

FINAL

ENGINEERING EVALUATION/COST  
ANALYSIS (EE/CA)  
LAND USE CONTROLS

**FORT BELVOIR**

MILITARY MUNITIONS RESPONSE  
PROGRAM

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*Prepared for*

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## LIST OF ACRONYMS AND ABBREVIATIONS

AEDB-R	Army Environmental Database-Restoration
AM	Action Memorandum
AMSL	Above Mean Sea Level
AR	Army Regulation
BRAC	Base Realignment And Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Constituents of Concern
CSM	Conceptual Site Model
CTT	Closed, Transferring, and Transferred
DERP	Defense Environmental Restoration Program
DF	Draft Final
DMM	Discarded Military Munitions
DoD	Department of Defense
DPW	Directorate of Public Works
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
FS	Feasibility Study
FY	Fiscal Year
HRR	Historical Records Review
IC	Institutional Control
IMCOM	Installation Management Command
INRMP	Integrated Natural Resource Management Plan
LUC	Land Use Control
LUCP	Land Use Control Plan
LUR	Land Use Restriction
MC	Munitions Constituents
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MRSP	Munitions Response Site Prioritization Protocol
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
NPV	Net present value
NTCRA	Non-Time Critical Removal Action
O&M	Operations and Maintenance
OE	Ordnance and explosives (terminology replaced by “MEC”)
OSWER	Office of Solid Waste and Emergency Response

PA	Preliminary Assessment
RACER	Remedial Action Cost Engineering and Requirements ( <i>cost estimating software</i> )
RDX	Cyclotrimethylene trinitramine
REC	Record of Environmental Consideration
RI	Remedial Investigation
ROD	Record of Decision
SDZ	Surface Danger Zone
SI	Site Inspection
SL	Screening Level
SWMU	Solid Waste Management Unit
TNT	Trinitrotoluene
TPP	Technical Project Planning
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance
VADEQ	Virginia Department of Environmental Quality

## GLOSSARY OF TERMS

**Closed Range** – A military range that has been taken out of service as a range and that either has been put to new uses that are incompatible with range activities, or is not considered by the military to be a potential range area. A closed range is still under the control of a Department of Defense (DoD) component.

**Defense Site** – All locations that were owned by, leased to, or otherwise possessed or used by the DoD. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions.

**Discarded Military Munitions (DMM)** – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded explosive ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations. (10 U.S. Code [U.S.C.] 2710(e)(2)).

**Engineering Evaluation/Cost Analysis (EE/CA)** – An EE/CA is prepared for all non-time-critical removal actions as required by Section 300.415(b)(4)(i) of the National Contingency Plan. The goals of the EE/CA are to identify the extent of a hazard, to identify the objectives of the removal action, and to analyze the various alternatives that may be used to satisfy these objectives for cost, effectiveness, and implementability. (EP 75-1-3; citation taken from EM 1110-1-4009, *Engineering and Design: Military Munitions Response Actions*, [USACE, June 2007]).

**Explosive Ordnance Disposal (EOD)** – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance by a military response unit. It may also include explosive ordnance that has become hazardous by damage or deterioration.

**Explosives Safety** – A condition where operational capability and readiness, personnel, property, and the environment are protected from unacceptable effects of an ammunition or explosives mishap.

**Land Use Controls (LUCs)** – Physical, legal, or administrative mechanisms that restrict the use of, or limit access to, contaminated property to reduce risk to human health and the environment. Physical mechanisms encompass a variety of engineered remedies to contain or reduce contamination and physical barriers to limit access to property, such as fences or signs. The legal mechanisms are generally the same as those used for institutional controls (ICs) as discussed in the National Contingency Plan. ICs are a subset of LUCs and are primarily legal mechanisms imposed to ensure the continued effectiveness of land use restrictions imposed as part of a remedial decision. Legal mechanisms include restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions. (“DoD Management Guidance for the DERP,” citation taken from EM 1110-1-4009, *Engineering and Design: Military Munitions Response Actions*, [USACE, June 2007]).

**Military Munitions** – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the U.S. Coast Guard, the Department of Energy, and the Army National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, except that the term does include non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under 42 U.S.C. 2011 (Atomic Energy Act) have been completed. (10 U.S.C. 2710(e)(3)(A) and (B)).

**Military Range** – “Active range” and “inactive range” as these terms are defined in 40 CFR §226.201.

**Munitions and Explosives of Concern (MEC)** – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means unexploded ordnance, DMM, or munitions constituents (e.g., trinitrotoluene [TNT] or cyclotrimethylenetrinitramine [RDX]) present in high enough concentrations to pose an explosive hazard.

**Munitions Constituents (MC)** – Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 U.S.C. 2710).

**Munitions Debris (MD)** – Remnants of munitions (e.g. fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

**Non-Time Critical Removal Actions** – Actions initiated in response to a release or threat of a release that poses a risk to human health, its welfare, or the environment. Initiation of removal cleanup actions may be delayed for 6 months or more (40 CFR § 300.415).

**Operational Range** – A range that is under jurisdiction, custody, or control of the Secretary of Defense and that is used for range activities or, although not currently being used for range activities, is still considered by the Secretary to be a range and has not been put to new use incompatible with range activities. (10 U.S.C. 101(e)(3)(A) and (B)). Also includes “military range,” “active range,” and “inactive range” as those terms are defined in 40 CFR 266.201.

**Other than Operational Range** – Includes all property under jurisdiction, custody, or control of the Secretary of Defense that is not defined as an Operational Range.

**Range** – A designated land or water area that is set aside, managed, and used for DoD range activities such as:

- (A) Firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas.

- (B) Airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration (10 U.S.C. 101(e)(5)).

**Removal Action** – The cleanup or removal of released hazardous substances from the environment. Such actions may be taken in the event of the threat of release of hazardous substances into the environment and/or may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. In addition, the term includes, but is not limited to, security fencing or other measures to limit access, provision of alternative water supplies, and temporary evacuation and housing of threatened individuals not otherwise provided for (42 U.S.C. 5121 et seq.). The requirements for removal actions are addressed in 40 CFR §§300.410 and 330.415. The three types of removal are emergency, time-critical, and non-time-critical removals. (“DoD Management Guidance for the DERP,” citation taken from EM 1110-1-4009, *Engineering and Design: Military Munitions Response Actions*, [USACE, June 2007]).

**Time-Critical Removal Action** – A response to a release or threat of release that poses such a risk to public health (serious injury or death), or the environment, that clean up or stabilization actions must be initiated within 6 months.

**Unexploded Ordnance (UXO)** – UXO are military munitions that:

- (A) Have been primed, fused, armed, or otherwise prepared for action.
- (B) Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or materiel.
- (C) Remain unexploded, whether by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)).

## EXECUTIVE SUMMARY

The Army is establishing land use controls (LUCs) at installations within the Military Munitions Response Program (MMRP) to protect human health from potential hazards at Munitions Response Sites (MRSs) as an interim action while the sites progress to a final remedy. The MMRP addresses Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) within the framework of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. §§. 9601 et seq.). The LUCs considered under this phase of the MMRP are interim or non-time critical removal actions (NTCRA) that are required because the conditions at the site support a NTCRA according to 40 CFR 300.415(b)(2)(vi), including but not limited to the “threat of fire or explosion”.

Fort Belvoir is conducting its MMRP and has nine on-post MRSs where further actions are pending, as documented in the *Final Site Inspection Report, Fort Belvoir, Fairfax County, VA* (2008). These MRSs are eligible for LUCs as an interim action while their CERCLA responses continue.

This Engineering Evaluation/Cost Analysis (EE/CA) is a required step (along with an Action Memorandum [AM] and public involvement activities) in implementing the LUCs as a NTCRA at Fort Belvoir. This is a streamlined EE/CA that summarizes MRS information and comparatively evaluates LUCs against a No Action alternative. The EE/CA has a focused purpose and is not intended to result in a final remedy at Fort Belvoir. The nine MRSs at Fort Belvoir are at various stages of investigation, ranging from Remedial Investigations to completion, although decision documents have not been developed for any of them. A final remedy selection is anticipated to be complete for all sites by 2016.

Following the EE/CA, the Army will prepare an AM and finalize a Land Use Control Plan (LUCP) to guide the implementation of LUCs as a NTCRA.

### E.1 AGENCIES INVOLVED

The U.S. Army is the executing agency for the MMRP. The U.S. Environmental Protection Agency (USEPA) and the Virginia Department of Environmental Quality (VADEQ) are regulatory stakeholders for the Fort Belvoir. The installation is not on the National Priorities List (NPL) under CERCLA. The Army operates as the lead agency, and all MMRP cleanup is completed under CERCLA. The facility has a RCRA Part B Hazardous Waste Permit that applies to numerous Solid Waste Management Units (SWMUs) on the main post, which includes some former range areas covered by the MMRP. The installation has been assigned the Federal Facility Identification Number VA5210020082.

### E.2 DESCRIPTION OF MRSs

The *Closed, Transferring and Transferred (CTT) Range Inventory Report for Fort Belvoir* (Malcolm Pirnie, 2002) first identified 21 MRSs at Fort Belvoir, and determined that these were eligible for the MMRP based on preliminary information. A detailed review of the MRSs was made in the *Site Inspection (SI)* (USACE, 2008); during this review, two of the MRSs were split up into two parts (total of 23), and two other MRSs were combined into one (total of 22). Out of these 22 MRSs, twelve MRSs were identified as no further action (NFA), leaving ten MRSs that moved on to the RI/FS stage. Of these ten at the RI/FS stage, two were transferred, and eight

were left on-post and eligible for the MMRP LUCs. Since completion of the SI, training mines have been discovered at one MRS (the Mines and Booby Traps Area) that initially received an NFA determination, bringing it back into eligibility for MMRP LUCs. All together, nine MRSs will be addressed in this document. The SI is the primary basis for the site history provided in this report and in Table ES-1, and is supplemented with other newer documentation as necessary.

**Table ES-1: On-Post MRSs at Fort Belvoir**

MRS Name	AEDB-R No.	Acres	MEC Present?	MC Present?	MRSPP Score
Infiltration Course	FTBL-001-R-02	5	No	Yes	6
Combat Range Complex	FTBL-003-R-01	320	Yes	Yes*	4
Fort Belvoir North Area (formerly EPG)	FTBL-005-R-01	807	Yes	Yes	3
Grenade Court	FTBL-007-R-01	100	No	Yes	5
Tracy Road Range	FTBL-014-R-01	33	No	Yes (lead)	6
Demolition Area – 01	FTBL-018-R-01	420	Yes	No	3
Booby Trap Site	FTBL-024-R-01	13	Yes	No	6
Mines and Booby Traps Area	FTBL-026-R-01	110	Yes	No	**
T-16 Range	FTBL-027-R-01	232	Yes	No	5

\* = MC is only a concern in a limited portion of this site, not the whole MRS

\*\* = An MRSPP score has not yet been determined for this MRS

AEDB-R – Army Environmental Database - Restoration

MRSPP – Military Response Site Prioritization Protocol

The NTCRA LUCs presented here are intended to limit the risk posed by exposure to MEC and MC at these MRSs while further investigation and response actions are being implemented under CERCLA.

### E.3 REMOVAL ACTION OBJECTIVE

The objective of the NTCRA is to protect human health by minimizing exposure to MEC and MC, including but not limited to the potential for fire and explosion, at on-post MRSs while further response actions at the sites are evaluated and implemented.

### E.4 EVALUATION OF ALTERNATIVES

This EE/CA is focused on two alternatives—No Action and LUCs—for addressing the risks at on-post MRSs during the interim while the MMRP progresses and more permanent actions are investigated and implemented. The No Action alternative assumes that no additional steps will be taken to mitigate, monitor, or document the potential risks, though it does not remove existing controls at the MRSs. The LUCs alternative considered for Fort Belvoir involves a combination of Institutional Controls (ICs, including land use restrictions, notations in the Installation Master Plan, and dig permits) and Engineering Controls (including signs, markers, fences, and guards). These measures are considered and applied to all MRSs at Fort Belvoir and changed as necessary

to address individual MRS details. The LUCs alternative evaluated for this EE/CA is the combined set of LUCs selected for each MRS.

In this NTCRA, the No Action and LUCs alternatives are evaluated against the CERCLA criteria of effectiveness, implementability, and cost. The EE/CA evaluation determined that the LUCs alternative at Fort Belvoir could be implemented and would effectively meet the removal action objective.

## **E.5 RESIDUAL RISK MANAGEMENT**

The LUCs will reduce the probability of direct contact with the MEC or MC, and will thus reduce the exposure and explosive risk to humans at the MRSs.

However, no action will be taken with this NTCRA to remove or remediate the MEC and MC at the nine MRSs addressed at Fort Belvoir. Therefore, residual risk from the MEC and MC will remain on site. The LUCs alternative is a NTCRA and is not intended to be permanent or to replace the need for the more permanent solutions developed under the MMRP.

## **E.6 COSTS OF NO ACTION AND LUCs ALTERNATIVES**

The cost estimates for the LUCs alternative at Fort Belvoir were developed as shown in Appendix B. The cost summaries for the No Action and LUCs alternatives are shown in Table ES-2. As shown in Table ES-2, the No Action alternative will incur no additional cost because no action, reviews, or other activities are conducted. NTCRA LUCs will incur capital and operating costs in the short term while the full response action is developed and implemented for each MRSs in the MMRP.

**Table ES-2: Cost Summary of NTCRA Alternatives (cost in \$1,000s)**

Alternative	MRS	Area (Acres)	Capital Cost	Annual Operating Cost	O&M Years	Present Value
<b>Alternative 1 – No Action</b>						
Infiltration Course		5	\$ 0	\$ 0	NA	\$ 0
Combat Range Complex		320	\$ 0	\$ 0	NA	\$ 0
Fort Belvoir North Area (formerly EPG)		807	\$ 0	\$ 0	NA	\$ 0
Grenade Court		100	\$ 0	\$ 0	NA	\$ 0
Tracy Road Range		33	\$ 0	\$ 0	NA	\$ 0
Demolition Area – 01		420	\$ 0	\$ 0	NA	\$ 0
Booby Trap Site		13	\$ 0	\$ 0	NA	\$ 0
Mines and Booby Traps Area		110	\$ 0	\$ 0	NA	\$ 0
T-16 Range		232	\$ 0	\$ 0	NA	\$ 0
<b>Summary – all MRSs</b>		<b>2,040</b>	<b>\$ 0</b>	<b>\$ 0</b>	<b>NA</b>	<b>\$ 0</b>
<b>Alternative 2 – LUCs</b>						
Infiltration Course		5	\$ 6.8	\$ 1.9	4	\$ 12.1
Combat Range Complex		320	\$ 14.9	\$ 3.7	4	\$ 25.3
Fort Belvoir North Area (formerly EPG)		807	\$ 19.3	\$ 4.1	4	\$ 31.1
Grenade Court		100	\$ 9.8	\$ 2.2	4	\$ 16.0
Tracy Road Range		33	\$ 8.1	\$ 2.0	4	\$ 13.7
Demolition Area – 01		420	\$ 15.8	\$ 3.8	4	\$ 26.5
Booby Trap Site		13	\$ 8.8	\$ 3.1	4	\$ 17.5
Mines and Booby Traps Area		110	\$ 12.6	\$ 3.5	4	\$ 22.5
T-16 Range		232	\$ 13.8	\$ 3.6	4	\$ 24.0
<b>Summary – all MRSs</b>		<b>2,040</b>	<b>\$ 110.08</b>	<b>\$ 27.7</b>	<b>4</b>	<b>\$ 188.7</b>

Note: A 4-year period with a 2.75% discount rate is used for economic projections

NA – not applicable

O&M – operations and maintenance

The NTCRA LUC cost estimates cover new requirements and have not yet been incorporated into the Installation Action Plan, outyear budget, or Army Environmental Database - Restoration (AEDB-R). They are of a form and detail that should allow their incorporation, though that will be done after completion of this EE/CA.

## E.7 RECOMMENDED ALTERNATIVE

Alternative 1, No Action, is not capable of meeting the removal action objective of protecting human health from exposure to potential MEC and MC. LUCs (Alternative 2) is capable of meeting this objective, is feasible to implement, and incurs a reasonable cost beyond that of No Action. On the basis of this evaluation, it is recommended that the LUCs alternative be implemented at the nine Fort Belvoir MRSs.

## 1.0 OVERVIEW

### 1.1 REGULATORY FRAMEWORK/AUTHORIZATION

The Military Munitions Response Program (MMRP) is conducted under the Defense Environmental Restoration Program (DERP) to address Department of Defense (DoD) sites with unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations. In general, the MMRP follows the process established for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 U.S.C. §§. 9601 et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR § 300).

The Army began performing MMRP site inspections (SIs) in Fiscal Year 2003 (FY2003) and completed them nationwide by the end of FY2010. For various reasons, it may be years before most of the sites proceed beyond the SI. Due to the potential hazards posed by the possible presence of Munitions and Explosives of Concern (MEC) (which include UXO, DMM, and MC in sufficiently high concentrations to pose an explosive hazard), there is the potential for harm if appropriate controls are not maintained. Both the CERCLA and the DoD Ammunition and Explosives Safety Standards (DoD 6055.09) require the Army to prohibit unnecessary access to such sites and take appropriate actions to reduce the threat to public health or welfare.

To address the explosive hazards and the risks from MEC and MC at active installations and to meet the requirements in the *FY2010 Program Management Plan for the Active Sites Cleanup Program*, the U.S. Army Environmental Command (USAEC) is assisting installations in preparing and implementing Land Use Controls (LUCs) for their on-post munitions response sites (MRSs). Only Army-owned MRSs that are recommended for further action beyond the SI phase are included in this requirement. Sites with a no further action recommendation and MRSs located off Army-owned land will not be addressed in this action, although they are still being addressed as appropriate under the MMRP.

LUCs are considered a CERCLA response action, and as such, they must be applied via either a removal action (i.e., a non-time critical removal action [NTCRA]) or a remedial action. Because these LUCs are an interim action (not a final action) for each MRS, a NTCRA is the appropriate mechanism to implement them. A NTCRA requires the preparation and coordination with stakeholders of an Engineering Evaluation/Cost Analysis (EE/CA) and an Action Memorandum (AM), along with the required public involvement actions. This document is the EE/CA for Fort Belvoir, in accordance with the NCP (40 CFR 300.415(b)(4)(i)).

### 1.2 INSTALLATION DESCRIPTION

Fort Belvoir is located in Fairfax County, Virginia (Figure 1-1). It is approximately 18 miles southeast of Washington, D.C., approximately 95 miles north of Richmond, VA, and includes 8,658 acres along the Potomac River. The primary mission of this installation is to provide administrative support to the National Capital Region, but also supports over 100 satellite organizations to facilitate mobilization requirements, military operations, and contingency/force protection missions. Other organizations housed at the installation include two Major Army Command (MACOM) headquarters, 26 DoD agencies, 8 elements of the US Army Reserve and Army National Guard, and 19 agencies and direct reporting units of the Department of the Army. It is managed directly by Installation Management Command (IMCOM) Headquarters.



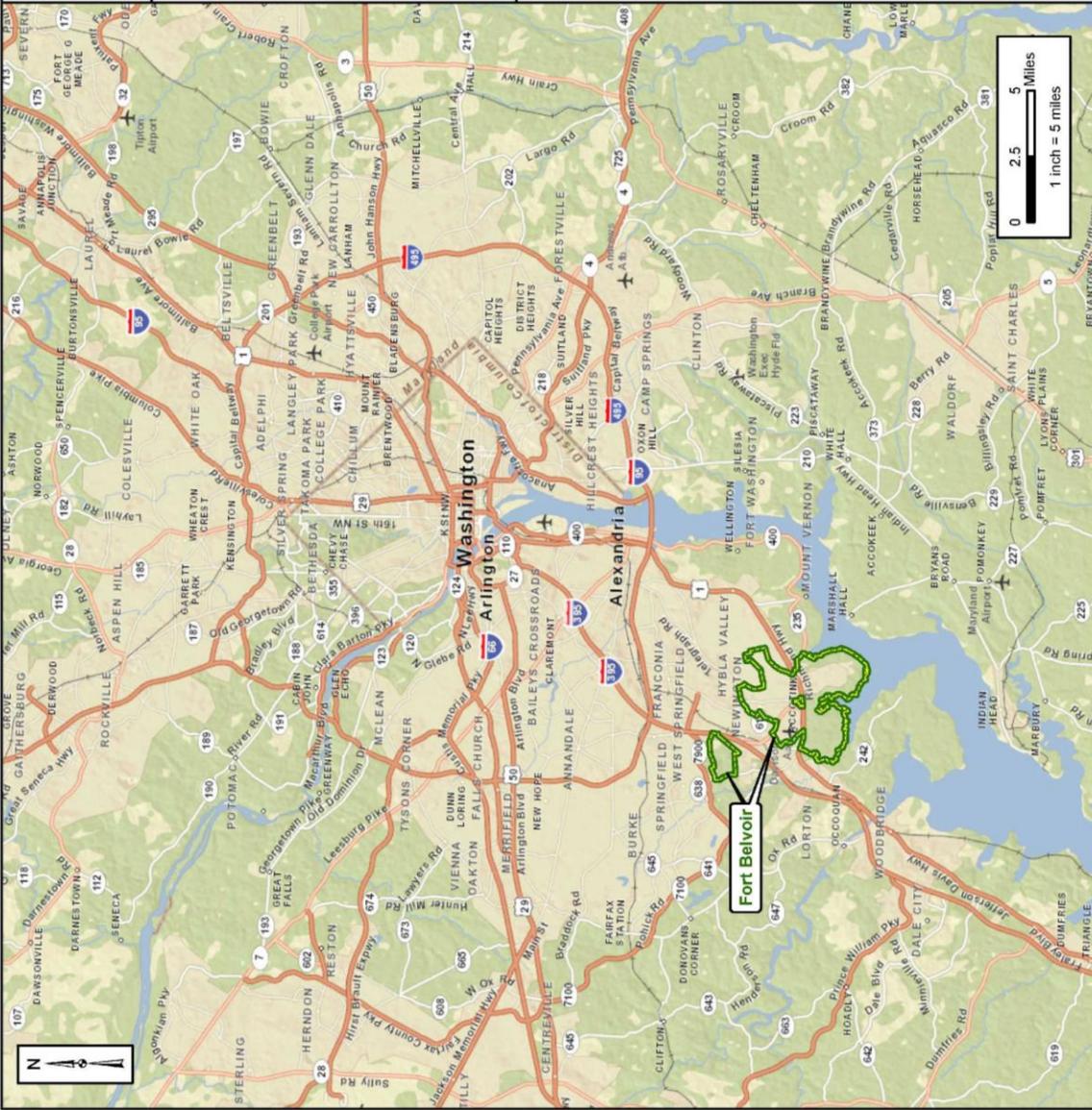
**Legend**

 Fort Belvoir Installation Boundary

Data Source: The DISDI Program, 2010  
 Street Map: ESRI Street Maps 9.3, North America



**Figure 1-1**  
**Fort Belvoir Installation Location Map**  
 Fort Belvoir, VA



### **1.3 MMRP INVESTIGATIONS TO DATE**

The MMRP SI at Fort Belvoir was completed in 2008. The SI process began with 21 MRSs that had been identified for the installation by the *Final Historical Records Review* (HRR; USACE, 2006) as being MMRP eligible, although two MRSs were later split due to differences in the necessary treatment of the sites (Demolition Area to 01 and 02, and Small Arms Range Complex and Infiltration Course). Additionally, two other MRSs were combined due to contiguous borders and similar historical uses. A total of ten moved on to the RI/FS stage at that time, eight of which were on-post and eligible for the MMRP LUCs. After completion of the document, one MRS (the Mines and Booby Traps Area) that had been designated NFA was brought back into the process, due to a hunter discovering training mines. Therefore, nine MRSs will be addressed in this EE/CA. A Remedial Investigation/ Feasibility Study (RI/FS) has either been completed, is in progress, or is planned for all nine of these MRSs (with varied objectives depending on the MRS), and a final remedy selection is anticipated in 2016.

### **1.4 PURPOSE AND SCOPE OF EE/CA**

The purpose of this EE/CA is to evaluate two alternatives—No Action and LUCs—for their mitigation of potential risks posed at on-post MRSs to human health. The evaluation is conducted in accordance with CERCLA and NCP requirements for NTCRAs, and covers the factors of effectiveness, implementability, and cost.

### **1.5 TECHNICAL PROJECT PLANNING (TPP) PROCESS**

The Technical Project Planning (TPP) process<sup>1</sup> has been used to date in the MMRP CERCLA activities at Fort Belvoir. Previous TPP meetings were held at the initiation of the RI process in 2009. The TPP will be used for this NTCRA to establish project objectives and communicate with stakeholders. A TPP meeting was held on March 30, 2012 to begin the process of communication regarding the current NTCRA LUCs project.

### **1.6 SUMMARY OF PUBLIC PARTICIPATION**

This EE/CA is prepared in Draft, Draft Final and Final versions. The Draft EE/CA is for Army-only review. The Draft Final EE/CA is for review by regulatory agencies (the U.S. Environmental Protection Agency [USEPA] and the Virginia Department of Environmental Quality [VADEQ]). The Final EE/CA will incorporate preceding comments and will have Army approval and regulatory stakeholder concurrence.

The Final EE/CA will be made available to the public for their review and comment. Public notification of the Final EE/CA will be printed in the Fairfax Times, the Washington Post, and the Mt. Vernon Voice when the document is ready for review, with the offer to present the EE/CA and its recommendations at a public meeting. The public meeting will be conducted only if requested. At the end of the 30-day public comment period, public comments on the Final

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<sup>1</sup> The four-phase TPP process is described in *EM 200-1-2 (Engineering Manual 200-1-2: Technical Project Planning Process*, U.S. Army Corps of Engineers [USACE], August 1998). The TPP team involves key decision-makers, including installation representatives, the USACE project manager, regulators, and other stakeholders. Their participation helps define the information needed to make decisions at the MRS, keeps them informed, and allows better buy-in to the process.

EE/CA will be addressed in the AM under its Section V, “Proposed Actions and Estimated Costs” and in an attached responsiveness summary. The Final EE/CA and AM will become part of the administrative record for the project, in accordance with 40 CFR § 300.800.

## 1.7 APPLICABLE REPORTS AND STUDIES

The MRSs at Fort Belvoir have been identified and inspected in the following reports:

- US Army Garrison Fort Belvoir, 2001a. Environmental and Natural Resource Division, Directorate of Installation Support. *Integrated Natural Resources Management Plan (INRMP)*. Prepared by Horne Engineering Services, Inc.
- US Army Garrison Fort Belvoir, 2001b. Environmental and Natural Resource Division, Directorate of Installation Support. *Environmental Assessment: Implementation of an Integrated Natural Resources Management Plan (INRMP)*, Fort Belvoir, Virginia. Prepared by Horne Engineering Services, Inc.
- US Army Garrison Fort Belvoir, 2007. *Decision Document: Solid Waste Management Unit (SWMU) M-26 Hydrocarbon Spill Area and Former Aboveground Test Tank Site (FATTS)*. Engineer Proving Ground, Fort Belvoir, Virginia.
- US Army Garrison Fort Belvoir, 2006. *Decision Document: Solid Waste Management Unit M-27 Waste Ordnance Pits at Range 1. Final Document*. Fort Belvoir, Virginia, April 2006.
- Malcolm Pirnie, 2002, *Closed, Transferring and Transferred Range/Site Inventory Report for Fort Belvoir*, September 2002.
- USACE, 2006, *Final Historical Records Review, Fort Belvoir*, prepared by Malcolm Pirnie for USACE.
- USACE, 2008, *Final Site Inspection Report, Fort Belvoir, Fairfax County, VA*, prepared by Malcolm Pirnie for USACE, January 2008.
- USACE, 2011, *Fort Belvoir Military Munitions Response Program, Remedial Investigation Report for T-16 Range, Final Document*, prepared by Shaw Environmental, Inc. for USACE, July 2011.
- USACE, 2012, *Fort Belvoir Military Munitions Response Program, Remedial Investigation Report for Four Munitions Response Sites: Demolition Area – 01, Demolition Area – USACE TD, Grenade Court, Booby Trap Site, Draft Final Document*. Prepared by Shaw Environmental, Inc. for USACE, February 2012.
- USACE, 2010, *Fort Belvoir Military Munitions Response Program, Site Specific Removal Action Report: Booby Trap Site, Booby Trap Fence Extension, and RV Travel Camp. Final document*. Prepared by Shaw Environmental, Inc. for USACE, April 2012.

These documents and policy and regulatory guides are listed in Appendix A, References. Additional data on the sites and their surroundings may be found in Installation Restoration Program /CERCLA documents that have been prepared for the installation.

## 2.0 SITE CHARACTERIZATION

The following on-post MRSs have been identified and are included in this EE/CA for NTCRA land use control consideration.

### 2.1 MRS DESCRIPTIONS

The nine MRSs considered in this EE/CA are described below. The locations for all nine are shown in Figure 2-1, and individual maps are depicted in Figures 2-2 through 2-10.

#### 2.1.1 Infiltration Course (FTBL-001-R-02)

The Infiltration Course (5 acres, Figure 2-2) was originally part of the Small Arms Range Complex, located in the south-central portion of the installation, near the Combat Range Complex. The 2008 SI made the recommendation to delineate the area as an MRS separate from the rest of the Small Arms Range Complex. The course is located just to the north of Accotink Bay, adjacent to the Pig Farm Range, and near the Grenade Court (which abuts other portions of the Small Arms Range Complex). The Infiltration Course first appears on maps in 1943. Although this area was used primarily for small arms, a memorandum from 1943 displays three machine gun emplacements and states that explosives (not to exceed 1.5 lbs) were available for use during training exercises to replicate live battle conditions. A memorandum with diagram from 1944 indicates the starting and enemy trenches and circles in which explosives were to be set in pits below ground. The course remained on installation maps until 1956.

During the SI process a visual survey was performed in an attempt to locate former berms. The visual survey discovered remains of a possible machine gun emplacement and two small mounds in the suspected firing area of the Infiltration Course. Nine composite soil samples were taken to test for MC, two of which were located on the infiltration course. The soil tests for the two samples from the Infiltration Course were tested only for lead. One of the two samples indicated levels of lead an order of magnitude higher than the background mean lead content for Fort Belvoir. Due to the concentrations of lead detected in this sample, the historic use of explosives at the Infiltration Course, and the lack of evidence that MEC is a concern at the MRS, the SI recommended an RI/FS for the MRS focused on MC (to include both metals and explosives).

**Munitions Response Site Prioritization Protocol (MRSPP) Score:** The MRSPP score for the Infiltration Course is 6.

**Current and Future Land Use:** The MRS is currently undeveloped, and vegetation consists primarily of coniferous trees. It is part of the Accotink Bay Wildlife Refuge, and is open for recreational use. Potential human receptors include installation personnel, contractors and visitors, residents, fishermen, hunters, boaters, waders, and trespassers. Future land use is expected to remain the same, no development is currently planned.

**Existing LUCs:** Access to Fort Belvoir is restricted, but the Infiltration Course is outside of the access control point. It is accessible through an unguarded vehicle gate. It is accessible to pedestrians, and connected to a trail network. Boaters could potentially enter the complex on the water side to the southwest, where access is unrestricted. As part of the Accotink Bay Wildlife Refuge, the Infiltration Course has environmental development restrictions.

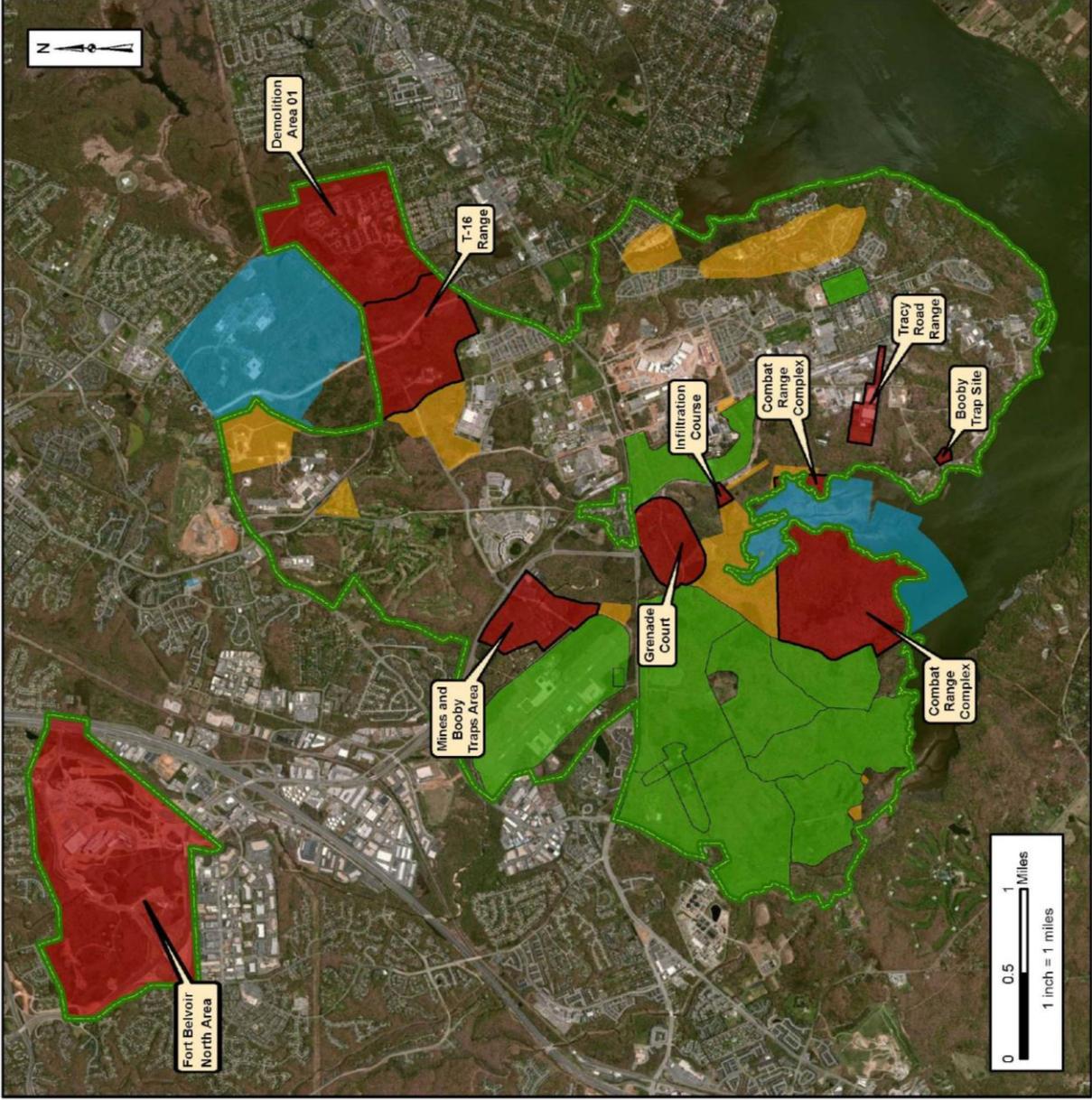



**Legend**

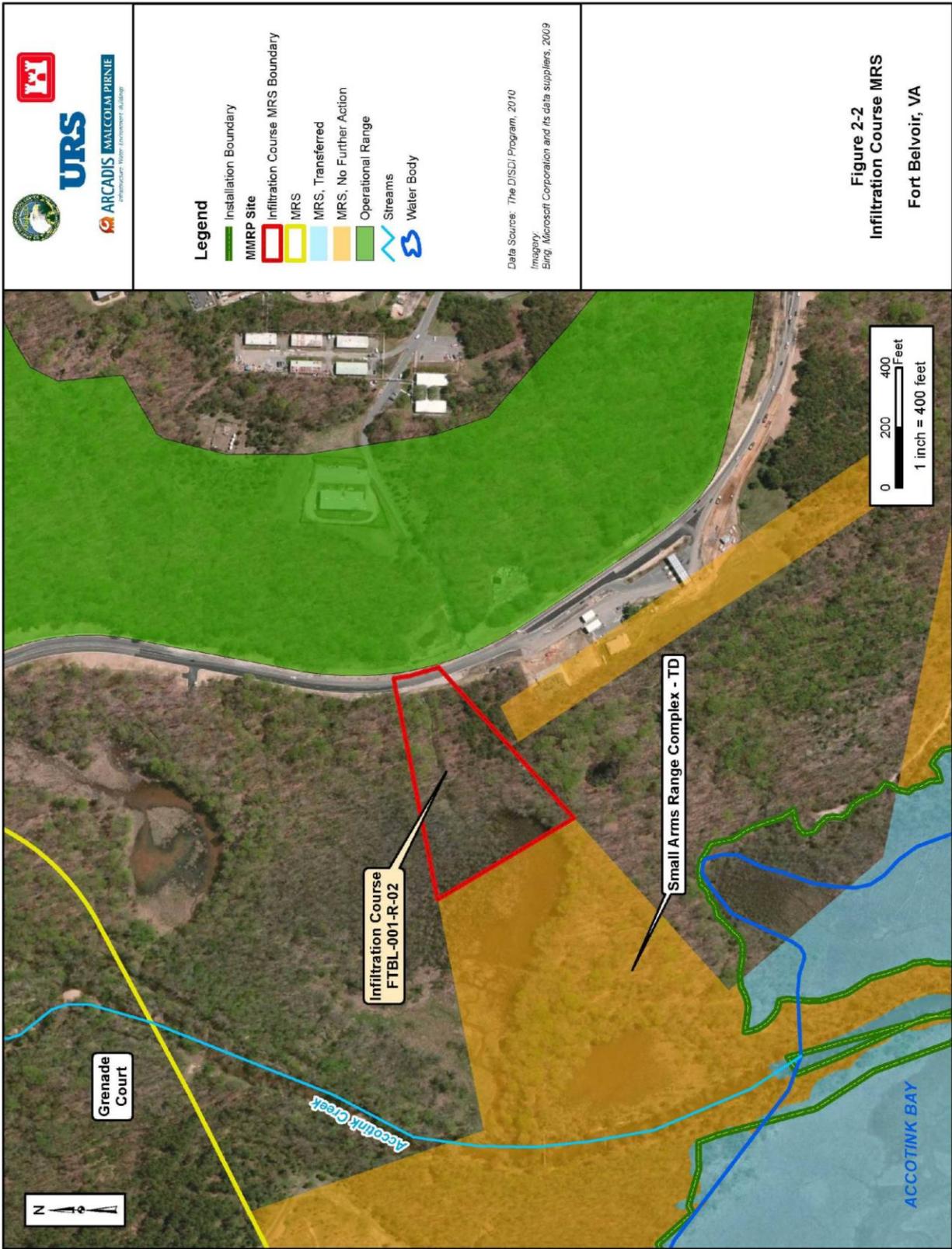
- Installation Boundary
- MRS
- MRS, Transferred
- MRS, No Further Action
- Operational Range

Data Source: The DISD/ Program, 2010

Imagery: Bing, Microsoft Corporation and its data suppliers, 2009



**Figure 2-1**  
**Fort Belvoir MRS Location Map**  
**Fort Belvoir, VA**



- Legend**
- Installation Boundary
  - MMRP Site
  - Infiltration Course MRS Boundary
  - MRS
  - MRS, Transferred
  - MRS, No Further Action
  - Operational Range
  - Streams
  - Water Body

Data Source: The DISDI Program, 2010  
 Imagery: Bing, Microsoft Corporation and its data suppliers, 2009

**Figure 2-2**  
**Infiltration Course MRS**  
**Fort Belvoir, VA**

### **2.1.2 Combat Range Complex (FTBL-003-R-01)**

The Combat Range Complex MRS (320 acres, Figure 2-3) is composed of three overlapping former ranges: the Bayliss Combat Range, the Lorton Combat Range, and the Lorton Assault Course. The complex itself previously overlapped the western and southwestern portion of the Accotink Bay, as well as encompassing a small area of land on the northeastern side of the Bay; however, due to the separation and transfer of the Combat Range Complex – TD, it no longer covers the water area, and simply extends up to the edge of the shore on each side. The actual area of concern within the complex is not adjacent to the Bay itself.

The history of the three ranges that create the complex are very similar to each other. The Bayliss Combat Range appears on maps from 1942 to 1956, although the area is labeled simply as Bayliss as early as 1930. Documents indicate that fragmentation grenades, rifle grenades, rocket launchers, mortars, and small arms rounds were used. Pits were located downrange, but their exact locations are unknown. A landscape range, pistol submachine gun line, and practice hand grenade court were indicated in the area in a document dated 1945, and the whole range probably closed sometime between 1962 and 1970.

The Lorton Combat Range also appears on maps from 1941 to 1956, but no details are available on the specific munitions or training activities on this part of the site. It is assumed that they are similar to those used at the Bayliss Combat Range. It was probably closed between 1956 and 1957.

There is a similar dearth of evidence regarding the Lorton Assault Course; it is also assumed to have similar munitions to Bayliss Combat Range, and estimates based on installation maps indicate a period of operation from 1949 to 1950.

During the SI, a visual magnetometer-assisted survey of this MRS was performed to identify MEC, and fifteen composite soil samples were collected to test for MC. No MEC were observed during the SI process, but several munitions debris (MD) items were found. Structures discovered during the sweep included two concrete bunkers, one observation bunker, and one wooden latrine building. SI soil testing results showed levels of aluminum, antimony, copper, and lead fell within the documented background range for the area, and the levels of zinc were elevated above the background range in one out of the fifteen samples. However, Region 3 Biological Technical Assistance Group (BTAG) Soil Screening Benchmarks were exceeded in all 15 samples for aluminum, lead, and zinc, and in five samples for copper. No explosives were detected above the laboratory reporting limits in any of the samples. The SI recommended this MRS for an RI/FS based primarily on MD, which could indicate the presence of MEC on the site, but indicated that MC sampling should also be included.

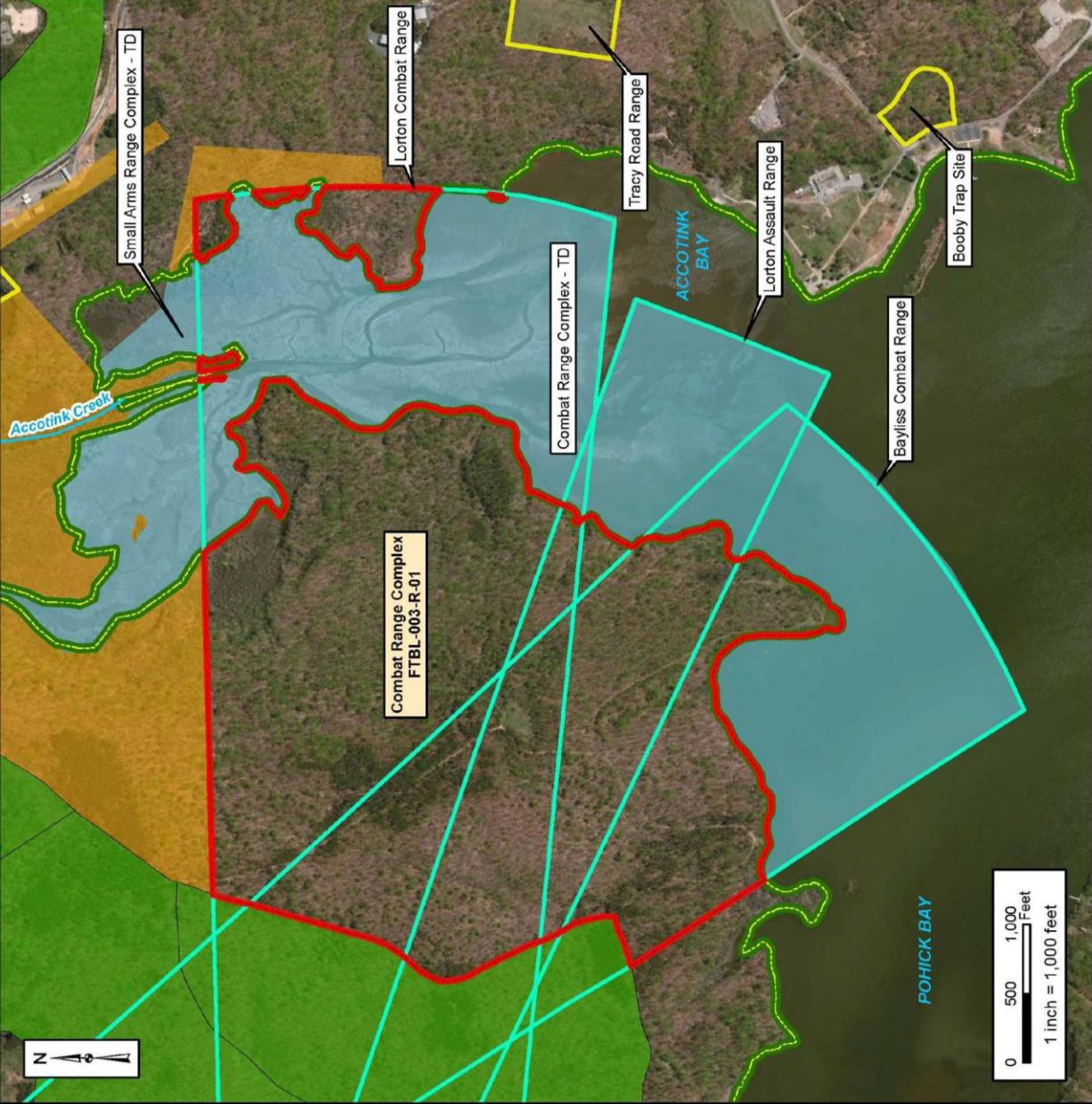
A draft final RI was completed for this MRS in February 2012. This document refines the CRC into three smaller areas: the Demolition Clearing (8 acres), where two MEC items were found during the RI; the rest of the MRS outside the Demolition Clearing (312 acres), which is less likely to contain significant levels of MEC; and the Small Arms Impact Zone (17.4 acres), which is directly across the bay from the Tracy Road Range and demonstrates elevated metals levels. The RI recommends that, for the FS, the MRS boundaries are redrawn to distinguish these separate spaces. The entire MRS has a chance of containing MEC, although the Demolition Clearing has the highest probability of this. The Small Arms Impact Zone, which completely encompasses the Demolition Clearing, contains elevated levels of metals; the FS will evaluate further potential action to address these hazards.



**Legend**

- Installation Boundary
- MMRP Site
- Combat Range Complex MRS Boundary
- MRS
- MRS, Transferred
- MRS, No Further Action
- Operational Range
- Fan Boundary
- Streams

Data Source: The DISDI Program, 2010  
 Imagery: Bing, Microsoft Corporation and its data suppliers, 2009



**Figure 2-3**  
**Combat Range Complex MRS**  
**Fort Belvoir, VA**

**MRSP Score:** The MRSP score for the Combat Range Complex MRS is 4.

**Current and Future Land Use:** The Combat Range Complex is currently heavily wooded and undeveloped, with only a few trails and unimproved roads running through it. A large portion of the MRS is located within the Accotink Creek Wildlife Refuge, and therefore is unavailable for development. Boaters can access the complex through the Accotink Bay, and hunting is permitted on the complex, making these individuals potential receptors for MEC and MC. Future expected land use is expected to remain the same as current land use.

**Existing LUCs:** Access onto the installation is restricted by land (for vehicles), but this MRS is outside of the access control point; additionally, access by water is unrestricted through the Accotink Bay. This MRS is connected to a trail network, and therefore accessible to pedestrians. The part of the MRS in the Accotink Creek Wildlife Refuge is restricted from development.

### **2.1.3 Fort Belvoir North Area (FTBL-005-R-01, formerly EPG)**

The Fort Belvoir North Area (FBNA, 807 acres, Figure 2-4), formerly the Engineer Proving Ground (EPG), is about 1.5 miles northwest of and noncontiguous to the main Fort Belvoir post. Its boundary initially appears on maps in 1941, after being acquired by the Army for the use as the Fort Belvoir Research, Development, and Engineering Center in the early 1940s. The primary mission of this part of the facility was the testing of military engineering equipment and supplies, and during the 1940s it was also heavily used for the development and testing of mines. Approximately ten ranges are included in the boundaries of this 807 acre parcel, and 44 Solid Waste Management Units (SWMUs) are located here as well, primarily within the range areas. Activities at this MRS were reduced and eventually came to a halt during the 1960s due to the increase of commercial and residential growth around the property. Potential munitions that would have been used include mortars, rockets, small arms, grenades, and mines.

Although most of the older structures had been removed, at the time of the 2008 SI, a few unused structures remained. Significant amounts of BRAC construction have been performed at the site since 2008, and some of these may no longer be present.

The topography of this MRS involves rolling hills ranging from 200 to 300 ft. above mean sea level (AMSL). The land is cut by deep slopes along the narrow Accotink Creek which runs from North to South through the property and includes 46 acres of wetlands. The western half is largely forested, with the exception of the former range areas, which are mostly cleared and primarily located on the flatter portions of the MRS. Between the ranges, geophysical surveys, and partial removal actions, a significant amount of the land in this area has been disturbed. The topography has changed recently with the completion of the Fairfax County Parkway construction and the 2005 BRAC related construction.

The HRR (USACE, 2006) recommended the MRS for further analysis; however, UXO clearance began within the areas affected by the planned Fairfax County Parkway construction in 2003. Additional clearance outside of the right of way began in 2005 as a result of the 2005 BRAC legislation. Therefore, the MRS was not actively tested in the 2008 SI. UXO clearance at the MRS was completed in June 2009. Three final removal actions were completed between 2002 and 2009; however, MEC and MC remain a concern at the MRS, and an FS evaluating no action or LUCs is currently underway.

**MRSP Score:** The MRSP score for FBNA is 3.

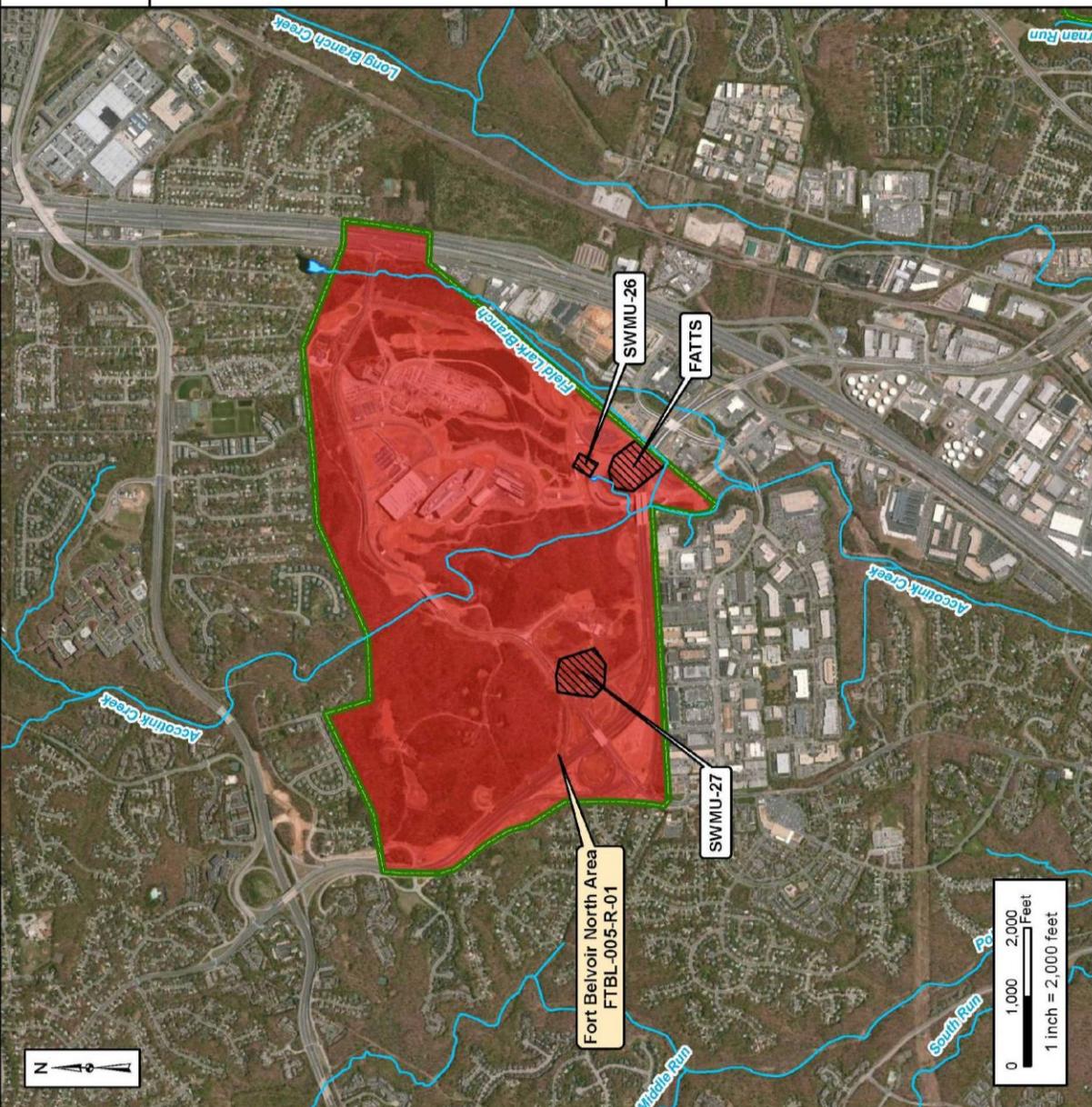



**Legend**

- Installation Boundary
- MMRP Site
- Fort Belvoir North Area MRS
- Streams
- Water Body
- Existing Land Use Restrictions

Data Source: The DISD/ Program, 2010

Imagery: Bing, Microsoft Corporation and its data suppliers, 2009



**Figure 2-4**  
**Fort Belvoir North Area MRS**  
**(Formerly EPG Area)**  
**Fort Belvoir, VA**

**Current and Future Land Use:** Parts of the FBNA MRS underwent significant development (such administration facilities and a future daycare) related to the increase of personnel at Fort Belvoir during the BRAC process. The road system and adjacent shared use path allows for public access through the facility. No additional development on the remaining range areas is planned at this time. Potential human receptors include authorized installation personnel, recreational users of pathways, visitors, contractors, and trespassers.

**Existing LUCs:** Two decision documents exist that address small portions of FBNA; they apply specifically to SWMU-27, SWMU-26, and FATTS (Former Aboveground Test Tank Site). These include a combination of restrictions on groundwater use, restrictions on soil removal, and requirements for long-term groundwater monitoring. No other decision documents have been issued relating to FBNA. Installation-wide institutional controls (such as dig permits) do still apply, despite the fact that this area is non-contiguous with the rest of the installation. Other land use restrictions include a partial boundary fence that is in the process of being constructed to limit trespassing from private residences to the north. Due to the new roadway and trail network, much of the MRS is essentially open to the public, and is not within any installation access control point.

#### **2.1.4 Grenade Court (FTBL-007-R-01)**

The Grenade Court MRS (100 acres, Figure 2-5) and the surrounding surface danger zone (SDZ) is located in the center of the Fort Belvoir installation. It is approximately 100 acres in size, and the court itself is located in the center of the MRS along the Accotink Creek. Elevation ranges from 10 to 50 ft. AMSL; the grenade court is placed on a relatively flat floodplain area along the river, while the SDZ rises up into hills surrounding the court.

Construction of the court began on March 21, 1941, and its primary use was testing of grenades and practice hand grenades. Sandbag emplacements were located on the north end of the court, and a 1949 map identifies the southern portion as a tank farm, possibly used for fuel storage and as a salvage yard. The tank farm was removed by 1961, and although previous aerial photographs displayed buildings associated with the tank farm, they have all been dismantled since that time. A very small area of the northeastern corner of the SDZ was developed as part of the South Post Planning District before the rest of the area was incorporated into Accotink Bay Wildlife Refuge.

For the 2008 SI, a visual surface sweep was conducted with magnetometer assistance in the search for MEC, and five composite soil samples were tested for MC (metals and explosives). No MEC or MD were found. No explosives were detected by the laboratory reporting limits. Aluminum, antimony, copper, lead, and zinc were detected at the MRS; one of the five soil samples exceeded the background range for copper, lead, and zinc, and another sample exceeded the background range for lead. The SI recommended that the RI/FS include further investigation of MC (but not MEC) at this MRS. However, the Draft Final RI from February 2012 evaluated the MRS primarily based on MEC (because the area with elevated metals MC found during the SI is being addressed under the RCRA program for the Accotink Landfill Area). Since no MEC was found by the RI, no further testing was performed for MC. When the RI is finalized, it will recommend that a FS be performed for this MRS, to evaluate the alternatives of permanent LUCs vs. no action.

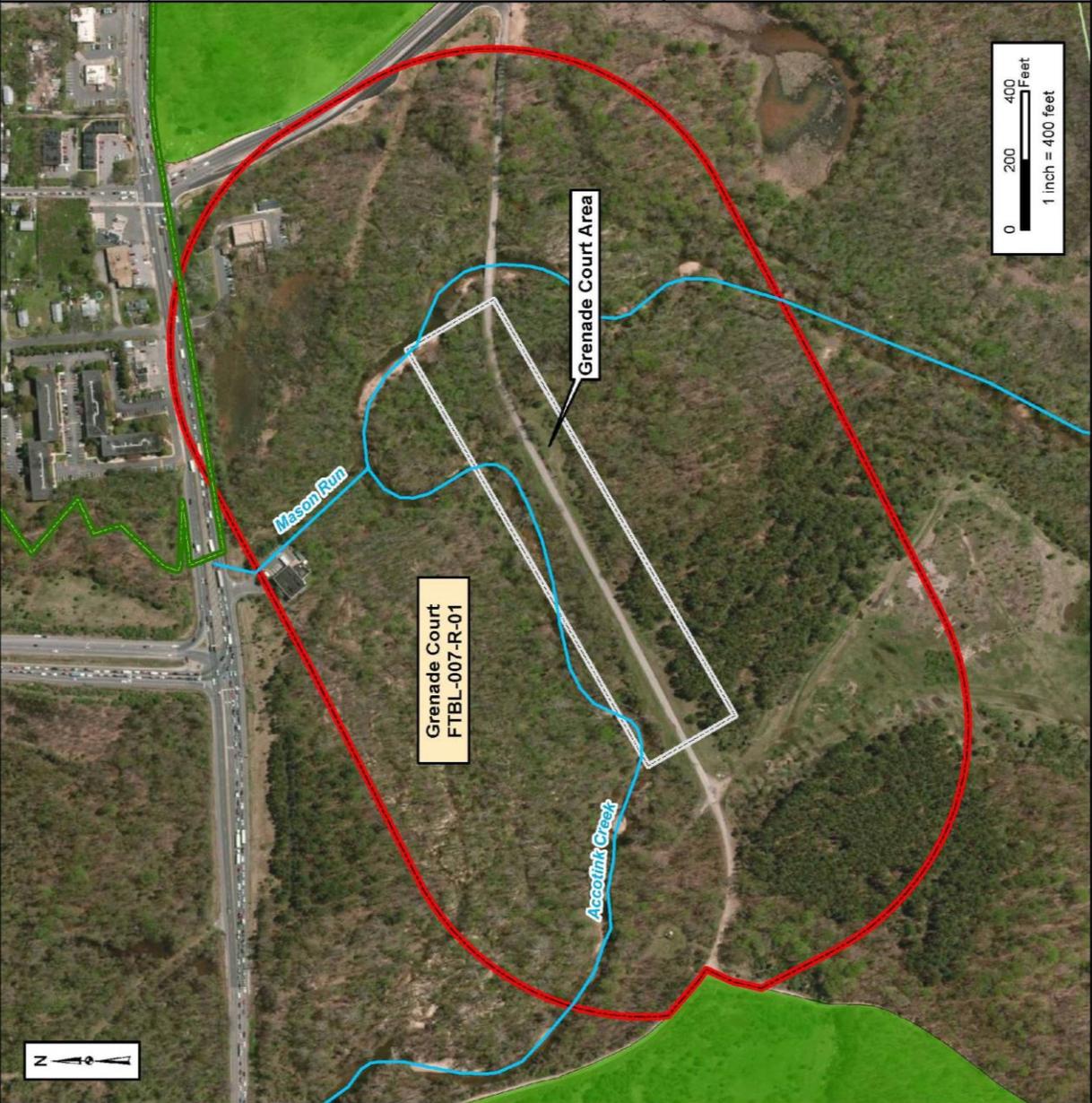
**MRSP Score:** The MRSP score for the Grenade Court is 5.



**Legend**

- Installation Boundary
- MMRP Site
- Grenade Court MRS
- Site Feature
- ~ Streams

Data Source: The DISDI Program, 2010  
Imagery: Bing, Microsoft Corporation and its data suppliers, 2009



**Figure 2-5**  
Grenade Court MRS  
Fort Belvoir, VA

**Current and Future Land Use:** The majority of the site is currently undeveloped. Poe Road runs through the middle of the MRS, and is in active use. Potential human receptors include authorized personnel, visitors, contractors, hunters, and trespassers. The land use is not expected to change.

**Existing LUCs:** Access to the installation is restricted by guards and surveillance, but the Grenade Court MRS is outside of the access control point. A fence is present in the northern portion of the MRS. It is accessible via Poe Road in the middle of the MRS, and is connected to a trail network that provides pedestrian access. The inclusion of the area into the Accotink Bay Wildlife Refuge presents restrictions on construction and other uses.

### **2.1.5 Tracy Road Range (FTBL-014-R-01)**

This MRS (33 acres, Figure 2-6) is located on the west side of the South Post area of Fort Belvoir. It was built in 1941 to train engineering troops, and consisted of firing lines, target butts, and range buildings. Initially, it included 88 targets with 200- and 300-yard firing points, 40 of which had an undeveloped 500-yard firing line. The range was closed sometime between 1956 and 1960. The residual berm is still present on the range, although the rest of the range has been extensively developed – for example, a building is located on top of the firing area itself, along with other buildings and paved areas. Four SWMU sites are contained within this MRS.

MEC analysis was not performed during the SI, due to the fact that primarily small arms were used at this MRS, and MEC was not expected to be present. A visual survey was performed to locate the residual berm and determine its position in relation to the SWMU. During this survey, one piece of MD was discovered, a small arms round that was deformed and unidentifiable. MC testing was performed only for lead, and was performed on one sample and one duplicate, both biased (non-randomly collected) samples. Both exceeded the background levels for Fort Belvoir, the BTAG benchmark, and the PRG for lead. The MRS was therefore recommended to progress to the RI/FS stage with a focus on MC (lead).

**MRSP Score:** The MRSP score for the Tracy Road Range is 6.

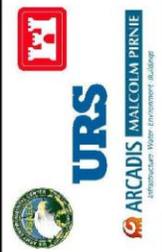
**Current and Future Land Use:** Since the range is largely paved and includes several buildings. Current human receptors include installation personnel, contractors and visitors, residents, hunters, and trespassers. Land use is not expected to change; no demolition or further development is planned.

**Existing LUCs:** Fort Belvoir has gates and surveillance when entering the installation. Tracy Road Range is within the access control point, but access to the MRS is not restricted once on the installation. There are several SWMUs that overlap the Tracy Road Range, and it has environmental development restrictions as part of the Theote Road Closed C/D/D Landfill (SWMU A-02).

### **2.1.6 Demolition Area – 01 (FTBL-018-R-01)**

The Demolition Area (420 acres, Figure 2-7) is located in the northeastern section of the installation. It had been delineated as two areas previous to the SI; these included the Demolition Area Transferred (TD) and the Demolition Area. The Demolition Area was composed of three noncontiguous segments under one MRS. The SI recommended splitting the Demolition Area into two MRSs, based on distinct findings and site histories. The easternmost

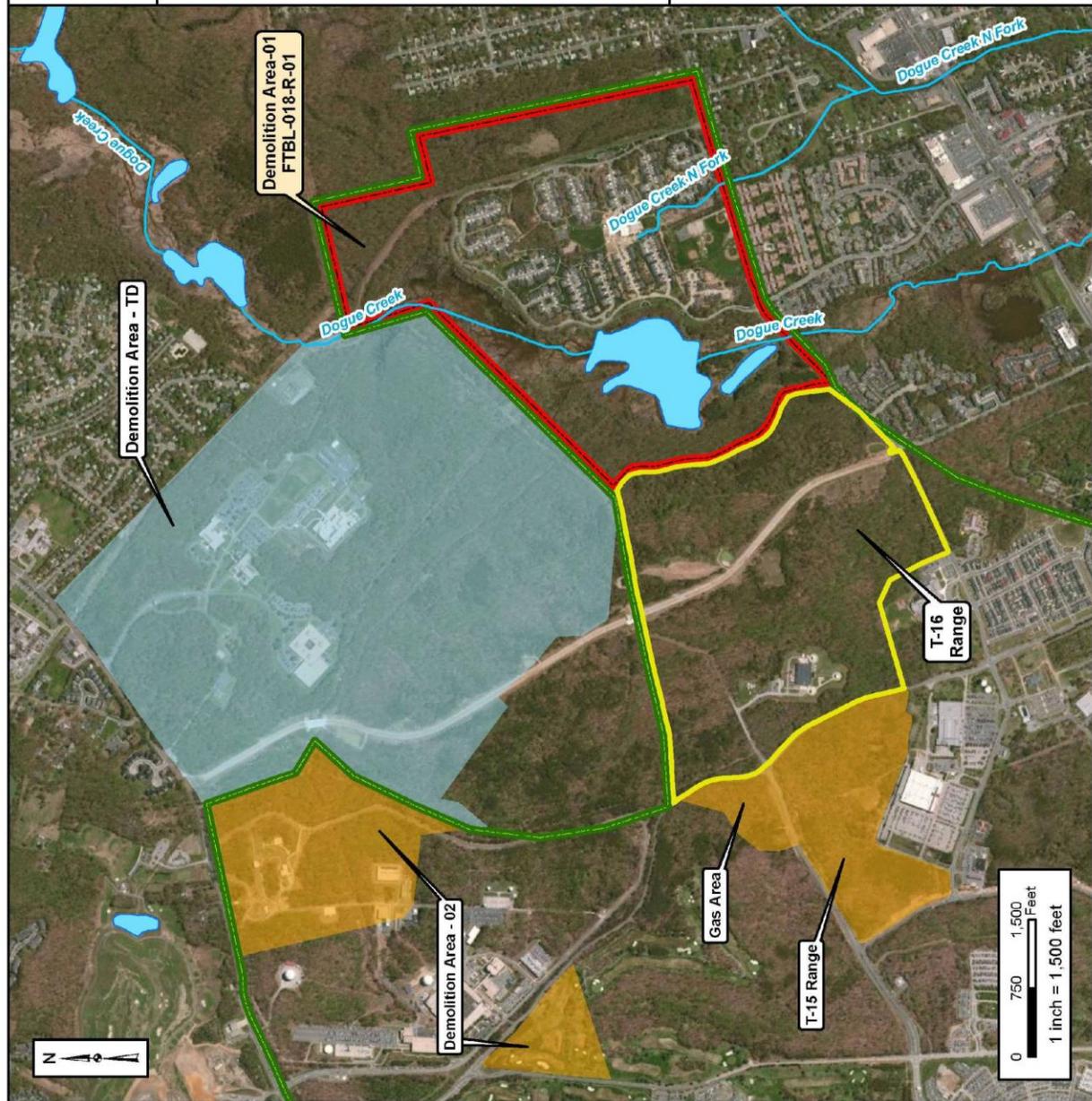




- Legend**
- Installation Boundary
  - MMRP Site
  - Demolition Area-01 MRS Boundary
  - MRS
  - MRS, Transferred
  - MRS, No Further Action
  - Streams
  - Water Body

Data Source: The DISCI Program, 2010  
 Imagery: Bing, Microsoft Corporation and its data suppliers, 2009

Figure 2-7  
 Demolition Area-01 MRS  
 Fort Belvoir, VA



segment now constitutes Demolition Area – 01, and the two westernmost segments now compose Demolition Area – 02. Of these, only Demolition Area – 01 will be considered in this document; Demolition Area – 02 was recommended for No Further Analysis (NFA) by the SI, and the Demolition Area TD is under different Army jurisdiction.

The Demolition Area as a whole was first identified on an archival map from 1940 that displayed tactical training areas. Its primary purpose, as indicated in 1944 memoranda, was to train engineers in the use of demolition materials and to practice demolition techniques. Demolition occurred on the surface, in steel pits, and below ground. It was operational between 1940 and 1951. Most of the core of the Demolition Area is undeveloped, due to overlap with the Jackson Miles Abbott Wetland Refuge and the Forest and Wildlife Corridor. The topography in this area is quite variable, ranging from 20 to 150 ft. AMSL.

The SI evaluated MEC using a magnetometer assisted surface sweep and visual survey conducted on approximately 10 acres of the 420-acre site, using a transect approach. MC was evaluated by collection and analysis of 5 composite surface soil samples. The single MEC item discovered was a live smoke grenade with a compromised fuse, rusted casing, and exposed filler. The only MD item discovered was an expended pop-up flare, which is consistent with the expected debris based on previous use. The MC laboratory results indicated that all five indicator elements – aluminum, antimony, copper, lead, and zinc – were either within the expected background range, or were not detectable above laboratory reporting limits. None of the explosives tested were above laboratory reporting limits. Based on SI field results, this MRS was recommended for an RI/FS with a primary focus on MEC, but indicated that the scope would also include secondary sampling for MC.

The Draft Final RI from February 2012 included a 100% visual surface sweep, which discovered three MD items, and an intrusive subsurface investigation, which uncovered 60 MD items. No MEC was discovered, but due to the past discovery, it was determined that there was still a potentially complete pathway for MEC. Two composite soil samples were collected from the area, and analytical results were compared to screening levels (SLs) drawn from the Oak Ridge National Laboratory Residential Soil and Industrial Soil SLs, among other sources. Five explosives were detected, but none of them exceeded the minimum SLs. The RI indicated that an FS should be performed to consider remedial options associated with the potential for MEC at this MRS, although there was no evidence to consider further action regarding MC.

**MRSP Score:** The MRSP score for Demolition Area – 01 is 3.

**Current and Future Land Use:** Current land use includes an undeveloped area, residential buildings (under lease to Fort Belvoir Residential Communities), administrative buildings, several roads, and recreational use by the public of the Wetland Refuge. Potential future land use could include a right-of-way for a public highway, and it is expected that potential human receptors will remain unchanged.

**Existing Land Use Controls:** Access to Fort Belvoir is restricted, but Demolition Area-01 is outside of the access control point. Current land use controls include developmental restrictions related to the Jackson Miles Abbott Wetland Refuge and the Forest and Wildlife Corridor in part of the Demolition Area. The rest of the MRS lacks site-specific land use controls.

### **2.1.7 Booby Trap Site (FTBL-024-R-01)**

This MRS is in the southeastern part of the installation on Gunston Cove (13 acres, Figure 2-8). It was first reported as occupying one acre under the name T-1A, and was used for 24 days during 1983. On installation maps from 1987 to 1989, it was labeled as a training area, but no information about the frequency or intensity of use during that time is available. The SI hypothesizes that the site may have been used for various practice activities (such as arming/disarming and installing/removing various munitions). Potential munitions include various practice simulators, including booby traps and mines.

This MRS was investigated during the HRR (USACE, 2006), the SI (USACE, 2008), and the Draft Final RI (USACE, 2012). Additionally, a MEC Removal Action was performed in 2009. Although the HRR included reports of MEC, no MEC was found during the SI, the removal action, or the RI. MD was found in each, although the RI notes that all of the MD discovered to date has been removed. The RI also indicated the discovery of three small disposal pits containing MD and firing devices on the site. The Draft Final RI determined that there were no remaining MEC concerns at the site.

Five composite soil samples were collected and tested for MC during the SI, and three soil samples were collected from the bottom of each pit during the RI. One groundwater sample was collected and tested for perchlorate during the SI. Primary or indicator elements associated with historical munitions use at this location include aluminium, antimony, copper, lead, zinc, and explosives. In the samples collected during the SI, four of the five key elements did not exceed their respective expected background ranges; only one of the five samples tested higher than the background range for lead, but was still below the EPA Region 9 Preliminary Remedial Goals (PRG) level. Neither explosives nor perchlorates were detected during the SI. All three of the RI soil samples tested positive for metal levels above the minimum SLs. Explosives detected included 2,4-dinitrotoluene, 2-nitrotoluene, 4-nitrotoluene, and cyclotrimethylene trinitramine (RDX); however, none of these were above the minimum SLs. The SI recommended this site for an RI/FS based primarily on MEC, but indicated that MC sampling should also be included. The Draft Final RI determined that there was limited metals MC, but the estimated risk was low and acceptable. MC is therefore not considered a concern moving forward. The Final RI will recommend this MRS for NFA.

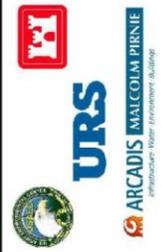
**MRSPP Score:** The MRSPP score for the Booby Trap Site is 6.

**Current and Future Land Use:** The Booby Trap site is currently wooded and undeveloped, but it is accessed by installation personnel for recreational purposes. It contains no known historical or extant structures. The land use is not expected to change.

**Existing Land Use Controls:** Access to Fort Belvoir is restricted, but the Booby Trap Site is outside of the access control point. This MRS is encompassed within a Fort Belvoir-recognized environmentally sensitive area, which the installation designated based on the Chesapeake Bay Preservation Act (U.S. Army Garrison Fort Belvoir, 2001b). As a result, there are existing developmental restrictions.

### **2.1.8 Mines and Booby Traps Area (FTBL-026-R-01)**

The Mines and Booby Traps Area MRS (110 acres, Figure 2-9) is located in the northwest part of the installation, just north of the Grenade Court. This MRS was recommended for No Further Analysis (NFA) during the SI process; no MEC or MD were discovered, no explosives were

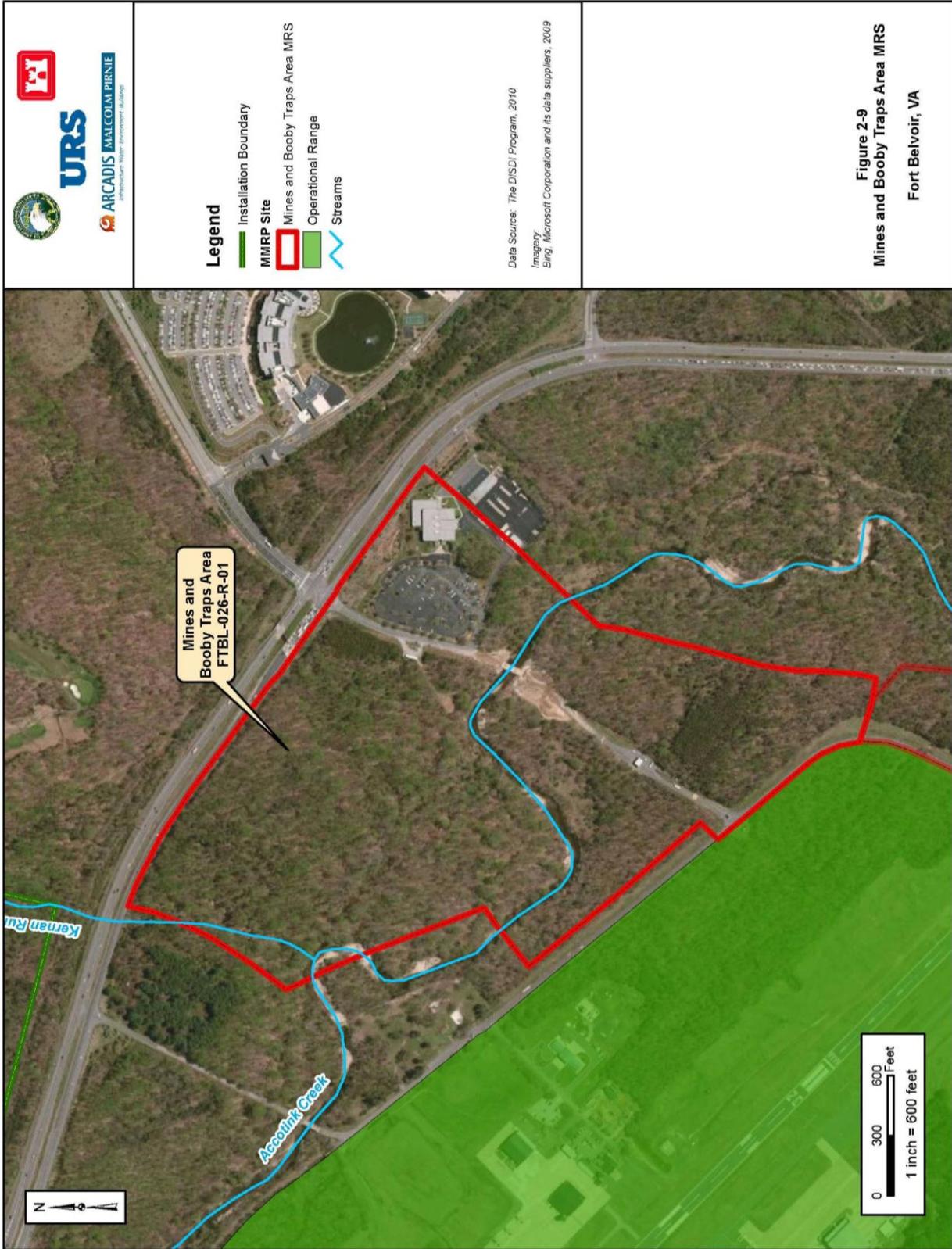


- Legend**
- Installation Boundary
  - MMRP Site
  - Booby Trap Site MRS
  - Water Body

Data Source: The DISD Program, 2010  
 Imagery: Bing, Microsoft Corporation and its data suppliers, 2009

**Figure 2-8**  
 Booby Trap Site MRS  
 Fort Belvoir, VA





detected, metals in the soil were within the background levels, and perchlorate was in one of two groundwater samples at a concentration lower than the DoD Level of Concern. However, after the SI was complete, a hunter in the area discovered original training mines dating to the site's historic usage as a training area for booby traps and anti-personnel mines from 1943 to 1947.

The Army Corps of Engineers performed a set of transects on the area, and a new SI just for this MRS is currently in progress. It is expected that an RI/FS focusing on MEC will be necessary, and thus, only MEC will be addressed by this document.

**MRSPP Score:** Due to the NFA designation during the SI, this MRS has no MRSPP score yet.

**Current and Future Land Use:** The MRS is currently undeveloped, with the exception of a road, a small building, and the associated parking lot in the eastern portion of the MRS. A portion of the MRS is being evaluated for future development. Potential receptors include installation personnel, contractors, and individuals using the area for hunting and other recreation purposes.

**Existing Land Use Controls:** Access to Fort Belvoir is restricted, but the Mines and Booby Traps Area is outside of the access control point. There are no current site-specific land use controls associated with the Mines and Booby Traps Area MRS.

### **2.1.9 T-16 Range (FTBL-027-R-01)**

This MRS (232 acres, Figure 2-10) is located in the north-central portion of Fort Belvoir, and is believed to have been used from 1926 to 1987. Specific activities and munitions associated with the MRS are unknown, but it was indicated an active area under various names on installation maps dated 1926, 1941, 1951, and 1987. There is one building on the western side of the MRS, but it is otherwise undeveloped. The area spans two watersheds (Accotink Creek and Dogue Creek) and ranges from gently to steeply sloping topography at elevations from 30 to 118 ft. AMSL. Vegetation includes a mixture of deciduous and coniferous trees. It also overlaps part of the Forest and Wildlife Corridor.

Testing was performed for both MEC and MC as part of the 2008 SI. Approximately 23 of the 232 acres were inspected by visual survey for MEC, assisted by the use of a magnetometer. Ten composite soil samples were tested for MC, and were chosen by visual observation; tests for TAL metals and explosives were performed. No MEC were located on the MRS, but significant amounts of MD, structural debris, and surface features were identified. For MC, no explosives were detected above laboratory reporting limits, and analytical results for all metals were within or below the background range levels. A few metals exceeded BTAG levels, although no other regulatory screening criteria were exceeded, so the SI recommended the site for further evaluation based on both MEC and MC.

The RI for this site was subsequently finalized in the summer of 2011 (USACE, 2011). The findings of that document indicated no MEC had been found on the MRS, and MC was of no concern. Despite the completion of the RI, it is expected to take two years for a decision document to move forward to completion. Therefore, the interim LUCs proposed will address only the potential of MEC.

**MRSPP Score:** The MRSPP score for the T-16 Range is 5.

**Current and Future Land Use:** Current land use is only active around the building complex on the site, which has incurred a high level of disturbance, whereas the rest of the site has low levels



of disturbance. Future land use will include a new Connector Road that is anticipated to traverse the MRS in a north/south direction, just to the east of its center. Current and future potential human receptors include installation personnel, contractors and visitors, trespassers, residents, and hunters. Security includes guards and surveillance at fort entrances, but site-specific access to the MRS is open to the south and east.

**Existing Land Use Controls:** Access to Fort Belvoir is controlled by fences and gates, but the T-16 Range will be outside of the access control point once construction begins on the new Connector Road. Current LUCs include developmental restrictions related to the Forest and Wildlife Corridor in the northern portion of the MRS, but the rest of the MRS lacks LUCs.

## **2.2 STREAMLINED RISK EVALUATION**

### **2.2.1 Conceptual Site Model**

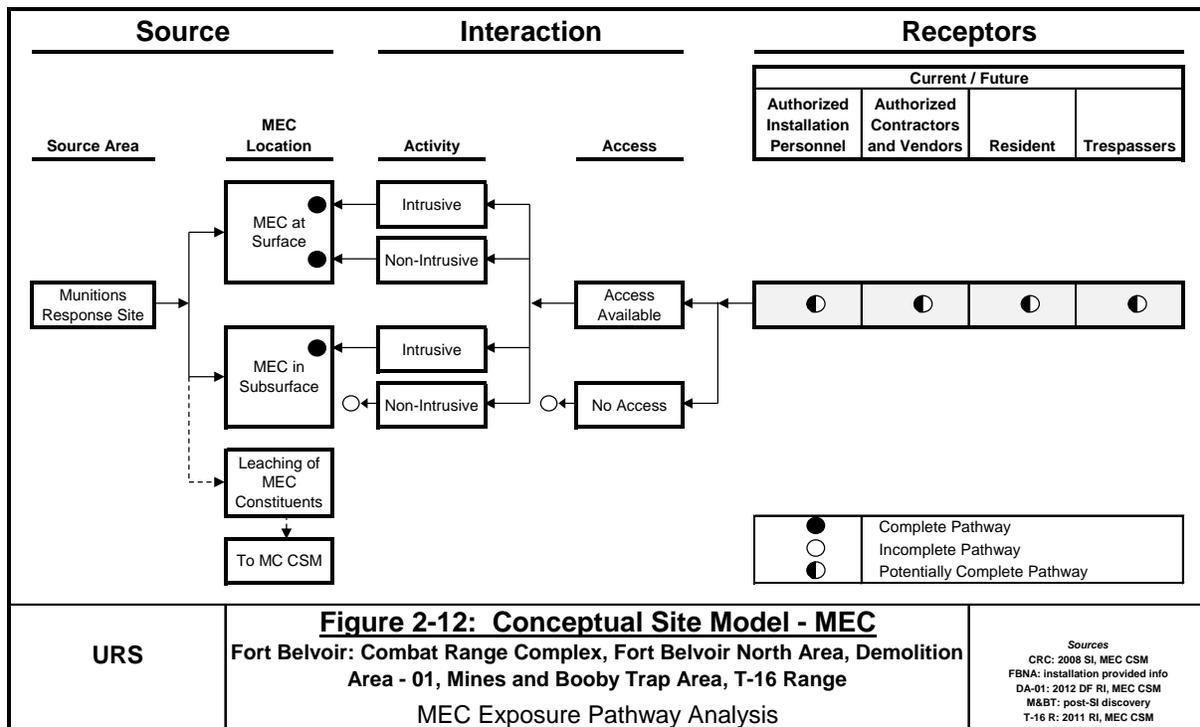
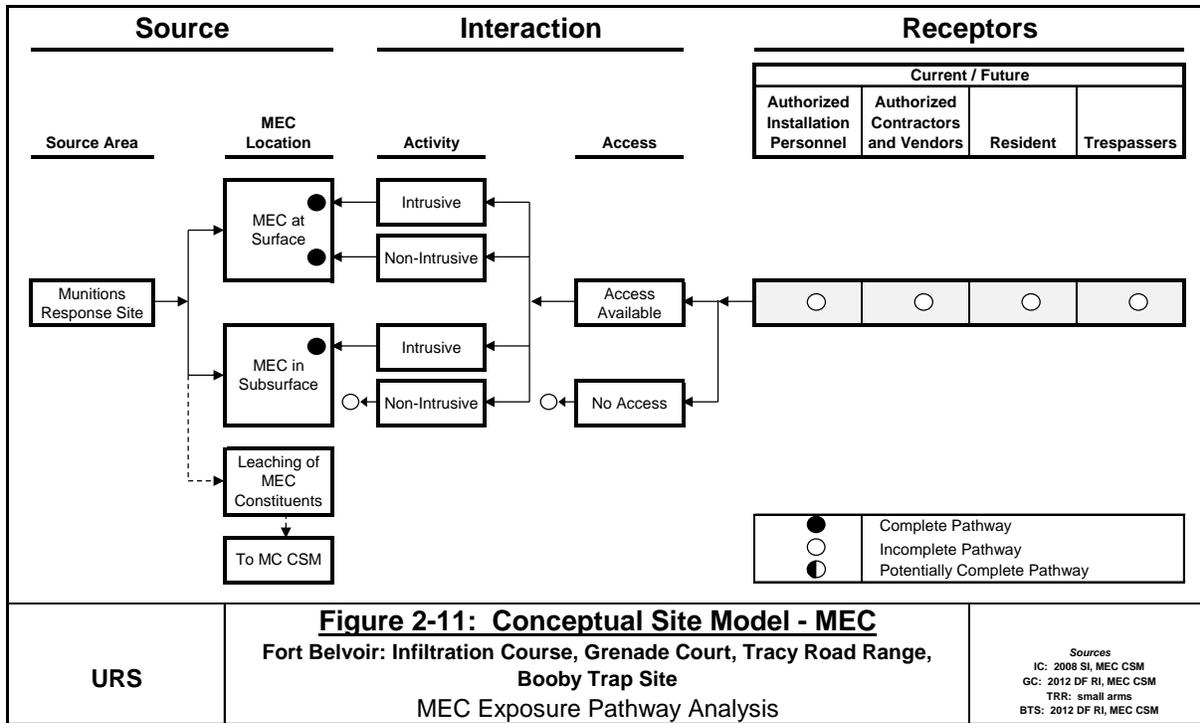
The Conceptual Site Models (CSMs) for potential exposure to MEC and MC at Fort Belvoir are exhibited in Figures 2-11 through 2-12, and 2-13 through 2-18, respectively.

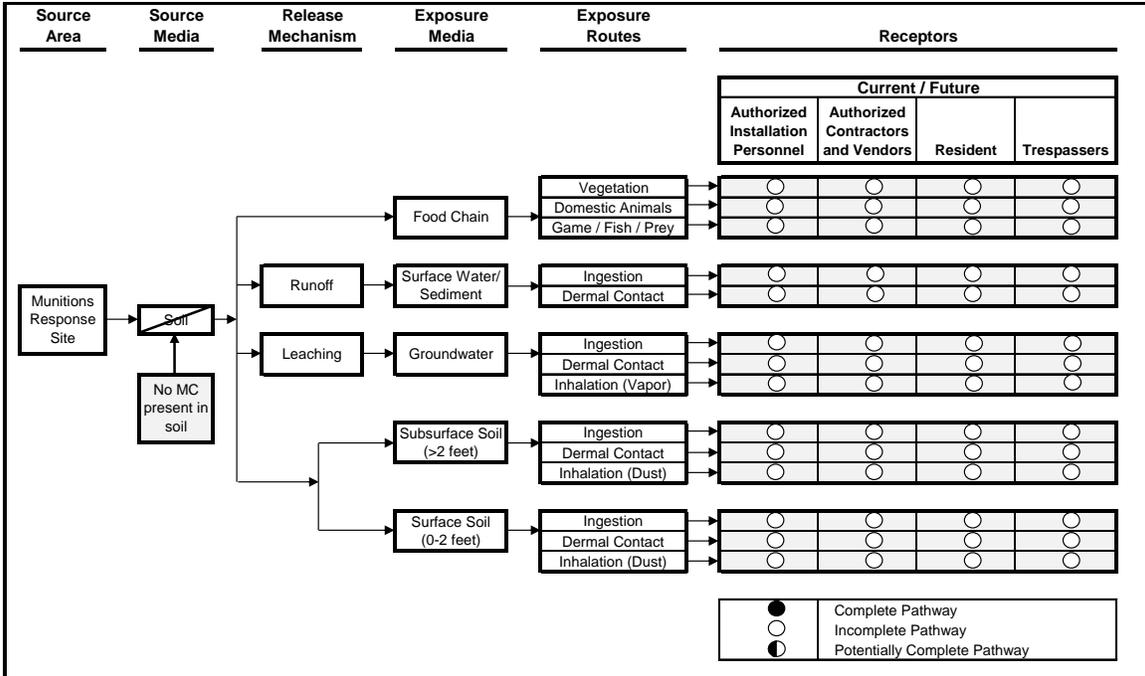
**CSM for MEC:** The CSMs for MEC consider exposure pathways via intrusive and non-intrusive activities at the site. There are two figures, in which the MRSs are grouped by the relevant risk present at the sites. Figure 2-11 demonstrates the incomplete exposure pathway at MRSs where there is no MEC expected to be present; Figure 2-12 demonstrates the exposure pathway where MEC has the potential to be present. Notes in the lower right of each figure indicate the documentation or rationale for the inclusion of each MRS in these groupings. The potential of creating an off-site explosive risk exposure pathway via leaching, surficial erosion, or other mechanism is considered minimal at all sites. The reduction of site access via physical and/or administrative methods proportionately reduces the exposure risk to MEC at the site. Elimination of access (shown in the No Access box in each figure) eliminates the exposure risk.

**CSM for MC:** The CSMs for MC consider exposure pathways and receptors for MC at the MRSs. LUCs would reduce or eliminate access to the site, and therefore reduce risk of direct contact with MC. Figure 2-13 groups MRSs where there is no evidence for presence of MC at the site. Figures 2-14 through 2-17 address MRSs where there is potential for MC. MRSs are grouped based on whether they have the same potential pathways. CSMs were developed based primarily on the most recent documentation (SIs or RIs) if these were known to reflect the current status of the MRS, and secondarily on the best available information in the event that changes had occurred since documents were last updated. Notes in the lower right of each figure indicate the documentation or rationale for the pathway of each MRS.

### **2.2.2 Risk Estimation**

The potential risks at the site, particularly from MEC explosive hazards, are not quantified at this stage of the MMRP. Qualitative risk estimates were documented using the MRSPP in the SI (USACE, 2008). The MRSPP implements the requirement established in Section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location in the DoD's inventory of defense sites known or suspected of containing MEC or MC. The MRSPP Priority Rating is on a scale of 1 to 8, with 1 being the most hazardous. For sites that do not have a chemical warfare munitions hazard, the highest score is 2 (for explosive hazard or human health hazard). The MRSPP estimates from the SI are used as an indicator of the relative risks of MRSs at Fort Belvoir.

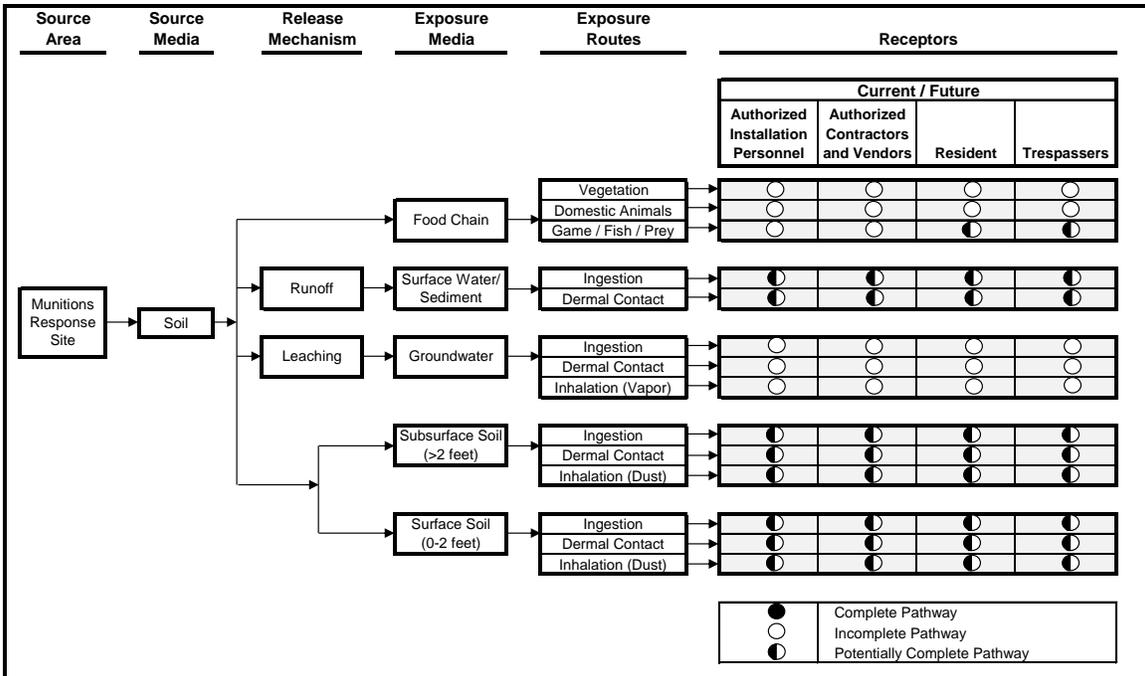




**Figure 2-13: Conceptual Site Model - MC**  
 Fort Belvoir: Demolition Area - 01, Mines and Booby Traps Area, T-16 Range  
 Munitions Constituents Exposure Pathway Analysis

URS

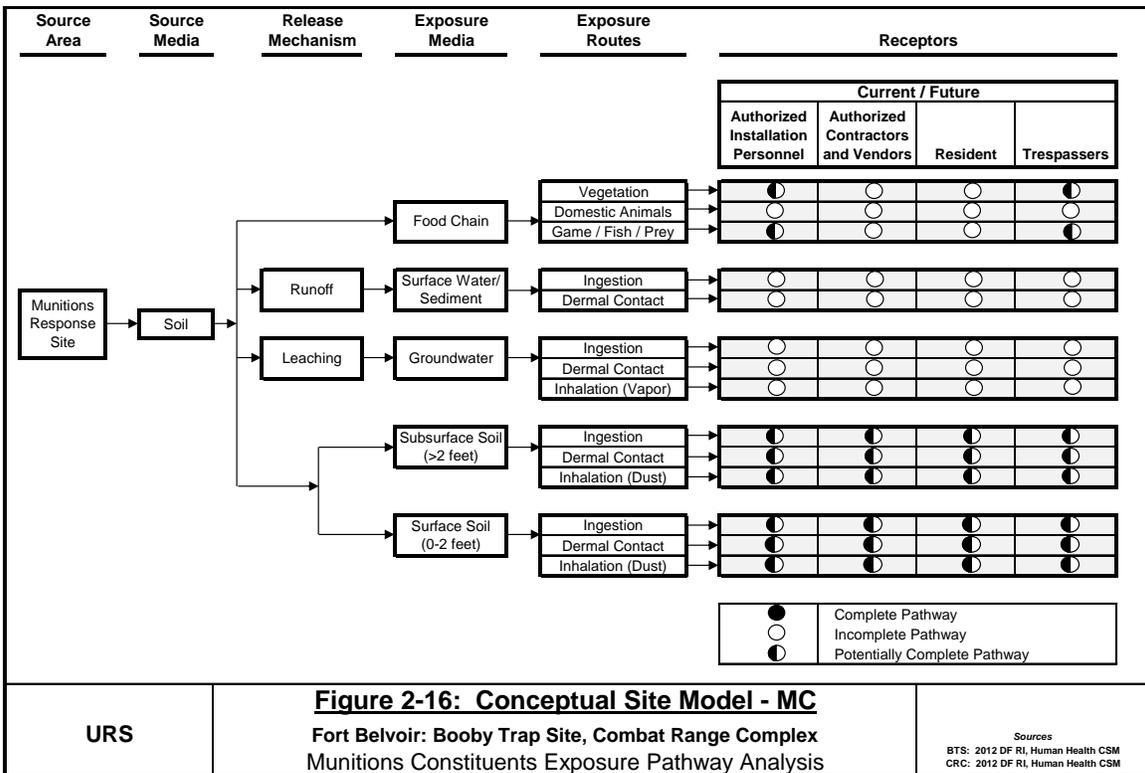
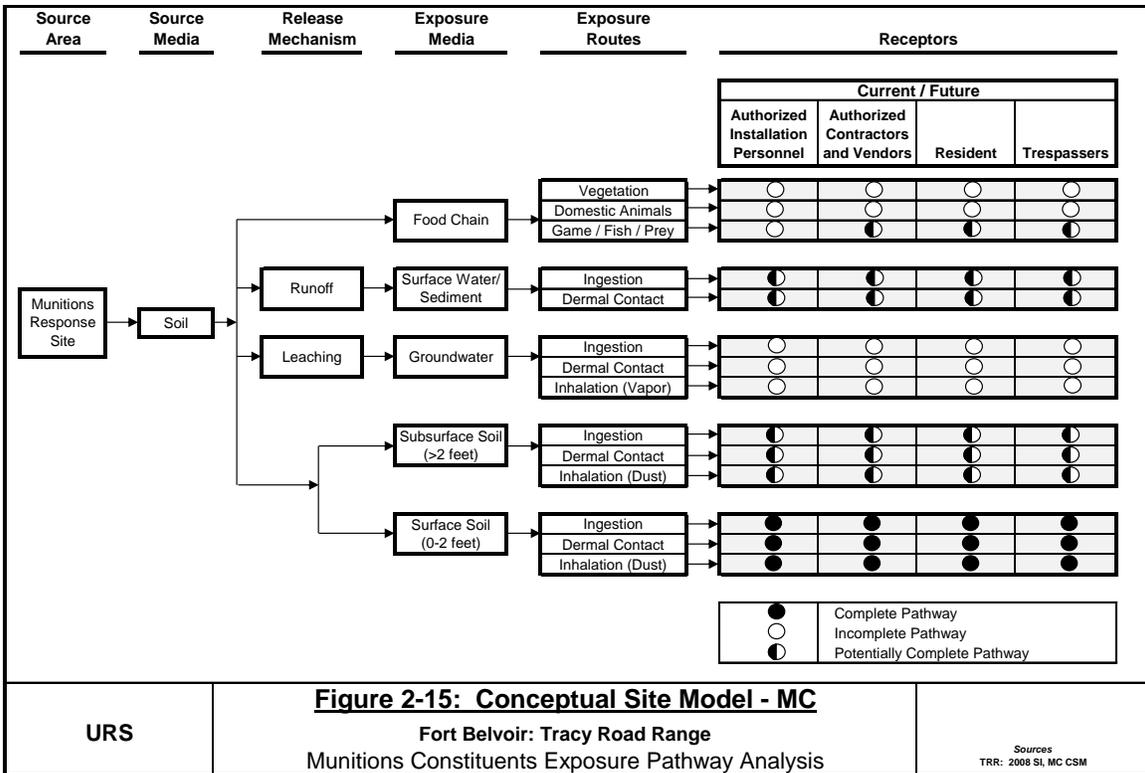
Sources  
 DA-01: 2012 DF RI, MC CSM  
 M&BTS: 2008 SI, MC CSM  
 T-16 R: Final 2011 RI, MC CSM



**Figure 2-14: Conceptual Site Model - MC**  
 Fort Belvoir: Infiltration Course, Grenade Court  
 Munitions Constituents Exposure Pathway Analysis

URS

Sources  
 IC: 2008 SI, MC CSM  
 GC: 2012 DF RI, MC CSM



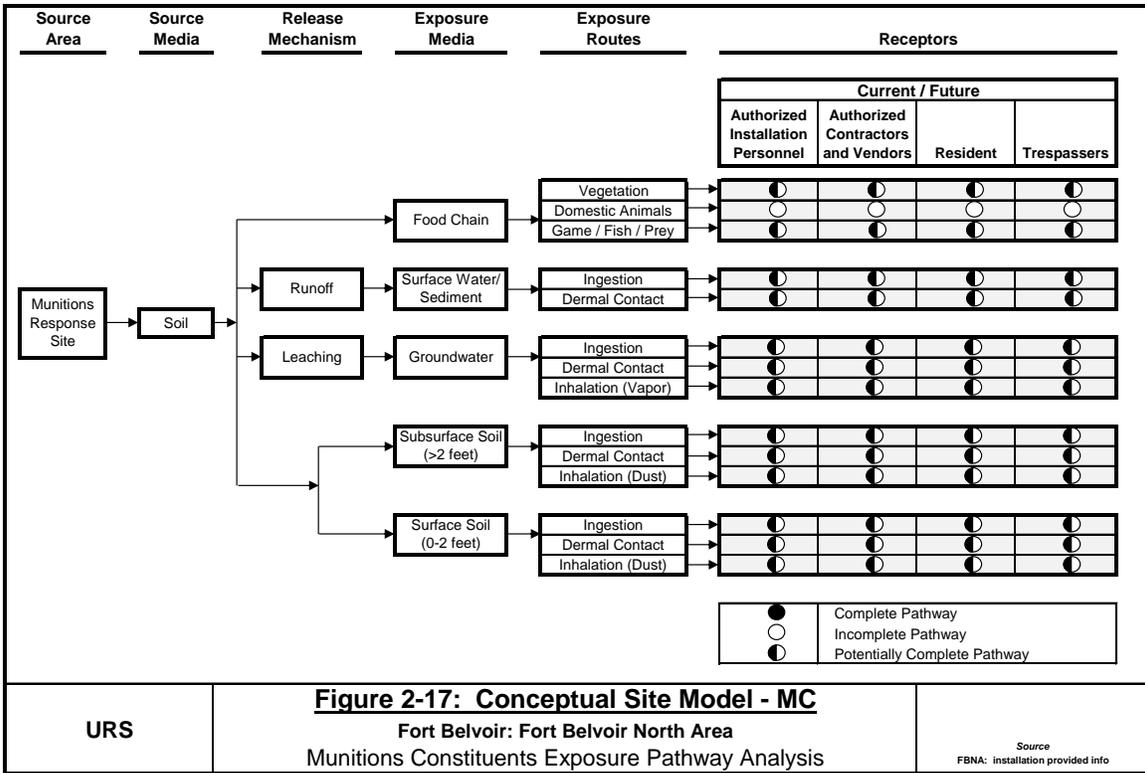


Table 2-1 shows the on-post MRSs under consideration in this EE/CA. These MRSs are grouped according to their MRSPP scores as an indicator of their relative risk, as indicated by the double lines between each increase in the MRSPP score. This grouping will be considered as specific LUC options are evaluated.

**Table 2-1: On Post MRSs Recommended for Further Action**

MRS Name	AEDB-R No.	Acres	COCs Present		MRSPP Score	Existing LUCs***
			MEC	MC		
Fort Belvoir North Area <i>(formerly EPG)</i>	FTBL-005-R-01	807	Yes	Yes	3	LUCs for two SWMUs and FATTS, partial fence
Demolition Area – 01	FTBL-018-R-01	420	Yes	No	3	Environmental development restrictions (partial)
Combat Range Complex	FTBL-003-R-01	320	Yes	Yes*	4	Environmental development restrictions
Grenade Court	FTBL-007-R-01	100	No	Yes	5	Environmental development restrictions, partial fence
T-16 Range	FTBL-027-R-01	232	Yes	No	5	Environmental development restrictions
Infiltration Course	FTBL-001-R-02	5	No	Yes	6	Environmental development restrictions, vehicle gate
Tracy Road Range	FTBL-014-R-01	33	No	Yes (lead)	6	Environmental development restrictions for state permitted landfill, installation access control point
Booby Trap Site	FTBL-024-R-01	13	Yes	No	6	Environmental development restrictions
Mines and Booby Traps Area	FTBL-026-R-01	110	Yes	No	**	No MRS-Specific LUCs

\* = MC is only a concern in a limited portion of this site, not the whole MRS

\*\* = An MRSPP score has not yet been determined for the Mines and Booby Trap MRS

\*\*\* = Column includes all location-specific LUCs. Installation-wide institutional controls include dig permits.

AEDB-R - Army Environmental Database – Restoration

COCs – Constituents of Concern

## **3.0 IDENTIFICATION OF NTCRA LAND USE CONTROL OBJECTIVES**

### **3.1 REMOVAL ACTION OBJECTIVE**

The objective of the NTCRA LUCs is to protect human health by minimizing human exposure to MEC and MC, including but not limited to the potential for fire and explosion, at on-post MRSs while further response actions are evaluated and implemented. CERCLA standard language is for remedial actions to protect both human health and the environment. The interim NTCRA LUCs considered under this phase of the MMRP are required because the conditions at the site support a NTCRA according to 40 CFR 300.415(b)(2)(vi), including, but not necessarily limited to “threat of fire or explosion.”

### **3.2 RESIDUAL RISK MANAGEMENT**

The NTCRA LUC is intended to reduce the probability of direct contact with the MEC or MC, and will thus reduce the exposure and explosive risk to humans at the MRSs.

However, no action will be taken with this NTCRA to remove or remediate the MEC and MC at the nine MRSs at Fort Belvoir. Therefore, residual risk from the MEC and MC will remain. The LUCs alternative is a NTCRA and is not intended to be permanent or to replace the need for the more permanent solutions developed under the MMRP.

### **3.3 STATUTORY REQUIREMENTS ON NTCRA LAND USE CONTROLS**

NTCRAs are conducted when a removal action is appropriate and there will be at least six months before on-site activities can begin, because NTCRAs can be established at a site more quickly than other CERCLA options. The NTCRA LUCs described here are interim (not final) actions for each MRS.

The NCP §300.415 provides the regulatory framework for NTCRAs. Guidance documents include *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (USEPA, 1993a) and the fact sheet, *Conducting Non-Time-Critical Removal Actions under CERCLA* (USEPA 1993b).

NCP §300.415(b)(4) specifies that a removal action requires preparing, with stakeholder involvement, an EE/CA and an AM, along with the required public involvement actions.

### **3.4 DETERMINATION OF NTCRA LAND USE CONTROL SCOPE**

Only Army-owned MRSs that are recommended for further action beyond the SI phase are included in this project. Sites with a No Further Action recommendation and MRSs located off Army-owned land will not be addressed in this action. Off-post MRSs are not being addressed because the Army cannot apply controls to land it does not own without the owner’s consent.

### **3.5 REGULATORY/OTHER STAKEHOLDER CONCERNS**

Fort Belvoir has regulatory oversight from USEPA and VADEQ as described in Section 1.6.

The primary regulatory and other stakeholder goals are to provide short- and medium-term protection of human health and the environment at the MRSs. This will be accomplished by limiting access, which will minimize human and ecological exposure to MEC and MC at the site.

### **3.6 PLANNED REMEDIAL ACTIVITIES**

This EE/CA is the first part of a series of actions intended to result in LUCs established at on-post MRSs within one year. It identifies the appropriate LUC measure for each MRS and combines these across all MRSs to provide the LUCs alternative for Fort Belvoir.

The Final EE/CA will be presented to the public for review and comment. Public participation will be sought with both a 30-day review and a public meeting if requested during the 30-day review period.

An Action Memorandum (AM) will follow the Final EE/CA and will document the selection and approval for the LUCs to be used at the installation's MRSs. The public input on the Final EE/CA will be incorporated into the AM, in Section V "Proposed Actions and Estimated Costs" and in an attached responsiveness summary. The recommended outline for an AM is provided in Appendix C.

Once the AM is complete, a Land Use Control Plan (LUCP) will be finalized. A Draft Final LUCP has been prepared (USACE, 2009) and will be revised to incorporate the findings of the EE/CA and AM. The LUCP explains the implementation and management of the LUCs at each MRS. In addition to background information and site information, the LUCP presents (i) existing LUCs, (ii) zoning and land use restrictions, (iii) DoD and non-DoD agency responsibilities, (iv) documentation requirements, (v) LUC monitoring, management, and maintenance, and (vi) LUC funding.

## **4.0 IDENTIFICATION AND ANALYSIS OF NTCRA ALTERNATIVES**

This EE/CA is focused on two alternatives (No Action and LUCs) for addressing the potential risks at on-post MRSs while the MMRP progresses and more permanent actions are investigated and implemented.

### **4.1 ALTERNATIVE 1 - NO ACTION**

A No Action alternative is retained as required by 40 CFR 300.430(e)(6). This alternative provides a baseline against which Alternative 2 – LUCs can be evaluated. Under the No Action alternative, no change in the baseline conditions would be implemented at an MRS.

For example, if no LUCs are currently in place, then no action of any kind, including LUC measures, reviews, or inspections, would be implemented at the MRS. Any MEC or MC would remain in place without protective barriers, warnings, or restrictions on use of the area. However, if LUCs are currently in place, then the LUCs will remain as established. The No Action alternative would, in this case, be evaluated based on no change to the existing condition (i.e., established LUCs). Since the LUC measures are already in place, the on-going reviews or inspections would be implemented as already planned with no change from what has already been budgeted or scheduled.

The No Action alternative has no implementation considerations because no actions would be taken that differ from the existing or baseline condition. As such, there are also no additional costs incurred with this alternative because there are no changes proposed. If there are no LUCs in place as the baseline condition, there are also no means to establish, evaluate, or confirm the No Action alternative's effectiveness in achieving the NTCRA objectives. In the case of Fort Belvoir, MRSs are already documented in the Master Plan and excavation permits are required across the installation, but no means exist to formally monitor or evaluate the effectiveness of current land use controls at these sites.

### **4.2 ALTERNATIVE 2 - LUCS**

The LUCs alternative consists of the set of measures selected for each MRS, or grouping of similar MRSs, that reduce or eliminate potential risks to human health at the installation. Standard installation-wide LUC components will be supplemented with MRS-specific measures, if necessary, to address the conditions at the individual sites.

A description of the potential components and their general and MRS-specific application at Fort Belvoir follows.

#### ***4.2.1 Identification and Screening of LUC Components***

The term “LUCs” encompasses administrative, engineering and other methods to reduce or eliminate potential risks to human health. The AEDB-R has a list of possible LUCs that includes 22 institutional controls, four engineering controls, and 21 Land Use Restrictions (LURs). To identify appropriate LUCs for a specific installation, the list is narrowed down to include short-term NTCRA options to address on-post MRSs while more permanent actions are determined.

The LUC measures considered in this EE/CA are listed below and described in this section.

## **1. Institutional Controls**

- a. Land Use Restrictions/Notations in Master Plan/Dig Permit
- b. Public Advisories (such as educational programs, public announcements, posted bulletins)

## **2. Engineering Controls:**

- a. Markers or Signs
- b. Fences
- c. Guards

## **3. Other Measures:**

- a. Periodic Inspections (i.e., Monitoring and Enforcement)
- b. Environmental Self Audit

### **4.2.1.1 Institutional Controls: Land Use Restrictions, Notations in the Master Plan, and Dig Permits**

The primary Institutional Control measure considered is the combination of Land Use Restrictions, Notations in the Master Plan, and Dig Permits. These three measures are dependent on one another and functionally grouped. The restrictions considered most likely to meet the on-post and NTCRA constraints at Fort Belvoir are:

- **Restrict Land Use:**
  - No new daycare/hospital/school use at any MRSs without prior review and approval by Fort Belvoir's Installation Safety Office.
  - No new residential use at any of these MRSs without prior review and approval by Fort Belvoir's Installation Safety Office.
- **Notations in the Master Plan:**
  - To indicate the MRS boundaries of all nine MRSs, notations will be made in the Master Plan; this will be done by the Master Planning Division of the Directorate of Public Works (DPW).
- **Dig Permits:**
  - Dig permits will be used for each excavation, will be subject to restrictions noted in the Fort Belvoir Master Plan, and will provide a control mechanism to ensure that the MMRP-based LUCs are followed. Implementation of dig permits is performed by the Operations and Management Section of the DPW. Fort Belvoir has an existing excavation permit process, which the NTCRA LUCs can be tailored to fit.
- **Media-Specific Restrictions**
  - Prohibit or otherwise manage excavation

Conditional restrictions will also likely be required at some MRSs, such as UXO clearance to a specified depth with any excavation, drilling, or disturbance of soil, or periodic surface clearance of the MRS if certain non-intrusive activities are allowed. All restrictions will require coordination with the installation master planner and other Army stakeholders. They must be approved by the garrison commander and IMCOM .

The Installation Master Plan is used for land use and construction project planning. Notations would be made in the Master Plan to identify MRSs and to document related LUC restrictions and zoning changes, if any. The Installation's Geographic Information System can be used to demarcate the MRSs and applicable LUCs.

Regulatory agencies do not consider Master Plans to be enforceable, but the Action Memorandum or other primary documents associated with the NTCRA LUC project may be enforceable.

LUCs are implemented through the master planning process at an installation, as described in Army Regulation (AR) 210-20, *Real Property Master Planning for Army Installations* (2005). The recommendations in the NTCRA are incorporated into the master planning process, but by themselves do not establish the LUCs. Ultimately, the Garrison Commander and the IMCOM Region Directorate will authorize the establishment of these LUCs.

Existing permit programs for the installation (such as dig permits, building permits, water/sewer connection permits, and excavation permitting systems) can be modified to include the prohibitions, restrictions or conditions established for MEC and MC at an MRS. These are often triggered by a DA Form 4283 (Facilities Engineering Work Request) and by the follow-up Record of Environmental Consideration (REC). The reviewing agencies will know of and convey to the applicants the LURs and LUCs at the site. In this way, the dig permits can be used to enforce prohibitions or notify construction crews of the potential risks and measures needed to mitigate risks.

To maintain a successful permit program, a system to verify compliance with the permit program and the authority to bring violators back into compliance is required. In the case of a MEC-contaminated site, a permit program can be established to require clearance by UXO-qualified personnel prior to excavation for footings or foundations.

#### **4.2.1.2 Institutional Controls: Public Advisories**

A variety of advisory, notification, or educational material could be used to alert the public of the potential risks at an MRS. These advisories may be helpful in alerting the public to safety consideration at the site, but they have several limitations. First, a large-scale community notice may create an exaggerated perception of actual risks posed at a site. Second, a one-time or even repeated advisory may, with time, have diminishing effectiveness, desensitizing the public to the risks and control measures taken at the site.

It is thus recommended that the advisories be targeted to the groups affected by LUCs. For instance, advisory pamphlets could be provided to buildings and houses adjacent to an MRS, or to crews and individuals when they apply for dig permits or building permits in the vicinity of the MRS. One potential source of advisory material that could be used by Fort Belvoir is the UXO 3Rs<sup>2</sup> program, which has been developed by the Army for educational purposes. This material could be used directly, or tailored to the specific needs of Fort Belvoir (for instance by

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<sup>2</sup> The 3Rs are

- RECOGNIZE — when you may have encountered a munition.
- RETREAT — do not touch, move or disturb it, but carefully leave the area.
- REPORT — call 911!

More information can be found at website <http://www.denix.osd.mil/uxo/> and other locations.

replacing the generic 911 number with the installation-specific 703-806-3104/3105). These 3Rs advisories could be prepared to warn of potential MEC explosive hazards in area, and then distributed to the public as part of the UXO safety education program.

#### **4.2.1.3 Engineering Controls: Signs and Markers, Fences, and Guards**

Signs and markers can be used to warn people of the potential dangers of MEC and MC at an MRS. This may limit potential contact, but will do nothing to restrict contact by those who cannot read or chose to ignore the warnings. The costs for sign coverage are roughly proportional to the linear footage of the perimeter. The generic estimate provided in Table 4-3 for sign installation is based on a square site covering 5 acres, with signs placed every 200 feet around the perimeter (approximately 1000 ft. at a 5-acre site). Signs have been recommended as an effective LUC for all MRSs at this installation. Signs would be implemented and maintained by the Fort Belvoir DPW Operations and Maintenance (O&M) Section.

A perimeter fence could be used to limit access to an MRS. For the NTCRA LUC, a medium-security, 5-foot high, industrial chain link fence (with 6-gauge galvanized steel wire, and no barbed wire at the top) is suggested. The cost of fence installation depends on the MRS site conditions and size. The generic estimate provided in Table 4-3 is for a square site covering 5 acres, with costs roughly proportional to the linear footage (approximately 1000 ft.) of the perimeter.

The stationing of guards to limit or control access to an MRS is labor-intensive and costly. As a result, it would normally not be recommended as a NTCRA LUC.

Fences and additional guards have not been recommended at any of the MRSs at Fort Belvoir. Guards and surveillance are already used at all entrances to the installation, and the cost of hiring more would not be commensurate with the estimated low level of risk present at these sites.

#### **4.2.1.4 Other Measures: Periodic Inspections**

The DoD Office of the Deputy Under Secretary of Defense (Environmental Security) recommends the following:

- **“Inspections:** The inspection of LUCs should become part of existing inspections conducted at the installation. Depending on the type of LUCs, these inspections could include a visual check to ensure that proper maintenance of LUCs is taking place.
- **“Environmental Self-Audit.** Evaluating and verifying LUCs should be part of the Component's environmental audit and self-inspection program, and should be incorporated into the self-audit checklist and required report.” (DoD, 2001a)

These inspections and environmental self-audits are estimated to cost \$1,000 annually per MRS. These inspections are combined in a program of “Monitoring and Enforcement” which will conduct an annual review to ensure that LUCs remain effective and land usage has not changed.

#### **4.2.2 *Evaluation of Alternative 2 LUC Components***

NTCRAs are evaluated on the basis of three of the CERCLA criteria: effectiveness, implementability, and cost. The following is a summary of each as applied to the MRSs at Fort Belvoir. MRS-specific adjustments are described in Section 4.3.

#### 4.2.2.1 Effectiveness

Effectiveness is evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health after implementation. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time. Table 4-1 shows the general effectiveness ratings of the LUC components.

**Table 4-1: Effectiveness of Alternative 2 LUC Components**

LUC Component	Short-Term Effectiveness		Long-Term Effectiveness	Overall Rating
	Time needed to reach full effectiveness	Construction impacts on human health	Reliable protection of human health	
1. Land Use Restrictions/ Notations in Master Plan/ Dig Permits	Immediate upon authorization	Not applicable	Yes to workers	●
2. Public Advisories	> 1 month	Not applicable	Some	○
3. Signs and Markers	< 1 week	No	Some	●
4. Fences	> 1 month	Some to workers	Yes	●
5. Guards	> 1 month	No	Yes	●

● Excellent   ● Good   ○ Average   ⊗ Poor   NA=Not Applicable   TBD=To Be Determined

#### 4.2.2.2 Implementability

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or unworkable at a site, and administrative feasibility, which reviews the ability to obtain permits, and the availability of necessary services, equipment, and skilled workers to implement the technology. All LUC components that passed the initial screening are considered technically feasible, so that factor is not shown here. Table 4-2 shows the general implementability ratings of the LUC components.

**Table 4-2: Implementability of Alternative 2 - LUCs**

LUC Component	Administrative Feasibility		Overall Rating
	Ability to obtain permits	Availability of services, equipment, workers	
1. Land Use Restrictions/ Notations in Master Plan/ Dig Permits	Yes	Not applicable	●
2. Public Advisories	Yes	Not applicable	●
3. Signs and Markers	Yes	Yes	●
4. Fences	Yes	Yes	●
5. Guards	Yes	Good use of personnel?	○

● Excellent   ● Good   ○ Average   ⊗ Poor   NA=Not Applicable   TBD=To Be Determined

### 4.2.2.3 Cost

Cost estimates are reviewed as capital (first year) costs, operation and maintenance (O&M) costs, and net present value (NPV) costs. Cost estimates were developed as shown in Appendix B. Table 4-3 provides generic costs for the variety of potential LUCs. The methodology for developing these costs is presented in Appendix B, and the methods are used to calculate MRS-specific costs proved later in this document.

**Table 4-3: Generic Summary of Alternative 2 - LUCs**  
(costs are in \$1,000s)

LUC Component	Cost Dependency	Capital Cost	Annual Operating Cost <sup>(1)</sup>	O&M Years	NPV <sup>(2)</sup>
• Land Use Restrictions/Notations in Master Plan/ Dig Permits <sup>(3)</sup>	No	\$ 43.2	\$ 6.5	4	\$ 61.8
• Public Advisories	No	\$ 6.8	\$ 6.8	4	\$ 30.0
• Signs and Markers	/linear feet of perimeter	\$ 10.9	\$ 0.1	4	\$ 11.2
• Fences	/linear feet of perimeter	\$ 56.1	\$ 5.6	4	\$ 72.1
• Guards	/installation	\$ 261.8	\$ 261.8	4	\$1,006.0

- Notes: (1) Annual costs include inspections and self-audits of the LUCs.  
 (2) A 4-year period with a 2.75% discount rate is used for economic projections.  
 (3) Institutional controls are not size dependent.

Two of the three engineering controls have costs that are size-dependent as discussed in Appendix B. The costs for signs and fences are roughly proportional to the linear feet of the perimeter, under the assumption that the MRS is square in shape. The costs for the other LUCs are independent (or minimally dependent) on MRS size.

### 4.3 INSTALLATION/MRS-SPECIFIC LUCs

The appropriate combination of administrative and engineered LUCs is outlined here for each MRS at Fort Belvoir. The LUC measure “Land Use Restrictions/Notations in Master Plan/Dig Permits” is appropriate for all MRSs at Fort Belvoir. It incorporates measurable and actionable means to limit exposure to the MEC and MC at each MRS at a relatively low cost.

The LUC measure of signs and markers (engineering control) is also appropriate for all MRSs at Fort Belvoir. Due to the fact that many of the MRSs do not have strong engineering controls currently in place, their boundaries are permeable, and they are therefore accessible. It would be undesirable to put fences around many of these MRSs, due to the environmental development restrictions in place. Table 4-4 shows the MRSs that require additional LUC measures (advisories) because of the specific conditions found.

**Table 4-4: On-Post MRSs Recommended for Further Action**

MRS Name	Acres	MEC Present?	MC Present?	MRSP Score	MRS-Specific LUC Components Needed? <sup>(1)</sup>					Comments
					Land Use Restrictions	Advisories	Signs/Markers	Fences	Guards	
Infiltration Course	5	No	Yes	6	Yes		Yes			Development restrictions due to sensitive environment, vehicle gate, future use not expected to change
Combat Range Complex	320	Yes	Yes*	4	Yes	Yes	Yes			Development restrictions due to sensitive environment, future use not expected to change
Fort Belvoir North Area (formerly EPG)	807	Yes	Yes	3	Yes	Yes	Yes	PP	PP	Contains two SWMUs with LUCs, limited fencing, use in flux due to BRAC construction
Grenade Court	100	No	Yes	5	Yes		Yes	PP		Development restrictions due to sensitive environment, partial fence, future use not expected to change
Tracy Road Range	33	No	Yes (lead)	6	Yes		Yes			Development restrictions due to sensitive environment, behind installation access point, future use not expected to change
Demolition Area - 01	420	Yes	No	3	Yes	Yes	Yes			Partial development restrictions due to sensitive environment, future use not expected to change
Booby Trap Site	13	Yes	No	6	Yes	Yes	Yes			Development restrictions due to sensitive environment, future use not expected to change
Mines and Booby Traps Area	110	Yes	No	**	Yes	Yes	Yes			No existing LUCs, evaluating for future development
T-16 Range	232	Yes	No	5	Yes	Yes	Yes			Partial development restrictions due to environment, future road

(1) MRS-Specific LUC Components: PP = Partially in place, LUC component already exists to some degree.  
 Yes = LUC Component needed  
 Blank = LUC Component not needed

\* = MC is only a concern in a limited portion of this site, not the whole MRS

\*\* = This MRS has not yet been issued an MRSP score

Table 4-5 summarizes LUCs Alternative components for Fort Belvoir, and includes an estimate of the costs associated with each.

**Table 4-5: Components and Cost Summary of LUCs Alternative at Fort Belvoir**  
(costs are in \$1,000s)

LUCs Alternative: Selected Components	LURs/ Notation in Master Plan / Dig Permits	Advisories	Signs/ Markers	Fences	Guards	Capital Cost	Annual Operating Cost <sup>(1)</sup>	O&M Years	Net Present Value <sup>(2)</sup>
<b>Infiltration Course</b>									
Institutional Controls	Yes					\$ 4.8	\$ 1.8	4	\$ 9.8
Other Controls			Y			\$ 2.0	\$ 0.1	4	\$ 2.3
<b>Combat Range Complex</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 8.9	\$ 0.8	4	\$ 11.2
<b>Fort Belvoir North Area</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 13.4	\$ 1.2	4	\$ 16.9
<b>Grenade Court</b>									
Institutional Controls	Yes					\$ 4.8	\$ 1.8	4	\$ 9.8
Other Controls			Y			\$ 5.0	\$ 0.4	4	\$ 6.1
<b>Tracy Road Range</b>									
Institutional Controls	Yes					\$ 4.8	\$ 1.8	4	\$ 9.8
Other Controls			Y			\$ 3.3	\$ 0.2	4	\$ 3.9
<b>Demolition Area – 01</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 9.9	\$ 0.9	4	\$ 12.4
<b>Booby Trap Site</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 2.9	\$ 0.2	4	\$ 3.4
<b>Mines and Booby Trap Area</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 6.7	\$ 0.6	4	\$ 8.3
<b>T-16 Range</b>									
Institutional Controls	Yes	Y				\$ 5.9	\$ 2.9	4	\$ 14.2
Other Controls			Y			\$ 7.9	\$ 0.7	4	\$ 9.8
<b>Total</b>						<b>\$ 110.0</b>	<b>\$ 27.7</b>	<b>4</b>	<b>\$ 188.7</b>

- Notes: (1) Annual costs include inspections and self-audits of the LUCs.  
(2) A 4-year period with a 2.75% discount rate is used for economic projections.  
(3) Institutional controls are not size dependent.

## 5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Alternative 1 - No Action and Alternative 2 - LUCs under consideration at Fort Belvoir are evaluated according to the three CERCLA criteria used with NTCRAs: effectiveness, implementability, and cost.

### 5.1 EFFECTIVENESS

Effectiveness is evaluated as both a short-term and long-term measure. Short-term effectiveness is defined by both the length of time needed until protection is in place and the impacts on human health after implementation. Long-term effectiveness concerns the ability of the alternative to reliably protect human health over time. The effectiveness of each alternative is summarized in Table 5-1 below. The No Action alternative has a poor effectiveness rating due to its inability to achieve the NTCRA objectives with any reliability, while the LUCs alternative is rated above average (good) in its effectiveness.

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

Alternative	Short-Term Effectiveness		Long-Term Effectiveness		Overall Rating
	Time need to reach full effectiveness	Construction impacts on human health	Reliable protection of human health	Reliable protection of environment <sup>(1)</sup>	
1. No Action	Unknown	●	⊗	NA	⊗
2. LUCs alternative	Immediate upon authorization	◐	●	NA	◐

● Excellent   ◐ Good   ○ Average   ⊗ Poor   NA=Not Applicable   TBD=To Be Determined

(1) CERCLA standard language is for remedial actions to protect both human health and the environment, but a NTCRA LUC only protects human health.

### 5.2 IMPLEMENTABILITY

Implementability addresses the feasibility of implementing an alternative. It includes technical feasibility by screening out alternatives that clearly would be ineffective or unworkable at a site, and administrative feasibility, which reviews the ability to obtain permits, and the availability of necessary services, equipment, and skilled workers to implement the technology. All LUCs that passed the initial screening are considered technically feasible, so that factor is not shown. The No Action alternative has no technical or administrative feasibility considerations (Table 5-2).

**Table 5-2: Comparison of Implementability of Alternatives**

Alternative	Administrative Feasibility		Overall Rating
	Ability to obtain permits	Availability of services, equipment, workers	
1. No Action	NA	NA	●
2. LUCs Alternative	●	◐	●

● Excellent   ◐ Good   ○ Average   ⊗ Poor   NA=Not Applicable   TBD=To Be Determined

### 5.3 COST

Cost estimates are reviewed as capital (first year) costs, O&M costs, and NPV costs.

Costs estimates were developed as shown in Appendix B. The cost summary for the alternatives is shown in Table 5-3. While the No Action alternative has no associated costs and thus is least expensive, implementing LUCs is a reasonably priced alternative at \$188,749 over a 4-year duration.

**Table 5-3: Cost Summary of Alternatives**  
*(costs are in \$1,000s)*

<b>Alternative</b>	<b>Cost Dependency</b>	<b>Capital Cost</b>	<b>Annual Operating Cost <sup>(1)</sup></b>	<b>O&amp;M Years</b>	<b>NPV <sup>(2)</sup></b>
1. No Action Alternative	No	\$ 0	\$ 0	NA	\$ 0
2. LUCs Alternative	Yes	\$ 110.0	\$ 27.7	4	\$ 188.7

- Notes: (1) Annual costs include inspections and audits of the LUCs.  
(2) A 4-year period with a 2.75% discount rate is used for economic projections.

## 6.0 RECOMMENDED NTCRA ALTERNATIVE

Two NTCRA alternatives were evaluated for their ability to meet the removal action objective of protection of human health at the on-post MRSs for Fort Belvoir.

- **Alternative 1 - No Action:** This alternative represents the baseline (current) conditions with no additional restrictions or protective measures.
- **Alternative 2 - LUCs:** This alternative includes a combination of institutional controls (land use restrictions, notation in the Installation Master Plan, dig permits) and signs for all MRSs, plus the MRS-specific measure of advisories at six MRSs (Combat Range Complex, Fort Belvoir North Area, Demolition Area – 01, Booby Trap Site, Mines and Booby Traps Area, and T-16 Range).

The No Action alternative does not meet the removal action objective and provides no means of protecting human health.

The LUCs alternative is effective and implementable. It meets the removal action objective and helps protect human health by limiting exposure to MEC and MC at the nine on-post MRSs. Because MEC and MC remain on site, risks will remain at the MRSs on-post; however, they will be controlled through LUCs. Therefore, Alternative 2 (LUCs) is recommended for implementation at Fort Belvoir.



## **APPENDICES**

Appendix A	References
Appendix B	Cost Breakdowns and Assumptions
Appendix C	Action Memorandum Outline



**APPENDIX A**

**REFERENCES**

## APPENDIX A: REFERENCES

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## **APPENDIX B**

### **Cost Breakdowns and Assumptions**

LUC Component Costs are shown for the following NTCRA LUC components which were developed RACER (Version 10.3.0).

#### **Appendix B.1: Institutional Controls**

- Notations in Master Plan
- Dig Permits
- Public Advisories
- Monitoring and Enforcement

#### **Appendix B.2: Engineering Controls**

- Fences
- Signs
- Guards

#### **Appendix B.3: Net Present Value Example**

#### **Appendix B.4: LUC Components and NPV Calculations –**

- Table B.4.1 Infiltration Course
- Table B.4.2 Combat Range Complex
- Table B.4.3 Fort Belvoir North Area
- Table B.4.4 Grenade Court
- Table B.4.5 Tracy Road Range
- Table B.4.6 Demolition Area – 01
- Table B.4.7 Booby Trap Site
- Table B.4.8 Mines and Booby Traps Area
- Table B.4.9 T-16 Range
- Table B.4.10 Summary of Fort Belvoir MRSs

## B.1: RACER Institutional Controls

### Notations in Master Plan

RACER Administrative Land Use Control Technology  
Implementation Tab

#### Assumptions/RACER Selections

Based on Modify Installation Master Plan task  
Low Complexity  
US location multiplier (1.0) (average costs for US as a whole)  
Active Government Installation selected on Systems Definition Tab

	<u>First Year</u>	<u>Annual</u>
Cost ** =	\$36,695	\$0

### Dig Permits

RACER Administrative Land Use Control Technology  
Monitoring and Enforcement Tab

#### Assumptions/RACER Selections

Based on Notice Letter task  
2 permits issued each year  
US location multiplier (1.0) (average costs for US as a whole)  
Active Government Installation selected on Systems Definition Tab

	<u>First Year</u>	<u>Annual</u>
Cost ** =	\$6,530	\$6,530

### Public Advisories

RACER Administrative Land Use Control Technology  
Monitoring and Enforcement Tab

#### Assumptions/RACER Selections

Based on Notice Letter task  
10 letters sent each year  
US location multiplier (1.0) (average costs for US as a whole)  
Active Government Installation selected on Systems Definition Tab

	<u>First Year</u>	<u>Annual</u>
Cost ** =	\$6,757	\$6,757

**Monitoring and Enforcement**

**RACER Administrative Land Use Control Technology  
Monitoring and Enforcement Tab**

**Assumptions/RACER Selections**

Based on Site Visit/Inspections task

1 Inspection, safety level D (default), 1 day, 2 people, no airfare, no mileage

US location multiplier (1.0) (average costs for US as a whole)

Active Government Installation selected on Systems Definition Tab

	<u>First Year</u>	<u>Annual</u>
<b>Cost ** =</b>	<b>\$0</b>	<b>\$9,404</b>

Notes: \* RACER Version 10.3.0  
\*\*costs include material, labor, and equipment and markup

## B.2: RACER Engineering Controls \*

### Fences and Signs

**RACER technology used: Fencing**

#### Assumptions/RACER selections

Linear feet (LF) of fencing assumes the site is square  
 Boundary fence type (5 foot high, galvanized chain link)  
 US location multiplier (1.0) (average costs for US as a whole)  
 Signs are placed on perimeter of site, approximately every 200 feet  
 Costs shown are first year costs. Assume 10% per year annual upkeep costs.

#### RACER Fencing Technology

Acres	LF	Fence Cost**	# Signs	Sign Cost**	Total Cost**
1	835	\$ 25,104	5	\$ 466	\$ 25,570
2	1,181	\$ 35,502	6	\$ 559	\$ 36,061
3	1,446	\$ 43,481	8	\$ 746	\$ 44,226
4	1,670	\$ 50,207	9	\$ 839	\$ 51,046
5	1,867	\$ 56,134	10	\$ 932	\$ 57,066
10	2,640	\$ 79,385	14	\$ 1,305	\$ 80,690
20	3,734	\$ 112,267	19	\$ 1,771	\$ 114,038
30	4,573	\$ 137,499	23	\$ 2,144	\$ 139,642
40	5,280	\$ 158,770	27	\$ 2,516	\$ 161,286
50	5,903	\$ 177,510	30	\$ 2,796	\$ 180,306
100	8,348	\$ 251,037	42	\$ 3,914	\$ 254,951
200	11,806	\$ 355,020	60	\$ 5,592	\$ 360,612
300	14,460	\$ 434,808	73	\$ 6,804	\$ 441,612
400	16,697	\$ 502,074	84	\$ 7,829	\$ 509,902
500	18,668	\$ 561,335	94	\$ 8,761	\$ 570,096
1000	26,400	\$ 793,848	132	\$ 12,302	\$ 806,150
2000	37,335	\$ 1,122,671	187	\$ 17,428	\$ 1,140,099
3000	45,726	\$ 1,374,985	229	\$ 21,343	\$ 1,396,328
4000	52,800	\$ 1,587,696	264	\$ 24,605	\$ 1,612,301
5000	59,032	\$ 1,775,098	296	\$ 27,587	\$ 1,802,685
10000	83,484	\$ 2,510,368	418	\$ 38,958	\$ 2,549,325
20000	118,064	\$ 3,550,196	591	\$ 55,081	\$ 3,605,277

### Guards

**RACER Administrative Land Use Control Technology  
 Monitoring and Enforcement Tab**

#### Assumptions/RACER selections

24/7 Coverage at one guard post = 168 hr/wk  
 Hourly rate = \$30 (includes RACER markup)  
 US location multiplier (1.0) (average costs for US as a whole)

	<u>First Year</u>	<u>Annual</u>
Cost ** =	\$261,818	\$261,818

Notes: \* RACER Version 10.3.0

\*\*costs include material, labor, and equipment and markup

## B.3: Net Present Value Example

(Used in generic summary of Alternative 2 costs, Section 4.2.1.4)

<b>Inputs and Assumptions</b>	
Site Size (acres)	5
First Year	2012
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>		1st Year	Annual	Years	Total	NPV
	Unit	Cost	Cost	Required		
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	/installation or major group	\$ 36,695	\$ -	4	\$ 36,695	\$ 36,695
Dig Permits	/installation or major group	\$ 6,530	\$ 6,530	4	\$ 26,120	\$ 25,090
Public Advisories	/installation or major group	\$ 6,757	\$ 6,757	4	\$ 27,028	\$ 25,962
Monitoring and Enforcement	/installation or major group	\$ -	\$ 9,404	4	\$ 28,212	\$ 26,729
<b>Engineering Controls</b>						
Signs	/5-acre site	\$ 10,932	\$ 93	4	\$ 11,212	\$ 11,197
Fence	/5-acre site	\$ 56,134	\$ 5,613	4	\$ 72,974	\$ 72,088
Guards	/installation or major group	\$ 261,818	\$ 261,818	4	\$ 1,047,272	\$ 1,005,973

<b>NPV Calculations</b>		2012	2013	2014	2015	2016	2017	2018	2019
	LUC Required?	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE
<b>Institutional Controls</b>									
	<b>NPV</b>								
Restrictions on land use / Notations in Master Plan	\$ 36,695	\$ 36,695	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 25,090	\$ 6,530	\$ 6,530	\$ 6,530	\$ 6,530	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 25,962	\$ 6,757	\$ 6,757	\$ 6,757	\$ 6,757	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 26,729	\$ -	\$ 9,404	\$ 9,404	\$ 9,404	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>									
	<b>NPV</b>								
Signs	\$ 11,197	\$ 10,932	\$ 93	\$ 93	\$ 93	\$ -	\$ -	\$ -	\$ -
Fence	\$ 72,088	\$ 56,134	\$ 5,613	\$ 5,613	\$ 5,613	\$ -	\$ -	\$ -	\$ -
Guards	\$ 1,005,973	\$ 261,818	\$ 261,818	\$ 261,818	\$ 261,818	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
 (2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.1: LUC Components and NPV Calculations – Infiltration Course

<b>Inputs and Assumptions</b>	
Site Size (acres)	5
Perimeter (ft.)	1867
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ -	\$ -	4	\$ -	\$ -
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 4,803</b>	<b>\$ 1,770</b>		<b>\$ 10,114</b>	<b>\$ 9,835</b>
<b>Engineering Controls</b>						
Signs	/ 5 acres	\$ 2,043	\$ 93	4	\$ 2,323	\$ 2,308
Fence	<u>not recommended</u>				\$ -	\$ -
Guards	<u>not recommended</u>				\$ -	\$ -
		<b>\$ 2,043</b>	<b>\$ 93</b>		<b>\$ 2,323</b>	<b>\$ 2,308</b>
<b>Infiltration Course</b>		<b>\$ 6,846</b>	<b>\$ 1,864</b>		<b>\$ 12,437</b>	<b>\$ 12,143</b>

<b>NPV Calculations</b>		2013	2014	2015	2016	2017	2018	2019	2020
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>									
	<b>NPV</b>								
	<b>Annual Cost</b>								
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>									
	<b>NPV</b>								
	<b>Annual Cost</b>								
Signs	\$ 2,308	\$ 2,043	\$ 93	\$ 93	\$ 93	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes:** (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.2: LUC Components and NPV Calculations – Combat Range Complex

<b>Inputs and Assumptions</b>	
Site Size (acres)	320
Perimeter (ft.)	14934
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 400 acres	\$ 8,940	\$ 783	4	\$ 11,289	\$ 11,165
Fence		<u>not recommended</u>			\$ -	\$ -
Guards		<u>not recommended</u>			\$ -	\$ -
		<b>\$ 8,940</b>	<b>\$ 783</b>		<b>\$ 11,289</b>	<b>\$ 11,165</b>
<b>Combat Range Complex</b>		<b>\$ 14,869</b>	<b>\$ 3,679</b>		<b>\$ 25,907</b>	<b>\$ 25,327</b>

<b>NPV Calculations</b>		<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 11,165	\$ 8,940	\$ 783	\$ 783	\$ 783	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.3: LUC Components and NPV Calculations – Fort Belvoir North Area

<b>Inputs and Assumptions</b>	
Site Size (acres)	807
Perimeter (ft.)	23716
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 1000 acres	\$ 13,414	\$ 1,230	4	\$ 17,104	\$ 16,910
Fence		<u>not recommended</u>			\$ -	\$ -
Guards		<u>not recommended</u>			\$ -	\$ -
		<b>\$ 13,414</b>	<b>\$ 1,230</b>		<b>\$ 17,104</b>	<b>\$ 16,910</b>
<b>Fort Belvoir North Area</b>		<b>\$ 19,342</b>	<b>\$ 4,127</b>		<b>\$ 31,723</b>	<b>\$ 31,072</b>

<b>NPV Calculations</b>	<b>LUC Required?</b>	<u>2013</u> TRUE	<u>2014</u> TRUE	<u>2015</u> TRUE	<u>2016</u> TRUE	<u>2017</u> FALSE	<u>2018</u> FALSE	<u>2019</u> FALSE	<u>2020</u> FALSE
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 16,910	\$ 13,414	\$ 1,230	\$ 1,230	\$ 1,230	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.4: LUC Components and NPV Calculations – Grenade Court

<b>Inputs and Assumptions</b>	
Site Size (acres)	100
Perimeter (ft.)	8348
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ -	\$ -	4	\$ -	\$ -
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 4,803</b>	<b>\$ 1,770</b>		<b>\$ 10,114</b>	<b>\$ 9,835</b>
<b>Engineering Controls</b>						
Signs	/ 100 acres	\$ 5,026	\$ 391	4	\$ 6,200	\$ 6,138
Fence		not recommended			\$ -	\$ -
Guards		not recommended			\$ -	\$ -
		<b>\$ 5,026</b>	<b>\$ 391</b>		<b>\$ 6,200</b>	<b>\$ 6,138</b>
<b>Grenade Court</b>		<b>\$ 9,828</b>	<b>\$ 2,162</b>		<b>\$ 16,314</b>	<b>\$ 15,973</b>

<b>NPV Calculations</b>	<b>LUC Required?</b>	<u>2013</u> TRUE	<u>2014</u> TRUE	<u>2015</u> TRUE	<u>2016</u> TRUE	<u>2017</u> FALSE	<u>2018</u> FALSE	<u>2019</u> FALSE	<u>2020</u> FALSE
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 6,138	\$ 5,026	\$ 391	\$ 391	\$ 391	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.5: LUC Components and NPV Calculations – Tracy Road Range

<b>Inputs and Assumptions</b>	
Site Size (acres)	33
Perimeter (ft.)	4796
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ -	\$ -	4	\$ -	\$ -
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 4,803</b>	<b>\$ 1,770</b>		<b>\$ 10,114</b>	<b>\$ 9,835</b>
<b>Engineering Controls</b>						
Signs	/ 30 acres	\$ 3,255	\$ 214	4	\$ 3,898	\$ 3,864
Fence	not recommended				\$ -	\$ -
Guards	not recommended				\$ -	\$ -
		<b>\$ 3,255</b>	<b>\$ 214</b>		<b>\$ 3,898</b>	<b>\$ 3,864</b>
<b>Tracy Road Range</b>		<b>\$ 8,057</b>	<b>\$ 1,985</b>		<b>\$ 14,012</b>	<b>\$ 13,699</b>

<b>NPV Calculations</b>	<b>LUC Required?</b>	<u>2013</u> TRUE	<u>2014</u> TRUE	<u>2015</u> TRUE	<u>2016</u> TRUE	<u>2017</u> FALSE	<u>2018</u> FALSE	<u>2019</u> FALSE	<u>2020</u> FALSE
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 3,864	\$ 3,255	\$ 214	\$ 214	\$ 214	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.6: LUC Components and NPV Calculations – Demolition Area - 01

<b>Inputs and Assumptions</b>	
Site Size (acres)	420
Perimeter (ft.)	17109
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 500 acres	\$ 9,872	\$ 876	4	\$ 12,500	\$ 12,362
Fence	<u>not recommended</u>				\$ -	\$ -
Guards	<u>not recommended</u>				\$ -	\$ -
		<b>\$ 9,872</b>	<b>\$ 876</b>		<b>\$ 12,500</b>	<b>\$ 12,362</b>
<b>Demolition Area - 01</b>		<b>\$ 15,801</b>	<b>\$ 3,773</b>		<b>\$ 27,119</b>	<b>\$ 26,524</b>

<b>NPV Calculations</b>		2013	2014	2015	2016	2017	2018	2019	2020
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 12,362	\$ 9,872	\$ 876	\$ 876	\$ 876	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes:** (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.7: LUC Components and NPV Calculations – Booby Trap Site

<b>Inputs and Assumptions</b>	
Site Size (acres)	13
Perimeter (ft.)	3010
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 20 acres	\$ 2,882	\$ 177	4	\$ 3,413	\$ 3,385
Fence	<u>not recommended</u>				\$ -	\$ -
Guards	<u>not recommended</u>				\$ -	\$ -
		<b>\$ 2,882</b>	<b>\$ 177</b>		<b>\$ 3,413</b>	<b>\$ 3,385</b>
<b>Booby Trap Site</b>		<b>\$ 8,811</b>	<b>\$ 3,074</b>		<b>\$ 18,032</b>	<b>\$ 17,547</b>

<b>NPV Calculations</b>		<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 3,385	\$ 2,882	\$ 177	\$ 177	\$ 177	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes:** (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.8: LUC Components and NPV Calculations – Mines and Booby Traps Area

<b>Inputs and Assumptions</b>	
Site Size (acres)	110
Perimeter (ft.)	8756
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 200 acres	\$ 6,703	\$ 559	4	\$ 8,381	\$ 8,293
Fence	<u>not recommended</u>				\$ -	\$ -
Guards	<u>not recommended</u>				\$ -	\$ -
		<b>\$ 6,703</b>	<b>\$ 559</b>		<b>\$ 8,381</b>	<b>\$ 8,293</b>
<b>Mines and Booby Traps Area</b>		<b>\$ 12,632</b>	<b>\$ 3,456</b>		<b>\$ 22,999</b>	<b>\$ 22,454</b>

<b>NPV Calculations</b>		<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 8,293	\$ 6,703	\$ 559	\$ 559	\$ 559	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes:** (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.9: LUC Components and NPV Calculations – T-16 Range

<b>Inputs and Assumptions</b>	
Site Size (acres)	232
Perimeter (ft.)	12716
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 4,077	\$ -	4	\$ 4,077	\$ 4,077
Dig Permits	Lump sum	\$ 726	\$ 726	4	\$ 2,902	\$ 2,788
Public Advisories	Lump sum	\$ 1,126	\$ 1,126	4	\$ 4,505	\$ 4,327
Monitoring and Enforcement	Lump sum	\$ -	\$ 1,045	4	\$ 3,135	\$ 2,970
		<b>\$ 5,929</b>	<b>\$ 2,897</b>		<b>\$ 14,619</b>	<b>\$ 14,162</b>
<b>Engineering Controls</b>						
Signs	/ 300 acres	\$ 7,915	\$ 680	4	\$ 9,956	\$ 9,849
Fence	<u>not recommended</u>				\$ -	\$ -
Guards	<u>not recommended</u>				\$ -	\$ -
		<b>\$ 7,915</b>	<b>\$ 680</b>		<b>\$ 9,956</b>	<b>\$ 9,849</b>
<b>T-16 Range</b>		<b>\$ 13,844</b>	<b>\$ 3,577</b>		<b>\$ 24,575</b>	<b>\$ 24,010</b>

<b>NPV Calculations</b>		<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
	<i>LUC Required?</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>TRUE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>	<i>FALSE</i>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 4,077	\$ 4,077	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 2,788	\$ 726	\$ 726	\$ 726	\$ 726	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 4,327	\$ 1,126	\$ 1,126	\$ 1,126	\$ 1,126	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 2,970	\$ -	\$ 1,045	\$ 1,045	\$ 1,045	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 9,849	\$ 7,915	\$ 680	\$ 680	\$ 680	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes: (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.

## B.4.10: LUC Components and NPV Calculations – Summary of Fort Belvoir MRSs

<b>Inputs and Assumptions</b>	
Site Size (acres)	2040
Perimeter (ft.)	37707
First Year	2013
Years NTCRA LUCs required	4
Annual O&M Eng. Controls	10%
i =	2.75%

<b>NTCRA LUC Costs</b>	<b>Units</b>	<b>1st Year Cost</b>	<b>Annual Cost</b>	<b>Years Required</b>	<b>Total</b>	<b>NPV</b>
<b>Institutional Controls</b>						
Restrictions on land use / Notations in Master Plan	Lump sum	\$ 36,695	\$ -	4	\$ 36,695	\$ 36,695
Dig Permits	Lump sum	\$ 6,530	\$ 6,530	4	\$ 26,120	\$ 25,090
Public Advisories	Lump sum	\$ 6,757	\$ 6,757	4	\$ 27,028	\$ 25,962
Monitoring and Enforcement	Lump sum	\$ -	\$ 9,404	4	\$ 28,212	\$ 26,729
		<b>\$ 49,982</b>	<b>\$ 22,691</b>		<b>\$ 118,055</b>	<b>\$ 114,476</b>
<b>Engineering Controls</b>						
Signs		\$ 60,048	\$ 5,005	4	\$ 75,063	\$ 74,274
Fence		<u>not recommended</u>			\$ -	\$ -
Guards		<u>not recommended</u>			\$ -	\$ -
		<b>\$ 60,048</b>	<b>\$ 5,005</b>		<b>\$ 75,063</b>	<b>\$ 74,274</b>
<b>Fort Belvoir - All MRSs</b>		<b>\$ 110,030</b>	<b>\$ 27,696</b>		<b>\$ 193,118</b>	<b>\$ 188,749</b>

<b>NPV Calculations</b>		<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
	<b>LUC Required?</b>	<b>TRUE</b>	<b>TRUE</b>	<b>TRUE</b>	<b>TRUE</b>	<b>FALSE</b>	<b>FALSE</b>	<b>FALSE</b>	<b>FALSE</b>
<b>Institutional Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Restrictions on land use / Notations in Master Plan	\$ 36,695	\$ 36,695	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Dig Permits	\$ 25,090	\$ 6,530	\$ 6,530	\$ 6,530	\$ 6,530	\$ -	\$ -	\$ -	\$ -
Public Advisories	\$ 25,962	\$ 6,757	\$ 6,757	\$ 6,757	\$ 6,757	\$ -	\$ -	\$ -	\$ -
Monitoring and Enforcement	\$ 26,729	\$ -	\$ 9,404	\$ 9,404	\$ 9,404	\$ -	\$ -	\$ -	\$ -
<b>Engineering Controls</b>		<b>NPV</b>		<b>Annual Cost</b>					
Signs	\$ 74,274	\$ 60,048	\$ 5,005	\$ 5,005	\$ 5,005	\$ -	\$ -	\$ -	\$ -
Fence	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Guards	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

- Notes:** (1) Sign costs include \$10,000 design costs plus \$93.2/sign produced.  
(2) LUCs that incur only annual costs without first-year costs begin in year 2, and are effectively totaled over three years.



**Appendix C**  
**Action Memorandum Outline**

## APPENDIX C: ACTION MEMORANDUM OUTLINE

USEPA recommends the following basic Action Memorandum outline

Heading

- I. Purpose
- II. Site Conditions and Background
  - A. Site Description
    - 1. Removal site evaluation
    - 2. Physical location
    - 3. Site characteristics
    - 4. Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant
    - 5. NPL status
    - 6. Maps pictures, and other graphic representations
  - B. Other Actions to Date
    - 1. Previous actions
    - 2. Current actions
  - C. State and Local Authorities' Role
    - 1. State and local actions to date
    - 2. Potential for continued State/local response
- III. Threats to Public Health or Welfare or the Environment and Statutory and Regulatory Authorities
- IV. Endangerment Determination
- V. Proposed Actions and Estimated Costs
  - A. Proposed Actions
    - 1. Proposed action description
    - 2. Contribution to remedial performance
    - 3. Engineering Evaluation/Cost Analysis (for non-time critical actions only)
    - 4. Applicable or relevant and appropriate requirements
    - 5. Project schedule
  - B. Estimated Costs
- VI. Expected Change in the Situation Should Action Be Delayed or Not Taken
- VII. Outstanding Policy Issues
- VIII. Recommendation

Attachment: Responsiveness Summary to Final EE/CA Report