-Site Disposal

This EE/CA compares the three removal action alternatives on the basis of their effectiveness, implementability, and cost. Based on the results of this comparison, Alternative 3 is recommended for implementation at the five SASRs. This alternative involves the in-situ chemical treatment of lead-

contaminated soils to stabilize the leachable lead, excavation of contaminated soils to achieve the cleanup goals for individual contaminants of concern, and off-site disposal of the excavated waste. A total of 8,809 cubic yards of contaminated soils are designated for removal. It is estimated that, of that, approximately 3,048 tons of lead-contaminated soils will exceed the U.S. Environmental Protection Agency (EPA) threshold for lead toxicity and require lead stabilization prior to excavation and disposal. A total of 3,810 tons of lead-contaminated soil (treated and untreated) will be shipped off-site for disposal as non-hazardous waste at a Subtitle D landfill, along with approximately 8,673 tons of PAH-contaminated soil and 598 tons of nitroglycerin-contaminated soil. After the contaminated soils have been removed, verification sampling of residual soils will be conducted to ensure that the removal action objectives have been met.

Alternative 3 is recommended because it is the most cost-effective alternative that would meet the stated RAOs. Implementation of this alternative would be effective in permanently reducing lead, PAH, and nitroglycerin concentrations at the five SASRs and eliminating the potential for unacceptable risks to human health and ecological receptors. Alternative 3 is technically and administratively feasible, and it constitutes a permanent remedy to existing contamination at these sites. This alternative is estimated to cost \$3,156,800 and will require approximately 5 months to complete.

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) to document the need for a removal action at five former Small Arms/Skeet Ranges (SASRs) located in the Stump Neck Annex portion of Naval Support Facility Indian Head (NSF-IH), Indian Head, Maryland. In coordination with the NSF-IH Partnering Team, the Navy is pursuing a non-time-critical removal action (NTCRA) under the guidance provided by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). This removal action is necessary to prevent, minimize, or mitigate damage to public health or welfare based on the potential for environmental contamination from lead, polycyclic aromatic hydrocarbons (PAHs), and nitroglycerin in soil at the five SASRs.

The five sites addressed in this EE/CA are designated as Unexploded Ordnance (UXO) sites, and include: the Marine Rifle Range (UXO 14), Old Skeet and Trap Range (UXO 15), Rum Point Skeet Range (UXO 16), Small Arms (Pistol) Range (UXO 17), and Roach Road Rifle Range (UXO 25). This EE/CA has been prepared under the Navy's Munitions Response Program (MRP) for Naval Facilities Engineering Command (NAVFAC) Washington as part of Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-04-D-0055, Contract Task Order (CTO) 423.

1.1 PURPOSE AND ORGANIZATION

This EE/CA provides the CERCLA documentation necessary to support a NTCRA for the five SASRs. This document is organized in six sections. Section 1.0 provides introductory information, including the purpose, organization, and regulatory framework for this EE/CA. Section 2.0 presents descriptive information and contaminant characterizations for each site. Section 3.0 identifies the removal action objectives (RAOs). Section 4.0 discusses potential removal technologies and describes the removal action alternatives evaluated. Section 5.0 provides a comparative analysis of the removal action alternatives, and Section 6.0 presents the recommended alternative. References and appendices are also included.

1.2 REGULATORY FRAMEWORK

This document is being issued by the U.S. Navy, who is the lead agency responsible for implementing the NTCRA at the five former SASRs, in partnership with U.S. Environmental Protection Agency (EPA) Region 3 and Maryland Department of the Environment (MDE). This EE/CA meets the requirements of Section 104 of CERCLA, as amended by SARA, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) presented in Title 40 of the Code of Federal Regulations (40 CFR) Part 300.

This EE/CA has been developed according to EPA's "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (EPA, 1993).

A NTCRA is being pursued under 40 CFR Part 300.415(b)(2), which defines the right and responsibility of the lead agency to instigate an appropriate removal action to mitigate or eliminate the threat posed to the public or the environment from a release. NTCRAs may constitute interim or final actions. In the case of the five SASRs, the NTCRA is planned as a final action to mitigate potential unacceptable risks to both human and ecological receptors based on exposure to munitions constituents (MC) in site soils.

Community involvement requirements for NTCRAs include making the EE/CA available for public review and comment for a period of 30 days. An announcement of the public comment period for this EE/CA will be placed in a local newspaper once the EE/CA has been reviewed and approved by the Partnering Team (i.e., Navy, EPA, MDE, NSF-IH, and interested stakeholders). Written responses to significant comments will be provided in a responsiveness summary to be attached to the Navy's Action Memorandum, and will be included in the Administrative Record for NSF-IH. Information in the Administrative Record can be accessed at the following repositories:

Indian Head Town Hall 4195 Indian Head Highway Indian Head, Maryland (301) 743-5511	Charles County Public Library 2 Garrett Avenue La Plata, Maryland (301) 934-9001	NSF-IH General Library Building 620 (The Crossroads) 4163 N. Jackson Road Indian Head, Maryland (301) 744-4747
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2.0 SITE CHARACTERIZATION

This section presents information about the five SASRs including site descriptions and background; summaries of previous investigations; characterization of the source, nature, and extent of contamination; human health and ecological risk evaluations; and conceptual site models.

2.1 SITE DESCRIPTION AND BACKGROUND

NSF-IH is located in northwestern Charles County, Maryland. It consists of the Main Installation and Stump Neck Annex (Figure 2-1). Stump Neck Annex covers approximately 1,100 acres on the Stump Neck peninsula at the confluence of the Potomac River and Chicamuxen Creek in Charles County, Maryland. Much of the Stump Neck peninsula lies within the Valley Firing Fan (Figure 2-2), which received fire from the Valley Gun Proving Site at the Main Installation from 1891 through 1921. General Smallwood State Park and private property parcels lie east and southeast, respectively, of Stump Neck Annex, and the Chicamuxen Wildlife Management Area (WMA) lies to the south, across Chicamuxen Creek.

Five former SASRs have been identified at NSF-IH Stump Neck Annex as “other than operational ranges” and are being addressed under the Navy’s MRP. These SASRs consist of the following sites: Marine Rifle Range (UXO 14), Old Skeet and Trap Range (UXO 15), Rum Point Skeet Range (UXO 16), Small Arms (Pistol) Range (UXO 17), and Roach Road Rifle Range (UXO 25) (Figure 2-3).

Under the MRP, military ranges that are considered to be “other than operational” are investigated and remediated, if necessary, for munitions and explosives of concern (MEC) and MC. MEC are generally not of concern at small arms ranges. However, there is a possibility that MEC could be encountered at the SASRs located within the Valley Firing Fan (i.e., the Marine Rifle Range and Old Skeet and Trap Range) as a result of errant projectiles fired from the Valley Gun Proving Site.

2.1.1 Site Location and History

Marine Rifle Range - UXO 14

The former Marine Rifle Range (MRR) is located south of Archer Avenue, within the Valley Firing Fan, and includes multiple Firing Lines, two Target Berms, and a Hillside Impact Area (Figures 2-4 to 2-6). The total area of the site is 30.4 acres. During its estimated period of use, 1911 to 1918, the range was used for small arms (.30-caliber) rifle training. Two sets of Firing Lines, one for each Target Berm, were located at 100-meter intervals over a 1,000-meter span. Targets were mounted on each berm and held in place by a series of chains and mechanical supports. Bullets that were fired low and missed the targets tended to accumulate in the Target Berm soil at the base of the targets. Bullets that were fired high and

missed the targets, or hit the targets and passed through, continued down range and accumulated in the Hillside Impact Area.

Old Skeet and Trap Range - UXO 15

The former Old Skeet and Trap Range (OSTR) is located north of Archer Avenue, between the MRR and Potomac River (Figures 2-7 and 2-8). Like the MRR, this site lies within the Valley Firing Fan. The total area of the OSTR is 29.3 acres. The site was reportedly used for small arms recreational activities from sometime after 1967 until 1991. Shotguns were used to fire on clay targets launched from two separate firing points. Impacted targets would shatter and fall to the ground surface, and the shot pellets, because of their ballistic momentum, greater density, and spherical shape, would travel further down range before falling to the ground. Missed targets would fall to the ground intact, and the expended shot would continue along an undisturbed trajectory toward the river.

Rum Point Skeet Range - UXO 16

The former Rum Point Skeet Range (RPSR) is a 900-foot wide fan-shaped area that covers 33.5 acres in the northeastern section of Stump Neck Annex (Figures 2-9 and 2-10). There is no available information regarding land use at the RPSR prior to 1991, although records show that the site was used for small arms (shotgun) recreational activities from 1991 until 2001. The range was primarily used and maintained by the Potomac River Gun Club. Shotguns were used to fire on clay targets launched from two concrete firing pads. Impacted targets would shatter and fall to the ground surface, and the shot pellets, because of their ballistic momentum, greater density, and spherical shape, would travel further down range before falling to the ground. Missed targets would fall to the ground intact, and the expended shot would continue along an undisturbed standard trajectory.

Small Arms (Pistol) Range - UXO 17

The former Small Arms (Pistol) Range (SAPR) was also previously known as the Old Pistol Range. It covers approximately 2 acres near the eastern perimeter of the Stump Neck peninsula, along the east side of Rum Point Road (Figures 2-11 and 2-12). The SAPR was used for small arms training from the mid-1980s to 1991. The range contained three Firing Lines with north-south orientation, a Target Area, and a Hillside Impact Area on the eastern edge of the range. Bullets fired from the Firing Lines would have passed through or around the targets and accumulated in the Hillside Impact Area behind the targets. Currently, the SAPR is an open field bounded on the east by a steep upward slope that borders General Smallwood State Park.

Roach Road Rifle Range - UXO 25

The former Roach Road Rifle Range (RRRR) is located in the central portion of Stump Neck Annex, directly west of Roach Road (Figures 2-13 and 2-14). The site is a 0.3-acre site that was used for small

arms (rifle and pistol) training from 1967 to 1986. The site contained eight firing stands, six targets, and a Hillside Impact Area on the western side of the range. Bullets fired from the firing stands would have passed through or around the targets and accumulated in the Hillside Impact Area behind the targets.

2.1.2 Topography and Vegetation

The Stump Neck Annex has a relatively low topographic profile. The highest point is the northeastern portion of the peninsula, which has an elevation of approximately 140 feet above mean sea level (msl). The lowest points lie along the shorelines of the Stump Neck Annex adjacent to Mattawoman Creek and Chicamuxen Creek. These areas are mostly flat, tidal marsh areas, although several 50- to 60-foot bluffs exist along Mattawoman Creek.

The land around the Stump Neck Annex is heavily vegetated. There are five basic vegetation types present including pine, hardwood, pine-hardwood mix, tidal and non-tidal wetlands, and urban landscape. Most of the forested land is either second or third growth; little, if any, virgin forest remains. The most abundant trees are Virginia pine, sweet gum, red oak, and yellow poplar. In addition, the following grasses are present: gama grass, panic grass, bermuda grass, and finger grass.

MRR - UXO 14

Surface elevations at the MRR vary from 5 to 60 feet above msl. The western portion of the range slopes slightly from 10 to 30 feet above msl, and the central and eastern portions of the range are relatively flat, with a general elevation of approximately 10 feet above msl. The Hillside Impact Area that borders the eastern side of the range slopes steeply from 5 to 60 feet above msl. Vegetation at the MRR is a mixture of mowed grass, grassy fields, hardwood forest, and wetland.

OSTR - UXO 15

Topographic relief at the OSTR is relatively flat; the elevation of the entire range is approximately 16 feet above msl. The site consists primarily of an open field with maintained grass.

RPSR - UXO 16

The general topography of the RPSR slopes gently downward from southeast to northwest. More than 90 percent of the range is located in upland terrain, at or above an elevation of 30 feet above msl. The cleared area of the range is fairly flat; however, west of the cleared area, the land slopes downward toward a wetlands area and beyond.

Vegetation is characterized by open fields with maintained grass surrounded by hardwood forests and wetlands. High grasses of the family Gramineae and genus *Festuca* were planted by the Potomac River Gun Club within specific zones to dissuade birds and waterfowl from grazing or nesting on the range.

There is a 100-yard transition zone between the grasses and the tree line containing a mix of high scrubs, bushes, and tall grasses. The trees are approximately 50 to 75 feet tall.

SAPR - UXO 17

The topography of the SAPR can be described as relatively flat with a steeply sloping hill on the eastern side, bordering General Smallwood State Park. The range floor has an elevation of approximately 100 feet above msl, and the Hillside Impact Area along the eastern boundary rises to approximately 130 feet above msl.

The SAPR is located adjacent to a hardwood forest area. The range is covered with high grass and surrounded by trees on the northern edge. Open fields, trees, grass, and an access road surround the range.

RRRR - UXO 25

The terrain at the RRRR is relatively flat, and has an elevation of approximately 50 feet above msl. There is a small downward slope toward the north. Vegetation at the RRRR is a mixture of shrubs and forest.

2.1.3 Hydrology

The Potomac River, Mattawoman Creek, and Chicamuxen Creek border the Stump Neck Annex. The Potomac River is a continuous, slow-moving, slightly brackish, tidal tributary to the Chesapeake Bay. Mattawoman Creek and Chicamuxen Creek are tributaries to the Potomac River, which are also tidally influenced. Both have large floodplains and contain large expanses of tidal wetlands and swamps. Many small streams cross the area, most of which drain directly into one of the three major waterways.

MRR - UXO 14

Wetlands are present in the eastern portion of the range, and also surround an unnamed tributary in the central portion of the range. Surface water runoff drains to these wetlands, unnamed tributaries, and drainage swales, ultimately flowing to the Potomac River. A portion of MRR along the wetlands is located within the 100-year floodplain.

OSTR - UXO 15

Surface runoff is to the north, toward the Potomac River, either directly or via a drainage ditch located along Archer Avenue. Although erosion on the range is considered to be minimal, surface soil contaminants may become mobile, particularly during extended periods of surface runoff.

RPSR - UXO 16

The RPSR has two small unnamed tributaries, and a wetlands area in the western portion of the range. Surface water runoff flows toward the wetlands and tributaries, which eventually drain into Mattawoman Creek. The tall fescue grass planted in the shot fall zone impedes surface runoff and minimizes erosion. The site was also graded during range operations so that surface runoff would be directed away from the shot fall zone toward the western edge of the range.

SAPR - UXO 17

The closest water body to the SAPR is an unnamed tributary along the western boundary of the range. Surface water runoff follows the topography at the range, flowing generally towards the unnamed tributary. There are no known wetlands in the vicinity of this site.

RRRR - UXO 25

There are no surface water bodies present at the RRRR. Based on topography, surface water flows to the north toward Chicamuxen Creek, which drains to the Potomac River.

2.1.4 Geology and Hydrogeology

MRR - UXO 14

According to the Soil Survey of Charles County (USDA, 1974), soils in the general vicinity of this site consist of silty sand with gravel at the ground surface underlain by silty sand with clay. Specifically, Keyport silt, Elkton silt loam, and Mattapex silt loam are present at this site. These soil types generally have low permeability, thus impeding the downward movement of rainwater through the vadose zone.

Based on Phase 2 SI groundwater sampling and a review of available information (e.g., Background Report [Tetra Tech, 2002], RCRA Facility Investigation (RFI) Verification Report [Brown and Root, 1998]), shallow groundwater flow beneath the MRR follows the general topography and is connected to the area's dominant surface water bodies (i.e., Mattawoman Creek, Chicamuxen Creek, and Potomac River). The depth to groundwater is about 5 to 10 feet below ground surface (bgs). Due to the proximity of the site to the river, it is possible that groundwater at the MRR experiences tidally induced fluctuations in elevation and quality.

OSTR - UXO 15

According to the Soil Survey of Charles County (USDA, 1974), the soils at the OSTR consist of Mattapex fine sandy loam with 0 to 2 percent slopes. Soils in this area generally have a surface layer of sandy silt and are moderately well-drained. Available moisture capacity is high, and permeability is moderately low.

Based on Phase 2 SI groundwater sampling and a review of available information (e.g., Background Report [Tetra Tech, 2002], RFI Report [Brown and Root, 1998]), shallow groundwater flow beneath the OSTR follows the general topography and is connected to the area's dominant surface water bodies (i.e., Mattawoman Creek and Potomac River). The depth to groundwater is about 5 to 10 feet bgs. Due to the proximity of the site to the river, groundwater at the OSTR experiences tidally induced fluctuations in elevation and quality.

RPSR - UXO 16

According to the Soil Survey of Charles County (USDA, 1974), the surface soil at the RPSR consists of a thick series of silty clays. The subsurface soil is a combination of Sassafras sandy loams with 0 to 5 percent slopes and moderate erodability. These soils form on upland terrains that are nearly level to moderately sloping. They are well-drained soils with moderate permeability.

Based on Phase 2 SI groundwater sampling and a review of available information (e.g., Background Report [Tetra Tech, 2002], RFI Report [Brown and Root, 1998]), shallow groundwater flow beneath the RPSR follows the general topography and is connected to the area's dominant surface water bodies (i.e., Mattawoman Creek and Potomac River). The depth to groundwater is about 5 to 10 feet bgs. Due to the distance between the site and the river, neither groundwater elevation nor quality is expected to fluctuate in response to tides.

SAPR - UXO 17

According to the Soil Survey of Charles County (USDA, 1974), the predominant soil types at the SAPR are silty loams and gravelly sandy loam. Specifically, the soils consist of moderately eroded, Beltsville silt loam with 2 to 5 percent slopes and a moderately eroded Aura gravelly loam with a 10 to 15 percent slope, both of which are moderate to well-drained soils that allow for downward movement of rainwater through the vadose zone.

During the 2009 SI, it was evident that soils from the western face of the Target/Impact Area berm had slumped to the bottom of the slope, likely consolidating much of the contaminated soil from the impact area at this location. This material appears to be in the process of being eroded by overland flow processes.

Based on Phase 2 SI groundwater sampling and a review of available information (e.g., Background Report [Tetra Tech, 2002], RFI Report [Brown and Root, 1998]), shallow groundwater flow beneath the SAPR follows the topography toward the unnamed tributary and is connected to the area's dominant surface water bodies (i.e., Mattawoman Creek and Potomac River). The depth to groundwater is about

5 to 10 feet bgs, with an inferred north-by-northwest flow direction. Due to the distance between the site and the river, neither groundwater elevation nor quality is expected to fluctuate in response to tides.

RRRR - UXO 25

According to the Soil Survey of Charles County (USDA, 1974), soils in the area consist of silty sand with gravel at the ground surface underlain by silty sand with clay. Specifically, Aura gravelly sandy loam is present at the range. This soil type is generally a well-draining gravelly soil that allow for the downward movement of rainwater through the vadose zone. Soil boring data from the 2009 SI at Area 8 (Tetra Tech, 2010), located approximately 400 feet northeast of the RRRR boundary, indicate that surficial deposits consist of gravel, sand, silt, clay, and peat mixtures with irregular bedding and an aggregate thickness of 0 to approximately 40 feet bgs.

In the absence of site-specific data, it is assumed that shallow groundwater flow beneath the RRRR follows the general topography and is connected to the area's dominant surface water bodies (i.e., Mattawoman Creek and Potomac River). Based on a review of available information, depth to water is estimated at 25 to 30 feet bgs, with an inferred northeast-by-north flow direction. Due to the distance between the site and the river, neither groundwater elevation nor quality is expected to fluctuate in response to tides.

2.1.5 Current and Potential Future Land Use

No public access is authorized at NSF-IH. Signs, partial fencing, locked/secured gates, login book/office check-in, and vehicle security patrols are used to control the entire facility.

MRR - UXO 14

The western portion of the MRR is partially developed, with a number of parking lots and warehouse-type structures, such as Building 2195, which is used by the Joint Services Explosive Ordnance Disposal (EOD) Equipment Support Facility. The central and eastern portions of the range are mostly wooded and undeveloped, with sparsely distributed structures (e.g., Buildings 2156 and 2075). There is a fenced maintenance yard in the central portion of the range that is used to store equipment (e.g., dump trucks, backhoes, etc.). Buildings located within the MRR are used primarily as offices and for storage. The wooded areas surrounding the existing buildings and the wetland area in the eastern portion of the range are currently unused. According to the installation personnel, there are no changes planned for future land use at this site.

OSTR - UXO 15

The OSTR is currently a routinely manicured grass field, which is used primarily for recreation. The site is also used as a helicopter pad and, approximately once a year, for amphibious training exercises. According to the NSF IH Master Plan, there are no anticipated changes in future land use at this site.

RPSR - UXO 16

From 1991 until 2001, the RPSR was maintained by the Potomac River Gun Club and used as a recreational skeet and trap range. Currently, the site is unused.

SAPR - UXO 17

The SAPR is currently an unused open field. Areas directly adjacent to the eastern and southern boundaries of the SAPR are part of General Smallwood State Park. Rum Point Road runs along the western border of the range.

RRRR - UXO 25

There is no available information on land use at the RRRR prior to 1963. From 1967 until 1986, the site was maintained as a rifle range. The site is currently undeveloped and is adjacent to an area used for staging dirt, gravel, telephone poles, and other road construction supplies. According to installation personnel, there are no changes planned for land use at this site. According to the 2003-2004 Stump Neck Annex Hunting Map, the RRRR is located within an upland hunting area.

2.1.6 Wetlands

The Stump Neck Annex is bordered by and contains large tracts of both tidal and non-tidal wetlands. Wetlands are valuable habitats for wildlife, and important groundwater recharge areas.

MRR - UXO 14

There are wetlands located in the central portion of the MRR surrounding an unnamed tributary, and in the eastern portion of the site. The wetlands located on the eastern edge of the range are protected under United States Executive Order 11990, which prohibits construction in a wetland area unless there is no practicable alternative and all possible measures are taken to minimize the environmental impacts. Wetlands are also protected under Section 404 of the Clean Water Act, and CERCLA activities that may impact wetlands must meet the substantive requirements of this Act.

The wetlands found at the MRR are categorized as Palustrine forested broad-leaved deciduous wetlands. A portion of the MRR is located in the 100-year floodplain surrounding the wetlands. Executive Order 11988 restricts development within the 100-year floodplain to water-dependent activities. Any

construction within the floodplain must be in accordance with regulations promulgated by the Federal Insurance Administration pursuant to the National Flood Insurance Act of 1968. Permits for construction within the 100-year floodplain are also required and are administered by the Waterway Permits Division of the Maryland Department of Natural Resources.

OSTR - UXO 15

No wetlands are known to exist at the OSTR. A portion of the OSTR is located within the 100-year floodplain.

RPSR - UXO 16

The RPSR has two small unnamed tributaries, and a wetlands area on the western portion of the range.

SAPR - UXO 17

No wetlands are known to exist at the SAR.

RRRR - UXO 25

No wetlands are known to exist at the RRRR.

2.1.7 Endangered and Special Status Species

According to the 1997 Wildlife Management Plan published by Naval District of Washington Indian Head, three endangered species are reported to be located within the Stump Neck Annex. Two of these three species, the rainbow snake and joint-vetch (flowering plant of the pea family), are federally endangered. The third species, the scaly blazing-star (perennial herb), is a species of special concern in the State of Maryland. As of the July 2001 Threatened and Endangered Plant/Animal Species of Charles County, Maryland report, the Maryland Department of Natural Resources Wildlife and Heritage Service still listed these three species as federally and state endangered for Charles County. These species potentially inhabit the MRR (UXO 14).

2.1.8 Cultural and Archaeological Resources

A Phase I Cultural Resources Survey and Supplemental Architectural Investigations were conducted at Stump Neck in 1996. As a result, 33 sites were identified and investigated. Only 17 of 33 were recommended for Phase II evaluations to determine their eligibility for listing on the National Register of Historic Places. Five of these 17 sites are considered to potentially overlap with the former ranges discussed in this report:

- Site 18CH388 – overlaps with the OSTR (UXO 15) and the MRR (UXO 14)
- Sites 18CH391, 18CH628, and 18CH630 – overlap with the RPSR (UXO 16)
- Site 18CH644 – overlaps with the SAR (UXO 17)

The architectural evaluation verified three National Register-eligible historic districts and identified one additional district: the Indian Head Residential Historic District containing 64 contributing resources; the Naval Powder Factory District containing 124 contributing resources; the Naval Proving Ground Historic District containing no contributing resources; and the Extrusion Plant Historic District containing 63 contributing resources. An additional area of the base, the Polaris facility, was recommended for further research, as it was considered potentially eligible for the National Register as an exceptionally significant area. The exact locations of the contributing resources within these districts were not available.

MRR - UXO 14

The Phase I Cultural Resources Survey of Stump Neck Annex and Supplemental Architectural Investigations (Goodwin, 1996) identified one site within the MRR. Site 18CH388 contained a mix of prehistoric and historic artifacts, and may correspond to Indian Head Quad File #4, a Late Woodland Indian village. A total of 645 artifacts were recovered at this site, which also overlaps UXO 15. In addition, a reinforced concrete retaining wall approximately 130 feet long and 33 feet high was identified in the area bordering the marsh on the eastern edge of the MRR. No sites were identified within the range Maryland Register of Historic Places (State Register) or the National Register of Historic Places.

According to the 2003-2004 Stump Neck Annex Hunting Map, hunting is permitted in the undeveloped portions of the MRR. The Chicamuxen WMA is located approximately 75 feet south of the MRR.

OSTR - UXO 15

According to the Phase I Cultural Resources Survey (Goodwin, 1996), there is one archaeological site located within the OSTR. Site 18CH388 contained a mix of prehistoric and historic artifacts, and may correspond to Indian Head Quad File #4, a Late Woodland Indian village. A total of 645 artifacts were recovered at this site, which also overlaps the MRR.

RPSR - UXO 16

The Phase I Cultural Resources Survey (Goodwin, 1996) identified three archaeological sites that partially overlap the RPSR;

- Site 18CH391: This site was previously identified in a 1966 historic survey. Artifacts recovered from this site were from the Late Archaic through Late Woodland periods. The size and nature of the site suggest that it was once a base camp or village. Many of the prehistoric materials were from the Ap horizon. The site overlaps the northeastern portion of the RPSR.
- Site 18CH628: This small Late Woodland site contained a wide variety of artifact classes including debitage, flake tools, ceramics, and fire-cracked rock. The artifacts provide evidence that the site was a resource procurement site or a briefly occupied camp. Cores and primary debitage were located in the southeastern portion of the site. Ceramic artifacts were located in the northwestern portion of the site. Recovered historic artifacts were most likely from field scatter. This site overlaps the eastern side of the RPSR.
- Site 18CH630: A diverse collection of prehistoric artifacts including debitage, a flake tool, a core, ceramics, and fire-cracked rock fragments were recovered at this small Late Woodland site. The artifacts were uncovered in unplowed Sassafras Silt Loam soils. The entire site is overlain by the northwestern section of the RPSR.

The RPSR is located in a species-protected area where hunting is not permitted.

SAPR - UXO 17

According to the Phase I Cultural Resources Survey (Goodwin, 1996), Cultural Site 18CH644 overlaps the SAPR. However, several shovel test pits were dug on the site, and all were negative for artifacts.

RRRR - UXO 25

The Phase I Cultural Resources Survey (Goodwin, 1996) did not identify any archeological sites within the RRRR. Historic and prehistoric artifacts were recovered but not in sufficient concentrations to warrant a site designation. No sites listed in the Maryland Register of Historic Places (State Register) or the National Register of Historic Places were identified at the RRRR.

According to the 2003-2004 Stump Neck Annex Hunting Map, hunting is permitted in the undeveloped portions of the RRRR. The Chicamuxen WMA is located approximately 500 feet north of the range and contains an eagle protection area.

2.1.9 Coastal Zones

The Coastal Zone of Maryland includes all land and water lying within coastal counties, one of which is Charles County. Within the Coastal Zone, Maryland has defined an area within which strict land use

management is needed to protect the Chesapeake Bay. The critical area is defined as a 1,000-foot-wide strip of land surrounding the bay and its tidal tributaries. Most construction within 100 feet of the Mean High Water Line (buffer) is prohibited. Most of the OSTR falls within the 100-foot buffer of the Mean High Water Line (buffer).

2.2 PREVIOUS REMOVAL ACTIONS

No previous CERCLA removal actions have occurred at these sites.

2.3 PREVIOUS INVESTIGATIONS

The five SASRs are being investigated under the Navy MRP, in accordance with the CERCLA process. Previous CERCLA investigations at these sites have included a Preliminary Assessment (PA) and Site Inspection (SI).

2.3.1 Preliminary Assessment

The initial stage of the CERCLA process, the PA, was completed in September 2005 (Malcolm Pirnie, 2005). It recommended further investigation of the five SASRs at Stump Neck Annex that were classified as “other than operational,” and identified them as Munitions Response Areas or Munitions Response Sites under the MRP. The PA used five primary sources of information to support the data collection effort, including historical archives, personal interviews, installation data repositories (including the Administrative Record), visual surveys, and off-facility data sources and repositories such as local libraries and museums.

2.3.2 Phase 1 Site Inspection

The next stage of the CERCLA process, the SI, was initiated in 2009, as documented in the SI Report (Tetra Tech, 2010). The first phase of the SI focused on the collection and analysis of surface soil, subsurface soil, and sediment samples to support screening-level risk evaluations and the identification of contaminants of potential concern (COPCs) at each of the five sites. The SI considered the background information provided in the PA to refine the conceptual site models and determine what data were necessary to evaluate the potential presence of contamination related to historical site use.

The initial SI field work was conducted from May through June 2009. It consisted of the collection of more than 450 soil and sediment samples, along with associated quality control samples (e.g., duplicates and blanks), in areas most likely to have been contaminated by former range operations. All soil and sediment samples were screened on-site for lead using X-ray fluorescence (XRF), and a subset of those samples was shipped off-site to a fixed-base laboratory (FBL) for analysis of select munitions-related metals, PAHs, and explosives (i.e., nitroglycerin).

Using the lead data generated for samples that were analyzed both in the field using XRF and also at the FBL, regression analyses were conducted to evaluate the strength of the correlation between the FBL analytical data and the XRF screening data. Results of the regression analyses indicated that the correlation between the on-site XRF and off-site FBL lead data was statistically acceptable at UXOs 14, 15, and 25, but not at UXOs 16 and 17. Thus, regression equations were derived for UXOs 14, 15, and 25 that allowed for the calculation of predicted FBL concentrations at sample locations where only XRF analyses were performed.

Analytical results were compared to the Project Action Limits (PALs) specified in the project Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP) (Tetra Tech, 2009). The PALs corresponded to the minimum screening values established for direct-contact residential exposure for human health or ecological receptors. Statistical comparisons between the site-specific data and installation-wide background data (Tetra Tech, 2002) were performed whenever the maximum reported concentration of a constituent exceeded its respective PAL.

Soil contaminants with maximum concentrations that exceeded both their respective PALs and background at each site were retained as COPCs and subjected to human health and ecological risk screening evaluations. Based on these evaluations, the SI resulted in the following recommendations:

- Proceed to a Remedial Investigation (RI) and Feasibility Study (FS) or conduct interim measures to address soil containing elevated concentrations of COPCs.
- Determine impacts to groundwater at each site.
- No further action with respect to sediment.

2.3.3 Phase 2 Site Inspection

In response to the Phase 1 SI recommendations, the Navy conducted a Phase 2 SI to determine the impacts of range operations on groundwater quality at the five SASRs. Fieldwork for the Phase 2 SI was conducted in September 2011, as documented in the Phase 2 SI Report (Tetra Tech, 2012). The objective of the Phase 2 SI was to collect groundwater data at each site to evaluate whether site-specific contaminants have migrated from soil to the underlying groundwater. Sampling locations were biased toward areas where contaminant concentrations in soil were among the highest for individual subareas of each site. The data collected were used to conduct a human health risk screening evaluation to determine whether actual contaminant concentrations measured in groundwater could pose an unacceptable risk to potential future human receptors.

As described in the Phase 2 SI Report, a total of ten temporary wells were installed at four of the five sites using Direct Push Technology (DPT). Wells were installed at UXO 14, UXO 15, UXO 16, and UXO 17;

however, the well planned for UXO 25 was not able to be installed due to unexpected site conditions that prevented access to the planned location. Prior to sampling, the wells were developed by means of low-flow purging until the water became visibly clear or until the well went dry. Nine of the ten wells were successfully developed. Groundwater samples were collected from the nine viable wells for analysis of location-specific contaminants (i.e., PAHs, nitroglycerin, and/or select total and dissolved metals). All of the analytical results for the samples collected were validated, in accordance with the Phase 2 UFP-SAP (Tetra Tech, 2011).

A human health risk screening evaluation was conducted to conservatively estimate potential risks posed to human receptors from contaminants present in the groundwater. Analytical results were compared to EPA Regional Screening Levels (RSLs), Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), and background concentrations. No potential human health risks associated with direct exposure to groundwater were identified at UXO 14, UXO 16, or UXO 17. However, potentially unacceptable human health risks were identified at UXO 15 based on exposure to measured concentrations of lead and six carcinogenic PAHs. A significant source of uncertainty in the evaluation was the high turbidity in samples collected from this site, which limited the ability to draw reliable conclusions regarding actual concentrations of groundwater contaminants in unfiltered samples. No risk evaluation was performed for UXO 25 because no groundwater sample was collected at that site.

The Phase 2 SI report recommended that further investigation of groundwater be conducted to complete the data collection and risk evaluation at UXO 25, and to evaluate the possible impacts of turbidity on the analytical results at UXO 15. The Partnering Team agreed to defer this evaluation until after the soil removal action is complete.

2.4 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The source, nature, and extent of soil contamination at the five SASRs, as indicated by PAL exceedances observed during the SI, are described below for each site. The complete analytical data sets for soil sampling conducted during the SI are provided in Appendix A. The data tables present the analytical results by location, and highlight all exceedances of the PALs specified in the SI UFP-SAP (Tetra Tech, 2009). Exceedances of the arsenic PAL (0.39 milligrams per kilogram [mg/kg]) shown in the data tables are not discussed below because all reported data were determined to be less than the adjusted screening level (9.7 mg/kg) derived through statistical data evaluations and comparisons to background.

2.4.1 Marine Rifle Range - UXO 14

Potential sources of contamination evaluated at UXO 14 included select metals (antimony, arsenic, copper, lead, tin, and zinc) resulting from bullet accumulations in soil at the Firing Line Area and on the tops and uprange (western) slopes of the Target Berms and Hillside Impact Area. Surface soil in the

Firing Line Area is also a potential source of nitroglycerin contamination as a result of incomplete consumption of propellant during firing activities.

Summary tables of analytical data collected during the SI are presented for each subarea of UXO 14 in Appendix A.1. For the discrete samples, the correlation between the on-site XRF and off-site FBL lead data was determined to be statistically acceptable. Consequently, an appropriate regression equation was derived, and the values predicted by this equation were used to supplement the analytical lead data for this site. The lead results, including both the reported FBL data and the predicted concentrations based on XRF results, are depicted on Figure 2-4. Analytical data that exceeded PALs for metals are depicted on Figure 2-5 for the Firing Line Area and Figure 2-6 for the Target Berms and Hillside Impact Area. Statistical summaries of all detected contaminants are provided in Appendix B.1.

Firing Line Area

In the Firing Line Area, results of the composite surface soil sampling indicated exceedances of the PALs for antimony (up to 1.4 mg/kg), zinc (up to 66.5 mg/kg), and lead (up to 52.5 mg/kg). The antimony PAL was exceeded at two locations, and the zinc PAL was exceeded at three locations. At all locations, lead detections were greater than the PAL but less than the human health criterion for residential exposure. The average lead concentration for this area was 24.5 mg/kg.

Target Berm 1

At Target Berm 1, results of the discrete surface soil sampling indicated exceedances of the PALs for copper (up to 107 mg/kg), tin (up to 9.1 mg/kg), and lead (up to 543 mg/kg). The copper PAL was exceeded at one location, and the tin PAL was exceeded at two locations. The lead PAL was exceeded at most locations, but the human health criterion for residential exposure was exceeded at only two locations. The average lead concentration for this area was 222 mg/kg.

Target Berm 2

At Target Berm 2, results of the discrete surface soil sampling indicated exceedances of the PALs for tin (up to 10.1 mg/kg) and lead (up to 606 mg/kg). The tin PAL was exceeded at one location. The lead PAL was exceeded at all locations, and the human health criterion for residential exposure was exceeded at twelve of those locations. The average lead concentration for this area was 288 mg/kg.

Hillside Impact Area

At the Hillside Impact Area, results of the discrete surface soil sampling indicated exceedances of the PALs for antimony (up to 0.32 mg/kg), copper (up to 276 mg/kg), tin (up to 81.8 mg/kg), zinc (up to 60.3 mg/kg), and lead (up to 904 mg/kg for the FBL data and 2,363 mg/kg for the XRF predicted value). The antimony PAL was exceeded at one location, but results were determined to be consistent with

background. The copper PAL was exceeded at four locations, the tin PAL was exceeded at twelve locations, and the zinc PAL was exceeded at three locations. The lead PAL was exceeded at all locations except one, and the human health criterion for residential exposure was exceeded at 43 of those locations. The average lead concentration for surface soil in this area was 316 mg/kg.

Discrete subsurface soil sampling results indicated exceedances of PALs for copper (up to 849 mg/kg), tin (up to 139 mg/kg), zinc (up to 53.9 mg/kg), and lead (up to 6,620 mg/kg). The copper PAL was exceeded at two locations at 1 to 2 feet bgs, and one location at 2 to 3 feet bgs. The tin PAL was exceeded at two locations at 1 to 2 feet bgs, and one location at 2 to 3 feet bgs. The zinc PAL was exceeded at one location at 1 to 2 feet bgs. The lead PAL was exceeded at three locations at 1 to 2 feet bgs, and one location at 2 to 3 feet bgs. The average lead concentration for subsurface soil in this area was 2,990 mg/kg.

2.4.2 Old Skeet and Trap Range - UXO 15

Potential sources of contamination evaluated at UXO 15 included select metals (antimony, arsenic, copper, lead, tin, and zinc) resulting from bullet accumulations in soil throughout the range, and PAHs resulting from clay target accumulations in soil near the Firing Points and in the Shot Fall/Target Area. Surface soil near the Firing Points is also a potential source of nitroglycerin contamination as a result of incomplete consumption of propellant during firing activities.

Summary tables of analytical data collected during the SI are presented in Appendix A.2. For the discrete soil samples, the correlation between the on-site XRF and off-site FBL lead data was determined to be statistically acceptable. Consequently, an appropriate regression equation was derived, and the values predicted by this equation were used to supplement the analytical lead data for this site. The lead results, including both the reported FBL data and the predicted concentrations based on XRF results, are depicted on Figure 2-7. Analytical results that exceeded PALs for metals and/or PAHs are depicted on Figure 2-8. Statistical summaries of all detected contaminants are provided in Appendix B.2.

Firing Points

Results of the composite surface soil sampling conducted near the firing points indicated two exceedances of the PALs for antimony (up to 0.68 mg/kg), zinc (up to 54.4 mg/kg), and lead (up to 77.2 mg/kg). Lead concentrations were less than the human health criterion for residential exposure at both sampling locations. The average lead concentration for this area was 72 mg/kg.

Shot Fall/Target Area

Results of the discrete surface soil sampling conducted in the Shot Fall/Target Area indicated exceedances of the PALs for antimony (up to 4.8 mg/kg), zinc (up to 53.3 mg/kg), and lead (up to

940 mg/kg). The antimony PAL was exceeded at ten locations, and the zinc PAL was exceeded at one location. The lead PAL was exceeded at all locations, and the human health criterion for residential exposure was exceeded at ten of those locations. The average lead concentration for this area was 320 mg/kg.

Results of the discrete subsurface soil sampling conducted in this area indicated PAL exceedances only for lead, with all samples exceeding the PAL but no samples exceeding the human health criterion for residential exposure.

Results of the discrete surface soil sampling for seven carcinogenic PAHs were used to calculate benzo(a)pyrene (BaP) equivalent concentrations for comparison to EPA's RSLs for residential exposure. A threshold value of 150 µg/kg, which corresponds to a cancer risk management benchmark of 10^{-5} , was used to evaluate direct exposure to the calculated BaP equivalent concentrations in soil. Fourteen samples exceeded this threshold, with calculated BaP equivalent concentrations of up to 59,903 µg/kg.

2.4.3 Rum Point Skeet Range - UXO 16

Potential sources of contamination evaluated at UXO 16 included select metals (antimony, arsenic, copper, lead, tin, and zinc) resulting from bullet accumulations in surface soil at the Range Area and PAHs resulting from clay target accumulations in soil near the Firing Points and in the Shot Fall/Target Area. Surface soil near the Firing Points is also a potential source of nitroglycerin contamination as a result of incomplete consumption of propellant during firing activities.

Summary tables of analytical data collected during the SI are presented in Appendix A.3. For the discrete surface soil samples, the correlation between the on-site XRF and off-site FBL lead data was not statistically acceptable. Consequently, predicted laboratory values for lead were not computed, and the XRF data were considered usable for screening purposes only. The lead results (FBL data only) are depicted on Figure 2-9. Analytical results that exceeded PALs for metals and/or PAHs are depicted on Figure 2-10. Statistical summaries of all detected contaminants are provided in Appendix B.3.

Firing Points

Results of the composite surface soil sampling conducted near the firing points indicated one exceedance of the PAL for antimony (up to 0.42 mg/kg) and one for lead (up to 48.7 mg/kg). Lead concentrations were less than the human health criterion for residential exposure at both sampling locations. The average lead concentration for this area was 28.9 mg/kg.

Shot Fall/Target Area

Results of the discrete surface soil sampling conducted in the Shot Fall/Target Area indicated exceedances of the PALs for antimony (up to 1.6 mg/kg) and lead (up to 616 mg/kg). The antimony PAL was exceeded at several locations, but concentrations were determined to be consistent with background. The lead PAL was exceeded at all but one location, but the human health criterion for residential exposure was exceeded at only one location. The average lead concentration for this area was 90.9 mg/kg.

Results of the discrete surface soil sampling for seven carcinogenic PAHs were used to calculate BaP equivalent concentrations for comparison to EPA's Regional Screening Levels for residential exposure. Thirteen samples exceeded the threshold value of 150 µg/kg used to evaluate direct exposure, based on a cancer risk management benchmark of 10^{-5} . BaP equivalent concentrations of up to 4,111 µg/kg were calculated for samples in this area.

2.4.4 Small Arms (Pistol) Range - UXO 17

Potential sources of contamination evaluated at UXO 17 include select metals (antimony, arsenic, copper, lead, tin, and zinc) resulting from bullet accumulations in soil at the Firing Line Area and Target Area. Surface soil in the Firing Line Area is also a potential source of nitroglycerin contamination as a result of incomplete consumption of propellant during firing activities.

Summary tables of analytical data collected during the SI are presented in Appendix A.4. For the discrete surface soil samples, the correlation between the on-site XRF and off-site FBL lead data was not statistically acceptable. Consequently, predicted laboratory values for lead were not computed, and the XRF data were considered usable for screening purposes only. The lead results (FBL data only) are depicted on Figure 2-11. Analytical results that exceeded PALs for metals and/or nitroglycerin are depicted on Figure 2-12. Statistical summaries of all detected contaminants are provided in Appendix B.4.

Firing Line Area

In the Firing Line Area, results of the composite surface soil sampling indicated exceedances of the PALs for antimony (up to 1.3 mg/kg), nitroglycerin (up to 20.4 mg/kg), and lead (up to 200 mg/kg). The antimony PAL was exceeded at three locations, but concentrations were determined to be consistent with background. The nitroglycerin PAL was exceeded at three locations. Lead detections at all three locations were greater than the PAL but less than the human health criterion for residential exposure. The average lead concentration for this area was 86.6 mg/kg.

Target Area

In the Target Area, results of the discrete surface soil sampling indicated exceedances of the PALs for antimony (up to 6.0 mg/kg) and lead (up to 706 mg/kg). The antimony PAL was exceeded at five locations. The lead PAL was exceeded at eight locations, and the human health criterion for residential exposure was exceeded at five of those locations. The average lead concentration for surface soil in this area was 314 mg/kg.

Results of the discrete subsurface soil sampling indicated exceedances of the PALs for antimony (up to 1.0 mg/kg), tin (up to 1.5 mg/kg), and lead (up to 132 mg/kg). The antimony PAL was exceeded at five locations: two locations at 1 to 2 feet bgs, one location at 4 to 6 feet bgs, one location at 6 to 8 feet bgs, and one location at 8 to 10 ft bgs. However, the antimony results were determined to be consistent with background. The tin PAL was exceeded at one location at 1 to 2 feet bgs. The lead PAL was exceeded at seven locations, but the human health criterion for residential exposure was not exceeded at any location. The average lead concentration for subsurface soil in this area was 59.6 mg/kg.

2.4.5 Roach Road Rifle Range - UXO 25

Potential sources of contamination evaluated at UXO 25 include select metals (antimony, arsenic, copper, lead, tin, and zinc) resulting from bullet accumulations in soil at the Firing Line Area and Target Area. Surface soil in the Firing Line Area is also a potential source of nitroglycerin contamination as a result of incomplete consumption of propellant during firing activities.

Summary tables of analytical data collected during the SI are presented in Appendix A.5. For the discrete soil samples, the correlation between the on-site XRF and off-site FBL lead data was determined to be statistically acceptable. Consequently, an appropriate regression equation was derived, and the values predicted by this equation were used to supplement the analytical lead data for this site. The lead results, including both the reported FBL data and the predicted concentrations based on XRF results, are depicted on Figure 2-13. Analytical results that exceeded PALs for metals are depicted on Figure 2-14. Statistical summaries of all detected contaminants are provided in Appendix B.5.

Firing Line Area

In the Firing Line Area, results of the composite surface soil sampling indicated no exceedances of any PALs. The average lead concentration for this area was 9.4 mg/kg.

Target Area

In the Target Area, results of the discrete surface soil sampling indicated exceedances of the PALs for antimony (up to 12.2 mg/kg), copper (up to 370 mg/kg), zinc (up to 63.9 mg/kg), and lead (up to

3,450 mg/kg). The antimony PAL was exceeded at nine locations, the copper PAL was exceeded at two locations, and the zinc PAL was exceeded at one location. The lead PAL was exceeded at all locations, and the human health criterion for residential exposure was exceeded at six of those locations. The average lead concentration for surface soil in this area was 349 mg/kg.

2.5 STREAMLINED RISK EVALUATION

This section presents an overview of the human health and ecological risk screening evaluations conducted for the five SASRs.

2.5.1 Human Health Risk Screening Evaluation

A human health risk screening evaluation was conducted as part of the SI (Tetra Tech, 2010). This evaluation provided conservative estimates of potential risk posed to human receptors based on direct contact exposures to measured concentrations of MC in soil at the five SASRs. The tables presented in Appendix B document the selection of soil COPCs for individual subareas at the five SASRs and present the associated calculations of incremental lifetime cancer risks (ILCRs) for carcinogenic COPCs, calculations of non-cancer hazard indices (HIs) for non-carcinogenic COPCs, and comparisons of lead concentrations to EPA risk-based screening levels.

Results of the human health risk screening evaluation were used to identify contaminants of concern (COCs) for the five SASRs. A COPC was reclassified as a human health COC if it contributed to the exceedance of one or more of the following risk management benchmarks:

- ILCR for carcinogenic contaminants: 10^{-5} (equivalent to one excess cancer death in 100,000).
- HI for non-carcinogenic contaminants: 1 (unity).
- Average lead concentration: 400 mg/kg (corresponds to EPA's RSL for residential exposure).

In the evaluation of direct contact exposures to lead, hot spot areas were also considered in the identification of COCs. In subareas where the average lead concentration was less than 400 mg/kg, but one or more discrete locations exhibited evidence of a hot spot (i.e., lead concentration was greater than the non-residential screening level of 800 mg/kg), lead was identified as a COC.

MRR - UXO 14

Human health risk screening results are discussed below for direct exposure to COPCs in site soils based on the results of the Phase 1 SI at UXO 14. Tables documenting the risk screening calculations for this site are provided in Appendix B.1.

Firing Line Area

For the composite surface soil samples collected from the Firing Line Area, antimony, copper, and nitroglycerin were selected as COPCs for the human health risk screening evaluation. Using the maximum detected concentrations of COPCs in soil, the calculated risks for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 10^{-5} , and the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. Lead concentrations were less than both the residential and non-residential screening levels. Based on the results of the human health risk screening evaluation, no COCs are identified for this subarea.

Target Berm 1

For the discrete surface soil samples collected from Target Berm 1, copper and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentration of copper in soil, the calculated HIs for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (543 mg/kg) was greater than the residential direct contact screening level but less than the non-residential screening level. The average FBL lead concentration for this subarea (222 mg/kg) was less than both screening levels, indicating that lead does not pose a potential human health risk. Based on the results of the human health risk screening evaluation, no COCs are identified for this subarea.

Target Berm 2

For the discrete surface soil samples collected from Target Berm 2, copper and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentration of copper in soil, the calculated HIs for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (606 mg/kg) was greater than the residential screening level but less than the non-residential screening level. The average FBL lead concentration for this subarea (288 mg/kg) was less than both screening levels, indicating that lead does not pose a potential human health risk. Based on the results of the human health risk screening evaluation, no COCs are identified for this subarea.

Hillside Impact Area

For the discrete surface soil samples collected from the Hillside Impact Area, copper and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not

carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentration of copper in soil, the calculated HIs for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (904 mg/kg) was greater than both the residential and non-residential screening levels. The average FBL lead concentration for this subarea (316 mg/kg) was less than both screening levels; however, XRF data from numerous locations exceeded one or both screening levels, confirming the presence of hot spots. Thus, lead is considered a COC in the surface soil.

For the discrete subsurface soil samples collected from the Hillside Impact Area, copper and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentration of copper in soil, the calculated HIs for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (6,620 mg/kg) was greater than both the residential and non-residential screening levels. The average FBL lead concentration for this subarea (2,990 mg/kg) was also greater than both screening levels, confirming that lead poses a potential human health risk and, thus, should be considered a COC in the subsurface soil.

OSTR - UXO 15

Human health risk screening results are discussed below for direct exposure to COPCs in site soil based on results of the Phase 1 SI at UXO 15. Tables documenting the risk screening calculations for this site are provided in Appendix B.2.

Firing Points

For the composite surface soil samples collected from the Firing Points, antimony and nitroglycerin were selected as COPCs for the human health risk screening evaluation. Using the maximum detected concentrations in soil, the calculated risks for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 10^{-5} , and the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. Lead concentrations were less than both the residential and non-residential screening levels. Based on the results of the human health risk screening evaluation, no COCs are identified for this subarea.

Shot Fall/Target Area

For the discrete surface soil samples collected from the Shot Fall/Target area, antimony, lead, and a number of PAHs were selected as COPCs for the human health risk screening evaluation. Using the maximum detected concentrations of carcinogenic PAHs in soil, the calculated risks for direct contact

exposures for both residential and nonresidential land uses exceeded the EPA target level of 10^{-5} . Using the maximum detected concentration of antimony in soil, the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (940 mg/kg) was greater than both the residential and non-residential screening levels. The average FBL lead concentration for this subarea (320 mg/kg) was less than both screening levels; however, XRF data from three distinct areas exceeded one or both screening levels, confirming the presence of hot spots. Based on the results of the human health risk screening evaluation, six carcinogenic PAHs and lead are identified as COCs in the surface soil.

For the discrete subsurface soil samples collected from the Shot Fall/Target area, no contaminants met the COPC selection criteria. Consequently, no human health risk screening evaluation was conducted and, thus, no COCs are identified for the subsurface soil.

RPSR - UXO 16

Human health risk screening results are discussed below for direct exposure to COPCs in site soil based on results of the Phase 1 SI at UXO 16. Tables documenting the risk screening calculations for this site are provided in Appendix B.3.

Firing Points

For the composite surface soil samples collected from the Firing Points, antimony was the only COPC selected for the human health risk screening evaluation. Using the maximum detected concentration of antimony in soil, the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. Lead concentrations were less than both the residential and non-residential screening levels. Based on the results of the human health risk screening evaluation, no COCs are identified for this subarea.

Shot Fall/Target Area

For the discrete surface soil samples collected from the Shot Fall/Target Area, lead and a number of PAHs were selected as COPCs for the human health risk screening evaluation. Using the maximum detected concentrations of carcinogenic PAHs in soil, the calculated risks for direct contact exposures for both residential and non-residential land uses exceeded the EPA target level of 10^{-5} . Using the maximum detected concentration of non-carcinogenic PAHs in soil, the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. Based on the results of the human health risk screening evaluation, three carcinogenic PAHs are identified as COCs for this subarea.

One FBL lead concentration (616 mg/kg) was greater than the residential screening level but less than the non-residential screening level. The average FBL lead concentration for this subarea (90.9 mg/kg) was less than both screening levels. XRF data from two locations slightly exceeded the residential screening level but did not suggest the presence of hot spots. Due to the lack of statistically acceptable correlation between the XRF and FBL results for this site, conclusions based on XRF data are uncertain. However, based on the single FBL exceedance of the residential screening level and the apparent lack of hot spots, lead is not identified as a COC for this subarea.

SAPR - UXO 17

Human health risk screening results are discussed below for direct exposure to COPCs in site soils based on the results of the Phase 1 SI at UXO 17. Tables documenting the risk screening calculations for this site are provided in Appendix B.4. (Note: Due to the visible sloughing of soil from the face of the backstop berm in the Target Area, soil from 0 to 4 feet bgs was considered to be "surface soil" along the base of the berm.)

Firing Line Area

For the composite surface soil samples collected from the Firing Line Area, nitroglycerin was the only COPC selected for the human health risk screening evaluation. Using the maximum detected concentrations of nitroglycerin in soil, the calculated risks for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 10^{-5} . The calculated HI exceeded the EPA target level of 1 for residential land use but not for non-residential land use. Lead concentrations were less than both the residential and non-residential screening levels. Based on the results of the human health risk screening evaluation, only nitroglycerin is identified as a COC for this subarea.

Target Area

For the discrete surface soil samples collected from the Target Area, antimony and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentration of antimony in soil, the calculated HIs for residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (706 mg/kg) was greater than the residential screening level but not the non-residential screening level. The average FBL lead concentration for this subarea (314 mg/kg) was less than both screening levels. XRF data from several locations exceeded one or both screening levels, suggesting the possible presence of hot spots. However, due to the lack of statistically acceptable correlation between the XRF and FBL results for this site, conclusions based on XRF data are uncertain.

Based on the results of the human health risk screening evaluation, and considering the uncertainty associated with XRF results, lead is identified as a COC in the surface soil.

For the discrete subsurface soil samples collected from the Target Area, no contaminants met the COPC selection criteria. Consequently, no human health risk screening evaluation was conducted and, thus, no COCs are identified for the subsurface soil.

RRRR - UXO 25

Human health risk screening results are discussed below for direct exposure to COPCs in site soils based on the results of the Phase 1 SI at UXO 25. Tables documenting the risk screening calculations for this site are provided in Appendix B.5.

Firing Line Area

For the composite subsurface soil samples collected from the Firing Line Area, no contaminants met the COPC selection criteria. Consequently, no human health risk screening evaluation was conducted and, thus, no COCs are identified for this subarea.

Target Area

For the discrete surface soil samples collected from the Target Area, antimony, copper, and lead were selected as COPCs for the human health risk screening evaluation. These contaminants are not carcinogenic; thus, no cancer risk was calculated. Using the maximum detected concentrations of antimony and copper in soil, the calculated HIs for direct contact exposures for both residential and nonresidential land uses were less than the EPA target level of 1. The maximum FBL lead concentration (3,450 mg/kg) was greater than both the residential and non-residential screening levels. The average FBL lead concentration for this subarea (349 mg/kg) was less than both screening levels; however, XRF data from numerous locations exceeded one or both screening levels, confirming the presence of hot spots. Thus, lead is considered a COC in the surface soil.

2.5.2 Ecological Risk Screening Evaluation

An ecological risk assessment (ERA) screening was conducted as part of the SI (Tetra Tech, 2010). This evaluation provided conservative estimates of potential risk posed to ecological receptors based on direct contact and food chain exposures to measured concentrations of MC in soil at the five SASRs. The evaluation included a comparison of maximum measured concentrations to screening level and threshold toxicity values, as well as the calculation of ecological effects quotients (EEQs) for contaminants with concentrations that exceeded those values. For chemicals retained as COPCs based on maximum

exposure assumptions, the model input parameters were refined to reflect more realistic assumptions that focused the evaluation only on chemicals posing the greatest risk. Tables documenting the ERA screening for each site are included in Appendix C.

Results of the ERA screening were used to identify COPCs for each site and determine whether further information was necessary to fully evaluate ecological risk to site receptors. For soil contaminants, the assessment endpoints (i.e., site receptors) included terrestrial plants and invertebrates, as well as wildlife (e.g., mammals and birds). The conclusions of the ERA screening at each site are discussed below for each of these receptor groups.

MRR - UXO 14

Results of the ERA screening for UXO 14 indicate that potentially unacceptable risks may exist due to exposure of terrestrial plants, invertebrates, and/or wildlife to copper, lead, and tin in soil.

Terrestrial Plants and Invertebrates

Maximum concentrations exceeded the copper screening level for risk to invertebrates in surface soil from Target Berm 1, Target Berm 2, and the Hillside Impact Area samples; therefore, copper was retained as a soil COPC. Maximum XRF concentrations exceeded the lead screening level for risk to invertebrates in surface soil from the Hillside Impact Area samples; therefore, lead was retained as a soil COPC. Maximum copper and lead concentrations exceeded their respective screening levels for risk to plants in surface soil from Target Berm 1, Target Berm 2, and the Hillside Impact Area samples; therefore, copper and lead were retained as soil COPCs. Tin was retained as a COPC for plants from the Hillside Impact Area because maximum concentrations of tin exceeded the screening level in the discrete soil samples. Nitroglycerin was eliminated as a soil COPC for invertebrates and plants because it was infrequently detected.

Mammals and Birds

Copper and lead were retained as soil COPCs for terrestrial wildlife because these contaminants are related to site activities, and observed concentrations resulted in ecological effects quotients (EEQs) greater than 1.0 in the food chain model.

OSTR - UXO 15

Results of the ERA screening for UXO 15 indicate that potentially unacceptable risks may exist due to exposure of terrestrial plants, invertebrates, and/or wildlife to PAHs, nitroglycerin, antimony, and lead in soil.

Terrestrial Plants and Invertebrates

Several PAHs were detected at concentrations in soil that exceeded invertebrate and plant screening levels. Because of the high concentrations of the PAHs and their high frequency of detection, PAHs were retained as soil COPCs. Lead concentrations exceeded the screening level for risk to plants; therefore, lead was retained as a soil COPC. Nitroglycerin was not eliminated as a COPC for risks to plants and invertebrates because although toxicity data are not available, it was detected in the two composite soil samples.

Mammals and Birds

PAHs, antimony, and lead were retained as soil COPCs for terrestrial wildlife because these contaminants are related to site activities, and observed concentrations resulted in EEQs greater than 1.0 in the food chain model.

RPSR - UXO 16

Results of the ERA screening for UXO 16 indicate that potentially unacceptable risks may exist due to exposure of terrestrial plants and wildlife to lead in soil. Potential risks were acceptable for terrestrial invertebrates.

Terrestrial Plants and Invertebrates

Lead was retained as a soil COPC for terrestrial plants because it was detected at concentrations that exceeded the screening level.

Mammals and Birds

Lead was retained as a soil COPC for terrestrial wildlife because it is related to site activities, and observed concentrations resulted in EEQs greater than 1.0 in the food chain model.

SAPR - UXO 17

Results of the ERA screening for UXO 17 indicate that potentially unacceptable risks may exist due to exposure of terrestrial plants, invertebrates, and/or wildlife to nitroglycerin, antimony, and lead in soil.

Terrestrial Plants and Invertebrates

Nitroglycerin was retained as a soil COPC for terrestrial invertebrates and plants because it was detected in three samples and no screening levels were available. Lead was retained as a soil COPC for terrestrial plants because it was detected at concentrations that exceeded screening levels.

Mammals and Birds

Antimony and lead were retained as soil COPCs for terrestrial wildlife because these contaminants are related to site activities, and observed concentrations resulted in EEQs greater than 1.0 in the food chain model.

RRRR - UXO 25

Results of the ERA screening for UXO 25 indicate that potentially unacceptable risks may exist due to exposure of terrestrial plants, invertebrates, and/or wildlife to copper, antimony and lead in soil.

Terrestrial Plants and Invertebrates

Copper and lead were retained as soil COPCs for terrestrial invertebrates because they were detected at concentrations that exceeded screening levels. Antimony, copper, and lead were retained as soil COPCs for terrestrial plants because they were detected at concentrations that exceeded screening levels.

Mammals and Birds

Antimony and lead were retained as soil COPCs for terrestrial wildlife because these contaminants are related to site activities, and observed concentrations resulted in EEQs greater than 1.0 in the food chain model.

2.5.3 Conceptual Site Models

Based on results of the site characterizations and risk screening evaluations, the conceptual site models (CSMs) for the five SASRs were updated, as shown on Figures 2-15 to 2-19. The updated CSM figures illustrate the potential exposure sources, pathways, human and ecological receptors under both current and hypothetical future land uses for each site. Potential human and ecological risks are characterized for receptors exposed to the potentially contaminated environmental media where unacceptable human and/or ecological risks may exist.

2.6 CONCLUSIONS

Site-specific COCs have been identified for individual subareas of each site, as shown in Table 2-1, based on results of the risk evaluations presented in this EE/CA.

Table 2-1 Contaminants of Concern

Site	Subarea	COC ¹	
		Surface Soil	Subsurface Soil
MRR - UXO 14	Hillside Impact Area	Lead	Lead
OSTR - UXO 15	Firing Points/Target Area	PAHs	--
	NW Shot Fall Area	Lead	--
	NE Shot Fall Area	Lead	--
RPSR - UXO 16	Firing Points/Target Area	PAHs	--
SAPR - UXO 17	Firing Line Area	Nitroglycerin	--
	Target Area	Lead ²	--
RRRR - UXO 25	Target Area	Lead	--

¹ COCs include contaminants that are present at concentrations that pose unacceptable risks to potential human health and ecological receptors. Contaminants discussed in the text as COCs based on results of the ecological risk evaluation only are not included on this list of COCs, but are addressed in Section 3.4 and Appendix E.

² Due to the visible evidence of soil sloughing from the face of the backstop berm in the UXO 17 Target Area, "surface soil" was considered to be soil from 0 to 4 feet bgs along the base of the berm.

The COCs shown in Table 2-1, which are associated with historical site operations at the five SASRs, are present at concentrations that pose unacceptable risks to potential human health and ecological receptors. These risks must be mitigated to ensure long-term protectiveness and prevent potential migration of contaminants to adjacent properties.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

Removal action objectives are developed to guide the removal action and ensure that it complies with regulatory requirements. This section identifies the statutory limits, applicable or relevant and appropriate requirements (ARARs), RAOs, removal action scope, and proposed schedule that pertain to this removal action.

3.1 STATUTORY LIMITS ON REMOVAL ACTION

The Navy, as the lead agency for cleanup of the five SASRs, has determined that a NTCRA is the appropriate response to contaminated soils at these sites. This determination was based on the relatively stable condition of the sites and the available planning period prior to implementation of the response. The NCP (40 CFR 300.415) dictates statutory limits of \$2 million and 12 months for EPA fund-financed removal actions, with statutory exemptions for emergencies and actions consistent with the removal action to be taken. However, the removal action evaluated in this EE/CA will not be EPA fund-financed, and the Navy MRP does not impose prescribed limits on cost or duration of removal actions. Thus, no statutory limits apply.

3.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are used to develop criteria by which removal action objectives and removal action technologies can be established. The definition of ARARs, as presented in the NCP, is as follows:

- **Applicable** requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be considered as applicable requirements.
- **Relevant and appropriate** requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental laws that, although not applicable to a hazardous substance, a pollutant, a contaminant, a remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site so that their use is well suited to the particular site.

ARARs can include any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated federal standard, requirement, criterion, or limitation.

ARARs are classified into three broad categories, based on the manner in which they are applied during a removal action. These categories are as follows:

- Chemical-Specific: Chemical-specific ARARs are health or risk management-based numbers or methodologies that result in the establishment of numerical values for a given media that would meet the NCP “threshold criterion” of overall protection of human health and the environment. These requirements generally set protective cleanup concentrations for the chemicals of concern in the designated media, or set safe concentrations of discharge for remedial activity. Chemical-specific ARARs may be concentration-based cleanup goals (CGs) or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop removal objectives.
- Location-Specific: Location-specific ARARs are considered in view of natural or manmade site features. These ARARs are intended to limit activities within designated areas.
- Action-Specific: Action-specific ARARs pertain to the implementation of a given remedy. These ARARs control or restrict hazardous substance-related or pollutant-related activities. These controls are considered when specific removal activities are planned for a site.

In addition to ARARs, other regulations and guidance may be classified as "To Be Considered" (TBC). TBCs are non-promulgated, non-enforceable guidelines or criteria that may aid in the development and evaluation of removal action alternatives and in the establishment of CGs.

Presumptive remedies have been developed on the federal level as preferred technologies for common categories of sites. EPA's Office of Solid Waste and Emergency Response (OSWER) has developed a series of directives describing these remedies and anticipates their use at all appropriate sites except under unusual site-specific circumstances. While the OSWER directives are national in scope and do not take into account all possible regulatory requirements, presumptive remedies are expected to be carried out in accordance with federal and state ARARs.

Chemical-, location-, and action- specific ARARs for the five SASRs are discussed in the subsections that follow.

3.2.1 Chemical-Specific ARARs

This section presents the federal and state chemical-specific ARARs and TBC criteria that pertain to the removal action at the five SASRs. These ARARs and TBC criteria, which are summarized on Table 3-1, provide medium-specific guidance on "acceptable" or "permissible" concentrations of contaminants.

Regional Screening Levels (RSLs) for the protection of human health and impacts to groundwater from soil contaminants were developed by Oak Ridge National Laboratory (ORNL) under an Interagency Agreement with EPA. These concentrations are calculated for a Target Hazard Quotient (THQ) of 1.0 for non-carcinogenic effects and a Target Risk (TR) of 10^{-6} for carcinogenic effects. The primary use of RSLs is for chemical screening during baseline risk assessments. The RSL table should be used in the selection of COPCs for the purposes of quantitative risk assessment. The levels are not enforceable, nor do they have official status as guidance. EPA Region 3 stresses that these levels should generally not be used to: "(1) set cleanup or no-action levels at CERCLA sites or Resource Conservation and Recovery Act (RCRA) Corrective Action sites, (2) substitute for EPA guidance for preparing baseline risk assessments, or (3) determine if a waste is hazardous under RCRA." The RSL values are not typically used as cleanup levels. Rather, cleanup levels are determined on a case-by-case basis, in accordance with the criteria listed in the NCP.

According to EPA Region 3, RSLs would likely be protective as "no-action" levels or CGs if the following criteria are met on a site-specific basis:

- A single medium is contaminated
- A single contaminant contributes nearly all of the health risk
- Volatilization or leaching of that contaminant from soil is expected not to be significant
- The exposure scenarios used in the RSLs table are appropriate for the site
- The fixed risk levels used in the RSLs table are appropriate for the soil
- Risk to ecological receptors is expected not to be significant

Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (August 1994) recommends screening levels for lead in soil for residential land use (400 parts per million [ppm]), describes how to develop site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards at RCRA Corrective Action facilities for residential land use, and describes a plan for soil lead cleanup at CERCLA sites and RCRA Corrective Action Facilities that have multiple sources of lead. The guidance presumes that risks due to lead will be addressed through remediation using excavation to meet the CG.

3.2.2 Location-Specific ARARs

Location-specific ARARs may result in restrictions on removal action activities depending on the characteristics of a site or its immediate surroundings. The location-specific ARARs discussed in this section are summarized in Table 3-2.

The Endangered Species Act (16 USC 1531, 50 CFR 402, COMAR 08.03.08) is intended to protect and, if possible, restore species of animals and plants that are endangered or threatened with extinction. Section 7 of the Act requires all federal agencies undertaking a construction project to consult with the U.S. Department of Interior, the U.S. Fish and Wildlife Service, and/or the National Marine Fisheries Service to determine whether the action could jeopardize the continued existence of any threatened or endangered species or result in the destruction of critical habitat for such species. To ensure that no endangered species or threatened species inhabit the five SASRs, state natural resources officials should be consulted prior to performing the removal action.

Protection of Wetlands. Executive Order 11990 provides for consideration of wetlands during remedial actions. Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands and enhance the natural and beneficial values of wetlands. If no practicable alternative exists to a removal action that may adversely affect a wetland, impacts from implementation of the remedy must be mitigated. 44 CFR 9 contains U.S. Department of Homeland Security policy for implementing the provisions of Executive Order 11990. Wetlands could be affected by activities at UXO 14 and UXO 16.

Floodplain Management. Executive Order 11988 requires federal agencies to develop procedures that consider potential flood hazards and floodplain management criteria when undertaking a project in a floodplain area and to avoid floodplain impacts to the fullest extent possible. Some areas of UXO 14 and UXO 15 are located in the 100-year floodplain.

National Historic Preservation Act (16 USC 470, 36 CFR 800). This Act is intended to preserve sites with archaeological and historic significance. Section 106 of the Act requires consultation with appropriate agencies to identify historic properties potentially affected by the site activities, assess the effects, and seek ways to avoid, minimize, or mitigate adverse effects on historic properties. Some areas of UXO 14, UXO 15, UXO 16, and UXO 17 overlap with archaeologically significant areas.

Migratory Bird Treaty Act (16 USC 703-712). This Act is intended to protect birds that have common migration patterns among the United States, Canada, Mexico, Japan, and the former Soviet Union. The Act makes it illegal to "kill...any migratory bird," or disturb nests or eggs, except as permitted by the Act. The Act also controls the harvest of such birds by establishing hunting seasons, bag limits, and methods

of harvest. To determine whether any birds and nesting areas are present, site surveys should be conducted prior to commencing removal activities.

The Bald and Golden Eagle Protection Act (16 USC 668) requires project activities to protect and preserve eagle habitat. Bald eagles have been observed at and near NSF-IH and Stump Neck Annex. Appropriate actions should be taken during removal activities to ensure that no eagles or their habitat are affected. Site surveys should be conducted prior to commencing removal activities to determine whether any bald eagles or potential nesting areas are present.

Fish and Wildlife Coordination Act (16 USC 661). This Act is intended to ensure that fish and wildlife conservation receives consideration and is coordinated with water resource development programs through planning, development, maintenance, and coordination of wildlife conservation and rehabilitation. The Act applies wherever the waters of any stream or other body of water greater than or equal to 4 hectares (10 acres) in surface area are proposed or authorized to be controlled or modified for any purpose by any U.S. Department or Agency or any public or private agency under federal permit or license. Due to the proximity of UXO 14 and UXO 15 to surface water bodies, the potential for impacts to fish and wildlife should be considered prior to commencing removal activities.

Chesapeake and Coastal Program would reduce the environmental impacts of coastal development, resolve significant conflicts between competing coastal uses and provide critical assistance to local governments in coastal planning and resource protection. Maryland has defined an area within which strict land use management is needed to protect the Chesapeake Bay. The critical area is defined as a 1,000-foot wide strip of land surrounding the bay and its tidal tributaries. Most construction within 100 feet of the Mean High Water Line (buffer) is prohibited.

3.2.3 Action-Specific ARARs

Action-specific ARARs may set controls or restrictions on particular types of activities considered as part of the removal action. The action-specific ARARs discussed in this section are summarized in Table 3-3.

National Pollutant Discharge Elimination System (NPDES) permit requirements (40 CFR 122, COMAR 26.08.02) governs the discharge of pollutants from any point source into U.S. waters. It may be necessary for removal actions to control and manage storm water during construction activities (including clearing, grading, and excavating) that result in land disturbance of equal to or greater than one acre.

Management of Remediation Waste Under RCRA - Area of Contamination Policy (EPA 530-F-98-026) allows wastes to be consolidated and treated in-situ within an Area of Contamination (AOC) without triggering RCRA waste management, land disposal restrictions, or minimum technology requirements.

An AOC would be defined for each site so that contaminated soil can be consolidated within the site boundaries prior to characterization, then treated in-situ (if necessary) prior to off-site disposal.

MDE Hazardous Waste Management System (COMAR 26.13.01-26.13.05) include requirements for generators, transporters, or owners or operators of treatment, storage, or disposal facilities. COMAR 26.13.02 identifies those solid wastes that are subject to regulation as hazardous wastes. COMAR 26.13.03 provides standards for generators of hazardous waste who treat, store, or dispose of hazardous wastes on-site. COMAR 26.13.05 provides standards for hazardous waste TSD facilities.

MDE Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities - Military Munitions (COMAR 26.13.10.27) identify when military munitions become solid waste and, if hazardous, how they are managed. Munitions found on a range may be consolidated within the range boundaries prior to characterization and off-site disposal.

MDE General Emission Standards, Prohibitions, and Restrictions (COMAR 26.11.06) provide standards for visible emission and particulate matter. Fugitive emissions and particulate matter from excavation, loading, stockpiling, and backfilling must be controlled.

Maryland Erosion and Sedimentation Control (COMAR 26.17.01) provides minimum standards for reducing losses from erosion and sedimentation during earth-moving activities. Basic controls and site stabilization measures must be taken when a project involves filling, displacing, or exposing earthen material. These regulations are applicable to all earth-moving activities (e.g., excavation, stockpiling, backfilling with clean borrow soils, etc.) that may be part of the removal action.

3.3 REMOVAL ACTION OBJECTIVES

The RAOs for the removal action at the five SASRs are as follows:

- Mitigate potential human health risks due to direct exposure to lead, PAHs, and nitroglycerin contamination in soil;
- Mitigate the potential erosion of contaminated soil, transport of contaminants, and subsequent exposure; and
- Ensure that post-removal action conditions provide an acceptable level of protection for ecological receptors against direct exposure and exposure via the food chain to lead, collocated metals, nitroglycerin, and PAHs in soil.

The objectives can be met by removal of the contaminated soils from each site.

3.4 REMOVAL ACTION SCOPE

The Navy's objective is unrestricted land use at the five SASRs. Cleanup goals were developed for the soil COCs based on chemical-specific ARARs (see Table 3-1) with a consideration of background concentrations derived for the NSF-IH installation in 2002 (Tetra Tech, 2002). In addition, the Partnering Team agreed that the CGs for carcinogenic COCs should reflect a cancer risk threshold of 10^{-5} , which is the midpoint of the EPA acceptability range of 10^{-4} to 10^{-6} . Table 3-4 presents the resulting contaminant-specific soil CGs for the five SASRs.

The scope of this removal action is to remove the lead-, PAH-, and nitroglycerin-contaminated soils that exceed CGs at each subarea of the five SASRs. For PAHs and nitroglycerin, the removal scope includes all areas where soil concentrations measured during the SI were greater than the CGs. This is consistent with the methodology used to evaluate human health risks for these contaminants, and ensures that all soils posing unacceptable risk due to exposure to PAHs and nitroglycerin are removed.

To determine the necessary removal action scope for lead-contaminated soils, however, arithmetic mean lead concentrations were used. This is consistent with the methodology used to evaluate both human health and ecological risks due to exposure to lead (and collocated metals). Of the individual subareas at each of the five sites, only the Hillside Impact Area at UXO 14 exhibited an average lead concentration in surface soils that exceeded the EPA threshold for residential land use (i.e., 400 mg/kg), indicating that soil from this subarea must be remediated for lead. In addition, the non-homogeneous distribution of lead associated with bullet accumulations and the observed presence of lead hot-spots within the Target Areas of UXO 15, UXO 17, and UXO 25 (i.e., discrete locations where lead concentrations exceeded 800 mg/kg), indicate that these subareas must also be remediated for lead.

The CGs for lead, PAHs, and nitroglycerin were used to define the initial limits of excavation at the five SASRs based on the soil data collected during the SI. Figures 2-4, 2-5, and 2-6 show the initial limits of excavation at UXO 14 (Marine Rifle Range); Figures 2-7 and 2-8 show the initial limits of excavation at UXO 15 (Old Skeet and Trap Range); Figures 2-9 and 2-10 show the initial limits of excavation at UXO 16 (Rum Point Skeet Range); Figures 2-11 and 2-12 show the initial limits of excavation at UXO 17 (Small Arms [Pistol] Range); and Figures 2-13 and 2-14 show the initial limits of excavation at UXO 25 (Roach Road Rifle Range). Actual limits of excavation may be revised during the removal action, as necessary to ensure that confirmation sampling results demonstrate attainment of the CGs.

The initial limits of excavation were used to estimate the quantities of soil that must be removed at each site to meet the specified CGs. Estimated soil quantities designated for removal are summarized in Table 3-5. The assumptions and calculations that provide the basis for these quantities are presented in

Appendix D. It is estimated that a total of 8,809 cubic yards (cy) (equivalent to 13,081 tons) of contaminated soil will be excavated during the removal action.

The RAOs described in Section 3.3 will be achieved through removal of contaminated soil from within the initial limits of excavation and replacement with clean backfill that contains background concentrations of contaminants. By removing soil that exceeds the CGs, potential human health risks will be mitigated; and by removing contaminated soil permanently from the sites, the potential for future migration of contaminants and subsequent exposure will be mitigated. By replacing contaminated soil with clean backfill, site conditions following the completion of the removal action will provide an acceptable level of protection for ecological receptors, as described in the Post-Removal Action Ecological Risk Evaluation presented in Appendix E.

3.5 REMOVAL ACTION SCHEDULE

This EE/CA will be placed in the Administrative Record, and notice of its availability for public review will be published in local newspapers along with a brief summary of its contents. The EE/CA will then be subjected to a 30-day public comment period. A public information session will be held during or immediately following the public comment period, if requested. If significant comments are received, a Responsiveness Summary will be prepared and attached to the Action Memorandum, which will be included in the NSF-IH Administrative Record. Following the finalization of the EE/CA and Action Memorandum, the Remedial Action Work Plan (RAWP) will be prepared.

Since this removal action has been designated non-time-critical, the start date is dependent on factors other than the urgency of the threat, including the time necessary to receive regulatory approval and public review of the EE/CA, the availability of adequate funding and contracting capacity, and the time required to develop and receive approval of the RAWP. Once the planning process is complete, the removal action can be implemented. Section 4 of this EE/CA identifies two alternatives that can be implemented to achieve the removal action objectives. The preferred alternative (Alternative 3) will require approximately 5 months to complete at all five sites. Because this alternative permanently removes all soil that poses an unacceptable risk, no follow-on actions such as long-term administrative controls or operation and maintenance activities are necessary.

A formal project schedule will be developed as part of the removal action decision document (i.e., Action Memorandum) and RAWP.

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section identifies general response actions applicable to the five SASRs and describes the development and evaluation of specific alternatives based on these actions that could be implemented to achieve the removal action objectives presented in Section 3.

4.1 GENERAL RESPONSE ACTIONS

General response actions are broad classes of responses or remedies that can be applied to meet the stated RAOs. Each action is intended to address specific constituents and possible migration pathways. Although an individual action may be capable of meeting a particular objective, combinations of actions may be more cost-effective in meeting all of the objectives.

The general response actions listed below were identified as being potentially applicable for the lead-, PAH-, and nitroglycerin-contaminated soils at the five SASRs:

- Excavation of contaminated soil
- Disposal of excavated waste
- Treatment of characteristic waste

As shown in Table 4-1, other response actions were considered for applicability to these sites. However, only technologies that contribute toward the Navy's objective of unrestricted land use were retained for evaluation in the EE/CA. General response actions that could be used to address the COCs identified for these sites but that would not achieve the goal of unrestricted release (e.g., institutional controls, source containment, on-site disposal) were rejected during the screening process and are not components of the removal action alternatives evaluated.

4.2 DEVELOPMENT OF ALTERNATIVES

Based on the general response actions retained during the screening process (see Table 4-1), the following three removal action alternatives have been developed for the five SASRs:

- Alternative 1: No Action
- Alternative 2: Excavation and Off-Site Disposal
- Alternative 3: In-Situ Treatment, Excavation, and Off-Site Disposal

These alternatives are described below.

4.2.1 Alternative 1 - No Action

Alternative 1 consists of no action. As outlined in CERCLA guidance (EPA, 1988), when developing removal alternatives, the “no action” response is evaluated to provide a comparative baseline against which other alternatives can be assessed. Under this alternative, the contaminated media would be left in place, without the application of land use controls (e.g., deed restrictions), construction of access controls (e.g., physical barriers), or implementation of containment, removal, treatment, or other mitigation measures to reduce the potential for future exposure to site contaminants. Because no removal action would be implemented, site conditions would be unchanged and long-term risks due to exposure to site contamination would remain the same as described in Section 2.5.

4.2.2 Alternative 2 - Excavation and Off-Site Disposal

Alternative 2 would involve the excavation of lead-, PAH-, and nitroglycerin-contaminated soils from the five SASRs followed by the off-site disposal of excavated wastes at appropriate disposal facilities. This alternative consists of the following major components: site preparation, UXO escort, cultural resources escort, waste characterization, soil excavation, confirmation sampling, off-site waste disposal, and site restoration. Prior to the commencement of work, a RAWP would be developed that would include details of the removal action design along with a Health and Safety Plan (HASP), Sampling and Analysis Plan (SAP), and Erosion and Sediment Control Plan (ESCP). In addition, the Comprehensive Work Approval Process (CWAP) would be completed to ensure that potential interactions with installation resources are considered and that work activities are coordinated with and approved by the appropriate installation contacts.

Site Preparation

Site preparation includes mobilization and setup of support facilities, utility clearance surveys, vegetation removal, temporary road construction, and establishment of soil erosion and sediment controls. Equipment and support facilities (e.g., excavators, loaders, office trailer, storage containers, sanitary facilities, etc.) would be mobilized to the site and set up or staged at approved locations. Utility clearance surveys, vegetation removal, and temporary road construction would be conducted where necessary to expose or provide access to the areas marked for excavation (see Figures 2-4 to 2-14). At UXO 14 and UXO 25, which are densely forested, trees 4 inches in diameter or greater (at 4.5 feet above the ground surface) would be left in place to maintain the structural stability of the sloped areas and to preserve significant ecological habitat. Grubbing of root systems associated with the smaller vegetation would be performed incidental to the excavation of contaminated soil from the indicated areas.

Erosion and sediment control measures would be established to ensure that soil disturbance activities do not adversely impact downgradient surface water bodies, floodplains, tidal marshes, or wetlands. During

vegetation clearance, road construction, soil excavation and stockpiling, waste loading, backfilling, and re-grading operations, erosion and sediment controls would be regularly inspected and maintained until excavation and backfilling is complete and the site vegetation is re-established. An ESCP would be prepared as part of the RAWP, in accordance with the substantive requirements of Maryland Standards and Specifications for Soil Erosion and Sediment Control (MDE, 2011).

UXO Avoidance Escort and Construction Support

At UXO 14 and UXO 15, UXO avoidance and construction support procedures are required during intrusive activities because these sites are located within the estimated firing fan of the Valley Impact Area and, thus, may contain MEC in the surface or subsurface soils. A qualified UXO technician must be present during all intrusive activities to conduct avoidance surveys and ensure that any MEC encountered are managed safely and appropriately. Based on past observations at these sites, it is anticipated that there is a low likelihood of encountering MEC during work activities and, thus, that Naval Ordnance Safety and Security Activity (NOSSA) would approve of the work being conducted using UXO avoidance and construction support only, under an approved Explosives Safety Submission Determination Request.

Cultural Resources Escort

Portions of UXO 14, UXO 15, UXO 16, and UXO 17 have been identified as Cultural Resources Protection Areas, where items of archaeological or cultural significance have been identified previously in subsurface materials. Thus, the State Historic Preservation Office (SHPO) must be consulted prior to the commencement of work, and the NSF-IH Cultural Resources Program Manager or qualified archeologist meeting the Secretary of the Interior standards must be present to observe excavation activities at these sites to ensure that any archeological artifacts encountered are properly documented and managed.

Waste Characterization

Soils designated for removal would be characterized prior to excavation to facilitate planning for the appropriate disposition of excavated waste. Approximately 10 samples (at least one per 1,500 tons) would be collected and analyzed for the full toxicity characteristic leaching procedure (TCLP) waste characterization suite. Approximately 20 samples (at least one per 200 tons) would be collected from areas designated for removal due to lead contamination and analyzed for TCLP lead only. Details of the waste characterization sampling program would be described in the SAP prepared as part of the RAWP.

Based on the SI results, it is anticipated that the PAH- and nitroglycerin-contaminated soil would be classified as non-hazardous waste. In the absence of site-specific TCLP data, it is estimated that 80 percent of the lead-contaminated soil would be classified as hazardous waste due to lead toxicity and that the remainder would be classified as non-hazardous waste.

Soil Excavation

Contaminated soil would be excavated from within the removal area boundaries shown on Figures 2-4 through 2-14. The corresponding removal depths and soil quantity estimates for each site are presented in Appendix D and summarized below.

Lead-Contaminated Soil: The total in-situ volume of lead-contaminated soil designated for removal would be approximately 2,565 cy. Lead-contaminated soil would be excavated from each site as follows:

MRR - UXO 14: Approximately 1,817 cy of soil would be excavated to a depth of 1 to 2 feet bgs at the Hillside Impact Area. The initial excavation limits are shown on Figures 2-4, 2-5, and 2-6.

OSTR - UXO 15: Approximately 526 cy of soil would be excavated to a depth of 1 foot bgs in discrete regions of the Shot Fall Area represented by SI Sample Locations X15SB064, X15SB013, and X15SB074. The initial excavation limits are shown on Figures 2-7 and 2-8.

SAPR - UXO 17: Approximately 178 cy of soil would be excavated to a depth of 1 foot bgs in regions of the Target Area represented by SI Sample Locations X17SB013 and X17SB014, and to a depth of 4 feet bgs in a region of the Target Area represented by SI Sample Locations X17SB004 and X17SB0005. The initial excavation limits are shown on Figures 2-11 and 2-12.

RRRR - UXO 25: Approximately 44 cy of soil would be excavated to a depth of 1 to 2 feet bgs at a region of the Target Area represented by SI Sample Locations X25SB019 and X25SB020. The initial excavation limits are shown on Figures 2-13 and 2-14.

PAH-Contaminated Soil: The total in-situ volume of PAH-contaminated soil designated for removal would be approximately 5,841 cy. PAH-contaminated soil would be excavated from each site as follows:

OSTR - UXO 15: Approximately 2,551 cy of soil would be excavated to a depth of 2 feet bgs in a region of the Shot Fall/Target Area represented by SI Sample Locations X15SB038 and X15SB053. The initial excavation limits are shown on Figures 2-7 and 2-8.

RPSR - UXO 16: Approximately 3,290 cy of soil would be excavated to a depth of 1 to 2 feet bgs in a region of the Target Area represented by SI Sample Locations X16SB056 and X16SB076. The initial excavation limits are shown on Figures 2-9 and 2-10.

Nitroglycerin-Contaminated Soil: The total in-situ volume of PAH-contaminated soil designated for removal would be approximately 403 cy. Nitroglycerin-contaminated soil would be excavated as follows:

SAPR - UXO 17: Approximately 403 cy of soil would be excavated to a depth of 1 foot bgs at the Firing Line Area. The initial excavation limits are shown on Figures 2-11 and 2-12.

Excavation operations would be performed by qualified excavation personnel with current Hazardous Waste Operations and Emergency Response (HAZWOPER) training, as required by the Occupational Health and Safety Administration (OSHA). Standard dust control techniques would be used during removal activities to mitigate fugitive dust emissions. The HASP submitted as part of the RAWP would specify the dust suppression techniques, air monitoring requirements, and action levels necessary to ensure worker safety, as well as the site access controls necessary to prevent members of the public from being exposed to contamination during removal operations.

Confirmation Sampling

Confirmation samples would be collected from the bottoms and sidewalls of each excavation area and analyzed for COCs to verify that relevant CGs have been met. Based on the confirmation sampling results, additional excavation would be conducted, as necessary, to remove residual soil that exceeds CGs. The confirmation sampling program would be described in the SAP prepared as part of the RAWP.

To expedite decision-making in the field, the lead confirmation sampling program may include the use of field screening using portable XRF instrumentation. This technology can provide nearly real-time field measurements of lead for use in determining whether additional excavation is necessary. The use of XRF can provide significant savings of time and cost relative to laboratory analyses because decisions regarding the need for additional excavation can be made within a few hours rather than a few days following removal of soil from within the initial excavation boundaries. To provide defensible documentation of removal action completeness, confirmation samples collected from the final excavation boundaries would be sent to the FBL for analytical testing upon meeting the lead CG through field screening.

Waste Disposal

Excavated waste would be containerized and transported off-site to an appropriate waste disposal facility. Hazardous waste would be transported to a RCRA Subtitle C (i.e., permitted) facility, and non-hazardous waste would be transported to a Subtitle D landfill.

Based on results of the SI, it is estimated that the following quantities of waste would require disposal:

Lead-Contaminated Soil: The total weight of lead-contaminated soil to be disposed off-site would be approximately 3,810 tons. Soil with TCLP lead concentrations greater than 5.0 milligrams per liter (mg/L)

(based on waste characterization sampling results) would be classified as hazardous waste based on lead toxicity and, thus, would be subject to special transportation and disposal requirements. In the absence of site-specific TCLP data, it is estimated that 80 percent (3,048 tons) would be classified as hazardous waste and need to be disposed at a Subtitle C facility, and that 20 percent (762 tons) would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

PAH-Contaminated Soil: The total weight of PAH-contaminated soil to be disposed off-site would be approximately 8,673 tons. It is estimated that the entire amount would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

Nitroglycerin-Contaminated Soil: The total weight of nitroglycerin-contaminated soil to be disposed off-site would be approximately 598 tons. It is estimated that the entire amount would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

Site Restoration

After confirming that the project CGs have been achieved, the excavated areas would be backfilled with clean material derived from an off-site borrow source. The backfill material would meet prescribed specifications for chemical constituents (e.g., NSF-IH background concentrations) and structural stability, as certified through laboratory analysis. The excavated areas would be backfilled and re-graded to the approximate original contours, ensuring appropriate site drainage. The backfilled areas would be compacted, as necessary, to ensure slope stability and covered with 6 inches of clean topsoil. All disturbed areas would be re-vegetated and covered with straw to minimize erosion until vegetation is sufficiently re-established.

4.2.3 Alternative 3 - In-Situ Treatment, Excavation, and Off-Site Disposal

Alternative 3 incorporates all components of Alternative 2 except for the off-site disposal of hazardous waste. Under Alternative 3, lead-contaminated soils that exceed EPA's TCLP criterion for lead toxicity would be chemically treated in-situ to stabilize the leachable lead, and all lead-, PAH-, and nitroglycerin-contaminated soils would be excavated and disposed off-site as non-hazardous waste. Contaminated soil would be excavated from within the removal area boundaries shown on Figures 2-4 through 2-14. The corresponding removal depths and soil quantity estimates for each site, which are the same as those estimated for Alternative 2, are presented in Appendix D.

The following major components of Alternative 2, as described in Section 4.2.2, would also apply to Alternative 3: site preparation, UXO escort, cultural resources escort, waste characterization, soil excavation, confirmation sampling, and site restoration. Under Alternative 3, however, a waste treatment component would be added to the process, and the waste disposal component would be revised, as

described below. As with Alternative 2, the planning and design process for Alternative 3 would consist of the preparation of a RAWP (including a HASP, SAP, and ESCP), as well as completion of the CWAP.

Waste Treatment

Lead-contaminated soils with TCLP lead concentrations greater than 5.0 mg/L (based on waste characterization sampling results) would be treated prior to removal to stabilize the leachable lead and render it non-hazardous. Under EPA's Area of Contamination (AOC) Policy (EPA, 1998), remediation wastes may be consolidated and treated within an AOC without triggering land disposal restrictions or minimum technology requirements normally associated with RCRA waste management. To maximize cost-effectiveness, Alternative 3 would be designed in a manner consistent with the AOC Policy, specifying consolidation (if necessary) and in-situ treatment of lead-contaminated soils within each AOC rather than excavation and ex-situ treatment at a centralized RCRA-compliant treatment area.

In the absence of site-specific TCLP data, it is estimated that 80 percent (3,048 tons) of the lead-contaminated soil would be classified as hazardous waste and, thus, would require treatment prior to removal from the AOC. The most commonly used in-situ treatment technology for lead-contaminated soils is chemical stabilization. This technology has been widely tested and successfully implemented at numerous remediation sites and is considered a reliable treatment technology for rendering lead-contaminated soils non-hazardous. Chemical stabilization converts leachable lead into insoluble minerals and mixed mineral forms, thereby minimizing the ability of lead to mobilize in the environment.

For the purposes of developing a cost estimate for this alternative, the treatment process is assumed to be chemical stabilization through the application of Maectite[®], a phosphate-based liquid reagent that binds leachable lead in soil within 3 to 5 hours (Sevenson, 1999 and 2012). This reagent can be applied in-situ and mechanically blended, as necessary, using traditional earth-moving equipment (e.g., excavator) to ensure complete contact with the contaminated soil. Once the chemical reaction is complete, the resulting mixture can be managed as non-hazardous waste and stockpiled or loaded directly into containers for transport to a Subtitle D landfill.

The waste treatment process requires that a treatability study be conducted prior to implementation to determine the optimal ratio of reagent-to-soil necessary to meet the treatment goal of 5.0 mg/L. The treatability study would be conducted using representative site soils and various proportions of reagent to ensure that the treatment design can consistently render the waste non-hazardous. Once the proper proportions are determined and treatment process is underway, waste composite samples would be collected from a representative portion of the treated soils to verify compliance with the waste facility acceptance criteria. The waste verification sampling program would be described in the SAP prepared as part of the RAWP.

Waste Disposal

Excavated waste would be containerized and transported off-site to an appropriate waste disposal facility. Since all lead-contaminated soils that exceed EPA's TCLP criterion for lead toxicity would be chemically treated in-situ to stabilize the leachable lead prior to removal, no hazardous waste would be generated or require transport and disposal at a RCRA Subtitle C (i.e., permitted) facility. All waste generated during the removal action would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

Based on results of the SI, it is estimated that a total of 13,081 tons of lead-, PAH-, and nitroglycerin-contaminated waste would require disposal, as follows:

Lead-Contaminated Soil: The total weight of lead-contaminated soil to be disposed off-site would be approximately 3,810 tons. Soil with TCLP lead concentrations greater than 5.0 mg/L would be treated on-site prior to loading. It is anticipated that the entire combined weight of lead-contaminated soil (3,048 tons treated and 762 tons untreated) would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

PAH-Contaminated Soil: The total weight of PAH-contaminated soil to be disposed off-site would be approximately 8,673 tons. It is anticipated that the entire amount would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

Nitroglycerin-Contaminated Soil: The total weight of nitroglycerin-contaminated soil to be disposed off-site would be approximately 598 tons. It is anticipated that the entire amount would be classified as non-hazardous waste suitable for disposal at a Subtitle D landfill.

4.3 EVALUATION CRITERIA

As specified in EPA guidance (EPA, 1993), the following evaluation criteria were used in evaluating the removal action alternatives for the five SASRs:

- Effectiveness: Short-term and long-term protection of human health and the environment, compliance with ARARs, the degree of protection achieved, the degree of contaminant destruction or immobility achieved, and the reliability and performance of the chosen alternative.
- Implementability: The degree of difficulty of implementation, associated risks and limitations, feasibility, and the limitations of the technology process. Implementability includes technical feasibility, administrative feasibility, and availability of services.

- Cost: Removal action costs including capital, operations and maintenance, and monitoring costs, if required.

4.4 DETAILED EVALUATION OF ALTERNATIVES

The three removal action alternatives were evaluated for the five SASRs on the basis of effectiveness, implementability, and cost, as described below.

4.4.1 Alternative 1 - No Action

Effectiveness

The “No Action” response would not achieve the long-term removal action objectives necessary for the protection of human health and the environment at the five SASRs. If contaminated soils are not removed, contaminants may migrate to surrounding sediments and surface soils, or to underlying groundwater and subsurface soils, thereby increasing risk to potential human and ecological receptors. This alternative would not comply with ARARs and would not reduce either the volume or mobility of contamination. Taking no action would not meet the specified RAOs for the five SASRs.

Implementability

The “No Action” alternative is immediately and easily implementable. No implementability concerns exist.

Cost

No costs are associated with this alternative.

4.4.2 Alternative 2 - Excavation and Off-Site Disposal

Effectiveness

The effectiveness of Alternative 2 is moderately high. This alternative provides long-term protection to human health and the environment by achieving the stated RAOs, although it does not fully satisfy the regulatory preference for treatment to permanently and significantly reduce toxicity, mobility, or volume of contaminated materials. All lead-, PAH-, and nitroglycerin-contaminated soils with concentrations greater than their respective CGs would be excavated and containerized for transportation and off-site disposal. This alternative would be designed and implemented in a manner that complies with the chemical-specific, location-specific and action-specific ARARs. Contaminated soil would be permanently removed, thereby eliminating unacceptable risks and minimizing the potential for future contaminant migration at the five SASRs. Unrestricted land use would be achieved following implementation of this alternative.

The high long-term effectiveness of this alternative is partially offset by the introduction of short-term risks to site workers, waste transporters, and members of the public located near waste transportation routes. Due to the generation, handling, and transportation of hazardous waste, there would be short-term occupational risks to workers involved in the excavation, loading, and transportation of contaminated waste. However, risks to site workers could be mitigated through the use of standard personal protective equipment, conventional dust suppression techniques, and site health and safety monitoring. Risks to waste transporters and members of the public could be mitigated through compliance with U.S. Department of Transportation (DOT), state, and local requirements for shipment of hazardous materials, including proper containerization, placarding, and manifesting procedures.

Implementability

Alternative 2 is easy to implement. No significant engineering, administrative, or construction difficulties are anticipated, although coordination with appropriate federal, state, and local agencies would be required. The labor, equipment, and materials necessary to implement this alternative are conventional and readily available. Multiple general and specialized contractors have the capability to perform the activities specified for this alternative, and disposal facilities permitted to accept contaminated soils classified as either hazardous or non-hazardous are available. The most significant challenge to implementability for this alternative is the need to remove vegetation and soil from the steep slopes at UXO 14 and UXO 25 without jeopardizing slope stability or causing undue erosion. However, this can be accomplished through careful application of field techniques and adequate erosion controls.

Cost

To develop a detailed cost analysis for Alternative 2, the required expenditures were estimated in terms of capital costs to complete the construction activities. There are no recurring costs (i.e., for institutional controls or operation and maintenance) associated with the removal alternative. Cost estimates for individual line items are based on quotations from potential vendors and subcontractors, engineering estimates, recent project experience on similar Navy projects, and values published by R.S. Means (R.S. Means, 2012). If implemented, the actual cost of Alternative 2 would depend on the final scope and design parameters presented in the RAWP, the schedule for implementation, competitive market conditions, actual scale weights of waste disposed, and other variables.

The cost of Alternative 2 (Excavation and Off-Site Disposal) is estimated to be approximately \$4,210,900. A detailed breakdown of costs for this alternative is presented in Appendix F.

4.4.3 Alternative 3 - In-Situ Treatment, Excavation, and Off-Site Disposal

Effectiveness

The effectiveness of Alternative 3 is high. This alternative provides long-term protection to human health and the environment by achieving the stated RAOs, and it satisfies the regulatory preference for treatment to permanently and significantly reduce toxicity, mobility, or volume of contaminated materials. All lead-, PAH-, and nitroglycerin-contaminated soils with concentrations greater than their respective CGs would be treated (as necessary), excavated, and containerized for transportation and off-site disposal. This alternative would be designed and implemented in a manner that complies with the chemical-specific, location-specific and action-specific ARARs. Contaminated soil would be permanently removed, thereby eliminating unacceptable risks and minimizing the potential for future contaminant migration at the five SASRs. Unrestricted land use would be achieved following implementation of this alternative.

Short-term risks to site workers, waste transporters, and members of the public located near waste transportation routes would exist to some extent, although no hazardous waste would be generated or transported. Due to the treatment of lead-contaminated soils in-situ and the handling and transportation of contaminated waste, there would be short-term occupational risks to workers involved in the treatment, excavation, loading, and transportation of contaminated (non-hazardous) waste. However, risks to site workers could be mitigated through the use of standard personal protective equipment, conventional dust suppression techniques, and site health and safety monitoring. Risks to waste transporters and members of the public would be minimal, as no hazardous materials would be transported over public roads.

Implementability

Alternative 3 is moderately easy to implement. No significant engineering, administrative, or construction difficulties are anticipated, although coordination with appropriate federal, state, and local agencies would be required. The labor, equipment, and materials necessary to implement this alternative are conventional and readily available. Multiple general and specialized contractors have the capability to perform the activities specified for this alternative, and disposal facilities that accept contaminated soils classified as non-hazardous are available. Chemical stabilization has been widely tested and implemented at various remediation sites and is considered a reliable treatment technology for reducing the leachability of lead-contaminated soils. The most significant challenge to implementability for this alternative is the need to remove vegetation and soil from the steep slopes at UXO 14 and UXO 25 without jeopardizing slope stability or causing undue erosion. However, this can be accomplished through careful application of field techniques and adequate erosion controls.

Cost

To develop a detailed cost analysis for Alternative 3, the required expenditures were estimated in terms of capital costs to complete the construction activities. There are no recurring costs (i.e., for institutional controls or operation and maintenance) associated with the removal alternative. Cost estimates for individual line items are based on quotations from potential vendors and subcontractors, engineering estimates, recent project experience on similar Navy projects, and values published by R.S. Means (R.S. Means, 2012). If implemented, the actual cost of Alternative 3 would depend on the final scope and design parameters presented in the RAWP, the schedule for implementation, competitive market conditions, actual scale weights of waste disposed, and other variables.

The cost of Alternative 3 (In-Situ Treatment, Excavation, and Off-Site Disposal) is estimated to be approximately \$3,156,800. A detailed breakdown of costs for this alternative is presented in Appendix F.

5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section provides a comparative analysis of the removal action alternatives. In accordance with EPA's "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" (EPA, 1993), the three removal action alternatives are compared on the basis of effectiveness, implementability, and cost.

5.1 EFFECTIVENESS

Levels of effectiveness were assessed based on the number of "effectiveness criteria" that would be satisfied by each alternative. The "effectiveness criteria," as listed in the EPA guidance (EPA, 1993), are identified as:

1. Protection of public health
2. Protection of workers during implementation
3. Protection of environment
4. Compliance with ARARs
5. Level of treatment and containment expected
6. Residual effect concerns

Alternative 1 would not achieve the RAOs or provide protection of human health and the environment because no action would be taken. Alternatives 2 and 3 would be able to achieve all of the identified RAOs discussed in Section 3. Alternatives 2 and 3 provide the highest level of protection for human health and the environment with regard to the removal and off-site disposal of contaminated soils with concentrations greater than the specified CGs. However, Alternatives 2 and 3 add potential short-term safety risks to site workers due to increased truck traffic within and around the five SASRs, and to members of the public due to increased truck traffic along the waste transportation routes.

The short-term effectiveness of both Alternatives 2 and 3 would be impacted by increased risks to site workers due to potential exposure to contaminated materials and general construction hazards, as well as to members of the public located along waste transportation routes due to increased truck traffic. Alternative 2 would pose additional short-term risks to site workers due to potential exposure to waste that is classified as hazardous based on lead toxicity. However, short-term risks to site workers could be mitigated using personal protective equipment, conventional dust suppression techniques, and site health and safety monitoring; and short-term risks to members of the public could be mitigated through compliance with regulatory requirements.

Alternative 1 would not comply with chemical-specific ARARs; and no location- or action-specific ARARs would apply if no action were taken. Alternatives 2 and 3 would comply with the chemical-specific and could be implemented in a manner that complies with location- and action-specific ARARs, as well.

Alternative 1 would not satisfy the statutory preference for treatment since no action would be performed. Under Alternative 2, all contaminated soils with concentrations greater than CGs would be permanently removed. However, this alternative does not include treatment; therefore, the regulatory preference for the reduction of toxicity, mobility, or volume of the contaminated waste through treatment would not be satisfied. Under Alternative 3, lead-contaminated soils that exhibit the lead toxicity characteristic would be treated through chemical stabilization prior to removal, which would significantly reduce the toxicity and mobility of lead in contaminated soils. In addition, all contaminated soils with concentrations greater than CGs would be permanently removed. The level of treatment for lead-contaminated soil is highest for Alternative 3.

Alternative 1 would not provide long-term effectiveness or permanence because no action would be taken. Alternatives 2 and 3 would provide the greatest long-term effectiveness and permanence because the contaminated soils would be permanently removed from the five SASR, resulting in mitigation of the existing human health and ecological risks. Alternatives 2 and 3 would not require future actions to remain protective.

5.2 IMPLEMENTABILITY

Levels of implementability were assessed based on the number of “implementability criteria” satisfied by each alternative. The “implementability criteria,” from the EPA Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993), are as follows:

1. Construction and operational considerations.
2. Demonstrated performance/useful life.
3. Adaptable to environmental conditions.
4. Contributes to remedial performance.
5. Can be completed in an acceptable timeframe.
6. Availability of equipment, personnel, and services, outside laboratory testing capacity, and offsite treatment and disposal capacity.
7. Permits required.
8. Easements or rights-of-way required.
9. Impact on adjoining property.
10. Ability to impose institutional controls.

The evaluation of implementability involves the evaluation of both technical and administrative feasibility. In general, technical feasibility is addressed by Items 1 through 6 above, and administrative feasibility is addressed by Items 7 through 10.

Alternative 1 is easily implementable because it involves no action. However, the lead-, PAH-, and nitroglycerin-contaminated soils would remain on-site; thus, risks to human health and ecological receptors would continue unabated. This alternative would not contribute to long-term remedial performance and could adversely impact adjoining property by allowing the potential for contaminants to migrate from their current locations to surrounding media.

Alternative 2 is easily implementable and involves standard construction techniques and equipment for excavating, loading, and transporting contaminated soils. There are several off-site landfills located within a reasonable distance from NSF-IH that accept contaminated (non-hazardous) waste. Hazardous lead-contaminated soils would need to be containerized and transported to a RCRA-permitted Subtitle C landfill, which are located much further away (e.g., Ohio, Michigan, New York, etc.) but are also available for use. Experienced HAZWOPER-certified workers and contracting companies are capable and readily available to excavate and transport the lead-, PAH-, and nitroglycerin-contaminated soils to the appropriate disposal facility.

Alternative 3 is moderately easy to implement. In general, Alternative 3 involves standard construction techniques and equipment for excavating and transporting lead-, PAH-, and nitroglycerin-contaminated soils. There are several off-site landfills located within a reasonable distance from NSF-IH that accept contaminated (non-hazardous) waste. Experienced HAZWOPER-certified workers and contracting companies are capable and readily available to excavate and transport the lead-, PAH-, and nitroglycerin-contaminated soils to the disposal facility. However, although chemical stabilization for hazardous lead-contaminated soils has been widely tested and implemented at various remediation sites, the reagents are typically proprietary and must be applied by one of only a few specialty subcontractors.

Since this removal action is being carried out under CERCLA (121(e)(1), 42 USC § 9621(e)(1)), the Navy is not required to pay fees associated with permitting, or to obtain the actual permits required by ARARs. However, the Navy will comply with the substantive requirements of the permitting process, and implementation of the removal action will proceed upon approval through a federal consistency determination from the state.

5.3 COST

There is no cost associated with Alternative 1. Alternative 2 is the most expensive alternative at approximately \$4,210,900. The next most expensive alternative is Alternative 3, which is estimated to

cost approximately \$3,156,800. Details of the cost analysis conducted for Alternatives 2 and 3 are presented in Appendix F.

The estimated costs for Alternatives 2 and 3 consist of capital costs only. There are no recurring or future costs associated with these removal alternatives because contaminated soils with concentrations greater than the CGs would be permanently removed from the site. Thus, no follow-on actions such as long-term administrative controls or operation and maintenance activities are necessary. Potential risks to human health and ecological receptors would be permanently mitigated, resulting in unrestricted land use and a No Further Action determination for soils at each site.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

This EE/CA was performed in accordance with current EPA and Navy guidance for conducting non-time-critical removal actions under CERCLA. The purpose of this EE/CA was to develop and evaluate removal action alternatives to address the lead-, PAH-, and nitroglycerin-contaminated soils that pose unacceptable risks at the five SASRs.

Upon screening the available technologies, three alternatives were developed, evaluated, and compared on the basis of effectiveness, implementability, and cost. The effectiveness evaluation included reviewing the protectiveness of each alternative; compliance with ARARs to the extent practicable; long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; and its ability to meet the RAOs. The implementability evaluation included a review of the technical feasibility, availability, and administrative feasibility of each alternative. The evaluation of cost included calculations of capital costs and potential future costs.

Considering the results of the evaluation and comparison of removal action alternatives, Alternative 3 (In-Situ Treatment, Excavation, and Off-Site Disposal) is recommended for implementation at the five SASRs. Under this alternative, lead-contaminated soils that exceed EPA's TCLP criterion for lead toxicity would be chemically treated in-situ to stabilize the leachable lead, and all lead-, PAH-, and nitroglycerin-contaminated soils would be excavated and disposed off-site as non-hazardous waste. The total excavation area would be approximately 154,487 ft²; and the total volume of contaminated soils to be excavated would be approximately 8,809 cubic yards. It is estimated that approximately 3,048 tons of hazardous lead-contaminated soils would be consolidated within the AOCs and treated in-situ prior to excavation and disposal using chemical stabilization technology. A total of approximately 13,081 tons of contaminated soil (3,810 tons of lead-contaminated soil, 8,673 tons of PAH-contaminated soil, and 598 tons of nitroglycerin-contaminated soil) would be shipped off-site for disposal as non-hazardous waste. After contaminated soils are excavated, but before the sites are backfilled, verification sampling would be conducted to ensure that CGs have been achieved.

Alternative 3 is recommended because it is the most cost-effective alternative that would meet the stated RAOs. Implementation of this alternative would be effective in permanently reducing lead, PAH, and nitroglycerin concentrations at the five SASRs and eliminating the potential for unacceptable risks to human health and ecological receptors. Alternative 3 is technically and administratively feasible, and it constitutes a permanent remedy to existing contamination at these sites. This alternative is estimated to cost \$3,156,800 and require approximately 5 months to complete.

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TABLES

**TABLE 3-1
 POTENTIAL CHEMICAL-SPECIFIC ARARs AND TBCs
 FIVE SMALL ARMS/SKEET RANGES
 NSF INDIAN HEAD STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND**

REQUIREMENT	CITATION	STATUS	COMMENTS
FEDERAL			
EPA Regional Screening Levels (RSLs), June 2011	EPA	TBC	These values are used in the risk screening evaluation and may aid in the selection of clean-up goals. (All sites.)
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (August, 1994)	EPA OSWER Directive #9355.4-12	TBC	Recommends screening levels for lead in soil for residential land use (400 ppm), describes how to develop site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards (MCSs) at RCRA Corrective Action facilities for residential land use, and describes a plan for soil lead cleanup at CERCLA sites and RCRA Corrective Action Facilities that have multiple sources of lead. Risks from lead will be addressed through remediation using excavation to meet the CG. (All sites.)
STATE			
There are no State chemical-specific ARARs.			

**TABLE 3-2
 POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
 FIVE SMALL ARMS/SKEET RANGES
 NSF INDIAN HEAD STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND**

REQUIREMENT	CITATION	STATUS	COMMENTS
FEDERAL			
Endangered Species Act of 1973, as amended	16 USC 1531 50 CFR Part 402	Relevant and Appropriate	May be applicable if any endangered or threatened species or habitats are present where remediation activities occur. Endangered/threatened species may be near all sites. If ESA species are present and Navy actions will have an effect on the listed species, then Navy will consult with USFWS. (MD Habitat Protection Area near UXO-16 and UXO-17. MD Natural Heritage Area near UXO-14, UXO-15, and UXO-25.)
Protection of Wetlands	Executive Order 11990	TBC	Defines federal requirements for carrying out Executive Order 11990 (Protection of Wetlands). No remedial activity that adversely affects a wetland shall be permitted if a practicable alternative is available. If there is no other practicable alternative, impacts must be minimized or mitigated. (Wetlands could be affected by activities at UXO-14 and UXO-16.)
Floodplain Management	Executive Order 11988	TBC	Defines federal requirements for carrying out Executive Order 11988 (Protection of Floodplains) to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial value of floodplains. (Some activities at UXO-14 and UXO-15 are located in the 100-year floodplain.)
National Historic Preservation Act	16 USC 470 et seq; 36 CFR 800	Applicable	Preserves sites with archaeological and historic significance. Section 106 of the Act requires consultation with appropriate agencies to identify historic properties potentially affected by the site activities, assess the effects, and seek ways to avoid, minimize, or mitigate adverse effects on historic properties. May be applicable if any prehistoric, historic, or archeological artifacts are encountered during site remediation. If artifacts are found, State Historic Preservation Office will be consulted per Section 106 of the Act. (May be applicable in UXO -14, UXO-15, UXO-16 and UXO-17.)

REQUIREMENT	CITATION	STATUS	COMMENTS
Migratory Bird Treaty Act	16 USC 703-712	Applicable	Provides protection for migrating birds, nests, and eggs. Makes it illegal for people to "take" migratory birds, their eggs, feathers, or nests. Appropriate actions will be taken during remedial action to ensure that no migratory birds or nests are affected. Site surveys will be conducted prior to beginning remedial activities to determine if any birds and nesting areas are present. (MD Waterfowl Staging Area near UXO-15 and UXO-14. Large tract of trees affected by UXO-14. Fewer trees affected at UXO-16, UXO-17, and UXO-25.)
The Bald and Golden Eagle Protection Act	16 USC 668-668(d)	Applicable	Requires project activities to protect and preserve eagle habitat. Bald eagles have been observed at and near NSF-IH and Stump Neck Annex. Appropriate actions will be taken during remedial action to ensure that no eagles and their habitat are affected. Site survey will be conducted at UXO-16 prior to beginning remedial activities to determine if any bald eagles or potential nesting areas are present.
Fish and Wildlife Coordination Act	16 USC Part 661 et seq.	Applicable	Requires any federal agency proposing to modify a body of water to coordinate with the US Fish and Wildlife Service or National Marine Fisheries Service and appropriate state agencies if an alteration of a body of water will occur as a result of remedial activities and affect fish or wildlife. Agencies will be consulted, and remedial activities will be conducted to avoid disturbance of affect fish and wildlife and their habitat. (Potential for alteration of body of water at UXO-14 and UXO-15.)
Clean Water Act, Section 404	Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material - 40 CFR Part 230 and 231; and 33 CFR 320 and 323	Applicable	No activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Controls discharges of dredged or fill material to protect aquatic ecosystems. Filling or discharge of dredged material will only occur where there is no other practicable alternative and any adverse impacts to aquatic ecosystems will be mitigated. Soil remediation or other remedial actions that include filling in wetlands will be implemented to meet these requirements, including mitigation of altered wetland/aquatic resource, as required. (UXO-14 is adjacent to wetlands and activities should be designed to avoid wetland impacts.)
STATE			
Tidal Wetlands	COMAR 26.24.01.02, 26.24.02.01B,	Applicable	Regulates activities on or near tidal wetlands. Avoid adverse impacts and minimize losses of tidal wetlands. (Wetlands could be affected by

REQUIREMENT	CITATION	STATUS	COMMENTS
	26.24.03.01-.06, 26.24.05.01		activities at UXO-14 and UXO-16.)
Non-Tidal Wetlands Act	COMAR 26.23.02.01, 26.23.02.04, 26.23.03.01-02	Applicable	Regulates activities on or near non-tidal wetlands. Avoid adverse impacts and minimize losses of non-tidal wetlands. (Wetlands could be affected by activities at UXO-14 and UXO-16.)
Endangered Species Act	COMAR 08.03.08	Relevant and Appropriate	Threatened and endangered species of plants and animals and their critical habitats must be conserved. (MD Habitat Protection Area near UXO-16 and UXO-17. MD Natural Heritage Area near UXO-14, UXO-15, and UXO-25.)
Chesapeake and Coastal Program	Department of Natural Resources	Relevant and Appropriate	This program would reduce the environmental impacts of coastal development, resolve significant conflicts between competing coastal uses and provide critical assistance to local governments in coastal planning and resource protection. (UXO-14 and UXO-15 fall within State Critical Area.)

**TABLE 3-3
POTENTIAL ACTION-SPECIFIC ARARS AND TBCS
FIVE SMALL ARMS/SKEET RANGES
NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND**

REQUIREMENT	CITATION	STATUS	COMMENTS
FEDERAL			
NPDES permit requirements - Discharge of storm water from construction activity to surface water.	40 CFR 122.26, 122.28, and 122.41	Applicable	Applicable for alternatives that will need to control and manage storm water during construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than 1 acre. (UXO-14 excavation will disturb an area greater than 1 acre.)
Management of Remediation Waste Under RCRA - Area of Contamination Policy	EPA 530-F-98-026, October 1998	To Be Considered	The Area of Contamination (AOC) policy allows wastes to be consolidated or treated in-situ within an AOC without triggering land disposal restrictions or minimum technology requirements. An AOC would be defined for each excavation area so that contaminated soils can be consolidated prior to characterization, then treated in-situ (if needed), and then transported for off-site disposal. (All sites)
STATE			
Discharge to surface water - Discharge of storm water from construction activity to surface water.	COMAR 26.08.02.02-1 26.08.02.03 26.08.02.03-1 26.08.02.03-2 26.08.02.03-3 26.08.02.03-4 26.08.02.04-1 26.08.02.05 26.08.02.09 26.08.03	Applicable	Applicable for alternatives that will need to control and manage storm water during construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than 1 acre. (UXO-14 excavation will disturb an area greater than 1 acre.)
Identification and Listing of Hazardous Waste	COMAR 26.13.02	Applicable	Prior to excavation and management, material to be transported off site would need to be tested to determine whether it is a hazardous waste. (All sites)
Hazardous Waste Management	COMAR 26.13.03 26.13.05	Applicable	Remedial activities performed in connection with the management of hazardous wastes will comply with the requirements of these regulations (All sites)
Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities - Military Munitions	COMAR 26.13.10.27	Applicable	Regulations identify when military munitions become solid waste, and if hazardous, how they are managed. Munitions found on a range can be consolidated within the range prior to characterization and off-site disposal. (May be applicable in UXO-14, UXO-15)

REQUIREMENT	CITATION	STATUS	COMMENTS
General Emission Standards, Prohibitions, and Restrictions - Visible Emissions and Particulate Matter	COMAR 26.11.06.02 26.11.06.03	Applicable	Fugitive emissions and particulate matter from excavation, loading, stockpiling, and backfilling will be controlled. (All sites)
Erosion and Sediment Control	COMAR 26.17.01.01 26.17.01.05 26.17.01.07 B & C 26.17.01.11	Applicable	Erosion and sediment controls will be put in place for land clearing, grading, and other earth disturbance during excavation, loading, stockpiling, and backfilling. (All sites)
Storm Water Management	COMAR 26.17.02.02 26.17.02.06 26.17.02.08 26.17.02.09	Applicable	Excavation and backfilling will alter the land so storm water management and control are needed. (All sites)

TABLE 3-4
CLEANUP GOALS FOR FIVE SMALL ARMS/SKEET RANGES
NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Residential Soil ¹ (mg/kg)
Lead	400
BaP Equivalent ²	0.15
Nitroglycerin	6.1

Note:

1. The references for soil cleanup goals are: EPA Regional Screening Levels for Soil (November 2011); Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (EPA OSWER 9355.4-12, August 1994).
2. The BaP equivalent is based on the EPA 1993 toxicity equivalency factors and the concentrations of the seven individual carcinogenic PAHs. BaP equivalents = (0.1) benzo(a)anthracene + (1.0)BaP + (0.1)benzo(b)flouranthene + (0.01) benzo(k)flouranthene +(0.001)chrysene + (1.0) dibenz(a,h)anthracene + (0.1) ideno(1,2,3cd)pyrene.

TABLE 3-5
SUMMARY OF PROPOSED SOIL REMOVAL QUANTITIES
FIVE SMALL ARMS/ SKEET RANGES
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Site Name	Area of Concern	COC	Excavation Area (square feet)	Volume (cubic yards)	Weight (tons)
Marine Rifle Range (UXO 14)	Hillside Impact Area	Lead	54,518	1,817	2,699
Old Skeet and Trap Range (UXO 15)	Firing Points/Target Area (Sample Locations X15SB038 and X15SB053)	PAHs	34,433	2,551	3,788
	Shot Fall Areas (Sample Locations X15SB064, X15SB013, and X15SB074)	Lead	14,199	526	781
Rum Point Skeet Range (UXO 16)	Target Area (Sample Locations X16SB056 and X16SB076)	PAHs	59,215	3,290	4,885
Small Arms (Pistol) Range (UXO 17)	Firing Line Area (Sample Locations X17SB008 and X17SB009)	Nitroglycerin	10,880	403	598
	Target Area (Sample Locations X17SB013, X17SB014, X17SB004, and X17SB0005)	Lead	2,259	178	265
Roach Road Rifle Range (UXO 25)	Target Area (Sample Locations X25SB019 and X25SB020)	Lead	985	44	65
Total Lead-Contaminated Soil:				2,565	3,810
Total PAH-Contaminated Soil:				5,841	8,673
Total Nitroglycerin-Contaminated Soil:				403	598
TOTAL CONTAMINATED SOIL:				8,809	13,081

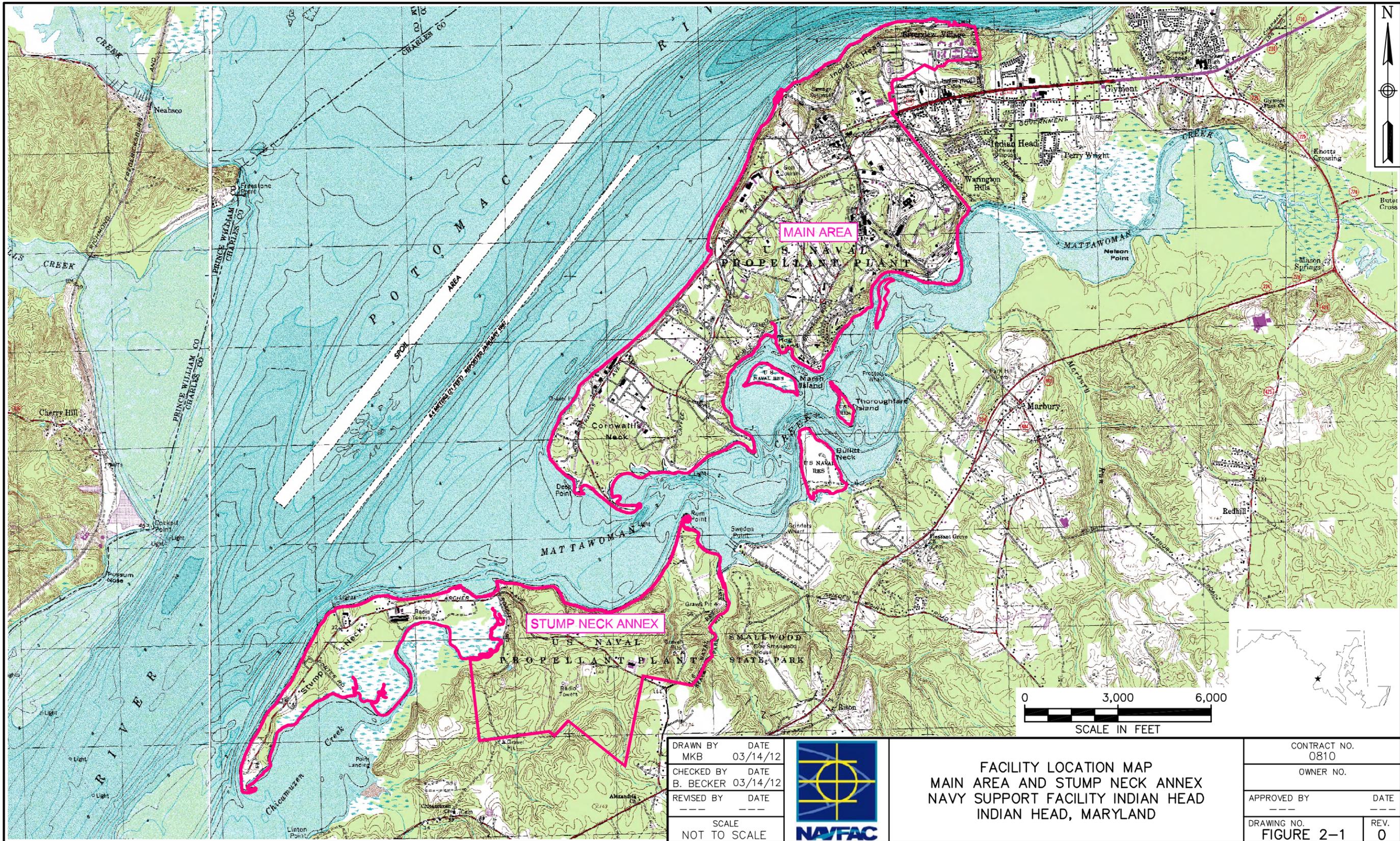
TABLE 4-1
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR
CONTAMINATED SOIL AT FIVE SMALL ARMS/SKEET RANGES
NSF INDIAN HEAD STUMP NECK ANNEX, MARYLAND
PAGE 1 OF 2

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING ACTION		SCREENING COMMENTS
				RETAIN	REJECT	
No Action	No Action	No Action	No remedial actions taken.	√		Retained as baseline for comparison, as required by NCP.
Institutional controls	Land Use Restrictions	Land Use Restrictions	Land use restrictions incorporated into the Navy planning documents.		√	Potentially applicable, though this constitutes a land use restriction and is therefore unacceptable.
	Access Restrictions	Fencing	Security fence is installed around contaminated areas to restrict access.		√	Potentially applicable, though this constitutes a land use restriction and is therefore unacceptable.
	Monitoring	Long-term Monitoring	Monitoring to assess the temporal variation in the levels of contamination at the site.		√	Potentially applicable, but will not achieve a reduction in risk to future residents and/or construction workers.
Containment	Capping	Soil Cover	A layer of native soil placed over the site with a vegetative cover to prevent direct contact and minimize erosion and surface migration of contaminated soils.		√	Technically feasible. However, prohibitive to unrestricted future land use.
		Single Barrier	Cap constructed with one low-permeability layer (clay or synthetic membrane) over the site to prevent direct contact and to minimize surface migration of contaminated soil.		√	Technically feasible. However, prohibitive to unrestricted future land use.
		Composite (Double) Barrier	Multi-media cap with two low-permeability layers (clay and/or synthetic membranes) constructed over the site to prevent direct contact. Provides better protection against failure than a single-barrier cap.		√	Technically feasible. However, prohibitive to unrestricted future land use.

TABLE 4-1
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR
CONTAMINATED SOIL AT FIVE SMALL ARMS/SKEET RANGES
NSF INDIAN HEAD STUMP NECK ANNEX, MARYLAND
PAGE 2 OF 2

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING ACTION		SCREENING COMMENTS
				RETAIN	REJECT	
Removal	Bulk Excavation	Mechanical Excavation	Mechanical removal of solid materials using conventional earth-moving equipment such as bulldozers, excavators, and front-end loaders.	√		Excavation is an accepted method of removing soil contamination.
	Confirmatory Sampling	Confirmatory Sampling	Sampling and testing of soil at the base and the sides of the excavation to ensure that all targeted soil has been removed.	√		Required to ensure the effectiveness of the excavation.
Disposal	On Site	Consolidation/ Engineered Disposal Cell	Excavation and deposition of all contaminated soils in an engineered disposal cell to minimize space and closure requirements, reduce infiltration, and minimize direct contact with contaminants.		√	Not implementable due to landfill siting regulations and significant restrictions on future land use.
	Off Site	Permitted Treatment, Storage, and Disposal Facility (TSD)	Excavated soil is classified as hazardous waste or banned from land disposal. Disposal of contaminated soils at a permitted commercial TSD facility (i.e., hazardous waste landfill).		√	Potentially applicable if the lead –contaminated soil fail the TCLP test. However, the cost is high.
		RCRA Subtitle D Solid Waste Disposal Facility	Excavated soil is classified as non-hazardous waste. Disposal of contaminated soils at an off-site permitted solid waste facility (e.g., intermediate or residual waste landfill) or industrial landfill.	√		Applicable. Technically feasible.
Treatment	Stabilization	Chemical Treatment	Chemical Treatment converts leachable lead into insoluble minerals and mixed mineral forms within the material or waste matrix as non-hazardous waste.	√		Hazardous waste can be treated through chemical treatment to render it non-hazardous.

FIGURES

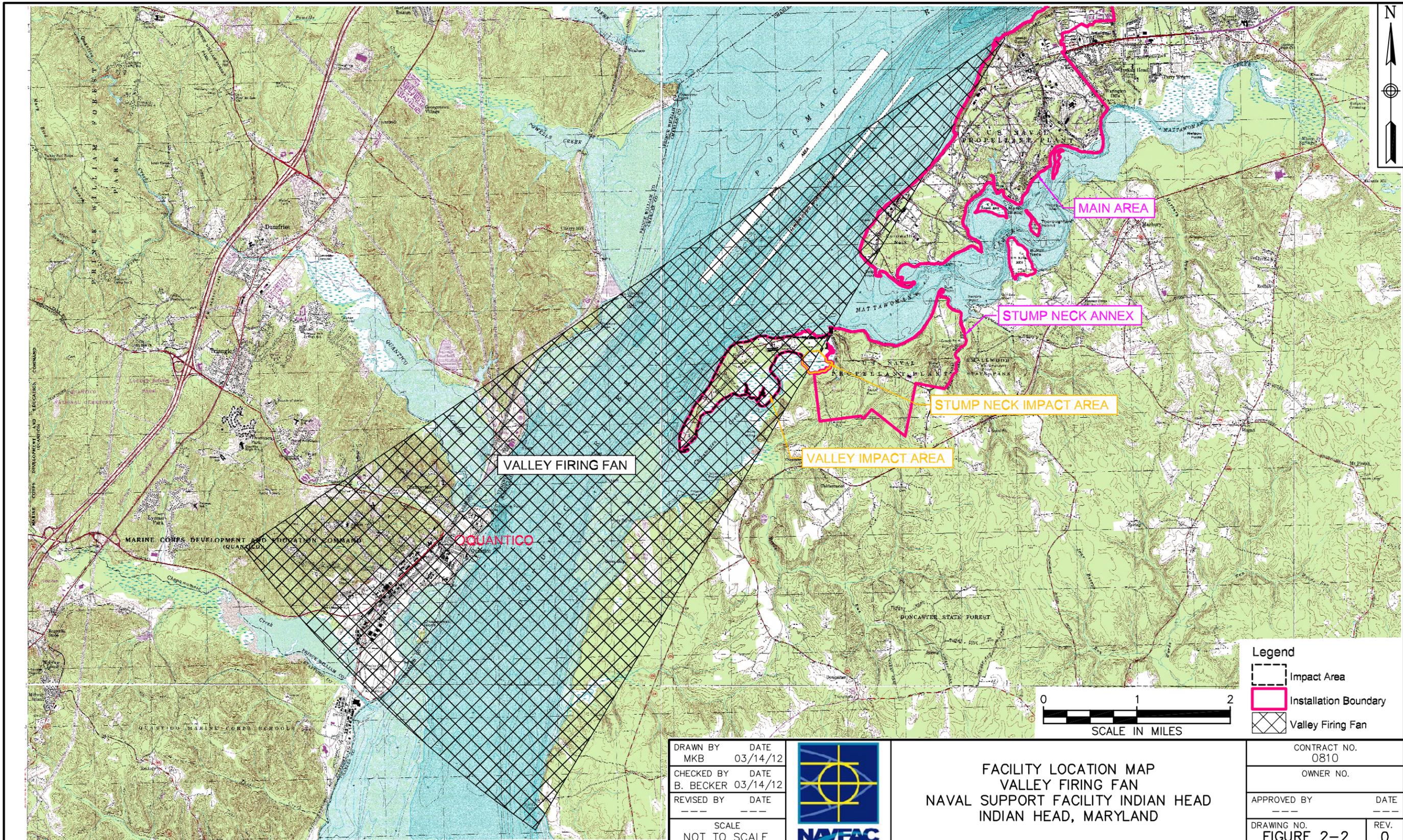


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FACILITY LOCATION MAP
 MAIN AREA AND STUMP NECK ANNEX
 NAVY SUPPORT FACILITY INDIAN HEAD
 INDIAN HEAD, MARYLAND

CONTRACT NO. 0810	
OWNER NO.	
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VALLEY FIRING FAN

VALLEY IMPACT AREA

STUMP NECK ANNEX

STUMP NECK IMPACT AREA

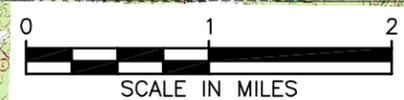
MAIN AREA

QUANTICO

MARINE CORPS DEVELOPMENT AND EDUCATION COMMAND (QUANTICO)

Legend

-  Impact Area
-  Installation Boundary
-  Valley Firing Fan

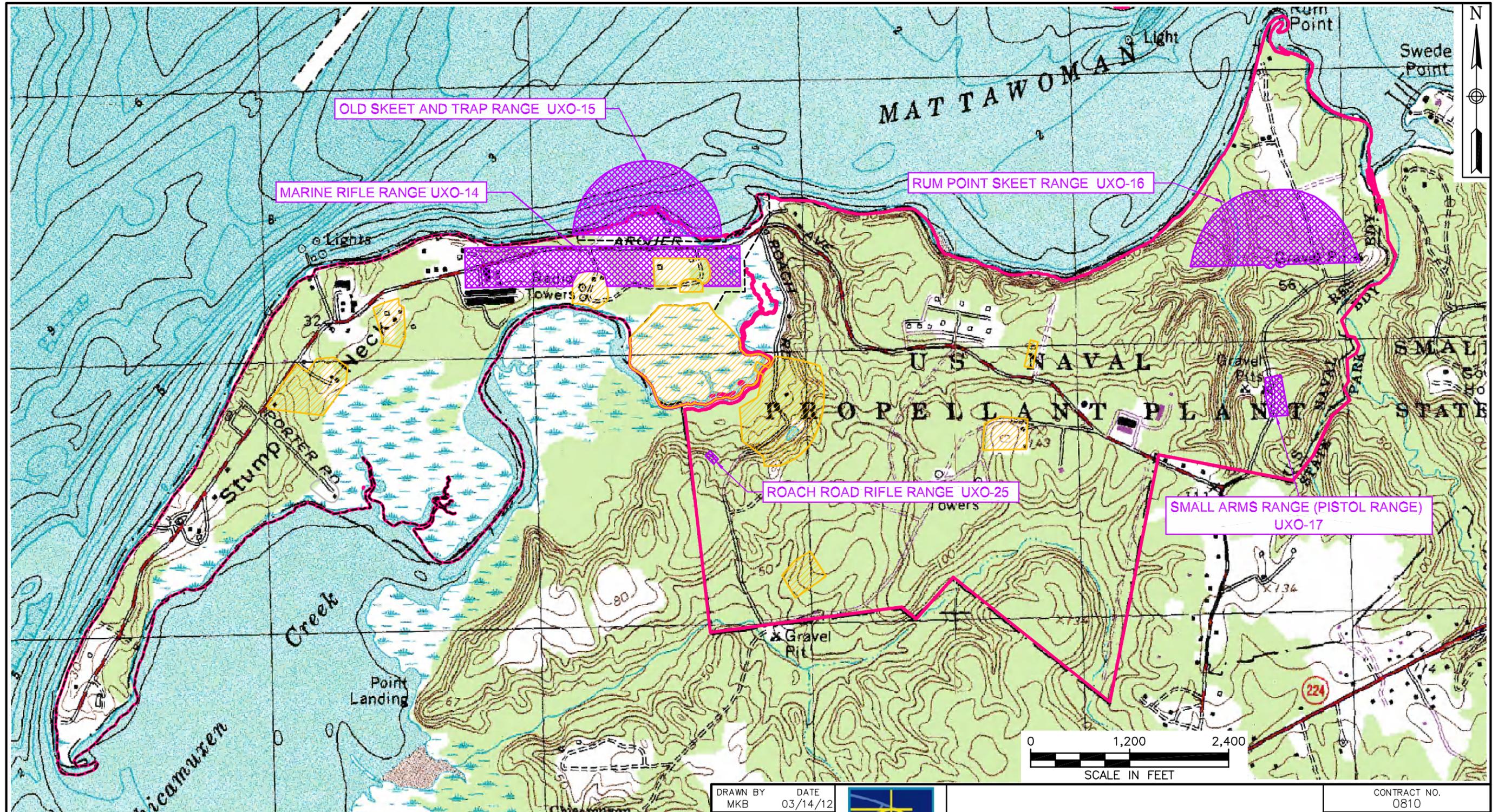


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FACILITY LOCATION MAP
VALLEY FIRING FAN
NAVAL SUPPORT FACILITY INDIAN HEAD
INDIAN HEAD, MARYLAND

CONTRACT NO.	
0810	
OWNER NO.	
APPROVED BY	DATE
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FIGURE 2-2	0



Legend	
	MRP Site Boundary - Small Arms/Skeet Range
	MRP Site Boundary - MEC Site Not Included In This Investigation
	Boundary Of Site Within Valley Firing Fan
	Installation Boundary

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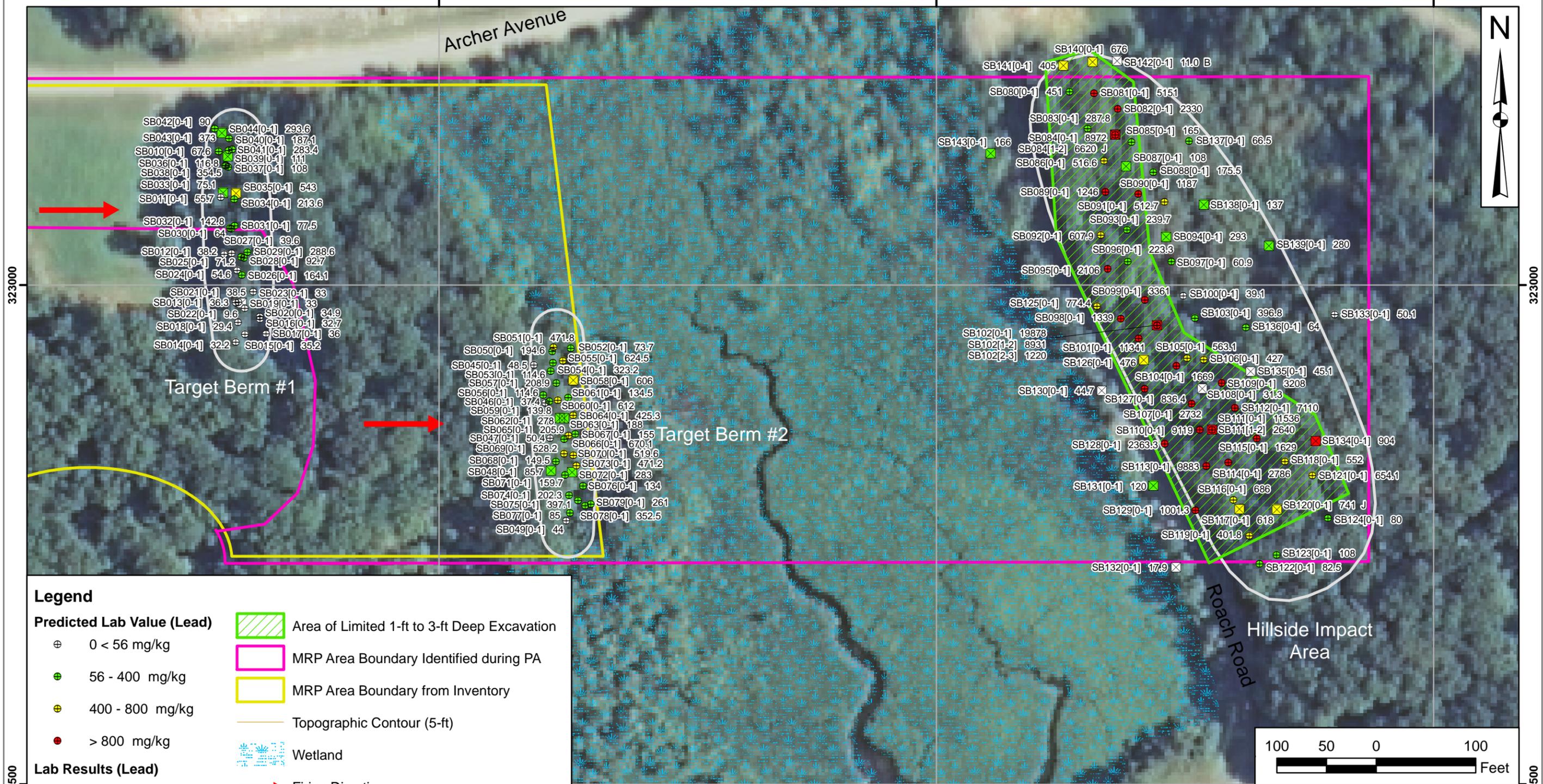
SMALL ARMS/SKEET RANGE LOCATION MAP
 NAVAL SUPPORT FACILITY INDIAN HEAD
 INDIAN HEAD, MARYLAND

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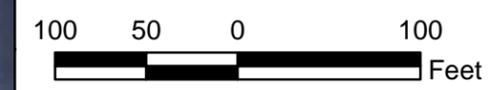
322500

322500

Legend

- Predicted Lab Value (Lead)**
- ⊕ 0 < 56 mg/kg
 - ⊕ 56 - 400 mg/kg
 - ⊕ 400 - 800 mg/kg
 - > 800 mg/kg
- Lab Results (Lead)**
- ⊗ 0 < 56 mg/kg
 - ⊗ 56 - 400 mg/kg
 - ⊗ 400 - 800 mg/kg
 - ⊗ > 800 mg/kg
- ▨ Area of Limited 1-ft to 3-ft Deep Excavation
 - ▭ MRP Area Boundary Identified during PA
 - ▭ MRP Area Boundary from Inventory
 - Topographic Contour (5-ft)
 - ▨ Wetland
 - Firing Direction

Aerial Photo: Indian Head, Charles County, MD
NAIP09 - National Agricultural Imagery Program



DRAWN BY K. MOORE	DATE 12/21/09
CHECKED BY B. BECKER	DATE 03/16/12
COST/SCHEDULE-AREA	
SCALE AS NOTED	



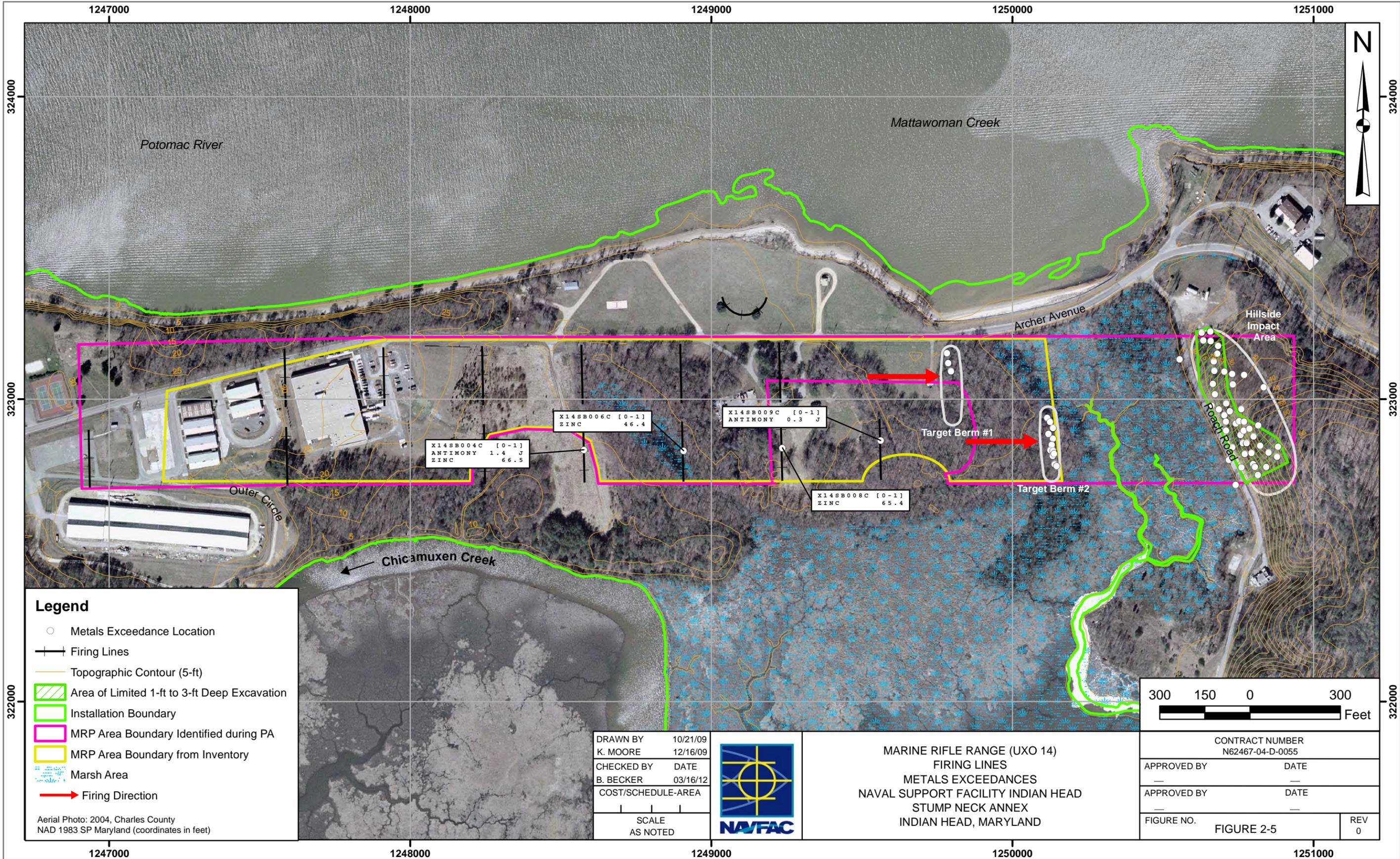
MARINE RIFLE RANGE (UXO 14)
LEAD DATA AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

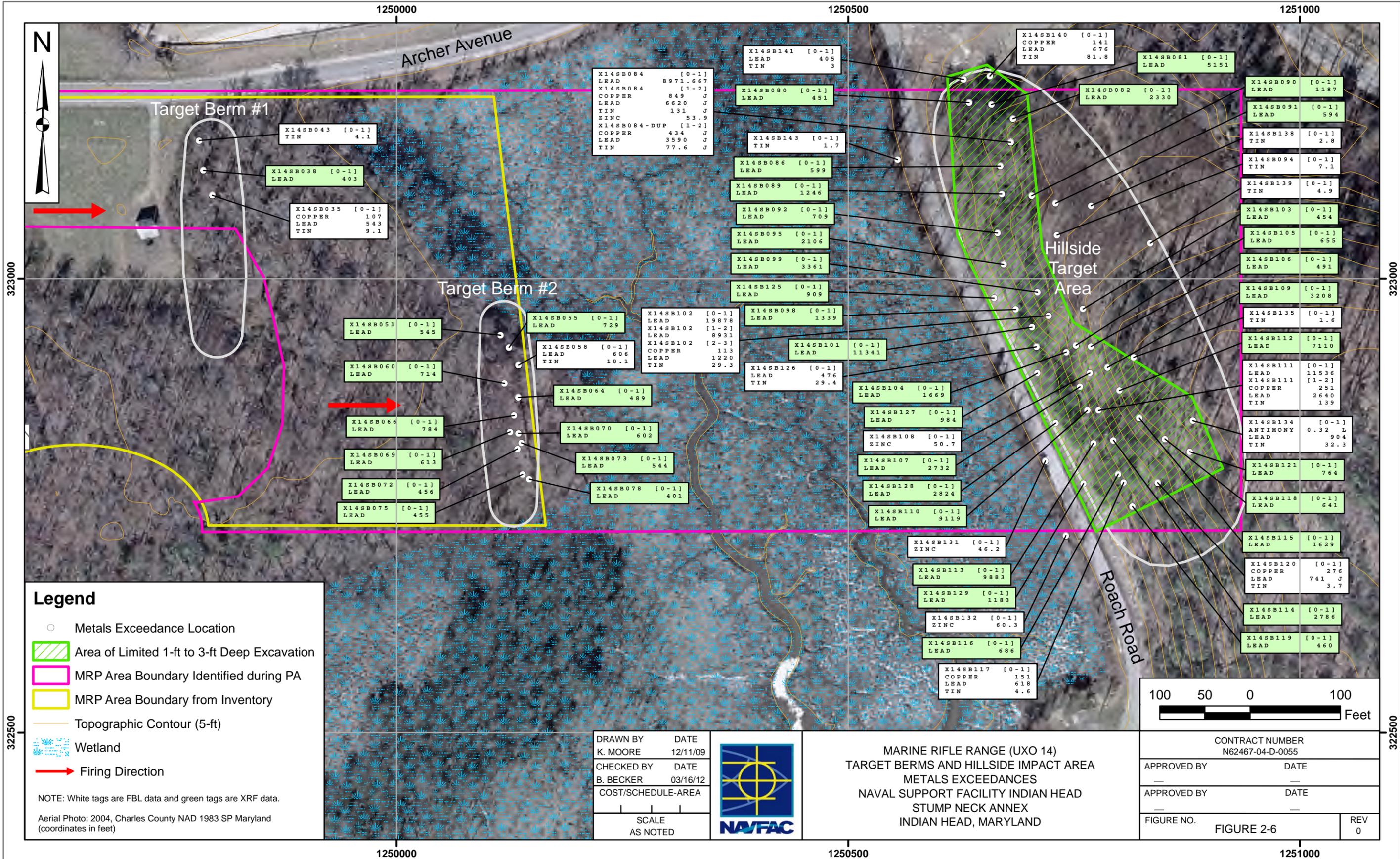
CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 2-4	0

125000

125050

125100





Legend

- Metals Exceedance Location
- ▨ Area of Limited 1-ft to 3-ft Deep Excavation
- ▭ MRP Area Boundary Identified during PA
- ▭ MRP Area Boundary from Inventory
- Topographic Contour (5-ft)
- Wetland
- Firing Direction

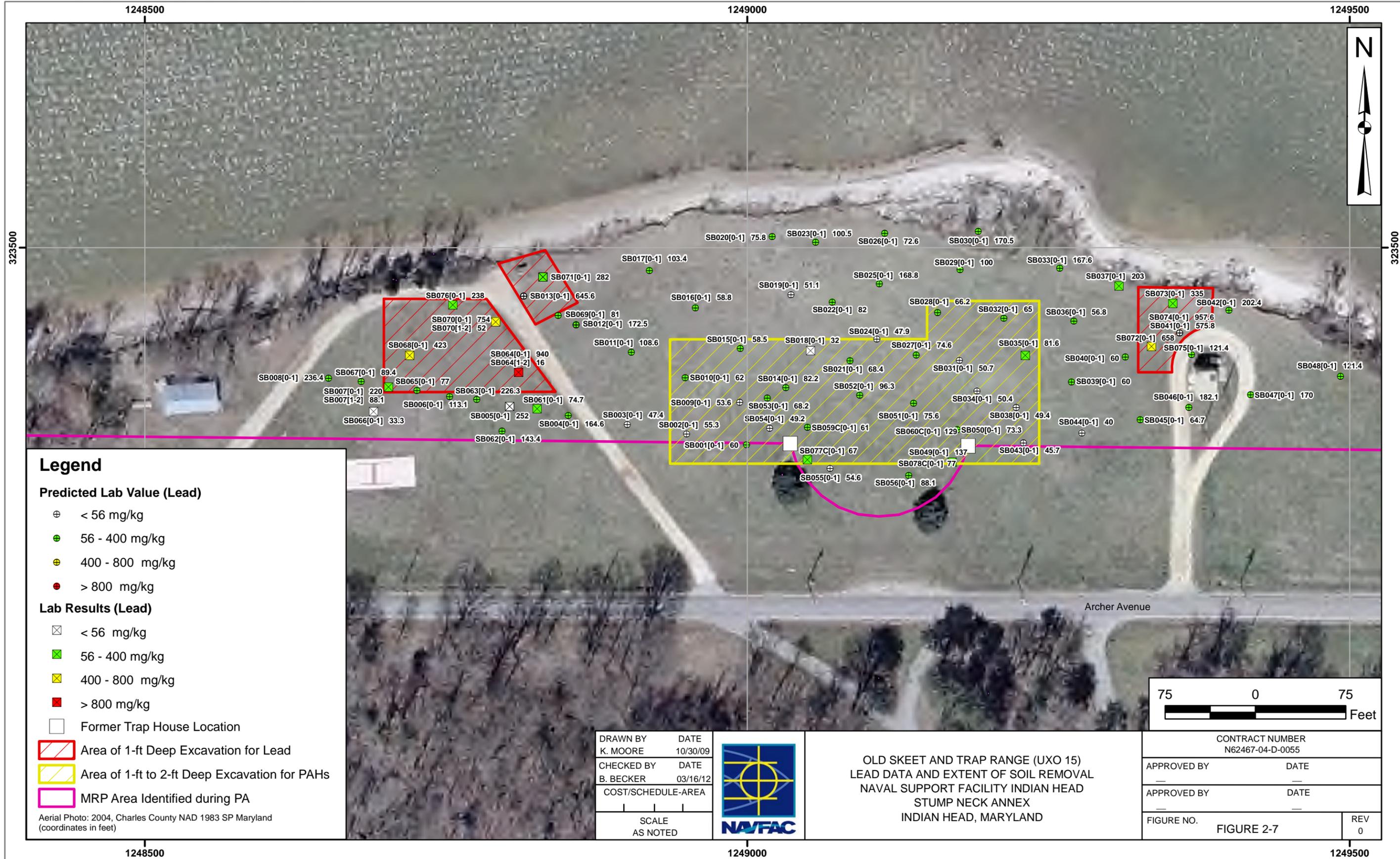
NOTE: White tags are FBL data and green tags are XRF data.
 Aerial Photo: 2004, Charles County NAD 1983 SP Maryland (coordinates in feet)

DRAWN BY	DATE
K. MOORE	12/11/09
CHECKED BY	DATE
B. BECKER	03/16/12
COST/SCHEDULE-AREA	
SCALE AS NOTED	



MARINE RIFLE RANGE (UXO 14)
 TARGET BERMS AND HILLSIDE IMPACT AREA
 METALS EXCEEDANCES
 NAVAL SUPPORT FACILITY INDIAN HEAD
 STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

CONTRACT NUMBER		N62467-04-D-0055	
APPROVED BY	DATE	APPROVED BY	DATE
—	—	—	—
APPROVED BY	DATE	APPROVED BY	DATE
—	—	—	—
FIGURE NO.	FIGURE 2-6	REV	0



Legend

Predicted Lab Value (Lead)

- ⊕ < 56 mg/kg
- ⊕ 56 - 400 mg/kg
- ⊕ 400 - 800 mg/kg
- > 800 mg/kg

Lab Results (Lead)

- ⊗ < 56 mg/kg
- ⊗ 56 - 400 mg/kg
- ⊗ 400 - 800 mg/kg
- ⊗ > 800 mg/kg

□ Former Trap House Location

▨ Area of 1-ft Deep Excavation for Lead

▨ Area of 1-ft to 2-ft Deep Excavation for PAHs

▭ MRP Area Identified during PA

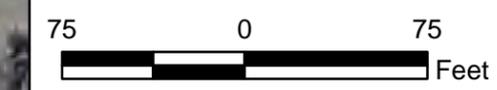
Aerial Photo: 2004, Charles County NAD 1983 SP Maryland (coordinates in feet)

DRAWN BY K. MOORE	DATE 10/30/09
CHECKED BY B. BECKER	DATE 03/16/12
COST/SCHEDULE-AREA	

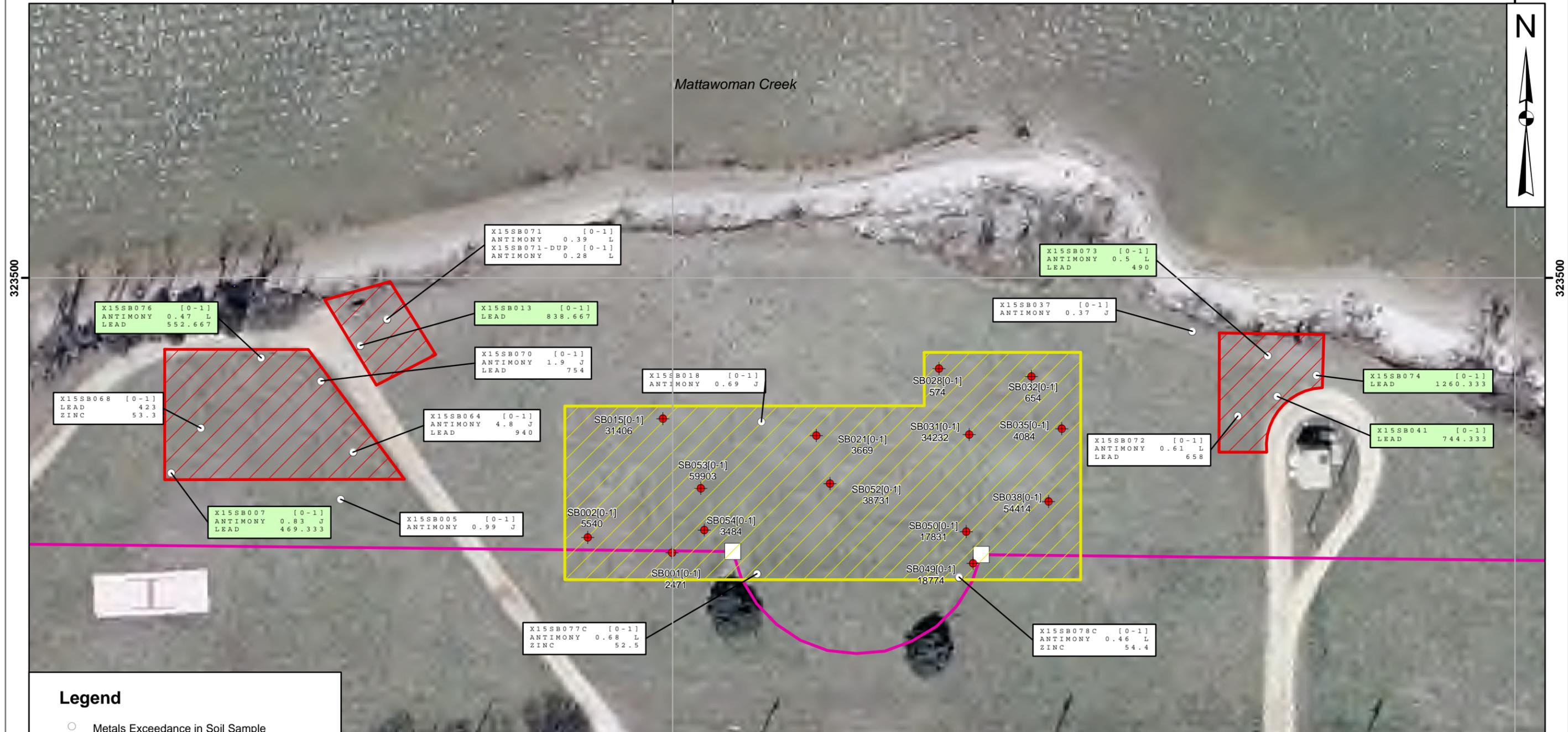
SCALE
AS NOTED



OLD SKEET AND TRAP RANGE (UXO 15)
LEAD DATA AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND



CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 2-7	0



Mattawoman Creek

Archer Avenue

Legend

- Metals Exceedance in Soil Sample
- ◆ Clay Target Remains, BaP >150 µg/kg
- ▨ Area of 1-ft Deep Excavation for Lead
- ▨ Area of 1-ft to 2-ft Deep Excavation for PAHs
- Former Trap House Location
- ▭ MRP Area Boundary Identified During PA

NOTE: White tags are FBL data and the green tags are XRF data.

Aerial Photo: 2004, Charles County
NAD 1983 SP Maryland (coordinates in feet)



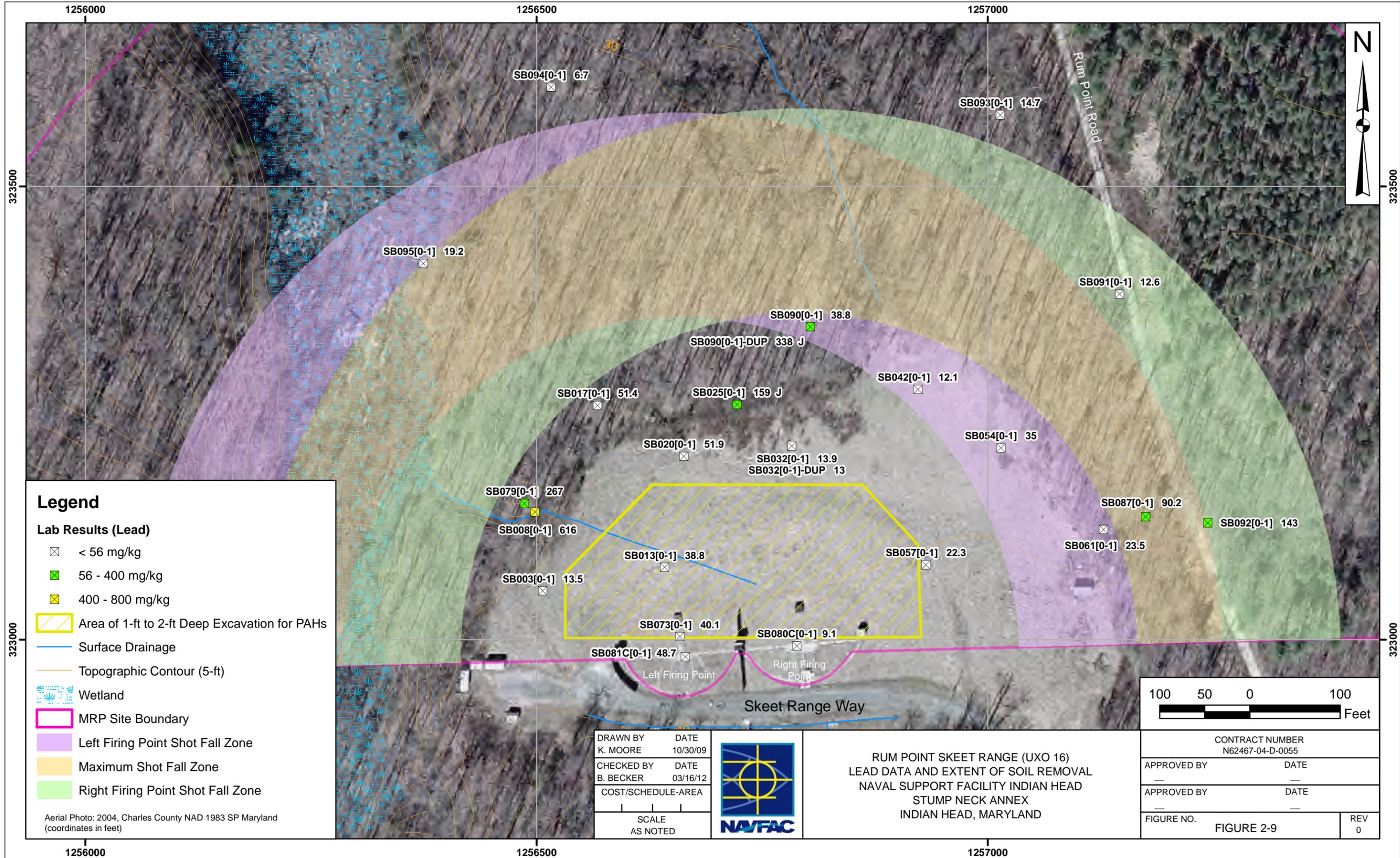
DRAWN BY	DATE
K. MOORE	12/21/09
CHECKED BY	DATE
B. BECKER	03/14/12
COST/SCHEDULE-AREA	

SCALE
AS NOTED



OLD SKEET AND TRAP RANGE (UXO 15)
METALS/PAH EXCEEDANCES AND
EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 2-8	0



Legend

Lab Results (Lead)

- ☒ < 56 mg/kg
- ☒ 56 - 400 mg/kg
- ☒ 400 - 800 mg/kg
- ▨ Area of 1-ft to 2-ft Deep Excavation for PAHs
- Surface Drainage
- Topographic Contour (5-ft)
- Wetland
- MRP Site Boundary
- Left Firing Point Shot Fall Zone
- Maximum Shot Fall Zone
- Right Firing Point Shot Fall Zone

Aerial Photo: 2004, Charles County NAD 1983 SP Maryland (coordinates in feet)

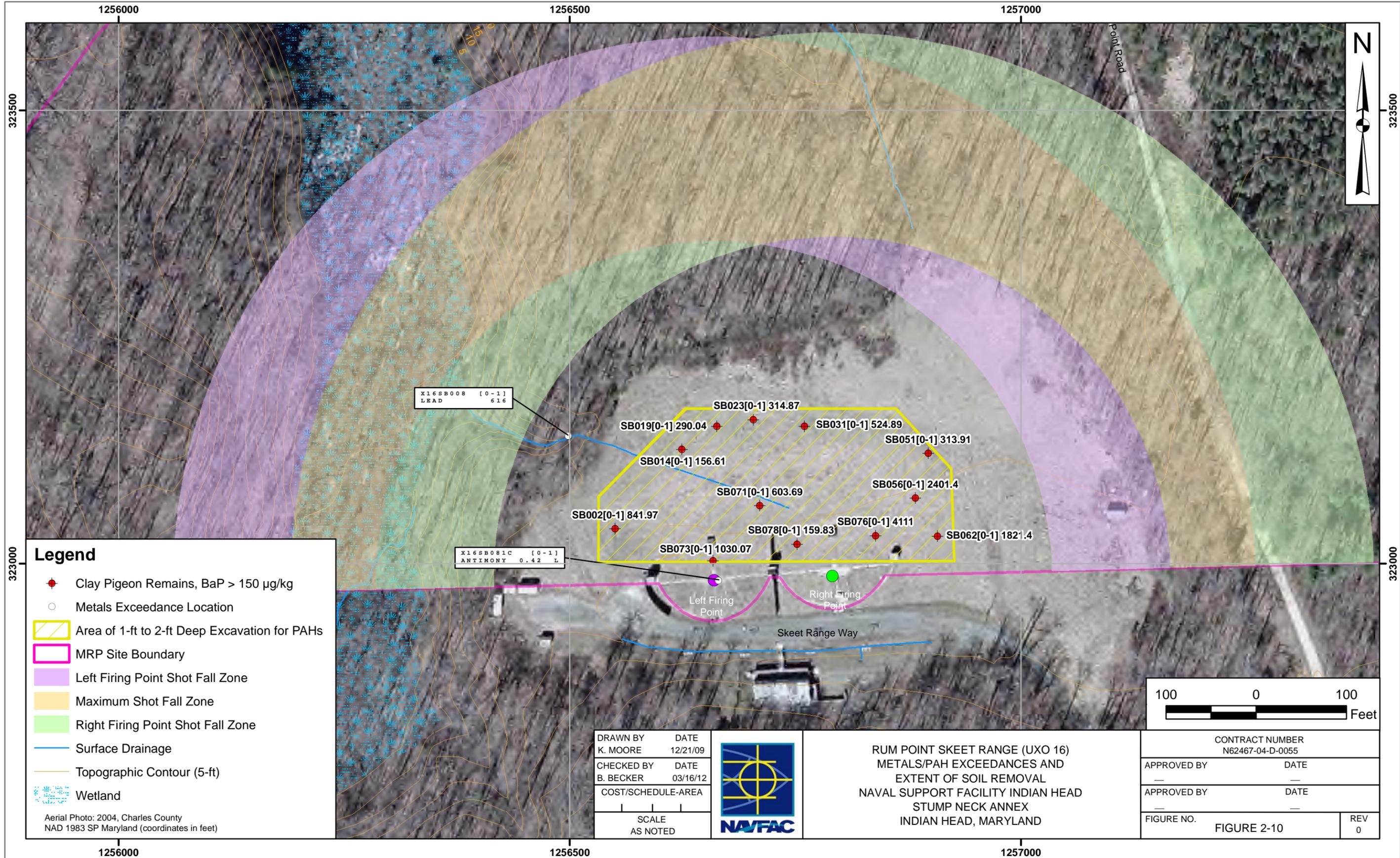
DRAWN BY K. MOORE	DATE 10/30/09
CHECKED BY B. BECKER	DATE 03/16/12
COST/SCHEDULE-AREA	

SCALE
AS NOTED



RUM POINT SKEET RANGE (UXO 16)
LEAD DATA AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 2-9	0



Legend

- ◆ Clay Pigeon Remains, BaP > 150 µg/kg
- Metals Exceedance Location
- Area of 1-ft to 2-ft Deep Excavation for PAHs
- MRP Site Boundary
- Left Firing Point Shot Fall Zone
- Maximum Shot Fall Zone
- Right Firing Point Shot Fall Zone
- Surface Drainage
- Topographic Contour (5-ft)
- Wetland

Aerial Photo: 2004, Charles County
NAD 1983 SP Maryland (coordinates in feet)

X16SB008 [0-1]
LEAD 616

X16SB081C [0-1]
ANTIMONY 0.42 L

SB019[0-1] 290.04 SB023[0-1] 314.87 SB031[0-1] 524.89 SB051[0-1] 313.91

SB014[0-1] 156.61 SB071[0-1] 603.69 SB056[0-1] 2401.4

SB002[0-1] 841.97 SB078[0-1] 159.83 SB076[0-1] 4111 SB062[0-1] 1821.4

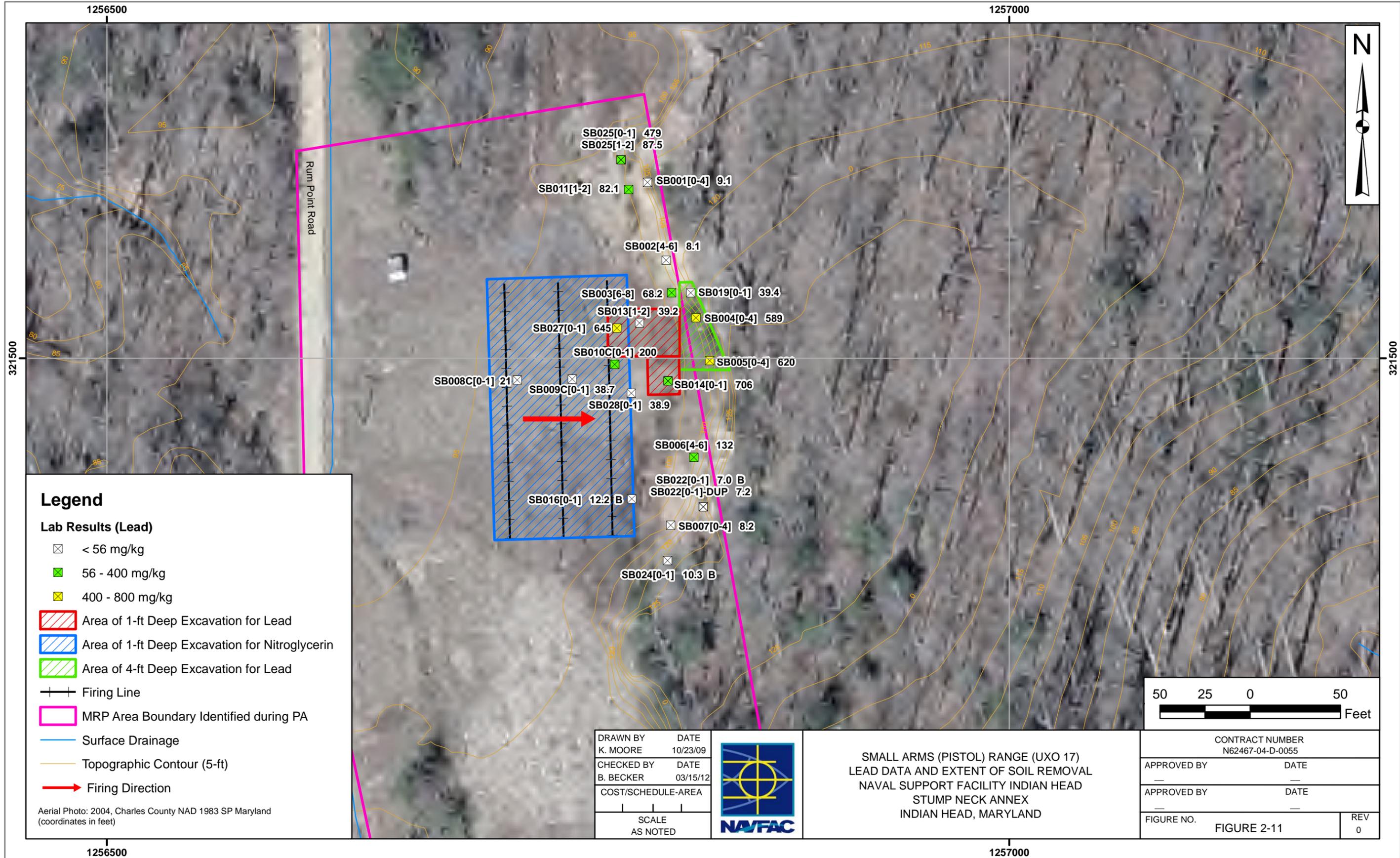
SB073[0-1] 1030.07

DRAWN BY K. MOORE	DATE 12/21/09
CHECKED BY B. BECKER	DATE 03/16/12
COST/SCHEDULE-AREA	
SCALE AS NOTED	



RUM POINT SKEET RANGE (UXO 16)
METALS/PAH EXCEEDANCES AND
EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

100 0 100 Feet	
CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO.	REV
FIGURE 2-10	0



Legend

Lab Results (Lead)

- ☒ < 56 mg/kg
- ☒ 56 - 400 mg/kg
- ☒ 400 - 800 mg/kg

- ▨ Area of 1-ft Deep Excavation for Lead
- ▨ Area of 1-ft Deep Excavation for Nitroglycerin
- ▨ Area of 4-ft Deep Excavation for Lead
- +— Firing Line
- ▭ MRP Area Boundary Identified during PA
- Surface Drainage
- Topographic Contour (5-ft)
- Firing Direction

Aerial Photo: 2004, Charles County NAD 1983 SP Maryland (coordinates in feet)

DRAWN BY K. MOORE	DATE 10/23/09
CHECKED BY B. BECKER	DATE 03/15/12
COST/SCHEDULE-AREA	

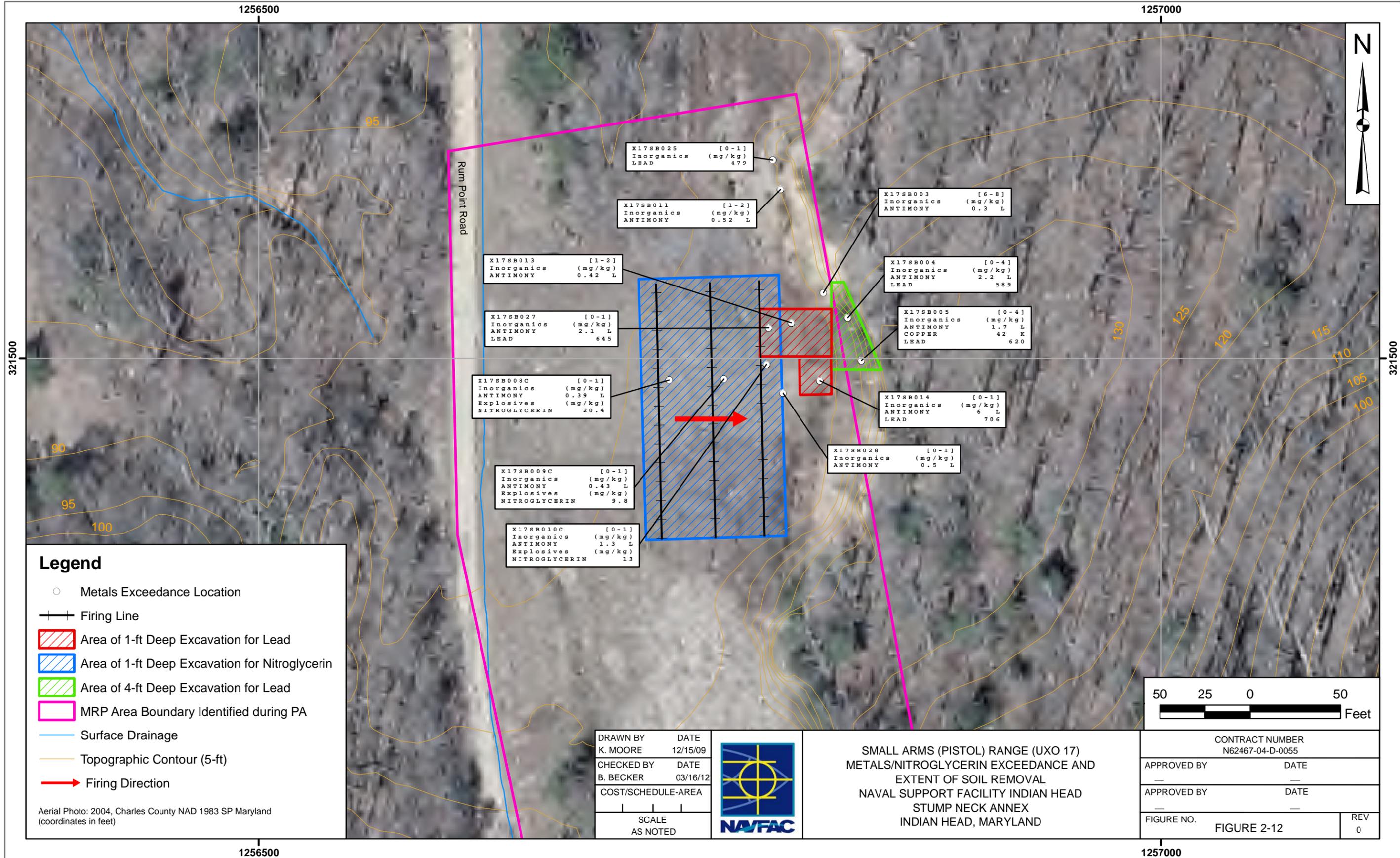
SCALE
AS NOTED

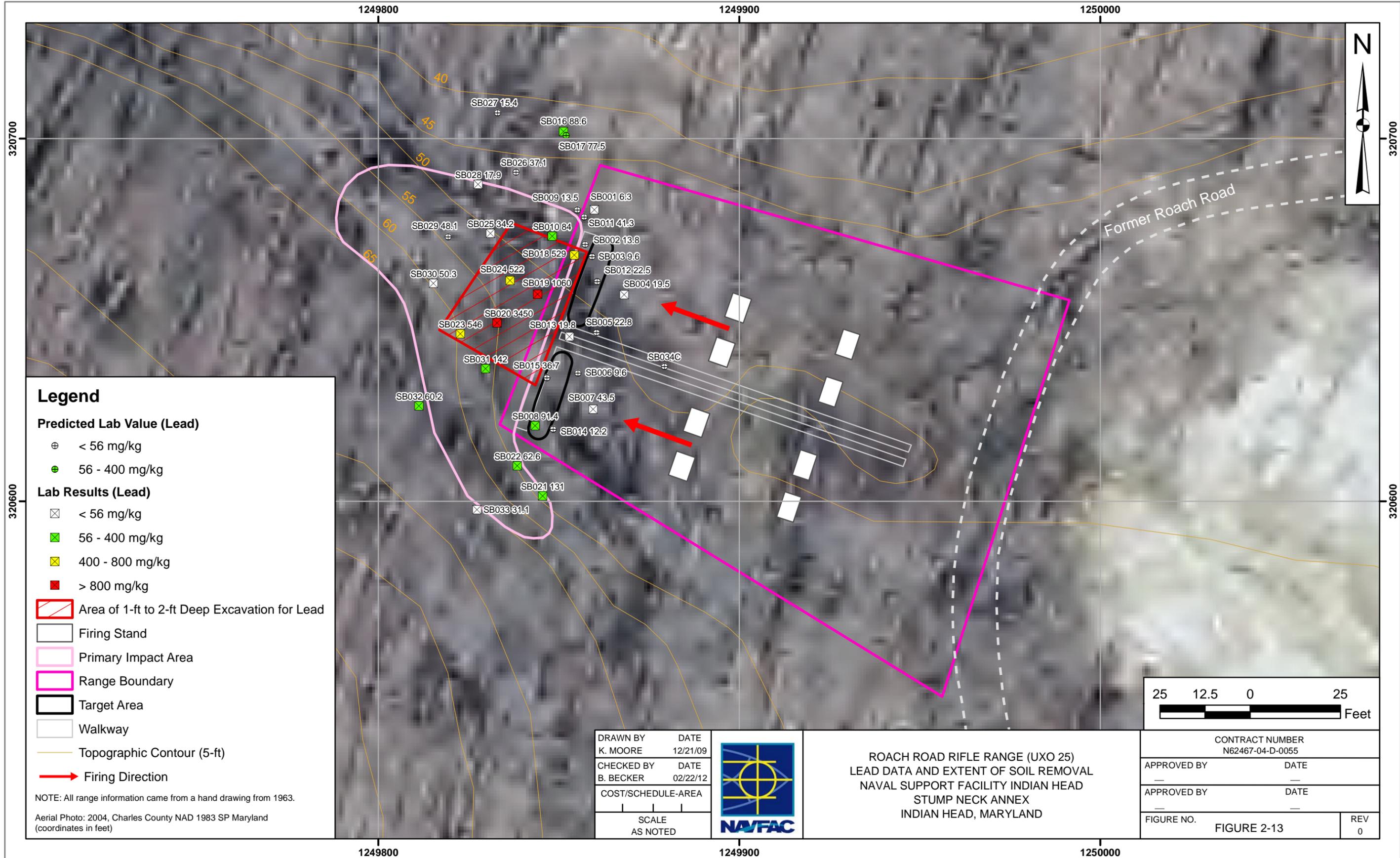


SMALL ARMS (PISTOL) RANGE (UXO 17)
LEAD DATA AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND



CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 2-11	0





Legend

Predicted Lab Value (Lead)

- ⊕ < 56 mg/kg
- 56 - 400 mg/kg

Lab Results (Lead)

- ⊗ < 56 mg/kg
- ⊗ 56 - 400 mg/kg
- ⊗ 400 - 800 mg/kg
- ⊗ > 800 mg/kg

▨ Area of 1-ft to 2-ft Deep Excavation for Lead

▭ Firing Stand

▭ Primary Impact Area

▭ Range Boundary

▭ Target Area

▭ Walkway

— Topographic Contour (5-ft)

→ Firing Direction

NOTE: All range information came from a hand drawing from 1963.

Aerial Photo: 2004, Charles County NAD 1983 SP Maryland (coordinates in feet)

DRAWN BY	DATE
K. MOORE	12/21/09

CHECKED BY	DATE
B. BECKER	02/22/12

COST/SCHEDULE-AREA

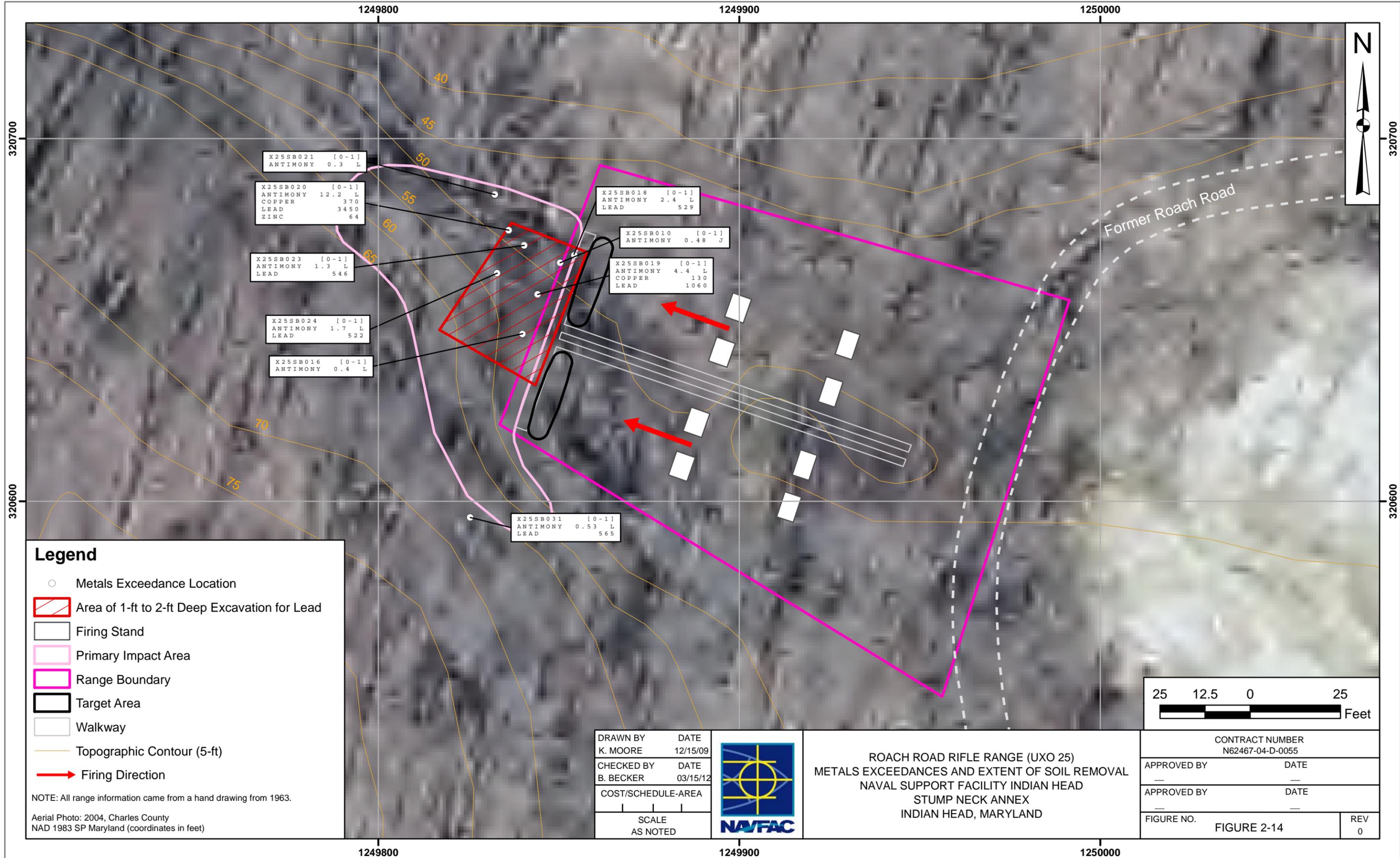
SCALE
AS NOTED



ROACH ROAD RIFLE RANGE (UXO 25)
LEAD DATA AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND



CONTRACT NUMBER N62467-04-D-0055	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO.	REV
FIGURE 2-13	0



X25SB021 [0-1]
ANTIMONY 0.3 L

X25SB020 [0-1]
ANTIMONY 12.2 L
COPPER 370
LEAD 3450
ZINC 64

X25SB023 [0-1]
ANTIMONY 1.3 L
LEAD 546

X25SB024 [0-1]
ANTIMONY 1.7 L
LEAD 522

X25SB016 [0-1]
ANTIMONY 0.4 L

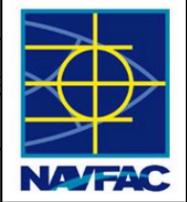
X25SB031 [0-1]
ANTIMONY 0.53 L
LEAD 565

X25SB018 [0-1]
ANTIMONY 2.4 L
LEAD 529

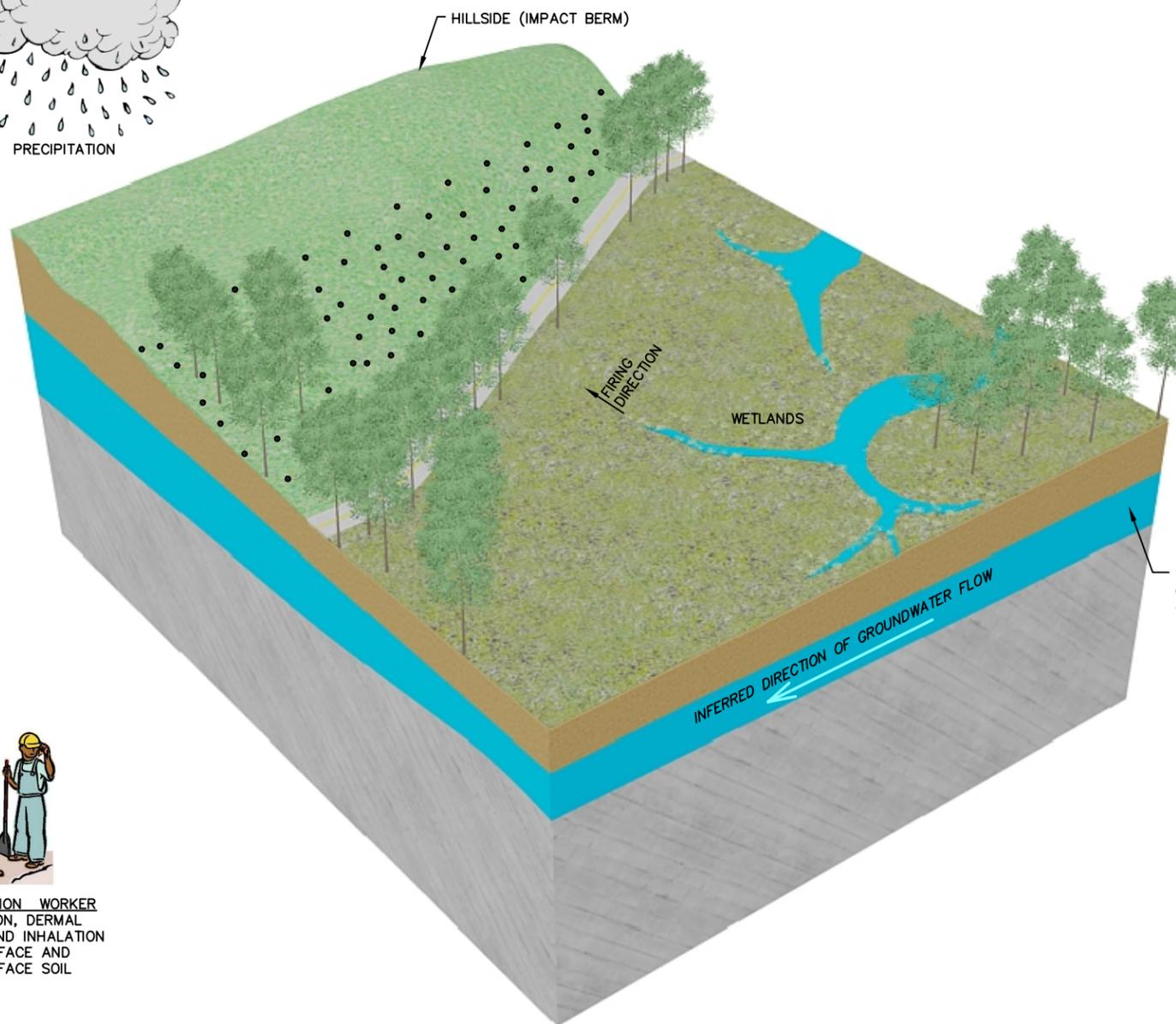
X25SB010 [0-1]
ANTIMONY 0.48 L

X25SB019 [0-1]
ANTIMONY 4.4 L
COPPER 130
LEAD 1060

Former Roach Road



ROACH ROAD RIFLE RANGE (UXO 25)
METALS EXCEEDANCES AND EXTENT OF SOIL REMOVAL
NAVAL SUPPORT FACILITY INDIAN HEAD
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND



**SITE WORKER/TRESSPASSER/
RECREATIONAL USER**
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE SOIL



FUTURE RESIDENT
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



CONSTRUCTION WORKER
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



ECOLOGICAL RECEPTOR
-INGESTION, DERMAL CONTACT,
AND INHALATION OF SURFACE SOIL
-INGESTION, DERMAL CONTACT
OF SURFACE WATER/SEDIMENT

LEGEND

••• AREA OF BULLET ACCUMULATION

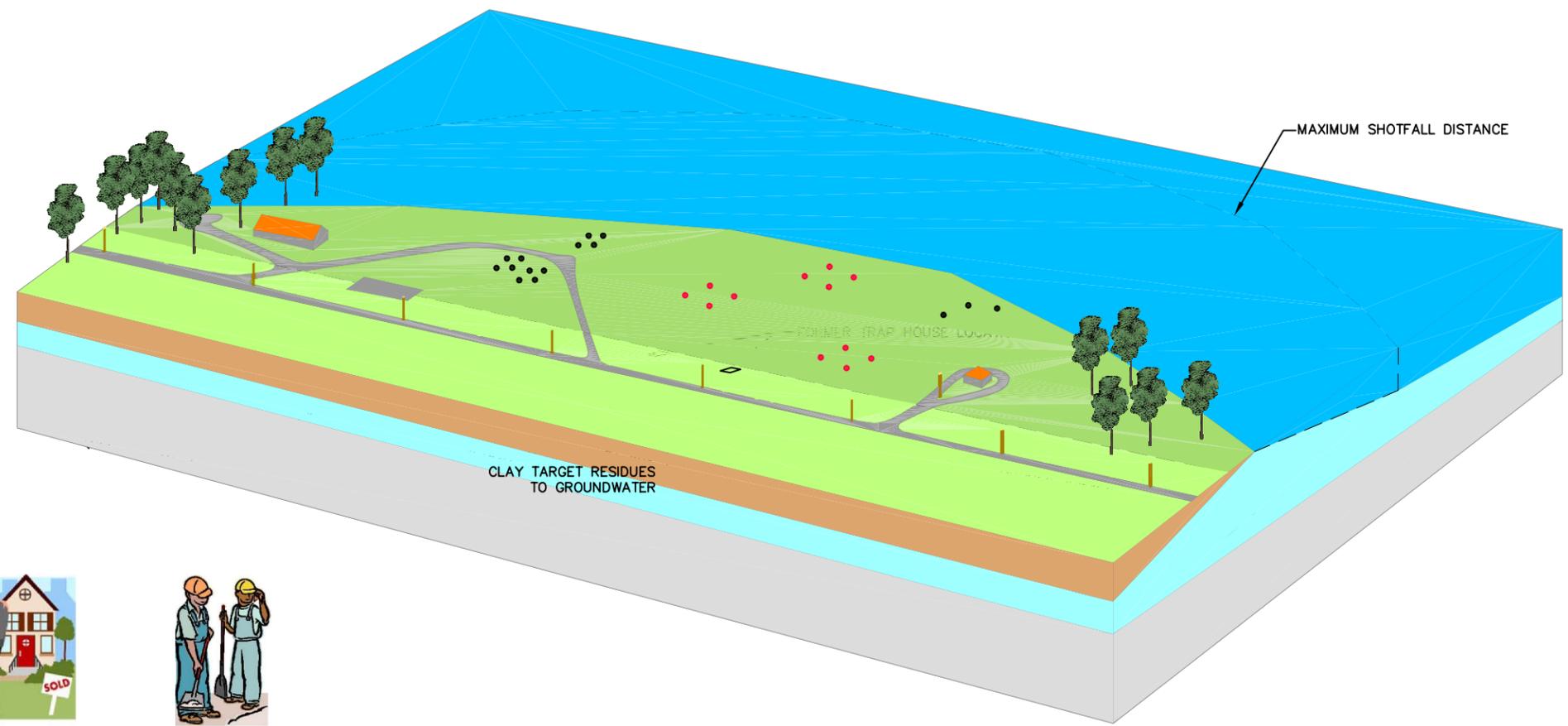
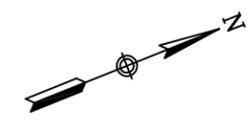
DRAWN BY MKB	DATE 03/14/12
CHECKED BY B. BECKER	DATE 03/14/12
REVISED BY ---	DATE ---

SCALE
NOT TO SCALE



MARINE RIFLE RANGE (UXO 14)
HILLSIDE IMPACT AREA
CONCEPTUAL SITE MODEL
NAVAL SUPPORT FACILITY
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CONTRACT NO. 0810	
OWNER NO.	
APPROVED BY ---	DATE ---
DRAWING NO. FIGURE 2-15	REV. 0



**SITE WORKER/TRESPASSER/
RECREATIONAL USER**
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE SOIL
-INGESTION AND DERMAL
CONTACT WITH SEDIMENT



FUTURE RESIDENT
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL
-INGESTION OF AND
DERMAL CONTACT WITH
GROUNDWATER
-INGESTION AND DERMAL
CONTACT WITH SEDIMENT



CONSTRUCTION WORKER
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL
-INGESTION OF AND
DERMAL CONTACT WITH
GROUNDWATER
-INGESTION AND DERMAL
CONTACT WITH SEDIMENT



ECOLOGICAL RECEPTOR
-INGESTION, DERMAL CONTACT,
AND INHALATION OF SURFACE SOIL
-INGESTION, DERMAL CONTACT
OF SURFACE WATER/SEDIMENT

LEGEND

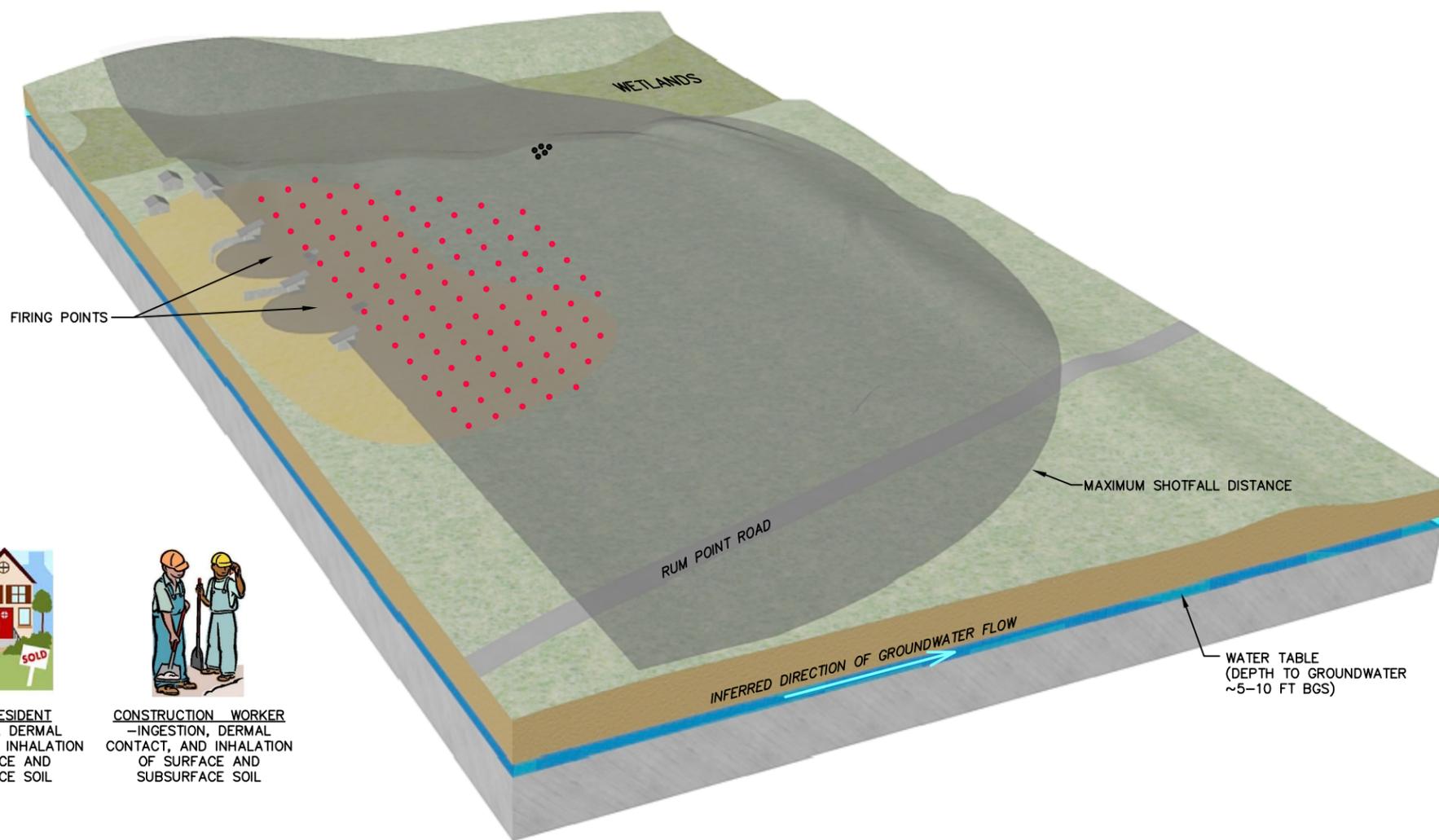
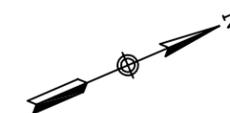
- AREA OF LEAD SHOT ACCUMULATION
- CLAY TARGET ACCUMULATIONS

DRAWN BY MKB	DATE 03/14/12
CHECKED BY B. BECKER	DATE 03/14/12
REVISED BY ---	DATE ---
SCALE NOT TO SCALE	



**OLD SKEET AND TRAP RANGE (UXO 15)
CONCEPTUAL SITE MODEL
NAVAL SUPPORT FACILITY
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND**

CONTRACT NO. 0810	
OWNER NO.	
APPROVED BY ---	DATE ---
DRAWING NO. FIGURE 2-16	REV. 0



**SITE WORKER/TRESSPASSER/
RECREATIONAL USER**
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE SOIL



FUTURE RESIDENT
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



CONSTRUCTION WORKER
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



ECOLOGICAL RECEPTOR
-INGESTION, DERMAL CONTACT,
AND INHALATION OF SURFACE SOIL
-INGESTION, DERMAL CONTACT
OF SURFACE WATER/SEDIMENT

LEGEND

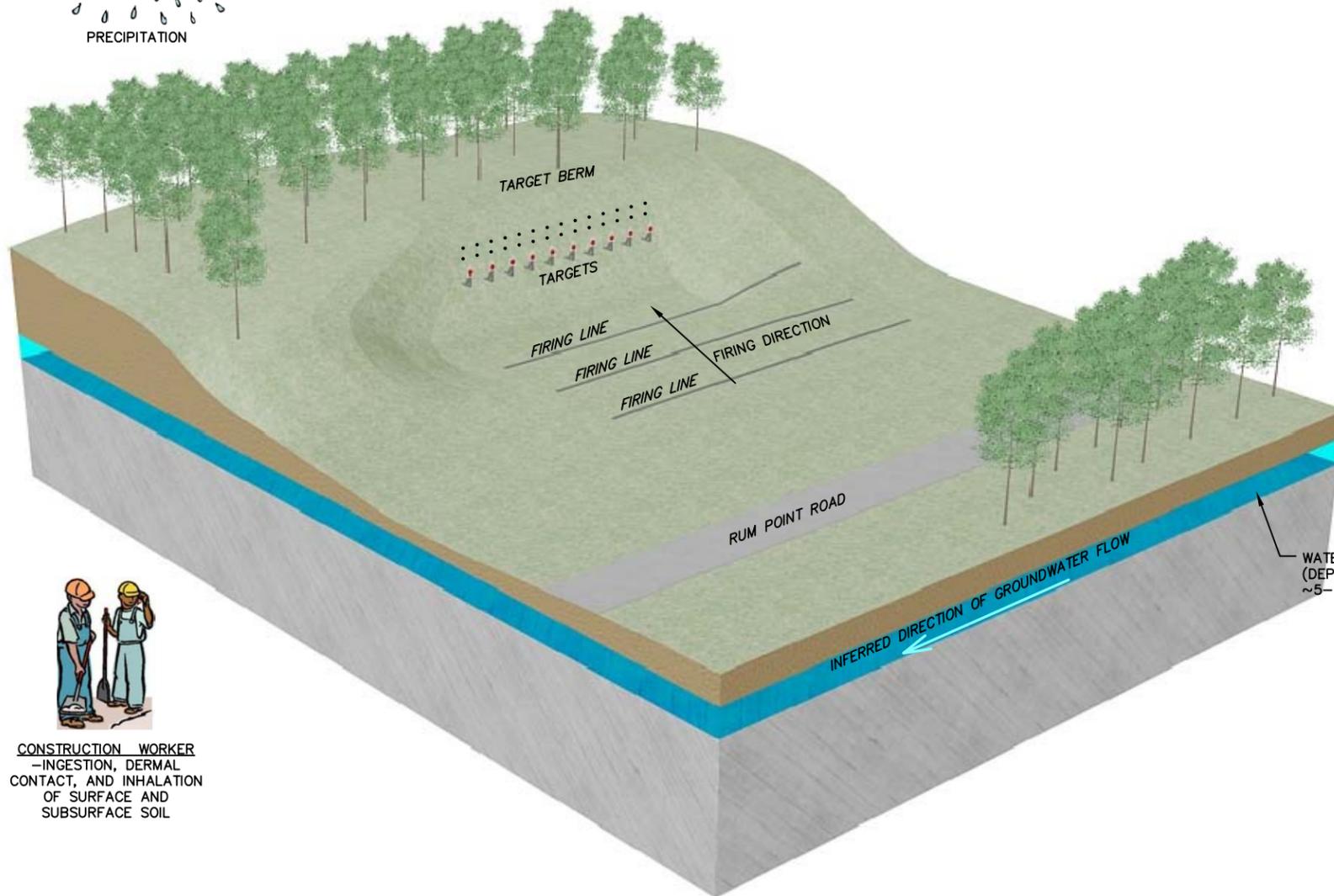
- AREA OF LEAD SHOT ACCUMULATION
- CLAY TARGET ACCUMULATIONS

DRAWN BY MKB	DATE 03/14/12
CHECKED BY B. BECKER	DATE 03/14/12
REVISED BY ---	DATE ---
SCALE NOT TO SCALE	



**RUM POINT SKEET RANGE (UXO 16)
CONCEPTUAL SITE MODEL FOR GROUNDWATER
NAVAL SUPPORT FACILITY
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND**

CONTRACT NO. 0810	
OWNER NO.	
APPROVED BY ---	DATE ---
DRAWING NO. FIGURE 2-17	REV. 0



**SITE WORKER/TRESSPASSER/
RECREATIONAL USER**
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE SOIL



FUTURE RESIDENT
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



CONSTRUCTION WORKER
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL



ECOLOGICAL RECEPTOR
-INGESTION, DERMAL CONTACT,
AND INHALATION OF SURFACE SOIL
-INGESTION, DERMAL CONTACT
OF SURFACE WATER/SEDIMENT

LEGEND

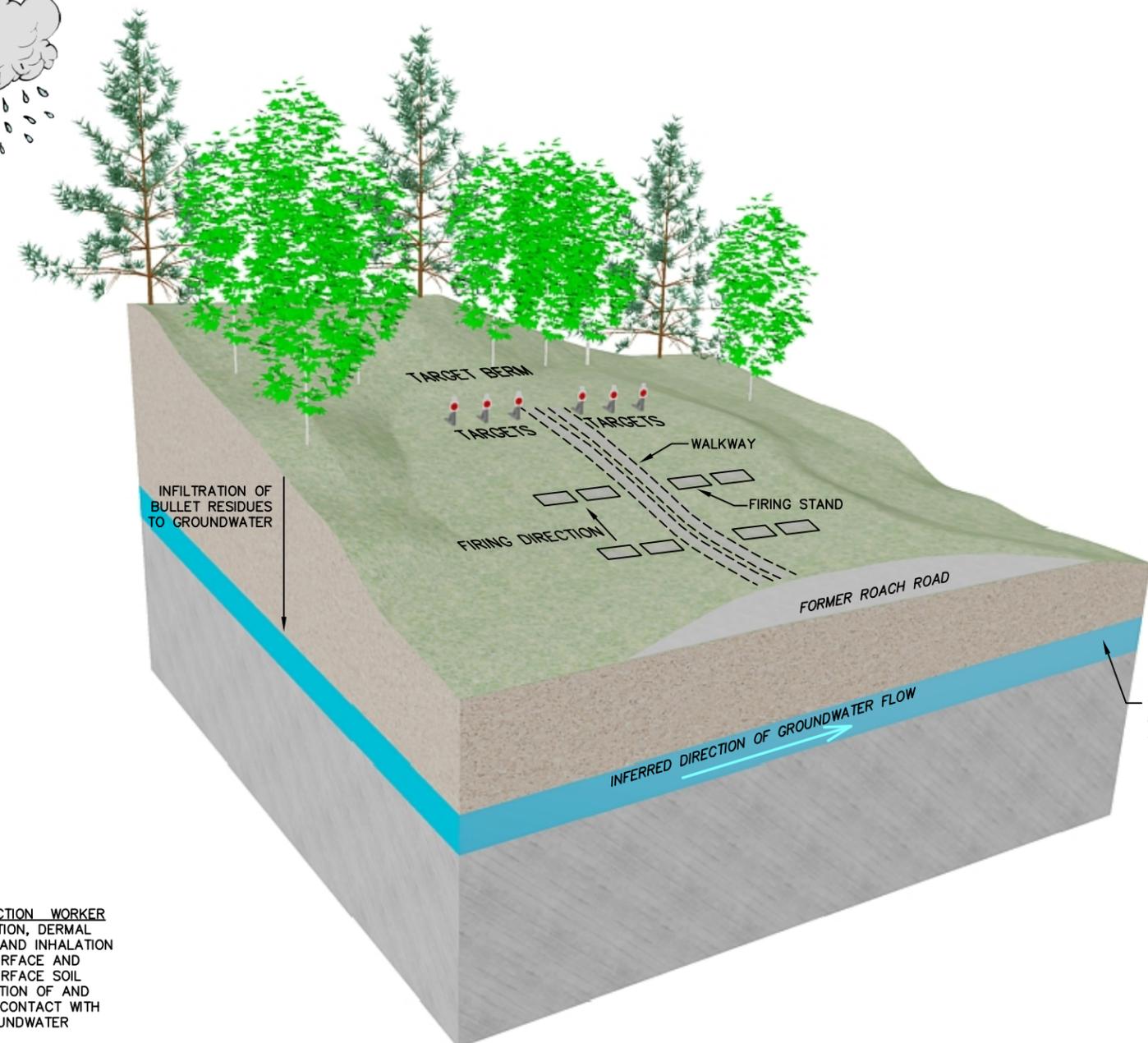
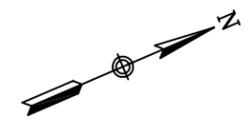
••• AREA OF BULLET ACCUMULATION

DRAWN BY MKB	DATE 03/15/12
CHECKED BY B. BECKER	DATE 03/15/12
REVISED BY ---	DATE ---
SCALE NOT TO SCALE	



SMALL ARMS (PISTOL) RANGE (UXO 17)
CONCEPTUAL SITE MODEL
NAVAL SUPPORT FACILITY
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CONTRACT NO. 0810	
OWNER NO.	
APPROVED BY ---	DATE ---
DRAWING NO. FIGURE 2-18	REV. 0



**SITE WORKER/TRESSPASSER/
RECREATIONAL USER**
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE SOIL



FUTURE RESIDENT
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL
-INGESTION OF AND
DERMAL CONTACT WITH
GROUNDWATER

CONSTRUCTION WORKER
-INGESTION, DERMAL
CONTACT, AND INHALATION
OF SURFACE AND
SUBSURFACE SOIL
-INGESTION OF AND
DERMAL CONTACT WITH
GROUNDWATER



ECOLOGICAL RECEPTOR
-INGESTION, DERMAL CONTACT,
AND INHALATION OF SURFACE SOIL
-INGESTION, DERMAL CONTACT
OF SURFACE WATER/SEDIMENT

LEGEND
••• AREA OF BULLET ACCUMULATION

DRAWN BY MKB	DATE 03/14/12
CHECKED BY B. BECKER	DATE 03/14/12
REVISED BY ---	DATE ---
SCALE NOT TO SCALE	



ROACH ROAD RIFLE RANGE (UXO 25)
CONCEPTUAL SITE MODEL
NAVAL SUPPORT FACILITY
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CONTRACT NO. 0810	
OWNER NO.	
APPROVED BY ---	DATE ---
DRAWING NO. FIGURE 2-19	REV. 0

APPENDIX A

SUMMARY OF FIELD SCREENING AND ANALYTICAL RESULTS

Table A.1-1
Summary of Chemicals Detected in Composite Surface Soil Samples
Firing Line Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 2

location		X14SB001C	X14SB002C	X14SB003C	X14SB004C	X14SB004C	X14SB004C	X14SB005C	X14SB006C								
nsample		X14SS001C0001	X14SS002C0001	X14SS003C0001	X14SS004C0001	X14SS004C0001-AVG	X14SS004C0001-D	X14SS005C0001	X14SS006C0001								
sample_dat		20090529	20090529	20090529	20090529	20090529	20090529	20090529	20090529								
qc_type		NM	NM	NM	NM	NM	FD	NM	NM								
sacode		NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL								
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO								
top_depth		0	0	0	0	0	0	0	0								
bottom_dep		1	1	1	1	1	1	1	1								
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT								
submatrix		SS	SS	SS	SS	SS	SS	SS	SS								
composite		Y	Y	Y	Y	Y	Y	Y	Y								
Inorganics (mg/kg)																	
ANTIMONY	0.27	0.15	J	0.19	J	0.18	J	1.4	J	1.4	J			0.13	J	0.19	J
ARSENIC	0.39	3.2		2.8		3		3.3		3.3				1.6		2	
COPPER	100	9.5	L	9.3	L	11.9	L	25.5	L	25.5	L			12.7	L	8	L
LEAD	11	18.4		17.6		19.6		52.5		52.5				12		36.7	
TIN	0.89	1.2	B	1.2	B	1.3	B	3.2	B	3.2	B			1.2	B	1	B
ZINC	46	29.6		26.7		36		66.5		66.5				25.1		46.4	
Explosives (mg/kg)																	
NITROGLYCERIN	6.1	1.2	UJ	1.2	UJ	1.2	UJ	1.2	UJ	1.2	UJ	1.2	UJ	1.2	UJ	1.2	UJ
XRF Field Parameters (mg/kg)																	
LEAD	11	19.667		18.333		15.667		82.333		82.333				16.667		19.667	
Miscellaneous Parameters (meq/100)																	
CATION EXCHANGE CAPACITY	NA																
Miscellaneous Parameters (s.u.)																	
PH	NA																
Miscellaneous Parameters (mg/kg)																	
TOTAL ORGANIC CARBON	NA																
Miscellaneous Parameters (%)																	
TOTAL SOLIDS	NA	83		79		76		84		84				86		79	

Table A.1-1
Summary of Chemicals Detected in Composite Surface Soil Samples
Firing Line Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 2

location		X14SB007C	X14SB008C	X14SB009C			
nsample		X14SS007C0001	X14SS008C0001	X14SS009C0001			
sample_dat		20090529	20090601	20090601			
qc_type		NM	NM	NM			
sacode		NORMAL	NORMAL	NORMAL			
matrix	PALs	SO	SO	SO			
top_depth		0	0	0			
bottom_dep		1	1	1			
depth_unit		FT	FT	FT			
submatrix		SS	SS	SS			
composite		Y	Y	Y			
Inorganics (mg/kg)							
ANTIMONY	0.27	0.16	J	0.19	J	0.3	J
ARSENIC	0.39	3		2.6		2.5	
COPPER	100	8.7	L	52.4	L	12.8	L
LEAD	11	21.2		22.3		20.1	
TIN	0.89	1.7	B	1.2	B	1.5	B
ZINC	46	31.9		65.4		34.5	
Explosives (mg/kg)							
NITROGLYCERIN	6.1	1.2	UJ	1.2	U	0.8	J
XRF Field Parameters (mg/kg)							
LEAD	11	19		30		22	
Miscellaneous Parameters (meq/100)							
CATION EXCHANGE CAPACITY	NA						
Miscellaneous Parameters (s.u.)							
PH	NA						
Miscellaneous Parameters (mg/kg)							
TOTAL ORGANIC CARBON	NA						
Miscellaneous Parameters (%)							
TOTAL SOLIDS	NA	84		80		73	

Table A.1-2
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 1
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 5

location		X14SB018	X14SB019	X14SB020	X14SB021	X14SB022	X14SB023	X14SB024	X14SB025
nsample		X14SS0180001	X14SS0190001	X14SS0200001	X14SS0210001	X14SS0220001	X14SS0230001	X14SS0240001	X14SS0250001
sample_dat		20090602	20090602	20090602	20090602	20090602	20090602	20090602	20090602
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					0.12	L		
ARSENIC	0.39					4.2			
COPPER	100					9.2			
LEAD	11					9.6			
TIN	0.89					1.8	B		
ZINC	46					29.8			
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	11.667	16	18.333	22.667	28.667	16	42	62
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA					20	K		
Miscellaneous Parameters (s.u.)									
PH	NA					4.8			
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA					15000			
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA					84			

Table A.1-2
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 1
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 5

location		X14SB034	X14SB035	X14SB036	X14SB037	X14SB038	X14SB039	X14SB040	X14SB041
nsample		X14SS0340001	X14SS0350001	X14SS0360001	X14SS0370001	X14SS0380001	X14SS0390001	X14SS0400001	X14SS0410001
sample_dat		20090602	20090602	20090602	20090602	20090602	20090602	20090602	20090602
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27		0.14	L			0.16	L	
ARSENIC	0.39		2.9				1.8		
COPPER	100		107				41		
LEAD	11		543				111		
TIN	0.89		9.1				2.9	B	
ZINC	46		33.3				23.3		
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	233.667	540.333	117	106.333	403.333	128.333	201.667	317.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA		85				84		

Table A.1-2
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 1
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 5

location		X14SB042	X14SB043	X14SB044	X14SB045
nsample		X14SS0420001	X14SS0430001	X14SS0440001	X14SS0450001
sample_dat		20090602	20090602	20090602	20090603
qc_type		NM	NM	NM	NM
sacode		NORMAL	NORMAL	NORMAL	NORMAL
matrix	PALs	SO	SO	SO	SO
top_depth		0	0	0	0
bottom_dep		1	1	1	1
depth_unit		FT	FT	FT	FT
submatrix		SS	SS	SS	SS
composite		N	N	N	N
Inorganics (mg/kg)					
ANTIMONY	0.27		0.13	L	
ARSENIC	0.39		1.3		
COPPER	100		76.5		
LEAD	11		373		
TIN	0.89		4.1		
ZINC	46		18.6		
Explosives (mg/kg)					
NITROGLYCERIN	6.1				
XRF Field Parameters (mg/kg)					
LEAD	11	84.667	389	330	34.667
Miscellaneous Parameters (meg/100)					
CATION EXCHANGE CAPACITY	NA				
Miscellaneous Parameters (s.u.)					
PH	NA				
Miscellaneous Parameters (mg/kg)					
TOTAL ORGANIC CARBON	NA				
Miscellaneous Parameters (%)					
TOTAL SOLIDS	NA		86		

Table A.1-3
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 2
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 4

location		X14SB046	X14SB047	X14SB048	X14SB049	X14SB050	X14SB051	X14SB052	X14SB053
nsample		X14SS0460001	X14SS0470001	X14SS0480001	X14SS0490001	X14SS0500001	X14SS0510001	X14SS0520001	X14SS0530001
sample_dat		20090603	20090603	20090603	20090603	20090603	20090603	20090603	20090603
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27			0.14	L				
ARSENIC	0.39			2.7					
COPPER	100			14.6					
LEAD	11			85.7					
TIN	0.89			2	B				
ZINC	46			33.1					
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	21.333	37	50.333	29.333	210.667	544.667	65	114.333
Miscellaneous Parameters (mg/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA			71					

Table A.1-3
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 2
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 4

location		X14SB054	X14SB055	X14SB056	X14SB057	X14SB058	X14SB059	X14SB060	X14SB061
nsample		X14SS0540001	X14SS0550001	X14SS0560001	X14SS0570001	X14SS0580001	X14SS0590001	X14SS0600001	X14SS0610001
sample_dat		20090603	20090603	20090603	20090603	20090603	20090603	20090603	20090603
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					0.15	L		
ARSENIC	0.39					1.6			
COPPER	100					88.6			
LEAD	11					606			
TIN	0.89					10.1			
ZINC	46					18.2			
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	365.667	728.667	114.333	228	661	144.667	713.667	138.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA					13	K		
Miscellaneous Parameters (s.u.)									
PH	NA					4.6			
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA					10000			
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA					84			

Table A.1-3
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 2
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 4

location		X14SB062	X14SB063	X14SB064	X14SB065	X14SB066	X14SB067	X14SB068	X14SB069	
nsample		X14SS0620001	X14SS0630001	X14SS0640001	X14SS0650001	X14SS0660001	X14SS0670001	X14SS0680001	X14SS0690001	
sample_dat		20090603	20090603	20090603	20090603	20090603	20090603	20090603	20090603	
qc_type		NM								
sacode		NORMAL								
matrix	PALs	SO								
top_depth		0	0	0	0	0	0	0	0	
bottom_dep		1	1	1	1	1	1	1	1	
depth_unit		FT								
submatrix		SS								
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27	0.17	L	0.11	B					
ARSENIC	0.39	3.1		2.1						
COPPER	100	29.7		40.8						
LEAD	11	278		188						
TIN	0.89	2	B	3	B					
ZINC	46	35.2		21.8						
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	286.333		172.667	488.667	224.333	783.667	163	156.333	612.667
Miscellaneous Parameters (mg/100)										
CATION EXCHANGE CAPACITY	NA									
Miscellaneous Parameters (s.u.)										
PH	NA									
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA									
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA	80		83						

Table A.1-3
Summary of Chemicals Detected in Discrete Soil Samples
Target Berm 2
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 4

location		X14SB070	X14SB071	X14SB072
nsample		X14SS0700001	X14SS0710001	X14SS0720001
sample_dat		20090603	20090603	20090603
qc_type		NM	NM	NM
sacode		NORMAL	NORMAL	NORMAL
matrix	PALs	SO	SO	SO
top_depth		0	0	0
bottom_dep		1	1	1
depth_unit		FT	FT	FT
submatrix		SS	SS	SS
composite		N	N	N
Inorganics (mg/kg)				
ANTIMONY	0.27			0.13 L
ARSENIC	0.39			3.3
COPPER	100			85
LEAD	11			283
TIN	0.89			2.5 B
ZINC	46			34.5
Explosives (mg/kg)				
NITROGLYCERIN	6.1			
XRF Field Parameters (mg/kg)				
LEAD	11	602.333	168.667	456.333
Miscellaneous Parameters (meq/100)				
CATION EXCHANGE CAPACITY	NA			
Miscellaneous Parameters (s.u.)				
PH	NA			
Miscellaneous Parameters (mg/kg)				
TOTAL ORGANIC CARBON	NA			
Miscellaneous Parameters (%)				
TOTAL SOLIDS	NA			81

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 9

location		X14SB080	X14SB081	X14SB082	X14SB083	X14SB084	X14SB084	X14SB084	X14SB084	X14SB084		
nsample		X14SS0800001	X14SS0810001	X14SS0820001	X14SS0830001	X14SS0840001	X14SB0840102	X14SB0840102-AVG	X14SB0840102-D			
sample_dat		20090604	20090604	20090604	20090604	20090604	20090616	20090616	20090616			
qc_type		NM	FD									
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP			
matrix	PALs	SO	SO									
top_depth		0	0	0	0	0	1	1	1			
bottom_dep		1	1	1	1	1	2	2	2			
depth_unit		FT	FT									
submatrix		SS	SS	SS	SS	SS	SB	SB	SB			
composite		N	N	N	N	N	N	N	N			
Inorganics (mg/kg)												
ANTIMONY	0.27						0.88	B	0.67	B	0.46	B
ARSENIC	0.39						7.8	J	5.9	J	4	J
COPPER	100						849	J	641.5	J	434	J
LEAD	11						6620	J	5105	J	3590	J
TIN	0.89						131	J	104.3	J	77.6	J
ZINC	46						53.9		46.65		39.4	
Explosives (mg/kg)												
NITROGLYCERIN												
XRF Field Parameters (mg/kg)												
LEAD	11	450.667	5150.667	2329.667	323	8971.667	357.667	357.667				
Miscellaneous Parameters (meq/100)												
CATION EXCHANGE CAPACITY	NA											
Miscellaneous Parameters (s.u.)												
PH	NA											
Miscellaneous Parameters (mg/kg)												
TOTAL ORGANIC CARBON	NA											
Miscellaneous Parameters (%)												
TOTAL SOLIDS	NA						79		78.5		78	

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 9

location		X14SB085	X14SB086	X14SB087	X14SB088	X14SB089	X14SB090	X14SB091	X14SB092
nsample		X14SS0850001	X14SS0860001	X14SS0870001	X14SS0880001	X14SS0890001	X14SS0900001	X14SS0910001	X14SS0920001
sample_dat		20090604	20090604	20090604	20090604	20090604	20090604	20090604	20090604
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27			0.12	L				
ARSENIC	0.39			3.2					
COPPER	100			32.6					
LEAD	11			108					
TIN	0.89			1.7	B				
ZINC	46			32.9					
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	175	598.667	279	187.667	1245.667	1186.667	594	708.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA			23	K				
Miscellaneous Parameters (s.u.)									
PH	NA			4.9					
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA			15000					
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA			85					

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 9

location		X14SB093	X14SB094	X14SB095	X14SB096	X14SB097	X14SB098	X14SB099	X14SB100
nsample		X14SS0930001	X14SS0940001	X14SS0950001	X14SS0960001	X14SS0970001	X14SS0980001	X14SS0990001	X14SS1000001
sample_dat		20090604	20090604	20090604	20090604	20090604	20090604	20090604	20090604
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27		0.14	L					
ARSENIC	0.39		2.4						
COPPER	100		39.5						
LEAD	11		293						
TIN	0.89		7.1						
ZINC	46		24.8						
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	265	337	2105.667	245.333	49.667	1339	3361.333	23.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA		83						

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 9

location		X14SB101	X14SB102	X14SB102	X14SB102	X14SB103	X14SB104	X14SB105	X14SB106
nsample		X14SS1010001	X14SS1020001	X14SB1020102	X14SB1020203	X14SS1030001	X14SS1040001	X14SS1050001	X14SS1060001
sample_dat		20090604	20090604	20090616	20090617	20090604	20090604	20090604	20090604
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	1	2	0	0	0	0
bottom_dep		1	1	2	3	1	1	1	1
depth_unit		FT							
submatrix		SS	SS	SB	SB	SS	SS	SS	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					0.18	B		
ARSENIC	0.39					3.9			
COPPER	100					113			
LEAD	11					1220			
TIN	0.89					29.3			
ZINC	46					25.8			
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	11340.67	19878	8931	2401.667	454.333	1668.667	654.667	490.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA					86			

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 9

location		X14SB107	X14SB108	X14SB109	X14SB110	X14SB111	X14SB111	X14SB112	X14SB113
nsample		X14SS1070001	X14SS1080001	X14SS1090001	X14SS1100001	X14SS1110001	X14SB1110102	X14SS1120001	X14SS1130001
sample_dat		20090604	20090604	20090604	20090604	20090604	20090616	20090604	20090604
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	1	0	0
bottom_dep		1	1	1	1	1	2	1	1
depth_unit		FT							
submatrix		SS	SS	SS	SS	SS	SB	SS	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27		0.14	L			0.6	B	
ARSENIC	0.39		6.9				2.2		
COPPER	100		21.9				251		
LEAD	11		31.3				2640		
TIN	0.89		1.6	B			139		
ZINC	46		50.7				9.8		
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	2731.667	54.333	3208.333	9119.333	11536	1842.667	7109.667	9883
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA		81				84		

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 9

location		X14SB114	X14SB115	X14SB116	X14SB117	X14SB118	X14SB119	X14SB120	X14SB121
nsample		X14SS1140001	X14SS1150001	X14SS1160001	X14SS1170001	X14SS1180001	X14SS1190001	X14SS1200001	X14SS1210001
sample_dat		20090604	20090604	20090604	20090604	20090604	20090604	20090604	20090604
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27				0.07	B		0.14	B
ARSENIC	0.39				1.1			1.6	B
COPPER	100				151			276	J
LEAD	11				618			741	J
TIN	0.89				4.6			3.7	
ZINC	46				7.2			9.3	
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	2786	1628.667	685.667	848.667	641.333	460.333	287.667	764.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA				15	K			
Miscellaneous Parameters (s.u.)									
PH	NA				4.6				
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA				28000				
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA				86			79	

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 7 of 9

location		X14SB122	X14SB123	X14SB124	X14SB125	X14SB126	X14SB127	X14SB128	X14SB129
nsample		X14SS1220001	X14SS1230001	X14SS1240001	X14SS1250001	X14SS1260001	X14SS1270001	X14SS1280001	X14SS1290001
sample_dat		20090604	20090604	20090604	20090609	20090609	20090609	20090609	20090609
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					0.07	B		
ARSENIC	0.39					1.2			
COPPER	100					53.3			
LEAD	11					476			
TIN	0.89					29.4			
ZINC	46					15.3			
Explosives (mg/kg)									
NITROGLYCERIN									
XRF Field Parameters (mg/kg)									
LEAD	11	75.667	106.333	72.667	909.333	512.333	984	2823.667	1182.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA					68			

Table A.1-4
Summary of Chemicals Detected in Discrete Soil Samples
Hillside Impact Area
Marine Rifle Range - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 9 of 9

location		X14SB138	X14SB139	X14SB140	X14SB141	X14SB142	X14SB143												
nsample		X14SS1380001	X14SS1390001	X14SS1400001	X14SS1410001	X14SS1420001	X14SS1430001												
sample_dat		20090616	20090616	20090616	20090616	20090617	20090617												
qc_type		NM	NM	NM	NM	NM	NM												
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL												
matrix	PALs	SO	SO	SO	SO	SO	SO												
top_depth		0	0	0	0	0	0												
bottom_dep		1	1	1	1	1	1												
depth_unit		FT	FT	FT	FT	FT	FT												
submatrix		SS	SS	SS	SS	SS	SS												
composite		N	N	N	N	N	N												
Inorganics (mg/kg)																			
ANTIMONY	0.27	0.14	B	0.14	B	0.32	B	0.1	B	0.14	B	0.14	B						
ARSENIC	0.39	2.2		2.3		3		1.2		4.8		3.8							
COPPER	100	28.2		63.4		141		13.6		9.8		20.3							
LEAD	11	137		280		676		405		11	B	166							
TIN	0.89	2.8		4.9		81.8		3		1.3	B	1.7							
ZINC	46	33.8		25.4		20		7		29.2		19.7							
Explosives (mg/kg)																			
NITROGLYCERIN																			
XRF Field Parameters (mg/kg)																			
LEAD	11	160.667		328.333		1031		351.333		19.333		289.667							
Miscellaneous Parameters (meq/100)																			
CATION EXCHANGE CAPACITY								NA											
Miscellaneous Parameters (s.u.)																			
PH								NA											
Miscellaneous Parameters (mg/kg)																			
TOTAL ORGANIC CARBON								NA											
Miscellaneous Parameters (%)																			
TOTAL SOLIDS								NA	85		84		81		85		86		84

Table A.2-1
Summary of Chemicals Detected in Composite Soil Samples
Firing Points
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 1

location		X15SB077C		X15SB078C	
nsample		X15SS077C0001		X15SS078C0001	
sample_dat		20090610		20090610	
qc_type		NM		NM	
sacode		NORMAL		NORMAL	
matrix	PALs	SO		SO	
top_depth		0		0	
bottom_dep		1		1	
depth_unit		FT		FT	
submatrix		SS		SS	
composite		Y		Y	
Inorganics (mg/kg)					
ANTIMONY	0.27	0.68	L	0.46	L
ARSENIC	0.39	2.6		2.7	
COPPER	100	23.3		14.8	
LEAD	11	66.7		77.2	
TIN	0.89	1.8	B	1.7	B
ZINC	46	52.5		54.4	
PAHs (ug/kg)					
1-METHYLNAPHTHALENE	22000				
2-METHYLNAPHTHALENE	31000				
ACENAPHTHENE	29000				
ACENAPHTHYLENE	29000				
ANTHRACENE	29000				
BENZO(A)ANTHRACENE	150				
BENZO(A)PYRENE	15				
BENZO(B)FLUORANTHENE	150				
BENZO(G,H,I)PERYLENE	1100				
BENZO(K)FLUORANTHENE	1100				
CHRYSENE	1100				
DIBENZO(A,H)ANTHRACENE	15				
FLUORANTHENE	29000				
FLUORENE	29000				
INDENO(1,2,3-CD)PYRENE	150				
NAPHTHALENE	330				
PHENANTHRENE	29000				
PYRENE	1100				
Explosives (mg/kg)					
NITROGLYCERIN	6.1	3.7	J	0.49	J
XRF Field Parameters (mg/kg)					
LEAD	11	67.667		81.333	
Miscellaneous Parameters (meq/100)					
CATION EXCHANGE CAPACITY	NA				
Miscellaneous Parameters (s.u.)					
PH	NA				
Miscellaneous Parameters (mg/kg)					
TOTAL ORGANIC CARBON	NA				
Miscellaneous Parameters (%)					
TOTAL SOLIDS	NA	81		82	
Miscellaneous Organic Parameters (%)					
TOTAL SOLIDS	NA				

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 11

location		X15SB007	X15SB008	X15SB009	X15SB010	X15SB011	X15SB012	X15SB012	X15SB013
nsample		X15SB0070102	X15SS0080001	X15SS0090001	X15SS0100001	X15SS0110001	X15SS0120001	X15SS0120001RE	X15SS0130001
sample_dat		20090602	20090527	20090527	20090527	20090527	20090527	20090527	20090527
qc_type		NM	NM						
sacode		NORMAL	NORMAL						
matrix	PALs	SO	SO						
top_depth		1	0	0	0	0	0	0	0
bottom_dep		2	1	1	1	1	1	1	1
depth_unit		FT	FT						
submatrix		SB	SS	SS	SS	SS	SS	SS	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27								
ARSENIC	0.39								
COPPER	100								
LEAD	11								
TIN	0.89								
ZINC	46								
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000					25	UJ		
2-METHYLNAPHTHALENE	31000					25	UJ		
ACENAPHTHENE	29000					25	U		
ACENAPHTHYLENE	29000					25	U		
ANTHRACENE	29000					25	U		
BENZO(A)ANTHRACENE	150					21	J		
BENZO(A)PYRENE	15					18	J		
BENZO(B)FLUORANTHENE	150					24	J		
BENZO(G,H,I)PERYLENE	1100					13	J		
BENZO(K)FLUORANTHENE	1100					11	J		
CHRYSENE	1100					15	J		
DIBENZO(A,H)ANTHRACENE	15					9.4	J		
FLUORANTHENE	29000					15	J		
FLUORENE	29000					25	U		
INDENO(1,2,3-CD)PYRENE	150					11	J		
NAPHTHALENE	330					25	U		
PHENANTHRENE	29000					6.2	J		
PYRENE	1100					15	J		
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	85.333	285.667	38.667	50	113	199.333	175.333	838.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA								
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA					79			

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 11

location		X15SB013	X15SB013	X15SB014	X15SB015	X15SB016	X15SB017	X15SB018	X15SB019	
nsample		X15SB0130102	X15SB0130102RE	X15SS0140001	X15SS0150001	X15SS0160001	X15SS0170001	X15SS0180001	X15SS0190001	
sample_dat		20090602	20090602	20090527	20090527	20090527	20090527	20090527	20090527	
qc_type		NM	NM	NM	NM	NM	NM	NM	NM	
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO	
top_depth		1	1	0	0	0	0	0	0	
bottom_dep		2	2	1	1	1	1	1	1	
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT	
submatrix		SB	SB	SS	SS	SS	SS	SS	SS	
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27							0.69	J	
ARSENIC	0.39							3.2		
COPPER	100							8.8	L	
LEAD	11							32		
TIN	0.89							1.3	B	
ZINC	46							30.5		
PAHs (ug/kg)										
1-METHYLNAPHTHALENE	22000				150	J			26	UJ
2-METHYLNAPHTHALENE	31000				230				26	UJ
ACENAPHTHENE	29000				2000	J			26	U
ACENAPHTHYLENE	29000				25	U			26	U
ANTHRACENE	29000				2500	J			26	U
BENZO(A)ANTHRACENE	150				17000				37	J
BENZO(A)PYRENE	15				23000				40	J
BENZO(B)FLUORANTHENE	150				21000				42	J
BENZO(G,H,I)PERYLENE	1100				11000				27	J
BENZO(K)FLUORANTHENE	1100				8400				25	J
CHRYSENE	1100				22000				35	J
DIBENZO(A,H)ANTHRACENE	15				3300	J			13	J
FLUORANTHENE	29000				16000				30	J
FLUORENE	29000				4200	U			26	U
INDENO(1,2,3-CD)PYRENE	150				12000				24	J
NAPHTHALENE	330				4200	U			26	U
PHENANTHRENE	29000				11000				11	J
PYRENE	1100				23000				28	J
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	36.667	39.667	77.333	45.333	45.667	106	47	35.333	
Miscellaneous Parameters (meq/100)										
CATION EXCHANGE CAPACITY	NA									
Miscellaneous Parameters (s.u.)										
PH	NA									
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA									
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA							87		
Miscellaneous Organic Parameters (%)										
TOTAL SOLIDS	NA				79				78	

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 11

location		X15SB020	X15SB021	X15SB022	X15SB023	X15SB024	X15SB025	X15SB026	X15SB027
nsample		X15SS0200001	X15SS0210001	X15SS0220001	X15SS0230001	X15SS0240001	X15SS0250001	X15SS0260001	X15SS0270001
sample_dat		20090527	20090527	20090527	20090527	20090527	20090527	20090527	20090528
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27								
ARSENIC	0.39								
COPPER	100								
LEAD	11								
TIN	0.89								
ZINC	46								
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000		27	U					
2-METHYLNAPHTHALENE	31000		17	J					
ACENAPHTHENE	29000		49						
ACENAPHTHYLENE	29000		27	U					
ANTHRACENE	29000		93						
BENZO(A)ANTHRACENE	150		3200						
BENZO(A)PYRENE	15		2300						
BENZO(B)FLUORANTHENE	150		1500						
BENZO(G,H,I)PERYLENE	1100		1200						
BENZO(K)FLUORANTHENE	1100		510						
CHRYSENE	1100		3600						
DIBENZO(A,H)ANTHRACENE	15		820						
FLUORANTHENE	29000		780						
FLUORENE	29000		29						
INDENO(1,2,3-CD)PYRENE	150		700						
NAPHTHALENE	330		20	J					
PHENANTHRENE	29000		500						
PYRENE	1100		1400						
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	68.667	58.667	77	102	31	194.333	64.333	67
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA								
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA		75						

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 11

location		X15SB028	X15SB029	X15SB030	X15SB031	X15SB032	X15SB033	X15SB034	X15SB035							
nsample		X15SS0280001	X15SS0290001	X15SS0300001	X15SS0310001	X15SS0320001	X15SS0330001	X15SS0340001	X15SS0350001							
sample_dat		20090527	20090527	20090527	20090528	20090528	20090527	20090528	20090528							
qc_type		NM														
sacode		NORMAL														
matrix	PALs	SO														
top_depth		0	0	0	0	0	0	0	0							
bottom_dep		1	1	1	1	1	1	1	1							
depth_unit		FT														
submatrix		SS														
composite		N	N	N	N	N	N	N	N							
Inorganics (mg/kg)																
ANTIMONY	0.27								0.27	J						
ARSENIC	0.39								2							
COPPER	100								9.6	L						
LEAD	11								81.6							
TIN	0.89								3.9	B						
ZINC	46								41							
PAHs (ug/kg)																
1-METHYLNAPHTHALENE	22000	23	UJ	27	UJ		7700	U	25	UJ			25	UJ		
2-METHYLNAPHTHALENE	31000	9.2	J	27	UJ		7700	U	11	J			19	J		
ACENAPHTHENE	29000	12	J	4.2	J		2600	J	47				150			
ACENAPHTHYLENE	29000	23	U	27	U		23	U	25	U			25	U		
ANTHRACENE	29000	26		27	U		3500	J	98				200			
BENZO(A)ANTHRACENE	150	400		53			18000		410				2000			
BENZO(A)PYRENE	15	400		58			24000		440				2900			
BENZO(B)FLUORANTHENE	150	240		66			26000		410				3200			
BENZO(G,H,I)PERYLENE	1100	230		46			14000		270				1800			
BENZO(K)FLUORANTHENE	1100	140		28			11000		270				1100			
CHRYSENE	1100	420		46			22000		290				2500			
DIBENZO(A,H)ANTHRACENE	15	91		22	J		4100	J	100				460			
FLUORANTHENE	29000	200		55			22000		620				1900			
FLUORENE	29000	8.3	J	27	U		7700	U	32				60			
INDENO(1,2,3-CD)PYRENE	150	170		36			16000		290				1900			
NAPHTHALENE	330	23	U	27	U		7700	U	8.6	J			56			
PHENANTHRENE	29000	160		28			14000		350				840			
PYRENE	1100	400		47			24000		420				2500			
Explosives (mg/kg)																
NITROGLYCERIN	6.1															
XRF Field Parameters (mg/kg)																
LEAD	11	55.667		101.333		196.667		34.667		54		192.667		34.333		69.667
Miscellaneous Parameters (meq/100)																
CATION EXCHANGE CAPACITY	NA											13	K			
Miscellaneous Parameters (s.u.)																
PH	NA											5				
Miscellaneous Parameters (mg/kg)																
TOTAL ORGANIC CARBON	NA											8500				
Miscellaneous Parameters (%)																
TOTAL SOLIDS	NA							85				88			80	
Miscellaneous Organic Parameters (%)																
TOTAL SOLIDS	NA	85		75				86		80					78	

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 11

location		X15SB036	X15SB037	X15SB038	X15SB039	X15SB040	X15SB041	X15SB041	X15SB042
nsample		X15SS0360001	X15SS0370001	X15SS0380001	X15SS0390001	X15SS0400001	X15SS0410001	X15SB0410102	X15SS0420001
sample_dat		20090528	20090528	20090528	20090528	20090528	20090528	20090602	20090528
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	1	0
bottom_dep		1	1	1	1	1	1	2	1
depth_unit		FT							
submatrix		SS	SS	SS	SS	SS	SS	SB	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27		0.37	J					
ARSENIC	0.39		1.6						
COPPER	100		7.3	L					
LEAD	11		203						
TIN	0.89		1.4	B					
ZINC	46		30.2						
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000			10000	U				
2-METHYLNAPHTHALENE	31000			10000	U				
ACENAPHTHENE	29000			5000	J				
ACENAPHTHYLENE	29000			24	U				
ANTHRACENE	29000			7200	J				
BENZO(A)ANTHRACENE	150			27000					
BENZO(A)PYRENE	15			38000					
BENZO(B)FLUORANTHENE	150			38000					
BENZO(G,H,I)PERYLENE	1100			22000					
BENZO(K)FLUORANTHENE	1100			18000					
CHRYSENE	1100			34000					
DIBENZO(A,H)ANTHRACENE	15			7000	J				
FLUORANTHENE	29000			38000					
FLUORENE	29000			3100	J				
INDENO(1,2,3-CD)PYRENE	150			27000					
NAPHTHALENE	330			10000	U				
PHENANTHRENE	29000			30000					
PYRENE	1100			45000					
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	43	247.667	33	47.333	47.333	744.333	18	239.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA		86						
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA			82					

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 7 of 11

location		X15SB043	X15SB044	X15SB045	X15SB046	X15SB047	X15SB048	X15SB049	X15SB050		
nsample		X15SS0430001	X15SS0440001	X15SS0450001	X15SS0460001	X15SS0470001	X15SS0480001	X15SS0490001	X15SS0500001		
sample_dat		20090528	20090528	20090528	20090528	20090528	20090528	20090528	20090528		
qc_type		NM									
sacode		NORMAL									
matrix	PALs	SO									
top_depth		0	0	0	0	0	0	0	0		
bottom_dep		1	1	1	1	1	1	1	1		
depth_unit		FT									
submatrix		SS									
composite		N	N	N	N	N	N	N	N		
Inorganics (mg/kg)											
ANTIMONY	0.27										
ARSENIC	0.39										
COPPER	100										
LEAD	11										
TIN	0.89										
ZINC	46										
PAHs (ug/kg)											
1-METHYLNAPHTHALENE	22000							150	J	86	J
2-METHYLNAPHTHALENE	31000							200		120	
ACENAPHTHENE	29000							1800	J	1500	J
ACENAPHTHYLENE	29000							24	U	25	U
ANTHRACENE	29000							2400	J	2000	J
BENZO(A)ANTHRACENE	150							10000		9700	
BENZO(A)PYRENE	15							13000		12000	
BENZO(B)FLUORANTHENE	150							14000		13000	
BENZO(G,H,I)PERYLENE	1100							9000		8200	
BENZO(K)FLUORANTHENE	1100							6100		5700	
CHRYSENE	1100							13000		14000	
DIBENZO(A,H)ANTHRACENE	15							2300	J	2600	J
FLUORANTHENE	29000							14000		12000	
FLUORENE	29000							1000	J	4200	U
INDENO(1,2,3-CD)PYRENE	150							10000		8900	
NAPHTHALENE	330							4000	U	330	
PHENANTHRENE	29000							11000		8200	
PYRENE	1100							16000		14000	
Explosives (mg/kg)											
NITROGLYCERIN	6.1										
XRF Field Parameters (mg/kg)											
LEAD	11	28	20.333	53.667	212.333	196	130.333	151.333	65.333		
Miscellaneous Parameters (meq/100)											
CATION EXCHANGE CAPACITY	NA						21	K			
Miscellaneous Parameters (s.u.)											
PH	NA						5.5				
Miscellaneous Parameters (mg/kg)											
TOTAL ORGANIC CARBON	NA						12000				
Miscellaneous Parameters (%)											
TOTAL SOLIDS	NA						84				
Miscellaneous Organic Parameters (%)											
TOTAL SOLIDS	NA						82		78		

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 8 of 11

location		X15SB051	X15SB052	X15SB053	X15SB054	X15SB055	X15SB056	X15SB059C	X15SB060C
nsample		X15SS0510001	X15SS0520001	X15SS0530001	X15SS0540001	X15SS0550001	X15SS0560001	X15SS059C0001	X15SS060C0001
sample_dat		20090527	20090527	20090527	20090527	20090527	20090527	20090601	20090601
qc_type		NM	NM						
sacode		NORMAL	NORMAL						
matrix	PALs	SO	SO						
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT	FT						
submatrix		SS	SS						
composite		N	N	N	N	N	N	Y	Y
Inorganics (mg/kg)									
ANTIMONY	0.27								
ARSENIC	0.39								
COPPER	100								
LEAD	11								
TIN	0.89								
ZINC	46								
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000		230	J	10000	U	6.1	J	
2-METHYLNAPHTHALENE	31000		3800	U	10000	U	20	J	
ACENAPHTHENE	29000		2600	J	4200	J	160		
ACENAPHTHYLENE	29000		23	U	25	U	23	U	
ANTHRACENE	29000		4100		5400	J	230		
BENZO(A)ANTHRACENE	150		23000		33000		1800		
BENZO(A)PYRENE	15		27000		42000		2300		
BENZO(B)FLUORANTHENE	150		26000		41000		2000		
BENZO(G,H,I)PERYLENE	1100		15000		25000		1900		
BENZO(K)FLUORANTHENE	1100		10000		16000		1200		
CHRYSENE	1100		31000		43000		2000		
DIBENZO(A,H)ANTHRACENE	15		5100		7600	J	620		
FLUORANTHENE	29000		23000		37000		2200		
FLUORENE	29000		1500	J	10000	U	94		
INDENO(1,2,3-CD)PYRENE	150		16000		27000		1700		
NAPHTHALENE	330		3800	U	10000	U	39		
PHENANTHRENE	29000		17000		24000		960		
PYRENE	1100		26000		44000		1600		
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	68.333	96.333	58.333	32.667	40	85.333	60.667	129.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA								
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA		86	80	86				

Table A.2-2
Summary of Chemicals Detected in Discrete Soil Samples
Old Skeet and Trap Range - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 11 of 11

location		X15SB073	X15SB074	X15SB075	X15SB076
nsample		X15SS0730001	X15SS0740001	X15SS0750001	X15SS0760001
sample_dat		20090602	20090602	20090602	20090602
qc_type		NM	NM	NM	NM
sacode		NORMAL	NORMAL	NORMAL	NORMAL
matrix	PALs	SO	SO	SO	SO
top_depth		0	0	0	0
bottom_dep		1	1	1	1
depth_unit		FT	FT	FT	FT
submatrix		SS	SS	SS	SS
composite		N	N	N	N
Inorganics (mg/kg)					
ANTIMONY	0.27	0.5	L		0.47
ARSENIC	0.39	2.2			2.7
COPPER	100	8.2			26
LEAD	11	335			238
TIN	0.89	1.3	B		2.2
ZINC	46	30.5			37.4
PAHs (ug/kg)					
1-METHYLNAPHTHALENE	22000				
2-METHYLNAPHTHALENE	31000				
ACENAPHTHENE	29000				
ACENAPHTHYLENE	29000				
ANTHRACENE	29000				
BENZO(A)ANTHRACENE	150				
BENZO(A)PYRENE	15				
BENZO(B)FLUORANTHENE	150				
BENZO(G,H,I)PERYLENE	1100				
BENZO(K)FLUORANTHENE	1100				
CHRYSENE	1100				
DIBENZO(A,H)ANTHRACENE	15				
FLUORANTHENE	29000				
FLUORENE	29000				
INDENO(1,2,3-CD)PYRENE	150				
NAPHTHALENE	330				
PHENANTHRENE	29000				
PYRENE	1100				
Explosives (mg/kg)					
NITROGLYCERIN	6.1				
XRF Field Parameters (mg/kg)					
LEAD	11	490	1260.333	130.333	552.667
Miscellaneous Parameters (meq/100)					
CATION EXCHANGE CAPACITY	NA				
Miscellaneous Parameters (s.u.)					
PH	NA				
Miscellaneous Parameters (mg/kg)					
TOTAL ORGANIC CARBON	NA				
Miscellaneous Parameters (%)					
TOTAL SOLIDS	NA	84			86
Miscellaneous Organic Parameters (%)					
TOTAL SOLIDS	NA				

TABLE A.2-3

BENZO(a)PYRENE EQUIVALENT CONCENTRATIONS IN DISCRETE SOIL SAMPLES
 OLD SKEET AND TRAP RANGE - UXO 15
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND
 PAGE 1 OF 2

location	X15SB001	X15SB002	X15SB003	X15SB011	X15SB015	X15SB019	X15SB021	X15SB028	X15SB029	X15SB031
nsample	X15SS0010001	X15SS0020001	X15SS0030001	X15SS0110001	X15SS0150001	X15SS0190001	X15SS0210001	X15SS0280001	X15SS0290001	X15SS0310001
matrix	SO									
submatrix	SS									
sacode	NORMAL									
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_dep	1	1	1	1	1	1	1	1	1	1
qc_type	NM									
sample_dat	20090527	20090527	20090527	20090527	20090527	20090527	20090527	20090527	20090527	20090528
PAH Concentrations (ug/kg)										
BENZO(A)ANTHRACENE	1500	3000	20 J	21 J	17000	37 J	3200	400	53	18000
BENZO(A)PYRENE	1600	3900	20 J	18 J	23000	40 J	2300	400	58	24000
BENZO(B)FLUORANTHENE	1700	4500	30	24 J	21000	42 J	1500	240	66	26000
BENZO(K)FLUORANTHENE	930	1600	12 J	11 J	8400	25 J	510	140	28	11000
CHRYSENE	1400	3600	13 J	15 J	22000	35 J	3600	420	46	22000
DIBENZO(A,H)ANTHRACENE	420	620 J	7.8 J	9.4 J	3300 J	13 J	820	91	22 J	4100 J
INDENO(1,2,3-CD)PYRENE	1200	2500	12 J	11 J	12000	24 J	700	170	36	16000
Benzo(a)pyrene (BaP) Equivalent (ug/kg)										
BAP EQUIVALENT-HALFND	2470.7	5539.6	34.133	33.125	31406	63.585	3668.7	573.82	95.826	34232

Toxicity Equivalency Factors (TEFs) for PAHs

PAH	TEF
BENZO(A)ANTHRACENE	0.1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	0.1
BENZO(K)FLUORANTHENE	0.01
CHRYSENE	0.001
DIBENZO(A,H)ANTHRACENE	1
INDENO(1,2,3-CD)PYRENE	0.1

BaP Screening Levels

Risk Level	1E-06	1E-05	1E-04
Resid screening level for BaP (ug/kg)	15	150	1500

Comparison to Residential Screening Level of 150 ug/kg

BAP EQUIVALENT-HALFND (ug/kg)	2,471	5,540	34	33	31,406	64	3,669	574	96	34,232
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TABLE A.2-3

BENZO(a)PYRENE EQUIVALENT CONCENTRATIONS IN DISCRETE SOIL SAMPLES
 OLD SKEET AND TRAP RANGE - UXO 15
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND
 PAGE 2 OF 2

location	X15SB032	X15SB035	X15SB038	X15SB049	X15SB050	X15SB052	X15SB053	X15SB054
nsample	X15SS0320001	X15SS0350001	X15SS0380001	X15SS0490001	X15SS0500001	X15SS0520001	X15SS0530001	X15SS0540001
matrix	SO							
submatrix	SS							
sacode	NORMAL							
top_depth	0	0	0	0	0	0	0	0
bottom_dep	1	1	1	1	1	1	1	1
qc_type	NM							
sample_dat	20090528	20090528	20090528	20090528	20090528	20090527	20090527	20090527
PAH Concentrations (ug/kg)								
BENZO(A)ANTHRACENE	410	2000	27000	10000	9700	23000	33000	1800
BENZO(A)PYRENE	440	2900	38000	13000	12000	27000	42000	2300
BENZO(B)FLUORANTHENE	410	3200	38000	14000	13000	26000	41000	2000
BENZO(K)FLUORANTHENE	270	1100	18000	6100	5700	10000	16000	1200
CHRYSENE	290	2500	34000	13000	14000	31000	43000	2000
DIBENZO(A,H)ANTHRACENE	100	460	7000 J	2300 J	2600 J	5100	7600 J	620
INDENO(1,2,3-CD)PYRENE	290	1900	27000	10000	8900	16000	27000	1700
Benzo(a)pyrene (BaP) Equivalent (ug/kg)								
BAP EQUIVALENT-HALFND	653.99	4083.5	54414	18774	17831	38731	59903	3484

Toxicity Equivalency Factors (TEFs) for PAHs

PAH	TEF
BENZO(A)ANTHRACENE	0.1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	0.1
BENZO(K)FLUORANTHENE	0.01
CHRYSENE	0.001
DIBENZO(A,H)ANTHRACENE	1
INDENO(1,2,3-CD)PYRENE	0.1

BaP Screening Levels

Risk Level	1E-06	1E-05
Resid screening level for BaP (ug/kg)	15	150

Comparison to Residential Screening Level of 150 ug/kg

BAP EQUIVALENT-HALFND (ug/kg)	654	4,084	54,414	18,774	17,831	38,731	59,903	3,484
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Table A.3-1
Summary of Chemicals Detected in Composite Soil Samples
Firing Points
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 1

location		X16SB080C	X16SB081C		
nsample		X16SS080C0001	X16SS081C0001		
sample_dat		20090614	20090614		
qc_type		NM	NM		
sacode		NORMAL	NORMAL		
matrix	PALs	SO	SO		
top_depth		0	0		
bottom_dep		1	1		
depth_unit		FT	FT		
submatrix		SS	SS		
composite		Y	Y		
Inorganics (mg/kg)					
ANTIMONY	0.27	0.14	L	0.42	L
ARSENIC	0.39	3		4.2	
COPPER	100	4.8		9.6	
LEAD	11	9.1		48.7	
TIN	0.89	1.2	B	1.1	B
ZINC	46	18.7		29	
PAHs (ug/kg)					
1-METHYLNAPHTHALENE	22000	23	U	23	U
2-METHYLNAPHTHALENE	31000	3.5	J	23	U
ACENAPHTHENE	29000	23	U	23	U
ACENAPHTHYLENE	29000	23	U	23	U
ANTHRACENE	29000	4.1	J	5.6	J
BENZO(A)ANTHRACENE	150	78		94	
BENZO(A)PYRENE	15	91		100	
BENZO(B)FLUORANTHENE	150	33		38	
BENZO(G,H,I)PERYLENE	1100	41		50	
BENZO(K)FLUORANTHENE	1100	5.8	J	7.7	J
CHRYSENE	1100	97		130	
DIBENZO(A,H)ANTHRACENE	15	12	J	18	J
FLUORANTHENE	29000	9.8	J	13	J
FLUORENE	29000	23	U	23	U
INDENO(1,2,3-CD)PYRENE	150	9.1	J	10	J
NAPHTHALENE	330	23	U	23	U
PHENANTHRENE	29000	21	J	24	
PYRENE	1100	92		110	
Explosives (mg/kg)					
NITROGLYCERIN	6.1	1.2	UJ	1.2	UJ
XRF Field Parameters (mg/kg)					
LEAD	11	21		73.333	
Miscellaneous Parameters (meq/100)					
CATION EXCHANGE CAPACITY	NA				
Miscellaneous Parameters (s.u.)					
PH	NA				
Miscellaneous Parameters (mg/kg)					
TOTAL ORGANIC CARBON	NA				
Miscellaneous Parameters (%)					
TOTAL SOLIDS	NA	88		89	
Miscellaneous Organic Parameters (%)					
TOTAL SOLIDS	NA	88		88	

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 13

location		X16SB001	X16SB002	X16SB003	X16SB004	X16SB005	X16SB006	X16SB007	X16SB008	
nsample		X16SS0010001	X16SS0020001	X16SS0030001	X16SS0040001	X16SS0050001	X16SS0060001	X16SS0070001	X16SS0080001	
sample_dat		20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613	
qc_type		NM								
sacode		NORMAL								
matrix	PALs	SO								
top_depth		0	0	0	0	0	0	0	0	
bottom_dep		1	1	1	1	1	1	1	1	
depth_unit		FT								
submatrix		SS								
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27			0.62	L				1	L
ARSENIC	0.39			4					5.1	
COPPER	100			6.9					10.4	K
LEAD	11			13.5					616	
TIN	0.89			1.1	B				1.9	B
ZINC	46			19.8					30.9	
PAHs (ug/kg)										
1-METHYLNAPHTHALENE	22000		2.6	L					23	U
2-METHYLNAPHTHALENE	31000		9.3	L					23	UL
ACENAPHTHENE	29000		23	UL					23	UL
ACENAPHTHYLENE	29000		23	UL					23	U
ANTHRACENE	29000		32	L					23	UL
BENZO(A)ANTHRACENE	150		630						6	J
BENZO(A)PYRENE	15		630						7.6	J
BENZO(B)FLUORANTHENE	150		200	L					6	J
BENZO(G,H,I)PERYLENE	1100		260	L					4.6	J
BENZO(K)FLUORANTHENE	1100		40	L					23	U
CHRYSENE	1100		770						10	J
DIBENZO(A,H)ANTHRACENE	15		120	L					23	U
FLUORANTHENE	29000		79	L					8.9	L
FLUORENE	29000		4.2	L					23	UL
INDENO(1,2,3-CD)PYRENE	150		78	L					3.4	J
NAPHTHALENE	330		23	UL					23	U
PHENANTHRENE	29000		140	L					3.2	L
PYRENE	1100		620						6.1	J
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	19.667	16.333	17	75.667	20.333	16	75.333	975.333	
Miscellaneous Parameters (meq/100)										
CATION EXCHANGE CAPACITY	NA								31	K
Miscellaneous Parameters (s.u.)										
PH	NA								4.7	
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA								38000	
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA			87					74	
Miscellaneous Organic Parameters (%)										
TOTAL SOLIDS	NA		87						87	

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 13

location		X16SB009	X16SB010	X16SB011	X16SB012	X16SB013	X16SB014	X16SB015	X16SB016
nsample		X16SS0090001	X16SS0100001	X16SS0110001	X16SS0120001	X16SS0130001	X16SS0140001	X16SS0150001	X16SS0160001
sample_dat		20090614	20090613	20090613	20090613	20090613	20090614	20090613	20090613
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					0.55	L		
ARSENIC	0.39					2			
COPPER	100					11.4	K		
LEAD	11					38.8			
TIN	0.89					1.2	B		
ZINC	46					34.9			
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000	23	UL			24	U	23	U
2-METHYLNAPHTHALENE	31000	23	UL			24	U	23	U
ACENAPHTHENE	29000	23	UL			24	U	23	U
ACENAPHTHYLENE	29000	23	UL			24	U	23	U
ANTHRACENE	29000	23	UL			1.8	J	7.3	J
BENZO(A)ANTHRACENE	150	8.8	L			26		100	
BENZO(A)PYRENE	15	8.7	L			38		120	
BENZO(B)FLUORANTHENE	150	11	L			16	J	47	
BENZO(G,H,I)PERYLENE	1100	6.2	L			22	J	58	
BENZO(K)FLUORANTHENE	1100	23	UL			4.3	J	9	J
CHRYSENE	1100	14	L			41		120	
DIBENZO(A,H)ANTHRACENE	15	23	UL			6.4	J	20	J
FLUORANTHENE	29000	8	L			7.4	J	20	J
FLUORENE	29000	23	UL			24	U	23	U
INDENO(1,2,3-CD)PYRENE	150	5.9	L			8.1	J	17	J
NAPHTHALENE	330	23	UL			24	U	23	U
PHENANTHRENE	29000	23	UL			5.3	J	31	
PYRENE	1100	9.5	L			26		110	
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	19.667	47.333	43.333	184.667	28	22	24	83.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA					7.9			
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA					9700			
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA					82			
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA	87				82	85		

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 13

location		X16SB017	X16SB018	X16SB019	X16SB020	X16SB021	X16SB022	X16SB023	X16SB023		
nsample		X16SS0170001	X16SS0180001	X16SS0190001	X16SS0200001	X16SS0210001	X16SS0220001	X16SS0230001	X16SS0230001-AVG		
sample_dat		20090613	20090613	20090614	20090613	20090613	20090613	20090613	20090613		
qc_type		NM									
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG		
matrix	PALs	SO									
top_depth		0	0	0	0	0	0	0	0		
bottom_dep		1	1	1	1	1	1	1	1		
depth_unit		FT									
submatrix		SS									
composite		N	N	N	N	N	N	N	N		
Inorganics (mg/kg)											
ANTIMONY	0.27	0.45	L			0.22	L				
ARSENIC	0.39	4.6				1.9	B				
COPPER	100	7.4	K			5.5					
LEAD	11	51.4				51.9					
TIN	0.89	1.5	B			1	B				
ZINC	46	26.2				22					
PAHs (ug/kg)											
1-METHYLNAPHTHALENE	22000			22	U			28	U	25.5	U
2-METHYLNAPHTHALENE	31000			22	U			28	UL	25.5	UL
ACENAPHTHENE	29000			22	U			28	UL	25.5	UL
ACENAPHTHYLENE	29000			22	U			28	U	25.5	U
ANTHRACENE	29000			10	J			12	L	12	L
BENZO(A)ANTHRACENE	150			170				210	J	107.65	J
BENZO(A)PYRENE	15			220				240	J	123.8	J
BENZO(B)FLUORANTHENE	150			79				89	J	46.4	J
BENZO(G,H,I)PERYLENE	1100			110				130	J	67.15	J
BENZO(K)FLUORANTHENE	1100			13	J			13	J	13	J
CHRYSENE	1100			210				240	J	124.4	J
DIBENZO(A,H)ANTHRACENE	15			42				41	J	26.25	J
FLUORANTHENE	29000			24				32	L	17.25	L
FLUORENE	29000			22	U			28	UL	25.5	UL
INDENO(1,2,3-CD)PYRENE	150			28				36		19.25	J
NAPHTHALENE	330			22	U			28	U	25.5	U
PHENANTHRENE	29000			37				40	L	25.75	L
PYRENE	1100			150				160	J	82.3	J
Explosives (mg/kg)											
NITROGLYCERIN	6.1										
XRF Field Parameters (mg/kg)											
LEAD	11	57.667	24.333	22	58	106	25	27.333	27.333		
Miscellaneous Parameters (meq/100)											
CATION EXCHANGE CAPACITY	NA										
Miscellaneous Parameters (s.u.)											
PH	NA										
Miscellaneous Parameters (mg/kg)											
TOTAL ORGANIC CARBON	NA										
Miscellaneous Parameters (%)											
TOTAL SOLIDS	NA	82			87						
Miscellaneous Organic Parameters (%)											
TOTAL SOLIDS	NA			89				72	80		

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 13

location		X16SB023	X16SB024	X16SB025	X16SB026	X16SB027	X16SB028	X16SB029	X16SB030
nsample		X16SS0230001-D	X16SS0240001	X16SS0250001	X16SS0260001	X16SS0270001	X16SS0280001	X16SS0290001	X16SS0300001
sample_dat		20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613
qc_type		FD	NM						
sacode		DUP	NORMAL						
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT
submatrix		SS	SS	SS	SS	SS	SS	SS	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27			0.73	B				
ARSENIC	0.39			4	J				
COPPER	100			8.8	J				
LEAD	11			159	J				
TIN	0.89			1.2	B				
ZINC	46			29.4	J				
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000	23	U			24	U		
2-METHYLNAPHTHALENE	31000	23	UL			24	UL		
ACENAPHTHENE	29000	23	UL			24	UL		
ACENAPHTHYLENE	29000	23	U			24	U		
ANTHRACENE	29000	23	UL			5.5	L		
BENZO(A)ANTHRACENE	150	5.3	J			81			
BENZO(A)PYRENE	15	7.6	J			110			
BENZO(B)FLUORANTHENE	150	3.8	J			41			
BENZO(G,H,I)PERYLENE	1100	4.3	J			58			
BENZO(K)FLUORANTHENE	1100	23	U			6.6	J		
CHRYSENE	1100	8.8	J			110			
DIBENZO(A,H)ANTHRACENE	15	23	UJ			21	J		
FLUORANTHENE	29000	2.5	L			17	L		
FLUORENE	29000	23	UL			24	UL		
INDENO(1,2,3-CD)PYRENE	150	2.5	J			18	J		
NAPHTHALENE	330	23	U			24	U		
PHENANTHRENE	29000	23	UL			21	L		
PYRENE	1100	4.6	J			71			
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11		23	155.667	20.667	22	14	126	24
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA			85					
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA	88				83			

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 13

location		X16SB037	X16SB037	X16SB037	X16SB038	X16SB039	X16SB040	X16SB041	X16SB042			
nsample		X16SS0370001	X16SS0370001-AVG	X16SS0370001-D	X16SS0380001	X16SS0390001	X16SS0400001	X16SS0410001	X16SS0420001			
sample_dat		20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613			
qc_type		NM	NM	FD	NM	NM	NM	NM	NM			
sacode		ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL			
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO			
top_depth		0	0	0	0	0	0	0	0			
bottom_dep		1	1	1	1	1	1	1	1			
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT			
submatrix		SS	SS	SS	SS	SS	SS	SS	SS			
composite		N	N	N	N	N	N	N	N			
Inorganics (mg/kg)												
ANTIMONY	0.27								0.11	B		
ARSENIC	0.39								1.7			
COPPER	100								3.9	K		
LEAD	11								12.1			
TIN	0.89								1	B		
ZINC	46								16.6			
PAHs (ug/kg)												
1-METHYLNAPHTHALENE	22000	22	U	22.5	U	23	U		24	UL	26	U
2-METHYLNAPHTHALENE	31000	22	UL	22.5	UL	23	UL		24	UL	26	U
ACENAPHTHENE	29000	22	UL	22.5	UL	23	UL		24	UL	26	U
ACENAPHTHYLENE	29000	22	U	22.5	UL	23	UL		24	UL	26	U
ANTHRACENE	29000	22	UL	22.5	UL	23	U		1.6	L	26	U
BENZO(A)ANTHRACENE	150	22	U	22.5	U	23	U		24	L	3.9	J
BENZO(A)PYRENE	15	22	U	22.5	U	23	U		29	L	5.8	J
BENZO(B)FLUORANTHENE	150	22	U	22.5	U	23	U		14	L	26	U
BENZO(G,H,I)PERYLENE	1100	22	U	22.5	U	23	U		18	L	3.4	J
BENZO(K)FLUORANTHENE	1100	22	U	22.5	U	23	U		24	UL	26	U
CHRYSENE	1100	22	U	3.3	J	3.3	J		30	L	7.7	J
DIBENZO(A,H)ANTHRACENE	15	22	U	22.5	U	23	U		6.1	L	26	U
FLUORANTHENE	29000	22	UL	22.5	UL	23	U		8.1	L	26	U
FLUORENE	29000	22	UL	22.5	UL	23	UL		24	UL	26	U
INDENO(1,2,3-CD)PYRENE	150	22	U	2.7	J	2.7	J		6.9	L	26	U
NAPHTHALENE	330	22	U	22.5	UL	23	UL		24	UL	26	U
PHENANTHRENE	29000	22	UL	22.5	UL	23	UL		6.5	L	26	U
PYRENE	1100	22	U	22.5	U	23	U		24	L	4.6	J
Explosives (mg/kg)												
NITROGLYCERIN	6.1											
XRF Field Parameters (mg/kg)												
LEAD	11	70.667	70.667		26.333	20.667	50.333	33.667	67.667			
Miscellaneous Parameters (meq/100)												
CATION EXCHANGE CAPACITY	NA											
Miscellaneous Parameters (s.u.)												
PH	NA								7.9			
Miscellaneous Parameters (mg/kg)												
TOTAL ORGANIC CARBON	NA								13000			
Miscellaneous Parameters (%)												
TOTAL SOLIDS	NA								64			
Miscellaneous Organic Parameters (%)												
TOTAL SOLIDS	NA	89	87.5	86			82		78			

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 7 of 13

		X16SB043 X16SS0430001	X16SB044 X16SS0440001	X16SB045 X16SS0450001	X16SB046 X16SS0460001	X16SB047 X16SS0470001	X16SB048 X16SS0480001	X16SB049 X16SS0490001	X16SB050 X16SS0500001
location									
nsample									
sample_dat		20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27								
ARSENIC	0.39								
COPPER	100								
LEAD	11								
TIN	0.89								
ZINC	46								
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000				24	U			
2-METHYLNAPHTHALENE	31000				24	U			
ACENAPHTHENE	29000				24	U			
ACENAPHTHYLENE	29000				24	U			
ANTHRACENE	29000				24	U			
BENZO(A)ANTHRACENE	150				2.6	J			
BENZO(A)PYRENE	15				24	U			
BENZO(B)FLUORANTHENE	150				3	J			
BENZO(G,H,I)PERYLENE	1100				24	U			
BENZO(K)FLUORANTHENE	1100				24	U			
CHRYSENE	1100				4.3	J			
DIBENZO(A,H)ANTHRACENE	15				24	U			
FLUORANTHENE	29000				5	J			
FLUORENE	29000				24	U			
INDENO(1,2,3-CD)PYRENE	150				3.1	J			
NAPHTHALENE	330				24	U			
PHENANTHRENE	29000				24	U			
PYRENE	1100				3.1	J			
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	38.667	32	27	22.333	32.333	94.667	64	37
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA								
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA				82				

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 8 of 13

location		X16SB051	X16SB052	X16SB053	X16SB054	X16SB055	X16SB056	X16SB057	X16SB058	
nsample		X16SS0510001	X16SS0520001	X16SS0530001	X16SS0540001	X16SS0550001	X16SS0560001	X16SS0570001	X16SS0580001	
sample_dat		20090613	20090614	20090614	20090614	20090614	20090614	20090614	20090614	
qc_type		NM								
sacode		NORMAL								
matrix	PALs	SO								
top_depth		0	0	0	0	0	0	0	0	
bottom_dep		1	1	1	1	1	1	1	1	
depth_unit		FT								
submatrix		SS								
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27				0.32	L		0.14	B	
ARSENIC	0.39				2.4			2.1		
COPPER	100				5.3	K		4.5	K	
LEAD	11				35			22.3		
TIN	0.89				1.1	B		1.3	B	
ZINC	46				27			21.1		
PAHs (ug/kg)										
1-METHYLNAPHTHALENE	22000	24	U				5.3	J	26	U
2-METHYLNAPHTHALENE	31000	24	U				25		26	U
ACENAPHTHENE	29000	24	U				3.6	J	26	U
ACENAPHTHYLENE	29000	24	U				24	U	26	U
ANTHRACENE	29000	18	J				75		26	U
BENZO(A)ANTHRACENE	150	240					1700		2.6	J
BENZO(A)PYRENE	15	240					1900		26	U
BENZO(B)FLUORANTHENE	150	98					660		26	U
BENZO(G,H,I)PERYLENE	1100	82					830		26	U
BENZO(K)FLUORANTHENE	1100	21	J				120		26	U
CHRYSENE	1100	300					2200		5.6	J
DIBENZO(A,H)ANTHRACENE	15	37					240		26	U
FLUORANTHENE	29000	40					180		4.8	J
FLUORENE	29000	24	U				9.4	J	26	U
INDENO(1,2,3-CD)PYRENE	150	26					220		3	J
NAPHTHALENE	330	24	U				24	U	26	U
PHENANTHRENE	29000	67					300		26	U
PYRENE	1100	200					1400		3.9	J
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	22	31	36.667	195	48.333	49.667	25.667	43	
Miscellaneous Parameters (meq/100)										
CATION EXCHANGE CAPACITY	NA									
Miscellaneous Parameters (s.u.)										
PH	NA									
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA									
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA				86			76		
Miscellaneous Organic Parameters (%)										
TOTAL SOLIDS	NA	84					82	78		

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 9 of 13

location		X16SB059	X16SB060	X16SB061	X16SB062	X16SB063	X16SB064	X16SB065	X16SB066
nsample		X16SS0590001	X16SS0600001	X16SS0610001	X16SS0620001	X16SS0630001	X16SS0640001	X16SS0650001	X16SS0660001
sample_dat		20090614	20090614	20090614	20090614	20090614	20090614	20090614	20090614
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27			0.2	L				
ARSENIC	0.39			6.5					
COPPER	100			6.5	K				
LEAD	11			23.5					
TIN	0.89			1.8	B				
ZINC	46			24.2					
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000				6.3	J			
2-METHYLNAPHTHALENE	31000				22	J			
ACENAPHTHENE	29000				4.4	J			
ACENAPHTHYLENE	29000				24	U			
ANTHRACENE	29000				68				
BENZO(A)ANTHRACENE	150				1500				
BENZO(A)PYRENE	15				1400				
BENZO(B)FLUORANTHENE	150				550				
BENZO(G,H,I)PERYLENE	1100				550				
BENZO(K)FLUORANTHENE	1100				60				
CHRYSENE	1100				1800				
DIBENZO(A,H)ANTHRACENE	15				200				
FLUORANTHENE	29000				160				
FLUORENE	29000				11	J			
INDENO(1,2,3-CD)PYRENE	150				140				
NAPHTHALENE	330				3.1	J			
PHENANTHRENE	29000				400				
PYRENE	1100				1300				
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	30.667	23	150	22.333	19.667	18.333	82.667	31.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA			74					
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA				84				

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 10 of 13

		X16SB067 X16SS0670001	X16SB069 X16SS0690001	X16SB070 X16SS0700001	X16SB071 X16SS0710001	X16SB072 X16SS0720001	X16SB073 X16SS0730001	X16SB074 X16SS0740001	X16SB075 X16SS0750001
location									
nsample									
sample_dat		20090614	20090614	20090614	20090614	20090614	20090614	20090614	20090614
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27						0.92	L	
ARSENIC	0.39						3.1		
COPPER	100						4.7	K	
LEAD	11						40.1		
TIN	0.89						1.3	B	
ZINC	46						22.6		
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000				2.4	J	4.8	J	
2-METHYLNAPHTHALENE	31000				10	J	17	J	
ACENAPHTHENE	29000				23	U	2.4	J	
ACENAPHTHYLENE	29000				23	U	23	U	
ANTHRACENE	29000				17	J	38		
BENZO(A)ANTHRACENE	150				420		690	L	
BENZO(A)PYRENE	15				480		820	L	
BENZO(B)FLUORANTHENE	150				170		220		
BENZO(G,H,I)PERYLENE	1100				190		300		
BENZO(K)FLUORANTHENE	1100				32		40		
CHRYSENE	1100				570		870	L	
DIBENZO(A,H)ANTHRACENE	15				59		110		
FLUORANTHENE	29000				46		85		
FLUORENE	29000				23	U	6.2	J	
INDENO(1,2,3-CD)PYRENE	150				48		78		
NAPHTHALENE	330				23	U	23	U	
PHENANTHRENE	29000				86		160		
PYRENE	1100				380		620	L	
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	60.667	78	28.333	24.333	18	42.667	58.667	23.667
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA						15	K	
Miscellaneous Parameters (s.u.)									
PH	NA						6.4		
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA						9400		
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA						89		
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA				86		87		

Table A.3-2
Summary of Chemicals Detected in Discrete Soil Samples
Rum Point Skeet Range - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 11 of 13

location		X16SB076	X16SB077	X16SB078	X16SB079	X16SB082	X16SB083	X16SB084	X16SB085
nsample		X16SS0760001	X16SS0770001	X16SS0780001	X16SS0790001	X16SS0820001	X16SS0830001	X16SS0840001	X16SS0850001
sample_dat		20090614	20090614	20090614	20090614	20090616	20090616	20090616	20090616
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1
depth_unit		FT							
submatrix		SS							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27					1.2	L		
ARSENIC	0.39					6.1			
COPPER	100					10.6	K		
LEAD	11					267			
TIN	0.89					1.3	B		
ZINC	46					31.6			
PAHs (ug/kg)									
1-METHYLNAPHTHALENE	22000	16	L		23	UL			
2-METHYLNAPHTHALENE	31000	68	L		23	UL			
ACENAPHTHENE	29000	7.7	L		23	UL			
ACENAPHTHYLENE	29000	23	UL		23	UL			
ANTHRACENE	29000	110	L		5.2	L			
BENZO(A)ANTHRACENE	150	2400			100	L			
BENZO(A)PYRENE	15	3200			120	L			
BENZO(B)FLUORANTHENE	150	1000			52	L			
BENZO(G,H,I)PERYLENE	1100	1500			65	L			
BENZO(K)FLUORANTHENE	1100	200	L		10	L			
CHRYSENE	1100	3000			130	L			
DIBENZO(A,H)ANTHRACENE	15	540			22	L			
FLUORANTHENE	29000	210	L		23	L			
FLUORENE	29000	21	J		23	UL			
INDENO(1,2,3-CD)PYRENE	150	260	L		24	L			
NAPHTHALENE	330	7.2	L		23	UL			
PHENANTHRENE	29000	620			22	L			
PYRENE	1100	2000			93	L			
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	28.667	15	16.667	266.667	135.333	407	409	159.333
Miscellaneous Parameters (meq/100)									
CATION EXCHANGE CAPACITY	NA								
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA				74				
Miscellaneous Organic Parameters (%)									
TOTAL SOLIDS	NA	87		87					

TABLE A.3-3

BENZO(a)PYRENE EQUIVALENT CONCENTRATIONS IN DISCRETE SURFACE SOIL SAMPLES
 RUM POINT SKEET RANGE - UXO 16
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND
 PAGE 1 OF 3

location	X16SB002	X16SB008	X16SB009	X16SB013	X16SB014	X16SB019	X16SB023	X16SB023	X16SB023
nsample	X16SS0020001	X16SS0080001	X16SS0090001	X16SS0130001	X16SS0140001	X16SS0190001	X16SS0230001	X16SS0230001-AVG	X16SS0230001-D
matrix	SO	SO							
submatrix	SS	SS							
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
top_depth	0	0	0	0	0	0	0	0	0
bottom_dep	1	1	1	1	1	1	1	1	1
qc_type	NM	FD							
sample_dat	20090613	20090613	20090614	20090613	20090614	20090614	20090613	20090613	20090613
PAH Concentrations (ug/kg)									
BENZO(A)ANTHRACENE	630	6.0 J	8.8 L	26	100	170	210 J	107.65 J	5.3 J
BENZO(A)PYRENE	630	7.6 J	8.7 L	38	120	220	240 J	123.8 J	7.6 J
BENZO(B)FLUORANTHENE	200 L	6.0 J	11 L	16 J	47	79	89 J	46.4 J	3.8 J
BENZO(K)FLUORANTHENE	40 L	23 U	23 UL	4.3 J	9.0 J	13 J	13 J	13 J	23 U
CHRYSENE	770	10 J	14 L	41	120	210	240 J	124.4 J	8.8 J
DIBENZO(A,H)ANTHRACENE	120 L	23 U	23 UL	6.4 J	20 J	42	41 J	26.25 J	23 UJ
INDENO(1,2,3-CD)PYRENE	78 L	3.4 J	5.9 L	8.1 J	17 J	28	36	19.25 J	2.5 J
Benzo(a)pyrene (BaP) Equivalent (ug/kg)									
BAP EQUIVALENT-HALFND	841.97	20.765	22.899	49.494	156.61	290.04	314.87	167.6344	20.3838

PARAMETER	TEF
BENZO(A)ANTHRACENE	0.1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	0.1
BENZO(K)FLUORANTHENE	0.01
CHRYSENE	0.001
DIBENZO(A,H)ANTHRACENE	1
INDENO(1,2,3-CD)PYRENE	0.1

BaP Screening Levels

Risk Level	1E-06	1E-05	1E-04
Resid screening level for BaP (ug/kg)	15	150	1500

Comparison to Residential Screening Level of 150 ug/kg

BAP EQUIVALENT-HALFND	842	21	23	49	157	290	315	168	20
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TABLE A.3-3

BENZO(a)PYRENE EQUIVALENT CONCENTRATIONS IN DISCRETE SURFACE SOIL SAMPLES
 RUM POINT SKEET RANGE - UXO 16
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND
 PAGE 2 OF 3

location	X16SB026	X16SB031	X16SB037	X16SB037	X16SB037	X16SB040	X16SB042	X16SB046	X16SB051
nsample	X16SS0260001	X16SS0310001	X16SS0370001	X16SS0370001-AVG	X16SS0370001-D	X16SS0400001	X16SS0420001	X16SS0460001	X16SS0510001
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
submatrix	SS	SS	SS	SS	SS	SS	SS	SS	SS
sacode	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
top_depth	0	0	0	0	0	0	0	0	0
bottom_dep	1	1	1	1	1	1	1	1	1
qc_type	NM	NM	NM	NM	FD	NM	NM	NM	NM
sample_dat	20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613	20090613
PAH Concentrations (ug/kg)									
BENZO(A)ANTHRACENE	81	300 L	22 U	22.5 U	23 U	24 L	3.9 J	2.6 J	240
BENZO(A)PYRENE	110	420	22 U	22.5 U	23 U	29 L	5.8 J	24 U	240
BENZO(B)FLUORANTHENE	41	120 L	22 U	22.5 U	23 U	14 L	26 U	3.0 J	98
BENZO(K)FLUORANTHENE	6.6 J	20 L	22 U	22.5 U	23 U	24 UL	26 U	24 U	21 J
CHRYSENE	110	390	22 U	3.3 J	3.3 J	30 L	7.7 J	4.3 J	300
DIBENZO(A,H)ANTHRACENE	21 J	58 L	22 U	22.5 U	23 U	6.1 L	26 U	24 U	37
INDENO(1,2,3-CD)PYRENE	18 J	43 L	22 U	2.7 J	2.7 J	6.9 L	26 U	3.1 J	26
Benzo(a)pyrene (BaP) Equivalent (ug/kg)									
BAP EQUIVALENT-HALFND	145.176	524.89	22 U	25.1358	25.6883	39.74	21.9277	24.9943	313.91

PARAMETER	TEF
BENZO(A)ANTHRACENE	0.1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	0.1
BENZO(K)FLUORANTHENE	0.01
CHRYSENE	0.001
DIBENZO(A,H)ANTHRACENE	1
INDENO(1,2,3-CD)PYRENE	0.1

BaP Screening Levels

Risk Level	1E-06	1E-05
Resid screening level for BaP (ug/kg)	15	150

Comparison to Residential Screening Level of 150 ug/kg

BAP EQUIVALENT-HALFND	145	525	22 U	25	26	40	22	25	314
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TABLE A.3-3

BENZO(a)PYRENE EQUIVALENT CONCENTRATIONS IN DISCRETE SURFACE SOIL SAMPLES
 RUM POINT SKEET RANGE - UXO 16
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND
 PAGE 3 OF 3

location	X16SB056	X16SB057	X16SB062	X16SB071	X16SB073	X16SB076	X16SB078	X16SB080C	X16SB081C
nsample	X16SS0560001	X16SS0570001	X16SS0620001	X16SS0710001	X16SS0730001	X16SS0760001	X16SS0780001	X16SS080C0001	X16SS081C0001
matrix	SO	SO							
submatrix	SS	SS							
sacode	NORMAL	NORMAL							
top_depth	0	0	0	0	0	0	0	0	0
bottom_dep	1	1	1	1	1	1	1	1	1
qc_type	NM	NM							
sample_dat	20090614	20090614	20090614	20090614	20090614	20090614	20090614	20090614	20090614
PAH Concentrations (ug/kg)									
BENZO(A)ANTHRACENE	1700	2.6 J	1500	420	690 L	2400	100 L	78	94
BENZO(A)PYRENE	1900	26 U	1400	480	820 L	3200	120 L	91	100
BENZO(B)FLUORANTHENE	660	26 U	550	170	220	1000	52 L	33	38
BENZO(K)FLUORANTHENE	120	26 U	60	32	40	200 L	10 L	5.8 J	7.7 J
CHRYSENE	2200	5.6 J	1800	570	870 L	3000	130 L	97	130
DIBENZO(A,H)ANTHRACENE	240	26 U	200	59	110	540	22 L	12 J	18 J
INDENO(1,2,3-CD)PYRENE	220	3.0 J	140	48	78	260 L	24 L	9.1 J	10 J
Benzo(a)pyrene (BaP) Equivalent (ug/kg)									
BAP EQUIVALENT-HALFND	2401.4	27.9956	1821.4	603.69	1030.07	4111	159.83	115.165	132.407

PARAMETER	TEF
BENZO(A)ANTHRACENE	0.1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	0.1
BENZO(K)FLUORANTHENE	0.01
CHRYSENE	0.001
DIBENZO(A,H)ANTHRACENE	1
INDENO(1,2,3-CD)PYRENE	0.1

BaP Screening Levels

Risk Level	1E-06	1E-05
Resid screening level for BaP (ug/kg)	15	150

Comparison to Residential Screening Level of 150 ug/kg

BAP EQUIVALENT-HALFND	2,401	28	1,821	604	1,030	4,111	160	115	132
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Table A.4-1
Summary of Chemicals Detected in Composite Surface Soil Samples
Firing Line Area
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 1

location		X17SB008C	X17SB009C	X17SB010C			
nsample		X17SS008C0001	X17SS009C0001	X17SS010C0001			
sample_dat		20090611	20090611	20090611			
qc_type		NM	NM	NM			
sacode		NORMAL	NORMAL	NORMAL			
matrix	PALs	SO	SO	SO			
top_depth		0	0	0			
bottom_dep		1	1	1			
depth_unit		FT	FT	FT			
submatrix		SS	SS	SS			
composite		Y	Y	Y			
Inorganics (mg/kg)							
ANTIMONY	0.27	0.39	L	0.43	L	1.3	L
ARSENIC	0.39	5		4.4		6.2	
COPPER	100	12		11.2		24	
LEAD	11	21		38.7		200	
TIN	0.89	0.92	B	1.4	B	1.3	B
ZINC	46	23.1		19		35.2	
Explosives (mg/kg)							
NITROGLYCERIN	6.1	20.4		9.8		13	
XRF Field Parameters (mg/kg)							
LEAD	11	96.333		73.333		156.333	
Miscellaneous Parameters (s.u.)							
PH	NA						
Miscellaneous Parameters (mg/kg)							
TOTAL ORGANIC CARBON	NA						
Miscellaneous Parameters (%)							
TOTAL SOLIDS	NA	91		91		91	

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 7

location		X17SB001	X17SB001	X17SB001	X17SB001	X17SB002	X17SB002	X17SB002	X17SB002	
nsample		X17SB0010004	X17SB0010408	X17SB0010810	X17SS0010001	X17SB0020004	X17SB0020406	X17SB0020608	X17SB0020810	
sample_dat		20090611	20090611	20090611	20090611	20090611	20090611	20090611	20090611	
qc_type		NM								
sacode		NORMAL								
matrix	PALs	SO								
top_depth		0	4	8	0	0	4	6	8	
bottom_dep		4	8	10	1	4	6	8	10	
depth_unit		FT								
submatrix		SB	SB	SB	SS	SB	SB	SB	SB	
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27	0.15	L					0.22	L	
ARSENIC	0.39	4.6						7.8		
COPPER	100	6						8.2		
LEAD	11	9.1						8.1		
TIN	0.89	1.1	B					0.92	B	
ZINC	46	15.6						24.1		
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	4.333	12.333	0	U		3.667	85.333	0	U
Miscellaneous Parameters (s.u.)										
PH	NA					7.3				
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA					660				
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA	92				91		88		

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 7

location		X17SB003	X17SB003	X17SB003	X17SB003	X17SB004	X17SB004	X17SB004	X17SB004	
nsample		X17SB0030004	X17SB0030406	X17SB0030608	X17SB0030810	X17SB0040004	X17SB0040406	X17SB0040608	X17SB0040810	
sample_dat		20090611	20090611	20090611	20090611	20090611	20090611	20090611	20090611	
qc_type		NM								
sacode		NORMAL								
matrix	PALs	SO								
top_depth		0	4	6	8	0	4	6	8	
bottom_dep		4	6	8	10	4	6	8	10	
depth_unit		FT								
submatrix		SB								
composite		N	N	N	N	N	N	N	N	
Inorganics (mg/kg)										
ANTIMONY	0.27			0.3	L		2.2	L	0.13	B
ARSENIC	0.39			5.7			7		4.2	
COPPER	100			8			37.1		5.3	
LEAD	11			68.2			589		8.9	
TIN	0.89			1	B		1.2	B	0.76	B
ZINC	46			17.9			33.2		14.8	
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11	16.333	85.333	126.333	7.667	2171	371.333	0	U	156
Miscellaneous Parameters (s.u.)										
PH	NA									
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA									
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA			90		91		91		

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 7

location		X17SB005	X17SB005	X17SB005	X17SB005	X17SB006	X17SB006	X17SB006	X17SB006
nsample		X17SB0050004	X17SB0050406	X17SB0050608	X17SB0050810	X17SB0060004	X17SB0060406	X17SB0060608	X17SB0060810
sample_dat		20090611	20090611	20090611	20090611	20090611	20090611	20090611	20090611
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	4	6	8	0	4	6	8
bottom_dep		4	6	8	10	4	6	8	10
depth_unit		FT							
submatrix		SB							
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27	1.7	L			0.3	L	1	L
ARSENIC	0.39	5.9				2.3	B	2.4	B
COPPER	100	42	K			7.8		10	
LEAD	11	620				32.4		132	
TIN	0.89	1.6	B			0.99	B	1	B
ZINC	46	23.8				14		13.1	
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	942.333	36.667	349.667	41.333	230	191	4.667	55.333
Miscellaneous Parameters (s.u.)									
PH	NA								
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA								
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA	87			89		91		

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 7

location		X17SB007	X17SB007	X17SB007	X17SB007	X17SB011	X17SB011	X17SB012	X17SB013		
nsample		X17SB0070004	X17SB0070406	X17SB0070608	X17SB0070810	X17SS0110001	X17SB0110102	X17SS0120001	X17SB0130102		
sample_dat		20090611	20090611	20090611	20090611	20090611	20090614	20090611	20090614		
qc_type		NM									
sacode		NORMAL									
matrix	PALs	SO									
top_depth		0	4	6	8	0	1	0	1		
bottom_dep		4	6	8	10	1	2	1	2		
depth_unit		FT									
submatrix		SB	SB	SB	SB	SS	SB	SS	SB		
composite		N	N	N	N	N	N	N	N		
Inorganics (mg/kg)											
ANTIMONY	0.27	0.19	L					0.52	L	0.42	L
ARSENIC	0.39	4.8						5.1		3.7	
COPPER	100	8.3						10.7		8.6	
LEAD	11	8.2						82.1		39.2	
TIN	0.89	1.3	B					1.2	B	0.86	B
ZINC	46	17.5						21.8		13.2	
Explosives (mg/kg)											
NITROGLYCERIN	6.1										
XRF Field Parameters (mg/kg)											
LEAD	11	4.333	24.333	0	U	6.667	405	101.667	10	30.667	
Miscellaneous Parameters (s.u.)											
PH	NA										
Miscellaneous Parameters (mg/kg)											
TOTAL ORGANIC CARBON	NA										
Miscellaneous Parameters (%)											
TOTAL SOLIDS	NA	87						90		93	

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 7

location		X17SB013	X17SB014	X17SB014	X17SB015	X17SB016	X17SB017	X17SB018	X17SB019
nsample		X17SS0130001	X17SS0140001	X17SB0140102	X17SS0150001	X17SS0160001	X17SS0170001	X17SS0180001	X17SS0190001
sample_dat		20090614	20090611	20090614	20090611	20090611	20090611	20090611	20090611
qc_type		NM							
sacode		NORMAL							
matrix	PALs	SO							
top_depth		0	0	1	0	0	0	0	0
bottom_dep		1	1	2	1	1	1	1	1
depth_unit		FT							
submatrix		SS	SS	SB	SS	SS	SS	SS	SS
composite		N	N	N	N	N	N	N	N
Inorganics (mg/kg)									
ANTIMONY	0.27		6 L	0.44 B			0.19 B		0.26 L
ARSENIC	0.39		8.7	5.5			5.1		8.5
COPPER	100		36.3	11.8			9.6		12
LEAD	11		706	77.6			12.2 B		39.4
TIN	0.89		1.5 B	1.5			1.3 B		0.56 B
ZINC	46		23.5	25.4			19.5		24
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	3247	2501	40.667	18	13.667	9.667	7	36
Miscellaneous Parameters (s.u.)									
PH	NA	7.3							
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA	10000							
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA	84	92	90		84			85

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 7

location		X17SB020	X17SB021	X17SB022	X17SB022	X17SB022	X17SB023	X17SB024	X17SB025				
nsample		X17SS0200001	X17SS0210001	X17SS0220001	X17SS0220001-AVG	X17SS0220001-D	X17SS0230001	X17SS0240001	X17SS0250001				
sample_dat		20090611	20090611	20090611	20090611	20090611	20090611	20090611	20090612				
qc_type		NM	NM	NM	NM	FD	NM	NM	NM				
sacode		NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL				
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO				
top_depth		0	0	0	0	0	0	0	0				
bottom_dep		1	1	1	1	1	1	1	1				
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT				
submatrix		SS	SS	SS	SS	SS	SS	SS	SS				
composite		N	N	N	N	N	N	N	N				
Inorganics (mg/kg)													
ANTIMONY	0.27			0.13	B	0.13	B	0.13	B	0.15	B	3.3	B
ARSENIC	0.39			3.5		3.55		3.6		3.9		5.1	
COPPER	100			8.2		8.1	K	8	K	7.2		26	
LEAD	11			7	B	5.35		7.2		10.3	B	479	
TIN	0.89			1	B	1	B	1	B	1.2	B	0.96	B
ZINC	46			13.7		13.75		13.8		14.8		20	
Explosives (mg/kg)													
NITROGLYCERIN	6.1												
XRF Field Parameters (mg/kg)													
LEAD	11	39	31.333	26	26			0	U	11.333		731.667	
Miscellaneous Parameters (s.u.)													
PH	NA												
Miscellaneous Parameters (mg/kg)													
TOTAL ORGANIC CARBON	NA												
Miscellaneous Parameters (%)													
TOTAL SOLIDS	NA			87	87	87		87		87		92	

Table A.4-2
Summary of Chemicals Detected in Discrete Soil Samples
Small Arms (Pistol) Range - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 7 of 7

location		X17SB025	X17SB026	X17SB027	X17SB028	X17SB029			
nsample		X17SB0250102	X17SS0260001	X17SS0270001	X17SS0280001	X17SS0290001			
sample_dat		20090614	20090612	20090612	20090612	20090614			
qc_type		NM	NM	NM	NM	NM			
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL			
matrix	PALs	SO	SO	SO	SO	SO			
top_depth		1	0	0	0	0			
bottom_dep		2	1	1	1	1			
depth_unit		FT	FT	FT	FT	FT			
submatrix		SB	SS	SS	SS	SS			
composite		N	N	N	N	N			
Inorganics (mg/kg)									
ANTIMONY	0.27	0.55	B		2.1	L	0.5	L	
ARSENIC	0.39	4.6			3.6		4		
COPPER	100	10.9			5.6	K	8.1	K	
LEAD	11	87.5			645		38.9		
TIN	0.89	1.2	B		0.58	B	1.1	B	
ZINC	46	24			10		13.5		
Explosives (mg/kg)									
NITROGLYCERIN	6.1								
XRF Field Parameters (mg/kg)									
LEAD	11	126.667	95.333	128.667	39		256		
Miscellaneous Parameters (s.u.)									
PH	NA						7.8		
Miscellaneous Parameters (mg/kg)									
TOTAL ORGANIC CARBON	NA						3100		
Miscellaneous Parameters (%)									
TOTAL SOLIDS	NA	91			92		93		

Table A.5-1
Summary of Chemicals Detected in Composite Soil Sample
Firing Line Area
Roach Road Rifle Range - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 1

location		X25SB034C	
nsample		X25SS034C0001	
sample_dat		20090615	
qc_type		NM	
sacode		NORMAL	
matrix	PALs	SO	
top_depth		0	
bottom_dep		1	
depth_unit		FT	
submatrix		SS	
composite		Y	
Inorganics (mg/kg)			
ANTIMONY	0.27	0.1	L
ARSENIC	0.39	4.3	
COPPER	100	8.5	
LEAD	11	9.4	
TIN	0.89	1.6	B
ZINC	46	30.2	
Explosives (mg/kg)			
NITROGLYCERIN	6.1	1.2	U
XRF Field Parameters (mg/kg)			
LEAD	11	0	U
Miscellaneous Parameters (s.u.)			
PH	NA		
Miscellaneous Parameters (mg/kg)			
TOTAL ORGANIC CARBON	NA		
Miscellaneous Parameters (%)			
TOTAL SOLIDS	NA	90	

Table A.5-2
Summary of Chemicals Detected in Discrete Soil Samples
Roach Road Rifle Range - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 5

location		X25SB001	X25SB002	X25SB003	X25SB004	X25SB005	X25SB006	X25SB007	X25SB007	X25S			
nsample		X25SS0010001	X25SS0020001	X25SS0030001	X25SS0040001	X25SS0050001	X25SS0060001	X25SS0070001	X25SS0070001-AVG	X25SS00			
sample_dat		20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	2009			
qc_type		NM	F										
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DL			
matrix	PALs	SO	Si										
top_depth		0	0	0	0	0	0	0	0	(
bottom_dep		1	1	1	1	1	1	1	1	1			
depth_unit		FT	F										
submatrix		SS	S										
composite		N	N	N	N	N	N	N	N	N			
Inorganics (mg/kg)													
ANTIMONY	0.27	0.02	B			0.15	B		0.02	B	0.09	B	0.16
ARSENIC	0.39	4.9				2.8			2.3	J	4.05	J	5.8
COPPER	100	13.1				7.4			10.3		10.4		10.5
LEAD	11	6.3				19.5			43.5		39		34.5
TIN	0.89	0.56	B			0.49	B		0.62	B	0.65	B	0.68
ZINC	46	36.4				30.6			27.5		30.15		32.8
Explosives (mg/kg)													
NITROGLYCERIN	6.1												
XRF Field Parameters (mg/kg)													
LEAD	11	0	U	12.667	U	8.333	29.667	22	8.333	32	32		
Miscellaneous Parameters (s.u.)													
PH	NA							7.6					
Miscellaneous Parameters (mg/kg)													
TOTAL ORGANIC CARBON	NA							4600					
Miscellaneous Parameters (%)													
TOTAL SOLIDS	NA	85					92		87	69	71.5		74

Table A.5-2
 Summary of Chemicals Detected in Discrete Soil Samples
 Roach Road Rifle Range - UXO 25
 Site Inspection
 NSF Indian Head - Stump Neck Annex
 Indian Head, Maryland
 Page 2 of 5

location		B007	X25SB008	X25SB009	X25SB010	X25SB011	X25SB012	X25SB013	X25SB014	X25SB015
nsample		70001-D	X25SS0080001	X25SS0090001	X25SS0100001	X25SS0110001	X25SS0120001	X25SS0130001	X25SS0140001	X25SS0150001
sample_dat		0615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615
qc_type		D	NM							
sacode		JP	NORMAL							
matrix	PALs	O	SO							
top_depth		0	0	0	0	0	0	0	0	0
bottom_dep		1	1	1	1	1	1	1	1	1
depth_unit		T	FT							
submatrix		S	SS							
composite		N	N	N	N	N	N	N	N	N
Inorganics (mg/kg)										
ANTIMONY	0.27	B	0.27	L		0.48	J		0.2	J
ARSENIC	0.39	J	2.4			8.5			4.4	
COPPER	100		11			14			9.2	
LEAD	11		91.4			84	J		19.8	J
TIN	0.89	B	0.51	B		1.4	B		1.2	B
ZINC	46		26.6			33.4			36.3	
Explosives (mg/kg)										
NITROGLYCERIN	6.1									
XRF Field Parameters (mg/kg)										
LEAD	11		94.667	12.333	158.667	41	21.667	12.333	11	36.333
Miscellaneous Parameters (s.u.)										
PH	NA							7.4		
Miscellaneous Parameters (mg/kg)										
TOTAL ORGANIC CARBON	NA							14000		
Miscellaneous Parameters (%)										
TOTAL SOLIDS	NA		86			81		80		

Table A.5-2
Summary of Chemicals Detected in Discrete Soil Samples
Roach Road Rifle Range - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 5

location		X25SB016	X25SB017	X25SB018	X25SB019	X25SB020	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	X25SB021	
nsample		X25SS0160001	X25SS0170001	X25SS0180001	X25SS0190001	X25SS0200001	X25SS0210001	X25SS0210001	X25SS0210001-AVG	X25SS0210001-D								
sample_dat		20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	
qc_type		NM	NM	NM	NM	NM	NM	NM	NM	NM								
sacode		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NOR							
matrix	PALs	SO	SO	SO	SO	SO	SO	SO	SO	SO								
top_depth		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
bottom_dep		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
depth_unit		FT	FT	FT	FT	FT	FT	FT	FT	FT								
submatrix		SS	SS	SS	SS	SS	SS	SS	SS	SS								
composite		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Inorganics (mg/kg)																		
ANTIMONY	0.27	0.4	L			2.4	L	4.4	L	12.2	L	0.3	L	0.285	L	0.27	L	0.19
ARSENIC	0.39	22.6				5.6		2.5		5		2.4		2.65		2.9		3.8
COPPER	100	24.8				48.5		130		370		10.9		10.05		9.2		11
LEAD	11	88.6				529		1060		3450		131		129		127		62.6
TIN	0.89	0.52	B			0.55	B	0.43	B	0.56	B	0.5	B	0.485	B	0.47	B	0.51
ZINC	46	43.8				32.4		45.1		63.9		26.8		25.85		24.9		23.1
Explosives (mg/kg)																		
NITROGLYCERIN	6.1																	
XRF Field Parameters (mg/kg)																		
LEAD	11	64.667		78.333	U	1676.333		2775		3877		177.667		177.667				60
Miscellaneous Parameters (s.u.)																		
PH	NA							7.4										
Miscellaneous Parameters (mg/kg)																		
TOTAL ORGANIC CARBON	NA							42000										
Miscellaneous Parameters (%)																		
TOTAL SOLIDS	NA	84				82		84		80		80		82.5		85		86

Table A.5-2
Summary of Chemicals Detected in Discrete Soil Samples
Roach Road Rifle Range - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 5

location		B022	X25SB023	X25SB024	X25SB025	X25SB026	X25SB027	X25SB028	X25SB029	X25SB030							
nsample		Z20001	X25SS0230001	X25SS0240001	X25SS0250001	X25SS0260001	X25SS0270001	X25SS0280001	X25SS0290001	X25SS0300001							
sample_dat		0615	20090615	20090615	20090615	20090615	20090615	20090615	20090615	20090615							
qc_type		M	NM														
sacode		MAL	NORMAL														
matrix	PALs	O	SO														
top_depth		0	0	0	0	0	0	0	0	0							
bottom_dep		1	1	1	1	1	1	1	1	1							
depth_unit		T	FT														
submatrix		S	SS														
composite		N	N	N	N	N	N	N	N	N							
Inorganics (mg/kg)																	
ANTIMONY	0.27	L	1.3	L	1.7	L	0.27	L	0.21	L	0.26	L					
ARSENIC	0.39		2.6		3.2		3.7		3.6		2.8						
COPPER	100		44		50.2		11.5		9.6		11						
LEAD	11		546		522		34.2		17.9		50.3						
TIN	0.89	B	0.55	B	0.58	B	0.5	B	1.5	B	1.7	B					
ZINC	46		37		40.6		22		25.2		28.4						
Explosives (mg/kg)																	
NITROGLYCERIN	6.1																
XRF Field Parameters (mg/kg)																	
LEAD	11		538.333		835.667		48		36.667		14.333		25.333		48		64.667
Miscellaneous Parameters (s.u.)																	
PH	NA																
Miscellaneous Parameters (mg/kg)																	
TOTAL ORGANIC CARBON	NA																
Miscellaneous Parameters (%)																	
TOTAL SOLIDS	NA		85		82		88				85				86		

Table A.5-2
Summary of Chemicals Detected in Discrete Soil Samples
Roach Road Rifle Range - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 5

location		X25SB031	X25SB032	X25SB033			
nsample		X25SS0310001	X25SS0320001	X25SS0330001			
sample_dat		20090615	20090615	20090615			
qc_type		NM	NM	NM			
sacode		NORMAL	NORMAL	NORMAL			
matrix	PALs	SO	SO	SO			
top_depth		0	0	0			
bottom_dep		1	1	1			
depth_unit		FT	FT	FT			
submatrix		SS	SS	SS			
composit		N	N	N			
Inorganics (mg/kg)							
ANTIMONY	0.27	0.53	L	0.24	L	0.13	B
ARSENIC	0.39	2.4	B	2.1	B	1.9	B
COPPER	100	13.3		13.4		9.5	
LEAD	11	142		60.2		31.1	
TIN	0.89	2.3	B	1.8	B	1.6	B
ZINC	46	30.3		30.8		35.2	
Explosives (mg/kg)							
NITROGLYCERIN	6.1						
XRF Field Parameters (mg/kg)							
LEAD	11	565		49		40.333	
Miscellaneous Parameters (s.u.)							
PH	NA			7.5			
Miscellaneous Parameters (mg/kg)							
TOTAL ORGANIC CARBON	NA			13000			
Miscellaneous Parameters (%)							
TOTAL SOLIDS	NA	85		87		86	

APPENDIX B

**SUPPORTING DOCUMENTATION FOR
HUMAN HEALTH RISK EVALUATION**

Table B.1-1
Identification of Human Health COPCs in Composite Surface Soil Samples from Firing Line
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 14

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	9/9	NA	NA	0.13	0.321	1.4	X14SS004C0001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	9/9	NA	NA	1.6	2.67	3.3	X14SS004C0001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	9/9	NA	NA	8	16.8	52.4	X14SS008C0001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	0/9	1	3.2	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	9/9	NA	NA	25.1	40.2	66.5	X14SS004C0001		2.3E+03	6.8E+02		6.8E+02	n		n
Explosives (mg/kg)															
Nitroglycerin	1/9	1.2	1.2	0.8	0.8	0.8	X14SS009C0001	2.9E+01	6.1E-01	1.7E-03		1.7E-03	Y		Y
Lead (mg/kg)															
Lead-Lab	9/9	NA	NA	12	24.5	52.5	X14SS004C0001		4.0E+02			4.0E+02	n		n
Lead-XRF Field	9/9	NA	NA	15.667	27	82.333	X14SS004C0001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.1-2
Identification of Human Health COPCs in Discrete Surface Soil Samples from Target Berm 1
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 14

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	5/5	NA	NA	0.1	0.13	0.16	X14SS0390001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	n		n
Arsenic	5/5	NA	NA	1.3	2.52	4.2	X14SS0220001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	5/5	NA	NA	9.2	51.6	107	X14SS0350001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	2/5	1.8	2.9	4.1	6.6	9.1	X14SS0350001		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	5/5	NA	NA	18.6	25.1	33.3	X14SS0350001		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	5/5	NA	NA	9.6	222	543	X14SS0350001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	35/35	NA	NA	11.667	120	540.333	X14SS0350001		4.0E+02			4.0E+02			
Lead-XRF Calc.	35/35	NA	NA	29.383	120	468.177	X14SS0350001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
1/2 the detection limit was used for B qualified data.
NA - Not applicable, statistic could not be calculated..

Table B.1-3
Identification of Human Health COPCs in Discrete Surface Soil Samples from Target Berm 2
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 14

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	4/5	0.11	0.11	0.13	0.148	0.17	X14SS0620001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	n		n
Arsenic	5/5	NA	NA	1.6	2.56	3.3	X14SS0720001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	5/5	NA	NA	14.6	51.7	88.6	X14SS0580001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	1/5	2	3	10.1	10.1	10.1	X14SS0580001		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	5/5	NA	NA	18.2	28.6	35.2	X14SS0620001		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	5/5	NA	NA	85.7	288	606	X14SS0580001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	35/35	NA	NA	21.333	298	783.667	X14SS0660001		4.0E+02			4.0E+02			
Lead-XRF Calc.	35/35	NA	NA	37.407	267	670.143	X14SS0660001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
1/2 the detection limit was used for B qualified data.
NA - Not applicable, statistic could not be calculated..

Table B.1-4
Identification of Human Health COPCs in Discrete Surface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 14

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	5/17	0.02	0.32	0.12	0.188	0.32	X14SS1340001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	n	n
Arsenic	16/17	1.6	1.6	1.1	3.28	7.3	X14SS1340001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	17/17	NA	NA	8.6	58.9	276	X14SS1200001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	11/17	0.49	1.7	1.6	15.7	81.8	X14SS1400001		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	17/17	NA	NA	7	28.3	60.3	X14SS1320001		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	16/17	11	11	17.9	316	904	X14SS1340001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	64/64	NA	NA	19.333	1980	19878	X14SS1020001		4.0E+02			4.0E+02			
Lead-XRF Calc.	44/44	NA	NA	35.747	384	2363.343	X14SS1280001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
1/2 the detection limit was used for B qualified data.
NA - Not applicable, statistic could not be calculated..

Table B.1-5
Identification of Human Health COPCs in Discrete Subsurface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 14

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	0/3	0.18	0.88	NA	NA	NA	NA		3.1E+00	6.6E-01	2.7E-01	2.7E-01	n		n
Arsenic	3/3	NA	NA	2.2	4	7.8	X14SB0840102	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	3/3	NA	NA	113	335	849	X14SB0840102		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	3/3	NA	NA	29.3	90.9	139	X14SB1110102		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	3/3	NA	NA	9.8	27.4	53.9	X14SB0840102		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	3/3	NA	NA	1220	2990	6620	X14SB0840102		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	4/4	NA	NA	357.667	3380	8931	X14SB1020102		4.0E+02			4.0E+02			
Lead-XRF Calc.	1/1	NA	NA	316.563	317	316.563	X14SB0840102, X14SB0840102-D		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated.

Table B.1-6
Risks and Hazard Indices for Direct Contact Exposures to Composite Surface Soil Samples from Firing Lines
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 6 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Antimony	0.321	1.4	Y		3.1E+01		4.5E-02		4.1E+02		3.4E-03
Copper	16.8	52.4	Y		3.1E+03		1.7E-02		4.1E+04		1.3E-03
Explosives (mg/kg)											
Nitroglycerin	0.8	0.8	Y	2.9E+01	6.1E+00	2.8E-08	1.3E-01	1.0E+02	6.2E+01	8.0E-09	1.3E-02
Total						2.8E-08	1.9E-01			8.0E-09	1.8E-02

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.1-7
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples from Target Berm 1
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 7 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Copper	51.6	107	Y		3.1E+03		3.5E-02		4.1E+04		2.6E-03
Total						0.0E+00	3.5E-02			0.0E+00	2.6E-03

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.1-8
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples from Target Berm 1
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 8 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	222	543	Y	4.0E+02	Y	8.0E+02	n

Table B.1-9
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples from Target Berm 2
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 9 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Copper	51.7	88.6	Y		3.1E+03		2.9E-02		4.1E+04		2.2E-03
Total						0.0E+00	2.9E-02			0.0E+00	2.2E-03

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.1-10
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples from Target Berm 2
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 10 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	288	606	Y	4.0E+02	Y	8.0E+02	n

Table B.1-11
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 11 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Copper	58.9	276	Y		3.1E+03		8.9E-02		4.1E+04		6.7E-03
Total						0.0E+00	8.9E-02			0.0E+00	6.7E-03

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.1-12
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 12 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	316	904	Y	4.0E+02	Y	8.0E+02	Y

Table B.1-13
Risks and Hazard Indices for Direct Contact Exposures to Discrete Subsurface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 13 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Copper	335	849	Y		3.1E+03		2.7E-01		4.1E+04		2.1E-02
Total						0.0E+00	2.7E-01			0.0E+00	2.1E-02

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.1-14
Evaluation of Direct Contact Exposures to Lead in Discrete Subsurface Soil Samples from Hillside Impact Area
Marine Rifle Range (MRR) - UXO 14
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 14 of 14

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	2990	6620	Y	4.0E+02	Y	8.0E+02	Y

Table B.2-1
Identification of Human Health COPCs in Composite Surface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 1 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	2/2	NA	NA	0.46	0.57	0.68	X15SS077C0001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	2/2	NA	NA	2.6	2.65	2.7	X15SS078C0001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	2/2	NA	NA	14.8	19.1	23.3	X15SS077C0001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	0/2	1.7	1.8	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	2/2	NA	NA	52.5	53.5	54.4	X15SS078C0001		2.3E+03	6.8E+02		6.8E+02	n		n
Explosives (mg/kg)															
Nitroglycerin	2/2	NA	NA	0.49	2.1	3.7	X15SS077C0001	2.9E+01	6.1E-01	1.7E-03		1.7E-03	Y		Y
Lead (mg/kg)															
Lead-Lab	2/2	NA	NA	66.7	72	77.2	X15SS078C0001		4.0E+02			4.0E+02	n		n
Lead-XRF Field	2/2	NA	NA	67.667	74.5	81.333	X15SS078C0001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.2-2
Identification of Human Health COPCs in Discrete Surface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	14/14	NA	NA	0.16	0.883	4.8	X15SS0640001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	14/14	NA	NA	1.6	3.31	7.2	X15SS0070001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	14/14	NA	NA	5.4	13.3	37.6	X15SS0680001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n	n	n
Tin	0/14	1.2	3.9	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n	n	n
Zinc	14/14	NA	NA	25.1	35.5	53.3	X15SS0680001		2.3E+03	6.8E+02		6.8E+02	n	n	n
PAHs (ug/kg)															
1-Methylnaphthalene	7/18	23	10000	5.4	95.6	230	X15SS0520001	2.2E+04	5.5E+05	1.5E+01		1.5E+01	Y	Y	Y
2-Methylnaphthalene	10/18	24	10000	9.2	71	230	X15SS0150001		3.1E+04	9.0E+02		9.0E+02	n	n	n
Acenaphthene	15/18	24	26	4.2	1400	5000	X15SS0380001		3.4E+05	2.7E+04		2.7E+04	n	n	n
Acenaphthylene	0/18	23	27	NA	NA	NA	NA		3.4E+05	2.7E+04		2.7E+04	n	n	n
Anthracene	15/18	25	27	1.9	1940	7200	X15SS0380001		1.7E+06	4.5E+05		4.5E+05	n	n	n
Benzo(a)anthracene	18/18	NA	NA	20	8340	33000	X15SS0530001	1.5E+02		1.4E+01		1.4E+01	Y	Y	Y
Benzo(a)pyrene	18/18	NA	NA	18	10700	42000	X15SS0530001	1.5E+01		4.6E+00	3.2E+02	4.6E+00	Y	Y	Y
Benzo(b)fluoranthene	18/18	NA	NA	24	10700	41000	X15SS0530001	1.5E+02		4.7E+01		4.7E+01	Y	Y	Y
Benzo(g,h,i)perylene	18/18	NA	NA	13	6290	25000	X15SS0530001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Benzo(k)fluoranthene	18/18	NA	NA	11	4500	18000	X15SS0380001	1.5E+03		4.6E+02		4.6E+02	Y	Y	Y
Chrysene	18/18	NA	NA	13	10700	43000	X15SS0530001	1.5E+04		1.4E+03		1.4E+03	Y	Y	Y
Dibenzo(a,h)anthracene	18/18	NA	NA	7.8	1950	7600	X15SS0530001	1.5E+01		1.6E+01		1.5E+01	Y	Y	Y
Fluoranthene	18/18	NA	NA	13	9720	38000	X15SS0380001		2.3E+05	2.1E+05		2.1E+05	n	n	n
Fluorene	10/18	24	10000	8.3	629	3100	X15SS0380001		2.3E+05	3.3E+04		3.3E+04	n	n	n
Indeno(1,2,3-cd)pyrene	18/18	NA	NA	11	6970	27000	X15SS0380001, X15SS0530001	1.5E+02		1.6E+02		1.5E+02	Y	Y	Y
Naphthalene	7/18	23	10000	8.6	118	330	X15SS0500001	3.9E+03	1.5E+04	5.6E-01		5.6E-01	Y	Y	Y
Phenanthrene	18/18	NA	NA	5.4	6820	30000	X15SS0380001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Pyrene	18/18	NA	NA	11	11400	45000	X15SS0380001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Lead (mg/kg)															
Lead-Lab	14/14	NA	NA	32	320	940	X15SS0640001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	72/72	NA	NA	20.333	188	1260.333	X15SS0740001		4.0E+02			4.0E+02			
Lead-XRF Calc.	72/72	NA	NA	40.047	164	957.647	X15SS0740001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.2-3
Identification of Human Health COPCs in Discrete Subsurface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 3 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	1/1	NA	NA	0.11	0.11	0.11	X15SB0050102		3.1E+00	6.6E-01	2.7E-01	2.7E-01	n		n
Arsenic	1/1	NA	NA	4.1	4.1	4.1	X15SB0050102	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	1/1	NA	NA	10.1	10.1	10.1	X15SB0050102		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	0/1	1.2	1.2	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	1/1	NA	NA	37.6	37.6	37.6	X15SB0050102		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	1/1	NA	NA	12.2	12.2	12.2	X15SB0050102		4.0E+02			4.0E+02	n		n
Lead-XRF Field	6/6	NA	NA	14.667	37.6	85.333	X15SB0070102		4.0E+02			4.0E+02			
Lead-XRF Calc.	6/6	NA	NA	35.853	52.8	88.147	X15SB0070102		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
1/2 the detection limit was used for B qualified data.
NA - Not applicable, statistic could not be calculated..

Table B.2-4
Risks and Hazard Indices for Direct Contact Exposures to Composite Surface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 4 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Antimony	0.57	0.68	Y		3.1E+01		2.2E-02		4.1E+02		1.7E-03
Explosives (mg/kg)											
Nitroglycerin	2.1	3.7	Y	2.9E+01	6.1E+00	1.3E-07	6.1E-01	1.0E+02	6.2E+01	3.7E-08	6.0E-02
Total						1.3E-07	6.3E-01			3.7E-08	6.1E-02

Table B.2-5
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 5 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening			Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening		
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk (Using Max.)	Calculated Cancer Risk (Using Avg.)	Calculated Hazard Index (Using Max.)	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk (Using Max.)	Calculated Cancer Risk (Using Avg.)	Calculated Hazard Index (Using Max.)
Inorganics (mg/kg)													
Antimony	0.883	4.8	Y		3.1E+01			1.5E-01		4.1E+02			1.2E-02
PAHs (ug/kg)													
1-Methylnaphthalene	95.6	230	Y	2.2E+04	5.5E+06	1.0E-08	4.3E-09	4.2E-05	9.9E+04	7.2E+07	2.3E-09	9.7E-10	3.2E-06
Benzo(a)anthracene	8340	33000	Y	1.5E+02		2.2E-04	5.6E-05		2.1E+03		1.6E-05	4.0E-06	
Benzo(a)pyrene	10700	42000	Y	1.5E+01		2.8E-03	7.1E-04		2.1E+02		2.0E-04	5.1E-05	
Benzo(b)fluoranthene	10700	41000	Y	1.5E+02		2.7E-04	7.1E-05		2.1E+03		2.0E-05	5.1E-06	
Benzo(k)fluoranthene	4500	18000	Y	1.5E+03		1.2E-05	3.0E-06		2.1E+04		8.6E-07	2.1E-07	
Chrysene	10700	43000	Y	1.5E+04		2.9E-06	7.1E-07		2.1E+05		2.0E-07	5.1E-08	
Dibenzo(a,h)anthracene	1950	7600	Y	1.5E+01		5.1E-04	1.3E-04		2.1E+02		3.6E-05	9.3E-06	
Indeno(1,2,3-cd)pyrene	6970	27000	Y	1.5E+02		1.8E-04	4.6E-05		2.1E+03		1.3E-05	3.3E-06	
Naphthalene	118	330	Y	3.9E+03	1.5E+05	8.5E-08	3.0E-08	2.2E-03	2.0E+04	6.7E+05	1.7E-08	5.9E-09	4.9E-04
Total						4.0E-03	1.0E-03	1.6E-01			2.9E-04	7.3E-05	1.2E-02

Table B.2-6
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples
Old Skeet and Trap Range (OSTR) - UXO 15
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	320	940	Y	4.0E+02	Y	8.0E+02	Y

Table B.3-1
Identification of Human Health COPCs in Composite Surface Soil Samples
Rum Point Skeet Range (RPSR) - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 1 of 5

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	2/2	NA	NA	0.14	0.28	0.42	X16SS081C0001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	2/2	NA	NA	3	3.6	4.2	X16SS081C0001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	2/2	NA	NA	4.8	7.2	9.6	X16SS081C0001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n	n	n
Tin	0/2	1.1	1.2	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n	n	n
Zinc	2/2	NA	NA	18.7	23.9	29	X16SS081C0001		2.3E+03	6.8E+02		6.8E+02	n	n	n
PAHs (ug/kg)															
1-Methylnaphthalene	0/2	23	23	NA	NA	NA	NA	2.2E+04	5.5E+05	1.5E+01		1.5E+01	n	n	n
2-Methylnaphthalene	1/2	23	23	3.5	3.5	3.5	X16SS080C0001		3.1E+04	9.0E+02		9.0E+02	n	n	n
Acenaphthene	0/2	23	23	NA	NA	NA	NA		3.4E+05	2.7E+04		2.7E+04	n	n	n
Acenaphthylene	0/2	23	23	NA	NA	NA	NA		3.4E+05	2.7E+04		2.7E+04	n	n	n
Anthracene	2/2	NA	NA	4.1	4.85	5.6	X16SS081C0001		1.7E+06	4.5E+05		4.5E+05	n	n	n
Benzo(a)anthracene	2/2	NA	NA	78	86	94	X16SS081C0001	1.5E+02		1.4E+01		1.4E+01	Y	n	n
Benzo(a)pyrene	2/2	NA	NA	91	95.5	100	X16SS081C0001	1.5E+01		4.6E+00	3.2E+02	4.6E+00	Y	n	n
Benzo(b)fluoranthene	2/2	NA	NA	33	35.5	38	X16SS081C0001	1.5E+02		4.7E+01		4.7E+01	n	n	n
Benzo(g,h,i)perylene	2/2	NA	NA	41	45.5	50	X16SS081C0001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Benzo(k)fluoranthene	2/2	NA	NA	5.8	6.75	7.7	X16SS081C0001	1.5E+03		4.6E+02		4.6E+02	n	n	n
Chrysene	2/2	NA	NA	97	114	130	X16SS081C0001	1.5E+04		1.4E+03		1.4E+03	n	n	n
Dibenzo(a,h)anthracene	2/2	NA	NA	12	15	18	X16SS081C0001	1.5E+01		1.6E+01		1.5E+01	Y	n	n
Fluoranthene	2/2	NA	NA	9.8	11.4	13	X16SS081C0001		2.3E+05	2.1E+05		2.1E+05	n	n	n
Fluorene	0/2	23	23	NA	NA	NA	NA		2.3E+05	3.3E+04		3.3E+04	n	n	n
Indeno(1,2,3-cd)pyrene	2/2	NA	NA	9.1	9.55	10	X16SS081C0001	1.5E+02		1.6E+02		1.5E+02	n	n	n
Naphthalene	0/2	23	23	NA	NA	NA	NA	3.9E+03	1.5E+04	5.6E-01		5.6E-01	n	n	n
Phenanthrene	2/2	NA	NA	21	22.5	24	X16SS081C0001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Pyrene	2/2	NA	NA	92	101	110	X16SS081C0001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Explosives (mg/kg)															
Nitroglycerin	0/2	1.2	1.2	NA	NA	NA	NA	2.9E+01	6.1E-01	1.7E-03		1.7E-03	n	n	n
Lead (mg/kg)															
Lead-Lab	2/2	NA	NA	9.1	28.9	48.7	X16SS081C0001		4.0E+02			4.0E+02	n	n	n
Lead-XRF Field	2/2	NA	NA	21	47.2	73.333	X16SS081C0001		4.0E+02			4.0E+02	n	n	n

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
1/2 the detection limit was used for B qualified data.
NA - Not applicable, statistic could not be calculated..

Table B.3-2
Identification of Human Health COPCs in Discrete Surface Soil Samples
Rum Point Skeet Range (RPSR) - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 2 of 5

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	12/20	0.03	0.73	0.2	0.674	1.6	X16SS0900001-D		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	n	n
Arsenic	18/20	0.16	1.9	1.1	3.27	6.5	X16SS0610001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	20/20	NA	NA	2.4	6.28	11.4	X16SS0130001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n	n	n
Tin	0/20	0.75	1.9	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n	n	n
Zinc	20/20	NA	NA	9.5	23	34.9	X16SS0130001		2.3E+03	6.8E+02		6.8E+02	n	n	n
PAHs (ug/kg)															
1-Methylnaphthalene	6/21	22	28	2.4	6.23	16	X16SS0760001	2.2E+04	5.5E+05	1.5E+01		1.5E+01	Y	n	n
2-Methylnaphthalene	7/21	22	28	6.4	22.5	68	X16SS0760001		3.1E+04	9.0E+02		9.0E+02	n	n	n
Acenaphthene	4/21	22	28	2.4	4.53	7.7	X16SS0760001		3.4E+05	2.7E+04		2.7E+04	n	n	n
Acenaphthylene	1/21	22	28	24	24	24	X16SS0310001		3.4E+05	2.7E+04		2.7E+04	n	n	n
Anthracene	15/21	22	26	1.6	28	110	X16SS0760001		1.7E+06	4.5E+05		4.5E+05	n	n	n
Benzo(a)anthracene	20/21	22	23	2.6	426	2400	X16SS0760001	1.5E+02		1.4E+01		1.4E+01	Y	Y	Y
Benzo(a)pyrene	18/21	22	26	5.8	548	3200	X16SS0760001	1.5E+01		4.6E+00	3.2E+02	4.6E+00	Y	Y	Y
Benzo(b)fluoranthene	18/21	22	26	3	185	1000	X16SS0760001	1.5E+02		4.7E+01		4.7E+01	Y	Y	Y
Benzo(g,h,i)perylene	18/21	22	26	3.4	239	1500	X16SS0760001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Benzo(k)fluoranthene	14/21	22	26	4.3	42.1	200	X16SS0760001	1.5E+03		4.6E+02		4.6E+02	n	n	n
Chrysene	21/21	22	22	3.3	510	3000	X16SS0760001	1.5E+04		1.4E+03		1.4E+03	Y	Y	Y
Dibenzo(a,h)anthracene	15/21	22	26	6.1	101	540	X16SS0760001	1.5E+01		1.6E+01		1.5E+01	Y	Y	Y
Fluoranthene	19/21	22	26	2.5	52.2	210	X16SS0760001		2.3E+05	2.1E+05		2.1E+05	n	n	n
Fluorene	5/21	22	28	4.2	10.4	21	X16SS0760001		2.3E+05	3.3E+04		3.3E+04	n	n	n
Indeno(1,2,3-cd)pyrene	20/21	22	26	2.5	51.6	260	X16SS0760001	1.5E+02		1.6E+02		1.5E+02	Y	n	n
Naphthalene	2/21	22	28	3.1	5.15	7.2	X16SS0760001	3.9E+03	1.5E+04	5.6E-01		5.6E-01	Y	Y	Y
Phenanthrene	16/21	22	26	3.2	126	620	X16SS0760001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Pyrene	20/21	22	23	3.1	369	2000	X16SS0760001		1.7E+05	1.5E+05		1.5E+05	n	n	n
Lead (mg/kg)															
Lead-Lab	20/20	NA	NA	6.7	90.9	616	X16SS0080001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	92/92	NA	NA	11.667	75.4	975.333	X16SS0080001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated.

Table B.3-3
Risks and Hazard Indices for Direct Contact Exposures to Composite Surface Soil Samples
Rum Point Skeet Range (RPSR) - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 3 of 5

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Antimony	0.28	0.42	Y		3.1E+01		1.4E-02		4.1E+02		1.0E-03
Total						0.0E+00	1.4E-02			0.0E+00	1.0E-03

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.3-4
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples
Rum Point Skeet Range (RPSR) - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 4 of 5

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening			Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening		
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk (Using Max.)	Calculated Cancer Risk (Using Avg.)	Calculated Hazard Index (Using Max.)	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk (Using Max.)	Calculated Cancer Risk (Using Avg.)	Calculated Hazard Index (Using Max.)
PAHs (ug/kg)													
Benzo(a)anthracene	426	2400	Y	1.5E+02		1.6E-05	2.8E-06		2.1E+03		1.1E-06	2.0E-07	
Benzo(a)pyrene	548	3200	Y	1.5E+01		2.1E-04	3.7E-05		2.1E+02		1.5E-05	2.6E-06	
Benzo(b)fluoranthene	185	1000	Y	1.5E+02		6.7E-06	1.2E-06		2.1E+03		4.8E-07	8.8E-08	
Chrysene	510	3000	Y	1.5E+04		2.0E-07	3.4E-08		2.1E+05		1.4E-08	2.4E-09	
Dibenzo(a,h)anthracene	101	540	Y	1.5E+01		3.6E-05	6.7E-06		2.1E+02		2.6E-06	4.8E-07	
Naphthalene	5.15	7.2	Y	3.9E+03	1.5E+05	1.8E-09	1.3E-09	4.8E-05	2.0E+04	6.7E+05	3.6E-10	2.6E-10	1.1E-05
Total						2.7E-04	4.7E-05	4.8E-05			1.9E-05	3.4E-06	1.1E-05

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.3-5
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples
Rum Point Skeet Range (RPSR) - UXO 16
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 5 of 5

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	90.9	616	Y	4.0E+02	Y	8.0E+02	n

Table B.4-1
Identification of Human Health COPCs in Composite Surface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 1 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	3/3	NA	NA	0.39	0.707	1.3	X17SS010C0001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	n	n
Arsenic	3/3	NA	NA	4.4	5.2	6.2	X17SS010C0001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	3/3	NA	NA	11.2	15.7	24	X17SS010C0001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	0/3	0.92	1.4	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	3/3	NA	NA	19	25.8	35.2	X17SS010C0001		2.3E+03	6.8E+02		6.8E+02	n		n
Explosives (mg/kg)															
Nitroglycerin	3/3	NA	NA	9.8	14.4	20.4	X17SS008C0001	2.9E+01	6.1E-01	1.7E-03		1.7E-03	Y		Y
Lead (mg/kg)															
Lead-Lab	3/3	NA	NA	21	86.6	200	X17SS010C0001		4.0E+02			4.0E+02	n		n
Lead-XRF Field	3/3	NA	NA	73.333	109	156.333	X17SS010C0001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.4-2
Identification of Human Health COPCs in Discrete Surface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 2 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	8/12	0.13	3.3	0.15	1.64	6	X17SS0140001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	12/12	NA	NA	3.5	5.4	8.7	X17SS0140001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	12/12	NA	NA	5.6	17.2	42	X17SB0050004		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	0/12	0.56	1.6	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	12/12	NA	NA	10	19.1	33.2	X17SB0040004		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	10/12	7	12.2	7.2	314	706	X17SS0140001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	25/26	0	0	3.667	439	3247	X17SS0130001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.4-3
Identification of Human Health COPCs in Discrete Subsurface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 3 of 6

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	6/9	0.13	0.55	0.22	0.46	1	X17SB0060406		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	n	n
Arsenic	7/9	2.3	2.4	3.7	5.23	7.8	X17SB0020406	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	9/9	NA	NA	5.3	9.03	11.8	X17SB0140102		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	1/9	0.76	1.2	1.5	1.5	1.5	X17SB0140102		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	9/9	NA	NA	13.1	18.7	25.4	X17SB0140102		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	9/9	NA	NA	8.1	59.6	132	X17SB0060406		4.0E+02			4.0E+02	n		n
Lead-XRF Field	20/24	0	0	4.667	93.3	371.333	X17SB0040406		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.4-4
Risks and Hazard Indices for Direct Contact Exposures to Composite Surface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 4 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Explosives (mg/kg)											
Nitroglycerin	14.4	20.4	Y	2.9E+01	6.1E+00	7.0E-07	3.3E+00	1.0E+02	6.2E+01	2.0E-07	3.3E-01
Total						7.0E-07	3.3E+00			2.0E-07	3.3E-01

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.4-5
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 5 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Antimony	1.64	6	Y		3.1E+01		1.9E-01		4.1E+02		1.5E-02
Total						0.0E+00	1.9E-01			0.0E+00	1.5E-02

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.4-6
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples
Small Arms (Pistol) Range (SAPR) - UXO 17
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 6 of 6

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	314	706	Y	4.0E+02	Y	8.0E+02	n

Table B.5-1
Identification of Human Health COPCs in Composite Surface Soil Samples
Roach Road Rifle Range (RRRR) - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 1 of 4

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	1/1	NA	NA	0.1	0.1	0.1	X25SS0200001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	n		n
Arsenic	1/1	NA	NA	4.3	4.3	4.3	X25SS0160001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	1/1	NA	NA	8.5	8.5	8.5	X25SS0200001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	n		n
Tin	0/1	1.6	1.6	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	1/1	NA	NA	30.2	30.2	30.2	X25SS0200001		2.3E+03	6.8E+02		6.8E+02	n		n
Explosives (mg/kg)															
Nitroglycerin	0/1	1.2	1.2	NA	NA	NA	NA	2.9E+01	6.1E-01	1.7E-03		1.7E-03	n		n
Lead (mg/kg)															
Lead-Lab	1/1	NA	NA	9.4	9.4	9.4	X25SS0200001		4.0E+02			4.0E+02	n		n

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

1/2 the detection limit was used for B qualified data.

NA - Not applicable, statistic could not be calculated..

Table B.5-2
Identification of Human Health COPCs in Discrete Surface Soil Samples
Roach Road Rifle Range (RRRR) - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 2 of 4

Chemical	Frequency of Detection	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Minimum Detected Concentration	Average of All Detected Samples	Maximum Detected Concentration	Sample with Maximum Detected Concentration	Residential Direct Contact Risk-Based Screening Levels in Soil		Risk-Based Screening Levels in Soil for Protection of Groundwater		Lowest Risk-Based Screening Level	Possible Human Health COPC?	Is Chemical Present Above Back-ground?	Human Health COPC?
								Cancer Risk (10 ⁻⁶)	Noncancer Hazard Index (0.1)	Tap Water RSL	MCL				
Inorganics (mg/kg)															
Antimony	16/20	0.02	0.16	0.19	1.58	12.2	X25SS0200001		3.1E+00	6.6E-01	2.7E-01	2.7E-01	Y	Y	Y
Arsenic	17/20	1.9	2.4	2.3	5.01	22.6	X25SS0160001	3.9E-01	2.2E+00	1.3E-03	2.9E-01	1.3E-03	Y	n	n
Copper	20/20	NA	NA	7.4	41.1	370	X25SS0200001		3.1E+02	5.1E+01	4.6E+01	4.6E+01	Y	Y	Y
Tin	0/20	0.43	2.3	NA	NA	NA	NA		4.7E+03	5.5E+03		4.7E+03	n		n
Zinc	20/20	NA	NA	22	33.9	63.9	X25SS0200001		2.3E+03	6.8E+02		6.8E+02	n		n
Lead (mg/kg)															
Lead-Lab	20/20	NA	NA	6.3	349	3450	X25SS0200001		4.0E+02			4.0E+02	Y	Y	Y
Lead-XRF Field	32/33	0	0	8.333	359	3877	X25SS0200001		4.0E+02			4.0E+02			
Lead-XRF Calc.	33/33	NA	NA	1.49	227	2754.83	X25SS0200001		4.0E+02			4.0E+02			

Footnotes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
 1/2 the detection limit was used for B qualified data.
 NA - Not applicable, statistic could not be calculated..

Table B.5-3
Risks and Hazard Indices for Direct Contact Exposures to Discrete Surface Soil Samples
Roach Road Rifle Range (RRRR) - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
 Page 3 of 4

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Residential Risk/ Hazard Index Screening		Non-residential Direct Contact Risk-Based Concentration in Soil		Non-residential Risk/ Hazard Index Screening	
				Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index	Based on Cancer Risk of 10 ⁻⁶	Based on Hazard Index of 1	Calculated Cancer Risk	Calculated Hazard Index
Inorganics (mg/kg)											
Antimony	1.58	12.2	Y		3.1E+01		3.9E-01		4.1E+02		3.0E-02
Copper	41.1	370	Y		3.1E+03		1.2E-01		4.1E+04		9.0E-03
Total							0.0E+00		5.1E-01		0.0E+00

Footnotes:

NA - Not applicable, statistic could not be calculated.

Table B.5-4
Evaluation of Direct Contact Exposures to Lead in Discrete Surface Soil Samples
Roach Road Rifle Range (RRRR) - UXO 25
Site Inspection
NSF Indian Head - Stump Neck Annex
Indian Head, Maryland
Page 4 of 4

Chemical	Average of All Detected Samples	Maximum Detected Concentration	Human Health COPC?	Residential Direct Contact Risk-Based Concentration in Soil		Non-residential Direct Contact Risk-Based Concentration in Soil	
				Value	Max. Exceeds Value?	Value	Max. Exceeds Value?
Lead (mg/kg)							
Lead-Lab	349	3450	Y	4.0E+02	Y	8.0E+02	Y

APPENDIX C

**SUPPORTING DOCUMENTATION FOR
ECOLOGICAL RISK EVALUATION**

TABLE C.1-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - COMPOSITE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 FIRING LINE AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	9/9	0.13 J	1.4 J	X14SB004C	NA	NA	0.32	0.32	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	9/9	1.6	3.3	X14SB004C	NA	NA	2.7	2.7	60	18	43	46	NO	BSL
COPPER	9/9	8 L	52.4 L	X14SB008C	NA	NA	17	17	80	70	28	49	YES	ASL
LEAD	9/9	12	52.5	X14SB004C	NA	NA	24	24	1700	120	11	56	YES	ASL
ZINC	9/9	25.1	66.5	X14SB004C	NA	NA	40	40	120	160	46	79	YES	ASL
XRF (mg/kg)														
LEAD	9/9	15.667	82.333	X14SB004C	NA	NA	27	27	1700	120	11	56	YES	ASL
Explosives (mg/kg)														
NITROGLYCERIN	1/9	0.8 J	0.8 J	X14SB009C	1.2	1.2	0.80	0.62	NA	NA	NA	NA	YES	NSL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 J = Estimated concentration
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

**TABLE C.1-2
 TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
 INSECTIVOROUS AND HERBIVOROUS RECEPTORS - COMPOSITE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 FIRING LINE AREA
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND**

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	1.4E-02	3.1E-04	NA	NA	4.9E-01	1.0E-02
ARSENIC	1.4E-03	6.8E-04	6.2E-03	1.4E-03	4.3E-02	2.1E-02	4.3E-02	9.9E-03
COPPER	2.0E-02	2.3E-03	5.3E-02	3.6E-03	3.5E-01	4.1E-02	1.4E-01	9.4E-03
LEAD	2.2E-02	8.1E-04	2.0E-02	4.9E-04	1.1E+00	4.0E-02	2.1E-01	5.2E-03
ZINC	7.0E-03	2.7E-03	2.4E-02	6.2E-03	6.5E-01	2.5E-01	3.4E-01	8.6E-02
Explosives								
NITROGLYCERIN	NA	NA	1.0E-02	9.6E-04	NA	NA	1.9E-02	1.7E-03

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.1-3
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 TARGET BERM 1
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	5/5	0.1 L	0.16 L	X14SB039	NA	NA	0.13	0.13	78	5	NA	0.27	YES	NSL
ARSENIC	5/5	1.3	4.2	X14SB022	NA	NA	2.5	2.5	60	18	43	46	NO	BSL
COPPER	5/5	9.2	107	X14SB035	NA	NA	52	52	80	70	28	49	YES	ASL
LEAD	5/5	9.6	543	X14SB035	NA	NA	222	222	1700	120	11	56	YES	ASL
TIN	2/5	4.1	9.1	X14SB035	1.8	2.9	6.6	3.3	NA	50	NA	7.62	YES	ASL/NSL
ZINC	5/5	18.6	33.3	X14SB035	NA	NA	25	25	120	160	46	79	NO	BSL
XRF (mg/kg)														
LEAD	35/35	11.667	540.333	X14SB035	NA	NA	120	120	1700	120	11	56	YES	ASL
LEAD-CALC	35/35	29.383	468.177	X14SB035	NA	NA	120	120	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE C.1-4
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
MARINE RIFLE RANGE (MRR) - UXO 14
TARGET BERM 1
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	6.1E-03	1.3E-04	NA	NA	2.0E-01	4.2E-03
ARSENIC	1.3E-03	6.4E-04	5.8E-03	1.3E-03	4.1E-02	2.0E-02	4.2E-02	9.5E-03
COPPER	3.6E-02	4.1E-03	8.6E-02	5.8E-03	1.1E+00	1.3E-01	4.3E-01	2.9E-02
LEAD	1.4E-01	5.0E-03	8.5E-02	2.1E-03	7.0E+00	2.6E-01	1.2E+00	3.1E-02
TIN	6.1E-03	2.4E-03	7.0E-03	4.7E-03	7.7E-02	3.1E-02	1.3E-02	8.5E-03
ZINC	5.3E-03	2.1E-03	1.9E-02	4.8E-03	5.5E-01	2.1E-01	2.9E-01	7.4E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.1-5
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 TARGET BERM 2
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	4/5	0.13 L	0.17 L	X14SB062	0.11	0.11	0.15	0.13	78	5	NA	0.27	YES	NSL
ARSENIC	5/5	1.6	3.3	X14SB072	NA	NA	2.6	2.6	60	18	43	46	NO	BSL
COPPER	5/5	14.6	88.6	X14SB058	NA	NA	52	52	80	70	28	49	YES	ASL
LEAD	5/5	85.7	606	X14SB058	NA	NA	288	288	1700	120	11	56	YES	ASL
TIN	1/5	10.1	10.1	X14SB058	2	3	10	3.0	NA	50	NA	7.62	YES	ASL/NSL
ZINC	5/5	18.2	35.2	X14SB062	NA	NA	29	29	120	160	46	79	NO	BSL
XRF (mg/kg)														
LEAD	35/35	21.333	783.667	X14SB066	NA	NA	298	298	1700	120	11	56	YES	ASL
LEAD-CALC	35/35	37.407	670.143	X14SB066	NA	NA	267	267	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

TABLE C.1-6
 TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
 INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 TARGET BERM 2
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	6.0E-03	1.3E-04	NA	NA	2.0E-01	4.2E-03
ARSENIC	1.3E-03	6.5E-04	5.9E-03	1.4E-03	4.2E-02	2.1E-02	4.2E-02	9.6E-03
COPPER	3.6E-02	4.1E-03	8.6E-02	5.8E-03	1.1E+00	1.3E-01	4.3E-01	2.9E-02
LEAD	1.7E-01	6.3E-03	1.0E-01	2.6E-03	8.7E+00	3.2E-01	1.5E+00	3.8E-02
TIN	5.4E-03	2.2E-03	6.3E-03	4.2E-03	6.9E-02	2.8E-02	1.1E-02	7.6E-03
ZINC	5.8E-03	2.2E-03	2.0E-02	5.1E-03	5.8E-01	2.2E-01	3.0E-01	7.7E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.1-7
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 HILLSIDE IMPACT AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	5/17	0.12 L	0.32 L	X14SB134	0.02	0.32	0.19	0.10	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	16/17	1.1	7.3	X14SB134	1.6	1.6	3.3	3.1	60	18	43	46	NO	BSL
COPPER	17/17	8.6	276	X14SB120	NA	NA	59	59	80	70	28	49	YES	ASL
LEAD	16/17	17.9	904	X14SB134	11	11	316	298	1700	120	11	56	YES	ASL
TIN	11/17	1.6	81.8	X14SB140	0.49	1.7	16	10	NA	50	NA	7.62	YES	ASL/NSL
ZINC	17/17	7	60.3	X14SB132	NA	NA	28	28	120	160	46	79	YES	ASL
XRF (mg/kg)														
LEAD	64/64	19.333	19878	X14SB102	NA	NA	1978	1978	1700	120	11	56	YES	ASL
LEAD-CALC	44/44	35.747	2363.34	X14SB128	NA	NA	384	384	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

**TABLE C.1-8
 TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
 INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 HILLSIDE IMPACT AREA
 NSF INDIAN HEAD -STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND**

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	4.8E-03	1.0E-04	NA	NA	1.5E-01	3.3E-03
ARSENIC	1.6E-03	8.0E-04	7.3E-03	1.7E-03	4.9E-02	2.4E-02	4.9E-02	1.1E-02
COPPER	3.8E-02	4.5E-03	9.1E-02	6.1E-03	1.2E+00	1.4E-01	4.9E-01	3.3E-02
LEAD	1.8E-01	6.4E-03	1.0E-01	2.6E-03	9.0E+00	3.3E-01	1.6E+00	3.9E-02
TIN	1.9E-02	7.6E-03	2.2E-02	1.5E-02	2.4E-01	9.6E-02	4.0E-02	2.7E-02
ZINC	5.7E-03	2.2E-03	2.0E-02	5.1E-03	5.8E-01	2.2E-01	3.0E-01	7.7E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.2-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - COMPOSITE SOIL
 OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
 FIRING POINTS
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	2/2	0.46 L	0.68 L	X15SB077C	NA	NA	0.57	0.57	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	2/2	2.6	2.7	X15SB078C	NA	NA	2.7	2.7	60	18	43	46	NO	BSL
COPPER	2/2	14.8	23.3	X15SB077C	NA	NA	19	19	80	70	28	49	NO	BSL
LEAD	2/2	66.7	77.2	X15SB078C	NA	NA	72	72	1700	120	11	56	YES	ASL
ZINC	2/2	52.5	54.4	X15SB078C	NA	NA	53	53	120	160	46	79	YES	ASL
XRF (mg/kg)														
LEAD	2/2	67.667	81.333	X15SB078C	NA	NA	75	75	1700	120	11	56	YES	ASL
Explosives (mg/kg)														
NITROGLYCERIN	2/2	0.49 J	3.7 J	X15SB077C	NA	NA	2.1	2.1	NA	NA	NA	NA	YES	NSL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern Rationale Codes for COPC Selection:
 NA = Not available or not applicable ASL = Above COPC Screening Level
 J = Estimated concentration BSL = Below COPC Screening Level
 L = Biased low concentration NSL = No Screening Level Available

TABLE C.2-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - COMPOSITE SOIL
OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
FIRING POINTS
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	2.5E-02	5.3E-04	NA	NA	8.7E-01	1.9E-02
COPPER	2.1E-02	2.5E-03	5.6E-02	3.8E-03	4.0E-01	4.7E-02	1.6E-01	1.1E-02
LEAD	5.2E-02	1.9E-03	3.9E-02	9.9E-04	2.7E+00	9.9E-02	4.9E-01	1.2E-02
ZINC	8.3E-03	3.2E-03	2.9E-02	7.3E-03	7.1E-01	2.7E-01	3.7E-01	9.4E-02
Explosives								
NITROGLYCERIN	NA	NA	3.4E-02	3.2E-03	NA	NA	6.3E-02	5.9E-03

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.2-3
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
 SHOT FALL/TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	14/14	0.16 J	4.8 J	X15SB064	NA	NA	0.88	0.88	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	14/14	1.6	7.2	X15SB007	NA	NA	3.3	3.3	60	18	43	46	NO	BSL
COPPER	14/14	5.4	37.6 L	X15SB068	NA	NA	13	13	80	70	28	49	YES	ASL
LEAD	14/14	32	940	X15SB064	NA	NA	320	320	1700	120	11	56	YES	ASL
ZINC	14/14	25.1	53.3	X15SB068	NA	NA	35	35	120	160	46	79	YES	ASL
PAHs (ug/kg)														
1-METHYLNAPHTHALENE	7/18	5.4 J	230 J	X15SB052	23	10000	96	812	29000	NA	NA	10000	YES	NSL
2-METHYLNAPHTHALENE	10/18	9.2 J	230	X15SB015	24	10000	71	917	29000	NA	NA	100000	YES	NSL
ACENAPHTHENE	15/18	4.2 J	5000 J	X15SB038	24	26	1399	1168	29000	20000	100	100000	YES	ASL
ANTHRACENE	15/18	1.9 J	7200 J	X15SB038	25	27	1935	1615	29000	100	100	100000	YES	ASL
BENZO(A)ANTHRACENE	18/18	20 J	33000	X15SB053	NA	NA	8341	8341	18000	100	100	1100	YES	ASL
BENZO(A)PYRENE	18/18	18 J	42000	X15SB053	NA	NA	10721	10721	18000	100	100	1100	YES	ASL
BENZO(B)FLUORANTHENE	18/18	24 J	41000	X15SB053	NA	NA	10706	10706	18000	100	100	1100	YES	ASL
BENZO(G,H,I)PERYLENE	18/18	13 J	25000	X15SB053	NA	NA	6294	6294	18000	100	100	1100	YES	ASL
BENZO(K)FLUORANTHENE	18/18	11 J	18000	X15SB038	NA	NA	4501	4501	18000	100	100	1100	YES	ASL
CHRYSENE	18/18	13 J	43000	X15SB053	NA	NA	10718	10718	18000	100	100	1100	YES	ASL
DIBENZO(A,H)ANTHRACENE	18/18	7.8 J	7600 J	X15SB053	NA	NA	1955	1955	18000	100	100	1100	YES	ASL
FLUORANTHENE	18/18	13 J	38000	X15SB038	NA	NA	9723	9723	29000	100	100	100000	YES	ASL
FLUORENE	10/18	8.3 J	3100 J	X15SB038	24	10000	629	1077	29000	100	100	100000	YES	ASL
				X15SB038;										
INDENO(1,2,3-CD)PYRENE	18/18	11 J	27000	X15SB053	NA	NA	6969	6969	18000	100	100	1100	YES	ASL
NAPHTHALENE	7/18	8.6 J	330	X15SB050	23	10000	118	1152	29000	100	100	100000	YES	ASL
PHENANTHRENE	18/18	5.4 J	30000	X15SB038	NA	NA	6820	6820	29000	100	100	100000	YES	ASL
PYRENE	18/18	11 J	45000	X15SB038	NA	NA	11362	11362	18000	100	100	1100	YES	ASL
XRF (mg/kg)														
LEAD	72/72	20.333	1260.33	X15SB074	NA	NA	188	188	1700	120	11	56	YES	ASL
LEAD-CALC	72/72	40.047	957.647	X15SB074	NA	NA	164	164	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

J = Estimated concentration

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE C.2-4
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
SHOT FALL/TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Semivolatile Organics								
1-METHYLNAPHTHALENE	5.7E-04	5.7E-05	6.9E-05	1.3E-05	2.2E-02	2.2E-03	4.0E-04	7.3E-05
2-METHYLNAPHTHALENE	4.9E-04	4.9E-05	6.0E-05	1.1E-05	1.6E-02	1.6E-03	2.9E-04	5.4E-05
ACENAPHTHENE	4.4E-04	4.4E-05	1.3E-05	2.4E-06	1.3E-01	1.3E-02	2.3E-03	4.3E-04
ANTHRACENE	3.7E-03	3.7E-04	4.2E-04	7.7E-05	3.0E-01	3.0E-02	5.3E-03	9.8E-04
BENZO(A)ANTHRACENE	4.3E-03	4.3E-04	2.7E-02	4.3E-04	1.0E+00	1.0E-01	1.9E+00	3.1E-02
BENZO(A)PYRENE	1.1E-02	1.1E-03	1.1E-01	1.8E-03	1.1E+00	1.1E-01	2.1E+00	3.3E-02
BENZO(B)FLUORANTHENE	2.3E-02	2.3E-03	2.7E-01	4.4E-03	2.1E+00	2.1E-01	4.0E+00	6.5E-02
BENZO(G,H,I)PERYLENE	2.2E-02	2.2E-03	2.8E-01	4.5E-03	1.4E+00	1.4E-01	2.7E+00	4.3E-02
BENZO(K)FLUORANTHENE	4.1E-03	4.1E-04	3.8E-02	6.0E-04	8.9E-01	8.9E-02	1.7E+00	2.7E-02
CHRYSENE	5.4E-03	5.4E-04	3.2E-02	5.1E-04	1.9E+00	1.9E-01	3.6E+00	5.7E-02
DIBENZO(A,H)ANTHRACENE	2.2E-03	2.2E-04	2.2E-02	3.5E-04	3.4E-01	3.4E-02	6.6E-01	1.1E-02
FLUORANTHENE	3.2E-02	3.2E-03	3.7E-03	6.8E-04	2.2E+00	2.2E-01	4.0E-02	7.4E-03
FLUORENE	4.0E-04	4.0E-05	1.2E-05	2.3E-06	7.7E-01	7.7E-02	1.4E-02	2.6E-03
INDENO(1,2,3-CD)PYRENE	6.9E-03	6.9E-04	6.7E-02	1.1E-03	1.5E+00	1.5E-01	2.9E+00	4.6E-02
NAPHTHALENE	8.4E-03	8.4E-04	1.1E-03	2.0E-04	3.9E-02	3.9E-03	7.1E-04	1.3E-04
PHENANTHRENE	1.9E-02	1.9E-03	2.1E-03	3.9E-04	9.0E-01	9.0E-02	1.6E-02	2.9E-03
PYRENE	5.2E-02	5.2E-03	6.6E-01	1.1E-02	1.5E+00	1.5E-01	2.9E+00	4.6E-02
Inorganics								
ANTIMONY	NA	NA	3.8E-02	8.1E-04	NA	NA	1.3E+00	2.9E-02
COPPER	1.8E-02	2.1E-03	4.8E-02	3.3E-03	2.8E-01	3.3E-02	1.1E-01	7.5E-03
LEAD	1.9E-01	6.9E-03	1.1E-01	2.8E-03	9.5E+00	3.5E-01	1.7E+00	4.2E-02
ZINC	6.5E-03	2.5E-03	2.3E-02	5.8E-03	6.2E-01	2.4E-01	3.3E-01	8.3E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.3-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - COMPOSITE SOIL
 RUM POINT SKEET RANGE (RPSR) - UXO 16
 FIRING POINTS
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	2/2	0.14 L	0.42 L	X16SB081C	NA	NA	0.28	0.28	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	2/2	3	4.2	X16SB081C	NA	NA	3.6	3.6	60	18	43	46	NO	BSL
COPPER	2/2	4.8	9.6	X16SB081C	NA	NA	7.2	7.2	80	70	28	49	NO	BSL
LEAD	2/2	9.1	48.7	X16SB081C	NA	NA	29	29	1700	120	11	56	YES	ASL
ZINC	2/2	18.7	29	X16SB081C	NA	NA	24	24	120	160	46	79	NO	BSL
PAHs (ug/kg)														
2-METHYLNAPHTHALENE	1/2	3.5 J	3.5 J	X16SB080C	23	23	3.5	7.5	29000	NA	NA	100000	YES	NSL
ANTHRACENE	2/2	4.1 J	5.6 J	X16SB081C	NA	NA	5	5	29000	100	100	100000	NO	BSL
BENZO(A)ANTHRACENE	2/2	78	94	X16SB081C	NA	NA	86	86	18000	100	100	1100	NO	BSL
BENZO(A)PYRENE	2/2	91	100	X16SB081C	NA	NA	96	96	18000	100	100	1100	NO	BSL
BENZO(B)FLUORANTHENE	2/2	33	38	X16SB081C	NA	NA	36	36	18000	100	100	1100	NO	BSL
BENZO(G,H,I)PERYLENE	2/2	41	50	X16SB081C	NA	NA	46	46	18000	100	100	1100	NO	BSL
BENZO(K)FLUORANTHENE	2/2	5.8 J	7.7 J	X16SB081C	NA	NA	6.8	6.8	18000	100	100	1100	NO	BSL
CHRYSENE	2/2	97	130	X16SB081C	NA	NA	114	114	18000	100	100	1100	YES	ASL
DIBENZO(A,H)ANTHRACENE	2/2	12 J	18 J	X16SB081C	NA	NA	15	15	18000	100	100	1100	NO	BSL
FLUORANTHENE	2/2	9.8 J	13 J	X16SB081C	NA	NA	11	11	29000	100	100	100000	NO	BSL
INDENO(1,2,3-CD)PYRENE	2/2	9.1 J	10 J	X16SB081C	NA	NA	9.6	9.6	18000	100	100	1100	NO	BSL
PHENANTHRENE	2/2	21 J	24	X16SB081C	NA	NA	23	23	29000	100	100	100000	NO	BSL
PYRENE	2/2	92	110	X16SB081C	NA	NA	101	101	18000	100	100	1100	YES	ASL
XRF (mg/kg)														
LEAD	2/2	21	73.333	X16SB081C	NA	NA	47	47	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 J = Estimated concentration
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

TABLE C.3-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - COMPOSITE SOIL
RUM POINT SKEET RANGE (RPSR) - UXO 16
FIRING POINTS
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Semivolatile Organics								
2-METHYLNAPHTHALENE	1.2E-04	1.2E-05	1.5E-05	2.8E-06	8.0E-04	8.0E-05	1.4E-05	2.7E-06
ANTHRACENE	3.6E-05	3.6E-06	4.4E-06	8.1E-07	8.9E-04	8.9E-05	1.6E-05	2.9E-06
BENZO(A)ANTHRACENE	1.2E-04	1.2E-05	1.3E-03	2.1E-05	1.1E-02	1.1E-03	2.0E-02	3.2E-04
BENZO(A)PYRENE	1.1E-04	1.1E-05	1.1E-03	1.8E-05	9.8E-03	9.8E-04	1.9E-02	3.0E-04
BENZO(B)FLUORANTHENE	7.7E-05	7.7E-06	9.1E-04	1.5E-05	7.0E-03	7.0E-04	1.3E-02	2.1E-04
BENZO(G,H,I)PERYLENE	7.6E-05	7.6E-06	8.5E-04	1.4E-05	1.0E-02	1.0E-03	1.9E-02	3.1E-04
BENZO(K)FLUORANTHENE	1.2E-05	1.2E-06	1.3E-04	2.1E-06	1.3E-03	1.3E-04	2.5E-03	4.1E-05
CHRYSENE	1.5E-04	1.5E-05	1.6E-03	2.5E-05	2.0E-02	2.0E-03	3.8E-02	6.0E-04
DIBENZO(A,H)ANTHRACENE	1.7E-05	1.7E-06	1.7E-04	2.7E-06	2.6E-03	2.6E-04	5.0E-03	8.1E-05
FLUORANTHENE	3.7E-05	3.7E-06	4.3E-06	8.0E-07	2.6E-03	2.6E-04	4.7E-05	8.7E-06
INDENO(1,2,3-CD)PYRENE	9.5E-06	9.5E-07	9.2E-05	1.5E-06	2.1E-03	2.1E-04	4.0E-03	6.3E-05
PHENANTHRENE	4.8E-04	4.8E-05	6.0E-05	1.1E-05	3.0E-03	3.0E-04	5.3E-05	9.7E-06
PYRENE	4.6E-04	4.6E-05	5.9E-03	9.4E-05	1.4E-02	1.4E-03	2.6E-02	4.1E-04
Inorganics								
ANTIMONY	NA	NA	1.3E-02	2.7E-04	NA	NA	4.3E-01	9.1E-03
ARSENIC	1.8E-03	9.2E-04	8.4E-03	1.9E-03	5.5E-02	2.7E-02	5.4E-02	1.2E-02
COPPER	1.3E-02	1.6E-03	3.8E-02	2.6E-03	1.5E-01	1.8E-02	6.0E-02	4.1E-03
LEAD	2.5E-02	9.2E-04	2.2E-02	5.5E-04	1.3E+00	4.6E-02	2.3E-01	5.9E-03
ZINC	5.2E-03	2.0E-03	1.8E-02	4.6E-03	5.4E-01	2.1E-01	2.9E-01	7.2E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.3-3
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 RUM POINT SKEET RANGE (RPSR) - UXO 16
 SHOT FALL/TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level					COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals	Lowest Value		
Inorganics (mg/kg)															
ANTIMONY	12/20	0.2 L	1.6 J	X16SB090	0.03	0.73	0.67	0.44	78	5	NA	0.27	0.27	YES	ASL/NSL
ARSENIC	18/20	1.1	6.5	X16SB061	0.16	1.9	3.3	3.0	60	18	43	46	18	NO	BSL
COPPER	20/20	2.4 K	11.4 K	X16SB013	NA	NA	6.3	6.3	80	70	28	49	28	NO	BSL
LEAD	20/20	6.7	616	X16SB008	NA	NA	91	91	1700	120	11	56	11	YES	ASL
ZINC	20/20	9.5	34.9	X16SB013	NA	NA	23	23	120	160	46	79	46	NO	BSL
PAHs (ug/kg)															
1-METHYLNAPHTHALENE	6/21	2.4 J	16 L	X16SB076	22	28	6.2	10	29000	NA	NA	100000	29000	YES	NSL
2-METHYLNAPHTHALENE	7/21	6.4 L	68 L	X16SB076	22	28	23	15	29000	NA	NA	100000	29000	YES	NSL
ACENAPHTHENE	4/21	2.4 J	7.7 L	X16SB076	22	28	4.5	10	29000	20000	100	100000	100	NO	BSL
ACENAPHTHYLENE	1/21	24 L	24 L	X16SB031	22	28	24	12	29000	100	100	100000	100	NO	BSL
ANTHRACENE	15/21	1.6 L	110 L	X16SB076	22	26	28	23	29000	100	100	100000	100	YES	ASL
BAP EQUIVALENT-HALFND	21/21	20.3838	4111	X16SB076	22	22	610	610					NA		
BENZO(A)ANTHRACENE	20/21	2.6 J	2400	X16SB076	22	23	426	406	18000	100	100	1100	100	YES	ASL
BENZO(A)PYRENE	18/21	5.8 J	3200	X16SB076	22	26	548	472	18000	100	100	1100	100	YES	ASL
BENZO(B)FLUORANTHENE	18/21	3 J	1000	X16SB076	22	26	185	161	18000	100	100	1100	100	YES	ASL
BENZO(G,H,I)PERYLENE	18/21	3.4 J	1500	X16SB076	22	26	239	206	18000	100	100	1100	100	YES	ASL
BENZO(K)FLUORANTHENE	14/21	4.3 J	200 L	X16SB076	22	26	42	32	18000	100	100	1100	100	YES	ASL
CHRYSENE	21/21	3.3 J	3000	X16SB076	22	22	510	510	18000	100	100	1100	100	YES	ASL
DIBENZO(A,H)ANTHRACENE	15/21	6.1 L	540	X16SB076	22	26	101	75	18000	100	100	1100	100	YES	ASL
FLUORANTHENE	19/21	2.5 L	210 L	X16SB076	22	26	52	48	29000	100	100	100000	100	YES	ASL
FLUORENE	5/21	4.2 L	21 J	X16SB076	22	28	10	12	29000	100	100	100000	100	NO	BSL
INDENO(1,2,3-CD)PYRENE	20/21	2.5 J	260 L	X16SB076	22	26	52	50	18000	100	100	1100	100	YES	ASL
NAPHTHALENE	2/21	3.1 J	7.2 L	X16SB076	22	28	5.2	11	29000	100	100	100000	100	NO	BSL
PHENANTHRENE	16/21	3.2 L	620	X16SB076	22	26	126	99	29000	100	100	100000	100	YES	ASL
PYRENE	20/21	3.1 J	2000	X16SB076	22	23	369	352	18000	100	100	1100	100	YES	ASL
XRF (mg/kg)															
LEAD	92/92	11.667	975.333	X16SB008	NA	NA	75	75	1700	120	11	56	11	YES	ASL

Shaded values indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

J = Estimated concentration

K = Biased high concentration

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE C.3-4
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
RUM POINT SKEET RANGE (RPSR) - UXO 16
SHOT FALL/TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Semivolatile Organics								
1-METHYLNAPHTHALENE	2.0E-04	2.0E-05	2.5E-05	4.6E-06	2.4E-03	2.4E-04	4.3E-05	7.9E-06
2-METHYLNAPHTHALENE	2.4E-04	2.4E-05	3.0E-05	5.5E-06	3.5E-03	3.5E-04	6.4E-05	1.2E-05
ACENAPHTHENE	2.3E-03	2.3E-04	2.9E-04	5.3E-05	5.1E-04	5.1E-05	9.1E-06	1.7E-06
ACENAPHTHYLENE	6.2E-05	6.2E-06	7.5E-06	1.4E-06	2.1E-02	2.1E-03	3.9E-04	7.1E-05
ANTHRACENE	1.3E-04	1.3E-05	1.5E-05	2.8E-06	4.3E-03	4.3E-04	7.7E-05	1.4E-05
BENZO(A)ANTHRACENE	3.7E-04	3.7E-05	3.5E-03	5.6E-05	5.0E-02	5.0E-03	9.4E-02	1.5E-03
BENZO(A)PYRENE	5.2E-04	5.2E-05	5.3E-03	8.5E-05	4.9E-02	4.9E-03	9.1E-02	1.5E-03
BENZO(B)FLUORANTHENE	3.5E-04	3.5E-05	4.1E-03	6.6E-05	3.2E-02	3.2E-03	6.1E-02	9.7E-04
BENZO(G,H,I)PERYLENE	4.3E-04	4.3E-05	5.0E-03	8.0E-05	4.6E-02	4.6E-03	8.8E-02	1.4E-03
BENZO(K)FLUORANTHENE	4.6E-05	4.6E-06	5.1E-04	8.1E-06	6.3E-03	6.3E-04	1.2E-02	1.9E-04
CHRYSENE	4.4E-04	4.4E-05	4.0E-03	6.4E-05	8.9E-02	8.9E-03	1.7E-01	2.7E-03
DIBENZO(A,H)ANTHRACENE	8.4E-05	8.4E-06	8.5E-04	1.4E-05	1.3E-02	1.3E-03	2.5E-02	4.0E-04
FLUORANTHENE	1.6E-04	1.6E-05	1.8E-05	3.4E-06	1.1E-02	1.1E-03	2.0E-04	3.7E-05
FLUORENE	1.0E-03	1.0E-04	1.3E-04	2.4E-05	8.2E-03	8.2E-04	1.5E-04	2.8E-05
INDENO(1,2,3-CD)PYRENE	5.0E-05	5.0E-06	4.8E-04	7.7E-06	1.1E-02	1.1E-03	2.1E-02	3.3E-04
NAPHTHALENE	3.7E-04	3.7E-05	4.7E-05	8.6E-06	1.7E-03	1.7E-04	3.1E-05	5.7E-06
PHENANTHRENE	1.2E-03	1.2E-04	1.5E-04	2.8E-05	1.3E-02	1.3E-03	2.3E-04	4.3E-05
PYRENE	1.6E-03	1.6E-04	2.0E-02	3.3E-04	4.7E-02	4.7E-03	9.0E-02	1.4E-03
Inorganics								
ANTIMONY	NA	NA	1.9E-02	4.1E-04	NA	NA	6.7E-01	1.4E-02
ARSENIC	1.5E-03	7.6E-04	7.0E-03	1.6E-03	4.7E-02	2.3E-02	4.7E-02	1.1E-02
COPPER	1.3E-02	1.5E-03	3.6E-02	2.4E-03	1.3E-01	1.5E-02	5.2E-02	3.5E-03
LEAD	6.3E-02	2.3E-03	4.6E-02	1.2E-03	3.3E+00	1.2E-01	6.0E-01	1.5E-02
ZINC	5.1E-03	2.0E-03	1.8E-02	4.5E-03	5.4E-01	2.1E-01	2.8E-01	7.2E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.4-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - COMPOSITE SOIL
SMALL ARMS (PISTOL) RANGE (SAPR) - UXO 17
FIRING LINE AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	3.1E-02	6.5E-04	NA	NA	1.1E+00	2.3E-02
ARSENIC	2.7E-03	1.3E-03	1.2E-02	2.8E-03	7.3E-02	3.6E-02	7.0E-02	1.6E-02
COPPER	1.9E-02	2.3E-03	5.2E-02	3.5E-03	3.3E-01	3.9E-02	1.3E-01	8.9E-03
LEAD	6.1E-02	2.2E-03	4.4E-02	1.1E-03	3.2E+00	1.2E-01	5.7E-01	1.4E-02
ZINC	5.4E-03	2.1E-03	1.9E-02	4.8E-03	5.6E-01	2.2E-01	2.9E-01	7.4E-02
Explosives								
NITROGLYCERIN	NA	NA	2.4E-01	2.2E-02	NA	NA	4.3E-01	4.0E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.4-3
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 SMALL ARMS (PISTOL) RANGE (SAPR) - UXO 17
 TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	8/12	0.15 L	6 L	X17SB014	0.13	3.3	1.6	1.2	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	12/12	3.5	8.7	X17SB014	NA	NA	5.4	5.4	60	18	43	46	NO	BSL
COPPER	12/12	5.6 K	42 K	X17SB005	NA	NA	17	17	80	70	28	49	YES	ASL
LEAD	10/12	7.2	706	X17SB014	7	12.2	314	263	1700	120	11	56	YES	ASL
ZINC	12/12	10	33.2	X17SB004	NA	NA	19	19	120	160	46	79	NO	BSL
XRF (mg/kg)														
LEAD	25/26	3.667	3247	X17SB013	0	0	439	422	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern Rationale Codes for COPC Selection:
 NA = Not available or not applicable ASL = Above COPC Screening Level
 K = Biased high concentration BSL = Below COPC Screening Level
 L = Biased low concentration NSL = No Screening Level Available

TABLE C.4-4
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
SMALL ARMS (PISTOL) RANGE (SAPR) - UXO 17
TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	5.2E-02	1.1E-03	NA	NA	1.9E+00	4.1E-02
ARSENIC	2.8E-03	1.4E-03	1.3E-02	2.9E-03	7.5E-02	3.7E-02	7.2E-02	1.6E-02
COPPER	2.0E-02	2.4E-03	5.4E-02	3.6E-03	3.6E-01	4.2E-02	1.4E-01	9.7E-03
LEAD	1.6E-01	5.8E-03	9.5E-02	2.4E-03	8.1E+00	2.9E-01	1.4E+00	3.6E-02
ZINC	4.6E-03	1.8E-03	1.6E-02	4.1E-03	5.1E-01	1.9E-01	2.7E-01	6.7E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.5-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - COMPOSITE SOIL
 ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
 FIRING LINE AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	1/1	0.1 L	0.1 L	X25SB034C	NA	NA	0.1	0.1	78	5	NA	0.27	YES	NSL
ARSENIC	1/2	4.3	4.3	X25SB034C	NA	NA	4.3	4.3	60	18	43	46	NO	BSL
COPPER	1/3	8.5	8.5	X25SB034C	NA	NA	8.5	8.5	80	70	28	49	NO	BSL
LEAD	1/4	9.4	9.4	X25SB034C	NA	NA	9.4	9.4	1700	120	11	56	NO	BSL
TIN	1/5	1.6 B	1.6 B	X25SB034C	NA	NA	1.6	1.6	NA	50	NA	7.62	YES	NSL
ZINC	1/6	30.2	30.2	X25SB034C	NA	NA	30	30	120	160	46	79	NO	BSL

Shaded cells indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

B = Result may be due to blank contamination

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE C.5-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - COMPOSITE SOIL
ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
FIRING LINE AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	4.7E-03	1.0E-04	NA	NA	1.5E-01	3.3E-03
ARSENIC	2.2E-03	1.1E-03	1.0E-02	2.3E-03	6.3E-02	3.1E-02	6.1E-02	1.4E-02
COPPER	1.5E-02	1.7E-03	4.0E-02	2.7E-03	1.8E-01	2.1E-02	7.1E-02	4.8E-03
LEAD	1.1E-02	3.9E-04	1.1E-02	2.7E-04	5.0E-01	1.8E-02	9.4E-02	2.4E-03
TIN	2.9E-03	1.2E-03	3.4E-03	2.3E-03	3.7E-02	1.5E-02	6.1E-03	4.1E-03
ZINC	6.0E-03	2.3E-03	2.1E-02	5.3E-03	5.9E-01	2.3E-01	3.1E-01	7.8E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE C.5-3
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
 TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	16/20	0.19 L	12.2 L	X25SB020	0.02	0.16	1.6	1.3	78	5	NA	0.27	YES	ASL/NSL
ARSENIC	17/20	2.3 J	22.6	X25SB016	1.9	2.4	5.0	4.4	60	18	43	46	YES	ASL
COPPER	20/20	7.4	370	X25SB020	NA	NA	41	41	80	70	28	49	YES	ASL
LEAD	20/20	6.3	3450	X25SB020	NA	NA	349	349	1700	120	11	56	YES	ASL
ZINC	20/20	22	63.9	X25SB020	NA	NA	34	34	120	160	46	79	YES	ASL
XRF (mg/kg)														
LEAD	32/33	8.333	3877	X25SB020	0	0	359	348	1700	120	11	56	YES	ASL
LEAD-CALC	33/33	1.49	2754.83	X25SB020	NA	NA	227	227	1700	120	11	56	YES	ASL

Shaded cells indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern Rationale Codes for COPC Selection:
 NA = Not available or not applicable ASL = Above COPC Screening Level
 J = Estimated concentration BSL = Below COPC Screening Level
 L = Biased low concentration NSL = No Screening Level Available

TABLE C.5-4
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NA	NA	5.4E-02	1.1E-03	NA	NA	1.9E+00	4.2E-02
ARSENIC	2.3E-03	1.1E-03	1.0E-02	2.3E-03	6.4E-02	3.2E-02	6.2E-02	1.4E-02
COPPER	3.1E-02	3.7E-03	7.8E-02	5.3E-03	8.7E-01	1.0E-01	3.4E-01	2.3E-02
LEAD	2.0E-01	7.4E-03	1.2E-01	2.9E-03	1.0E+01	3.7E-01	1.8E+00	4.5E-02
ZINC	6.4E-03	2.5E-03	2.2E-02	5.6E-03	6.1E-01	2.4E-01	3.2E-01	8.1E-02

NA = Not applicable because no NOAEL/LOAEL exists for this receptor.

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

APPENDIX D

SOIL QUANTITY CALCULATIONS

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12
<p>Purpose</p> <p>The purpose of this calculation is to provide an estimate of the removal volume of lead-, PAH-, and nitroglycerin-contaminated soils at the five former small arms/skeet ranges located at the Stump Neck Annex portion of Naval Support Facility Indian Head. The results of this calculation provide the basis for the cost estimate for Alternative 2.</p> <p>Assumptions</p> <ol style="list-style-type: none"> 1. Use the data presented in the Site Inspection Report (Tetra Tech, 2010) to determine the lateral and vertical extent of contamination (and subsequently, the excavation boundaries and volumes) at the five former small arms/skeet ranges. 2. Figure 2-1 shows the initial limits of excavation at UXO 14 - Marine Rifle Range. Figure 2-2 shows the initial limits of excavation at UXO15 - Old Skeet and Trap Range. Figure 2-3 shows the initial limits of excavation at UXO16 - Rum Point Skeet Range. Figure 2-4 shows the initial limits of excavation at UXO 17 - Small Arms (Pistol) Range. Figure 2-5 shows the initial limits of excavation at UXO 25 - Roach Road Rifle Range. Excavation limits may be expanded, as necessary to meet cleanup goals, based on the confirmation sampling results. 3. Clearing will be performed only within the excavation areas shown on Figures 2-1 to 2-5. However, woody vegetation that is 4 inches in diameter or greater (at 4.5 feet above the ground surface) will not be removed from UXO 14 or UXO 25 because of the need to preserve habitat and maintain the structural stability of the sloped areas. Grubbing will be performed incidental to excavation of contaminated soil from the indicated areas. Grubbed materials from the excavation areas will be disposed at an off-site solid or hazardous waste disposal facility, dependent on waste disposal characterization results. 4. Temporary access roads will be constructed to provide access to the excavation areas at UXO 14 and UXO 25. 5. Based on Phase 2 SI groundwater investigation results, groundwater is not expected to be encountered at the planned excavation depths within the areas marked for removal. 6. Assume all PAH-contaminated soils and nitroglycerin-contaminated soils will be classified as nonhazardous waste. Contaminated soils will be shipped off-site for disposal as nonhazardous waste. 7. Assume 80% of lead-contaminated soils will not meet the toxicity characteristic leaching procedure (TCLP) criterion for lead characteristic and, thus, will be classified as hazardous waste. All hazardous lead-contaminated soils will be shipped off-site for disposal as hazardous waste. 8. Confirmation sampling for lead-contaminated soil includes in situ field screening and off-site 			

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12

laboratory testing. Lead analysis in the field of confirmatory samples will be conducted using field-portable X-ray fluorescence (XRF) instrumentation (i.e., XRF Environmental Metals Analyzer). The excavation and field screening process will be repeated until cleanup goals have been achieved at all excavation boundaries. Upon demonstrating attainment of cleanup goals through field screening, analytical samples will be collected and shipped to a fixed-based laboratory for final confirmation.

- Verification sampling will be conducted at PAH- and nitroglycerin-contaminated soil removal areas.
- Soil density is assumed to be 110 pounds per cubic foot (lbs/ft³).
- Excavations will be backfilled using clean fill obtained from outside the installation.

Volume Estimates

Lead-Contaminated Soil Removal

UXO 14 - Marine Rifle Range

Soil will be excavated to a depth of ~1-2 feet bgs from the Hillside Impact Area in the areas of bullet accumulations.

- Excavation area: 54,518 ft².
- Volume of lead-contaminated soil = 1.5 ft x 54,518 ft² = 81,777 ft³ = 3,029 cubic yards (yd³).

Trees 4 inches in diameter or larger will not be disturbed. Hence, the excavation will be limited to approximately 60% of the overall excavation area based on the observed density of trees at this site. The total amount of soil to be removed is estimated at 49,066 ft³ = 1,817 yd³.

UXO15 - Old Skeet And Trap Range

Soil will be excavated to a depth of 1 foot bgs within three separate areas that contain sample locations X15SB064, X15SB013, and X15SB074, respectively.

- Excavation area:
 - X15SB064 Area: 8,753 ft²;
 - X15SB013 Area: 2,146 ft²;
 - X15SB074 Area: 3,301 ft².

Volume of lead-contaminated soil = 1 ft x 14,200 ft² = 14,200 ft³ = 526 yd³

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12

UXO 17 - Small Arms (Pistol) Range

Soil will be excavated to a depth of 1 foot bgs within two separate areas that contain sample locations X17SB013 and X17SB014, respectively, and to a depth of 4 feet bgs within one area that contains sample locations X17SB004 and X17SB0005.

- Excavation area:
 - X17SB013 Area: 1,043 ft²;
 - X17SB014 Area: 365 ft²;
 - X17SB004 and X17SB0005 Area: 852 ft².
- Volume of lead-contaminated soil = 1 ft x 1,408 ft² + 4 ft x 852 ft² = 4,816 ft³ = 178 yd³

UXO 25 - Roach Road Rifle Range

Soil will be excavated to a depth of ~1-2 feet bgs within one area that contains sample locations X25SB019 and X25SB020.

- Excavation area:
 - X25SB019 and X25SB020 Area: 985 ft².
- Volume of lead-contaminated soil = 1.5 ft x 985 ft² = 1478 ft³ = 55 yd³

Trees 4 inches in diameter or more will not be disturbed. Hence, the excavation will be limited to approximately 80% of the overall excavation area based on the observed density of trees at this site. The total amount of soil to be removed is estimated at 1,182 ft³ = 44 yd³.

Total Quantities for All Sites

Total in-place volume of lead-contaminated soil designated for off-site disposal = 69,264 ft³ = 2,565 yd³

Using an expansion factor of 20% for in-place to loose ("fluff") soil, the total loose volume of lead-contaminated soil designated for off-site disposal = 2,565 x 1.20 = 3,078 yd³.

Using a soil density of 110 lbs/ft³, the weight of lead-contaminated soil designated for off-site disposal = 69,264 ft³ x 110 lbs/ft³ / 2,000 pounds per ton = 3,810 tons.

In the absence of site-specific data, it is assumed that 80% of lead-contaminated soils will not meet the TCLP criterion for lead characteristic and will be classified as hazardous waste.

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12

The weight of hazardous lead-contaminated soils = 3810 tons x 80% = 3,048 tons.

These hazardous lead-contaminated soils will be containerized for transportation and disposal at a RCRA Subtitle C (i.e., hazardous waste) facility.

Approximately 762 tons of lead-contaminated soil will be shipped off-site for disposal as non-hazardous waste.

PAH-Contaminated Soil Removal

UXO15 - Old Skeet And Trap Range

Soil will be excavated to a depth of 2 feet bgs within one area that contains sample locations X15SB038 and X15SB053.

- Excavation area:
X15SB038 and X15SB053 Area: 34,433 ft².
- Volume of PAH-contaminated soil = 2 ft x 34,433 ft² = 68,866 ft³ = 2,551 yd³.

UXO16 - Rum Point Skeet Range

Soil will be excavated to a depth of ~1-2 feet bgs within one area that contains sample locations X16SB056 and X16SB076.

- Excavation area:
X16SB056 and X16SB076 Area: 59,215 ft²;
- Volume of PAH-contaminated soil = 1.5 ft x 59,215 ft² = 88,823 ft³ = 3,290 yd³.

Total Quantities for All Sites

Total in-place volume of PAH-contaminated soil designated for off-site disposal = 157,689 ft³ = 5,840 yd³

Using an expansion factor of 20% for in-place to loose ("fluff") soil, the total loose volume of PAH-contaminated soil designated for off-site disposal = 5,840 x 1.20 = 7,008 yd³.

Using a soil density of 110 lbs/ft³, the weight of PAH-contaminated soil designated for off-site disposal =

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12

157,689 ft³ x 110 lbs/ft³ / 2,000 pounds per ton = 8,673 tons.

Nitroglycerin-Contaminated Soil Removal

Soil will be excavated to a depth of 1 foot bgs within one area that contains sample locations X17SB008 and X17SB009.

- Excavation area:
X17SB008 and X17SB009 Area: 10,880 ft².
- Volume of lead-contaminated soil = 1 ft x 10,880 ft² = 10,880 ft³ = 403 yd³.

Using an expansion factor of 20% for in-place to loose (“fluff”) soil, the total loose volume of nitroglycerin-contaminated soil designated for off-site disposal = 403 x 1.20 = 484 yd³.

Using a soil density of 110 lbs/ft³, the weight of nitroglycerin-contaminated soil designated for off-site disposal = 10,880 ft³ x 110 lbs/ft³ / 2,000 pounds per ton = 598 tons.

Estimated Construction Duration

- UXO 14 - Marine Rifle Range: 1.5 Months
- UXO 15 - Old Skeet And Trap Range: 1.5 Months
- UXO 16 - Rum Point Skeet Range: 1 Month
- UXO 17 - Small Arms (Pistol) Range: 3 Weeks
- UXO 25 - Roach Road Rifle Range: 1 Week

Summary

- Total 3,048 tons of hazardous lead-contaminated soil will be excavated and containerized for transportation and disposal at a RCRA Subtitle C (hazardous waste) facility.
- Total 762 tons of lead-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
- Total 8,673 tons of PAH-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
- Total 598 tons of nitroglycerin-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
- Total in-place volume of contaminated soils designated for off-site disposal will be 8,809 yd³. Using an expansion factor of 20%, this is 10,571 yd³ of loose soil.

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 2 – Excavation and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By: B. Becker	Date: 3/16/12
<p>6. Total area to be backfilled = $154,487 \text{ ft}^2 = \underline{17,165 \text{ yd}^2}$. To ensure a proper vegetative base, the total volume of topsoil needed = $77,244 \text{ ft}^3 = \underline{2,861 \text{ yd}^3}$. The weight of topsoil = $77,244 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2,000 \text{ pounds per ton} = \underline{4,248 \text{ tons}}$.</p> <p>7. To restore each excavation area to its original elevation, the total volume of clean backfill needed = $8,809 \text{ yd}^3 - 2,861 \text{ yd}^3 = \underline{5,948 \text{ yd}^3}$. The weight of clean backfill = $5,948 \text{ yd}^3 \times 27 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2,000 \text{ pounds per ton} = \underline{8,833 \text{ tons}}$.</p> <p>8. The removal action (Alternative 2) will require approximately 5 months to complete at all five SASRs.</p>			

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 3–Treatment, Excavation, and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By : B. Becker	Date: 3/6/12
<p>Purpose</p> <p>The purpose of this calculation is to provide an estimate of the removal volume of lead-, PAH-, and nitroglycerin-contaminated soils at the five former small arms/skeet ranges located at the Stump Neck Annex portion of Naval Support Facility Indian Head. The results of this calculation provide the basis for the cost estimate for Alternative 3.</p> <p>Assumptions</p> <ol style="list-style-type: none"> 1. Use the data presented in the Site Inspection Report (Tetra Tech, 2010) to determine the lateral and vertical extent of contamination (and subsequently, the excavation boundaries and volumes) at the five former small arms/skeet ranges. 2. Figure 2-1 shows the initial limits of excavation at UXO 14 - Marine Rifle Range. Figure 2-2 shows the initial limits of excavation at UXO15 - Old Skeet and Trap Range. Figure 2-3 shows the initial limits of excavation at UXO16 - Rum Point Skeet Range. Figure 2-4 shows the initial limits of excavation at UXO 17 - Small Arms (Pistol) Range. Figure 2-5 shows the initial limits of excavation at UXO 25 - Roach Road Rifle Range. Excavation limits may be expanded, as necessary to meet cleanup goals, based on the confirmation sampling results. 3. Clearing will be performed only within the excavation areas shown on Figures 2-1 to 2-5. However, woody vegetation that is 4 inches in diameter or greater (at 4.5 feet above the ground surface) will not be removed from UXO 14 or UXO 25 because of the need to preserve habitat and maintain the structural stability of the sloped areas. Grubbing will be performed incidental to excavation of contaminated soil from the indicated areas. Grubbed materials from the excavation areas will be disposed at an off-site solid or hazardous waste disposal facility, dependent on waste disposal characterization results. 4. Temporary access roads will be constructed to provide access to the excavation areas at UXO 14 and UXO 25. 5. Based on Phase 2 SI groundwater investigation results, groundwater is not expected to be encountered at the planned excavation depths within the areas marked for removal. 6. Assume all PAH-contaminated soils and nitroglycerin-contaminated soils will be classified as nonhazardous waste. Contaminated soils will be shipped off-site for disposal as nonhazardous waste. 7. Assume 80% of lead-contaminated soils will not meet the toxicity characteristic leaching procedure (TCLP) criterion for lead characteristic and, thus, will be classified as hazardous waste. In-situ chemical treatment of lead-contaminated soils will be conducted prior to removal. Treated soils will be sampled to verify that they meet TCLP criterion for land disposal and, if so, will be 			

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 3—Treatment, Excavation, and Off-Site Disposal			
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shipped off-site for disposal as nonhazardous waste.

8. Confirmation sampling for lead-contaminated soil includes in situ field screening and off-site laboratory testing. Lead analysis in the field of confirmatory samples will be conducted using field-portable X-ray fluorescence (XRF) instrumentation (i.e., XRF Environmental Metals Analyzer). The excavation and field screening process will be repeated until cleanup goals have been achieved at all excavation boundaries. Upon demonstrating attainment of cleanup goals through field screening, analytical samples will be collected and shipped to a fixed-based laboratory for final confirmation.
9. Verification sampling will be conducted at PAH- and nitroglycerin-contaminated soil removal areas.
10. Soil density is assumed to be 110 pounds per cubic foot (lbs/ft³).
11. Excavations will be backfilled using clean fill obtained from outside the installation.

Volume Estimates

The lateral and vertical extents of soil removal for Alternative 3 are the same as that of Alternative 2.

Lead-Contaminated Soil Removal

UXO 14 - Marine Rifle Range

Soil will be excavated to a depth of ~1-2 feet bgs from the Hillside Impact Area in the areas of bullet accumulations. Trees 4 inches in diameter or more will not be disturbed. Hence, the excavation will be limited to approximately 60% of the overall excavation area based on the observed density of trees at this site. The total amount of soil to be removed is estimated at 49,066 ft³ = 1,817 yd³.

UXO15 - Old Skeet And Trap Range

Soil will be excavated to a depth of 1 foot bgs within three separate areas that contain sample locations X15SB064, X15SB013, and X15SB074, respectively.

Volume of lead-contaminated soil = 1 ft x 14,200 ft² = 14,200 ft³ = 526 yd³

UXO 17 - Small Arms (Pistol) Range

Soil will be excavated to a depth of 1 foot bgs within two separate areas that contain sample locations X17SB013 and X17SB014, respectively, and to a depth of 4 feet bgs within one area that contains

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 3–Treatment, Excavation, and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By : B. Becker	Date: 3/6/12

sample locations X17SB004 and X17SB0005.

Volume of lead-contaminated soil = $1 \text{ ft} \times 1,408 \text{ ft}^2 + 4 \text{ ft} \times 852 \text{ ft}^2 = 4,816 \text{ ft}^3 = 178 \text{ yd}^3$

UXO 25 - Roach Road Rifle Range

Soil will be excavated to a depth of ~1-2 feet bgs within one area that contains sample locations X25SB019 and X25SB020.

Volume of lead-contaminated soil = $1.5 \text{ ft} \times 985 \text{ ft}^2 = 1,478 \text{ ft}^3 = 55 \text{ yd}^3$

Trees 4 inches in diameter or larger will not be disturbed. Hence, the excavation will be limited to approximately 80% of the overall excavation area based on the observed density of trees at this site. The total amount of soil to be removed is estimated at $1,182 \text{ ft}^3 = 44 \text{ yd}^3$.

Total Quantities for All Sites

Total in-place volume of lead-contaminated soil designated for off-site disposal = $69,264 \text{ ft}^3 = \underline{2,565 \text{ yd}^3}$.

Using an expansion factor of 20% for in-place to loose (“fluff”) soil, the total loose volume of lead-contaminated soil designated for off-site disposal = $2,565 \times 1.20 = \underline{3,078 \text{ yd}^3}$.

Using a soil density of 110 lbs/ft^3 , the weight of lead-contaminated soil designated for off-site disposal = $69,264 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2,000 \text{ pounds per ton} = \underline{3,810 \text{ tons}}$.

In the absence of site-specific data, it is assumed that 80% of lead-contaminated soils will not meet the TCLP criterion for lead characteristic and will be classified as hazardous waste. These lead-contaminated soils will be subject to in-situ chemical stabilization prior to removal.

The weight of hazardous lead-contaminated soil requiring chemical treatment is estimated to be $3,810 \text{ tons} \times 80\% = \underline{3,048 \text{ tons}}$.

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 3–Treatment, Excavation, and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By : B. Becker	Date: 3/6/12

PAH-Contaminated Soil Removal

UXO15 - Old Skeet And Trap Range

Soil will be excavated to a depth of 2 feet bgs within one area that contains sample locations X15SB038 and X15SB053.

Volume of PAH-contaminated soil = 2 ft x 34,433 ft² = 68,866 ft³ = 2,551 yd³.

UXO16 - Rum Point Skeet Range

Soil will be excavated to a depth of ~1-2 feet bgs within one area that contains sample locations X16SB056 and X16SB076.

Volume of PAH-contaminated soil = 1.5 ft x 53,616 ft² = 80,424 ft³ = 2,979 yd³.

Total Quantities for All Sites

Total in-place volume of PAH-contaminated soil designated for off-site disposal = 157,689 ft³ = 5,840 yd³

Using an expansion factor of 20% for in-place to loose (“fluff”) soil, the total loose volume of PAH-contaminated soil designated for off-site disposal = 5,840 x 1.20 = 7,008 yd³.

Using a soil density of 110 lbs/ft³, the weight of PAH-contaminated soil designated for off-site disposal = 157,689 ft³ x 110 lbs/ft³ / 2,000 pounds per ton = 8,673 tons.

Nitroglycerin-Contaminated Soil Removal

UXO 17 - Small Arms (Pistol) Range

Soil will be excavated to a depth of 1 foot bgs within one area that contains sample locations X17SB008 and X17SB009.

Volume of lead-contaminated soil = 1 ft x 10,880 ft² = 10,880 ft³ = 403 yd³.

Client: NSF Indian Head Stump Neck Annex		Project Number: N62467-04-D-0055, CTO 423	
Subject: Five Small Arms/Skeet Ranges Alternative 3—Treatment, Excavation, and Off-Site Disposal			
By: X. Chen	Checked By: S. Nesbit	Approved By : B. Becker	Date: 3/6/12

Using an expansion factor of 20% for in-place to loose (“fluff”) soil, the total loose volume of nitroglycerin-contaminated soil designated for off-site disposal = $403 \times 1.20 = 484 \text{ yd}^3$.

Using a soil density of 110 lbs/ft^3 , the weight of nitroglycerin-contaminated soil designated for off-site disposal = $10,880 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2000 \text{ pounds per ton} = \underline{598 \text{ tons}}$.

Estimated Construction Duration

1. UXO 14 - Marine Rifle Range: 1.5 Months
2. UXO 15 - Old Skeet And Trap Range: 1.5 Months
3. UXO 16 - Rum Point Skeet Range: 1 Month
4. UXO 17 - Small Arms (Pistol) Range: 3 Weeks
5. UXO 25 - Roach Road Rifle Range: 1 Week

Summary

1. Total 3,048 tons of hazardous lead-contaminated soil requires in-situ chemical stabilization prior to removal. Treated soil will be excavated and shipped off-site for disposal as non-hazardous waste.
2. Total 3,810 tons of lead-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
3. Total 8,673 tons of PAH-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
4. Total 598 tons of nitroglycerin-contaminated soil will be shipped off-site for disposal as non-hazardous waste.
5. Total in-place volume of contaminated soils designated for off-site disposal will be 8,809 yd³. Using an expansion factor of 20%, this is 10,571 yd³ of loose soil.
6. Total area to be backfilled = $154,487 \text{ ft}^2 = \underline{17,165 \text{ yd}^2}$. To ensure a proper vegetative base, the total volume of topsoil needed = $77,244 \text{ ft}^3 = \underline{2,861 \text{ yd}^3}$. The weight of topsoil = $77,244 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2,000 \text{ pounds per ton} = \underline{4,248 \text{ tons}}$.
7. To restore each excavation area to its original elevation, the total volume of clean backfill needed = $8,809 \text{ yd}^3 - 2,861 \text{ yd}^3 = \underline{5,948 \text{ yd}^3}$. The weight of clean backfill = $5,948 \text{ yd}^3 \times 27 \text{ ft}^3 \times 110 \text{ lbs/ft}^3 / 2,000 \text{ pounds per ton} = \underline{8,833 \text{ tons}}$.
8. The removal action (Alternative 3) will require approximately 5 months to complete at the five former SASRs.

APPENDIX E

POST-REMOVAL ACTION ECOLOGICAL RISK EVALUATION

Post-Removal Action Ecological Risk Screening Evaluation

The ecological risk assessment (ERA) screening conducted as part of the Site Inspection (SI) was updated to reflect the expected site conditions following the completion of the removal action at the five Small Arms/Skeet Ranges (SASRs). The data used in this evaluation consisted of: SI data (Tetra Tech, 2010) to represent soil located outside the planned removal action boundaries, and installation-wide background concentrations presented in the Background Soil Investigation Report (Tetra Tech, 2002) to represent clean backfill emplaced following the removal of contaminated soil from within the planned excavation boundaries.

This evaluation provided conservative estimates of potential risk posed to ecological receptors based on direct contact and food chain exposures to concentrations of contaminants in soil at the five SASRs. The evaluation included a comparison of average and maximum measured concentrations to screening level and threshold toxicity values, as well as the calculation of ecological effects quotients (EEQs) for contaminants with concentrations that exceeded those values. For chemicals retained as COPCs based on maximum exposure assumptions, the model input parameters were refined to reflect more realistic assumptions that focused the evaluation only on chemicals posing the greatest risk. Tables documenting the post-removal action ERA screening for each of the five SASRs are included in this appendix.

Results of the post-removal action ERA screening were used to identify COPCs for each site and determine whether further information was necessary to fully evaluate ecological risk to site receptors. For soil contaminants, the assessment endpoints (i.e., site receptors) included terrestrial plants and invertebrates, as well as wildlife (e.g., mammals and birds). The conclusions of the updated ERA screening at each site are discussed below for each of these receptor groups.

UXO 14

For UXO 14, only soil at the Hillside Impact Area will be affected by the planned removal action. Thus, the ERA screening evaluations conducted for the Firing Line Area and Target Berms during the SI also apply to post-removal action conditions at those subareas. The discussion below relates to surface soil at the Hillside Impact Area, only.

During the SI, copper was retained as a COPC for risks to plants, invertebrates, and wildlife; lead was retained as a COPC for risks to plants and wildlife; and tin was retained as a COPC for risk to plants. For the post-removal action evaluation, risks to plants, invertebrates, and wildlife from residual and background concentrations of copper, lead, and tin were re-evaluated assuming that contaminated soil was removed from all locations within the planned excavation boundaries and replaced with soil

containing background levels of these constituents. Results of the post-removal action ERA screening evaluation for UXO 14 are shown on Tables E.1-1 and E.1-2.

The maximum concentration of copper (63.4 mg/kg) was less than the screening values for protection of plants and invertebrates; therefore, copper was eliminated as a COPC for risks to plants and invertebrates. The maximum concentration of tin (7.1 mg/kg) was less than screening value for plants; therefore, tin was eliminated as a COPC for risks to plants. The maximum concentration of lead (293 mg/kg) was greater than the screening value for plants indicating potential risks to plants. However, the average lead concentration (94.7 mg/kg) was less than the screening value. Lead concentrations in three samples in a forested area and one sample along Roach Road exceeded the screening value for plants. Any potential impacts to plants due to lead exposure would be limited to a small area.

Based on food chain modeling using average chemical concentrations in surface soil, the EEQs for terrestrial receptors were all less than 1.0 for copper; therefore, copper was eliminated as a COPC for wildlife. Based on food chain modeling using average chemical concentrations in surface soil, the EEQ based on the no-observed-adverse-effects level (NOAEL) for lead was less than 1.0 for terrestrial mammals, but was slightly greater than 1.0 for terrestrial birds (3.4). However, the food chain model assumes that the receptors obtain their entire diet from the site or subarea being evaluated, and it is unlikely that wildlife receptors would obtain their entire diet from the Hillside Impact Area. Also, the EEQ based on the lowest-observed-adverse-effects level (LOAEL) for terrestrial birds was less than 1.0. Therefore, impacts to birds from lead are not expected.

UXO 15

During the SI, antimony was retained as a COPC for risks to wildlife in surface soil; lead was retained as a COPC for risks to plants and wildlife in surface soil; and PAHs were retained as COPCs for risks to invertebrates and wildlife in surface soil. For the post-removal action evaluation, risks to plants, invertebrates, and wildlife from concentrations of antimony and lead in surface soil were re-evaluated assuming that contaminated soil was removed from all locations within the planned excavation boundaries and replaced with soil containing background levels of these constituents. Post-removal action risks did not need to be evaluated for PAHs because all sampling locations that exceeded the ecological screening levels lie within the planned excavation boundaries. Results of the post-removal action ERA screening evaluation for UXO 15 are shown on Tables E.2-1 and E.2-2.

The maximum concentration of lead (252 mg/kg) was greater than the screening value for plants, indicating potential risks to plants. However, the average lead concentration (84.9 mg/kg) was less than

the screening value. Lead concentrations in two samples exceeded the screening value for plants. Any potential impacts to plants from lead would be limited to a small area.

Based on food chain modeling using average chemical concentrations in surface soil, the EEQs for terrestrial receptors were less than 1.0 for antimony; therefore, antimony was eliminated as a COPC for wildlife. Based on food chain modeling using average chemical concentrations in surface soil, the EEQ based on the NOAEL for lead was less than 1.0 for terrestrial mammals, but slightly greater than 1.0 for terrestrial birds (3.1). However, the food chain model assumes that the receptors obtain their entire diet from the site or subarea being evaluated, and it is unlikely that wildlife receptors would obtain their entire diet from this site. Also, the EEQ based on the LOAEL for terrestrial birds was less than 1.0. Therefore, impacts to birds from lead are not expected.

UXO 16

During the SI, lead was retained as a COPC for risks to plants and wildlife in surface soil. For the post-removal action evaluation, risks to plants and wildlife from lead concentrations in surface soil were re-evaluated assuming that contaminated soil was removed from all locations within the planned excavation boundaries and replaced with soil containing background levels of these constituents. Results of the post-removal action ERA screening evaluation for UXO 16 are shown on Tables E.3-1 and E.3-2.

The maximum concentration of lead (616 mg/kg) was greater than the screening value for plants, indicating potential risks to plants. However, the average lead concentration (93.2 mg/kg) was below the screening value. Lead concentrations in five samples exceeded the screening value for plants, and nearby samples were less than screening values. Any potential impacts to plants from lead would be limited to a small area.

Based on food chain modeling using average chemical concentrations in surface soil, the EEQ based on the NOAEL for lead was less than 1.0 for terrestrial mammals, but slightly greater than 1.0 for terrestrial birds (3.4). However, the food chain model assumes that the receptors obtain their entire diet from the site or subarea being evaluated, and it is unlikely that wildlife receptors would obtain their entire diet from this site. Also, the EEQ based on the LOAEL for terrestrial birds was less than 1.0. Therefore, impacts to birds from lead are not expected.

UXO 17

During the SI, antimony was retained as a COPC for risks to wildlife in surface soil; nitroglycerin was retained as a COPC for risks to terrestrial invertebrates and plants because it was detected and no

screening levels were available; and lead was retained as a COPC for risks to plants and wildlife in surface soil. For the post-removal action evaluation, risks to plants and wildlife from concentrations of antimony and lead in surface soil were re-evaluated assuming that contaminated soil was removed from all locations within the planned excavation boundaries and replaced with soil containing background levels of these constituents. Post-removal action risks did not need to be evaluated for nitroglycerin because all sampling locations where this contaminant was detected lie within the planned excavation boundaries. Results of the post-removal action ERA screening evaluation for UXO 17 are shown on Tables E.4-1 and E.4-2.

The maximum concentration of lead (479 mg/kg) was greater than the screening value for plants, indicating potential risks to plants. However, the average lead concentration (76.7 mg/kg) was below the screening value. Lead concentrations in two samples exceeded the screening value for plants. Any potential impacts to plants from lead would be limited to a small area.

Based on food chain modeling using average chemical concentrations in surface soil, the EEQs for terrestrial receptors were less than 1.0 for antimony; therefore, antimony was eliminated as a COPC for wildlife. Based on food chain modeling using average chemical concentrations in surface soil, the EEQ based on the NOAEL for lead was less than 1.0 for terrestrial mammals, but slightly greater than 1.0 for terrestrial birds (2.9). However, the food chain model assumes that the receptors obtain their entire diet from the site or subarea being evaluated, and it is unlikely that wildlife receptors would obtain their entire diet from this site. Also, the EEQ based on the LOAEL for terrestrial birds was less than 1.0. Therefore, impacts to birds from lead are not expected.

UXO 25

During the SI, antimony was retained as a COPC in the SI for risks to plants and wildlife in surface soil; copper was retained as a COPC for risks to plants and invertebrates in surface soil; and lead was retained as a COPC for risk to plants, invertebrates, and wildlife in surface soil. For the post-removal action evaluation, risks to plants, invertebrates, and wildlife from concentrations of antimony, copper, and lead in surface soil were re-evaluated assuming that contaminated soil was removed from all locations within the planned excavation boundaries and replaced with soil containing background levels of these constituents. Results of the post-removal action ERA screening evaluation for UXO 25 are shown on Tables E.5-1 and E.5-2.

The maximum concentration of antimony (0.53 mg/kg) was less than the screening value for plants; therefore, antimony was eliminated as a COPC for risks to plants. The maximum concentration of copper (24.8 mg/kg) was less than screening values based on protection of plants and invertebrates; therefore,

copper was eliminated as a COPC for risks to plants and invertebrates. The maximum concentration of lead (142 mg/kg) was greater than the screening value for plants, indicating potential risks to plants. However, the average lead concentration (53.8 mg/kg) was below the screening value. Lead from two locations exceeded the screening value for plants. Any potential impacts to plants from lead would be limited to a small area. The maximum concentration of lead was less than screening value for invertebrates; therefore, lead was eliminated as a COPC for risks to invertebrates.

Based on food chain modeling using average chemical concentrations in surface soil, the EEQs for terrestrial receptors were less than 1.0 for antimony; therefore, antimony was eliminated as a COPC for wildlife. Based on food chain modeling using average chemical concentrations in surface soil, the EEQ based on the NOAEL for lead was less than 1.0 for terrestrial mammals, but slightly greater than 1.0 for terrestrial birds (2.3). However, the food chain model assumes that the receptors obtain their entire diet from the site or subarea being evaluated, and it is unlikely that wildlife receptors would obtain their entire diet from this site. Also, the EEQ based on the LOAEL for terrestrial birds was less than 1.0. Therefore, impacts to birds from lead are not expected.

TABLE E.1-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 MARINE RIFLE RANGE (MRR) - UXO 14
 HILLSIDE IMPACT AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
COPPER	17/17	8.6	63.4	X14SB139	NA	NA	23.3	23.3	80	70	28	49	YES	ASL
LEAD	16/17	17.9	293	X14SB094	11	11	100	94.7	1700	120	11	56	YES	ASL
TIN	5/17	1.6	7.1	X14SB094	0.49	1.7	3.6	1.6	NA	50	NA	7.62	YES	ASL/NSL

Shaded cells indicate that the overall average concentration exceeds the screening level or a screening level is not available. Bolded values/text indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

TABLE E.1-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
MARINE RIFLE RANGE (MRR) - UXO 14
HILLSIDE IMPACT AREA
NSF INDIAN HEAD -STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
COPPER	1.6E-01	1.8E-02	6.1E-02	4.1E-03	4.9E-01	5.7E-02	1.9E-01	1.3E-02
LEAD	4.4E-01	1.6E-02	4.7E-02	1.2E-03	3.4E+00	1.2E-01	6.2E-01	1.6E-02

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE E.2-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
 SHOT FALL/TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	14/14	0.11	0.99 J	X15SB005	NA	NA	0.2	0.2	78	5	NA	0.27	YES	ASL/NSL
LEAD	14/14	33.3	252	X15SB005	NA	NA	84.9	84.9	1700	120	11	56	YES	ASL

Shaded cells indicate that the overall average concentration exceeds the screening level or a screening level is not available. Bolded values/text indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

J = Estimated concentration

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE E.2-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
OLD SKEET AND TRAP RANGE (OSTR) - UXO 15
SHOT FALL/TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
ANTIMONY	NV	NV	9.2E-03	2.0E-04	NV	NV	3.0E-01	6.5E-03
LEAD	4.0E-01	1.5E-02	4.4E-02	1.1E-03	3.1E+00	1.1E-01	5.6E-01	1.4E-02

Cells are shaded if the value is greater than 1.0

NV - Value Not Available

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE E.3-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 RUM POINT SKEET RANGE (RPSR) - UXO 16
 SHOT FALL/TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
LEAD	20/20	6.7	616	X16SB008	NA	NA	93.2	93.2	1700	120	11	56	YES	ASL

Shaded cells indicate that the overall average concentration exceeds the screening level or a screening level is not available. Bolded values/text indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 J = Estimated concentration
 K = Biased high concentration
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

TABLE E.3-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
RUM POINT SKEET RANGE (RPSR) - UXO 16
SHOT FALL/TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
LEAD	4.3E-01	1.6E-02	4.7E-02	1.2E-03	3.4E+00	1.2E-01	6.1E-01	1.5E-02

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE E.4-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 SMALL ARMS (PISTOL) RANGE (SAPR) - UXO 17
 TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	3/12	0.15 L	0.5 L	X17SB028	0.13	3.3	0.28	1.0	78	5	NA	0.27	YES	ASL/NSL
LEAD	11/12	7.2	479	X17SB025	7	10.3	83.2	76.7	1700	120	11	56	YES	ASL

Shaded cells indicate that the overall average concentration exceeds the screening level or a screening level is not available. Bolded values/text indicate that the maximum concentration exceeds the screening level.

- 1 Sample and duplicate are considered as one sample when determining the frequency of detection.
- 2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.
- 3 Average of detected concentrations only.
- 4 Average of all analytical results.

COPC = Chemical of Potential Concern
 NA = Not available or not applicable
 K = Biased high concentration
 L = Biased low concentration

Rationale Codes for COPC Selection:
 ASL = Above COPC Screening Level
 BSL = Below COPC Screening Level
 NSL = No Screening Level Available

TABLE E.4-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
SMALL ARMS (PISTOL) RANGE (SAPR) - UXO 17
TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs				
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew		
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	
Inorganics									
LEAD	3.7E-01	1.3E-02	4.1E-02	1.0E-03	2.9E+00	1.0E-01	5.2E-01	1.3E-02	

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE E.5-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
 ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
 TARGET AREA
 SITE INSPECTION
 NSF INDIAN HEAD - STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Minimum Nondetect	Maximum Nondetect	Average of Positive Results ⁽³⁾	Overall Average ⁽⁴⁾	Ecological Screening Level				COPC (yes/no)?	Rationale for COPC selection
									Invertebrates	Plants	Avian	Mammals		
Inorganics (mg/kg)														
ANTIMONY	10/20	0.19 L	0.53 L	X25SB031	0.02	0.16	0.29	0.18	78	5	NA	0.27	YES	ASL/NSL
COPPER	20/20	7.4	24.8	X25SB016	NA	NA	14.4	14.4	80	70	28	49	NO	BSL
LEAD	20/20	6.3	142	X25SB031	NA	NA	58.3	58.3	1700	120	11	56	YES	ASL

Shaded cells indicate that the overall average concentration exceeds the screening level or a screening level is not available. Bolded values/text indicate that the maximum concentration exceeds the screening level.

1 Sample and duplicate are considered as one sample when determining the frequency of detection.

2 Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations detected.

3 Average of detected concentrations only.

4 Average of all analytical results.

COPC = Chemical of Potential Concern

NA = Not available or not applicable

J = Estimated concentration

L = Biased low concentration

Rationale Codes for COPC Selection:

ASL = Above COPC Screening Level

BSL = Below COPC Screening Level

NSL = No Screening Level Available

TABLE E.5-2
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INSECTIVOROUS AND HERBIVOROUS RECEPTORS - SURFACE SOIL
ROACH ROAD RIFLE RANGE (RRRR) - UXO 25
TARGET AREA
NSF INDIAN HEAD - STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs				
	Bobwhite Quail		Meadow Vole		Robin		Short-Tailed Shrew		
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	
Inorganics									
LEAD	2.9E-01	1.1E-02	3.4E-02	8.6E-04	2.3E+00	8.3E-02	4.1E-01	1.0E-02	

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

APPENDIX F
COST ESTIMATES

APPENDIX F
COST ESTIMATES

This EE/CA was developed to evaluate removal action alternatives that address the lead-, PAH-, and nitroglycerin-contaminated soils that pose unacceptable risks at the five small arms/skeet ranges (SASRs). The cost estimates used for comparison in the alternatives analysis are based on the assumption that removal activities can be conducted at all five SASRs in a single mobilization. However, it is possible that funding constraints may dictate separate mobilizations for one or more of the sites. To assist with implementation planning, cost tables are presented in this appendix to address both potential funding scenarios. Detailed cost tables are presented for both Alternatives 2 and 3 based on: 1) all sites being addressed in a single mobilization, and 2) each site being addressed in a separate mobilization. A summary breakdown of the overall and site-specific cost estimates is presented in the table below.

Scenario / Site	Alternative 2	Alternative 3
All Sites in Single Mobilization		
Total	\$4,210,860	\$3,156,732
Each Site in Separate Mobilization		
UXO 14	\$1,734,240	\$1,006,350
UXO 15	\$1,224,637	\$1,008,431
UXO 16	\$913,565	\$913,565
UXO 17	\$385,116	\$306,719
UXO 25	\$131,648	\$113,788
Total	\$4,389,206	\$3,348,853

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal
Capital Cost

Item	Quantity	Unit	Unit Cost			Extended Cost			Subtotal		
			Subcontract	Material	Labor Equipment	Subcontract	Material	Labor Equipment			
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	300	hr			\$39.00	\$0	\$0	\$11,700	\$0	\$11,700	
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 3 days)	1	ls		\$1,000.00	\$1,500.00	\$200.00	\$0	\$1,000	\$1,500	\$200	\$2,700
2.2 Soil Sampling (TCLP Lead)	20	ea	150.00	\$10.00			\$3,000	\$200	\$0	\$0	\$3,200
2.3 Characterization/Offsite Disposal Soil Testing	10	ea	850.00	\$20.00			\$8,500	\$200	\$0	\$0	\$8,700
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	5	mo				\$400.00	\$0	\$0	\$0	\$2,000	\$2,000
3.2 Field Office Support	5	mo		\$200.00			\$0	\$1,000	\$0	\$0	\$1,000
3.3 Storage Trailer	5	mo				\$103.00	\$0	\$0	\$0	\$515	\$515
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	4500.00				\$4,500	\$0	\$0	\$0	\$4,500
3.5 Site Utilities	5	mo	200.00				\$1,000	\$0	\$0	\$0	\$1,000
3.6 Underground Utility Clearances	1	ls	4500.00				\$4,500	\$0	\$0	\$0	\$4,500
3.7 Construction Survey Support	10	day	1150.00				\$11,500	\$0	\$0	\$0	\$11,500
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	30	day		\$200.00	\$300.00		\$0	\$6,000	\$9,000	\$0	\$15,000
3.10 XRF Rental	2	mo				\$3,500.00	\$0	\$0	\$0	\$7,000	\$7,000
3.11 Site Superintendent	5	mo			\$8,229.76		\$0	\$0	\$41,149	\$0	\$41,149
3.12 Site Health & Safety and QA/QC	5	mo			\$6,827.04		\$0	\$0	\$34,135	\$0	\$34,135
3.13 Materials Storage Pad, 25' X 25'	5	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$5,000	\$1,250	\$1,000	\$7,250
3.14 Decontamination Services	5	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$5,500	\$10,125	\$7,000	\$22,625
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		6000.00			\$0	\$6,000	\$0	\$0	\$6,000
4.2 Clear Site, cut & chip trees to 4" diam.	2	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$7,200	\$5,900	\$13,100
4.3 Clear Site, grasses & brush	4	acre			\$370.00	\$345.00	\$0	\$0	\$1,480	\$1,380	\$2,860
4.4 Erosion and Sedimentation Controls	1	ls	15000.00				\$15,000	\$0	\$0	\$0	\$15,000
4.5 Equipment Decon Pad (5 Sites)	1	ls		\$7,000.00	\$6,000.00	\$850.00	\$0	\$7,000	\$6,000	\$850	\$13,850
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	5	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$72,952	\$57,848	\$130,800
5.2 Site Labor, (1 laborer)	5	mo			\$6,160.00		\$0	\$0	\$30,800	\$0	\$30,800
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	2	mo			\$11,102.12	\$8,749.44	\$0	\$0	\$22,204	\$17,499	\$39,703
5.4 Front End Loader, 3 cy (145HP)	3	mo			\$11,102.12	\$8,546.66	\$0	\$0	\$33,306	\$25,640	\$58,946
5.5 UXO Technician	3	mo			\$6,827.04		\$0	\$0	\$20,481	\$0	\$20,481
5.6 Off Site Disposal, Hazardous for Lead	3,048	ton	325.00				\$990,600	\$0	\$0	\$0	\$990,600
5.7 Off Site Disposal, Non-Hazardous Soil	10,033	ton	65.00				\$652,145	\$0	\$0	\$0	\$652,145
5.8 Confirmatory Sampling, (lead only, 72 hr TAT)	80	ea	46.00	\$10.00			\$3,680	\$800	\$0	\$0	\$4,480
5.9 Confirmatory Sampling, (PAHs only, 72 hr TAT)	35	ea	250.00	\$10.00			\$8,750	\$350	\$0	\$0	\$9,100
5.10 Confirmatory Sampling, (nitroglycerin only, 72 hr TA	10	ea	230.00	\$10.00			\$2,300	\$100	\$0	\$0	\$2,400

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal
Capital Cost

Item	Quantity	Unit	Unit Cost			Extended Cost				Subtotal	
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor		Equipment
6 SITE RESTORATION											
6.1 Clean backfill	5,948	cy		\$19.60	\$0.53	\$0.34	\$0	\$116,581	\$3,152	\$2,022	\$121,756
6.2 Topsoil, Furnish and Place, 6" thickness	17,165	sy		\$5.40	\$0.63	\$0.41	\$0	\$92,691	\$10,814	\$7,038	\$110,543
6.3 Dozer, Crawler 105 H. P.	1	mo			\$11,281.60	\$9,979.60	\$0	\$0	\$11,282	\$9,980	\$21,261
6.4 Fine Grading and seeding, incl. lime, fert, and seed	17,165	sy		\$0.56	\$1.78	\$0.33	\$0	\$9,612	\$30,554	\$5,664	\$45,831
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	200	hr			\$39.00		\$0	\$0	\$7,800	\$0	\$7,800
Subtotal							\$1,705,475	\$252,034	\$367,824	\$154,366	\$2,479,700
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$1,705,475	\$256,067	\$316,329	\$148,346	\$2,426,217
Overhead on Labor Cost @ 30%									\$94,899		\$94,899
G & A on Labor Cost @ 10%									\$31,633		\$31,633
G & A on Material Cost @ 10%								\$25,607			\$25,607
G & A on Equipment Cost @ 10%										\$14,835	\$14,835
G & A on Subcontract Cost @ 10%							\$170,548				\$170,548
Tax on Materials and Equipment Cost @ 6%								\$15,364		\$8,901	\$24,265
Total Direct Cost							\$1,876,023	\$297,037	\$442,861	\$172,081	\$2,788,002
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$286,314
Profit on Total Direct Cost @ 10%											\$278,800
Subtotal											\$3,353,116
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$67,062
Total Field Cost											\$3,420,179
Contingency on Total Field Costs @ 20%											\$684,036
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$106,646
TOTAL CAPITAL COST											\$4,210,860

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 14-Marine Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	120	hr			\$39.00		\$0	\$0	\$4,680	\$0	\$4,680
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 2 days)	1	ls		\$400.00	\$1,000.00	\$150.00	\$0	\$400	\$1,000	\$150	\$1,550
2.2 Soil Sampling (TCLP Lead)	12	ea	150.00	\$10.00			\$1,800	\$120	\$0	\$0	\$1,920
2.3 Characterization/Offsite Disposal Soil Testing	2	ea	850.00	\$20.00			\$1,700	\$40	\$0	\$0	\$1,740
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	2	mo				\$400.00	\$0	\$0	\$0	\$600	\$600
3.2 Field Office Support	2	mo		\$200.00			\$0	\$300	\$0	\$0	\$300
3.3 Storage Trailer	2	mo				\$103.00	\$0	\$0	\$0	\$155	\$155
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	2	mo	200.00				\$400	\$0	\$0	\$0	\$400
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	6	day	1150.00				\$6,900	\$0	\$0	\$0	\$6,900
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	15	day		\$200.00	\$300.00		\$0	\$3,000	\$4,500	\$0	\$7,500
3.10 XRF Rental	1	mo				\$3,500.00	\$0	\$0	\$0	\$3,500	\$3,500
3.11 Site Superintendent	2	mo			\$8,229.76		\$0	\$0	\$16,460	\$0	\$16,460
3.12 Site Health & Safety and QA/QC	2	mo			\$6,827.04		\$0	\$0	\$13,654	\$0	\$13,654
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	2	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$2,200	\$4,050	\$2,800	\$9,050
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		4000.00			\$0	\$4,000	\$0	\$0	\$4,000
4.2 Clear Site, cut & chip trees to 4" diam.	1.5	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$5,400	\$4,425	\$9,825
4.3 Clear Site, grasses & brush	1.5	acre			\$370.00	\$345.00	\$0	\$0	\$555	\$518	\$1,073
4.4 Erosion and Sedimentation Controls	1	ls	8000.00				\$8,000	\$0	\$0	\$0	\$8,000
4.5 Equipment Decon Pad	1	ls		\$3,500.00	\$3,000.00	\$425.00	\$0	\$3,500	\$3,000	\$425	\$6,925
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	2	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$29,181	\$23,139	\$52,320
5.2 Site Labor, (1 laborer)	2	mo			\$6,160.00		\$0	\$0	\$12,320	\$0	\$12,320
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	2	mo			\$11,102.12	\$8,749.44	\$0	\$0	\$22,204	\$17,499	\$39,703
5.4 UXO Technician	2	mo			\$6,827.04		\$0	\$0	\$13,654	\$0	\$13,654
5.5 Off Site Disposal, Hazardous for Lead	2,159	ton	325.00				\$701,675	\$0	\$0	\$0	\$701,675
5.6 Off Site Disposal, Non-Hazardous Soil	540	ton	65.00				\$35,100	\$0	\$0	\$0	\$35,100
5.7 Confirmatory Sampling, (lead only, 72 hr TAT)	50	ea	46.00	\$10.00			\$2,300	\$500	\$0	\$0	\$2,800
5.8 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.9 Confirmatory Sampling, (nitroglycerin only, 72 hr TA	0	ea	230.00	\$10.00			\$0	\$0	\$0	\$0	\$0

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 14-Marine Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Extended Cost				Subtotal
				Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
6 SITE RESTORATION											
6.1 Clean backfill	1,212	cy		\$19.60	\$0.53	\$0.34	\$0	\$23,755	\$642	\$412	\$24,810
6.2 Topsoil, Furnish and Place, 6" thickness	3,635	sy		\$5.40	\$0.63	\$0.41	\$0	\$19,629	\$2,290	\$1,490	\$23,409
6.3 Dozer, Crawler, 105 H. P.	2	week			\$2,564.00	\$2,754.00	\$0	\$0	\$5,128	\$5,508	\$10,636
6.4 Fine Grading and seeding, incl. lime, fert, and seed	3,635	sy		\$0.56	\$1.78	\$0.33	\$0	\$2,036	\$6,470	\$1,200	\$9,705
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	100	hr			\$39.00		\$0	\$0	\$3,900	\$0	\$3,900
Subtotal							\$760,875	\$60,480	\$150,278	\$64,850	\$1,036,483
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$760,875	\$61,447	\$129,239	\$62,321	\$1,013,883
Overhead on Labor Cost @ 30%									\$38,772		\$38,772
G & A on Labor Cost @ 10%									\$12,924		\$12,924
G & A on Material Cost @ 10%								\$6,145			\$6,145
G & A on Equipment Cost @ 10%										\$6,232	\$6,232
G & A on Subcontract Cost @ 10%							\$76,088				\$76,088
Tax on Materials and Equipment Cost @ 6%								\$3,687		\$3,739	\$7,426
Total Direct Cost							\$836,963	\$71,279	\$180,935	\$72,292	\$1,161,469
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$106,174
Profit on Total Direct Cost @ 10%											\$116,147
Subtotal											\$1,383,790
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$27,676
Total Field Cost											\$1,411,466
Contingency on Total Field Costs @ 20%											\$282,293
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$40,481
TOTAL CAPITAL COST											\$1,734,240

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 15 - Old Skeet and Trap Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	100	hr			\$39.00		\$0	\$0	\$3,900	\$0	\$3,900
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$300.00	\$500.00	\$80.00	\$0	\$300	\$500	\$80	\$880
2.2 Soil Sampling (TCLP Lead)	4	ea	150.00	\$10.00			\$600	\$40	\$0	\$0	\$640
2.3 Characterization/Offsite Disposal Soil Testing	4	ea	850.00	\$20.00			\$3,400	\$80	\$0	\$0	\$3,480
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1.5	mo				\$400.00	\$0	\$0	\$0	\$600	\$600
3.2 Field Office Support	1.5	mo		\$200.00			\$0	\$300	\$0	\$0	\$300
3.3 Storage Trailer	1.5	mo				\$103.00	\$0	\$0	\$0	\$155	\$155
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1.5	mo	200.00				\$300	\$0	\$0	\$0	\$300
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	5	day		\$200.00	\$300.00		\$0	\$1,000	\$1,500	\$0	\$2,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	1.5	mo			\$8,229.76		\$0	\$0	\$12,345	\$0	\$12,345
3.12 Site Health & Safety and QA/QC	1.5	mo			\$6,827.04		\$0	\$0	\$10,241	\$0	\$10,241
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	1.5	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$1,650	\$3,038	\$2,100	\$6,788
4 SITE PREPARATION											
4.1 Clear Site, grasses & brush	1	acre			\$370.00	\$345.00	\$0	\$0	\$370	\$345	\$715
4.2 Erosion and Sedimentation Controls	1	ls	2500.00				\$2,500	\$0	\$0	\$0	\$2,500
4.3 Equipment Decon Pad	1	ls		\$2,500.00	\$1,500.00	\$225.00	\$0	\$2,500	\$1,500	\$225	\$4,225
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1.5	mo		\$14,590.40	\$11,569.68		\$0	\$0	\$21,886	\$17,355	\$39,240
5.2 Site Labor, (1 laborer)	1.5	mo		\$6,160.00			\$0	\$0	\$9,240	\$0	\$9,240
5.3 Front End Loader, 3 cy (145HP)	1.5	mo		\$11,102.12	\$8,546.66		\$0	\$0	\$16,653	\$12,820	\$29,473
5.4 UXO Technician	1.5	mo		\$6,827.04			\$0	\$0	\$10,241	\$0	\$10,241
5.5 Off Site Disposal, Hazardous for Lead	625	ton	325.00				\$203,125	\$0	\$0	\$0	\$203,125
5.6 Off Site Disposal, Non-Hazardous Soil	3,944	ton	65.00				\$256,360	\$0	\$0	\$0	\$256,360
5.7 Confirmatory Sampling, (lead only, 72 hr TAT)	15	ea	46.00	\$10.00			\$690	\$150	\$0	\$0	\$840
5.8 Confirmatory Sampling, (PAHs only, 72 hr TAT)	20	ea	250.00	\$10.00			\$5,000	\$200	\$0	\$0	\$5,200
5.9 Confirmatory Sampling, (nitroglycerin only, 72 hr TAT)	0	ea	230.00	\$10.00			\$0	\$0	\$0	\$0	\$0

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 15 - Old Skeet and Trap Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 SITE RESTORATION											
6.1 Clean backfill	2,176	cy		\$19.60	\$0.53	\$0.34	\$0	\$42,650	\$1,153	\$740	\$44,543
6.2 Topsoil, Furnish and Place, 6" thickness	5,404	sy		\$5.40	\$0.63	\$0.41	\$0	\$29,182	\$3,405	\$2,216	\$34,802
6.3 Dozer, Crawler, 105 H. P.	1	week			\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
6.4 Fine Grading and seeding, incl. lime, fert, and seed	5,404	sy		\$0.56	\$1.78	\$0.33	\$0	\$3,026	\$9,619	\$1,783	\$14,429
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	60	hr			\$39.00		\$0	\$0	\$2,340	\$0	\$2,340
Subtotal							\$477,275	\$82,077	\$111,683	\$45,402	\$716,437
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$477,275	\$83,391	\$96,047	\$43,631	\$700,344
Overhead on Labor Cost @ 30%									\$28,814		\$28,814
G & A on Labor Cost @ 10%									\$9,605		\$9,605
G & A on Material Cost @ 10%								\$8,339			\$8,339
G & A on Equipment Cost @ 10%										\$4,363	\$4,363
G & A on Subcontract Cost @ 10%							\$47,728				\$47,728
Tax on Materials and Equipment Cost @ 6%								\$5,003		\$2,618	\$7,621
Total Direct Cost							\$525,003	\$96,733	\$134,466	\$50,612	\$806,814
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$86,832
Profit on Total Direct Cost @ 10%											\$80,681
Subtotal											\$974,328
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$19,487
Total Field Cost											\$993,814
Contingency on Total Field Costs @ 20%											\$198,763
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$32,060
TOTAL CAPITAL COST											\$1,224,637

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 16-Rum Point Skeet Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	80	hr			\$39.00		\$0	\$0	\$3,120	\$0	\$3,120
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$50.00	\$500.00	\$80.00	\$0	\$50	\$500	\$80	\$630
2.2 Characterization/Offsite Disposal Soil Testing	1	ea	850.00	\$20.00			\$850	\$20	\$0	\$0	\$870
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1	mo				\$400.00	\$0	\$0	\$0	\$400	\$400
3.2 Field Office Support	1	mo		\$200.00			\$0	\$200	\$0	\$0	\$200
3.3 Storage Trailer	1	mo				\$103.00	\$0	\$0	\$0	\$103	\$103
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1	mo	200.00				\$200	\$0	\$0	\$0	\$200
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 Site Superintendent	1	mo			\$8,229.76		\$0	\$0	\$8,230	\$0	\$8,230
3.10 Site Health & Safety and QA/QC	1	mo			\$6,827.04		\$0	\$0	\$6,827	\$0	\$6,827
3.11 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.12 Decontamination Services	1	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$1,100	\$2,025	\$1,400	\$4,525
4 SITE PREPARATION											
4.1 Clear Site, grasses & brush	1	acre			\$370.00	\$345.00	\$0	\$0	\$370	\$345	\$715
4.2 Erosion and Sedimentation Controls	1	ls	2500.00				\$2,500	\$0	\$0	\$0	\$2,500
4.3 Equipment Decon Pad	1	ls		\$2,500.00	\$1,500.00	\$225.00	\$0	\$2,500	\$1,500	\$225	\$4,225
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$14,590	\$11,570	\$26,160
5.2 Site Labor, (1 laborer)	1	mo			\$6,160.00		\$0	\$0	\$6,160	\$0	\$6,160
5.3 Front End Loader, 3 cy (145HP)	1	mo			\$11,102.12	\$8,546.66	\$0	\$0	\$11,102	\$8,547	\$19,649
5.4 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.5 Off Site Disposal, Non-Hazardous Soil	4,885	ton	65.00				\$317,525	\$0	\$0	\$0	\$317,525
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	0	ea	46.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	15	ea	250.00	\$10.00			\$3,750	\$150	\$0	\$0	\$3,900

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 16-Rum Point Skeet Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 SITE RESTORATION											
6.1 Clean backfill	2,193	cy		\$19.60	\$0.53	\$0.34	\$0	\$42,983	\$1,162	\$746	\$44,891
6.2 Topsoil, Furnish and Place, 6" thickness	6,580	sy		\$5.40	\$0.63	\$0.41	\$0	\$35,532	\$4,145	\$2,698	\$42,375
6.3 Dozer, Crawler, 105 H. P.	1	week			\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
6.4 Fine Grading and seeding, incl. lime, fert, and seed	6,580	sy		\$0.56	\$1.78	\$0.33	\$0	\$3,685	\$11,712	\$2,171	\$17,569
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	40	hr			\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal							\$330,125	\$87,220	\$76,758	\$34,068	\$528,171
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$330,125	\$88,615	\$66,012	\$32,740	\$517,492
Overhead on Labor Cost @ 30%									\$19,804		\$19,804
G & A on Labor Cost @ 10%									\$6,601		\$6,601
G & A on Material Cost @ 10%								\$8,862			\$8,862
G & A on Equipment Cost @ 10%										\$3,274	\$3,274
G & A on Subcontract Cost @ 10%							\$33,013				\$33,013
Tax on Materials and Equipment Cost @ 6%								\$5,317		\$1,964	\$7,281
Total Direct Cost							\$363,138	\$102,794	\$92,417	\$37,978	\$596,326
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$69,700
Profit on Total Direct Cost @ 10%											\$59,633
Subtotal											\$725,659
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$14,513
Total Field Cost											\$740,172
Contingency on Total Field Costs @ 20%											\$148,034
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$25,359
TOTAL CAPITAL COST											\$913,565

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 17 - Small Arms (Pistol) Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	60	hr			\$39.00		\$0	\$0	\$2,340	\$0	\$2,340
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$150.00	\$500.00	\$80.00	\$0	\$150	\$500	\$80	\$730
2.2 Soil Sampling (TCLP Lead)	3	ea	150.00	\$10.00			\$450	\$30	\$0	\$0	\$480
2.3 Characterization/Offsite Disposal Soil Testing	2	ea	850.00	\$20.00			\$1,700	\$40	\$0	\$0	\$1,740
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1	mo				\$400.00	\$0	\$0	\$0	\$400	\$400
3.2 Field Office Support	1	mo		\$200.00			\$0	\$200	\$0	\$0	\$200
3.3 Storage Trailer	1	mo				\$103.00	\$0	\$0	\$0	\$103	\$103
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1	mo	200.00				\$200	\$0	\$0	\$0	\$200
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	5	day		\$200.00	\$300.00		\$0	\$1,000	\$1,500	\$0	\$2,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	3	week			\$1,870.40		\$0	\$0	\$5,611	\$0	\$5,611
3.12 Site Health & Safety and QA/QC	3	week			\$1,551.60		\$0	\$0	\$4,655	\$0	\$4,655
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	3	week		\$275.00	\$506.25	\$350.00	\$0	\$825	\$1,519	\$1,050	\$3,394
4 SITE PREPARATION											
4.1 Clear Site, cut & chip trees	0.2	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$720	\$590	\$1,310
4.2 Clear Site, grasses & brush	0.3	acre			\$370.00	\$345.00	\$0	\$0	\$111	\$104	\$215
4.3 Erosion and Sedimentation Controls	1	ls	1000.00				\$1,000	\$0	\$0	\$0	\$1,000
4.4 Equipment Decon Pad	1	ls		\$1,500.00	\$1,000.00	\$200.00	\$0	\$1,500	\$1,000	\$200	\$2,700
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	3	week			\$3,316.00	\$3,236.00	\$0	\$0	\$9,948	\$9,708	\$19,656
5.2 Site Labor, (1 laborer)	3	week			\$1,400.00		\$0	\$0	\$4,200	\$0	\$4,200
5.3 Front End Loader, 3 cy (145HP)	3	week			\$2,564.00	\$2,362.00	\$0	\$0	\$7,692	\$7,086	\$14,778
5.4 Off Site Disposal, Hazardous for Lead	212	ton	325.00				\$68,900	\$0	\$0	\$0	\$68,900
5.5 Off Site Disposal, Non-Hazardous Soil	651	ton	65.00				\$42,315	\$0	\$0	\$0	\$42,315
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	10	ea	46.00	\$10.00			\$460	\$100	\$0	\$0	\$560
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.8 Confirmatory Sampling, (nitroglycerin only, 72 hr TA	10	ea	230.00	\$10.00			\$2,300	\$100	\$0	\$0	\$2,400

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 17 - Small Arms (Pistol) Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 SITE RESTORATION											
6.1 Clean backfill	338	cy		\$19.60	\$0.53	\$0.34	\$0	\$6,625	\$179	\$115	\$6,919
6.2 Topsoil, Furnish and Place, 6" thickness	1,460	sy		\$5.40	\$0.63	\$0.41	\$0	\$7,884	\$920	\$599	\$9,402
6.3 Dozer, Crawler, 105 H. P.	3	day			\$512.80	\$751.80	\$0	\$0	\$1,538	\$2,255	\$3,794
6.4 Fine Grading and seeding, incl. lime, fert, and seed	1,460	sy		\$0.56	\$1.78	\$0.33	\$0	\$818	\$2,599	\$482	\$3,898
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	40	hr			\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal							\$122,625	\$20,271	\$47,782	\$27,001	\$217,680
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$122,625	\$20,596	\$41,092	\$25,948	\$210,261
Overhead on Labor Cost @ 30%									\$12,328		\$12,328
G & A on Labor Cost @ 10%									\$4,109		\$4,109
G & A on Material Cost @ 10%								\$2,060			\$2,060
G & A on Equipment Cost @ 10%										\$2,595	\$2,595
G & A on Subcontract Cost @ 10%							\$12,263				\$12,263
Tax on Materials and Equipment Cost @ 6%								\$1,236		\$1,557	\$2,793
Total Direct Cost							\$134,888	\$23,891	\$57,529	\$30,100	\$246,408
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$33,798
Profit on Total Direct Cost @ 10%											\$24,641
Subtotal											\$304,847
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$6,097
Total Field Cost											\$310,944
Contingency on Total Field Costs @ 20%											\$62,189
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$11,984
TOTAL CAPITAL COST											\$385,116

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 25 - Roach Road Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	60	hr			\$39.00		\$0	\$0	\$2,340	\$0	\$2,340
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$300.00	\$600.00	\$100.00	\$0	\$300	\$600	\$100	\$1,000
2.2 Soil Sampling (TCLP Lead)	1	ea	150.00	\$10.00			\$150	\$10	\$0	\$0	\$160
2.3 Characterization/Offsite Disposal Soil Testing	1	ea	850.00	\$20.00			\$850	\$20	\$0	\$0	\$870
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	0.5	mo				\$400.00	\$0	\$0	\$0	\$200	\$200
3.2 Field Office Support	0.5	mo		\$200.00			\$0	\$100	\$0	\$0	\$100
3.3 Storage Trailer	0.5	mo				\$103.00	\$0	\$0	\$0	\$52	\$52
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	0.5	mo	200.00				\$100	\$0	\$0	\$0	\$100
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	3	day		\$200.00	\$300.00		\$0	\$600	\$900	\$0	\$1,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	1	week			\$1,870.40		\$0	\$0	\$1,870	\$0	\$1,870
3.12 Site Health & Safety and QA/QC	1	week			\$1,551.60		\$0	\$0	\$1,552	\$0	\$1,552
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	1	week		\$275.00	\$506.25	\$350.00	\$0	\$275	\$506	\$350	\$1,131
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		2000.00			\$0	\$2,000	\$0	\$0	\$2,000
4.2 Clear Site, cut & chip trees to 4" diam.	0.3	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$1,080	\$885	\$1,965
4.3 Clear Site, grasses & brush	0.2	acre			\$370.00	\$345.00	\$0	\$0	\$74	\$69	\$143
4.4 Erosion and Sedimentation Controls	1	ls	1000.00				\$1,000	\$0	\$0	\$0	\$1,000
4.5 Equipment Decon Pad	1	ls		\$1,500.00	\$1,000.00	\$200.00	\$0	\$1,500	\$1,000	\$200	\$2,700
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1	week			\$3,316.00	\$3,236.00	\$0	\$0	\$3,316	\$3,236	\$6,552
5.2 Site Labor, (1 laborer)	1	week			\$1,400.00		\$0	\$0	\$1,400	\$0	\$1,400
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	1	week			\$2,564.00	\$2,443.00	\$0	\$0	\$2,564	\$2,443	\$5,007
5.4 Off Site Disposal, Hazardous for Lead	52	ton	325.00				\$16,900	\$0	\$0	\$0	\$16,900
5.5 Off Site Disposal, Non-Hazardous Soil	13	ton	65.00				\$845	\$0	\$0	\$0	\$845
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	5	ea	46.00	\$10.00			\$230	\$50	\$0	\$0	\$280
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 2: Excavation and Off-Site Disposal - UXO 25 - Roach Road Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 SITE RESTORATION											
6.1 Clean backfill	30	cy		\$19.60	\$0.53	\$0.34	\$0	\$588	\$16	\$10	\$614
6.2 Topsoil, Furnish and Place, 6" thickness	88	sy		\$5.40	\$0.63	\$0.41	\$0	\$475	\$55	\$36	\$567
6.3 Dozer, Crawler 105 H. P.	1	week			\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
6.4 Fine Grading and seeding, incl. lime, fert, and seed	88	sy		\$0.56	\$1.78	\$0.33	\$0	\$49	\$157	\$29	\$235
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	40	hr			\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal							\$25,375	\$6,967	\$22,744	\$14,594	\$69,681
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$25,375	\$7,079	\$19,560	\$14,025	\$66,039
Overhead on Labor Cost @ 30%									\$5,868		\$5,868
G & A on Labor Cost @ 10%									\$1,956		\$1,956
G & A on Material Cost @ 10%								\$708			\$708
G & A on Equipment Cost @ 10%										\$1,402	\$1,402
G & A on Subcontract Cost @ 10%							\$2,538				\$2,538
Tax on Materials and Equipment Cost @ 6%								\$425		\$841	\$1,266
Total Direct Cost							\$27,913	\$8,212	\$27,384	\$16,269	\$79,777
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)											\$15,508
Profit on Total Direct Cost @ 10%											\$7,978
Subtotal											\$103,262
Health & Safety Monitoring @ 2% (includes air quality monitoring)											\$2,065
Total Field Cost											\$105,328
Contingency on Total Field Costs @ 20%											\$21,066
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)											\$5,255
TOTAL CAPITAL COST											\$131,648

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal
Capital Cost

Item	Quantity	Unit	Unit Cost			Extended Cost			Subtotal		
			Subcontract	Material	Labor	Equipment	Subcontract	Material		Labor	Equipment
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	300	hr			\$39.00		\$0	\$0	\$11,700	\$0	\$11,700
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 3 days)	1	ls		\$1,000.00	\$1,500.00	\$200.00	\$0	\$1,000	\$1,500	\$200	\$2,700
2.2 Soil Sampling (TCLP Lead)	20	ea	150.00	\$10.00			\$3,000	\$200	\$0	\$0	\$3,200
2.3 Characterization/Offsite Disposal Soil Testing	10	ea	850.00	\$20.00			\$8,500	\$200	\$0	\$0	\$8,700
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	5	mo				\$400.00	\$0	\$0	\$0	\$2,000	\$2,000
3.2 Field Office Support	5	mo		\$200.00			\$0	\$1,000	\$0	\$0	\$1,000
3.3 Storage Trailer	5	mo				\$103.00	\$0	\$0	\$0	\$515	\$515
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	4500.00				\$4,500	\$0	\$0	\$0	\$4,500
3.5 Site Utilities	5	mo	200.00				\$1,000	\$0	\$0	\$0	\$1,000
3.6 Underground Utility Clearances	1	ls	4500.00				\$4,500	\$0	\$0	\$0	\$4,500
3.7 Construction Survey Support	10	day	1150.00				\$11,500	\$0	\$0	\$0	\$11,500
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	30	day		\$200.00	\$300.00		\$0	\$6,000	\$9,000	\$0	\$15,000
3.10 XRF Rental	2	mo				\$3,500.00	\$0	\$0	\$0	\$7,000	\$7,000
3.11 Site Superintendent	5	mo			\$8,229.76		\$0	\$0	\$41,149	\$0	\$41,149
3.12 Site Health & Safety and QA/QC	5	mo			\$6,827.04		\$0	\$0	\$34,135	\$0	\$34,135
3.13 Materials Storage Pad, 25' X 25'	5	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$5,000	\$1,250	\$1,000	\$7,250
3.14 Decontamination Services	5	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$5,500	\$10,125	\$7,000	\$22,625
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		6000.00			\$0	\$6,000	\$0	\$0	\$6,000
4.2 Clear Site, cut & chip trees to 4" diam.	2	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$7,200	\$5,900	\$13,100
4.3 Clear Site, grasses & brush	4	acre			\$370.00	\$345.00	\$0	\$0	\$1,480	\$1,380	\$2,860
4.4 Erosion and Sedimentation Controls	1	ls	15000.00				\$15,000	\$0	\$0	\$0	\$15,000
4.5 Equipment Decon Pad (5 Sites)	1	ls		\$7,000.00	\$6,000.00	\$850.00	\$0	\$7,000	\$6,000	\$850	\$13,850
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	5	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$72,952	\$57,848	\$130,800
5.2 Site Labor, (1 laborer)	5	mo			\$6,160.00		\$0	\$0	\$30,800	\$0	\$30,800
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	2	mo			\$11,102.12	\$8,749.44	\$0	\$0	\$22,204	\$17,499	\$39,703
5.4 Front End Loader, 3 cy (145HP)	3	mo			\$11,102.12	\$8,546.66	\$0	\$0	\$33,306	\$25,640	\$58,946
5.5 UXO Technician	3	mo			\$6,827.04		\$0	\$0	\$20,481	\$0	\$20,481
5.6 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.7 Off Site Disposal, Non-Hazardous Soil	13,081	ton	65.00				\$850,265	\$0	\$0	\$0	\$850,265
5.8 Confirmatory Sampling, (lead only, 72 hr TAT)	80	ea	46.00	\$10.00			\$3,680	\$800	\$0	\$0	\$4,480
5.9 Confirmatory Sampling, (PAHs only, 72 hr TAT)	35	ea	250.00	\$10.00			\$8,750	\$350	\$0	\$0	\$9,100
5.10 Confirmatory Sampling, (nitroglycerin only, 72 hr TA`	10	ea	230.00	\$10.00			\$2,300	\$100	\$0	\$0	\$2,400

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Extended Cost				Subtotal
				Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
6 HAZARDOUS WASTE TREATMENT											
6.1 Hazardous Lead-Contaminated Soil Treatment	3,048	ton	25.00				\$76,200	\$0	\$0	\$0	\$76,200
6.2 Offsite Disposal Soil Testing (TCLP Lead only)	35	ea	150.00	\$10.00			\$5,250	\$350	\$0	\$0	\$5,600
7 SITE RESTORATION											
7.1 Clean backfill	5,948	cy		\$19.60	\$0.53	\$0.34	\$0	\$116,581	\$3,152	\$2,022	\$121,756
7.2 Topsoil, Furnish and Place, 6" thickness	17,165	sy		\$5.40	\$0.63	\$0.41	\$0	\$92,691	\$10,814	\$7,038	\$110,543
7.3 Dozer, Crawler, 105 H. P.	1	mo			\$11,281.60	\$9,979.60	\$0	\$0	\$11,282	\$9,980	\$21,261
7.4 Fine Grading and seeding, incl. lime, fert, and seed	17,165	sy		\$0.56	\$1.78	\$0.33	\$0	\$9,612	\$30,554	\$5,664	\$45,831
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	200	hr			\$39.00		\$0	\$0	\$7,800	\$0	\$7,800
Subtotal							\$994,445	\$252,384	\$367,824	\$154,366	\$1,769,020
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$994,445	\$256,422	\$316,329	\$148,346	\$1,715,542
Overhead on Labor Cost @ 30%									\$94,899		\$94,899
G & A on Labor Cost @ 10%									\$31,633		\$31,633
G & A on Material Cost @ 10%								\$25,642			\$25,642
G & A on Equipment Cost @ 10%										\$14,835	\$14,835
G & A on Subcontract Cost @ 10%							\$99,445				\$99,445
Tax on Materials and Equipment Cost @ 6%								\$15,385		\$8,901	\$24,286
Total Direct Cost							\$1,093,890	\$297,450	\$442,861	\$172,081	\$2,006,281
Indirects on Total Direct Cost @ 25%							(excluding transportation and disposal cost)				\$289,004
Profit on Total Direct Cost @ 10%											\$200,628
Subtotal											\$2,495,914
Health & Safety Monitoring @ 2%							(includes air quality monitoring)				\$49,918
Total Field Cost											\$2,545,832
Contingency on Total Field Costs @ 20%											\$509,166
Engineering on Total Field Cost @ 6%							(excluding transportation and disposal cost)				\$101,734
TOTAL CAPITAL COST											\$3,156,732

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 14 - Marine Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	120	hr			\$39.00		\$0	\$0	\$4,680	\$0	\$4,680
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 2 days)	1	ls		\$400.00	\$1,000.00	\$150.00	\$0	\$400	\$1,000	\$150	\$1,550
2.2 Soil Sampling (TCLP Lead)	12	ea	150.00	\$10.00			\$1,800	\$120	\$0	\$0	\$1,920
2.3 Characterization/Offsite Disposal Soil Testing	2	ea	850.00	\$20.00			\$1,700	\$40	\$0	\$0	\$1,740
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	2	mo				\$400.00	\$0	\$0	\$0	\$800	\$800
3.2 Field Office Support	2	mo		\$200.00			\$0	\$400	\$0	\$0	\$400
3.3 Storage Trailer	2	mo				\$103.00	\$0	\$0	\$0	\$206	\$206
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	2	mo	200.00				\$400	\$0	\$0	\$0	\$400
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	6	day	1150.00				\$6,900	\$0	\$0	\$0	\$6,900
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	15	day		\$200.00	\$300.00		\$0	\$3,000	\$4,500	\$0	\$7,500
3.10 XRF Rental	1	mo				\$3,500.00	\$0	\$0	\$0	\$3,500	\$3,500
3.11 Site Superintendent	2	mo			\$8,229.76		\$0	\$0	\$16,460	\$0	\$16,460
3.12 Site Health & Safety and QA/QC	2	mo			\$6,827.04		\$0	\$0	\$13,654	\$0	\$13,654
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	2	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$2,200	\$4,050	\$2,800	\$9,050
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		6000.00			\$0	\$6,000	\$0	\$0	\$6,000
4.2 Clear Site, cut & chip trees to 4" diam.	1.5	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$5,400	\$4,425	\$9,825
4.3 Clear Site, grasses & brush	1.5	acre			\$370.00	\$345.00	\$0	\$0	\$555	\$518	\$1,073
4.4 Erosion and Sedimentation Controls	1	ls	8000.00				\$8,000	\$0	\$0	\$0	\$8,000
4.5 Equipment Decon Pad	1	ls		\$7,000.00	\$6,000.00	\$850.00	\$0	\$7,000	\$6,000	\$850	\$13,850
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	2	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$29,181	\$23,139	\$52,320
5.2 Site Labor, (1 laborer)	2	mo			\$6,160.00		\$0	\$0	\$12,320	\$0	\$12,320
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	2	mo			\$11,102.12	\$8,749.44	\$0	\$0	\$22,204	\$17,499	\$39,703
5.4 UXO Technician	2	mo			\$6,827.04		\$0	\$0	\$13,654	\$0	\$13,654
5.5 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.6 Off Site Disposal, Non-Hazardous Soil	2,699	ton	65.00				\$175,435	\$0	\$0	\$0	\$175,435
5.7 Confirmatory Sampling, (lead only, 72 hr TAT)	50	ea	46.00	\$10.00			\$2,300	\$500	\$0	\$0	\$2,800
5.8 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.9 Confirmatory Sampling, (nitroglycerin only, 72 hr TA`	0	ea	230.00	\$10.00			\$0	\$0	\$0	\$0	\$0

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 14 - Marine Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 HAZARDOUS WASTE TREATMENT											
6.1 Hazardous Lead-Contaminated Soil Treatment	2,159	ton	25.00				\$53,975	\$0	\$0	\$0	\$53,975
6.2 Offsite Disposal Soil Testing (TCLP Lead only)	24	ea	150.00	\$10.00			\$3,600	\$240	\$0	\$0	\$3,840
7 SITE RESTORATION											
7.1 Clean backfill	1,212	cy		\$19.60	\$0.53	\$0.34	\$0	\$23,755	\$642	\$412	\$24,810
7.2 Topsoil, Furnish and Place, 6" thickness	3,635	sy		\$5.40	\$0.63	\$0.41	\$0	\$19,629	\$2,290	\$1,490	\$23,409
7.3 Dozer, Crawler, 105 H. P.	2	week			\$2,564.00	\$2,754.00	\$0	\$0	\$5,128	\$5,508	\$10,636
7.4 Fine Grading and seeding, incl. lime, fert, and seed	3,635	sy		\$0.56	\$1.78	\$0.33	\$0	\$2,036	\$6,470	\$1,200	\$9,705
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	100	hr			\$39.00		\$0	\$0	\$3,900	\$0	\$3,900
Subtotal							\$257,110	\$66,320	\$153,278	\$65,527	\$542,235
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$257,110	\$67,381	\$131,819	\$62,971	\$519,282
Overhead on Labor Cost @ 30%									\$39,546		\$39,546
G & A on Labor Cost @ 10%									\$13,182		\$13,182
G & A on Material Cost @ 10%								\$6,738			\$6,738
G & A on Equipment Cost @ 10%										\$6,297	\$6,297
G & A on Subcontract Cost @ 10%							\$25,711				\$25,711
Tax on Materials and Equipment Cost @ 6%								\$4,043		\$3,778	\$7,821
Total Direct Cost							\$282,821	\$78,162	\$184,547	\$73,047	\$618,577
Indirects on Total Direct Cost @ 25%											\$110,785
Profit on Total Direct Cost @ 10%											\$61,858
Subtotal											\$791,220
Health & Safety Monitoring @ 2%											\$15,824
Total Field Cost											\$807,044
Contingency on Total Field Costs @ 20%											\$161,409
Engineering on Total Field Cost @ 6%											\$37,897
TOTAL CAPITAL COST											\$1,006,350

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal -UXO 15 - Old Skeet and Trap Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	100	hr			\$39.00		\$0	\$0	\$3,900	\$0	\$3,900
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$300.00	\$500.00	\$80.00	\$0	\$300	\$500	\$80	\$880
2.2 Soil Sampling (TCLP Lead)	4	ea	150.00	\$10.00			\$600	\$40	\$0	\$0	\$640
2.3 Characterization/Offsite Disposal Soil Testing	4	ea	850.00	\$20.00			\$3,400	\$80	\$0	\$0	\$3,480
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1.5	mo				\$400.00	\$0	\$0	\$0	\$600	\$600
3.2 Field Office Support	1.5	mo		\$200.00			\$0	\$300	\$0	\$0	\$300
3.3 Storage Trailer	1.5	mo				\$103.00	\$0	\$0	\$0	\$155	\$155
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1.5	mo	200.00				\$300	\$0	\$0	\$0	\$300
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	5	day		\$200.00	\$300.00		\$0	\$1,000	\$1,500	\$0	\$2,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	1.5	mo			\$8,229.76		\$0	\$0	\$12,345	\$0	\$12,345
3.12 Site Health & Safety and QA/QC	1.5	mo			\$6,827.04		\$0	\$0	\$10,241	\$0	\$10,241
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	1.5	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$1,650	\$3,038	\$2,100	\$6,788
4 SITE PREPARATION											
4.1 Clear Site, grasses & brush	1	acre			\$370.00	\$345.00	\$0	\$0	\$370	\$345	\$715
4.2 Erosion and Sedimentation Controls	1	ls	2500.00				\$2,500	\$0	\$0	\$0	\$2,500
4.3 Equipment Decon Pad	1	ls		\$2,500.00	\$1,500.00	\$225.00	\$0	\$2,500	\$1,500	\$225	\$4,225
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1.5	mo		\$14,590.40	\$11,569.68		\$0	\$0	\$21,886	\$17,355	\$39,240
5.2 Site Labor, (1 laborer)	1.5	mo		\$6,160.00			\$0	\$0	\$9,240	\$0	\$9,240
5.3 Front End Loader, 3 cy (145HP)	1.5	mo		\$11,102.12	\$8,546.66		\$0	\$0	\$16,653	\$12,820	\$29,473
5.4 UXO Technician	1.5	mo		\$6,827.04			\$0	\$0	\$10,241	\$0	\$10,241
5.5 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.6 Off Site Disposal, Non-Hazardous Soil	4,569	ton	65.00				\$296,985	\$0	\$0	\$0	\$296,985
5.7 Confirmatory Sampling, (lead only, 72 hr TAT)	15	ea	46.00	\$10.00			\$690	\$150	\$0	\$0	\$840
5.8 Confirmatory Sampling, (PAHs only, 72 hr TAT)	20	ea	250.00	\$10.00			\$5,000	\$200	\$0	\$0	\$5,200
5.9 Confirmatory Sampling, (nitroglycerin only, 72 hr TAT)	0	ea	230.00	\$10.00			\$0	\$0	\$0	\$0	\$0

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal -UXO 15 - Old Skeet and Trap Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 HAZARDOUS WASTE TREATMENT											
6.1 Hazardous Lead-Contaminated Soil Treatment	625	ton	25.00				\$15,625	\$0	\$0	\$0	\$15,625
6.2 Offsite Disposal Soil Testing (TCLP Lead only)	7	ea	150.00	\$10.00			\$1,050	\$70	\$0	\$0	\$1,120
7 SITE RESTORATION											
7.1 Clean backfill	2,176	cy		\$19.60	\$0.53	\$0.34	\$0	\$42,650	\$1,153	\$740	\$44,543
7.2 Topsoil, Furnish and Place, 6" thickness	5,404	sy		\$5.40	\$0.63	\$0.41	\$0	\$29,182	\$3,405	\$2,216	\$34,802
7.3 Dozer, Crawler, 105 H. P.	1	week			\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
7.4 Fine Grading and seeding, incl. lime, fert, and seed	5,404	sy		\$0.56	\$1.78	\$0.33	\$0	\$3,026	\$9,619	\$1,783	\$14,429
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	60	hr			\$39.00		\$0	\$0	\$2,340	\$0	\$2,340
Subtotal							\$331,450	\$82,147	\$111,683	\$45,402	\$570,682
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$331,450	\$83,462	\$96,047	\$43,631	\$554,590
Overhead on Labor Cost @ 30%									\$28,814		\$28,814
G & A on Labor Cost @ 10%									\$9,605		\$9,605
G & A on Material Cost @ 10%								\$8,346			\$8,346
G & A on Equipment Cost @ 10%										\$4,363	\$4,363
G & A on Subcontract Cost @ 10%							\$33,145				\$33,145
Tax on Materials and Equipment Cost @ 6%								\$5,008		\$2,618	\$7,626
Total Direct Cost							\$364,595	\$96,816	\$134,466	\$50,612	\$646,489
Indirects on Total Direct Cost @ 25%											\$87,376
Profit on Total Direct Cost @ 10%											\$64,649
Subtotal											\$798,514
Health & Safety Monitoring @ 2%											\$15,970
Total Field Cost											\$814,484
Contingency on Total Field Costs @ 20%											\$162,897
Engineering on Total Field Cost @ 6%											\$31,050
TOTAL CAPITAL COST											\$1,008,431

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 16-Rum Point Skeet Range
Capital Cost

Item	Quantity	Unit	Unit Cost			Extended Cost			Subtotal		
			Subcontract	Material	Labor Equipment	Subcontract	Material	Labor Equipment			
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	80	hr			\$39.00	\$0	\$0	\$3,120	\$0	\$3,120	
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$50.00	\$500.00	\$80.00	\$0	\$50	\$500	\$80	\$630
2.2 Characterization/Offsite Disposal Soil Testing	1	ea	850.00	\$20.00			\$850	\$20	\$0	\$0	\$870
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1	mo				\$400.00	\$0	\$0	\$0	\$400	\$400
3.2 Field Office Support	1	mo		\$200.00			\$0	\$200	\$0	\$0	\$200
3.3 Storage Trailer	1	mo				\$103.00	\$0	\$0	\$0	\$103	\$103
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1	mo	200.00				\$200	\$0	\$0	\$0	\$200
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 Site Superintendent	1	mo			\$8,229.76		\$0	\$0	\$8,230	\$0	\$8,230
3.10 Site Health & Safety and QA/QC	1	mo			\$6,827.04		\$0	\$0	\$6,827	\$0	\$6,827
3.11 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.12 Decontamination Services	1	mo		\$1,100.00	\$2,025.00	\$1,400.00	\$0	\$1,100	\$2,025	\$1,400	\$4,525
4 SITE PREPARATION											
4.1 Clear Site, grasses & brush	1	acre			\$370.00	\$345.00	\$0	\$0	\$370	\$345	\$715
4.2 Erosion and Sedimentation Controls	1	ls	2500.00				\$2,500	\$0	\$0	\$0	\$2,500
4.3 Equipment Decon Pad	1	ls		\$2,500.00	\$1,500.00	\$225.00	\$0	\$2,500	\$1,500	\$225	\$4,225
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1	mo			\$14,590.40	\$11,569.68	\$0	\$0	\$14,590	\$11,570	\$26,160
5.2 Site Labor, (1 laborer)	1	mo			\$6,160.00		\$0	\$0	\$6,160	\$0	\$6,160
5.3 Front End Loader, 3 cy (145HP)	1	mo			\$11,102.12	\$8,546.66	\$0	\$0	\$11,102	\$8,547	\$19,649
5.4 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.5 Off Site Disposal, Non-Hazardous Soil	4,885	ton	65.00				\$317,525	\$0	\$0	\$0	\$317,525
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	0	ea	46.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	15	ea	250.00	\$10.00			\$3,750	\$150	\$0	\$0	\$3,900

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 16-Rum Point Skeet Range
Capital Cost

Item	Quantity	Unit	Unit Cost			Subcontract	Extended Cost			Subtotal
			Material	Labor	Equipment		Material	Labor	Equipment	
6 SITE RESTORATION										
6.1 Clean backfill	2,193	cy	\$19.60	\$0.53	\$0.34	\$0	\$42,983	\$1,162	\$746	\$44,891
6.2 Topsoil, Furnish and Place, 6" thickness	6,580	sy	\$5.40	\$0.63	\$0.41	\$0	\$35,532	\$4,145	\$2,698	\$42,375
6.3 Dozer, Crawler, 105 H. P.	1	week		\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
6.4 Fine Grading and seeding, incl. lime, fert, and seed	6,580	sy	\$0.56	\$1.78	\$0.33	\$0	\$3,685	\$11,712	\$2,171	\$17,569
7 POST CONSTRUCTION COST										
7.1 Contractor Completion Report	40	hr		\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal						\$330,125	\$87,220	\$76,758	\$34,068	\$528,171
Local Area Adjustments						100.0%	101.6%	86.0%	96.1%	
Subtotal						\$330,125	\$88,615	\$66,012	\$32,740	\$517,492
Overhead on Labor Cost @ 30%								\$19,804		\$19,804
G & A on Labor Cost @ 10%								\$6,601		\$6,601
G & A on Material Cost @ 10%							\$8,862			\$8,862
G & A on Equipment Cost @ 10%									\$3,274	\$3,274
G & A on Subcontract Cost @ 10%						\$33,013				\$33,013
Tax on Materials and Equipment Cost @ 6%							\$5,317		\$1,964	\$7,281
Total Direct Cost						\$363,138	\$102,794	\$92,417	\$37,978	\$596,326
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)										\$69,700
Profit on Total Direct Cost @ 10%										\$59,633
Subtotal										\$725,659
Health & Safety Monitoring @ 2% (includes air quality monitoring)										\$14,513
Total Field Cost										\$740,172
Contingency on Total Field Costs @ 20%										\$148,034
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)										\$25,359
TOTAL CAPITAL COST										\$913,565

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 17 - Small Arms (Pistol) Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	120	hr			\$39.00		\$0	\$0	\$4,680	\$0	\$4,680
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$150.00	\$500.00	\$80.00	\$0	\$150	\$500	\$80	\$730
2.2 Soil Sampling (TCLP Lead)	3	ea	150.00	\$10.00			\$450	\$30	\$0	\$0	\$480
2.3 Characterization/Offsite Disposal Soil Testing	2	ea	850.00	\$20.00			\$1,700	\$40	\$0	\$0	\$1,740
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	1	mo				\$400.00	\$0	\$0	\$0	\$400	\$400
3.2 Field Office Support	1	mo		\$200.00			\$0	\$200	\$0	\$0	\$200
3.3 Storage Trailer	1	mo				\$103.00	\$0	\$0	\$0	\$103	\$103
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	1	mo	200.00				\$200	\$0	\$0	\$0	\$200
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	5	day		\$200.00	\$300.00		\$0	\$1,000	\$1,500	\$0	\$2,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	3	week			\$1,870.40		\$0	\$0	\$5,611	\$0	\$5,611
3.12 Site Health & Safety and QA/QC	3	week			\$1,551.60		\$0	\$0	\$4,655	\$0	\$4,655
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	3	week		\$275.00	\$506.25	\$350.00	\$0	\$825	\$1,519	\$1,050	\$3,394
4 SITE PREPARATION											
4.1 Clear Site, cut & chip trees	0.2	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$720	\$590	\$1,310
4.2 Clear Site, grasses & brush	0.3	acre			\$370.00	\$345.00	\$0	\$0	\$111	\$104	\$215
4.3 Erosion and Sedimentation Controls	1	ls	1000.00				\$1,000	\$0	\$0	\$0	\$1,000
4.4 Equipment Decon Pad	1	ls		\$1,500.00	\$1,000.00	\$200.00	\$0	\$1,500	\$1,000	\$200	\$2,700
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	3	week			\$3,316.00	\$3,236.00	\$0	\$0	\$9,948	\$9,708	\$19,656
5.2 Site Labor, (1 laborer)	3	week			\$1,400.00		\$0	\$0	\$4,200	\$0	\$4,200
5.3 Front End Loader, 3 cy (145HP)	3	week			\$2,564.00	\$2,362.00	\$0	\$0	\$7,692	\$7,086	\$14,778
5.4 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.5 Off Site Disposal, Non-Hazardous Soil	763	ton	65.00				\$49,595	\$0	\$0	\$0	\$49,595
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	10	ea	46.00	\$10.00			\$460	\$100	\$0	\$0	\$560
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0
5.8 Confirmatory Sampling, (nitroglycerin only, 72 hr TA	10	ea	230.00	\$10.00			\$2,300	\$100	\$0	\$0	\$2,400

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal - UXO 17 - Small Arms (Pistol) Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
6 HAZARDOUS WASTE TREATMENT											
6.1 Hazardous Lead-Contaminated Soil Treatment	212	ton	25.00				\$5,300	\$0	\$0	\$0	\$5,300
6.2 Offsite Disposal Soil Testing (TCLP Lead only)	3	ea	150.00	\$10.00			\$450	\$30	\$0	\$0	\$480
7 SITE RESTORATION											
7.1 Clean backfill	338	cy		\$19.60	\$0.53	\$0.34	\$0	\$6,625	\$179	\$115	\$6,919
7.2 Topsoil, Furnish and Place, 6" thickness	1,460	sy		\$5.40	\$0.63	\$0.41	\$0	\$7,884	\$920	\$599	\$9,402
7.3 Dozer, Crawler, 105 H. P.	3	day			\$512.80	\$751.80	\$0	\$0	\$1,538	\$2,255	\$3,794
7.4 Fine Grading and seeding, incl. lime, fert, and seed	1,460	sy		\$0.56	\$1.78	\$0.33	\$0	\$818	\$2,599	\$482	\$3,898
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	40	hr			\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal							\$66,755	\$20,301	\$50,122	\$27,001	\$164,180
Local Area Adjustments							100.0%	101.6%	86.0%	96.1%	
Subtotal							\$66,755	\$20,626	\$43,105	\$25,948	\$156,434
Overhead on Labor Cost @ 30%									\$12,931		\$12,931
G & A on Labor Cost @ 10%									\$4,310		\$4,310
G & A on Material Cost @ 10%								\$2,063			\$2,063
G & A on Equipment Cost @ 10%										\$2,595	\$2,595
G & A on Subcontract Cost @ 10%							\$6,676				\$6,676
Tax on Materials and Equipment Cost @ 6%								\$1,238		\$1,557	\$2,794
Total Direct Cost							\$73,431	\$23,926	\$60,347	\$30,100	\$187,804
Indirects on Total Direct Cost @ 25%							(excluding transportation and disposal cost)				\$34,412
Profit on Total Direct Cost @ 10%											\$18,780
Subtotal											\$240,996
Health & Safety Monitoring @ 2%							(includes air quality monitoring)				\$4,820
Total Field Cost											\$245,816
Contingency on Total Field Costs @ 20%											\$49,163
Engineering on Total Field Cost @ 6%							(excluding transportation and disposal cost)				\$11,740
TOTAL CAPITAL COST											\$306,719

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal- UXO 25 - Roach Road Rifle Range
Capital Cost

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Documents & Plans	60	hr			\$39.00		\$0	\$0	\$2,340	\$0	\$2,340
2 INITIAL CHARACTERIZATION											
2.1 Sample Collection (2 persons for 1 day)	1	ls		\$300.00	\$600.00	\$100.00	\$0	\$300	\$600	\$100	\$1,000
2.2 Soil Sampling (TCLP Lead)	1	ea	150.00	\$10.00			\$150	\$10	\$0	\$0	\$160
2.3 Characterization/Offsite Disposal Soil Testing	1	ea	850.00	\$20.00			\$850	\$20	\$0	\$0	\$870
3 MOBILIZATION, DEMOBILIZATION AND FIELD SUPPORT											
3.1 Office Trailer	0.5	mo				\$400.00	\$0	\$0	\$0	\$200	\$200
3.2 Field Office Support	0.5	mo		\$200.00			\$0	\$100	\$0	\$0	\$100
3.3 Storage Trailer	0.5	mo				\$103.00	\$0	\$0	\$0	\$52	\$52
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.5 Site Utilities	0.5	mo	200.00				\$100	\$0	\$0	\$0	\$100
3.6 Underground Utility Clearances	1	ls	1500.00				\$1,500	\$0	\$0	\$0	\$1,500
3.7 Construction Survey Support	2	day	1150.00				\$2,300	\$0	\$0	\$0	\$2,300
3.8 Equipment Mobilization/Demobilization	5	ea			\$188.00	\$566.00	\$0	\$0	\$940	\$2,830	\$3,770
3.9 XRF Scientist	3	day		\$200.00	\$300.00		\$0	\$600	\$900	\$0	\$1,500
3.10 XRF Rental	1	week				\$1,200.00	\$0	\$0	\$0	\$1,200	\$1,200
3.11 Site Superintendent	1	week			\$1,870.40		\$0	\$0	\$1,870	\$0	\$1,870
3.12 Site Health & Safety and QA/QC	1	week			\$1,551.60		\$0	\$0	\$1,552	\$0	\$1,552
3.13 Materials Storage Pad, 25' X 25'	1	ls		\$1,000.00	\$250.00	\$200.00	\$0	\$1,000	\$250	\$200	\$1,450
3.14 Decontamination Services	1	week		\$275.00	\$506.25	\$350.00	\$0	\$275	\$506	\$350	\$1,131
4 SITE PREPARATION											
4.1 Temporary Access Roads, 4" gravel, geotextile	1	ls		2000.00			\$0	\$2,000	\$0	\$0	\$2,000
4.2 Clear Site, cut & chip trees to 4" diam.	0.3	acre			\$3,600.00	\$2,950.00	\$0	\$0	\$1,080	\$885	\$1,965
4.3 Clear Site, grasses & brush	0.2	acre			\$370.00	\$345.00	\$0	\$0	\$74	\$69	\$143
4.4 Erosion and Sedimentation Controls	1	ls	1000.00				\$1,000	\$0	\$0	\$0	\$1,000
4.5 Equipment Decon Pad	1	ls		\$1,500.00	\$1,000.00	\$200.00	\$0	\$1,500	\$1,000	\$200	\$2,700
5 EXCAVATION AND DISPOSAL											
5.1 Excavator, 3/4cy Capacity	1	week			\$3,316.00	\$3,236.00	\$0	\$0	\$3,316	\$3,236	\$6,552
5.2 Site Labor, (1 laborer)	1	week			\$1,400.00		\$0	\$0	\$1,400	\$0	\$1,400
5.3 Crawler Loader 1 to 1-1/2 cy (80HP)	1	week			\$2,564.00	\$2,443.00	\$0	\$0	\$2,564	\$2,443	\$5,007
5.4 Off Site Disposal, Hazardous for Lead	0	ton	325.00				\$0	\$0	\$0	\$0	\$0
5.5 Off Site Disposal, Non-Hazardous Soil	65	ton	65.00				\$4,225	\$0	\$0	\$0	\$4,225
5.6 Confirmatory Sampling, (lead only, 72 hr TAT)	5	ea	46.00	\$10.00			\$230	\$50	\$0	\$0	\$280
5.7 Confirmatory Sampling, (PAHs only, 72 hr TAT)	0	ea	250.00	\$10.00			\$0	\$0	\$0	\$0	\$0
6 HAZARDOUS WASTE TREATMENT											
6.1 Hazardous Lead-Contaminated Soil Treatment	52	ton	25.00				\$1,300	\$0	\$0	\$0	\$1,300
6.2 Offsite Disposal Soil Testing (TCLP Lead only)	1	ea	150.00	\$10.00			\$150	\$10	\$0	\$0	\$160

NSF INDIAN HEAD STUMP NECK ANNEX
INDIAN HEAD, MARYLAND
FIVE SMALL ARMS/SKEET RANGES
Alternative 3: Treatment, Excavation, and Off-Site Disposal- UXO 25 - Roach Road Rifle Range
Capital Cost

Item	Quantity	Unit	Unit Cost			Subcontract	Extended Cost			Subtotal
			Material	Labor	Equipment		Material	Labor	Equipment	
7 SITE RESTORATION										
7.1 Clean backfill	30	cy	\$19.60	\$0.53	\$0.34	\$0	\$588	\$16	\$10	\$614
7.2 Topsoil, Furnish and Place, 6" thickness	88	sy	\$5.40	\$0.63	\$0.41	\$0	\$475	\$55	\$36	\$567
7.3 Dozer, Crawler 105 H. P.	1	week		\$2,564.00	\$2,754.00	\$0	\$0	\$2,564	\$2,754	\$5,318
7.4 Fine Grading and seeding, incl. lime, fert, and seed	88	sy	\$0.56	\$1.78	\$0.33	\$0	\$49	\$157	\$29	\$235
8 POST CONSTRUCTION COST										
8.1 Contractor Completion Report	40	hr		\$39.00		\$0	\$0	\$1,560	\$0	\$1,560
Subtotal						\$13,305	\$6,977	\$22,744	\$14,594	\$57,621
Local Area Adjustments						100.0%	101.6%	86.0%	96.1%	
Subtotal						\$13,305	\$7,089	\$19,560	\$14,025	\$53,979
Overhead on Labor Cost @ 30%								\$5,868		\$5,868
G & A on Labor Cost @ 10%								\$1,956		\$1,956
G & A on Material Cost @ 10%							\$709			\$709
G & A on Equipment Cost @ 10%									\$1,402	\$1,402
G & A on Subcontract Cost @ 10%						\$1,331				\$1,331
Tax on Materials and Equipment Cost @ 6%							\$425		\$841	\$1,267
Total Direct Cost						\$14,636	\$8,223	\$27,384	\$16,269	\$66,512
Indirects on Total Direct Cost @ 25% (excluding transportation and disposal cost)										\$15,572
Profit on Total Direct Cost @ 10%										\$6,651
Subtotal										\$88,734
Health & Safety Monitoring @ 2% (includes air quality monitoring)										\$1,775
Total Field Cost										\$90,509
Contingency on Total Field Costs @ 20%										\$18,102
Engineering on Total Field Cost @ 6% (excluding transportation and disposal cost)										\$5,177
TOTAL CAPITAL COST										\$113,788