FINAL

SUPPLEMENTAL
ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORT
ALPHA AREA
McCLELLAN, ALABAMA

PREPARED FOR

Matrix Environmental Services L.L.C.
and
McClellan Joint Powers Authority

PREPARED BY:

URS GROUP, INC.

January 2006

The views, opinions, and/or findings contained in the report are those of the author(s) and should not be construed as an Official Joint Powers Authority / Matrix Design Group position, policy, or decision, unless so designated by other documentation.

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ACRONYMS

ADEM	Alabama Department of Environmental Management
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
ASR	Archives Search Report
BRAC	Base Realignment and Closure
CDTF	Chemical Decontamination Training Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DDESB	Department of Defense Explosives Safety Board
DGM	Digital Geophysical Mapping
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
ESS	Explosives Safety Submission
FCR	Field Change Request
GIS	Geographical Information System
GPO	Geophysical Prove-Out
GPS	Global Positioning System
HE	High Explosive
HEAT	High Explosive Anti-Tank
IT	IT Corporation
JPA	Joint Powers Authority
LAW	Light Antitank Weapon
LUCAP	Land Use Control Assurance Plan
MEC	Munitions and Explosives of Concern
MES	Matrix Environmental Services L.L.C.
MOUT	Military Operations in Urbanized Terrain
MSL	Mean Sea Level
mV	millivolt
NCP	National Contingency Plan
NEPA	National Environmental Policy Act

ACRONYMS (CONTINUED)

NFA	No Further Action
OERIA	Ordnance and Explosives Risk Impact Assessment
PDA	Personal Digital Assistant
PR	Passive Recreation
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RTK	Real-Time Kinematic
RTS	Robotic Total Station
SOP	Standard Operating Procedure
TBC	To Be Considered
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USC	United States Code
UXO	Unexploded Ordnance
VDS	Validation of Detection System
WP	White Phosphorus

EXECUTIVE SUMMARY

URS Group, Inc. (URS) was tasked to perform a Supplemental Engineering Evaluation/ Cost Analysis (EE/CA) for munitions and explosives of concern (MEC) in portions of the Alpha Area of the former Fort McClellan, Anniston, Alabama (see Figure 1-1). The area of the investigation was based on the Alabama Department of Environmental Management requirements for additional site characterization in the M6-1M Remainder – Passive Recreation (PR) and M6-1M Remainder – Industrial/Active Recreation sectors. The Supplemental EE/CA was conducted to provide additional data to support the No Further Action (NFA) recommendations for unrestricted land use provided in the *Final Engineering Evaluation/Cost Analysis, Alpha Area of the Redevelopment Area, Fort McClellan* prepared by Foster Wheeler Environmental Corporation (Foster Wheeler) on behalf of the U.S. Army, dated September 2003, or to suggest further MEC response actions that may be required.

The Supplemental EE/CA investigation was to include the digital geophysical mapping (DGM) of approximately 77,000 linear feet of transects and the intrusive investigation of up to 1,250 of the detected subsurface anomalies. The transects were to have a spatial separation of approximately 100 ft, and digital geophysical data were to be acquired in each transect over an approximate 5 ft wide footprint.

The investigation area was divided into two distinct work areas for the Supplemental EE/CA, the Northern Transect and Southern Transect Areas (see Figure 2-1). The Northern Transect Area is located north of the Military Operation in Urbanized Terrain (MOUT) training facility and south of the northernmost perimeter fence of McClellan. The Northern Transect Area includes DGM Transects 1 through 26. The Southern Transect Area is located south of the MOUT site and north and west of the Chemical Decontamination Training Facility (CDTF). The CDTF is commonly referred to as the Cobra Facility. The Southern Transect Area includes DGM Transects 27 through 56.

The Northern Transect Area covers approximately 93 acres with a total of 40,768 linear feet of transect and DGM. Data from the DGM were evaluated with 959 subsurface anomalies detected above the 3-millivolt (mV) threshold set by the results of the geophysical prove-out (GPO) and reported in the GPO Letter Report (see Appendix A). Of the 959 anomalies detected,

627 anomalies underwent the reacquisition process, and 22 of the 627 anomalies resulted in failure to reestablish anomaly presence. In all, 605 anomalies (63%) were investigated with 58 (10%) anomalies being classified as containing MEC scrap or MEC fragmentation. No MEC was found in the Northern Transect Area.

The Southern Transect Area covers approximately 87 acres with a total of 37,005 linear feet of transect and DGM. Data from the DGM were evaluated with 1,052 subsurface anomalies detected above the 3-mV threshold set by the results of the GPO and reported in the GPO Letter Report (see Appendix A). Of the 1,052 anomalies detected, 610 anomalies underwent the reacquisition process and 15 of the 610 anomalies resulted in failure to reestablish anomaly presence. In all, 595 anomalies were investigated (57%), with 189 anomalies being classified as containing MEC, MEC scrap, or MEC fragmentation (32%). Eleven MEC items were recovered in the Southern Transect Area as follows:

- 40mm high explosives (HE) grenade M381;
- Four 60mm HE mortars M49;
- White phosphorus (WP) hand grenade M15, with pinned fuze;
- Two MKII practice grenades, with detonators, pinned fuze;
- 81mm WP mortar M57, functioned with WP residue;
- Fuze hand grenade, with possible primer present; and
- Rifle grenade, smoke, functioned with smoke charge residue.

URS evaluated data collected during the Supplemental EE/CA investigation and from the previous investigation conducted by the U.S. Army Corps of Engineers and its subcontractors. With this data URS subdivided the Northern and Southern Transect Areas into smaller subsections based on the risk of human exposure to MEC.

The Northern Transect Area was divided into two subsections: NT-1 and NT-2. NT-1, 87.4 acres, encompasses Transect 1 to Transect 14 and includes a portion of Transects 15, 16, 17, and 18 (see Figure 2-2). No MEC was recovered from the NT-1 area. Based on further analysis in 2009, NT-1 was further divided into a northern area – NT-1N (45.5 acres) and a southern area NT-1S (41.9 acres) which include potions of a 200-foot buffer area originally assigned to M6-1M Transect Area 2 (North) - PR. NT-2, 18.4 acres, encompasses Transects 19 through 26 and the

remaining portions of Transects 15, 16, 17, and 18. No MEC items were recovered from the NT-2 area.

The Southern Transect Area was broken down into three subsections: ST-1, ST-2, and ST-3. The unnamed road (east/west road) that bisects the Southern Transect Area east to west and splits south just north of the Cobra Facility was the main terrain feature for the boundaries of the southern subsections (see Figure 2-3). ST-1, 7.3 acres, encompasses Transects 27 through 36 north of the east/west road. Four MEC items were recovered in this relatively small area, including three 60mm HE mortars M49 and one 40mm HE grenade M381. This area is just southwest of the M6-1M Transect Area 1 (South) sector, which has been recommended for 1-ft clearance by the U.S. Army in the *Final Engineering Evaluation/Cost Analysis, Alpha Area of the Redevelopment Area, Fort McClellan* (Foster Wheeler 2003). ST-2, 61.7 acres, includes Transects 27 through 56 south of the east/west road with portions extending north along Transects 50 through 53. Three MEC items were recovered from this area, including two MKII practice grenades with live detonators, one found during the intrusive investigation and one found during the surface sweep, and one smoke rifle grenade, expended with smoke charge residue. ST-3, 15.9 acres, encompasses Transects 40 through 53 north of the east/west road with the exception of the area designated as ST-2 along Transects 50 through 53. Four MEC items were recovered from this area, including one 60mm HE mortar M49, one 81mm WP mortar M57 with WP residue, one WP hand grenade M15 with pinned fuze, and one hand grenade fuze with possible primer present.

Alternative response actions designed to reduce the risk of human exposure to MEC were identified and evaluated. A baseline assessment of the potential risk thought to exist at each of the areas (NT-1N, NT-1S, NT-2, ST-1, ST-2, and ST-3) was performed following industry standard guidance. Because projected land use is a critical element of a human risk assessment, separate risks were evaluated for sectors that contained more than one land use or whose end land use may change to meet future development requirements. Projected land use within the Supplemental EE/CA investigation area includes industrial and McClellan Park System.

For each area, the risk was evaluated assuming no action to be taken at the site and then for the five other alternatives, each of which included positive actions to reduce the risk of exposure to

MEC. This resulted in a qualitative relative ranking of the effectiveness of the alternatives for reducing the risk of exposure to MEC. The alternatives included Alternative 1 (No Further Action), Alternative 2 (Area-Specific Land Use Controls), Alternative 3 (Construction Support), Alternative 4 (Surface Clearance), Alternative 5 (Clearance to 1 ft), and Alternative 6 (Clearance to Depth).

The six response action alternatives were then evaluated against the National Contingency Plan evaluation criteria of effectiveness, implementability, and cost. The alternatives were individually evaluated against the criteria and subsequently evaluated comparatively on a sector-specific basis, resulting in a relative ranking of alternatives for each sector.

Based on a consideration of all the information available, including the risk assessments and the comparative analysis of the alternatives, response action alternatives were recommended for each sector, which are listed below. More detailed explanations and supporting rationale for each recommendation are included in this report.

Northern Transect Area NT-1N is recommended for surface clearance. No MEC was found in this area. The MEC-related items recovered during the Supplemental EE/CA do not indicate the area sustained use as a range or training area for weapons systems that may employ HE warheads. However, given that this area is proposed for industrial future use, sufficient (non-explosively hazardous) surficial munitions debris, including grenades and 37mm fragmentation, was found to warrant a surface clearance to remove any residual risk potentially present from discarded military munitions (DMM) or potential training, target, or disposal areas missed by the Supplemental EE/CA transect sampling. If any MEC are found, the surface clearance results will be utilized to define additional 1 foot clearance area(s).

Northern Transect Area NT-1S is recommended for NFA based on non-intrusive land use (McClellan Park System). The MEC-related items recovered during the Supplemental EE/CA do not indicate the area sustained use as a range or training area for weapons systems that may employ HE warheads.

Northern Transect Area NT-2 is recommended for surface clearance based on non-intrusive

land use (McClellan Park System). Residual risk that may remain will be managed through the inclusion of a deed restriction that will prohibit digging in this area without construction support. The MEC-related items recovered during the Supplemental EE/CA indicate the area was used extensively as a training area. It appears this area was utilized as a fire and maneuver training area as opposed to a weapons impact range. The practice rockets and rocket components recovered may have been employed during combined arms infantry training. This type of training has infantry troops utilizing all weapons systems available to them for the suppression of enemy fire, while other friendly units maneuver to gain positional advantage over the enemy forces. Historical documentation, however, does not indicate the use of this area as a fire and maneuver training area but as tank ranges with no history of rocket use. With these factors being taken into consideration and the fact that other rocket ranges such as "Rocket City" were discovered and had been previously unknown before the closure of McClellan, it is considered prudent to assume that there might be, however slight, the possibility that other undocumented rocket ranges exist in the area and precautions must be taken to ensure positive identification and response to items that may be discovered during the redevelopment of the area.

Construction support for the redevelopment of this area may be limited to on-call unexploded ordnance (UXO) services if other MEC removal activities are concurrently being conducted at McClellan. If concurrent MEC removal activities are not being conducted, a contracted on-site MEC response team that is capable of identification and disposal of MEC will be required to respond to the possible MEC threat. If MEC is encountered during construction activities, additional construction support may be required, to include surface and subsurface clearance of MEC in designated areas where construction activities are planned. UXO-qualified personnel, using metal detection instruments, will detect MEC items that may exist on or below the ground surface in areas where intrusive building activities are planned.

Southern Transect Areas ST-1 and ST-3 are recommended for clearance to 1 ft. Residual risk that may remain will be managed through the inclusion of a deed restriction that will prohibit digging in this area without performing clearance to depth. ST-1 and ST-3 bound the EE/CA M6-1M Transect Area 1 (South)-PR to the southwest and to the east-southeast, respectively. It is recommended that the initial boundaries of the M6-1M Transect Area 1 (South)-PR be extended out

to include ST-1 and ST-3 and any future removal actions associated with the M6-1M Transect Area 1 (South)-PR be conducted in these areas also. Components of this alternative include land surveying and brush clearing operations to prepare the site. Geophysical detection instruments will be used to locate subsurface anomalies, which subsequently will be investigated down to 12 in. After identification, the item will be disposed of as scrap or MEC in accordance with a previously approved Work Plan.

Southern Transect Area ST-2 is recommended for surface clearance. The MEC-related items recovered during the Supplemental EE/CA do not indicate the area sustained use as a range or training area for weapons systems that may employ HE warheads. However, two MKII practice grenades with live detonators and intact safety pins (DMM) were found, along with sufficient surficial munitions debris to warrant a surface clearance to remove any residual risk potentially present from DMM or potential training, target, or disposal areas missed by the Supplemental EE/CA transect sampling. If any MEC are found, the surface clearance results will be utilized to define additional 1 foot clearance area(s).

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1.0 INTRODUCTION

1.1 Background

The Supplemental Engineering Evaluation/Cost Analysis (EE/CA) conducted on portions of the Alpha Area of the former Fort McClellan (McClellan), Alabama, was undertaken to provide additional data to support the initial EE/CA recommendation of No Further Action (NFA) for unrestricted land use or suggest further munitions and explosives of concern (MEC) response actions that may be required. Federal law requires that government facilities that have undergone closure and are subject to reuse be fully investigated in order to determine the possible need for and extent of required remediation.

1.2 Project Authorization

Matrix Environmental Services L.L.C. (MES), under contract with the Anniston-Calhoun County Fort McClellan Development Joint Powers Authority (JPA), subcontracted URS Group Inc. (URS) to perform the Supplemental EE/CA on approximately 180 acres in the Alpha Area at McClellan. This work supports continuing MEC site characterization activities associated with the transfer of Army property to the JPA, the local redevelopment authority. Figure 1-1 shows the location of McClellan. The property was previously used by the U.S. Department of Defense (DoD) as an active military installation. In 1995, the property was closed and transferred to the JPA under federal authorities created for Base Realignment and Closure (BRAC).

1.3 Purpose and Scope

The purpose of the Supplemental EE/CA conducted on the approximately 180 acres of the Alpha Area is to provide additional data to support NFA for unrestricted use recommendations provided in the *Final Engineering Evaluation/Cost Analysis, Alpha Area of the Redevelopment Area, Fort McClellan* (Army EE/CA) prepared by Foster Wheeler Environmental Corporation (Foster Wheeler), dated September 2003, or to suggest further MEC response actions that may be required.

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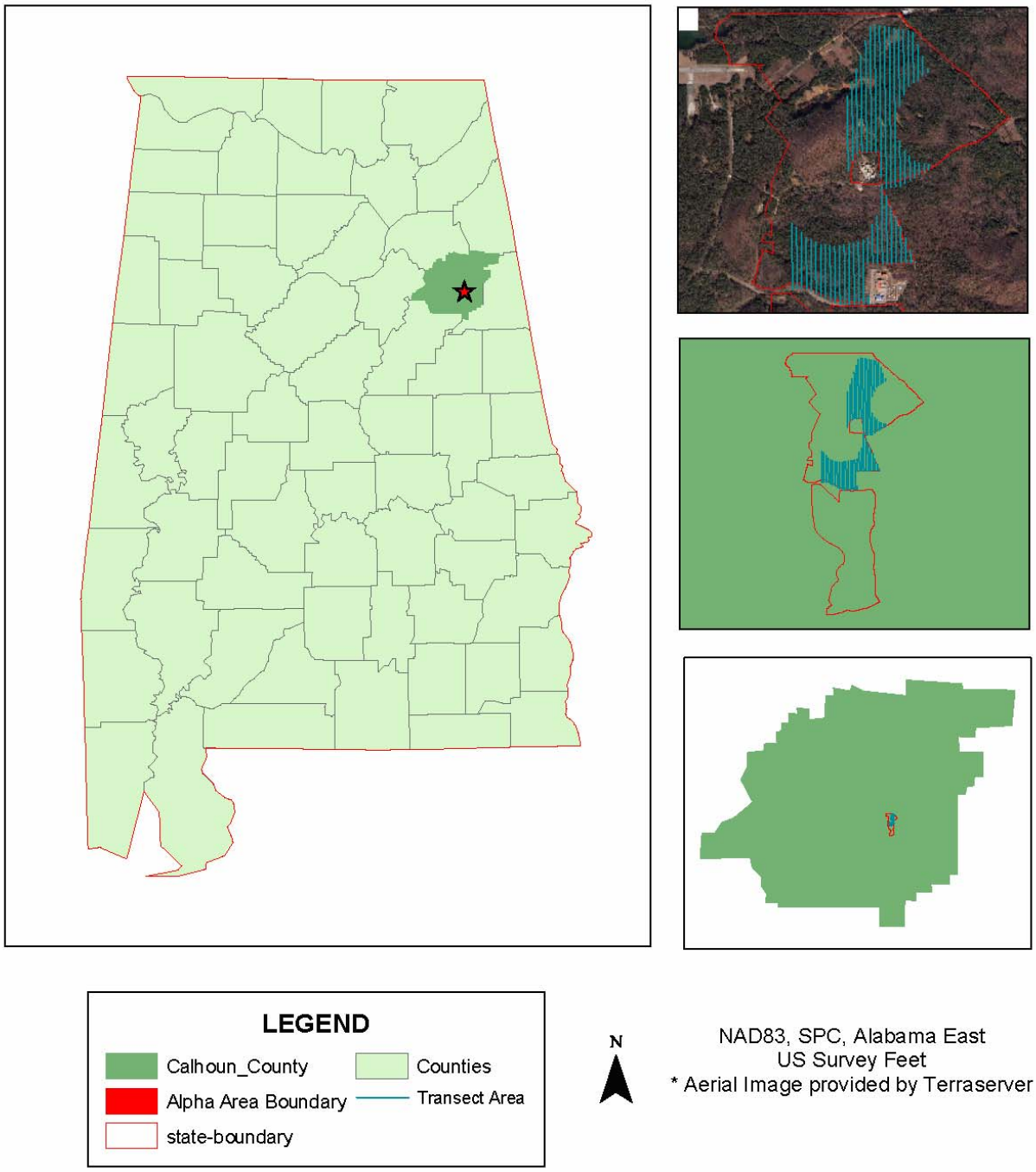

Figure 1-1. Site Map

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The scope of this Supplemental EE/CA was to conduct a transect-based geophysical mapping and intrusive investigation of approximately 77,000 linear feet within the 180 acres of the Alpha Area. Included in the Supplemental EE/CA were the design, installation, and reporting of results for a geophysical prove-out (GPO)/validation of detection system (VDS) plot and subsequent system validations. The Supplemental EE/CA required surveying, brush cutting, and MEC surface sweeps of the transects prior to geophysical mapping, followed by intrusive investigation and cataloging of up to 1,250 selected subsurface anomalies. The scope also called for the proper disposal of all MEC and MEC-related scrap and fragmentation, development and maintenance of a geographical information system (GIS)-based web tracking system, and preparation of a Supplemental EE/CA Report.

1.4 Engineering Evaluation/Cost Analysis Process

The EE/CA process includes evaluating all archival data; conducting initial visual field reconnaissance, geophysical mapping, and intrusive field investigations to characterize the type, distribution, and extent of MEC items within the boundaries of the site; and analysis of the field investigation data to determine the risks associated with the current and proposed future uses of the property.

URS characterized the investigation area through the use of a transect-based geophysical mapping and intrusive investigation process. The transects, which were placed 100 ft apart and were up to 5 ft wide, underwent survey, brush removal, and surface sweeps prior to digital geophysical mapping (DGM). Once the transects were ready for DGM, the geophysical crews would map the transects utilizing the EM61-MKII with positional data provided by a Robotic Total Station (RTS) survey system.

The geophysical data were then downloaded from the equipment and processed utilizing GeoSoft's Oasis Montaj 5.1.7 software. The processed data were then submitted for review by the quality control (QC) geophysics manager before being forwarded for anomaly selection.

Anomaly selection was achieved by review of the geophysical data and the selection of an initial list of target anomalies for intrusive investigation. The target anomalies were

intrusively investigated, and data gathered from those investigations were then used for the selection and subsequent intrusive investigation of the remaining targets.

Following field investigation activities, response action alternatives were developed and evaluated. Response action alternatives were developed according to DoD 6055.9-STD, Chapter 12, Paragraph 12.3.4.3, "Site-Specific Remediation Depth Determination." This process requires consideration of types and distribution of MEC, depths of MEC, and proposed land reuse in making final remedy selections. Six alternatives were developed for the Supplemental Alpha Area EE/CA:

Alternative 1: No Further Action
Alternative 2: Area-Specific Land Use Controls
Alternative 3: Construction Support
Alternative 4: Surface Clearance
Alternative 5: Clearance to 1 ft
Alternative 6: Clearance to Depth

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Location

McClellan occupies 18,929 acres northeast of the city of Anniston, in Calhoun County, Alabama. To the west of McClellan are the areas known as Weaver and Blue Mountain and to the north is the city of Jacksonville. The Talladega Forest is located east of McClellan. The portion of McClellan addressed in this Supplemental EE/CA is the Alpha Area, which lies in the north-central portion of the installation, immediately northeast of the main cantonment area. The Alpha Area comprises part of the northern portion of the Redevelopment Area and is adjacent to the northern boundary of McClellan. It extends from the northern boundary of McClellan near Reilly Airfield south to Bains Gap Road. The Bravo Area is south and west of the Alpha Area and comprises the remainder of the Redevelopment Area. The Choccolocco Mountains and the Choccolocco Corridor, which comprise the Charlie Area, are east of the Redevelopment Area. Figure 2-1 shows the location of the Alpha Area within McClellan.

2.2 Physical Description

The Alpha Area is predominantly heavily to moderately wooded with mixed pines and hardwoods, with some open areas that were cleared for various activities during the active operation of the installation. Numerous paved and unpaved secondary roads are present, along with occasional structures, many of which are no longer used. The Alpha Area surrounds two active facilities, the Chemical Decontamination Training Facility (CDTF) and the Military Operations in Urbanized Terrain (MOUT). The CDTF is commonly referred to as the Cobra Facility and has been transferred to the Department of Homeland Defense. The MOUT is currently owned by the Alabama National Guard.

McClellan is situated near the southern terminus of the Appalachian Mountain chain. All but the easternmost portion of the former Main Post lie within the Valley and Ridge Province of the Appalachian Highlands. The portion of McClellan east of Choccolocco Creek lies within the Piedmont Province. The age of the consolidated sedimentary and metamorphic rocks ranges from Precambrian to Pennsylvanian. On a large scale, most of the rocks have been intensely

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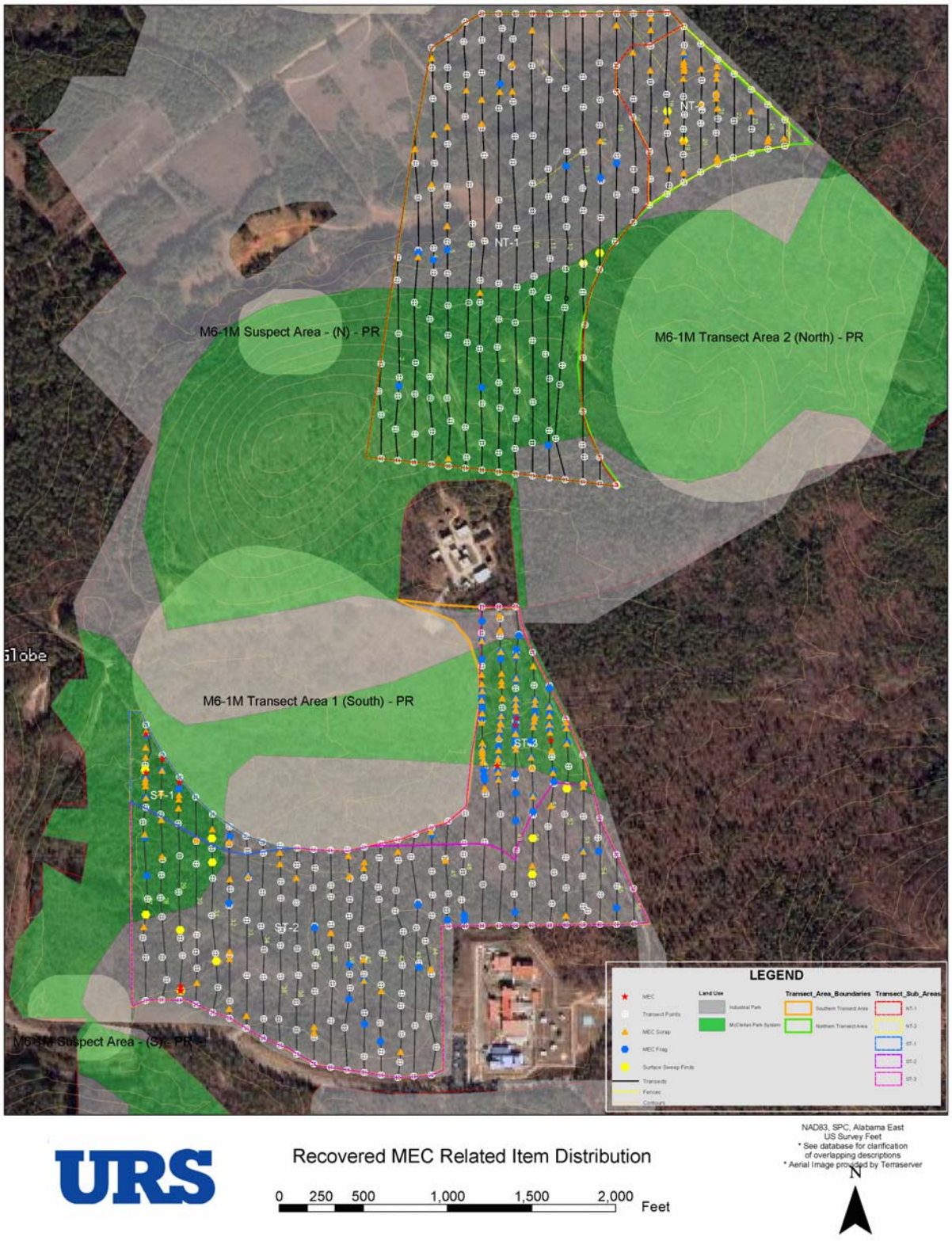

Figure 2-1. Supplemental EE/CA Location Area

Further detail provided on enclosed CD.

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folded into an aggregate of northeast-southwest trending anticlines and synclines with associated thrust faults. The shallow geology in the area is characterized by colluvial deposits. The presence of metamorphic rocks, as well as iron-bearing cements within the sedimentary rocks, increases the potential for minerals such as magnetite and other associated magnetic minerals.

The topographic gradient at McClellan generally increases toward the south and east of the main installation. Local relief on McClellan is in excess of 1,320 ft. The lower elevations [700 ft above mean sea level (MSL)] occur along Cane Creek, near Baltzell Gate Road, while the maximum elevations (2,063 ft above MSL) occur on Choccolocco Mountain, which traverses the area in a north/south direction, with the steep easterly slopes grading abruptly into Choccolocco Valley. The western slopes are more continuous with the southern extension, maintaining elevations up to 900 ft above MSL near the western reservation boundary. The northern extension decreases in elevation in the vicinity of Reilly Airfield. The central portion of McClellan is characterized by flat to gently sloping land. Topography within the Alpha Area consists of gentle to moderately sloped rolling hills, with intervening, relatively flat-lying valleys. Elevations range from approximately 800 ft above MSL along the western edge of the Alpha Area to 1,088 ft above MSL at the highest point. Surface drainage is predominantly to the west by way of Cave Creek and Cane Creek and their tributaries.

2.3 Site History

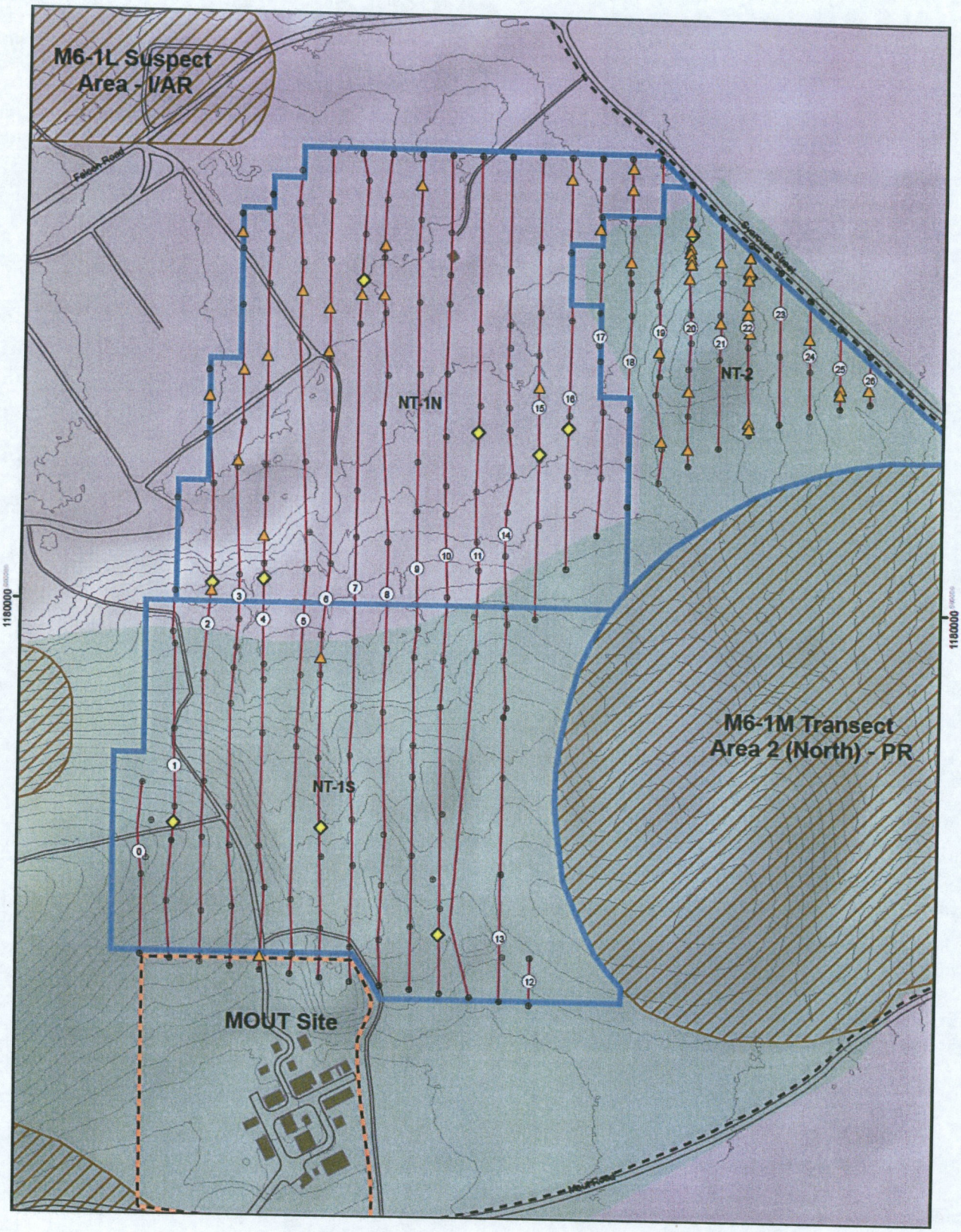
McClellan has documented use as a military training area since 1912, when the Alabama National Guard used it for artillery training. However, the Choccolocco Mountains may have been used for artillery training by the units stationed at Camp Shipp in the Blue Mountain Area during the Spanish American War as early as 1898. The 29th Infantry Division used areas of McClellan for training prior to being ordered to France during World War I. In 1917, Congress authorized the establishment of Camp McClellan, and in 1929, the camp was officially designated as Fort McClellan. Prior to World War II, the 27th Infantry Division assembled at McClellan for training, and during the war, many other units used the site for various training purposes. Following World War II, in June 1947, McClellan was put in inactive status. McClellan was reactivated in January 1950 and the site was used for National Guard training and was selected as the site for the Army's Chemical Corps School.

The history of McClellan, as described in the Archives Search Report (ASR) Findings [U.S. Army Corps of Engineers (USACE) 1999a] and ASR Conclusions and Recommendations (USACE 1999b), includes training activities and the use of conventional weapons (i.e., mortars, anti-tank guns, and artillery pieces). McClellan was recommended for closure under the BRAC Program and was closed in September 1999.

During the Supplemental EE/CA, historic subsurface bunker complexes were discovered on a hill top in the Northern Transect Area east of Transect 19 and west of Transect 21 (see Figure 2-2 and Photo 1 in Appendix B) and in the Southern Transect Area on a hill top in the vicinity of Transect 42 (see Figure 2-3).

The bunker complex in the north included at least two separate bunkers that appear to have been built in the years following World War I and subsequently upgraded. These bunkers were constructed of thick wood timbers with the ceiling supported by what appeared to be steel railroad track. The bunkers were approximately 12 ft high, 10 ft wide, and 12 ft long with a wood staircase entry way. They contained a system of levers, pulleys, wire rope, and electrical switches that were apparently used to actuate pop-up targets that surrounded the complexes (see Photos 2 and 3 in Appendix B). It is thought that the levers, pulleys, and wire rope actuation were superceded by the use of electrical switches. Several target pits were discovered in this general area. The target pits consisted of wooden footings emerging from the ground; secured to these were sections of 0.5-in. pipe that appear to have acted as the target pivot system (see Photos 4 and 5 in Appendix B). The composition of the target frame is unknown. These target pits were located along the ridge line of the hill with what appeared to be man-made trenches, which may have been utilized as firing points downslope from the target pits. Throughout the bunker area, various cables and wire rope were noted during the investigation.

The bunker complex in the south appeared to be of the same construction and use as the complex in the north; however, only one bunker entrance was found in the Southern Transect Area. The southern bunker was located between Transects 41 and 42 approximately 500 ft north of the investigation boundary.



Legend

- MEC Scrap
- MEC Frag
- Transect Points
- Northern Transects
- Northern Transect Area
- Alpha Boundary
- EE/CA Further Action Areas
- McClellan Park System
- Buildings
- Contours (10 foot)
- Roads

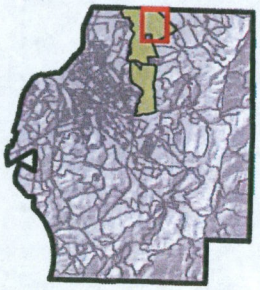
0 150 300 600 Feet

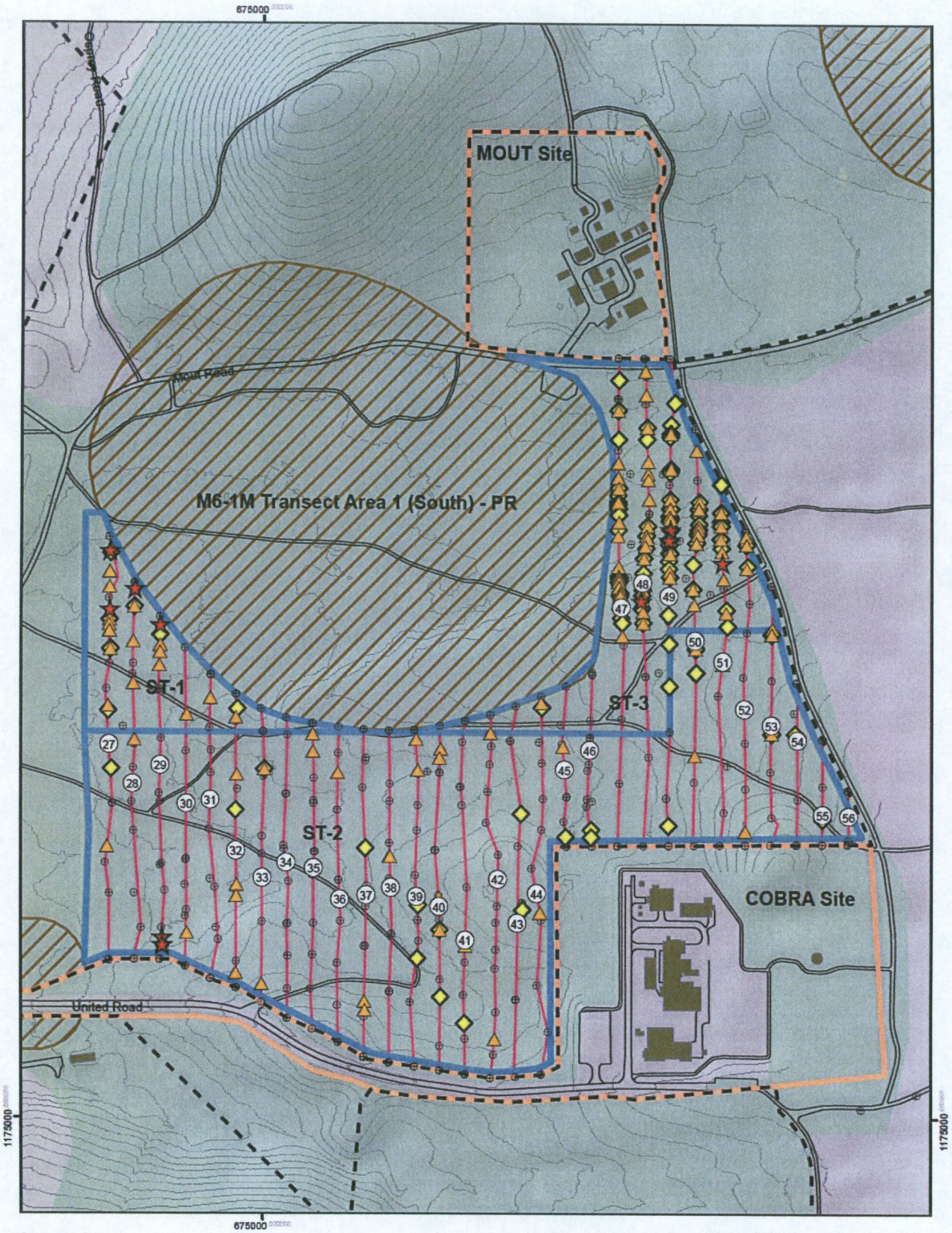
FIGURE 2-2
ALPHA SUPPLEMENTAL EE/CA
NORTHERN TRANSECTS

McCLELLAN
ANNISTON, ALABAMA

Matrix Environmental Services, L.L.C.

Area Enlarged Above





Legend

- MEC
- MEC Scrap
- MEC Frag
- Transect Points
- Contours (10 foot)
- Southern Transects
- Roads
- Alpha Boundary
- Transferred Property
- Southern Transect Area
- EE/CA Further Action Areas
- McClellan Park System
- Buildings

0 175 350 700 Feet

FIGURE 2-3
ALPHA SUPPLEMENTAL EE/CA
SOUTHERN TRANSECTS

McCLELLAN
ANNISTON, ALABAMA

Matrix Environmental Services, L.L.C.

Area Enlarged Above

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The pop-up target pits surrounding the bunkers appear to have been utilized for the training of infantry units in fire and maneuver, while the bunkers were utilized as a control point for the actuation of the targets and for the protection of the target operators from small arms and infantry portable weapons fire.

2.4 Demographic Profile

McClellan is located in Calhoun County at the foothills of the Appalachian Mountains. The surrounding communities, including Weaver, Pelham Range, and Anniston (the county seat), offer multiple centers of activity such as Oxford Lake and Civic Center, Cheaha State Park, Jacksonville State University, Anniston Museum of Natural History, Northeast Alabama Regional Medical Center, and several theaters, park facilities, and golf courses.

According to the 2000 Census of Population and Housing, Calhoun County is home to approximately 112,249 people within a 608 square-mile area, averaging 184.6 people per square mile. The percentage of individuals under age 19 is 26.8%; the percentage over age 65 is 14.2%. The median age is 37.2. Approximately 79.7% of the population is white, 18.8% African American, 0.8% American Indian or Alaska Native, 0.8% Asian, 0.1% Native Hawaiian or Pacific Islander, and 0.8% other races.

Housing in Calhoun County is composed of 51,322 multiple and single family dwellings. Approximately 72.5% of the households are owner occupied, and 27.5% of the households are rental units.

The total population for the city of Anniston is 24,276. The percentage of individuals under the age of 19 is 26.3% and over the age of 65 is 18.7%. The median age is 39.3. Approximately 46.7% of the population is white, 48.7% is African American, 0.3% is American Indian or Alaska Native, 0.8% is Asian, and 0.7% other races. Anniston has approximately 10,447 occupied housing units of which 59.5% are owner occupied and 40.5% are rented.

Calhoun County's medical facilities serve as the medical center, and the court system serves as the legal and accounting center of northeast Alabama. Retail, entertainment, and recreational establishments also thrive in this area.

A variety of industries including federal and civilian government, services, durable goods manufacturing, and the area's agricultural industry are strong contributors to the local economy. Mead Ink, Hager (hinges), Parker Hannifin (valves), Bear (knives), Springs Industries (comforters), and Allied Signal (aircraft systems) are just a few of the more than 150 industries located in Calhoun County.

McClellan is the home of several federal agencies, private ventures, and institutes of learning. Currently 2,800 peopled are employed at McClellan and over 1,200 students attend school. Also included in the redevelopment of McClellan was the privatization of the former military housing. Close to 500 residents now call McClellan home.

2.5 Current and Future Land Use

At this time, the Alpha Area remains unused with the exception of the Cobra and MOUT sites. The Supplemental EE/CA was conducted in an effort to release the area for further development/use or to suggest further MEC response actions that may be required prior to the desired development or use. The planned future development or use of the area prior to this additional characterization based on JPA's reuse map dated 2002 included approximately 130 acres of industrial parklands and 47 acres of McClellan Park System. Utilizing the recommendations provided in this Supplemental EE/CA, the stakeholders reevaluated and made adjustments to the future proposed land use. Specific uses include eliminating industrial land use in the Southern Transect Area, thereby converting the entire area to McClellan Park System land use and refining the boundaries for the industrial and McClellan Park System in the Northern Transect Area to better account for the typography and findings from this investigation. These land use recommendations/changes have not yet been finalized at the time of this writing,

2.6 Analysis of Historical Records

For the development of the conceptual site model for the Supplemental EE/CA, URS utilized historical range data provided in the *Archives Search Report Findings Fort McClellan, Anniston, Alabama* (USACE 1999a), the *Archives Search Report Conclusions and Recommendations*, *Fort McClellan, Anniston Alabama* (USACE 1999b), and the *Final Engineering Evaluation/Cost Analysis, Alpha Area of the Redevelopment Area, Fort McClellan* (Foster Wheeler 2003).

The following is a list of ranges that were identified in the area investigated in the Supplemental EE/CA;

- World War 1 Machine Gun Range,
- Tank Combat Range,
- Defendum Rifle Range,
- World War II Machine Gun Range,
- Range 31,
- 37mm Anti-Tank Range (T31),
- Tank Range 1,
- Tank Range 2, and
- Training Area 31 (part of Range 30).

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3.0 SITE CHARACTERIZATION

3.1 Previous Investigations

A number of previous investigations have been conducted at McClellan to determine the potential for the presence of MEC in the Alpha Area, the latest of which was the Army EE/CA performed by Foster Wheeler. During the EE/CA, Foster Wheeler investigated sample grids located within the area covered by the Supplemental EE/CA. The MEC-related results of these grids are listed in Table 3-1. Only one item was listed as unexploded ordnance (UXO), a signal type rifle grenade. It is not clear whether the item had been fired and failed to function as designed, functioned but had not been completely expended, or was unfired and had been dropped during maneuver exercises.

Table 3-1

Foster Wheeler EE/CA
MEC-Related Grid Sampling Results

URS Transect[a]	FW Grid	Target Type[b]	Dig Comments
43	A047	MEC Scrap	75mm projo, shrapnel
8	A072	UXO	1 rifle grenade, signal, green, live
3	A078	MEC Scrap	1 flare
3	A078	MEC Scrap	1 rifle grenade signal illumination
21	A087	MEC Scrap	mine frag, anti tank, M15
21	A088	MEC Scrap	mine frag, anti tank, M15
21	A089	MEC Scrap	1 rocket ogive, 3.5 in.
21	A090	MEC Scrap	1 rocket nose cone, 3.5 in.
21	A091	MEC Scrap	1 rocket ogive, 3.5 in.
21	A092	MEC Scrap	1 rocket warhead, 2.36 in., wax filled
21	A093	MEC Scrap	1 flare, empty
21	A094	MEC Scrap	1 M11 rifle grenade, practice
21	A095	MEC Scrap	mortar fins, 60mm
21	A096	MEC Scrap	1 grenade, practice
13	A109	MEC Scrap	1 signal, illumination, flare scrap
17	A130	MEC Scrap	1 practice rocket minus nose

[a]Positional data for the Foster Wheeler sample grid locations are not known. The transects associated with the grid are approximations derived from the comparison of figures provided in the Alpha Area EE/CA and URS GIS data.
[b]Foster Wheeler target types correspond to URS classifications in the intrusive investigation results found in Appendix I.

In addition to the EE/CA, several other Army contracted investigations have been conducted. During the time Foster Wheeler was conducting the EE/CA, IT Corporation (IT) was conducting other environmental sampling in the Alpha Area. IT discovered two MEC scrap

items in the area covered by the Supplemental EE/CA; these were two rifle grenades in the vicinity of Transect 18. It is not known what type of rifle grenades these were. It is possible that they were practice, signaling smoke, or white phosphorus (WP) smoke. For details of other investigations conducted in the Alpha Area, refer to the Army EE/CA Report (Foster Wheeler 2003).

3.2 Deviations From Approved Work Plan

For the Supplemental EE/CA, a Site-Specific Work Plan was prepared (URS 2005). This plan addressed site history and characteristics, project management, investigative approach, QC, explosives management, environmental protection, and health and safety. The draft Work Plan was provided to the Alabama Department of Environmental Management (ADEM) and approved by ADEM via email to MES on 14 January 2005. The final Work Plan was published in early February 2005.

During the course of the investigation, several Work Plan Field Change Requests (FCRs) were submitted and approved for use; of these, only one was considered a major change. The FCRs are described below and contained in Appendix C.

An FCR was submitted for the addition of a standard operating procedure (SOP) for the surveying and brush clearing of the transects. This SOP did not alter the Work Plan, but added detail to the specific operations.

An FCR was submitted to remove the requirement for the U.S. Fish and Wildlife Service to inspect all transects prior to the initiation of brush removal activities. This was requested due to the extent of acreage the transects covered and the fact that after the brush clearing operations were complete the QC inspection of the transects may require additional removal of vegetation and/or relocating the transect. To prevent the possibility that Long Leaf Pine would be harmed, all field personnel were required to undergo training on the species that may be encountered in the Alpha Area and recognition of those species. Also, the brush removal subcontractor, Envirogrind, LLC, had extensive experience working on McClellan and in the Alpha Area itself.

An FCR was submitted to remove the requirement for the placement of pin flags along the transects and over the quality assurance (QA)/QC seed items. This requirement would have involved the placement of thousands of pin flags along the approximately 14 miles of transects. Biodegradable spray paint was utilized in place of the pin flags, which were intended to ensure that complete geophysical mapping of the transects was accomplished. As the EM61 carrier traversed the transect, the EM61 data operator marked his walked path with the spray paint, thus allowing the EM61 carrier to overlap the geophysical coverage on subsequent passes. The use of the paint, however, did not allow for the marking of the QA/QC seed items with pin flags as these would be the only pin flags along the transects during the mapping process and nullified the principal of the blind QA/QC seed item. With the elimination of the pin flags it was determined that the best course of action to ensure the QA/QC seed items were passed over by the EM61 team was to place them as close to the center line of the transect as possible. This procedure was followed for all QA/QC seed items in the Northern and Southern Transect Areas. However, placement of the seed items along the center line of the transect did not ensure that the EM61 team will pass over the item or that they would have positional tracking at the time they were mapping the area where the seed items were placed.

An FCR was submitted to utilize an RTS survey system for the reacquisition of target anomalies as this was the type of system utilized for positional control of the EM61 during the geophysical mapping phase of the Supplemental EE/CA. The Work Plan called for the use of either the Trimble 5700 Real-Time Kinematic (RTK) Global Positioning System (GPS) or conventional survey techniques for the reacquisition of the target anomalies. The RTS is a line of sight system utilizing a robotic base station and a rover unit. The base and rover communicate utilizing a radio link with the base sending positional data to the rover.

An FCR was submitted to change the selection criteria of the QC lots. The criteria for the QC lots were a distance of 0.25 mile, but the FCR requested this criteria be changed to be based on data files. An individual data file consists of geophysical data from a single day of data collection for a single instrument. The files can contain data from multiple transect lines but generally represent a composite surveyed distance in the range of 0.25 mile. The selection based on data files in place of the 0.25 mile distance criteria allowed other criteria including data

collection personnel, EM instruments (referred to as W or V units) system, survey date, presence of seed items, and lag/latency issues, to be incorporated into the QC lot selection process.

An FCR was submitted to eliminate the need for the precision survey of target anomalies after the target anomaly location was fixed utilizing the EM61. The process of precision surveying the fixed target anomaly location was conducted on the first 121 target anomalies reacquired. The offset distance and direction of the fixed position from the mapped positions showed only minor offsets and no systematic deviations. The majority of these offset distances and directions were well within the minimum standards set by the Work Plan. As such, it was requested that the requirement for precision survey of the fixed locations be replaced with the use of a tape measure and quadrant location to record the target anomaly offset.

An FCR was submitted to change the requirements for the weighing of multiple MEC scrap items associated with the same target anomaly. The weighing of the scrap provides no direct information regarding the concentrations of MEC contamination in the investigation area. The FCR also requested the elimination of precision survey of MEC items that were discovered since the mapping of the anomalies was conducted with precision survey equipment providing positional data, and all offsets were well within the required offset limits as set forth in the Work Plan.

An FCR was submitted to remove the requirement for the use of a 40 degree slope as the point at which terrain becomes impassable to the field teams. It was determined that the field teams were in the best position to determine what was and what was not passable with the equipment load they were required to carry.

A final FCR was submitted to eliminate the need for transect survey remapping of 30% of the investigated transects. This FCR was the only FCR determined to be a major change to the Work Plan. The Supplemental EE/CA is utilized as a tool to determine whether future follow-on work is required in an area. The EE/CA is strictly an investigation and is not used to perform a removal action; as such, there was no need to conduct the geophysical remapping of 30% of the transects as called out in the Work Plan. The following are the specific reasons for the elimination of the 30% remapping:

- The EE/CA process is an investigation, not a removal action; therefore, proving that the area is free of MEC contamination is not a requirement. Also, not all target anomalies on the transects were chosen for intrusive investigation and would remain during the remapping.
- When intrusive investigations are conducted on anomalies that contain geologic concentrations of ferrous material, not all the ferrous concentrations are removed. Once the intrusive investigation has determined that the anomaly was the result of a geologic ferrous concentration, that investigation stopped and the hole is backfilled with the spoils from the excavation. As such, the ferrous concentrations will remain and be detected on the subsequent remapping efforts, possibly leading to the false assumption that the anomaly was never investigated or the investigation was not completed. Also, it is possible that while excavating the anomaly the concentration of geologic ferrous material might have been brought closer to the surface possibly increasing its millivolt (mV) response value.
- Duplicating the exact lines walked during the initial mapping of the transects is not possible. The biodegradable paint that was used during the initial mapping for geophysical coverage has since worn away. This could possibly result in additional anomalies being detected beyond the area of the transect that was initially mapped and the false assumption that the original data were not accurate.
- Several of the anomalies were discovered to be man-made features, and as such, no effort was made to remove these items. This may have resulted in additional confusion when comparing the two mapping efforts. These man-made features include underground bunkers, fence lines, and culverts.

3.3 Engineering Evaluation/Cost Analysis Investigation

3.3.1 Overview of Investigation Approach

From 17 January through 30 June 2005, URS performed a transect-based site investigation over an area encompassing approximately 180 acres by utilizing DGM and intrusive investigation. This investigation was an effort to fill data gaps to support a proposed NFA for unrestricted land use within the Alpha Area. The Supplemental EE/CA consisted of the geophysical mapping of transects up to 5 ft wide and totaling approximately 77,000 linear feet. The data gathered from the mapping effort were analyzed and target anomalies were chosen for intrusive investigation and cataloging.

3.3.2 Selection of Areas of Investigation

The area to be investigated during the Supplemental EE/CA came from a letter (30 September 2003) request by ADEM for additional data to support NFA for unrestricted land use of portions of the areas identified in the EE/CA as M6-1M Remainder-Passive Recreation (PR) and M6-1M Remainder-Industrial/Active Recreation. Figure 2-1 shows the areas investigated.

3.3.3 Munitions and Explosives of Concern Sampling Procedures

Numerous steps were involved with the methodology for conducting the Supplemental EE/CA that URS performed in the Alpha Area. These included the installation of a GPO/VDS plot, survey, brush clearing and MEC surface sweep of transects, validation of geophysical equipment and teams, geophysical mapping of transects, and the intrusive investigation and cataloging of target anomalies.

3.3.3.1 Geophysical Prove-Out/Validation of Detection System Plot

In December 2004 URS installed a GPO/VDS plot and conducted the GPO. The GPO/VDS plot was installed at the former Ammunition Supply Point. The details of the installation of the plot and the results of the GPO can be found in the GPO Letter Report provided in Appendix A.

3.3.3.2 Transect Preparation

3.3.3.2.1 Survey

The Alpha Area Supplemental EE/CA was a transect-based investigation covering approximately 77,000 linear feet of transects, which were proposed to run through moderate to heavily wooded areas. A transect spacing of approximately 100 ft was called for in the scope of work, with the Work Plan calling for a deviation from this spacing not to exceed 10%.

The Work Plan initially called for the use of RTK GPS for the survey and EM61 positional tracking or the use of conventional survey methods if GPS coverage was not available. The use of RTK GPS was eliminated due to signal interference from the tree canopy. It was determined that a conventional survey would need to be employed to delineate the transects. URS subcontracted to a licensed Alabama land surveyor, Skipper Engineering, for the placement of the transect end points and traverse points along the purposed transects. Appendix D contains a list of the end points, traverse points, and their positional data.

Rebar was utilized for the end points, while 60 penny nails were utilized for traverse points. The benefit of using rebar and nails as end and traverse points is that as the DGM of the transects was completed and the data were processed, the known positional data associated with the end and traverse points could be utilized to check the positional accuracy of the mapping equipment.

The survey crews started surveying the transects from the end points adhering to the proposed transect path as best as possible. When the survey crews encountered conditions that prevented the transect from continuing, such as terrain features or trees in excess of 3 in. in diameter or the Long Leaf Pine, the crews would place a traverse point. The transect would then be rerouted around the obstacle, maintaining line of site with the traverse point. Once the transect had cleared the obstacle, a traverse pin was again placed. The continued objectives of the survey crews were to adhere to the proposed transect path as best as possible and maintain line of sight between survey points. The line of site between survey points was critical for the positional tracking of the EM61 during DGM.

The survey crews were escorted by UXO technicians at all times during the survey process. The UXO technicians ensured that the area where an end point or traverse point was to be placed was free of subsurface anomalies.

3.3.3.2.2 Brush Removal

Once the transect path had been set and marked, a subcontracted brush crew, Envirogrind LLC, removed any vegetation that would hinder the collection of geophysical data. The brush

crew utilized chain saws and brush cutters to clear the transects. The brush crew was limited in the size of the vegetation that could be removed; no trees in excess of 3 in. in diameter were cut. The brush crew was also escorted at all times by a UXO technician.

3.3.3.2.3 Transect Quality Control

Upon completion of brush cutting in the transects, a QC check of the transect was performed. This QC check was not delineated in the Work Plan; however, it was vital to ensure proper line of sight was maintained along the length of the transect. This line of site allowed the RTS to properly track the EM61 and provide positional data. The geophysical collection crews performed these QC checks as they had the necessary experience with the EM61 and the data collection process. Few corrections beyond the removal of additional brush or trees or the movement of a traverse point a small distance were required. If a traverse point was relocated, the survey crew reestablished the survey position for the traverse point.

3.3.3.2.4 Surface Sweep

Detector-aided surface sweeps were conducted on all transects prior to the geophysical survey. The purpose of surface sweeps prior to the geophysical surveys was to remove any metallic object from the ground surface, whether it was MEC, MEC-related scrap, or not, so as not to interfere with the gathering of subsurface anomaly data.

During the surface sweeps of the transects, 13 MEC-related items (i.e., MEC scrap or MEC fragmentation) were recovered along with 1 MEC item (see Table 3-2). The MEC item, an MKII practice hand grenade with a live detonator, was located in the very southern portion of Transect 29 (see Figure 2-3). The grenade was in surprisingly good condition, with the nomenclature of the fuze still legible (see Appendix B, Photo 6). The grenade detonator and fuze initiator were disposed of by detonation.

Table 3-2

Surface Sweep Results[a]

Number	Transect	Date	Classification	Item Type	Description	Sector
1	13	24-Feb-05	MEC Scrap	2.36 in. Rocket Practice	Practice rocket with ballistic rod	NT-1
2	14	24-Feb-05	MEC Scrap	Grenade, Smoke	M18 Smoke, expended	NT-1
3	19	23-Feb-05	MEC Scrap	3.5 in. Rocket, Practice	Rocket motor and fuze assembly	NT-2
4	18	23-Feb-05	MEC Scrap	Grenade, Practice	MKII practice grenade without detonator	NT-2
5	27	30-Mar-05	MEC Scrap	40mm Grenade, Practice	Seven 40mm practice grenades found at northern end of T27	ST-1
6	27	30-Mar-05	MEC Scrap	Grenade, Rifle, Smoke	Expended	ST-2
7	29	23-Mar-05	MEC	Grenade, Practice	MKII practice grenade with detonator	ST-2
8	29	30-Mar-05	MEC Scrap	Grenade, WP	Part of M34 WP grenade	ST-2
9	50	21-Mar-05	MEC Frag	81mm, Mortar, High Explosive (HE)	Mortar body with tail boom (possible result of a disposal shot)	ST-2
10	50	22-Mar-05	MEC Frag	81mm, Mortar, HE	Mortar body with tail boom (possible result of a disposal shot)	ST-2
11	52	23-Mar-05	MEC Scrap	81mm, Mortar, HE	Tail boom	ST-2
12	31	24-Mar-05	MEC Scrap	Grenade, Rifle, Smoke	Expended	ST-2
13	31	15-Mar-05	MEC Scrap	Grenade, Rifle, Smoke	Expended. Items 13 and 14 located within 2 ft of each other	ST-1
14	31	16-Mar-05	MEC Scrap	Grenade, Rifle, Smoke	Expended. Items 13 and 14 located within 2 ft of each other	ST-2

[a]Surface find locations are included on Figures 2-1 through 2-3. Multiple items that were located within a few feet of each other are shown as one symbol.

QC of the surface sweeps was achieved by the placement of blind seed items along the transects. The QC seed items consisted of randomly numbered 18-in. lengths of 0.5-in. rebar set underneath the ground cover. The placement of the seed items was recorded utilizing measurements from transect traverse points. Section 4, Table 4-1 of the Work Plan called for the placement of blind seed items in 25% of the available 56 ¼-mile lots. This would equate to 14 blind seed items being placed throughout the investigation area. In all, 141 blind seed items were placed in the investigation area, with 66 being placed in the Northern Transect Area and 75 being placed in the Southern Transect Area (see Appendix E). A thorough surface sweep warranted the additional use of blind seed items to remove any possible surface ferrous items prior to the DGM.

During the surface sweep of the first two transects, T6 and T5, the three-person sweep team utilized two Fisher all-metals detectors operated side by side to cover the 5 ft width of the transect followed by a single Schonstedt magnetometer. When the surface sweep of these transects was completed, it was determined that the sweep team had missed a seed item in each

transect. Five out of six were recovered from T6, while four out of five were recovered from T5. The sweep team determined that the Fisher was less effective as the instrument reached the outer arch of the sweep. The detector head of the instrument would rise above the optimum surface separation distance at the outer arch of the sweep, diminishing the response of the instrument. This appeared to be the root cause for the missed seed items. The corrective action implemented for this deficiency was to have the sweep teams utilize two Schonstedt magnetometers followed by a single Fisher. With the implementation of this approach, 100% of the remaining seed items were detected and recovered by the surface sweep team.

Geophysical QC Blind Seed Items

Prior to the mapping of the transects, blind seed items were installed along the transects by the UXO QC Specialist. The blind seed items were distributed throughout the transects in a random manner, with a density that exceeded the Work Plan requirements. In all, 16 QC blind seed items were placed within the investigation area, equally distributed between the northern and southern transects (see Table 3-3).

Table 3-3
QC Blind Seed Items

Transect	Anomaly	Easting	Northing	Initial mV	Reacq mV	Item Type	Description	Depth
5	2163	676187.89	1181080.72	41	157	3.5-in. Rocket Practice	Seed Item 071	18 in.
8	1865	676494.00	1179435.00	146.4	287	75mm Projo.	Seed Item 050	3 in.
9	1973	676595.50	1179624.00	44.2	60	Grenade, WP	Seed Item 080	1 in.
10	1326	676696.50	1178952.50	37.7	58	Grenade, Rifle, Practice	Seed Item 013	6 in.
14	1551	677104.50	1180284.00	29.3	42	75mm Projo.	Seed Item 048	1 in.
16	1812	677296.00	1181231.50	177.7	197	75mm Projo.	Seed Item 010	18 in.
19	2160	677596.44	1180695.17	4.6	9.1	Grenade, Hand, Practice	Seed Item 104	10 in.
24	2161	678094.54	1180694.70	3.7	3.7	Grenade, Hand, Practice	Seed Item 008	10 in.
29	2590	674593.50	1176756.50	538.7	590	4.2-in. Projectile	Seed Item 61	30 in.
33	2798	675000.50	1176132.00	1720.9	2500	Landmine	Seed Item 63	1 in.
37	QC-1070	675399.90	1175496.70	75.0	80	Grenade, WP	Seed Item 77	2 in.
39	QC-1209	675601.72	1175911.90	120.0	157	2.36 in. Rocket	Seed Item 89	0 in.
45	2224	676189.50	1176186.50	6.9	18	Grenade, Frag, M67	Seed Item 74	0 in.
48	2731	676493.30	1177054.86	10.8	43	37mm Projectile	Seed Item 85	6 in.
50	QC-1123	676710.54	1177438.18	8.1	25.7	3-ft 50 Cal. Projectile	Seed Item 05	4 in.
54	1665	677090.00	1176500.50	3.4	4	Grenade, Frag, MKII	Seed Item 102	3 in.

Prior to the QC blind seed items being placed, the proposed area was investigated with a Schonstedt and Fisher to ensure no other anomalies were present. The location was excavated to the planned depth and the seed item was placed in the hole. The item was checked for depth of placement positioning in the hole and then the distance to a traverse or end point was measured for positional data. The blind seed information was then provided to the URS Geophysical QC Manager for comparison to mapped and processed data.

The blind seed items were left in place and targeted for intrusive investigation. This allowed URS to perform a QC check on the quality of the intrusive investigation. The blind seed items were removed as they were investigated.

3.3.3.3 Geophysical Data Acquisition

Following surface sweeps and brush removal from each transect, geophysical data were collected to identify subsurface metallic anomalies. The EM61-MKII was mated with a reflective prism that the RTS survey system utilized to track and record the position of the EM61-MKII. The RTS survey system was set up on one of the precision surveyed end or traverse points that had been installed along the transects. The RTS was then back-sited utilizing a second traverse or end point for positional accuracy. The RTS survey system tracked the prism and recorded time stamped positional data to an internal memory card. The RTS survey system collected this positional data every 1 second. After completion of the data collection for the day, the positional data from the RTS survey system were downloaded and merged with the EM61-MKII data.

The EM61-MKII was operated in skirt mode. Utilizing this method of data collection, two operators were required for the equipment, the coil operator and the data collector. It was the responsibility of the coil operator to maintain a steady pace and ensure that the coil remained in the proper orientation and height above the ground surface. The optimal height of carry was determined to be 16 in. as documented in the GPO Letter Report. The data collector was tethered to the coil operator with a 3-m data cable. It was the data collector's responsibility to operate the Allegro Field PC and mark the traversed path of the coil operator with biodegradable spray paint. The marking of the traversed path with the spray paint gave the coil operator a visual reference

of the area already mapped and allowed the coil operator to collect overlapping data and ensure a minimal amount of data holidays. Each leg of the transects was mapped with three passes of the coil over the terrain to ensure complete data coverage of the transect. Geophysical data were digitally recorded at a rate of 8 readings per second.

Prior to and after the collection of data, QC tests were completed to ensure proper data collection and to identify any possible positional accuracy deviations. These tests are listed below:

Equipment/Electronics Warm-Up. Equipment/electronics warm-up was conducted to minimize sensor drift due to thermal stabilization. The manufacturer's instructions for equipment startup was followed. If instrument readings failed to stabilize within the recommended warm-up period, an additional 5 minutes was added. If instrument readings failed to stabilize after the additional 5 minutes, troubleshooting procedures were initiated.

Vibration Test (Cable Shake). A vibration test, also known as a cable shake, was used to identify shorting cables and problematic connectors. Cables were shaken for a minimum of 5 seconds with the instrument held in a static position. Acceptance criteria include an absence of data spikes in the data profile during the test.

Static Background and Static Standard Response (Spike) Test. A static background and static standard response test was performed to quantify instrument background readings or electronic drift, locate potential interference spikes in the time domain, and determine impulse response and repeatability of the instrument to a standard test item. A minimum of 3 minutes of static background data were collected after instrument warm-up, followed by a 1-minute standard (spike) test, followed by 1-minute of static background data collection. A standard 2-in.-diameter, steel trailer ball was used for the spike test. The data collector monitored the readings to confirm stability. Acceptance criteria include ±2.5 mV deviation from the background or null response (0 mV in leveled data) for the static background test and ±20% of average response over standard item response for the static spike test.

Height Optimization. The coil operator was fitted with a carry harness specific to that operator. The harness was set so that the bottom coil of the EM61-MKII was 16 in. above the ground. Every time the operator donned the equipment, this measurement was verified and corrected if needed.

Six Line Test. A six line test was performed in one of two static line test locations established by URS. These areas had been background surveyed for anomalous response and surveyed control points had been established. The test lines were 50 ft long and marked to facilitate data collection over the exact same line each time the test was performed. Background response over the test was established in lines 1 and 2. A standard response spike target was used for lines 3 through 6. Repeatability of response amplitude, positional accuracy, and latency was evaluated. Figure 3-1 is a schematic of the six line test. The acceptance criteria include ±20% for repeatability of amplitude response and ±20 cm for positional accuracy.

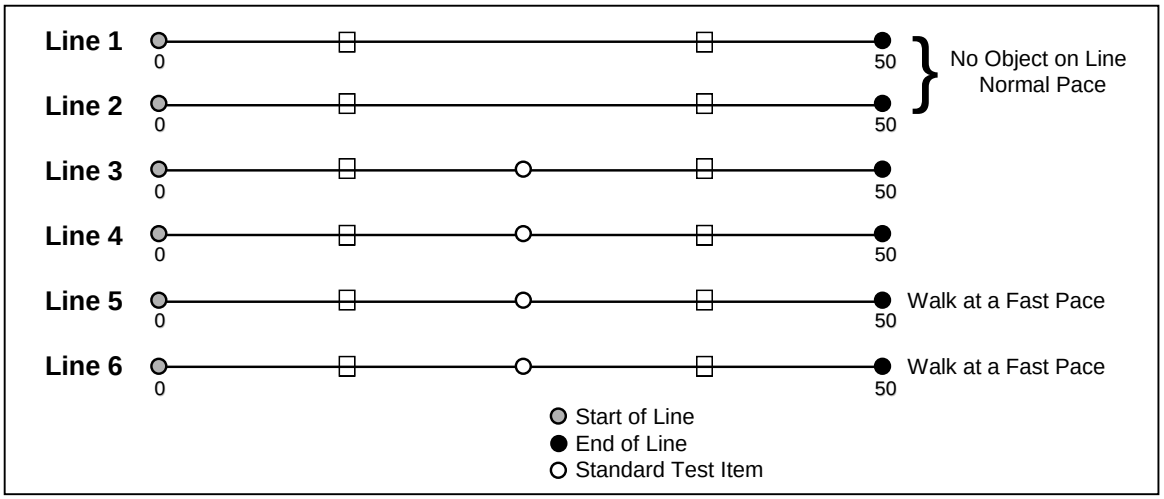

Figure 3-1. Six Line Test

Repeat Data. To determine positional and data repeatability, the six line test was conducted at the close of data collection. This six line test was repeated utilizing the same six line test area as at the start of the data collection. Errors in position repeatability outside acceptable tolerances indicate a problem in navigation or navigation equipment. Errors in amplitude repeatability outside acceptable tolerances indicate detector system problems or

operator errors. The acceptance criteria for data repeatability include ±20% for response amplitude and ±20 cm for positional accuracy.

Upon conclusion of the data collection for the day, positional and geophysical data were downloaded from the data loggers and uploaded to an FTP site for processing by URS personnel in Denver, Colorado.

3.3.3.4 Geophysical Data Processing and Interpretation

Geophysical data were processed using two software packages, Geonics DAT61 and GeoSoft Oasis Montaj with the UX-Detect extension (Oasis Montaj). The DAT61 program was used to download the raw data from the data loggers and format the data for input into UX-Detect for subsequent data processing, analysis, display, and targeting. In addition, Microsoft Excel and Microsoft Notes were used to format the raw RTS positioning data to facilitate merger of these data with the EM61-MKII data using DAT61.

The final output file from DAT61 was imported into the Oasis Montaj program for detailed analysis and processing. Data processing focused on the time gate 3 data from the MKII, which as indicated by the results of the GPO represents the data channel that provided the best combination of high detection rate of the MEC items expected within the Alpha Area and a low false alarm rate.

The first step of processing each data file in Oasis Montaj involved plotting a line path map to provide a graphical depiction of the tracking of the EM61-MKII along each transect included in the data file. The line path map was analyzed to verify that the raw EM61-MKII data were properly merged with the RTS positioning data. For a significant percentage of the files, this initial step revealed problems with the positional data file merger with the EM61-MKII data file. These problems primarily related to clock synchronization issues between the MKII data logger and the RTS data logger. In circumstances where the line path maps revealed suspected problems with the positional file merger, the initial data file exported from DAT61 was discarded and the raw data files were re-imported into DAT61, analyzed, and the merger processes repeated until a correct merger was verified by review of the line path map. In a

limited number of cases, issues with the file merger could not be resolved and these data sets were discarded and the field data were re-collected.

The next step in data processing involved correcting the geophysical data for instrument drift and data off-set. Instrument drift is the gradual change in the geophysical instrument's reference reading. It would be desirable if the EM61-MKII always indicated a response of 0 mV in the absence of a metal object. However, because of instrument drift, the reference reading varies above and below 0 mV in an episodic manner. Signal processing tools within Oasis Montaj provide a means of correcting this episodic drift and thereby effectively leveling the readings such that the background response is close to 0 mV. It should also be noted that signal inference resulting from conditions such as iron rich or other metallic mineral-rich soils can also influence the EM61-MKII response values recorded in the absence of an actual metal object.

There are three methods for correcting instrument drift in Oasis Montaj, including low-pass filtering, target signal exclusion through histogram analysis, and fixed block processing. The latter method involves breaking the data set into blocks of fixed size. The blocks are then analyzed and a background value is calculated for each block. The values are then splined and the resulting drift correction varies smoothly and continuously along the whole of the line path. This method is useful for data collected across long survey lines as is the general case for the Alpha Area data.

The field data collection program included pre- and post-collection QC tests that included static reference tests that provide some measure of instrument drift. Data sets that exhibited drift greater than the limits established for the data collection QC program were discarded and subsequently re-collected. The data processing QC program included analysis of the background noise and data leveling. These parameters were evaluated by plotting select data sets as single lines by plotting reading number versus response value. The results of this evaluation indicated that the corrected data indicate a background noise level less than 2 mV. This evaluation also indicated that the selected fixed-block size drift correction provided a smooth and continuous background response for all data sets analyzed.

The next data processing step involved correcting for latency. Latency is the time between a given response registering in the sensor and when the response is recorded in the electronic data file. Latency correction involves correcting the data for the distance between the positional sensor and the EM61-MKII coil by subtracting the offset in data points (fiducials) from the start fiducial of the data channel. For data sets collected along adjacent survey lines recorded in opposite heading directions, the effect of relatively small degrees of offset causes point response features, such as an individual ordnance item located between two lines, to appear stretched in the respective heading directions along the oppositely oriented survey lines. As the value of offset increases, this same point feature will appear as two anomalies separated by distance approximately equal to twice the offset distance. Application of the offset correction involves determining the number of data points (fiducials) to subtract from the beginning of each set of data channel values.

For the Alpha Area investigation, the offset correction was primarily applied by evaluating data channel responses associated with the metal traverse pins placed at heading direction turning points marked along each transect line. Processing involved an iterative process of applying incrementally increasing values of offset and analyzing the respective response contour maps until anomalies associated with known traverse pins converged to single, well-defined point features. In numerous circumstances, particularly for the transects located in the Northern Transect Area, an accurate listing of the positions of the traverse pins was not available to the geophysical data processor at the time the data were initially processed. In these cases the data processor estimated the offset by converging pairs of response anomalies located along oppositely oriented survey lines where the features represented a single feature located between the separated anomalies. Each of the initial processing data sets was subsequently reviewed during the QC phase of the project, at which time a complete and accurate set of traverse pin location data was available. The QC review revealed numerous instances where the value of the offset correction applied in the initial data processing did not provide an adequate representation of the locations of the subsequently known traverse pins. The QC review also included comparison of the results of the indicated target locations for the results of the initial processing to the subsequently known locations of the ordnance seed items. These comparisons provided an additional means of evaluating the accuracy of the offset correction applied during initial data processing. In cases where the QC review indicated apparent problems associated with the offset

corrections applied during initial data processing, QC reprocessing of the data set was completed. Appendix F provides the geophysical data and associated files. Appendix G contains the QA materials developed by MES and NAEVEA Geophysics.

After evaluating and applying the drift and latency corrections, data processing continued by gridding and contouring the corrected data to produce color-enhanced contour maps of the time gate 3 response values. All data sets were contoured using a common color contour scheme. The data were then ready for running through the target selection routine within the UX-Detect module in Oasis Montaj. Initial targeting was completed using the automated target picking tool. The automated picking results were then analyzed and the target list revised to remove duplicate targets and targets associated with known features such as traverse pins and the location of the RTS instrument. The revision also included adding targets missed by the automated picking routine.

3.3.3.5 Target Anomaly Selection

Several factors were taken into consideration while selecting target anomalies, including:

- A minimum threshold of 3 mV as established in the GPO Letter Report (see Appendix A),
- Results of the surface sweeps,
- Visual observations,
- Anomaly amplitude,
- Anomaly size,
- Spatial distribution, and
- Results of the intrusive investigation.

Target anomaly selection for the transect areas was accomplished in four phases. A total of 400 anomalies were initially selected for investigation in the Northern Transect Area, followed by the intrusive investigation of those anomalies. After the data from the initial 400 investigations were reviewed, the remaining anomalies were chosen for investigation. The additional target anomalies were chose to supplement the existing characterization data with a focus around the areas where MEC fragmentation and MEC scrap where identified. In addition,

some target locations were selected in order to provide a representative spatial distribution. A full range of mV responses were represented in the selected target anomalies. This same process was applied to the Southern Transect Area. The process of selecting initial anomalies for investigation and review of the data allowed the selection of the additional anomalies to be concentrated in areas where the data indicated a higher probability of MEC contamination.

3.3.3.6 Target Reacquisition

The target reacquisition process involved uploading the geophysically mapped target anomaly locations into the internal memory of the RTS and rover units and positioning the RTS over either a transect end point or traverse point and navigating to the anomaly location utilizing the rover. The survey team then placed a white non-metallic pin flag with the anomaly identification number at the site of the mapped location.

The reacquisition team utilized the pin flag, placed by the survey team, for anomaly identification and as a reference point to begin the geophysical reacquisition. The reacquisition team utilized the EM61-MKII in the towed configuration as the primary reacquisition instrument; however, Fisher and Schonstedt magnetometers were also utilized. The EM61 was positioned over the anomaly location and maneuvered back and forth until a peak amplitude response was achieved. This response was entered into the personal digital assistant (PDA) as the reacquisition mV response. The coil was then lowered over the anomaly to fix the exact location. This process involved finding the peak amplitude along two axes, 180 degrees out from each other. The position was then marked with a yellow non-metallic pin flag with the anomaly identification number and the white pin flag was removed. On three occasions no contacts were located using the EM61-MKII; however, subsurface anomalies were detected with the Schonstedt and flagged for intrusive investigation.

For the first 121 target positions that were recovered in the field, precision survey instrumentation was used to re-define the apparent target centroid and dimensions. Offset distances between the originally mapped and reacquired locations were recorded and migrated to the project GIS for analysis. The data indicated that over 90% of the target positions fell within the R_{crit} of 3 ft and that no consistent offsets in a single direction were noted.

With this data URS requested an FCR eliminating the use of precision survey for offset distances. The FCR requested authorization to use tape measures and a quadrant system to record target offset distances. The FCR was approved and the remaining target reacquisition offsets were conducted in this manner.

The reacquisition amplitude of the target anomalies was reviewed for consistently smaller amplitude responses then those recorded during the geophysical survey as required by the Work Plan. It was determined that there were no systematic occurrences where the reacquisition amplitude did not meet or exceed the survey amplitude; however, several anomalies where reacquisition amplitudes did not meet or exceed the survey amplitude were re-interrogated. No patterns could be discerned from this additional data.

In all 1,237 anomalies underwent the reacquisition process, with 37 anomalies being listed as no contact and 1,200 anomalies being investigated and identified. The results of the anomaly reacquisition can be found in Appendix H.

3.3.3.7 Intrusive Investigation

Intrusive investigations of the selected target anomalies were performed following the reacquisition process. The intrusive teams reacquired the pin flags noting the anomaly numbers annotated on the flags. The team leader initiated the anomaly investigation on the PDA while the dig team members prosecuted the anomaly. The intrusive investigation of the anomaly continued until the dig location was clear of ferrous and non-ferrous material or the dig site was determined to contain only natural ferrous concentrations. As items were removed from the dig they were cataloged in the PDA and measured for offset from the anomaly pin flag. At completion of the dig, the intrusive team performed a final sweep around the pin flag to a distance of 3 ft to ensure no anomalies remained.

PDAs with an ordnance database were utilized for cataloguing the intrusive investigation. The database utilized drop-down menus and had specific entry fields that were required to be

filled out before the PDA would allow the team leader to close out the investigation. The database utilized an item classification for the first level of entry. These classifications included:

- MEC,
- MEC scrap,
- MEC fragmentation,
- Small arms,
- Non-MEC geologic,
- QA/QC,
- False positive,
- Non-MEC historic, and
- Other.

If more than one occurrence of non-MEC geologic was encountered during the intrusive investigation of the target anomalies, the team leader only catalogued it once.

Other data entry levels included item type (only for MEC-related items), depth, offset, and a written description of the recovery. The full details of the results of the intrusive investigation can be found in Appendix I.

3.4 Demolition Operations

Demolition operations were conducted as needed for the destruction of MEC or for the explosive investigation of items that could not be positively identified by outward characteristics such as HE or inert filled.

Explosive investigations (see Photos 7 and 8 in Appendix B) were conducted on two 2.36-in. rockets recovered in NT-2 to determine whether the rockets contained HE. The 2.36-in. rocket comes in several configurations: HE-filled [High Explosive Anti-Tank (HEAT)], practice with an inert red wax filler, or practice with a ballistic rod. In the practice rockets, the red wax filler and the ballistic rod are used to simulate the weight of the explosive filler of a HEAT warhead. If the warhead is intact, there are no visible features to indicate the composition of the rocket warhead. Explosive conical-shaped charges were used to breach the skin of the weapon as

opposed to using bulk explosives. The use of the shaped charges allowed field teams to determine that the warheads with the red wax filler were practice (see Photos 9 and 10 in Appendix B). If the warhead had been HE-filled, it would sympathetically detonate when the jet produced by the shaped charge penetrated the explosives. The rockets were positively identified as practice rockets because pieces of the warhead with red wax residue were recovered.

All other MEC items were disposed of by detonation through the use of bulk explosive or shaped charges. Items that could not be positively identified as being free of energetic residue, such as rocket motors, were also disposed of by detonation.

3.5 Nature, Source, and Extent of Munitions and Explosives of Concern

The overall investigation area was broken down into separate transect areas, the Northern Transect Area and the Southern Transect Area. After review of the findings of the investigations, the two sub-areas were broken down into five smaller subsections (see Figure 2-1). The Northern Transect Area was broken down into two further subsections: NT-1 and NT-2. NT-1 extended from Transect 1 to Transect 14 and portions of Transects 15, 16, 17, and 18 (see Figure 2-2). NT-2 includes the remaining portions of Transects 15, 16, 17, and 18 as well as Transects 19 through 26. The Southern Transect Area was broken down into three smaller subsections: ST-1, ST-2, and ST-3. The road that completely crosses the Southern Transect Area east to west (east/west road) and splits south just east of Transect 46 assists in the break up of these subsections. ST-1 encompasses the northern tips of Transects 27 through 36 north of the east/west road (see Figure 2-3). ST-2 includes the portions of Transects 27 through 56 south of the east/west road with portions extending north along Transects 50 through 53. ST-3 encompasses the area north of the east/west road east of Transect 40 through Transect 53 with the exception of the ST-2 extension.

Northern Transect Area NT-1

In all, 488 target anomalies were intrusively investigated in NT-1. Of those, 30 anomalies (6%) contained MEC-related scrap or fragmentation; no MEC was recovered in NT-1 (see Figure 3-2 and Table 3-4). Ten of the 30 anomalies included slap flare projectile bodies. A slap

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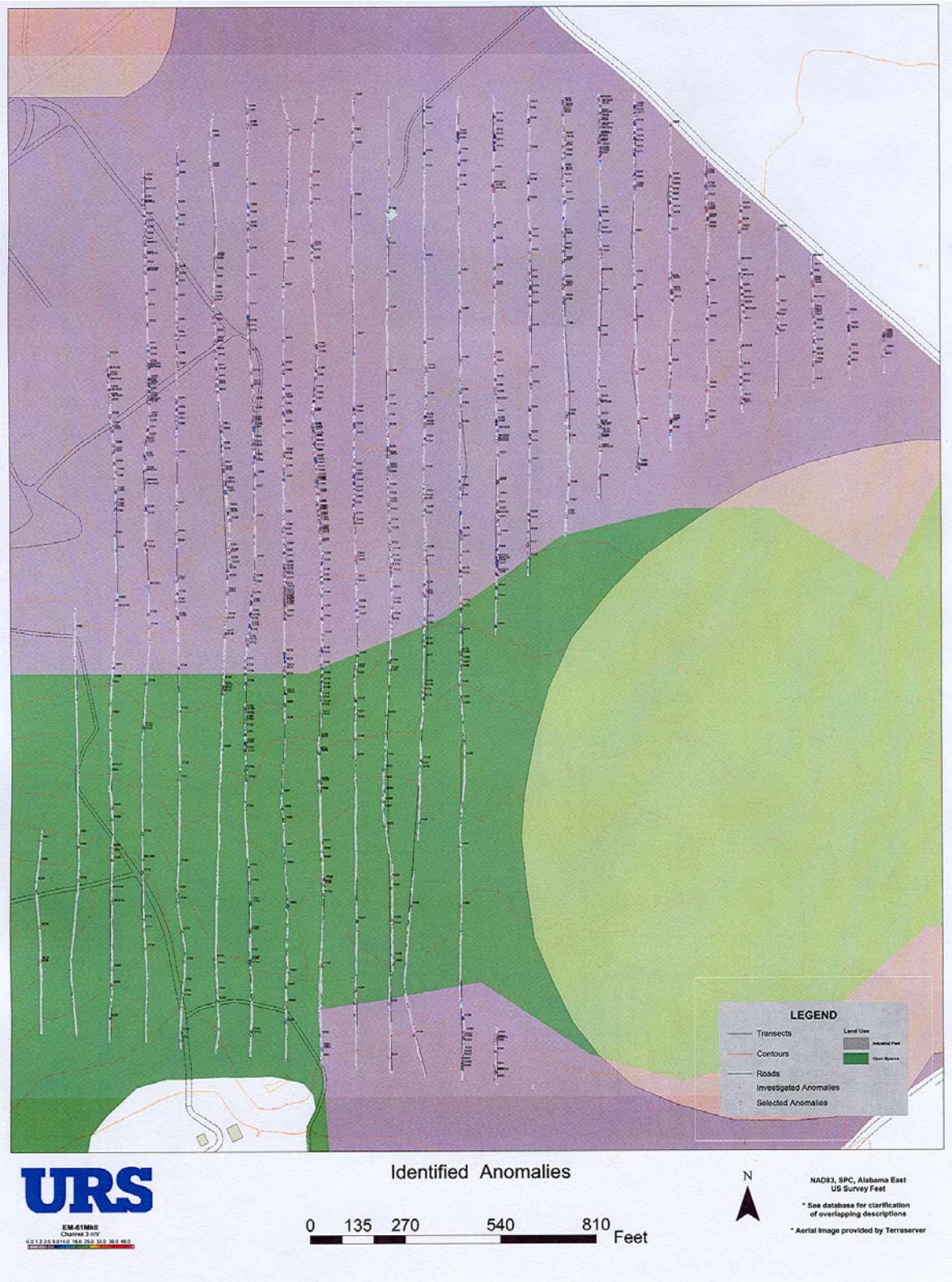

Figure 3-2. Northern Transects Geophysically Mapped/Investigated Anomalies

Further detail provided on enclosed CD.

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Table 3-4

NT-1 MEC-Related Items

Transect	Anomaly	Classification	Item Type	Description
2	1079	MEC Fragmentation	Unknown	Frag
3	QC-1018	MEC Scrap	40mm Projo.	Expended aluminum cartridge for 40mm projectile
3	1095	MEC Fragmentation	37mm Projo.	37mm HE approximately ⅓ of the projectile
3	QC-1016	MEC Scrap	37mm TP	Piece of rotating band
4	QC-1012	MEC Scrap	Slap Flare	Expended
4	1240	MEC Scrap	Slap Flare	Expended
4	1220	MEC Scrap	Unknown	Trip flare tree bracket
4	1720	MEC Fragmentation	37mm Projo.	37mm HE approximately ⅓ of the projectile
5	1298	MEC Scrap		Tail boom
5	1855	MEC Scrap	Unknown	Steel nose fuze with no booster. Possible steel ogive
5	1739	MEC Fragmentation	37mm Projo.	37mm HE approximately ⅓ of the projectile
5	1722	MEC Scrap	Grenade	Expended initiator of grenade
6	1064	MEC Scrap	Unknown	Tail boom of rifle grenade.
7	1278	MEC Scrap	Slap Flare	Expended
7	1275	MEC Scrap	Grenade	Safety pin
7	1768	MEC Scrap	Slap Flare	Expended
7	1752	MEC Fragmentation	Unknown	Fragment 3 X ½ X ¼ in.
8	1404	MEC Fragmentation	Unknown	A piece of frag. 5 X ½ X ½ in.
9	1313	MEC Scrap	Slap Flare	Expended
9	1309	MEC Scrap	Slap Flare	Expended
9	1403	MEC Scrap	Slap Flare	Expended
10	1361	MEC Scrap	Slap Flare	Expended
11	1324	MEC Fragmentation	Unknown	1 X 3 X ¼ in.
12	1438	MEC Fragmentation	37mm Projo.	37mm HE frag
14	1501	MEC Scrap	Grenade, Rifle, Smoke	Rifle grenade, M23A1, Red Streamer
14	QC-1024	MEC Fragmentation	37mm HE	Piece of fragmentation
15	1539	MEC Scrap	Slap Flare	Expended
15	1524	MEC Fragmentation	Unknown	½ in. Square
17	1610	MEC Scrap	Unknown	Grenade spoon
17	QC-1042	MEC Scrap	Slap Flare	Expended

flare is a signaling or illumination device employed by the military. The projectile is propelled from its firing cylinder by small rocket motors. Once the motors have burned through, an expelling charge pushes the pyrotechnic signal or flare from the projectile body. These items are generally short range (a few hundred feet of altitude); however, after the expelling charge fires, the light-weight projectile bodies drift back to the ground. This could allow the projectile body to be located a significant distance from where it was employed. These may have been fired anywhere throughout the northern Alpha Area, Charlie Area, or the cantonment area. There is no hazard associated with these projectile bodies.

Several pieces of fragmentation from 37mm and other unknown projectiles were located throughout NT-1. These fragments may have come from one of the many ranges that were located near this area or from those whose fans of fire crossed over the area. These ranges include the Combat Tank Range, Tank Ranges 1 and 2, and the Defendum Rifle Range. The Army utilized the M5 Stuart Tank during World War II. This tank's main armament was a 37mm gun and may have been used on any of the tank ranges. The ASR mentions that a sub-caliber device for use in tank main guns utilized 37mm ammunition with black powder charges and was utilized on the Defendum Rifle Range. Three of the four 37mm fragmentation items are described by field personnel as one-third of a 37mm projectile. All three of these were recovered in the same general area along with a rotating band from a 37mm, listed as MEC scrap. These were spread out over three consecutive transects; however, it is possible that these three fragments and the rotating band are from the same projectile, as no other fragments from 37mm projectiles were found in this area. The remaining fragments recovered could not be identified with any weapons system. These appeared to be randomly spread throughout the NT-1 area and do not appear to represent an impact area.

The remaining MEC-related items recovered are indicative of training areas, such as grenade safety pins, booby trap mounting bracket, and tail booms from either smoke or signal type rifle grenades.

Overall, the amount of MEC-related items recovered in NT-1 is considered minimal.

Northern Transect Area NT-2

In all, 117 anomalies were intrusively investigated in NT-2. Of those, 28 anomalies (24%) contained MEC-related scrap or fragmentation; no MEC was recovered in NT-2 (see Figure 3-2 and Table 3-5). The heaviest concentrations of MEC-related items in the area were recovered between Transects 18 and 21 (see Figure 2-2). This is the general vicinity of the underground bunker and target complex described in Section 2.3.

The types and quantity of MEC-related items recovered and the presence of an underground bunker system are indicative of a fire and maneuver training area. These MEC-

Table 3-5

NT-2 MEC-Related Items

Transect	Anomaly	Classification	Item Type	Description
18	1566	MEC Scrap	2.36-in. rocket, practice	2.36-in. rocket practice, red wax filled
18	1585	MEC Scrap	40mm Practice	40mm practice
17	1595	MEC Scrap	3.5-in. rocket, WP	3.5-in. rocket, WP, expended
21	1611	MEC Scrap	2.36-in. rocket, practice	Fin off rocket
21	1611	MEC Scrap	Grenade, smoke rifle	Tail boom for grenade
21	1613	MEC Scrap	Unknown	Tail boom of rifle grenade
21	1619	MEC Scrap	Grenade, rifle, illumination	Empty illumination rifle grenade
21	1621	MEC Scrap	2.36-in. rocket, practice	2.36-in. rocket practice
21	1622	MEC Scrap	Unknown	Rifle grenade tail boom
21	1623	MEC Fragmentation	Unknown	Fragment
21	1624	MEC Scrap	2.36-in. rocket, practice	2.36 rocket motor
21	1626	MEC Scrap	Grenade, smoke rifle	Retaining clip for grenade
21	1626	MEC Scrap	Grenade, smoke rifle	Tail boom
24	1651	MEC Scrap	Unknown	Grenade spoon
24	1652	MEC Scrap	Grenade, smoke rifle	Expended propellant section
24	1652	MEC Scrap	Grenade, smoke rifle	Expended smoke section of grenade
25	1661	MEC Scrap	Slap flare	Expended
19	1666	MEC Scrap	60mm mortar	Empty 60mm body. Possible WP round expended
19	1670	MEC Scrap	Grenade, rifle, illumination	Rifle grenade, illumination
19	1677	MEC Scrap	Unknown	40 mm aluminum cartridge case
19	1678	MEC Scrap	3.5-in. rocket, practice	3.5-in. rocket laying 5 ft from flag on the surface
19	1678	MEC Scrap	Grenade, rifle, illumination	Rifle grenade illumination
19	1679	MEC Scrap	2.36-in. rocket, practice	Venturi
19	1680	MEC Scrap	3.5-in. rocket, practice	3.5-in. warhead section “empty”
19	1680	MEC Scrap	3.5-in. rocket, practice	3.5-in. warhead section “empty”
19	1681	MEC Scrap	3.5-in. rocket practice	Aluminum fin
19	1684	MEC Fragmentation	Unknown	Piece of metal frag 1 x 2 in.
19	1685	MEC Scrap	Unknown	Unknown MEC scrap metal
20	1694	MEC Scrap	40mm Practice	40mm brass base of projectile
20	1699	MEC Scrap	Unknown	Tail boom off a rifle grenade
16	1813	MEC Scrap	Unknown	Grenade spoon
21	QC-1050	MEC Scrap	Grenade, MK-2	Initiator of grenade
23	QC-1052	MEC Scrap	3.5-in. rocket practice	Nose cone

related items included 2.36-in. and 3.5-in. practice rockets, expended smoke grenades, and functioned practice grenades.

A review of the ASR shows that the Tank Combat Range and Tank Ranges 1 and 2 may have impacted the NT-2 area; however, the ASR suggests no ranges in the NT-2 area where practice rockets may have been used. The rockets recovered may have been the result of undocumented limited use by military units during training. The presence of these items suggests the area may have been used as a fire and maneuver training area for combined arms exercises with the occasional employment of man portable rockets. The MEC fragmentation recovered in the NT-2 area may be associated with the ranges listed above; however, the quantity of MEC fragmentation does not indicate that the NT-2 area encompasses the impact area associated with these ranges.

Southern Transect Area ST-1

In all, 49 anomalies were intrusively investigated in ST-1. Of those, 21 anomalies (43%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-6). Four MEC items were recovered in ST-1: one 40mm HE grenade M381 and three 60mm HE mortars M49 with fuzes. A review of the ASR indicates that ST-1 is located within the boundaries of Range 31, which included the use of 40mm grenades, Fougasse, smoke, flamethrower, light antitank weapons (LAW), incendiary rockets, and other explosive ordnance. ST-1 is relatively small in size and is considered heavily contaminated with MEC and MEC-related items based on the results of this study.

Southern Transect Area ST-2

In all, 344 anomalies were intrusively investigated in ST-2. Of those, 52 anomalies (15%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-7). Two MEC items were recovered in ST-2 during intrusive operations (see Table 3-7) and one during surface sweeps (see Table 3-2). The MEC items included two MKII practice grenades with live detonators, one found during intrusive operations and one found during surface sweeps, and one smoke rifle grenade that only had a small quantity of its smoke charge remaining. All

Figure 3-3. Southern Transects Geophysically Mapped/Investigated Anomalies

Further detail provided on enclosed CD.

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Table 3-6

ST-1 MEC-Related Items

Transect	Anomaly	Classification	Item Type	Description
27	2954	MEC Scrap	2.36-in. rocket, practice	Rocket
27	**2958**	**MEC**	**40mm grenade HE**	**40mm grenade fired**
27	2953	MEC Scrap	2.36-in. rocket HEAT	Fragments
27	2952	MEC Scrap	Unknown	Scrap, 8X1.5 in.
27	2952	MEC Scrap	Unknown	Piece of frag
27	2951	MEC Scrap	40mm grenade smoke	Base
27	**2948**	**MEC**	**60mm mortar HE**	**60mm mortar w/fuze**
27	2947	MEC Fragmentation	Grenade, MK 2	3 pieces of fragments
27	2947	MEC Scrap	Grenade, MK 2	Fuze expended x2
27	2946	MEC Scrap	Grenade, smoke	FS smoke grenade
27	2945	MEC Scrap	Grenade, smoke	FS smoke grenade. 1/2 of container
27	2945	MEC Scrap	Grenade, smoke	FS smoke, 1/2 of container
27	2943	MEC Fragmentation	Unknown	Piece of fragment
27	2943	MEC Fragmentation	Unknown	Piece of fragment
27	2943	MEC Scrap	2.36-in. rocket, practice	Rocket
28	**2975**	**MEC**	**60mm mortar HE/fuzed**	**60mm mortar w/fuze**
28	2972	MEC Fragmentation	Unknown	Small piece of fragment
28	2972	MEC Scrap	Grenade, smoke	Pinned spoon and initiator. Top of end only
28	2968	MEC Scrap	Grenade, smoke	Top of grenade with initiator. Expended
29	**2598**	**MEC**	**60mm mortar HE**	**60mm mortar w/fuze**
29	2597	MEC Fragmentation	Unknown	2x8 in. piece of frag
29	2594	MEC Scrap	Grenade, smoke rifle	Tailboom
29	2592	MEC Scrap	Grenade, WP	Part of grenade body
29	2590	MEC Scrap	Grenade, WP	Part of the body
31	2454	MEC Scrap	2.36-in. rocket practice	Warhead section
32	2878	MEC Fragmentation	Unknown	Piece of fragment
32	2877	MEC Scrap	Unknown	Pot smoke floating SGF2 AN-M7. Containers size is approximately 5 gal

Table 3-7

ST-2 MEC-Related Items

Transect	Anomaly	Classification	Item Type	Description
27	2940	MEC Scrap	Grenade, MK 2	Initiator
27	2940	MEC Scrap	Grenade, MK 2	Initiator
27	2938	MEC Fragmentation	Unknown	Piece of fragment
27	2933	MEC Fragmentation	Unknown	Piece of fragment
27	2925	MEC Scrap	37mm TP	37mm
28	2966	MEC Scrap	Grenade, smoke	Half of fs smoke
28	2964	MEC Scrap	40mm grenade, smoke	Fuze to grenade
29	**2550**	**MEC**	**Grenade, MK 2, practice**	**With a live fuze**
29	**2548**	**MEC**	**Grenade, rifle, smoke**	**Still has smoke mixture inside**
29	2548	MEC Scrap	Grenade, rifle, smoke	Expended but intact
30	2541	MEC Scrap	Unknown	Grenade spoon
30	2885	MEC Scrap	Slap flare	Expended
32	2871	MEC Scrap	Grenade, smoke	Aluminum half shell
32	2866	MEC Fragmentation	Unknown	2x0.5 in. piece of fragment
32	2807	MEC Scrap	Grenade, rifle, smoke	Tailboom
32	2806	MEC Scrap	Slap flare	Expended
32	2803	MEC Scrap	Grenade, smoke	Grenade spoon
33	2800	MEC Fragmentation	Unknown	Piece of fragment
33	2800	MEC Fragmentation	Unknown	Piece of fragment
33	2800	MEC Scrap	60mm mortar, illumination	Mortar
33	2790	MEC Scrap	60mm mortar, practice	Practice mortar
35	1957	MEC Scrap	Grenade, smoke	FS smoke grenade. Both halves
35	1955	MEC Scrap	Grenade, smoke	FS smoke grenade. One half
36	2413	MEC Scrap	Grenade, smoke	FS smoke grenade. Both halves
37	2433	MEC Fragmentation	Unknown	Piece of fragment
37	QC-1069	MEC Scrap	Grenade, rifle, illumination	Expended illuminating rifle grenade
37	QC-1067	MEC Scrap	Grenade, MK 2, practice	Fuze expended, practice MKII
38	QC-1246	MEC Scrap	Grenade, smoke	Half of a aluminum grenade body
38	QC-1241	MEC Scrap	Grenade, smoke	Half of an aluminum smoke grenade
39	2348	MEC Scrap	Grenade, smoke	Aluminum grenade half bodies 4 each
39	2346	MEC Scrap	Grenade, smoke	Intact aluminum smoke grenade expended
39	QC-1207	MEC Fragmentation	Unknown	Thin case frag 1x4 in.
39	QC-1202	MEC Fragmentation	Grenade, MK 2	1x1 in. fragment
40	2784	MEC Scrap	Unknown	FS grenade. Two aluminum halves
40	2784	MEC Scrap	Unknown	FS grenade. Half of canister
40	2783	MEC Scrap	Grenade, smoke	FS smoke grenade. Both halves
40	2770	MEC Scrap	Grenade, rifle, smoke	Grenade
40	2765	MEC Fragmentation	Unknown	Piece of fragment
40	2765	MEC Scrap	Grenade, smoke	One half of FS grenade shell
40	2763	MEC Fragmentation	Unknown	Piece of fragment
41	QC-1226	MEC Scrap	Grenade, rifle, smoke	Tail boom
41	1896	MEC Fragmentation	Unknown	Fragment
42	1891	MEC Scrap	Grenade, rifle, illumination	Grenade, rifle
43	2308	MEC Fragmentation	81mm mortar, HE	Mortar fragments
43	2294	MEC Fragmentation	Unknown	MKII fragments
44	2251	MEC Scrap	Slap flare	Expended
45	2225	MEC Scrap	Fuze	M1901 PTTF

Table 3-7

(Continued)

Transect	Anomaly	Classification	Item Type	Description
45	2223	MEC Fragmentation	Unknown	Thick case fragment 1x3 in.
46	2160	MEC Fragmentation	Unknown	Thick case fragment 0.5x2 in.
46	2170	MEC Fragmentation	Unknown	Piece of fragment
49	2098	MEC Fragmentation	Unknown	Large piece of fragment
50	QC-1079	MEC Scrap	Unknown	81mm tail
51	2018	MEC Scrap	81mm mortar, HE	Fins x 2
51	2018	MEC Scrap	81mm mortar, HE	Tail fragment
52	1925	MEC Scrap	Grenade, rifle, illumination	Expended round
53	1920	MEC Fragmentation	60mm mortar, HE	Fragment
53	1920	MEC Fragmentation	Unknown	Possible 60mm piece
53	1920	MEC Fragmentation	81mm mortar, HE	Main body piece
53	1920	MEC Scrap	60mm mortar, HE	60mm fin piece
53	1920	MEC Scrap	60mm mortar, HE	Piece of fin
53	1920	MEC Scrap	60mm mortar, HE	Fin assembly
53	1911	MEC Fragmentation	60mm mortar, HE	1.5x5 in. fragment
53	1911	MEC Fragmentation	60mm mortar, HE	1.5x2 in. fragment
53	1911	MEC Fragmentation	60mm mortar, HE	1x4 in. fragment
53	1911	MEC Scrap	60mm mortar, HE	Tail boom
54	1665	MEC Fragmentation	60mm mortar, HE	Small fragment
55	1663	MEC Fragmentation	105mm projo, HE	2x1.5 in.

the MEC items located in ST-2 were located within 100 ft of each other. The two MKII practice grenades appear to have been dropped or discarded as the safety pins were present on both items.

The MEC scrap and fragmentation recovered in ST-2 indicates that the area was not used as an impact site for Range 31's HE weapons. There is a light presence of MEC fragmentation; however, the fragmentation is widely spread out with no evident concentrations. These fragments may be the result of detonations to the north of ST-2 in the area that was designated in the EE/CA as M6-1M Transect Area 1 (South)-PR and has been recommended for cleanup by the Army. The majority of the fragments recovered in ST-2 are listed as "unknown" item type, as the UXO Technicians could not determine what weapon system produced the fragments. The type of MEC scrap recovered and the presence of the underground bunker and target complex indicate the ST-2 area was more that likely utilized as a fire and maneuver training area.

Southern Transect Area ST-3

In all, 202 anomalies were intrusively investigated in ST-3. Of those, 116 anomalies (57%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-8). The four MEC items recovered include a WP hand grenade M15 with pinned fuze, 81mm WP mortar M57 with WP residue, 60mm HE mortar M49 with a sheared off fuze, and a hand grenade fuze with a possible live primer.

Table 3-8

ST-3 MEC-Related Items

Transect	Anomaly	Classification	Item Type	Description
53	1921	MEC Scrap	81mm mortar, illumination	81mm fin
53	1921	MEC Scrap	60mm mortar, HE	Fin assembly
52	1941	MEC Scrap	81mm mortar, HE	Tail of mortar
52	1942	MEC Fragmentation	57mm HE	Base of projectile
52	1944	MEC Fragmentation	Unknown	Fragments × 3
52	1944	MEC Fragmentation	Unknown	Fragment.
52	1944	MEC Scrap	60mm mortar, HE	Piece of fin
52	1944	MEC Scrap	60mm mortar, HE	Piece of 60mm fin
52	1944	MEC Scrap	81mm mortar, HE	81mm fin
52	1946	MEC Scrap	81mm mortar, HE	Tail of mortar
51	2019	MEC Fragmentation	Unknown	Piece of fragment
51	2021	MEC Scrap	81mm mortar, HE	Tailfin assembly
51	2022	MEC Fragmentation	81mm mortar, HE	Fin and 8 pieces of fragments
51	2025	MEC Scrap	60mm mortar, HE	Fin
51	**2026**	**MEC**	**Grenade, WP**	**M15 WP smoke grenade**
51	2027	MEC Fragmentation	81mm mortar, HE	Large piece of fragment
51	2028	MEC Fragmentation	81mm mortar, HE	Part of tail
51	2028	MEC Fragmentation	Unknown	Piece
51	2028	MEC Fragmentation	Unknown	Piece
51	2028	MEC Scrap	81mm mortar, HE	Part of tail
51	2029	MEC Fragmentation	105mm projo, HE	Part of nose
51	2029	MEC Fragmentation	Unknown	Piece
51	2029	MEC Fragmentation	60mm mortar, HE	Part of body and fin assembly
51	2029	MEC Fragmentation	Unknown	Piece
51	2029	MEC Fragmentation	Unknown	Piece of fragment
51	2029	MEC Fragmentation	105mm projo, HE	Piece
51	2029	MEC Fragmentation	105mm projo, HE	Fuze adapter
51	2029	MEC Scrap	81mm mortar, HE	Fin assembly
51	2030	MEC Fragmentation	81mm mortar, WP	Piece of fragment
51	2030	MEC Fragmentation	81mm mortar, WP	Part of mainbody and fin
51	2030	MEC Fragmentation	Unknown	Five pieces of fragments
51	2030	MEC Fragmentation	Unknown	Four pieces of fragments
51	2031	MEC Fragmentation	Unknown	Small piece
51	2031	MEC Fragmentation	Unknown	Small piece
51	2031	MEC Scrap	81mm mortar, HE	Tail fins
51	2031	MEC Scrap	81mm mortar, HE	Piece of fin
51	2031	MEC Scrap	Unknown	Piece of aluminum

Table 3-8

(Continued)

Transect	Anomaly	Classification	Item Type	Description
51	2032	MEC Fragmentation	57mm HE	Fragment
51	2032	MEC Fragmentation	Unknown	Fragment
49	2104	MEC Fragmentation	Unknown	Piece of fragment
49	2107	MEC Fragmentation	81mm mortar, HE	Two pieces of fragment
49	2110	MEC Fragmentation	Unknown	Piece of fragment
49	2115	MEC Fragmentation	81mm mortar, HE	Tail-boom and body fragments
49	2115	MEC Scrap	81mm mortar, HE	Fin
47	2184	MEC Scrap	60mm mortar, HE	Stabilizer off tail fin. Tail fin
47	2188	MEC Fragmentation	81mm mortar, HE	Piece of fragment
47	2189	MEC Scrap	2.36-in. rocket, HEAT	Warhead
47	2191	MEC Fragmentation	Unknown	Piece of fragment
47	2195	MEC Fragmentation	Unknown	Piece of fragment
47	2195	MEC Scrap	81mm mortar, HE	Tail boom
47	2196	MEC Fragmentation	Unknown	Piece of fragment
47	2196	MEC Scrap	Grenade, MK 2	Initiator and pinned spoon off grenade
47	2196	MEC Scrap	60mm, mortar, HE	Piece of fin from stabilizer
47	2196	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2196	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2196	MEC Scrap	81mm mortar, HE	Tail fin and piece of fin
47	2198	MEC Scrap	81mm mortar, HE	Tail fin assembly
47	2198	MEC Scrap	81mm mortar, HE	Tail fin
47	2198	MEC Scrap	81mm mortar, HE	Tail fin assembly
47	2198	MEC Scrap	81mm mortar, HE	Fuze
47	2202	MEC Fragmentation	Unknown	Small piece of fragment
47	2202	MEC Fragmentation	60mm mortar, HE	Piece of fragment with fin
47	2202	MEC Fragmentation	Unknown	Piece of fragment
47	2202	MEC Scrap	Grenade, smoke	FS smoke. Half of shell
47	2202	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2203	MEC Fragmentation	Unknown	Piece of fragment
47	2203	MEC Fragmentation	Unknown	Piece of fragment
47	2203	MEC Fragmentation	Unknown	Piece of fragment
47	2203	MEC Scrap	81mm mortar, HE	Fin
47	2203	MEC Scrap	81mm mortar, HE	Fin
47	2203	MEC Scrap	60mm mortar, HE	Fin
47	2203	MEC Scrap	60mm mortar, HE	Fin
47	2204	MEC Fragmentation	Unknown	Piece of fragment
47	2204	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2204	MEC Scrap	81mm mortar, HE	Tail assembly
47	2204	MEC Scrap	60mm mortar, HE	Fin assembly
47	2208	MEC Scrap	81mm mortar, HE	Fin
47	2220	MEC Scrap	60mm mortar, HE	Piece of fin
47	2222	MEC Fragmentation	Unknown	Piece of fragment
44	2244	MEC Fragmentation	Unknown	Piece of fragment
44	2245	MEC Scrap	Grenade, smoke	Half of aluminum smoke grenade
47	2255	MEC Scrap	81mm mortar, HE	Fin
47	2255	MEC Scrap	81mm mortar, HE	Tail boom
47	2256	MEC Fragmentation	81mm mortar, WP	Tail boom and split body
47	2256	MEC Fragmentation	Unknown	2 × piece fragment

Table 3-8

(Continued)

Transect	Anomaly	Classification	Item Type	Description
47	2256	MEC Fragmentation	Unknown	Two pieces of fragment. 8 × 2 in. and 2 × 2 in.
47	2257	MEC Fragmentation	81mm mortar, WP	Mortar
47	2257	MEC Fragmentation	Unknown	Piece of fragment
47	2257	MEC Fragmentation	Unknown	Piece of fragment
47	2257	MEC Fragmentation	Unknown	Piece of fragment
47	2258	MEC Fragmentation	81mm mortar, HE	Mortar
47	2259	MEC Fragmentation	60mm mortar, HE	Piece of fragment
47	2259	MEC Scrap	Unknown	Expended signal flare
47	2260	MEC Fragmentation	Unknown	Large piece of fragment
47	2262	MEC Fragmentation	Unknown	Small piece of fragment
47	2262	MEC Fragmentation	Unknown	Piece of fragment
47	2262	MEC Scrap	60mm mortar, HE	4 pieces of tail fin and fuze
47	2262	MEC Scrap	81mm mortar, HE	Tail fin and a piece of fin
47	2264	MEC Scrap	81mm mortar, HE	Tail fin
47	2264	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2264	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2268	MEC Scrap	60mm mortar, HE	Fin off tail boom
47	2268	MEC Scrap	60mm mortar, HE	Fin off tail boom
47	2271	MEC Fragmentation	Unknown	Large piece of fragment
47	2276	MEC Fragmentation	Unknown	Piece of fragment
47	2276	MEC Scrap	60mm mortar, HE	Piece of fin from stabilizer
47	2281	MEC Fragmentation	75mm projectile, HE	Piece of fragment
48	2287	MEC Scrap	Grenade, smoke	Smoke half shell
48	2292	MEC Scrap	Unknown	60mm tail
42	2345	MEC Scrap	Grenade, smoke	Half of FS smoke grenade
48	2721	MEC Fragmentation	81mm mortar, HE	Fragment
48	2721	MEC Scrap	81mm mortar, HE	Fragment
48	2723	MEC Scrap	Unknown	1 × 4 in. piece of body
48	2724	MEC Fragmentation	Unknown	Piece of fragment
48	**2726**	**MEC**	**60mm mortar, HE**	**Mortar/fuze sheared off**
48	2727	MEC Scrap	81mm mortar, HE	Tail fin
48	2727	MEC Scrap	60mm mortar, HE	Piece of the fin stabilizer from tail
48	2728	MEC Scrap	81mm mortar, HE	Tailboom and fins
48	2731	MEC Fragmentation	81mm mortar, HE	1 × 1 in. piece of fragment
48	2731	MEC Scrap	81mm mortar, HE	Tailboom
48	2733	MEC Scrap	81mm mortar, WP	Part of mainbody and fin
48	2735	MEC Fragmentation	Unknown	1 × 1 in. fragment
48	2737	MEC Fragmentation	81mm mortar, HE	Fragment 3 × 3 in.
48	2737	MEC Fragmentation	81mm mortar, HE	Fragments 1 × 2 in.
48	2737	MEC Scrap	81mm mortar, HE	Tailboom
48	2739	MEC Fragmentation	Unknown	Piece of fragment
48	2740	MEC Scrap	37mm TP	Projectile
48	2742	MEC Scrap	81mm mortar, HE	Tail fin
48	2743	MEC Fragmentation	81mm mortar, HE	Body and tail boom
48	2743	MEC Fragmentation	81mm mortar, HE	Fragments
48	2743	MEC Fragmentation	81mm mortar, HE	Body scrap
48	2743	MEC Scrap	60mm mortar, HE	Tail boom
48	2743	MEC Scrap	81mm mortar, HE	Tail fin/boom
48	2746	MEC Fragmentation	81mm mortar, HE	Fragments

Table 3-8

(Continued)

Transect	Anomaly	Classification	Item Type	Description
48	2746	MEC Scrap	Unknown	Tail boom
48	2748	MEC Scrap	81mm mortar, HE	Tail boom
48	2750	MEC Scrap	81mm mortar, HE	Tail fin
48	2751	MEC Scrap	60mm mortar, HE	Tail
48	2752	MEC Scrap	40mm grenade, smoke	Aluminum body
48	2754	MEC Fragmentation	81mm mortar, HE	Tail fin with three other small pieces
48	2756	MEC Fragmentation	Unknown	Fragments 3 each
48	2756	MEC Scrap	60mm mortar, HE	Tail boom
48	2756	MEC Scrap	Unknown	1 tail fin 60mm
51	QC-1055	MEC Scrap	Landmine AT, practice	3 × 3 × 0.5 in.
50	QC-1083	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1083	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1083	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1083	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1088	MEC Scrap	81mm mortar HE	Piece of 81mm fin
50	QC-1091	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1093	MEC Fragmentation	Unknown	Large piece of fragment
50	QC-1093	MEC Fragmentation	Unknown	Seven pieces of fragments
50	QC-1093	MEC Fragmentation	Unknown	Small pieces frag × 6
50	QC-1093	MEC Scrap	81mm mortar, HE	Fin
50	QC-1093	MEC Scrap	Unknown	Tail of 81mm
50	QC-1093	MEC Scrap	81mm mortar, HE	Piece of tail fin
50	QC-1093	MEC Scrap	81mm mortar, HE	Fin
50	QC-1094	MEC Fragmentation	Unknown	Piece fragment
50	QC-1094	MEC Fragmentation	Unknown	2 pieces fragment
50	QC-1094	MEC Scrap	81mm mortar, HE	Fin assembly
50	QC-1095	MEC Scrap	81mm mortar, illumination	Fin
50	QC-1095	MEC Scrap	81mm mortar, illumination	Tail boom
50	QC-1096	MEC Fragmentation	Unknown	Piece
50	QC-1096	MEC Fragmentation	81mm mortar, illumination	6 × fragments
50	QC-1096	MEC Fragmentation	81mm mortar, WP	Tail and body
50	QC-1097	MEC Fragmentation	Unknown	Piece
50	QC-1098	MEC Fragmentation	Unknown	Pieces of fragment × 3
50	QC-1098	MEC Fragmentation	Unknown	Piece fragment × 2
50	QC-1098	MEC Fragmentation	Unknown	Fragment × 4 plus tail assembly
50	QC-1098	MEC Fragmentation	60mm mortar, HE	Piece
50	QC-1098	MEC Scrap	60mm mortar, HE	Fin assembly
50	QC-1098	MEC Scrap	81mm mortar, HE	Fin assembly
50	QC-1098	MEC Scrap	81mm mortar, HE	Fin
50	QC-1098	MEC Scrap	81mm mortar, HE	Fin
50	QC-1098	MEC Scrap	81mm mortar, HE	Fin
50	QC-1104	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1104	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1104	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1104	MEC Scrap	60mm mortar, HE	Tail fin
50	QC-1107	MEC Fragmentation	Unknown	Pieces of frag × 4
50	QC-1107	MEC Fragmentation	Unknown	Piece of fragment

Table 3-8

(Continued)

Transect	Anomaly	Classification	Item Type	Description
50	QC-1107	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1107	MEC Scrap	Unknown	81mm tail fin
50	QC-1107	MEC Scrap	81mm mortar, HE	Piece of fin
50	QC-1117	MEC Fragmentation	Unknown	Piece
50	QC-1117	MEC Scrap	Unknown	Fin
50	QC-1117	MEC Scrap	81mm mortar, HE	Tail assembly
50	QC-1117	MEC Scrap	81mm mortar, HE	Fin
50	QC-1117	MEC Scrap	81mm mortar, HE	Fin assembly
50	QC-1118	MEC Fragmentation	81mm mortar, WP	Large piece of fragment
50	QC-1118	MEC Fragmentation	81mm mortar, WP	Tail boom and body part
50	QC-1118	MEC Fragmentation	81mm mortar, WP	Fragments × 5
50	QC-1121	MEC Fragmentation	Unknown	Piece of fragment
50	QC-1121	MEC Scrap	60mm mortar, HE	Fin assembly
50	QC-1127	MEC Scrap	60mm mortar, HE	Fin assembly
49	QC-1137	MEC Scrap	81mm mortar, HE	Tailboom
49	QC-1137	MEC Scrap	60mm mortar, HE	Tail fin
49	QC-1138	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1138	MEC Fragmentation	Unknown	Three pieces of fragments
49	QC-1138	MEC Scrap	81mm mortar, HE	Three tail fins of 81mm
49	QC-1139	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1142	MEC Fragmentation	Unknown	Fragments × 6
49	QC-1142	MEC Scrap	Grenade, smoke	FS smoke ball
49	QC-1142	MEC Scrap	Grenade, smoke	Half of fs smoke
49	QC-1142	MEC Scrap	81mm mortar, HE	81mm tail
49	QC-1142	MEC Scrap	Unknown	81 mm tail piece
49	QC-1144	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1145	MEC Fragmentation	Unknown	6 pieces fragment
49	QC-1145	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1145	MEC Scrap	81mm mortar, HE	Fin assembly
49	QC-1145	MEC Scrap	81mm mortar, HE	2 fins
49	QC-1145	MEC Scrap	81mm mortar, HE	Fin
49	QC-1146	MEC Fragmentation	Unknown	Piece
49	QC-1156	MEC Fragmentation	60mm mortar, HE	Tail section and body fragment
49	QC-1164	MEC Fragmentation	Unknown	Piece of fragment
49	**QC-1165**	**MEC**	**81mm mortar, WP**	**Mortar encountered 12 in. below ground surface with WP present, which ignited upon being excavated**
49	QC-1165	MEC Fragmentation	Unknown	Large piece of fragment
49	QC-1165	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1165	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1165	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1165	MEC Fragmentation	Unknown	Large piece of fragment
49	**QC-1167**	**MEC**	**Fuze, grenade**	**Hand grenade initiator with pin and spoon. Possible primer still within**
49	QC-1167	MEC Fragmentation	81mm mortar, WP	Part of main body and tail
49	QC-1167	MEC Fragmentation	Unknown	Four pieces of fragments
49	QC-1167	MEC Fragmentation	Unknown	Three pieces of fragments
49	QC-1167	MEC Fragmentation	Unknown	5 pieces of fragments. Various sizes
49	QC-1168	MEC Fragmentation	Unknown	Five pieces of fragments

Table 3-8

(Continued)

Transect	Anomaly	Classification	Item Type	Description
49	QC-1168	MEC Scrap	81mm mortar, HE	81mm tail fin
49	QC-1169	MEC Fragmentation	Unknown	Large piece of fragment
49	QC-1170	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1170	MEC Fragmentation	Unknown	Five pieces of fragments
49	QC-1170	MEC Fragmentation	Unknown	Two pieces of fragments
49	QC-1170	MEC Fragmentation	Unknown	Three pieces of fragments
49	QC-1170	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1170	MEC Scrap	Unknown	Large section of illumination mortar
49	QC-1171	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1171	MEC Fragmentation	Unknown	Pieces of fragment × 3
49	QC-1171	MEC Fragmentation	Unknown	Fragment
49	QC-1171	MEC Scrap	81mm mortar, HE	Tail boom
49	QC-1171	MEC Scrap	81mm mortar, HE	Piece of tail fin
49	QC-1171	MEC Scrap	81mm mortar, HE	Piece of tail fin
49	QC-1172	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1172	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1172	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1172	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1174	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1176	MEC Fragmentation	Unknown	Piece fragment
49	QC-1176	MEC Scrap	81mm mortar, HE	Fin assembly
49	QC-1176	MEC Scrap	81mm mortar, HE	Fin
49	QC-1176	MEC Scrap	81mm mortar, HE	Fin
49	QC-1180	MEC Fragmentation	Unknown	Piece fragment
49	QC-1184	MEC Fragmentation	Unknown	Piece of fragment
49	QC-1184	MEC Scrap	81mm mortar, HE	Tail fin
49	QC-1184	MEC Scrap	Unknown	Piece of tail fin
48	RD-2728	MEC Fragmentation	Unknown	Piece of fragment
48	RD-2728	MEC Scrap	60mm mortar, WP	Tail of mortar
48	RD-2737	MEC Scrap	60mm mortar, WP	Tail fin of mortar
48	RD-2743	MEC Fragmentation	Unknown	Two pieces of fragments
48	RD-2743	MEC Scrap	Grenade, smoke	FS Smoke. Half of container
48	RD-2746	MEC Fragmentation	Unknown	Piece of fragment

According to the ASR, ST-3 is in the direct fan of fire for Range 31 and the Defendum Rifle Range; however, it is unlikely that the Defendum Rifle Range contributed to the MEC-related items because, according to the ASR, the items used at the range are direct fire weapons and there is a mountain between the ST-3 area and the firing point. Another possible source for the MEC-related items is what appears to be an open burn/open detonation pit adjacent to Transect 50. It is possible that ordnance that failed to function or was determined to be unserviceable was brought to the area and detonated. This would account for the MEC items listed as 105mm projectile fragmentation being present in this area and ST-2, since no use of that weapon system is listed in the ASR for this area.

For the relatively small size of the area encompassed by ST-3 and the large quantity of MEC-related items recovered, this area is considered to be heavily contaminated.

3.6 Description of Hazards

No MEC items were located in NT-1 during the Supplemental EE/CA; however, a rifle grenade, signal green smoke was recovered during the Army EE/CA. This type of item possesses minimal explosive safety hazard and is typical of a training area.

No MEC items were recovered during the Supplemental EE/CA in NT-2. The bunker complex in this area appears to have been used as a fire and maneuver training area, so the use of munitions containing HE is highly unlikely, but cannot be completely ruled out. Also, the recovery of practice rockets leads to the possibility that rocket motors that had not been completely expended during flight may be present.

During the Supplemental EE/CA, four MEC items were recovered in ST-1: a 40mm HE grenade M381 and three 60mm HE mortars M49. It can be inferred that additional items of these types will be located throughout ST-1. The 40mm HE grenades M381 have the possibility of being equipped with an all-ways acting fuze, which is very sensitive and should not be disturbed, while the 60mm HE mortars M49 were equipped with point detonating fuzes, which are less sensitive, but do present a significant explosive hazard.

Three MEC items were located in ST-2 during the Supplemental EE/CA. These items included two MKII practice grenades with live detonators and a smoke rifle grenade with residual filler. Theses types of items possess minimal explosive safety hazard and are typical of a training area.

Large quantities of 60mm and 81mm mortar fragmentation were found in ST-3 along with four MEC items. The MEC items included a 60mm HE mortar M49 with a sheared off fuze, 81mm WP mortar M57 with WP residue, WP hand grenade M15, and a hand grenade fuze. It can

be inferred that additional items of these types will be located throughout ST-3. The items present a high explosive safety hazard.

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4.0 MUNITIONS AND EXPLOSIVES OF CONCERN RISK AND PROTECTIVENESS ASSESSMENT

4.1 Ordnance and Explosives Risk Impact Assessment

An explosive safety risk exists if a person can come near or into contact with a MEC item and act on it to cause a detonation. The potential for an explosive safety risk depends upon three critical elements: a source (presence of MEC), a receptor or person, and interaction between the source and receptor (such as picking up or disturbing the item by digging). There is no risk if any one element is missing. Each of the three elements provided a basis for implementing effective risk management response actions. A qualitative risk evaluation was conducted using the *Interim Guidance, Ordnance and Explosives Risk Impact Assessment* (OERIA) (USACE 2001). The OERIA process conducted for this Supplemental EE/CA follows the same methodology as the OERIA performed in the Army EE/CA. A brief summary of the OERIA risk evaluation methodology is provided below.

The potential posed by MEC was characterized qualitatively by evaluating three primary risk factors. The three primary risk factors include presence of MEC, site characteristics, and human factors. These particular factors were highlighted because of their role in determining or affecting the level of risk posed by MEC that may be present in an area. Information on these factors was compiled and evaluated to develop a qualitative assessment of the potential for exposure to MEC and overall protectiveness in each risk assessment sector (NT-1, NT-2, ST-1, ST-2, and ST-3). The OERIA process was applied to develop a baseline estimate of the potential for exposure given current site conditions and known site activities. The process was then applied again for each risk assessment sector for different response action alternatives (e.g., land use controls, construction support, surface removal, etc.) to evaluate the potential for exposure to MEC assuming the conduct of activities likely to be associated with the future industrial and/or McClellan Park System use of the Alpha Area. The results of these risk assessments were used as major inputs to the effectiveness criterion used later in the comparative evaluation of alternative response actions (see Sections 7.0 and 8.0). Results of the OERIA for each risk assessment sector are summarized in Tables 4-1 through 4-5. The following paragraphs describe the components of the primary risk factors.

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Table 4-1

OERIA Table for NT-1

Area:	**Alpha**
Sector:	**NT-1**
Area Size:	**79.34**
Area Geophysically Surveyed:	**3.65**
Area Intrusively Investigated	**2.23**

Alternatives	**Ordnance (1,2,4)**							**Site**		**Human Current Use**			**Human Future Use McClellan Park System**			**Human Future Use Industrial**			**Overall Rank**		
	MEC Type		**MEC Sensitivity**		**MEC Item Depth Distribution**		**MEC Item Density(3)**	**Site Access**	**Site Stability**	**Activity**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**Likelihood of Near Term Reuse**	**MEC Contact Probability Level**	**Exposed Population (Number or Freq. Of Use)**	**Likelihood of Near Term Reuse**	**Current Land Use**	**Future Land Use McClellan Park System**	**Future Land Use (Industrial)**
		No.		**No.**	**Depth Range**	**%**	**Items/Acre**														
Baseline Risk Assessment (Existing Conditions)	Cat. 3	0	Cat. 3	0	Surface	6%	0.90	Limited Restriction	Site Stable	No Sanctioned Use	Low	Occasional	Low	Occasional	High	Low	Frequent	High			
	Cat. 2	0	Cat. 2	0	>0 to 1 ft	84%	12.10														
	Cat. 1	0	Cat. 1	0	1 ft to Depth	10%	1.34														
	Cat. 0	32	Cat. 0	32	Overall		14.34														
Alternative 1 - No Further Action					No Impact						No Impact	No Impact	No Impact	No Impact		No Impact	No Impact		Baseline	Baseline	Baseline
Alternative 2 - Land Use Controls					No Impact						C	B	C	B		C	B		High	High	Moderate
Alternative 3 – Construction Support					C						NA	NA	C	B		C	B		High	High	Moderate
Alternative 4 - Surface Clearance					B						B	A	B	A		B	A		High	High	High
Alternative 5 - Clearance to 1 ft					A						A	A	A	A		A	A		High	High	High
Alternative 6 - Clearance to Depth					A						A	A	A	A		A	A		High	High	High

(1) Totals include intrusive investigations that recovered a MEC-related item; totals do not include multiple items per target anomaly.
(2) Totals include MEC-related items found during surface sweep.
(3) MEC densities calculated from MEC related items found with in intrusively investigated area.
(4) Does not include the one MEC item discovered during the Army EE/CA.

Impact Code
A = Signifies the greatest impact on reducing potential exposures to MEC; relatively less impact as the letter ranking goes to B, C, and subsequent letters.
HIGH = Most protective relative to projected land use.
LOW = Least protective relative to projected land use.
MODERATE = Protectiveness level between low and high.
BASELINE = Protectiveness level associated with Alternative 1 - No Further Action.

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Table 4-2

OERIA Table for NT-2

Area:	**Alpha**
Sector:	**NT-2**
Area Size:	**13.60**
Area Geophysically Surveyed:	**0.63**
Area Intrusively Investigated	**0.28**

Alternatives	Ordnance (1,2)							Site		Human Current Use			Human Future Use McClellan Park System			Human Future Use Industrial			Overall Rank		
	MEC Type		MEC Sensitivity		MEC Item Depth Distribution		MEC Item Density(3)	Site Access	Site Stability	Activity	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	Likelihood of Near Term Reuse	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	Likelihood of Near Term Reuse	Current Land Use	Future Land Use McClellan Park System	Future Land Use (Industrial)
		No.		No.	Depth Range	%	Items/Acre														
Baseline Risk Assessment (Existing Conditions)	Cat. 3	0	Cat. 3	0	Surface	7%	7.27	Limited Restriction	Site Stable	No Sanctioned Use	Low	Occasional	Low	Occasional	High	Low	Frequent	High			
	Cat. 2	0	Cat. 2	0	0 to 1 ft	86%	101.76														
	Cat. 1	0	Cat. 1	0	1 ft to Depth	7%	7.27														
	Cat. 0	30	Cat. 0	30	Overall		101.76														
Alternative 1 - No Further Action					No Impact						No Impact	No Impact	No Impact	No Impact		No Impact	No Impact		Baseline	Baseline	Baseline
Alternative 2 - Land Use Controls					No Impact						C	B	C	B		C	B		Moderate	Moderate	Low
Alternative 3 - Construction Support					C						NA	NA	C	B		C	B		High	Moderate	Moderate
Alternative 4 - Surface Clearance					B						B	A	B	A		B	A		High	High	Moderate
Alternative 5 - Clearance to 1 ft					A						A	A	A	A		A	A		High	High	High
Alternative 6 - Clearance to Depth					A						A	A	A	A		A	A		High	High	High

(1) Totals include intrusive investigations that recovered a MEC-related item; totals do not include multiple items per target anomaly.
(2) Totals include MEC-related items found during surface sweep.
(3) MEC densities calculated from MEC-related items found within intrusively investigated area.

Impact Code
A = Signifies the greatest impact on reducing potential exposures to MEC; relatively less impact as the letter ranking goes to B, C, and subsequent letters.
HIGH = Most protective relative to projected land use.
LOW = Least protective relative to projected land use.
MODERATE = Protectiveness level between low and high.
BASELINE = Protectiveness level associated with Alternative 1 - No Further Action.

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Table 4-3

OERIA Table for ST-1

Area:	**Alpha**
Sector:	**ST-1**
Area Size:	**5.02**
Area Geophysically Surveyed:	**0.23**
Area Intrusively Investigated	**0.19**

Alternatives	**Ordnance (1,2)**							**Site**		**Human Current Use**			**Human Future Use McClellan Park System**			**Human Future Use Industrial**			**Overall Rank**		
	MEC Type		**MEC Sensitivity**		**MEC Item Depth Distribution**		**MEC Item Density(3)**	**Site Access**	**Site Stability**	**Activity**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**Likelihood of Near Term Reuse**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**Likelihood of Near Term Reuse**	**Current Land Use**	**Future Land Use McClellan Park System**	**Future Land Use (Industrial)**
		No.		**No.**	**Depth Range**	**%**	**Items/Acre**														
Baseline Risk Assessment (Existing Conditions)	Cat. 3	4	Cat. 3	1	Surface	9%	10.43	Limited Restriction	Site Stable	No Sanctioned Use	Moderate	Occasional	Significant	Occasional	High	Significant	Frequent	High			
	Cat. 2	0	Cat. 2	3	0 to 1 ft	86%	99.07														
	Cat. 1	0	Cat. 1	0	1 ft to Depth	5%	5.21														
	Cat. 0	19	Cat. 0	19	Overall		114.71														
Alternative 1 - No Further Action					No Impact						No Impact	No Impact	No Impact	No Impact		No Impact	No Impact		Baseline	Baseline	Baseline
Alternative 2 - Land Use Controls					No Impact						C	B	C	B		C	B		Low	Low	Low
Alternative 3 - Construction Support					C						NA	NA	C	B		C	B		Moderate	Moderate	Moderate
Alternative 4 - Surface Clearance					B						B	B	B	B		B	B		Moderate	Moderate	Low
Alternative 5 - Clearance to 1 ft					A						A	A	A	A		A	A		High	High	Moderate
Alternative 6 - Clearance to Depth					A						A	A	A	A		A	A		High	High	High

(1) Totals include intrusive investigations that recovered a MEC-related item; totals do not include multiple items per target anomaly.
(2) Totals include MEC-related items found during surface sweep.
(3) MEC densities calculated from MEC-related items found within intrusively investigated area.

Impact Code
A = Signifies the greatest impact on reducing potential exposures to MEC; relatively less impact as the letter ranking goes to B, C, and subsequent letters.
HIGH = Most protective relative to projected land use.
LOW = Least protective relative to projected land use.
MODERATE = Protectiveness level between low and high.
BASELINE = Protectiveness level associated with Alternative 1 - No Further Action.

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Table 4-4
OERIA Table for ST-2

Area:	**Alpha**
Sector:	**ST-2**
Area Size:	**66.03**
Area Geophysically Surveyed:	**3.04**
Area Intrusively Investigated	**1.71**

Alternatives	Ordnance (1,2)							Site		Human Current Use			Human Future Use McClellan Park System			Human Future Use Industrial			Overall Rank		
	MEC Type		MEC Sensitivity		MEC Item Depth Distribution		MEC Item Density(3)	Site Access	Site Stability	Activity	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	Likelihood of Near Term Reuse	MEC Contact Probability Level	Exposed Population (Number or Frequency of Use)	Likelihood of Near Term Reuse	Current Land Use	Future Land Use McClellan Park System	Future Land Use (Industrial)
		No.		No.	Depth Range	%	Items/Acre														
Baseline Risk Assessment (Existing Conditions)	Cat. 3	0	Cat. 3	0	Surface	21%	8.17	Limited Restriction	Site Stable	No Sanctioned Use	Significant	Occasional	Significant	Occasional	High	Significant	Frequent	High			
	Cat. 2	0	Cat. 2	0	0 to 1 ft	79%	30.35														
	Cat. 1	3	Cat. 1	3	1 ft to Depth	0%	0														
	Cat. 0	62	Cat. 0	62	Overall		37.93														
Alternative 1 - No Further Action					No Impact						No Impact	No Impact	No Impact	No Impact		No Impact	No Impact		Baseline	Baseline	Baseline
Alternative 2 - Land Use Controls					No Impact						C	B	C	B		C	B		High	High	Moderate
Alternative 3 - Construction Support					C						NA	NA	C	B		C	B		High	High	Moderate
Alternative 4 - Surface Clearance					B						B	A	B	A		B	A		High	High	High
Alternative 5 - Clearance to 1 ft					A						A	A	A	A		A	A		High	High	High
Alternative 6 - Clearance to Depth					A						A	A	A	A		A	A		High	High	High

(1) Totals include intrusive investigations that recovered a MEC-related item; totals do not include multiple items per target anomaly.
(2) Totals include MEC-related items found during surface sweep.
(3) MEC densities calculated from MEC-related items found within intrusively investigated area.

Impact Code
A = Signifies the greatest impact on reducing potential exposures to MEC; relatively less impact as the letter ranking goes to B, C, and subsequent letters
HIGH = Most protective relative to projected land use.
LOW = Least protective relative to projected land use.
MODERATE = Protectiveness level between low and high.
BASELINE = Protectiveness level associated with Alternative 1 - No Further Action.

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Table 4-5

OERIA Table for ST-3

Area:	**Alpha**
Sector:	**ST-3**
Area Size:	**15.63**
Area Geophysically Surveyed:	**0.72**
Area Intrusively Investigated	**0.42**

Alternatives	**Ordnance (1,2)**							**Site**		**Human Current Use**			**Human Future Use McClellan Park System**			**Human Future Use Industrial**			**Overall Rank**		
	MEC Type		**MEC Sensitivity**		**MEC Item Depth Distribution**		**MEC Item Density(3)**	**Site Access**	**Site Stability**	**Activity**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**Likelihood of Near Term Reuse**	**MEC Contact Probability Level**	**Exposed Population (Number or Frequency of Use)**	**Likelihood of Near Term Reuse**	**Current Land Use**	**Future Land Use McClellan Park System**	**Future Land Use (Industrial)**
		No.		**No.**	**Depth Range**	**%**	**Items/Acre**														
Baseline Risk Assessment (Existing Conditions)	Cat. 3	1	Cat. 3	NA	Surface	0%	0	Limited Restriction	Site Stable	No Sanctioned Use	Moderate	Occasional	Significant	Occasional	High	Significant	Frequent	High			
	Cat. 2	2	Cat. 2	1	0 to 1 ft	89%	245.21														
	Cat. 1	1	Cat. 1	3	1 ft to Depth	11%	30.95														
	Cat. 0	112	Cat. 0	112	Overall		276.15														
Alternative 1 - No Further Action					No Impact						No Impact	No Impact	No Impact	No Impact		No Impact	No Impact		Baseline	Baseline	Baseline
Alternative 2 - Land Use Controls					No Impact						C	B	C	B		C	B		Low	Low	Low
Alternative 3 - Construction Support					C						NA	NA	C	B		C	B		Moderate	Moderate	Moderate
Alternative 4 - Surface Clearance					B						B	B	B	B		B	B		Moderate	Moderate	Low
Alternative 5 - Clearance To 1 Foot Depth					A						A	A	A	A		A	A		High	High	Moderate
Alternative 6 - Clearance to Depth					A						A	A	A	A		A	A		High	High	High

(1) Totals include intrusive investigations that recovered a MEC-related item; totals do not include multiple items per target anomaly.
(2) Totals include MEC-related items found during surface sweep.
(3) MEC densities calculated from MEC-related items found within intrusively investigated area.

Impact Code
A = Signifies the greatest impact on reducing potential exposures to MEC; relatively less impact as the letter ranking goes to B, C, and subsequent letters.
HIGH = Most protective relative to projected land use.
LOW = Least protective relative to projected land use.
MODERATE = Protectiveness level between low and high.
BASELINE = Protectiveness level associated with Alternative 1 - No Further Action.

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4.1.1 Presence of Munitions and Explosives of Concern Factors

Four categories are evaluated within the presence of MEC risk factor as discussed below.

- Ordnance Type - The type of MEC present affects the likelihood of injury and the severity of a potential incident involving that MEC. The OERIA documentation defines four general categories for this factor as shown in Table 4-6.
- Ordnance Sensitivity - MEC sensitivity affects the likelihood that the item will detonate or release energy if encountered and disturbed. Factors considered in evaluating sensitivity include fuzing and environmental factors such as weathering. The OERIA documentation defines four general categories for this factor as shown in Table 4-7.
- Ordnance Depth - MEC depth on or beneath the surface of the ground affects the likelihood that an individual will be exposed as the result of his or her activities.
- Ordnance Quantity or Density - MEC quantity or density affects the likelihood that an individual will be exposed to an item. There is an assumed direct relationship between MEC density and the potential for harm. The presence of more MEC items is expected to present more potential for exposure. Density can be estimated either qualitatively or quantitatively.

4.1.2 Site Characteristics Factors

Two categories are evaluated in the site characteristics risk factor as discussed below.

- Site Accessibility: The accessibility of the site affects the likelihood of people being exposed to MEC. Any man-made barriers (e.g., walls or fences) or natural barriers (e.g., steep terrain or topography, or dense vegetative cover) that preclude or limit access to the site are considered relative to their effectiveness in limiting or controlling accessibility to the site. The OERIA documentation defines three categories for this factor as shown in Table 4-8.
- Site Stability: Site stability affects the likelihood of coming into contact with MEC as the result of recurring natural processes (e.g., frost heave, sand movement, or erosion) or because of extreme natural events (e.g., tornadoes, earthquakes, or hurricanes). The OERIA documentation defines three categories for this factor as shown in Table 4-9.

Table 4-6

Category Descriptions and Assignment Rules for the MEC Type Risk Factor

Category	Description	Assignment Rules
3	MEC that will kill an individual if detonated by an individual's activities	• All HE-filled items (fired or unfired) • Any item whose identity was unspecified or undetermined (conservative default assumption) Examples: 60mm Mortar, 75mm HE, and 3.5-in. rocket
2	MEC that will cause major injury to an individual if detonated by an individual's activities	• All non-HE filled, non practice items Examples: Smoke Hand Grenade and Rifle Grenade
1	MEC that will cause minor injury to an individual if detonated by an individual's activities	• All practice ordnance (fired or unfired) Examples: 2.36-in. Practice Rocket and M-2 Practice Grenade
0	Inert MEC scrap, will cause no injury	• All non-energetic items

NOTE: If a number of like items were found in an area and the identification information associated with these items was not uniform or complete, the conservative assumption was made that the incompletely specified items were similar to the more completely specified items of that type with the highest (most hazardous) assigned category.

Table 4-7

Category Descriptions and Assignment Rules for the MEC Sensitivity Risk Factor

Category	Description	Assignment Rules
3	MEC that is very sensitive	• All HE-filled items fired • Any 40mm grenades or LAW munitions • Any item whose fuzing was unspecified or undetermined (conservative default assumption)
2	MEC that is less sensitive	• Any item not classified as Category 3, 1, or 0
1	MEC that may have functioned correctly or is unfuzed but may have residual risk	• All practice ordnance or items (fired or unfired)
0	Inert MEC scrap, will cause no injury	• All non-energetic items

NOTE: If a number of like items were found in an area and the identification information associated with these items was not uniform or complete, the conservative assumption was made that the incompletely specified items were similar to the more completely specified items of that type with the highest (most sensitive) assigned category.

Table 4-8

Category Descriptions for MEC Site Accessibility

Access Level	Access Description
No restriction site	No man-made barriers, gentle slopping terrain, no vegetation that restricts access, no water that restricts access
Limited access	Man-made barriers, vegetation that restricts access, water snow or ice cover and/or terrain restricts access
Complete restriction to access	All points of entry are controlled

Table 4-9

Category Descriptions for MEC Site Stability

Access Level	Access Description
Site stable	MEC should not be exposed by natural events
Moderately stable site	MEC may be exposed by natural events
Site unstable	MEC most likely will be exposed by natural events

4.1.3 Human Risk Factors

Two categories are evaluated in the primary human risk factor as discussed below.

- Activities - The types of activities conducted at a site are related to the likelihood of people coming into contact with MEC. The activities are generally classified as "recreational" (e.g., hiking, biking, or camping) or "occupational" (e.g., farming, industrial, retail, or construction). The OERIA process also considers the contact probability level associated with an activity or set of similar activities. The OERIA documentation defines three categories for this factor: Low, Moderate, and Significant. In order to assign such a score, the general guidelines presented in Table 4-10 were considered. In general, recreational activities are projected to have a higher contact probability for the surface and near-surface soils, and lower contact probabilities relative to deeper soils (i.e., greater than 6 in. below the ground surface). Activities associated with redevelopment or occupational land uses are anticipated to disturb the soil to greater depths and have higher contact probabilities at these greater depths than the recreational activities. The OERIA guidance states to use the minimum depth of MEC found in the area as the depth to consider in the analysis.

Table 4-10

Category Descriptions for the MEC Contact Probability Level

Examples of Activities	Shallowest MEC Depth	MEC Contact Probability
Child play, short cuts, hunting, fishing, hiking, swimming, and jogging	0–6 in.	Significant
	6–12 in.	Low
	>12 in.	Low
Picnic, camping, metal detecting	0–6 in.	Significant
	6–12 in.	Moderate
	>12 in.	Low
Construction, archaeology, crop farming	0–6 in.	Significant
	6–12 in.	Significant
	>12 in.	Moderate

- Human Population - The population or number of people using the site affects the likelihood of encountering MEC. Again, there is an assumed direct relationship between the number of people using the area and the potential for harm. The presence of more people conducting activities in the area as well as an increase in their

frequency of use is expected to present more potential for MEC exposure. The OERIA documentation suggests that an estimate of the number of people using the site can be made based on the type of site, access restrictions, population, or other demographic information.

4.2 Baseline Risk Assessment

This step of the OERIA process involved compiling and documenting what is known about the set of risk factors established for the site for each risk assessment sector. The basis for this assessment is the conditions at the site as they currently exist consistent with the information gathered to date. Wherever appropriate, the OERIA factor definitions contained in the Interim OERIA Guidance were used (as noted above). Other site-specific considerations in addition to the Interim Guidance are discussed for each sector in Sections 4.2.1 through 4.2.5 and Section 4.3.

4.2.1 Northern Transect Area NT-1

Each of the three primary risk factors associated with OERIA are discussed below with respect to the baseline risk assessment performed for this sector.

- Presence of MEC. The presence of MEC factors documented for NT-1 in Table 4-1 were derived from the Supplemental EE/CA field investigation data discussed in Section 3.0 of this report. Only inert MEC scrap and MEC fragmentation, MEC type Category 0, was recovered in NT-1 during the Supplemental EE/CA. The majority of MEC-related items were found from 0- to 1-ft depth with some items recovered from depths greater than 1 ft.
- Site Characteristics. Access to the site is currently limited by gates, signage, and natural terrain. MEC is not anticipated to be exposed from natural events; therefore, the site is considered stable.
- Human Risks. The human risk factors were evaluated for current land use, McClellan Park System land use, and industrial land use as summarized below:
  - Current Land Use. The MEC contact probability for this land use is considered low since currently there is no active use of the site and all items recovered during this Supplemental EE/CA were Category 0. Likewise, the frequency of use is considered occasional since the exposed population consists of unauthorized users.
  - McClellan Park System Land Use. It is likely that land use for this sector will change from the current use (i.e., the likelihood of near term reuse is high). Under

the McClellan Park System land use scenario, the MEC contact probability is considered low because all the items recovered during the Supplemental EE/CA were inert. The frequency of use by recreational users is considered occasional.

— Industrial Land Use. As stated above, the likelihood of near term reuse of this sector is high. Under the industrial land use scenario, the MEC contact probability is considered low because all the items recovered during the Supplemental EE/CA were inert. The frequency of use is considered frequent due to a significant increase in use (daily) under this scenario.

4.2.2 Northern Transect Area NT-2

Each of the three primary risk factors associated with OERIA are discussed below with respect to the baseline risk assessment performed for this sector.

- Presence of MEC. The presence of MEC factors documented for NT-2 in Table 4-2 were derived from the Supplemental EE/CA field investigation data discussed in Section 3.0 of this report. Only inert MEC scrap and MEC fragmentation, MEC type Category 0, was recovered in NT-2 during the Supplemental EE/CA. The majority of MEC-related items were found from 0- to 1-ft depth with some items recovered from depths greater than 1 ft.
- Site Characteristics. Access to the site is currently limited by gates, signage, and natural terrain. MEC is not anticipated to be exposed from natural events; therefore, the site is considered stable.
- Human Risks. The human risk factors were evaluated for current land use, McClellan Park System land use, and industrial land use as summarized below:
  — Current Land Use. The MEC contact probability for this land use is considered low since currently there is no active use of the site. Likewise, the frequency of use is considered occasional since the exposed population consists of unauthorized users.
  — McClellan Park System Land Use. It is likely that land use for this sector will change from the current use (i.e., the likelihood of near term reuse is high). Under the McClellan Park System land use scenario, the MEC contact probability is considered low because all the items recovered during the Supplemental EE/CA were inert. The frequency of use is also considered occasional from the recreational users.
  — Industrial Land Use. As stated above, the likelihood of near term reuse of this sector is high. Under the industrial land use scenario, the MEC contact probability is considered low because all the items recovered during the Supplemental EE/CA were inert. The frequency of use is considered frequent due to a significant increase in use (daily) under this scenario.

4.2.3 Southern Transect Area ST-1

Each of the three primary risk factors associated with OERIA are discussed below with respect to the baseline risk assessment performed for this sector.

- Presence of MEC. The presence of MEC factors documented for ST-1 in Table 4-3 were derived from the Supplemental EE/CA field investigation data discussed in Section 3.0 of this report. Four MEC items (three 60mm HE mortars M49 and one 40mm HE grenade M381) were recovered from this sector ranging from Category 3 to Category 2 sensitivity. The remaining MEC-related items recovered were Category 0 (MEC scrap and MEC fragmentation). All MEC-related items were found from surface to 1 ft depth.
- Site Characteristics. Access to the site is currently limited by gates, signage, and natural terrain. MEC is not anticipated to be exposed from natural events; therefore, the site is considered stable.
- Human Risks. The human risk factors were evaluated for current land use, McClellan Park System land use, and industrial land use as summarized below:
  - Current Land Use. The MEC contact probability for this land use is considered moderate since currently there is occasional active use of the site. Likewise, the frequency of use is considered occasional since the exposed population consists of unauthorized users.
  - McClellan Park System Land Use. It is likely that land use for this sector will change from the current use (i.e., the likelihood of near term reuse is high). Under the McClellan Park System land use scenario, the MEC contact probability is considered significant due to the increased surface activity. The frequency of use is also considered occasional from the recreational users.
  - Industrial Land Use. As stated above, the likelihood of near term reuse of this sector is high. Under the industrial land use scenario, the MEC contact probability is considered significant due to the increased surface activity and the exposure to potential subsurface hazards during construction activities. The frequency of use is considered frequent due to a significant increase in use (daily) under this scenario.

4.2.4 Southern Transect Area ST-2

Each of the three primary risk factors associated with OERIA are discussed below with respect to the baseline risk assessment performed for this sector.

- Presence of MEC. The presence of MEC factors documented for ST-2 in Table 4-4 were derived from the Supplemental EE/CA field investigation data discussed in Section 3.0 of this report. Three MEC items (two MKII practice grenades, one which

was recovered during the surface sweep, and one partially expended smoke rifle grenade) were recovered from this sector were Category 1 sensitivity. The remaining MEC-related items recovered were Category 0 (MEC scrap and MEC fragmentation). All MEC-related items were found from surface to 1 ft depth. The two MKII practice grenades appear to have been dropped or discarded as the safety pins were present on both items.

- Site Characteristics. Access to the site is currently limited by gates, signage, and natural terrain. MEC is not anticipated to be exposed from natural events; therefore, the site is considered stable.
- Human Risks. The human risk factors were evaluated for current land use, McClellan Park System land use, and industrial land use as summarized below:
  - Current Land Use. The MEC contact probability for this land use is considered significant since a MEC item was discovered on the surface and currently there is occasional active use of the site. Likewise, the frequency of use is considered occasional since the exposed population consists of unauthorized users.
  - McClellan Park System Land Use. It is likely that land use for this sector will change from the current use (i.e., the likelihood of near term reuse is high). Under the McClellan Park System land use scenario, the MEC contact probability is considered significant due the discovery of a MEC item on the surface in this area. The frequency of use is also considered occasional from the recreational users.
  - Industrial Land Use. As stated above, the likelihood of near term reuse of this sector is high. Under the industrial land use scenario, the MEC contact probability is considered significant due to the increased surface activity and the exposure to potential subsurface hazards during construction activities. The frequency of use is considered frequent due to a significant increase in use (daily) under this scenario.

4.2.5 Southern Transect Area ST-3

Each of the three primary risk factors associated with OERIA are discussed below with respect to the baseline risk assessment performed for this sector.

- Presence of MEC. The presence of MEC factors documented for ST-3 in Table 4-5 were derived from the Supplemental EE/CA field investigation data discussed in Section 3.0 of this report. Four MEC items (one WP hand grenade M15, one 81mm WP mortar M57, one 60mm HE mortar M49, and one hand grenade fuze) were recovered from this sector ranging from Category 2 to Category 3 sensitivity. The remaining MEC-related items recovered were Category 0 (MEC scrap and MEC fragmentation). The majority of MEC-related items were found from 0- to 1-ft depth with some items recovered from depths greater than 1 ft.

- Site Characteristics. Access to the site is currently limited by gates, signage, and natural terrain. MEC is not anticipated to be exposed from natural events; therefore, the site is considered stable.
- Human Risks. The human risk factors were evaluated for the current land use, McClellan Park System land use, and industrial land use as summarized below:
  - Current Land Use. The MEC contact probability for this land use is considered moderate since currently there is occasional active use of the site. Likewise, the frequency of use is considered occasional since the exposed population consists of unauthorized users.
  - McClellan Park System Land Use. It is likely that land use for this sector will change from the current use (i.e., the likelihood of near term reuse is high). Under the McClellan Park System land use scenario, the MEC contact probability is considered significant due to the increased surface activity. The frequency of use is also considered occasional from the recreational users.
  - Industrial Land Use. As stated above, the likelihood of near term reuse of this sector is high. Under the industrial land use scenario, the MEC contact probability is considered significant due to the increased surface activity and the exposure to potential subsurface hazards during construction activities. The frequency of use is considered frequent due to a significant increase in use (daily) under this scenario.

4.3 Assessment of Candidate Response Action Alternatives

After the baseline risk assessment was completed, six candidate response action alternatives (see Table 4-11) were assessed for each of the five risk assessment sectors (NT-1, NT-2, ST-1, ST-2, and ST-3). The OERIA risk factors were evaluated assuming the successful implementation of each alternative. The response alternatives were comparatively ranked with respect to their impact on protectiveness and reducing MEC-related exposure and risk in each area (refer to Tables 4-1 through 4-5). Each response action alternative was assessed and scored using the same process that was used for the baseline assessment with the following exceptions:

- Since the MEC type and sensitivity would only be impacted if all MEC-related items were removed, these factors were not evaluated across the candidate response action alternatives.
- Since Alternative 2, Land Use Controls, is the only candidate response action that affects site access, this factor was not evaluated for each alternative. Therefore, impacts to this factor are represented in the evaluation of Alternative 2.
- Other risk factors that are not applicable to the evaluation of response action alternatives include impacts to the current land use activity and impacts to the likelihood of near term reuse.

Table 4-11

Response Action Alternatives Addressed in the Risk Assessment

Alternative	Description
Alternative 1 – No Further Action	The NFA alternative involves no additional action at the site. This alternative does not impose any land use controls (i.e., as described for Alternative 2). This alternative was evaluated for each sector of the Alpha Area as a baseline for comparing other alternatives.
Alternative 2 – Area-Specific Land Use Controls	This alternative involves minimizing or controlling potential exposures to the public or the environment that may be associated with the MEC within an area using area-specific land use controls. These land use controls may consist of one or more institutional controls or engineering controls tailored to an area, including a deed restriction that prohibits digging in the area without construction support by UXO-qualified personnel, signage, and/or periodic inspection and maintenance activities associated with the signs.
Alternative 3 – Construction Support	This alternative includes providing on-site support or on-call UXO services depending upon site-specific conditions and current/future land use. If concurrent MEC removal activities are not being conducted, a contracted on-site MEC response team capable of identification and disposal of MEC will be required to respond to the possible MEC threat. If MEC is encountered during construction support, it may be necessary for the construction support to include surface and subsurface clearance of MEC in designated areas where construction activities are planned. UXO-qualified personnel, using metal detection instruments, will detect MEC items that may exist on or below the ground surface in areas where intrusive building activities are planned.
Alternative 4 – Surface Clearance	This alternative involves removal of surface MEC from the site. Surface clearance involves detecting and removing those MEC items exposed or partially exposed on the ground surface. The area is divided into investigation grids and a visual search (aided by hand-held metal detection instruments) conducted by UXO personnel walking through each grid, visually scanning the surface for MEC. Detected items will then be investigated to identify them as MEC, MEC scrap, or non-MEC scrap. Items known or suspected to be MEC will be marked with a pin flag for later disposition. MEC items suspected to be UXO will be destroyed. Unfuzed UXO items could be removed and consolidated and then destroyed. MEC scrap will be removed, inspected, certified safe, and disposed of in an appropriate manner. Land surveying would be a necessary component of this alternative. This alternative will include a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.
Alternative 5 – Clearance to 1 ft	This alternative will include the surface and subsurface clearance of MEC items to a depth of 1 ft. The depth of 1 ft was selected based on site-specific information, future land use, and the type of ordnance items that have been found in the vicinity and that may be present within the study area, and typical penetration depths for the types of MEC items that may be present. Implementation of this alternative will require land surveying and brush clearing operations to prepare the site. Geophysical detection instruments will be used to locate subsurface anomalies. These anomalies subsequently will be investigated down to 12 in. After identification, the item will be disposed of as scrap or MEC in accordance with a previously approved MEC operations Work Plan. This alternative will include a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.
Alternative 6 – Clearance to Depth	This alternative includes the surface and subsurface clearance of MEC items to a depth corresponding to the maximum depth of detected MEC in each sector. Under this alternative, investigation (i.e., excavation) of an anomaly (i.e., suspect MEC item) will continue until the source of the anomaly is found, or until it is determined that no detected MEC item is present. This alternative differs from Alternative 5 in that the depth of clearance is not limited to 1 ft. Implementation of this alternative would require land surveying and brush clearing operations. After the area is cleared of surface contamination, a subsurface investigation will be conducted. Due to the requirement to detect items deeper than 1 ft, this alternative will be performed using sensitive instruments capable of detecting anomalies at greater depths. Using a suitably sensitive detection system, the entire study area will be surveyed to locate potential MEC items. The anomalies will then be investigated to identify them as MEC, MEC scrap, or non-MEC scrap (metallic scrap). After identification, the items will be disposed of as scrap or MEC in accordance with the previously approved MEC operations Work Plan.

For the remaining applicable risk factors, the impact (i.e., increased protectiveness and reduction of MEC-related exposure and risk) was then assigned a relative ranking where "A" equated to greatest impact and subsequent letters signify relatively less impact. Alternatives that were judged to have relatively the same impact on a given factor were assigned the same letter ranking.

4.3.1 Overall Relative Ranking

Once all six alternatives were scored relative to their impact on reducing potential MEC exposures, the alternatives were assigned an overall relative ranking using best professional judgment in consideration of available data and information. The published documentation for the OERIA methodology does not provide specific guidance on how an overall ranking should be developed. This guidance also does not place limits or otherwise constrain this development. As such, a simple, but systematic, approach was used to generate an overall ranking of the response action alternatives with respect to MEC exposure potential and protectiveness. This approach was based in large measure on professional judgment, logic, and an explicit effort to maintain consistency across the selected OERIA risk factors and across the different candidate response action alternatives.

All the identified risk factors (ordnance, site, and human) were considered in the development of the overall protectiveness ranking for each response action alternative. The relationship of these factors on protectiveness was evaluated collectively to develop an overall protectiveness ranking for each alternative for that area for both current and projected future land use. The protectiveness levels that were used include:

- HIGH - Assigned to the alternative or set of alternatives with the best level of MEC protectiveness or risk reduction relative to existing conditions and the projected activities for that area. An overall ranking of high was assigned when the implementation of the response action alternative would be projected to eliminate exposure to MEC throughout the entire sector given the depth distribution of MEC observed during the characterization work and the nature of the activity associated with current or future land use.
- LOW - Assigned to the alternative or set of alternatives with the lowest level of MEC protectiveness or risk reduction relative to existing conditions and the projected

activities for that area. An overall ranking of low was assigned when the implementation of the response action alternative would be projected to result in potential exposure to MEC throughout the entire sector given the depth distribution of MEC observed during the characterization work and the nature of the activity associated with the current or future land use.

- MODERATE - Assigned to alternatives with a level of protectiveness or risk reduction greater than low and less than high. An overall ranking of moderate was assigned when the implementation of the response action alternative would reduce exposure to MEC to some degree for the majority of potential users throughout the entire sector or for a subset of specific users within a portion of the sector (i.e., construction workers within the construction footprint).
- BASELINE - Assigned protectiveness level for Alternative 1 (No Further Action).

Once the overall OERIA rankings for all candidate response action alternatives for a given risk assessment sector were developed, the set of rankings was reviewed collectively across the five risk assessment sectors to ensure that ordering was consistent with the risk factor scores that were used to develop them. The rankings also were examined to look for possible inconsistencies across the various risk factors considered in the assessment.

The overall protectiveness rankings for the response action alternatives in each risk assessment sector are compiled in Table 4-12. A summary of how these rankings were developed is presented in the sections that follow. Note that since Alternative 1 (No Further Action) represents the baseline evaluation (see Section 4.2), this alternative is not discussed in Sections 4.3.2 through 4.3.6.

Table 4-12

Overall Protectiveness Rankings for the Candidate Response Action Alternatives for Each Alpha Area Risk Assessment Sector

Response Action Alternatives						
Risk Assessment Sector/Land Use	**Alternative 1** No Further Action	**Alternative 2** Area-Specific Land Use Controls	**Alternative 3** Construction Support	**Alternative 4** Surface Clearance	**Alternative 5** Clearance to 1 ft	**Alternative 6** Clearance to Depth
NT-1 (see Table 4-1)						
Current Use	Baseline	High	High	High	High	High
McClellan Park System	Baseline	High	High	High	High	High
Industrial	Baseline	Moderate	Moderate	High	High	High

Table 4-12

(Continued)

Response Action Alternatives						
Risk Assessment Sector/Land Use	**Alternative 1** No Further Action	**Alternative 2** Area-Specific Land Use Controls	**Alternative 3** Construction Support	**Alternative 4** Surface Clearance	**Alternative 5** Clearance to 1 ft	**Alternative 6** Clearance to Depth
NT-2 (see Table 4-2)						
Current Use	Baseline	Moderate	High	High	High	High
McClellan Park System	Baseline	Moderate	Moderate	High	High	High
Industrial	Baseline	Low	Moderate	Moderate	High	High
ST-1 (see Table 4-3)						
Current Use	Baseline	Low	Moderate	Moderate	High	High
McClellan Park System	Baseline	Low	Moderate	Moderate	High	High
Industrial	Baseline	Low	Moderate	Low	Moderate	High
ST-2 (see Table 4-4)						
Current Use	Baseline	High	High	High	High	High
McClellan Park System	Baseline	High	High	High	High	High
Industrial	Baseline	Moderate	Moderate	High	High	High
ST-3 (see Table 4-5)						
Current Use	Baseline	Low	Moderate	Moderate	High	High
McClellan Park System	Baseline	Low	Moderate	Moderate	High	High
Industrial	Baseline	Low	Moderate	Low	Moderate	High

4.3.2 Assessment and Overall Relative Ranking of Alternatives for NT-1

Alternatives 2 and 3 scored high on the current and McClellan Park System land use scenarios and moderate on the industrial land use scenario, while Alternatives 4–6 scored high for overall rank on all land use scenarios. The relatively high overall ranking for all alternatives reflects the low level of risk posed by this sector. The comparative analysis of the response alternatives with respect to their relative impact on the presence of MEC and human risks factors, which comprise the basis for the overall ranking, is reflected in Table 4-1 and is summarized below:

- Presence of MEC. Only Alternatives 3–6 have an impact on the presence of MEC factor. Alternative 4 received a score of B due to the removal of surface MEC followed by Alternative 3, which received a score of C for the removal of MEC in construction footprints. Since the majority of MEC-related items were recovered from surface to 1 ft depth, Alternatives 5 and 6 received a score of A (highest) for impact on MEC depth and density.

- Human Risk. The comparative analysis of alternatives resulted in the same scores for each of the three different land use scenarios with the exception of the current land use scenario. Since Alternative 3 involves construction support and the current land use scenario does not include construction activities, scoring of this factor for Alternative 3 was not applicable. Alternatives 2 and 3 received a score of C and B for impact on MEC contact probability and exposure, respectively, for the removal of MEC in construction footprints. Alternative 4 received a score of B and A for impact on MEC contact probability and exposure, respectively, from the removal of surface MEC. Lastly, Alternatives 5 and 6 received a score of A for impact on both MEC contact probability and exposure due to removal of MEC to a depth equivalent to or exceeding the depth of contamination.

4.3.3 Assessment and Overall Relative Ranking of Alternatives for NT-2

Alternative 2 scored moderate on the current and McClellan Park System land use scenarios and low on the industrial land use scenario, while Alternative 3 scored high on the current land use scenario and moderate on the McClellan Park System and industrial land use scenarios. Alternative 4 scored high on the current and McClellan Park System land use scenarios and moderate on the industrial land use scenario, while Alternatives 5–6 scored high for overall rank on all land use scenarios; The relatively high overall ranking for all alternatives reflects the low level of risk posed by this sector. The comparative analysis of the response alternatives with respect to their relative impact on the presence of MEC and human risks factors, which comprise the basis for the overall ranking, is reflected in Table 4-2 and is summarized below:

- Presence of MEC. Only Alternatives 3–6 have an impact on the presence of MEC factor. Since MEC-related items were only recovered from surface to 1 ft depth, Alternative 4 received a score of B due to the removal of surface MEC followed by Alternative 3, which received a score of C for the removal of MEC in construction footprints. Alternatives 5 and 6 received a score of A (highest) for impact on MEC depth and density.
- Human Risk. The comparative analysis of alternatives resulted in the same scores for each of the three different land use scenarios with the exception of the current land use scenario. Since Alternative 3 involves construction support and the current land use scenario does not include construction activities, scoring of this factor for Alternative 3 was not applicable. Alternatives 2 and 3 received a score of C and B for impact on MEC contact probability and exposure, respectively, for the removal of MEC in construction footprints. Alternative 4 received a score of B and A for impact on MEC contact probability and exposure, respectively, from the removal of surface MEC. Lastly, Alternatives 5 and 6 received a score of A for impact on both MEC

contact probability and exposure due to removal of MEC to a depth equivalent to or exceeding the depth of contamination.

4.3.4 Assessment and Overall Relative Ranking of Alternatives for ST-1

Alternative 2 scored low for all land use scenarios. Alternative 3 scored moderate for all land use scenarios, while Alternative 4 scored moderate on the current and McClellan Park System land use scenarios and low on the industrial land use scenario. Alternative 5 scored high for overall rank on the current and McClellan Park System land use scenarios and moderate on industrial land use, while Alternative 6 scored high for overall rank on all land use scenarios. The wide range of overall rankings for the alternatives reflects the high level of risk posed by this sector. The comparative analysis of the response alternatives with respect to their relative impact on the presence of MEC and human risks factors, which comprise the basis for the overall ranking, is reflected in Table 4-3 and is summarized below:

- Presence of MEC. Only Alternatives 3–6 have an impact on the presence of MEC factor. Alternative 4 received a score of B due to the removal of surface MEC followed by Alternative 3, which received a score of C for the removal of MEC in construction footprints. Since MEC-related items were only recovered from surface to 1 ft depth, Alternatives 5 and 6 received a score of A (highest) for impact on MEC depth and density.
- Human Risk. The comparative analysis of alternatives resulted in the same scores for each of the three different land use scenarios with the exception of the current land use scenario. Since Alternative 3 involves construction support and the current land use scenario does not include construction activities, scoring of this factor for Alternative 3 was not applicable. Alternatives 2 and 3 received a score of C and B for impact on MEC contact probability and exposure, respectively, for the removal of MEC in construction footprints. Alternative 4 received a score of B for impact on both MEC contact probability and exposure from the removal of surface MEC. Lastly, Alternatives 5 and 6 received a score of A for impact on both MEC contact probability and exposure due to removal of MEC to a depth equivalent to or exceeding the depth of contamination.

4.3.5 Assessment and Overall Relative Ranking of Alternatives for ST-2

Alternatives 2 and 3 scored high on the current and McClellan Park System land use scenarios and moderate on the industrial land use scenario, while Alternatives 4–6 scored high for overall rank on all land use scenarios. The relatively high overall ranking for all alternatives

reflects the low level of risk posed by this sector. The comparative analysis of the response alternatives with respect to their relative impact on the presence of MEC and human risks factors, which comprise the basis for the overall ranking, is reflected in Table 4-4 and is summarized below:

- Presence of MEC. Only Alternatives 3–6 have an impact on the presence of MEC factor. Alternative 4 received a score of B due to the removal of surface MEC followed by Alternative 3, which received a score of C for the removal of MEC in construction footprints. Since MEC-related items were only recovered from surface to 1 ft depth, Alternatives 5 and 6 received a score of A (highest) for impact on MEC depth and density.
- Human Risk. The comparative analysis of alternatives resulted in the same scores for each of the three different land use scenarios with the exception of the current land use scenario. Since Alternative 3 involves construction support and the current land use scenario does not include construction activities, scoring of this factor for Alternative 3 was not applicable. Alternatives 2 and 3 received a score of C and B for impact on MEC contact probability and exposure, respectively, for the removal of MEC in construction footprints. Alternative 4 received a score of B and A for impact on MEC contact probability and exposure, respectively, from the removal of surface MEC. Lastly, Alternatives 5 and 6 received a score of A for impact on both MEC contact probability and exposure due to removal of MEC to a depth equivalent to or exceeding the depth of contamination.

4.3.6 Assessment and Overall Relative Ranking of Alternatives for ST-3

Alternative 2 scored low on all land use scenarios. Alternative 3 scored moderate for all land use scenarios, while Alternative 4 scored moderate on the current and McClellan Park System land use scenarios and low on the industrial land use scenario. Alternative 5 scored high for overall rank on the current and McClellan Park System land use scenarios and moderate on the industrial land use scenario, while Alternative 6 scored high for overall rank on all land use scenarios. The wide range of overall rankings for the alternatives reflects the high level of risk posed by this sector. The comparative analysis of the response alternatives with respect to their relative impact on the presence of MEC and human risks factors, which comprise the basis for the overall ranking, is reflected in Table 4-5 and is summarized below:

- Presence of MEC. Only Alternatives 3–6 have an impact on the presence of MEC factor. Alternative 4 received a score of B due to the removal of surface MEC followed by Alternative 3, which received a score of C for the removal of MEC in

construction footprints. Since MEC-related items were only recovered from surface to 1 ft depth, Alternatives 5 and 6 received a score of A (highest) for impact on MEC depth and density.

- Human Risk. The comparative analysis of alternatives resulted in the same scores for each of the three different land use scenarios with the exception of the current land use scenario. Since Alternative 3 involves construction support and the current land use scenario does not include construction activities, scoring of this factor for Alternative 3 was not applicable. Alternatives 2 and 3 received a score of C and B for impact on MEC contact probability and exposure, respectively, for the removal of MEC in construction footprints. Alternative 4 received a score of B for impact on both MEC contact probability and exposure from the removal of surface MEC. Lastly, Alternatives 5 and 6 received a score of A for impact on both MEC contact probability and exposure due to removal of MEC to a depth equivalent to or exceeding the depth of contamination.

5.0 IDENTIFICATION OF RESPONSE ACTION OBJECTIVES

This chapter presents the response action objectives for the Supplemental EE/CA investigation area. A number of factors must be considered when establishing specific objectives for a response action. The objectives must be able to meet the requirements set forth in the applicable or relevant and appropriate requirements (ARARs), while still being realistic and achievable in terms of cost. The alternatives considered for reducing the explosive threat posed by potential MEC remaining at the Alpha Area must be effective, implementable, and economical. These criteria were used to evaluate the potential response actions considered for the Alpha Area in Section 7.0.

5.1 Response Action Objectives

The Supplemental EE/CA is intended to determine the most effective alternatives that will meet the response action objectives, which are to:

- Ensure protectiveness of site workers and public during all response action operations,
- Ensure overall protectiveness of the public after completion of the response action,
- Comply with ARARs to the extent practicable, and
- Facilitate the intended future uses of the property.

Compliance with the ARARs is the goal during the redevelopment of McClellan; however, at times this goal may not be practicable. MEC poses a unique safety risk that must be considered in determining whether it is "practicable" to comply with an ARAR. For example if a MEC item is discovered and must be blown in place and this action threatens a protected plant, the threat to human health and safety outweigh the destruction of the plant during the destruction of the MEC item. Therefore, a waiver of the ARAR that ordinarily would require protection of the plant would be appropriate.

5.2 Applicable or Relevant and Appropriate Requirements

Applicable requirements are those cleanup standards, control standards, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site [40 Code of Federal Regulations (CFR) 300.5]. Relevant and appropriate requirements are cleanup standards and control standards, and the substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site, address problems or situations sufficiently similar to those encountered at a site where their use is well-suited (40 CFR 300.5). A requirement that is relevant and appropriate must be complied with to the same degree as if it were applicable. It is important to note that only those state standards that are identified by the state in a timely manner and are more stringent than the federal requirements may be considered ARARs [40 CFR 300.400(g)(4)].

Although the requirements of CERCLA Chapter 121 generally apply as a matter of law only to remedial actions, it is considered essential that ARARs will be identified and attained to the extent practicable at McClellan. Two factors are applied to determine whether identifying and attaining ARARs is practical in a particular response situation. These factors include the urgency of the situation and the scope of the response action to be taken.

ARARs are identified on a site-specific basis and involve a two-part analysis. First, a determination is made whether a given requirement is applicable. Second, if it is not applicable, a determination is made whether it is both relevant and appropriate. When this analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable. There are three categories of ARARs: chemical-specific, location-specific, and action-specific.

According to the National Contingency Plan (NCP), chemical-specific ARARs are usually health or risk-based standards that establish the acceptable amount of concentration of a

chemical that may remain in, or be discharged to, the ambient environment. Location-specific ARARs generally are restrictions placed upon the concentration of a hazardous substance or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. Action-specific ARARs are usually technology or activity-based requirements or limitations placed on remedial activities taken with respect to hazardous wastes, or requirements to conduct certain actions to address particular circumstances at a site. These ARARs may specify particular performance levels, actions, or technologies to be used to manage hazardous substances, pollutants, or contaminants.

Non-promulgated advisories or guidance documents issued by federal or state governments do not have the status of potential ARARs. However, these "to be considered" (TBC) criteria may be used in determining the necessary level of cleanup for human safety and protection of the environment. In addition, specific requirements must be followed when conducting MEC response actions. Potential ARARs and TBCs for the EE/CA of the Alpha Area are discussed in the following paragraphs.

5.3 Potential Applicable or Relevant and Appropriate Requirements/To Be Considered

There are no applicable chemical-specific ARARs. Potential location-specific ARARs are presented in Table 5-1.

The National Environmental Policy Act (NEPA), as implemented by Army Regulation (AR) 200-2, Environmental Effects of Army Actions, is applicable to future land use alternatives that involve developing the site for commercial or residential purposes that could result in environmental impacts.

MEC response actions will be executed in compliance with the Military Munitions Rule (40 CFR 260 et al.); the MEC requirements of Ammunition and Explosives Safety Standards (DoD 6055.9-STD); Ammunition and Explosives Safety Standards (AR 385-64); Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives; and other applicable MEC publications.

Table 5-1

List of Potential Applicable or Relevant and Appropriate Requirements to be Considered

ARAR/TBC	Citation	Description	Comments
Chemical-Specific			
None required			
Location Specific			
Archaeological Resources Protection Act of 1979	43 CFR 7 36 CFR 296 32 CFR 229 18 CFR 1312	Protection of archaeological resources on public land	Potential ARAR for site activities that could impact an archaeological resource area
American Indian Religious Freedom Act	42 United States Code (USC) 1996	Requires consultation with Native Americans about traditional religious and cultural sites on federal lands to protect and provide access to such sites	Potential ARAR for site activities that could impact a cultural site
Clean Water Act, Section 404(B)(1) Guidelines	40 CFR 230.10	Establishes criteria for evaluating impacts to waters of the United States and sets factors for considering mitigation measures. Outlines the requirements for discharges of dredged or fill material into waters of the United States	Potential ARAR for sampling work, placement of equipment, any site removal or backfilling work within tidal areas and wetlands, and dredge and fill activities
Endangered Species Act of 1973, as amended	16 USC 1531	Provides for the consideration of the impacts on endangered and threatened species and their critical habitats	Potential ARAR for activities in areas where there is considered to be current populations of endangered or threatened species of flora and fauna
Fish and Wildlife Conservation Act	16 USC 2901 50 CFR 83	Protects fish and wildlife when federal actions result in modification of a water body; requires consultation with U.S. Fish and Wildlife Service and state wildlife agencies to mitigate losses	Potential ARAR if the work activity is within a conservation area
Protection of Wetlands	33 CFR 320 Executive Order 11990	Requires consideration of impacts to wetlands in order to minimize their destruction, loss, or degradation and to preserve/enhance wetland values	Potential ARAR for sampling work, placement of equipment, and any site removal or backfilling work within tidal areas and wetlands
Protection of Historic Resources	36 CFR 800	Requires consideration of impacts to historic and cultural resources	Potential ARAR for site activities that could impact historic and cultural resources
Preservation of Historical and Archaeological Data	16 USC 469a 36 CFR 66	Requires the preservation of archaeological and historical data from destruction or becoming lost	Potential ARAR for site activities that could impact historic and archaeological data
Native American Graves Protection and Repatriation Act	43 CFR 10	Consultation with Native Americans must occur before excavation of ancestral remains and other items commences	Potential ARAR for site activities that could impact Native American graves
Act for the Preservation of American Antiquities	16 CFR 251.50-64 43 CFR 3	A permit must be obtained before excavation of antiquities occurs	Potential ARAR for site activities that could impact American antiquities
Wilderness Act of 1964	PL 88-577 16 USC 1131-1136	Preserves and protects the wilderness areas	Potential ARAR for site activities that could impact wilderness areas
Migratory Bird Treaty Act of 1918	16 USC 703-712	Prevents the disturbance of birds, nests, and eggs	Potential ARAR for site activities that could impact birds, their nests, and their eggs

Table 5-1

(Continued)

ARAR/TBC	Citation	Description	Comments
Location Specific (continued)			
Protection and Enhancement of Sacred Indian Sites, 1976	Executive Order 13007	Protects sacred Native American sites	Potential ARAR for site activities that could impact sacred Indian sites
Action-Specific			
National Ambient Air Quality Standards	40 CFR 50	Air quality standards for ambient air	Potential ARAR of any on-site detonation of MEC
Particulate Emission Controls	40 CFR 50.6	Specifies limitations for the emissions of particulate matter	Potential ARAR for on-site soil disturbances that generate dust
Environmental Effects of Army Actions	AR 200-2 (NEPA 40 CFR 1500-1508)	States that the need for an Environmental Assessment or Environmental Impact Statement must be evaluated if there is a potential for adverse impacts to the environment	Potential ARAR for site activities that could require NEPA actions
Occupational Safety and Health Act	29 USC 651-667	States that safety and health standards will be enforced during MEC removal activities	Potential ARAR for site activities that may involve MEC removal activities
Resource Conservation and Recovery Act (RCRA) Military Munitions Rule	62 CFR 6654	Specifies the identification and management of residual munitions	Potential ARAR for site activities that may involve residual munitions
Safety and Health Requirements on Conventional Ordnance and Explosives Act	ER 385-1-95	Specifies the responsibilities in regard to safety and health for MEC response actions	Potential ARAR for site activities that may involve MEC response actions
TBC Criteria			
RCRA Management of Military Munitions	Military Munitions Rule (40 CFR 264 and 26 Subpart EE; 266 Subpart M)	Amendments to hazardous waste identification and management rules for military munitions and definition of explosive emergencies	Potential TBC for removal and management of UXO pursuant to RCRA
Department of Army Ammunition and Explosive Safety Standards	AR 385-64	Requires army standards to be implemented for locating, handling, and disposing of munitions	Potential TBC for site activities that may involve munitions
Department of Defense Ordnance Safety Standards	DoD 6055.9-STD	Requires that during detection, removal, and disposal of MEC there must be specialized personnel attending	Potential TBC for site activities that may involve detection, removal, and disposal of MEC
Explosives Safety Submissions (ESSs) for Removal of Ordnance and Explosives From Real Property	DoD Explosives Safety Board (DDESB) Memorandum	Specifies requirements for explosive safety submissions for removal actions	Potential TBC for site activities that may involve explosive safety submissions
Explosives Safety Policy for Real Property containing Conventional Ordnance and Explosives	Letter, Department of the Army	Specifies the policy for explosives safety controls on real property containing MEC	Potential TBC for site activities that may require explosive safety controls

5.4 Intended Land Use

According to the approved land use planning information available to date, the Supplemental EE/CA investigation area has two designated future land uses: McClellan Park System and industrial. The exact extent of the two land uses at this time is not definitive and may be revised as future redevelopment of McClellan is considered.

6.0 IDENTIFICATION AND ANALYSIS OF RESPONSE ACTION ALTERNATIVES

Six response action alternatives have been identified as reasonable measures for protection of the public and the environment from exposure to MEC. This chapter presents a description and evaluation of each alternative considered for the Supplemental EE/CA investigation area. Section 7.0 presents a comparative analysis of the alternatives within each sector, resulting in a relative ranking of alternatives for each sector. The alternatives developed for the Supplemental EE/CA include:

- Alternative 1 − No Further Action
- Alternative 2 − Area-Specific Land Use Controls
- Alternative 3 − Construction Support
- Alternative 4 − Surface Clearance
- Alternative 5 − Clearance to 1 ft
- Alternative 6 − Clearance to Depth

Table 4-11 provides a description of each response action alternative. These alternatives are designed to focus on the risk assumed to be present based on the information derived from archives and the additional investigations completed as part of this Supplemental EE/CA effort. However, the potential exists that some residual MEC contamination could remain following the implementation of the removal alternatives. For removal alternatives (except the clearance to depth alternative), residual contamination may potentially exist below the depth of clearance selected for the alternative, although the information upon which the clearance depth was selected indicated that all MEC contamination should be within the selected clearance depth or the intended land use is not expected to disturb the area beneath the selected clearance depth. Although state of the art technology is employed in the detection and removal of MEC, it is not possible to ensure that 100% of all MEC within the boundary of the investigation area is removed during the removal action.

6.1 Description of Alternatives

6.1.1 Alternative 1 − No Further Action

The NFA alternative requires no action at the site. This alternative does not impose any land use controls (i.e., as described for Alternative 2). This alternative was evaluated for each sector of the Supplemental EE/CA investigation area as a baseline for comparing other alternatives.

6.1.2 Alternative 2 − Area-Specific Land Use Controls

This alternative focuses on minimizing or controlling potential exposures to the public or the environment that may be associated with the MEC within the study area using area-specific land use controls. These land use controls may consist of one or more institutional controls or engineering controls tailored to the investigation area, including a deed restriction that prohibits digging in the area without construction support by UXO-qualified personnel, signage, fencing or enhanced security measures, and/or periodic inspection and maintenance activities. This alternative also would increase public awareness of the ordnance history and the potential dangers posed by any MEC that may still be present at McClellan.

6.1.3 Alternative 3 − Construction Support

Alternative 3 includes providing on-site support or on-call UXO services depending upon site-specific conditions and current/future land use. If concurrent MEC removal activities are not being conducted, a contracted on-site MEC response team capable of identification and disposal of MEC will be required to respond to the possible MEC threat. If MEC is encountered during the construction support, it may be necessary for the construction support, to include the surface and subsurface clearance of MEC in designated areas where construction activities are planned. UXO-qualified personnel, using metal detection instruments, will detect MEC items that may exist on or below the ground surface in areas where intrusive building activities are planned.

6.1.4 Alternative 4 − Surface Clearance

This alternative involves removal of surface MEC from the site. The area is divided into investigation grids and a visual search (aided by hand-held metal detection instruments) conducted by UXO personnel walking through each grid, visually scanning the surface for MEC. Detected items will then be investigated to identify them as MEC, MEC scrap, or non-MEC scrap. Items known or suspected to be MEC will be marked with a pin flag for later disposition. MEC items suspected to be UXO will be destroyed. Unfuzed UXO items could be removed and consolidated and then destroyed. MEC scrap will be removed, inspected, certified safe, and disposed of in an appropriate manner. Land surveying would be a necessary component of this alternative. This alternative will include a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.

6.1.5 Alternative 5 − Clearance to 1 ft

Alternative 5 includes the surface and subsurface clearance of MEC items to a depth of 1 ft. The depth of 1 ft was selected based on site-specific information, future land use, and type of ordnance items that have been found in the vicinity and that may be present within the study area, and typical penetration depths for the types of MEC items that may be present. Implementation of this alternative will require land surveying and brush clearing operations to prepare the site. Geophysical detection instruments will be used to locate subsurface anomalies. These anomalies will subsequently be investigated down to 12 in. After identification, the item will be disposed of as scrap or MEC in accordance with a previously approved MEC operations Work Plan. This alternative will include a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.

6.1.6 Alternative 6 − Clearance to Depth

This alternative includes surface and subsurface clearance of MEC items to a depth corresponding to the maximum depth of MEC encountered in each sector. Under this alternative, investigation (i.e., excavation) of an anomaly (i.e., suspect MEC item) will continue until the source of the anomaly is found or until it is determined that no MEC item is present. This

alternative differs from Alternative 5 in that the depth of clearance is not limited to 1 ft. Implementation of this alternative would require land surveying and brush clearing operations.

After the sector is cleared of surface contamination, a subsurface investigation will be conducted. Due to the requirement to detect items deeper than 1 ft, this alternative will be performed using sensitive instruments capable of detecting anomalies at greater depths. Using a suitably sensitive detection system, the entire study area will be surveyed to locate potential MEC items. The anomalies will then be investigated to identify them as MEC, MEC scrap, or non-MEC scrap (metallic scrap). After identification, the items will be disposed of as scrap or MEC in accordance with the previously approved MEC operations Work Plan.

6.2 Evaluation of Alternatives

This section presents a general evaluation of each alternative by comparing the alternatives to three main criteria:

- Effectiveness
- Implementability
- Cost

The effectiveness criterion considers overall protection to human health and the environment, compliance with ARARs or other requirements, long-term effectiveness and permanence, and short-term effectiveness. The implementability criterion considers technical feasibility, availability of services and materials, administrative feasibility, state acceptance, and community acceptance. Cost is evaluated for each alternative on an area-specific basis. Appendix J contains cost estimates and pertinent assumptions. These criteria are more fully described in the following paragraphs.

6.2.1 Effectiveness

Overall protection to human health and the environment. Evaluates the effectiveness of an alternative and its ability to meet the objective within the scope of the proposed alternative. It is considered in terms of protectiveness of public health and the environment.

Compliance with ARARs or other requirements. Serves as a final check to assess whether each alternative meets potential federal and state ARARs as identified in the EE/CA process. ARARs are "those cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" (40 CFR 300.5). Selection of an ARAR is dependent upon the hazardous substances present at the site, site characteristics and location, and action selected for remediation. Chemical-specific ARARs are health- or risk-based concentration limits for specific hazardous substances. Location-specific ARARs address circumstances such as the presence of endangered species on the site or location of the site in a 100-year floodplain. Action-specific ARARs control or restrict specific types of actions selected as alternatives for site cleanup. No chemical-specific ARARs exist for remediation of sites containing MEC.

Long-term effectiveness and permanence. Addresses the effectiveness of an alternative in terms of the risk remaining at the site after the risk reduction objectives have been met, and generally considers the magnitude of risk remaining following the implementation of the alternative, and the adequacy and reliability of the controls that are used to manage residual risk remaining at the site.

Short-term effectiveness. Evaluates the potential effects on human health and the environment during the implementation of the alternative and considers the potential risk to the community and workers implementing the response action alternatives, and the potential for adverse impacts to the environment.

6.2.2 Implementability

Technical feasibility. Addresses the practicality of completing the alternative considering physical constraints.

Administrative feasibility. Addresses the activities required to coordinate with multiple offices and agencies (e.g., obtaining permits for off-site activities, right-of-way or alignment agreements, compliance with statutory limits, and enforcement of land use controls) and private property owners.

Availability of services and materials. Addresses the availability of personnel, equipment, and materials required to implement the alternative.

Regulatory acceptance. Addresses the concerns and issues that the State of Alabama and local government agencies may have regarding the alternative. Regulatory acceptance will be a factor in the final selection of the alternative(s) presented in the EE/CA Action Memorandum.

Community acceptance. Addresses concerns and issues the public and other stakeholders may have regarding the alternative. Community acceptance will be a factor in the final selection of the alternative(s) presented in the EE/CA Action Memorandum.

6.2.3 Cost

Costs for implementing individual alternatives are provided in Section 7.0 and cost estimates and pertinent assumptions are included in Appendix J.

6.3 Effectiveness

6.3.1 Alternative 1 − No Further Action

Alternative 1 provides no reduction in the risk of MEC exposure and no protection of the environment. Since MEC exposure is dependent on the type of land use, the risk of future MEC exposure can be expected to change (increase or decrease) if the land use changes. Since no action is taken, there are no impacts to human health or the environment during implementation. Because no action is taken, no location-specific, action-specific, or chemical-specific ARARs are applicable.

6.3.2 Alternative 2 − Area-Specific Land Use Controls

Alternative 2 [limited to security patrols, access controls (e.g., gates), deed restrictions and warning signs] will not include the removal or destruction of MEC; therefore, it cannot be seen as providing absolute protection to public health and the environment. The threat to public health and the environment of MEC exposure will be reduced only to the extent that the controls are initially effective and remain so. To achieve long-term effectiveness, public education is necessary to inform new residents, workers, and occasional recreational users of the potential site hazards.

Action-specific ARARs and location-specific ARARs applicable to this alternative will be determined based on which component of this alternative is implemented. Area-specific land use controls may consist of several different institutional and/or engineering controls. Applicable action-specific ARARs and location-specific ARARs will be followed. There are no chemical-specific ARARs requiring removal of MEC to regulatory levels.

6.3.3 Alternative 3 − Construction Support

Alternative 3 will be effective in dealing with potential MEC items that may be encountered during construction activities. Upon discovery of MEC items in an area previously determined to be low probability for encountering MEC, the determination of probability of

encountering MEC and appropriate level of construction support will be reevaluated. Upon determination of moderate to high probability of encountering MEC, construction support should shift from standby to active clearance in the footprint of the proposed construction. The shift from standby to active clearance will be effective in the removal of MEC items most likely to be encountered by construction workers and will reduce the risk of an accidental encounter with MEC within construction footprint areas. Overall protection of the public and the environment will be strongly related to the quantity of MEC that is on or near the surface. In footprint areas where surface MEC is more common, this alternative will greatly reduce the level of risk. Therefore, this alternative should be reliable, but it will be much less reliable in areas outside the footprints.

Short-term effectiveness is dependent upon the potential for UXO workers to be exposed to MEC during implementation of the alternative. Adherence to safety procedures and associated Site Safety and Health Plans will significantly limit the risk to UXO workers. Implementation of this alternative should have no short-term risk to the affected community and minimal adverse environmental impacts.

Action-specific ARARs potentially applicable to this alternative include National Ambient Air Quality Standards and the Occupational Safety and Health Act. During construction, any MEC items found will be removed by UXO-qualified personnel. No location-specific ARARs are applicable to this alternative. There are no chemical-specific ARARs requiring removal of MEC to regulatory levels. TBC criteria applicable to this alternative include RCRA Management of Military Munitions, Department of the Army Ammunition and Explosive Safety Standards, ESSs for Removal of Ordnance and Explosives from Real Property, and Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives.

6.3.4 Alternative 4 − Surface Clearance

Alternative 4 will be effective in the removal of MEC items located on the surface and therefore will greatly reduce the risk of an accidental encounter with MEC. However, MEC that may be present in the subsurface will not be removed. Thus, this alternative will provide only limited protection against intrusive (i.e., digging, excavation) activities. Additionally,

freeze/thaw cycles or erosion may potentially allow near-surface MEC to migrate to the surface. The overall extent to which surface clearance will increase overall protection of public health and the environment will be directly related to the quantity of MEC that is presently located on the surface. Effectiveness to protect the public will be increased by the inclusion of a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.

Short-term effectiveness will be dependent upon the potential for UXO workers to be exposed to MEC during implementation of the alternative. Adherence to safety procedures and Site Safety and Health Plans will significantly limit the risk to UXO workers. In the event that MEC is discovered and detonation in-place is the preferred disposal option, the surrounding area may be affected by noise and ground shock. Environmental impacts from clearance should be minimal.

Action-specific ARARs potentially applicable to this alternative include National Ambient Air Quality Standards and the Occupational Safety and Health Act. During implementation of the alternative, MEC items located on the surface within the specified area will be removed by UXO-qualified personnel. Location-specific ARARs potentially applicable to this alternative include the Protection of Wetlands. Location-specific ARARs will be followed by avoiding site activities that could potentially affect sensitive habitats. There are no chemical-specific ARARs requiring removal of MEC to regulatory levels. TBC criteria applicable to this alternative include RCRA Management of Military Munitions, Department of the Army Ammunition and Explosive Safety Standards, ESSs for Removal of Ordnance and Explosives from Real Property, and Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives.

6.3.5 Alternative 5 − Clearance to 1 ft

Alternative 5 will significantly reduce the potential for direct contact with MEC. It will be an effective and permanent solution for reducing risk of exposure. The risk of near-surface MEC being moved to the surface by freeze/thaw cycles or erosion should be eliminated since MEC would be removed down to a depth of 12 in. (frost depth is 6 in. at McClellan).

Short-term effectiveness will be dependent upon the potential for UXO workers to be exposed to MEC during implementation of this alternative. Adherence to safety procedures and Site Safety and Health Plans will significantly limit the risk to UXO workers. The short-term risk to the public resulting from implementation is minimal. In the event that MEC is discovered and detonation in-place is the preferred disposal option, the surrounding area may be affected by noise and ground shock. Environmental impacts from implementing this alternative should be minimal. This alternative will also include a deed restriction that prohibits digging in the study area without construction support by UXO-qualified personnel.

Action-specific ARARs potentially applicable to this alternative include National Ambient Air Quality Standards and the Occupational Safety and Health Act. During implementation of the alternative, any MEC items located within 1 ft below ground surface within the specified area will be removed by UXO-qualified personnel. Location-specific ARARs potentially applicable to this alternative include the Protection of Wetlands. Location-specific ARARs will be followed by avoiding site activities that could potentially affect sensitive habitats. There are no chemical-specific ARARs requiring removal of MEC to regulatory levels. TBC criteria applicable to this alternative include RCRA Management of Military Munitions, Department of the Army Ammunition and Explosive Safety Standards, ESSs for Removal of Ordnance and Explosives from Real Property, and Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives.

6.3.6 Alternative 6 − Clearance to Depth

Alternative 6 will significantly reduce the potential for direct contact with MEC and be an effective and permanent solution for reducing risk of exposure. The risk of MEC being moved to the surface by freeze/thaw cycles or erosion would be eliminated since all detectable subsurface MEC will be removed.

Short-term effectiveness will depend on the potential for UXO workers to be exposed to MEC during implementation. Adherence to safety procedures and Site Safety and Health Plans will significantly limit the risk to UXO workers. The short-term risk to the public resulting from

implementation will be minimal. In the event that MEC is discovered and detonation in-place is the preferred disposal option, the area may be affected by noise and ground shock. Environmental impacts from implementing this alternative should be minimal.

Action-specific ARARs potentially applicable to this alternative include National Ambient Air Quality Standards and the Occupational Safety and Health Act. During implementation of this alternative, any MEC items detected within the specified area will be removed by UXO-qualified personnel. Location-specific ARARs potentially applicable to this alternative include the Protection of Wetlands. Location-specific ARARs will be followed by avoiding site activities that could potentially affect sensitive habitats. There are no chemical-specific ARARs requiring removal of MEC to regulatory levels. TBC criteria applicable to this alternative include RCRA Management of Military Munitions, Department of the Army Ammunition and Explosive Safety Standards, ESSs for Removal of Ordnance and Explosives from Real Property, and Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives.

6.4 Implementability

6.4.1 Alternative 1 − No Further Action

Technically, this alternative will be easy to implement, since there are no investigations or response actions being taken. However, administratively, implementation of this alternative may be difficult. An ESS must be prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB. Furthermore, since this alternative takes no action to remove or reduce the risk of exposure to MEC, there may be a strong reluctance on the part of ADEM, the local government, and/or community to accept this approach, particularly in any areas where there is known or suspected presence of MEC.

6.4.2 Alternative 2 − Area-Specific Land Use Controls

Technically, this alternative will be relatively easy to implement, as it will not require any special materials or equipment. It will require services and materials (all readily available) to

install warning signs and gates at selected locations and provide security patrols. UXO personnel will be required to clear the area prior to installation of signs and ensure that proper safety precautions are implemented to prevent untrained personnel from handling MEC. Otherwise, no special services or operators are required and the services required are readily available. However, administratively, implementation of this alternative may be difficult. An ESS document must be prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB.

Since this alternative takes no action to remove MEC, there may be some reluctance on the part of ADEM, the local government, and/or community to accept this approach, particularly in any areas where there is known or suspected presence of MEC. A positive community relations program will be warranted to support implementation of this alternative.

6.4.3 Alternative 3 − Construction Support

Alternative 3 will be easy to implement technically, but less so administratively. In areas determined to have a low probability of encountering MEC, on-call support is technically easy to implement and services are readily available. In areas determined to have a moderate to high probability of encountering MEC, the alternative will require equipment, skills, personnel, and technologies associated with MEC detection, excavation, and disposal. UXO personnel will be required to clear the construction area prior to initiation of work activities and ensure that proper safety precautions are implemented to prevent untrained personnel from handling MEC. Construction support consisting of clearance in a limited construction footprint area as described above is also considered technically easy to implement and personnel, equipment, and materials are readily available.

Administratively, activities associated with this alternative will need to be coordinated with construction contractors. Permits and/or approvals may be required if it becomes necessary to transport MEC off-site for disposal. A Construction Support Work Plan will be required. An ESS prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB will be required. Since this alternative does little to

reduce the potential risk in the non-construction footprint areas, ADEM, the local government, and the community may be reluctant to accept this alternative.

6.4.4 Alternative 4 − Surface Clearance

Alternative 4 will be technically and administratively feasible. Technically, efforts associated with implementing this alternative will vary based on the topography, terrain, and vegetative cover. Implementation of this alternative will require equipment, skills, personnel, and technologies associated with land clearing and MEC detection, excavation, and disposal. UXO-qualified personnel must be used during implementation of all aspects of this alternative. Proper safety precautions must be implemented to prevent untrained individuals from handling MEC.

Administratively, selection of this alternative will require an approved Work Plan that describes in detail, the procedures, equipment, and personnel required to implement this removal action. In addition, an ESS prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB will be required.

This alternative reduces the public's risk of accidental exposure to MEC; as a result ADEM, the local government, and the community may be willing to accept this alternative. However, concerns may still be expressed since this alternative does not remove subsurface MEC items and therefore does not decrease the risk resulting from intrusive activities. A positive community relations program may be warranted if this alternative is selected for implementation.

6.4.5 Alternative 5 − Clearance to 1 ft

Alternative 5 will be technically and administratively feasible. Technically, efforts associated with implementing this alternative will vary based on the topography, terrain, and vegetative cover, and will require equipment, skills, personnel, and technologies associated with land clearing and MEC detection, excavation, and disposal. UXO-qualified personnel must be used during implementation of all aspects of this alternative. Proper safety precautions must be implemented to prevent untrained individuals from handling MEC.

An approved Work Plan that describes in detail, the procedures, equipment, and personnel required to implement this removal action will be required. An ESS prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB will also be required.

It is anticipated that ADEM, the local government, and the local community will be willing to accept this alternative since it is designed to remove both surface and subsurface MEC. However, some individuals may be concerned that the alternative will disrupt routine activities in the area and potentially destroy property and/or habitat by excavation and detonation in-place. A positive community relations program may be warranted to support implementation of this alternative to ensure the public that appropriate measures will be taken to minimize inconveniences and prevent damage to local property or habitat.

6.4.6 Alternative 6 − Clearance to Depth

Alternative 6 will be technically and administratively feasible. Technically, efforts associated with implementing this alternative will vary based on the topography, terrain, and vegetative cover, and will require equipment, skills, personnel, and technologies associated with land clearing and MEC detection, excavation, and disposal. UXO-qualified personnel must be used during implementation of all aspects of this alternative. Proper safety precautions must be implemented to prevent untrained individuals from handling MEC.

Administratively, an approved Work Plan that describes in detail, the procedures, equipment, and personnel required to implement this removal action will be required. An ESS prepared in accordance with DoD 6055.9- STD, Ammunition and Explosives Safety Standards, and approved by the DDESB will also be required.

It is anticipated that ADEM, the local government, and the local community will be willing to accept this alternative since it is designed to remove both surface and subsurface MEC. However, some individuals may be concerned that the alternative will disrupt routine activities in the area and potentially destroy property and/or habitat by excavation and detonation in-place. A positive community relations program may be warranted to support implementation of this

alternative to ensure the public that appropriate measures will be taken to minimize inconveniences and prevent damage to local property or habitat.

6.5 Cost

6.5.1 Alternative 1 − No Further Action

The cost to implement Alternative 1 includes the effort associated with the preparation of the ESS and should be relatively independent of the sector to which it is applied. The level of effort covers the initial preparation and submittal of a draft and final ESS. Section 7.0 provides cost estimates for individual sectors.

6.5.2 Alternative 2 − Area-Specific Land Use Controls

The estimate for Alternative 2 is dependent upon the size, material, number, and spacing of signs and gates. Section 7.0 provides cost estimates for individual sectors.

6.5.3 Alternative 3 − Construction Support

The estimated cost to provide construction support will depend on the nature and duration of construction activities. The estimate includes the cost for management and UXO construction support (this will vary depending on the total acreage and the future land use). Section 7.0 provides cost estimates for individual sectors.

6.5.4 Alternative 4 − Surface Clearance

The estimated cost to perform Alternative 4 varies with surface MEC density, topography, coverage area, vegetative cover, and site access. The cost to implement this alternative is based on the estimated density of surface MEC, which is based on the information developed during this Supplemental EE/CA investigation and available from previous investigations conducted in the Alpha Area. The estimate includes the cost for management; the

Removal Report; site preparation; MEC detection, excavation, and disposal; MEC scrap disposal; and posting of signs. Section 7.0 provides cost estimates for individual sectors.

6.5.5 Alternative 5 − Clearance to 1 ft

The estimated cost to perform Alternative 5 varies with MEC density, topography, coverage area, vegetative cover, and site access. The cost to implement this alternative is based on the estimated density of surface and subsurface MEC, which is based on the information developed during this Supplemental EE/CA investigation and available from previous investigations conducted in the Alpha Area. The estimate includes the cost for management; the Removal Report; site preparation; MEC detection, excavation, and disposal; and MEC scrap disposal. Engineering controls may be utilized to decrease the area requiring evacuation during this response action. If engineering controls are employed for sectors near inhabited areas, the costs for implementing this alternative may increase. Also, areas contaminated to the point of requiring mechanical removal are not anticipated and are not part of these cost estimates. Section 7.0 provides cost estimates for individual sectors.

6.5.6 Alternative 6 − Clearance to Depth

The estimated cost to perform Alternative 6 varies with MEC density, topography, coverage area, vegetative cover, and site access. The cost to implement this alternative is based on the estimated density of surface and subsurface MEC, which is based on the information developed during this Supplemental EE/CA investigation and available from previous investigations conducted in the Alpha Area. The estimate includes the cost for management; the Removal Report; site preparation; MEC detection, excavation, and disposal; and MEC scrap disposal. Engineering controls may be utilized to decrease the area requiring evacuation during this response action. If engineering controls are employed for sectors near inhabited areas, the costs for implementing this alternative may increase. Also, areas contaminated to the point of requiring mechanical removal are not anticipated and are not part of these cost estimates. Section 7.0 provides cost estimates for individual sectors.

7.0 COMPARATIVE ANALYSIS OF RESPONSE ACTION ALTERNATIVES

In the preceding chapter, six alternatives for addressing MEC-related risks within the Supplemental EE/CA investigation area were described and individually evaluated with respect to effectiveness, implementability, and cost. In this chapter, a comparative analysis uses the same three criteria to evaluate the alternatives on a sector-specific basis, resulting in a relative ranking of alternatives for each sector. In Section 4.0, within each of the identified sectors, a MEC risk and protectiveness assessment (risk assessment) was performed for each of the alternatives. The results of the risk assessments were integrated into the "effectiveness" evaluation completed below for each alternative.

The sectors for which the comparative analysis was performed are listed below. The description of the different land uses and the selected designations for each individual sampling sector are presented in Section 4.2.2. Because land use determines the frequency and type of activity, it is a critical component to the determination of future risk due to the presence of MEC. Thus in Section 4.0, for each sector, separate risk assessments were completed for each different land use, potentially resulting in a different relative ranking of alternatives for that same sector. Several of the sectors have more than one projected future land use. The land uses are McClellan Park System and industrial.

7.1 Northern Transect Area NT-1

7.1.1 Effectiveness

Based on the assessments completed in Section 4.0, the most effective alternatives for protection of human health and the environment were judged to be the removal alternatives −Alternative 4 (Surface Clearance), Alternative 5 (Clearance to 1 ft), and Alternative 6 (Clearance to Depth), followed by Alternative 3 (Construction Support) and Alternative 2 (Area-Specific Land Use Controls). Alternative 1 (No Further Action) was considered to be the least effective. The removal alternatives received a high rating. For this sector, MEC was not found. MEC scrap was found on the surface and up to 3 ft below the surface. Because of the low density of MEC scrap found, area-specific land use controls offer a moderate level of protectiveness.

Surface clearance (i.e., Alternative 4) was considered to provide a high level of protectiveness, with Alternatives 5 and 6 providing only an incremental increase in protectiveness.

With respect to the other effectiveness criteria, Alternative 1 (No Further Action) clearly has the least short-term effects since no action is being taken that might impact local workers or the public. Alternative 2 (Area-Specific Land Use Controls) also presents little short-term effects since the only activity that might have impact on the workers or the public involves installation of a limited number of warning signs. The removal alternatives (Alternatives 3, 4, 5, and 6) have the greatest potential impact on the workers and public since each involves the potential of more direct contact with MEC, if present. Overall, Alternative 1 will have the least short-term effects, followed by Alternatives 2 and 3, and then Alternatives 4, 5, and 6. Among the latter three alternatives, the short-term effects will increase from Alternative 4 to 6, since each has a potential for longer and more intense exposure to MEC, if present. With respect to the compliance with ARARs criterion, each alternative will comply.

7.1.2 Implementability

All six alternatives are technically feasible with Alternative 1 being the most technically feasible since there is no action required at the site (i.e., investigation or removal actions). Alternative 2 is the second most technically feasible alternative. It requires that technical actions be taken at the site (i.e., installation of signage at the site). The remaining alternatives are each technically feasible but less so than Alternatives 1 and 2, because they each involve more intense site activities and dependence on technology.

In summary, Alternative 1 will be the most technically feasible, Alternative 2 next, followed by Alternatives 3, 4, 5, and 6.

All six alternatives are administratively feasible; however, all six alternatives will require the preparation and DDESB approval of an ESS. Alternatives 3 through 6 will each require the preparation and approval of a Work Plan since each alternative involves on-site MEC activities. Alternatives 2, 3, 4, and 5 will also require compliance with the Land Use Control Assurance

Plan (LUCAP) for McClellan since each involves the implementation of area-specific land use controls.

In summary, considering these requirements, Alternative 1 will be the simplest to administer, with Alternative 6 next, and Alternatives 2, 3, 4, and 5 being the most difficult of the alternatives to administer due to the inclusion of area-specific land use controls and the requirements to comply with the LUCAP.

7.1.3 Cost

The projected costs to implement the alternatives are summarized below:

- Alternative 1 (No Further Action) − $20,000. An ESS (preparation, draft, and final) will be prepared for a group of areas.
- Alternative 2 (Area-Specific Land Use Controls) − $21,600. This cost includes planning and sign posting. No annual maintenance costs are included.
- Alternative 3 (Construction Support) − $243,970. This estimate is based on an assumption of 24 hours of UXO Specialist support per acre and includes planning.
- Alternative 4 (Surface Clearance) − $761,100. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 5 (Clearance to 1 ft) − $1,840,282. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 6 (Clearance to Depth) − $2,520,543. This cost includes management and planning, MEC removal activities, and reporting.

7.2 <u>Northern Transect Area NT-2</u>

7.2.1 Effectiveness

Based on the assessments completed in Section 4.0, the most effective alternatives for protection of human health and the environment were judged to be the removal alternatives −Alternative 4 (Surface Clearance), Alternative 5 (Clearance to 1 ft), and Alternative 6 (Clearance to Depth), followed by Alternative 3 (Construction Support) and Alternative 2 (Area-Specific Land Use Controls). Alternative 1 (No Further Action) was considered to be the least

effective. The removal alternatives received a high rating. For this sector, MEC was not found. MEC scrap was found on the surface and up to 24 in. below the surface. Because of the low density of MEC scrap found, area-specific land use controls offer a moderate level of protectiveness. Surface clearance (i.e., Alternative 4) was considered to provide a high level of protectiveness, with Alternatives 5 and 6 providing only an incremental increase in protectiveness.

With respect to the other effectiveness criteria, Alternative 1 (No Further Action) clearly has the least short-term effects since no action is being taken that might impact local workers or the public. Alternative 2 (Area-Specific Land Use Controls) also presents little short-term effects since the only activity that might have impact on the workers or the public involves installation of a limited number of warning signs. The removal alternatives (Alternatives 3, 4, 5, and 6) have the greatest potential impact on the workers and public since each involves the potential of more direct contact with MEC, if present. Overall, Alternative 1 will have the least short-term effects, followed by Alternative 2 and 3, and then Alternatives 4, 5, and 6. Among the latter three alternatives, the short-term effects will increase from Alternative 4 to 6, since each has a potential for longer and more intense exposure to MEC, if present. With respect to the compliance with ARARs criterion, each alternative will comply.

7.2.2 Implementability

All six alternatives are technically feasible with Alternative 1 being the most technically feasible since there is no action required at the site (i.e., investigation or removal actions). Alternative 2 is the second most technically feasible alternative. It requires that technical actions be taken at the site (i.e., installation of signage at the site). The remaining alternatives are each technically feasible but less so than Alternatives 1 and 2, because they each involve more intense site activities and dependence on technology.

In summary, Alternative 1 will be the most technically feasible, Alternative 2 next, followed by Alternatives 3, 4, 5, and 6.

All six alternatives are administrative feasible; however, all six alternatives will require the preparation and DDESB approval of an ESS. Alternatives 3 through 6 will each require the preparation and approval of a Work Plan since each alternative involves on-site MEC activities. Alternatives 2, 3, 4, and 5 will also require compliance with the LUCAP for McClellan since each involves the implementation of area-specific land use controls.

In summary, considering these requirements, Alternative 1 will be the simplest to administer, with Alternative 6 next, and Alternatives 2, 3, 4, and 5 being the most difficult of the alternatives to administer due to the inclusion of area-specific land use controls and the requirements to comply with the LUCAP.

7.2.3 Cost

The projected costs to implement the alternatives are summarized below:

- Alternative 1 (No Further Action) − $20,000. An ESS (preparation, draft, and final) will be prepared for a group of areas.
- Alternative 2 (Area-Specific Land Use Controls) − $15,600. This cost includes planning and sign posting. No annual maintenance costs are included.
- Alternative 3 (Construction Support) − $47,355. This estimate is based on an assumption of 24 hours of UXO Specialist support per acre and includes planning.
- Alternative 4 (Surface Clearance) − $167,074. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 5 (Clearance to 1 ft) − $391,050. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 6 (Clearance to Depth) − $527,824. This cost includes management and planning, MEC removal activities, and reporting.

7.3 <u>Southern Transect Area ST-1</u>

7.3.1 Effectiveness

Based on the assessments completed in Section 4.0, the most effective alternatives for protection of human health and the environment were judged to be the removal alternatives —

Alternative 5 (Clearance to 1 ft) and Alternative 6 (Clearance to Depth), followed by Alternative 3 (Construction Support) and Alternative 4 (Surface Clearance). Alternative 2 (Area-Specific Land Use Controls) was considered to provide even less protection and Alternative 1 (No Further Action) was considered to be the least effective. Alternative 4 received a moderate rating and Alternatives 5 and 6 received a high rating. MEC was found down to 8 in. MEC scrap was found on the surface and down to 36 in. below the surface. Surface clearance (i.e., Alternative 4) would provide a moderate level of protectiveness, and Alternatives 5 and 6 would provide an increased level of protectiveness.

With respect to the other effectiveness criteria, Alternative 1 (No Further Action) clearly has the least short-term effects since no action is being taken that might impact local workers or the public. Alternative 2 (Area-Specific Land Use Controls) also presents little short term effects since the only activity that might have impact on the workers or the public involves installation of a limited number of warning signs. The removal alternatives (Alternatives 3, 4, 5, and 6) have the greatest potential impact on the workers and public since each involves the potential of more direct contact with MEC. In summary, Alternative 1 will have the least short-term effects, followed by Alternatives 2 and 3, and then Alternatives 4, 5, and 6. Among the latter three alternatives, the short-term effects will increase from Alternative 4 to 6, since each has the potential for longer and more intense exposure to MEC. With respect to the compliance with ARARs criterion, each alternative will comply.

7.3.2 Implementability

All six alternatives are technically feasible with Alternative 1 being the most technically feasible since there is no action required at the site (i.e., investigation or removal actions). Alternative 2 is the second most technically feasible alternative. It requires that technical actions be taken at the site (i.e., installation of signage at the site). The remaining alternatives are each technically feasible but less so than Alternatives 1 and 2, because they each involve more intense site activities and dependence on technology.

In summary, Alternative 1 will be the most technically feasible, Alternative 2 next, followed by Alternatives 3, 4, 5, and 6.

Regarding administrative feasibility, all six alternatives will require the preparation and DDESB approval of an ESS. Alternatives 3 through 6 will each require the preparation and approval of a Work Plan since each alternative involves on-site MEC activities. Alternatives 2, 3, 4, and 5 will require compliance with the LUCAP for McClellan since each involves the implementation of area-specific land use controls.

In summary, considering these requirements, Alternative 1 will be the simplest to administer, with Alternative 6 next, and Alternatives 3, 4, and 5 being the most difficult of the alternatives to administer due to the inclusion of area-specific land use controls and the requirements to comply with the LUCAP.

Services and materials will be required and are readily available for preparing the plans mentioned above and to complete the field work associated with Alternatives 3 through 6. Based on the levels of services needed, Alternative 1 will require the least services and materials since it only requires effort to prepare the ESS. More services and materials will be required for the implementation of Alternative 2 since it requires the preparation of the ESS, installation of signs, as well as coordination with the LUCAP. Even more services and materials will be required for Alternative 3 since it requires a Work Plan for construction support activities and the field service activities to provide the actual construction support. Alternative 4 will be similar in scope of required services and materials. Alternatives 5 and 6 will require the most in services and materials.

In summary, Alternative 1 will require the least in services and materials to implement, with Alternative 2 next. Alternatives 3 and 4 will require a higher level of services and materials than Alternatives 1 and 2, but less than Alternatives 5 and 6.

The level of regulatory and/or community acceptance for each alternative can be expected to largely depend on the protection (or the perception of protection) that each alternative offers. For this sector, MEC has been detected within the range of 0 to 1 ft in an area where the future land use is projected to be McClellan Park System. Alternative 1 (No Further Action) does nothing to provide any degree of protection and therefore is unlikely to be accepted

by the regulatory community or the public. Alternative 2 (Area-Specific Land Use Controls) would probably be received more favorably since it will provide some degree of protection; however, since it leaves MEC in place, it is likely to be unacceptable to both regulators and the public. Alternative 3 (Construction Support) may receive similar levels of acceptance as Alternative 2. Alternative 3 provides protection to construction workers and removes MEC within the construction footprint. The projected future land use is McClellan Park System, with little expected construction activities. Alternative 4 (Surface Clearance) can be expected to receive a higher level of acceptance than any of the previous alternatives since it includes actual removal of potential MEC from the surface. However, it does not remove any MEC that may exist below the surface. Alternative 5 (Clearance to 1 ft) and Alternative 6 (Clearance to Depth) can be expected to receive the most support from the regulators and public, with Alternative 6 receiving the highest level of support.

In summary, the alternatives that may be best received by the regulators and/or public would be Alternative 6 (Clearance to Depth), followed closely by Alternative 5 (Clearance to 1 ft), followed next by Alternative 4 (Surface Clearance), and then Alternative 2 (Area-Specific Land Use Controls) and Alternative 3 (Construction Support). Alternative 1 (No Further Action) would likely be the least acceptable alternative.

7.3.3 Cost

The projected costs to implement the alternatives are summarized below:

- Alternative 1 (No Further Action) − $20,000. An ESS (preparation, draft, and final) will be prepared for a group of areas.
- Alternative 2 (Area-Specific Land Use Controls) − $15,600. This cost includes planning and sign posting. No annual maintenance costs are included.
- Alternative 3 (Construction Support) − $15,375. This estimate is based on an assumption of 120 hours of UXO Specialist support per acre and includes planning.
- Alternative 4 (Surface Clearance) − $85,764. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 5 (Clearance to 1 ft) − $203,514. This cost includes management and planning, MEC removal activities, and reporting.

- Alternative 6 (Clearance to Depth) − $291,639. This cost includes management and planning, MEC removal activities, and reporting.

7.4 Southern Transect Area ST-2

7.4.1 Effectiveness

Based on the assessments completed in Section 4.0, the most effective alternatives for protection of human health and the environment were judged to be the removal alternatives −Alternative 4 (Surface Clearance), Alternative 5 (Clearance to 1 ft), and Alternative 6 (Clearance to Depth), followed by Alternative 3 (Construction Support) and Alternative 2 (Area-Specific Land Use Controls). Alternative 1 (No Further Action) was considered to be the least effective. The removal alternatives received a high rating. For this sector, MEC was found; however, the items were unused practice items and signaling items that had not been completely expended. MEC scrap was found on the surface and up to 1 ft below the surface. Because of the low density of MEC and MEC scrap found, area-specific land use controls offer a moderate level of protectiveness. Surface clearance (i.e., Alternative 4) was considered to provide a high level of protectiveness, with Alternatives 5 and 6 providing only an incremental increase in protectiveness.

With respect to the other effectiveness criteria, Alternative 1 (No Further Action) clearly has the least short-term effects since no action is being taken that might impact local workers or the public. Alternative 2 (Area-Specific Land Use Controls) also presents little short term effects since the only activity that might have impact on the workers or the public involves installation of a limited number of warning signs. The removal alternatives (Alternatives 3, 4, 5, and 6) have the greatest potential impact on the workers and public since each involves the potential of more direct contact with MEC, if present. Overall, Alternative 1 will have the least short-term effects, followed by Alternatives 2 and 3, and then Alternatives 4, 5, and 6. Among the latter three alternatives, the short-term effects will increase from Alternative 4 to 6 since each has a potential for longer and more intense exposure to MEC, if present. With respect to the compliance with ARARs criterion, each alternative will comply.

7.4.2 Implementability

All six alternatives are technically feasible with Alternative 1 being the most technically feasible since there is no action required at the site (i.e., investigation or removal actions). Alternative 2 is the second most technically feasible alternative. It requires that technical actions be taken at the site (i.e., installation of signage at the site). The remaining alternatives are each technically feasible but less so than Alternatives 1 and 2, because they each involve more intense site activities and dependence on technology.

In summary, Alternative 1 will be the most technically feasible, Alternative 2 next, followed by Alternatives 3, 4, 5, and 6.

Regarding administrative feasibility, all six alternatives are administrative feasible; however, all six alternatives will require the preparation and DDESB approval of an ESS. Alternatives 3 through 6 will each require the preparation and approval of a Work Plan since each alternative involves on-site MEC activities. Alternatives 2, 3, 4, and 5 will also require compliance with the LUCAP for McClellan since each involves the implementation of area-specific land use controls.

In summary, considering these requirements, Alternative 1 will be the simplest to administer, with Alternative 6 next, and Alternatives 2, 3, 4, and 5 being the most difficult of the alternatives to administer due to the inclusion of area-specific land use controls and the requirements to comply with the LUCAP.

7.4.3 Cost

The projected costs to implement the alternatives are summarized below:

- Alternative 1 (No Further Action) − $20,000. An ESS (preparation, draft, and final) will be prepared for a group of areas.
- Alternative 2 (Area-Specific Land Use Controls) − $19,200. This cost includes planning and sign posting. No annual maintenance costs are included.

- Alternative 3 (Construction Support) − $178,350. This estimate is based on an assumption of 24 hours of UXO Specialist support per acre and includes planning.
- Alternative 4 (Surface Clearance) − $562,850. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 5 (Clearance to 1 ft) − $1,356,600. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 6 (Clearance to Depth) − $2,014,845. This cost includes management and planning, MEC removal activities, and reporting.

7.5 Southern Transect Area ST-3

7.5.1 Effectiveness

Based on the assessments completed in Section 4.0, the most effective alternatives for protection of human health and the environment were judged to be the removal alternatives−Alternative 5 (Clearance to 1 ft) and Alternative 6 (Clearance to Depth), followed by Alternative 3 (Construction Support) and Alternative 4 (Surface Clearance). Alternative 2 (Area-Specific Land Use Controls) was considered to provide even less protection and Alternative 1 (No Further Action) was considered to be the least effective. Alternative 4 received a moderate rating, and Alternatives 5 and 6 received a high rating. MEC was found down to 18 in. MEC scrap was found on the surface and down to 1 ft below the surface. Surface clearance (i.e., Alternative 4) would provide a moderate level of protectiveness, and Alternatives 5 and 6 would provide an increased level of protectiveness.

With respect to the other effectiveness criteria, Alternative 1 (No Further Action) clearly has the least short-term effects since no action is being taken that might impact local workers or the public. Alternative 2 (Area-Specific Land Use Controls) also presents little short term effects since the only activity that might have impact on the workers or the public involves installation of a limited number of warning signs. The removal alternatives (Alternatives 3, 4, 5, and 6) have the greatest potential impact on the workers and public since each involves the potential of more direct contact with MEC. In summary, Alternative 1 will have the least short-term effects, followed by Alternatives 2 and 3, and then Alternatives 4, 5, and 6. Among the latter three alternatives, the short-term effects will increase from Alternative 4 to 6 since each has the

potential for longer and more intense exposure to MEC. With respect to the compliance with ARARs criterion, each alternative will comply.

7.5.2 Implementability

All six alternatives are technically feasible with Alternative 1 being the most technically feasible since there is no action required at the site (i.e., investigation or removal actions). Alternative 2 is the second most technically feasible alternative. It requires that technical actions be taken at the site (i.e., installation of signage at the site). The remaining alternatives are each technically feasible but less so than Alternatives 1 and 2, because they each involve more intense site activities and dependence on technology.

In summary, Alternative 1 will be the most technically feasible, Alternative 2 next, followed by Alternatives 3, 4, 5, and 6.

Regarding administrative feasibility, all six alternatives will require the preparation and DDESB approval of an ESS. Alternatives 3 through 6 will each require the preparation and approval of a Work Plan since each alternative involves on-site MEC activities. Alternatives 2, 3, 4, and 5 will require compliance with the LUCAP for McClellan since each involves the implementation of area-specific land use controls.

In summary, considering these requirements, Alternative 1 will be the simplest to administer, with Alternative 6 next, and Alternatives 3, 4, and 5 being the most difficult of the alternatives to administer due to the inclusion of area-specific land use controls and the requirements to comply with the LUCAP.

Services and materials will be required and are readily available for preparing the plans mentioned above and to complete the field work associated with Alternatives 3 through 6. Based on the levels of services needed, Alternative 1 will require the least services and materials since it only requires effort to prepare the ESS. More services and materials will be required for the implementation of Alternative 2 since it requires the preparation of the ESS, installation of signs, as well as coordination with the LUCAP. Even more services and materials will be required for

Alternative 3 since it requires a Work Plan for construction support activities and the field service activities to provide the actual construction support. Alternative 4 will be similar in scope of required services and materials. Alternatives 5 and 6 will require the most in services and materials.

In summary, Alternative 1 will require the least in services and materials to implement, with Alternative 2 next. Alternatives 3 and 4 will require a higher level of services and materials than Alternatives 1 and 2, but less than Alternatives 5 and 6.

The level of regulatory and/or community acceptance for each alternative can be expected to largely depend on the protection (or the perception of protection) that each alternative offers. For this sector, MEC has been detected within the range of 0 to 1 ft in an area where the future land use is projected to be McClellan Park System and possible industrial use. Alternative 1 (No Further Action) does nothing to provide any degree of protection and therefore is unlikely to be accepted by the regulatory community or the public. Alternative 2 (Area-Specific Land Use Controls) would probably be received more favorably since it will provide some degree of protection; however, since it leaves MEC in place, it is likely to be unacceptable to both regulators and the public. Alternative 3 (Construction Support) may receive similar levels of acceptance as Alternative 2. Alternative 3 provides protection to construction workers and removes MEC within the construction footprint. The projected future land use is McClellan Park System, with little expected construction activities. Alternative 4 (Surface Clearance) can be expected to receive a higher level of acceptance than any of the previous alternatives since it includes actual removal of potential MEC from the surface. However, it does not remove any MEC that may exist below the surface. Alternative 5 (Clearance to 1 ft) and Alternative 6 (Clearance to Depth) can be expected to receive the most support from the regulators and public, with Alternative 6 receiving the highest level of support.

In summary, the alternatives that may be best received by the regulators and/or public would be Alternative 6 (Clearance to Depth), followed closely by Alternative 5 (Clearance to 1 ft), followed next by Alternative 4 (Surface Clearance), and then Alternative 2 (Area-Specific Land Use Controls) and Alternative 3 (Construction Support). Alternative 1 (No Further Action) would likely be the least acceptable alternative.

7.5.3 Cost

The projected costs to implement the alternatives are summarized below:

- Alternative 1 (No Further Action) − $20,000. An ESS (preparation, draft, and final) will be prepared for a group of areas.
- Alternative 2 (Area-Specific Land Use Controls) − $15,600. This cost includes planning and sign posting. No annual maintenance costs are included.
- Alternative 3 (Construction Support) − $47,662. This estimate is based on an assumption of 120 hours of UXO Specialist support per acre and includes planning.
- Alternative 4 (Surface Clearance) − $215,467. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 5 (Clearance to 1 ft) − $780,488. This cost includes management and planning, MEC removal activities, and reporting.
- Alternative 6 (Clearance to Depth) − $1,339,150. This cost includes management and planning, MEC removal activities, and reporting.

8.0 RECOMMENDED RESPONSE ACTION ALTERNATIVES

In Section 6.0, six alternatives for reducing MEC risk within the Supplemental EE/CA investigation area were individually evaluated against the NCP evaluation criteria of effectiveness, implementability, and cost. In Section 7.0, a comparative analysis was performed, evaluating the same six alternatives on an area-specific basis, using the same NCP criteria. As a result of the comprehensive evaluation of alternatives by sector, the following paragraphs present the recommendations for implementation.

8.1 Northern Transect Area NT-1

8.1.1 Description and History

This area consists of 87.4 acres in the northwestern portion of the Supplemental EE/CA area. In all, 488 target anomalies were intrusively investigated in NT-1. Of those, 30 anomalies (6%) contained MEC-related scrap or fragmentation; no MEC was recovered in NT-1. Ten of the 30 anomalies included slap flare projectile bodies. A slap flare is a signaling or illumination device employed by the military. The projectile is propelled from its firing cylinder by small rocket motors. Once the motors have burned through, an expelling charge pushes the pyrotechnic signal or flare from the projectile body. These items are generally short range, a few hundred feet of altitude; however, after the expelling charge fires, the lightweight projectile bodies drift back to the ground. This could allow the projectile body to fall a great distance from where it was employed. These may have been fired anywhere throughout the northern Alpha Area, Charlie Area, or the cantonment area. There is no hazard associated with these projectile bodies. However, a rifle grenade, signal green smoke was also recovered during the Army EE/CA. This type of item possesses minimal explosive safety hazard and is typical of a training area.

Several pieces of fragmentation from 37mm and other unknown projectiles were located throughout NT-1. These fragments may have come from one of the many ranges that were located near this area or from those whose fans of fire crossed over the area. These ranges include the Combat Tank Range, Tank Ranges 1 and 2, and the Defendum Rifle Range. The Army utilized the

M5 Stuart Tank during World War II. It had as its main armament a 37mm gun, and these tanks may have been used on any of the tank ranges. Also, the ASR mentions that a sub-caliber device for use in tank main guns utilized 37mm ammunition with black powder charges and was utilized on the Defendum Rifle Range. Three of the four 37mm fragmentation items are described by field personnel as ⅓ of a 37mm projectile. All three of these were recovered in the same general area along with a rotating band from a 37mm, listed as MEC scrap. These were spread out over three consecutive transects; however, it is possible that these three fragments and the rotating band are from the same projectile, as no other fragments from 37mm projectiles were found in this area. The remaining fragments recovered were unidentifiable as far as the weapons system. These appeared to be randomly spread throughout the NT-1 area and do not appear to represent an impact area.

The remaining MEC-related items recovered are indicative of training areas, such as grenade safety pins, a booby trap mounting bracket, and tail booms from either smoke or signal type rifle grenades.

Based on further analysis in 2009, NT-1 was further divided into a northern area – NT-1N (45.5 acres) and a southern area NT-1S (41.9 acres) which include potions of a 200-foot buffer area originally assigned to M6-1M Transect Area 2 (North) - PR.

8.1.2 Recommendations

The recommended alternative for the Northern Transect Area NT-1Nis a surface clearance. No MEC was found in this area. The MEC-related items recovered during the Supplemental EE/CA do not indicate the area sustained use as a range or training area for weapons systems that may employ HE warheads. However, given that this area is proposed for unrestricted future use, sufficient (non-explosively hazardous) surficial munitions debris, including grenades and 37mm fragmentation, was found to warrant a surface clearance to remove any residual risk potentially present from discarded military munitions (DMM) or potential training, target, or disposal areas missed by the Supplemental EE/CA transect sampling. If any MEC are found, the surface clearance results will be utilized to define additional 1 foot clearance area(s). This alternative does not impose any land use controls; however, it should

include a deed notice in the property transfer documents that informs future property owners of the historical use and provides notification procedures in the event a MEC item is discovered.

The recommended alternative for the Northern transect Area NT-1S (41.9 acres) is NFA for unrestricted land use in this area. This alternative requires no action at the site and, therefore, may leave undiscovered MEC in the environment that could pose a potential risk to the public. This alternative does not impose any land use controls; however, it should include a deed notice in the property transfer documents that informs future property owners of the historical use and provides notification procedures in the event a MEC item is discovered.

8.1.3 Supporting Rationale

The risk analysis in Section 4.0 and the comparative analysis in Section 6.0 indicated that NFA would be appropriate for this area. Only one MEC item of minimal explosive safety hazard was recovered from this site. In addition, a few MEC scrap items and fragmentation were found and the density is very low and widely distributed. The types of MEC scrap items that were found in this area include items such as expended illumination signals and practice grenades. These items indicate that this portion of the Supplemental EE/CA investigation area was primarily used for maneuver training activities. The documented historical use of this area, combined with the types of practice items found, support the recommendation for NFA. However, based on further review of the data and subsequent discussions with ADEM in November 2009, it was determined that a surface clearance would be appropriate for the NT-1N area (where the majority of the MEC-related items were found) for industrial land use,

8.2 Northern Transect Area NT-2

8.2.1 Description and History

This area consists of 13.6 acres in the northeastern portion of the Supplemental EE/CA investigation area. This sector was developed around an area of appreciable topographic relief, which makes this area more suitable for recreation than industrial/commercial development.

Although no MEC was recovered during the Supplemental EE/CA investigation, a relatively moderate concentration of MEC fragmentation and MEC scrap is located in the vicinity of an underground bunker and target complex. In all, 117 anomalies were intrusively investigated in NT-2. Of those, 28 anomalies (23%) contained MEC-related scrap or fragmentation; no MEC was recovered in NT-2. The heaviest concentrations of MEC-related items were recovered between Transects 18 and 21 (see Figure 2-2). This is the general vicinity of the underground bunker and target complex described in Section 2.3.

The types and quantities of MEC-related items recovered (see Table 3-4) and the presence of an underground bunker system are indicative of a fire and maneuver training area. The recovered MEC-related items included 2.36-in. and 3.5-in. practice rockets, expended smoke grenades, and functioned practice grenades.

A review of the ASR shows that the Tank Combat Range as well as Tank Ranges 1 and 2 may have impacted the NT-2 area. However, the ASR suggests no ranges in the NT-2 area where practice rockets may have been used. The rockets recovered may have been the result of undocumented limited use by military units during training. The presence of these items in a limited quantity does not indicate the presence of a "Rocket Range," but suggests the area may have been used as a fire and maneuver training area for combined arms exercises with the occasional employment of man portable rockets. The MEC fragmentation recovered in the NT-2 area may be associated with the ranges listed above; however, the quantity of MEC fragmentation does not indicate that the NT-2 area encompasses the impact area associated with these ranges.

8.2.2 Recommendations

The recommended alternative for this area is surface clearance. Since further use of the land is for public recreation, the perception of risk to the public is a concern because of the concentration of MEC fragmentation and MEC scrap. Implementation of surface clearance will remove the inert ordnance items on the surface and will provide public assurance that a MEC safety risk does not remain. Residual risk that may remain will be managed through the inclusion of a deed that will prohibit digging in this area without construction support. For example, if the current/future land

owner changes the land use to include intrusive activities, such as camping, facility construction, new trails, parking areas, etc., construction support will be required in the footprint of these areas.

8.2.3 Supporting Rationale

The risk analysis in Section 4.0 and the comparative analysis in Section 6.0 indicated that surface clearance would be appropriate for this area. Several MEC scrap items and a few MEC fragments were found in this area. MEC scrap is concentrated in the area between Transects 18 and 21 with the heaviest concentrations on Transects 19 and 21. The types of MEC scrap items that were found in this area included items such as expended 2.36-in. practice rockets, 3.5-in. practice rockets, and practice grenades. These items plus the presence of the underground bunker complex indicate that this portion of the Supplemental EE/CA investigation area was primarily used as a fire and maneuver training area. The presence of the practice rockets, however, raises the possibility that the area may have experienced the use of HE rockets. The undocumented use of HE rockets in unknown areas has been encountered previously at McClellan and as such cannot be discounted in this area. The documented historical use of this area, and the presence of the underground bunker complex combined with the types of practice items found and consideration of public perception and future land use, support the recommendation for surface clearance.

8.3 Southern Transect Area ST-1

8.3.1 Description and History

This area consists of approximately 5 acres in the southwestern portion of the Supplemental EE/CA investigation area. In all, 49 anomalies were intrusively investigated in ST-1. Of those, 21 anomalies (42%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-5). Four MEC items were recovered in ST-1, these included one 40mm HE grenade M381 and three 60mm HE mortars M49 with fuzes. A review of the ASR indicates that ST-1 is located within the boundaries of Range 31, which included the use of 40mm grenades, fougasse, smoke, flamethrower, LAW, incendiary rockets, and other explosive ordnance. ST-1 is relatively small in size and could be considered to be heavily contaminated with MEC and MEC-related items.

8.3.2 Recommendations

The recommended alternative for Southern Transect Area ST-1 is clearance to 1 ft. Components of this alternative would include land surveying and brush clearing operations to prepare the site. Geophysical detection instruments will be used to locate subsurface anomalies, which subsequently will be investigated down to 12 in. After identification, the items would be disposed of as scrap or MEC in accordance with a previously approved MEC operations Work Plan. Residual risk that may remain will be managed through the inclusion of a deed that will prohibit digging in this area without performing clearance to depth. For example, if the current/future land owner changes the land use to include intrusive activities, such as camping, facility construction, new trails, parking areas, etc., clearance to depth will be required in the footprint of these areas.

8.3.3 Supporting Rationale

The risk analysis in Section 4.0 and the comparative analysis completed in Section 6.0 indicated that clearance to 1 ft should provide the appropriate protection for this area. MEC scrap and fragmentation were found to a depth of 12 in. and UXO to a depth of 8 in. in this sector. The majority of the MEC scrap was found at lesser depths. The projected future use of this sector is the McClellan Park System, which for this specific area consists of activities such as hiking, walking, and biking (McClellan Park System activities in this specific area will not include camping and other intrusive activities such as construction of facilities, new trails, parking areas, etc.). Consistent with the McClellan Park System land use is the occasional incidental interaction with surface and very near surface (0 – 6 in.) soils. Given the depth at which items were identified, the future land use of this area, and the inclusion of a deed restriction, the recommendation of clearance to 1 ft is considered appropriate.

8.4 Southern Transect Area ST-2

8.4.1 Description and History

This area consists of approximately 66 acres in the southern portion of the Supplemental EE/CA area. In all, 344 anomalies were intrusively investigated in ST-2. Of those, 52 anomalies (15%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-6). Two MEC items were recovered in ST-2 during intrusive operations and one during surface sweeps. The MEC items included two MKII practice grenades with live detonators, one found during intrusive operations and one found during surface sweeps, and one smoke rifle grenade, which only had a small quantity of its smoke charge remaining. All the MEC items located in ST-2 were located within 100 ft of each other. The two MKII practice grenades appear to have been dropped or discarded as the safety pins were present on both items.

The MEC scrap and fragmentation recovered in ST-2 do not indicate that the area was used as an impact site for Range 31's HE weapons. There is a light presence of MEC fragmentation; however, the fragmentation is widely spread out with no evident concentrations. These fragments may be the result of detonations to the north of ST-2 in the area that was designated in the EE/CA as M6-1M Transect Area 1 (South)-PR and has been recommended for 1 ft clearance. The majority of the fragments recovered in ST-2 are listed as "unknown" item type, as the UXO Technicians could not determine what weapon system produced the fragments. The type of MEC scrap recovered and presence of the underground bunker and target complex indicates the ST-2 area was likely utilized as a fire and maneuver training area.

8.4.2 Recommendations

The recommended alternative for Southern Transect Area ST-2 is NFA for unrestricted land use in this area. This alternative requires no action at the site and, therefore, may leave undiscovered MEC in the environment that could pose a potential risk to the public. This alternative does not impose any land use controls; however, it should include a deed notice in the property transfer documents that informs future property owners of the historical use and provides notification procedures in the event a MEC item is discovered. However, based on further review of the data and subsequent discussions with ADEM in November 2009, it was determined that a surface clearance would be appropriate for the NT-1N area (where the majority of the MEC-related items were found) for unrestricted land use,

8.4.3 Supporting Rationale

The risk analysis in Section 4.0 and the comparative analysis in Section 6.0 indicated that NFA would be appropriate for this area. Only three MEC items, two pinned (i.e., safety pin intact) practice grenades and a partially expended smoke rifle grenade, and a few MEC scrap and fragmentation items were found in this area. The scrap/fragmentation density is very low and widely distributed throughout the area. The types of MEC scrap items that were found in this area include items such as expended illumination signals and practice grenades with the MEC fragmentation being of an unknown weapons system. These items indicate that this portion of the Supplemental EE/CA investigation area was primarily used for fire and maneuver training activities. The documented historical use of this area, combined with the types of practice items found, support the recommendation for NFA.

8.5 Southern Transect Area ST-3

8.5.1 Description and History

This area consists of 15.6 acres in the southwestern portion of the Supplemental EE/CA area. In all, 202 anomalies were intrusively investigated in ST-3. Of those, 116 anomalies (57%) contained MEC, MEC-related scrap, or fragmentation (see Figure 3-3 and Table 3-7). The MEC items recovered include a WP hand grenade M15 with pinned fuze, 81mm WP mortar M57 with WP residue, 60mm HE mortar M49 with a sheared off fuze, and a hand grenade fuze with a possible live primer.

According to the ASR, ST-3 is in the direct fan of fire for Range 31 and the Defendum Rifle Range; however, it is unlikely that the Defendum Rifle Range contributed to the MEC-related items as the items listed as used at the range by the ASR are direct fire weapons and there is a mountain between the ST-3 area and the firing point. Another possible source for the MEC-related items is what appears to be an Open Burn/Open Detonation pit adjacent to Transect 50. It is possible that ordnance that failed to function or was determined to be unserviceable was brought to the area and detonated. This would account for the MEC items listed as 105mm projectile fragmentation being

present in this area and ST-2, since no known use of that weapon system is listed in the ASR for this area.

8.5.2 Recommendations

The recommended alternative for Southern Transect Area ST-3 is clearance to 1 ft. Components of this alternative include land surveying and brush clearing operations to prepare the site. Geophysical detection instruments will be used to locate subsurface anomalies, which subsequently will be investigated down to 12 in. After identification, the item will be disposed of as scrap or MEC in accordance with a previously approved MEC operations Work Plan. Residual risk that may remain will be managed through the inclusion of a deed that will prohibit digging in this area without performing clearance to depth. For example, if the current/future land owner changes the land use to include intrusive activities, such as camping, facility construction, new trails, parking areas, etc., clearance to depth will be required in the footprint of these areas.

8.5.3 Supporting Rationale

The risk analysis in Section 4.0 and the comparative analysis completed in Section 6.0 indicated that clearance to 1 ft should provide the appropriate protection for this area. MEC scrap and fragmentation were found to a depth of 24 in. and UXO to a depth of 12 in. in this sector. The majority of the scrap/fragmentation was found at lesser depths. The projected future use of this area at this time is the McClellan Park System, which for this specific area consists of activities such as hiking, walking, and biking (McClellan Park System activities in this specific area will not include camping and other intrusive activities such as construction of facilities, new trails, parking areas, etc.). Consistent with the McClellan Park System land use is the occasional incidental interaction with surface and very near surface (0–6 in.) soils. This alternative will include a deed restriction that prohibits digging in this area without performing clearance to depth. Given the depth at which items were identified, the future land use of this area, and the inclusion of a deed restriction, the recommendation of clearance to 1 ft is considered to be appropriate.

8.6 Costs

In Table 8-1, implementation costs for each of the alternatives represent stand-alone response actions. However, assuming that these alternatives will be implemented collectively, considerable cost savings are possible from the sharing of cost items among the various sites. For example, each area includes the cost for the preparation of an ESS. However, it is likely that only one ESS that addresses all areas could be prepared if the alternatives are collectively implemented, thus saving on the costs associated with duplication of efforts.

The boundary of the areas and corresponding acreage discussed in the previous sections are approximate. The boundaries were estimated based on the results of the DGM and recovered MEC and MEC-related items found during the Supplemental EE/CA investigation. All clearance areas will include a 200-ft buffer zone free of MEC. To achieve this 200-ft buffer zone, a step-out process may be required to ensure the buffer zone is free of MEC contamination. The cost estimates for recommended alternatives do not include the cost associated with any potential step-out areas.

8.7 Recurring Review

Follow-on activities associated with the Alpha Area will be conducted by the JPA in the form of recurring reviews. The recurring review process is consistent with Section 121(c) of

Table 8-1

Recommended Alternatives

			Estimated Cost
Northern Transect Area NT-1N	Surface Clearance	45.5	$450,000
Northern Transect Area NT-1S	No Further Action	41.9	$20,000
Northern Transect Area NT-2	Surface Clearance	18.4	$167,074
Southern Transect Area ST-1	Clearance to 1 ft	7.3	$203,514
Southern Transect Area ST-2	No Further Action	61.7	$20,000
Southern Transect Area ST-3	Clearance to 1 ft	15.50	$780,488

CERLCA, as amended by the Superfund Amendments and Reauthorization Act, and Section 300.430(f)(4)(ii) of the NCP. Recurring review as outlined by these statutes requires that periodic (at least every 5 years) reviews be conducted for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure

following the completion of remedial actions.

With the implementation of each alternative, recurring reviews should be completed every 5 years to ensure public health, safety, and the environment are being protected by these response actions. The reviews will evaluate site-specific factors that may impact the continued effectiveness of the response actions, such as changes in physical conditions at the site and/or changes in public accessibility and land use. More specifically, the reviews will focus on answering the following questions:

- Is the response functioning as intended?
- Are the assumptions used at the time of response selection still valid?
- Does new information indicate that the previously selected response is no longer protective of human health, safety, and the environment considering the best available technology?

9.0 REFERENCES

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