

Final
ORDNANCE AND EXPLOSIVES
FINAL REMOVAL ACTION REPORT
M2 Parcel
Fort McClellan, Alabama

PREPARED FOR:

U.S. ARMY ENGINEERING AND SUPPORT CENTER
HUNTSVILLE



Contract Number DACA87-99-D-0010
Delivery Order 0005
Project No. 2215.0005.0000.0000
Geographical District:
Mobile

PREPARED BY:

Foster Wheeler Environmental Corporation
Huntsville, Alabama

29 November 2000

The views, opinions, and/or findings contained in this report are those of the author (s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

Statement of Clearance
M2 Parcel, Fort McClellan, Alabama

The M2 Parcel, located within the boundary of Fort McClellan, Alabama, has been given careful search and has been cleared of all dangerous and explosive ordnance reasonably possible to detect. The ordnance items described in the enclosed final removal action report were recovered from the property.

It is recommended that:

The M2 Parcel be used for any purpose for which the land is suited.

This action has been conducted in accordance with Army Regulations 385-64 (Ammunition and Explosives Safety Standards) and the DDESB approved Explosives Safety Submission, 405-90 (Disposal of Real Estate).

SUBMITTED BY:

Harry L. Spear (date)
Col, EN
Commander, Engineering and Support Center,
Huntsville

APPROVED BY:

Glynn D. Ryan (date)
BRAC Site Manager

Enclosure:

Ordnance and Explosives Final Removal Action Report
M2 Parcel, Fort McClellan, Alabama

Ordnance and Explosives Removal Action
M2 Parcel, Fort McClellan, Alabama

Foster Wheeler Environmental Corporation performed an ordnance and explosives (OE) clearance action to remove dangerous OE materials from the M2 Parcel located at Fort McClellan, Alabama. The work was executed in accordance with work plans approved by the Engineering and Support Center, Huntsville and with the Explosive Safety Submission approved by the Department of Defense Explosive Safety Board for this project, and was performed in a manner consistent with current accepted industry standards for detection and removal of dangerous OE materials. However, complete and total assurance that all potentially dangerous OE items have been removed is not possible. Therefore, residual OE contamination may still be present within the limits of the M2 parcel.

John C. McIlrath, P.E. (date)
Project Manager

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ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ALDOT	Alabama Department of Transportation
ASP	Ammunition Supply Point
ASR	Archives Search Report
bgs	below ground surface
CEHNC	U. S. Army Corps of Engineers, Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CWM	Department of Defense Explosives Safety Board
DID	Data Item Description
DoD	Department of Defense
EA	Environmental Assessment
ESS	Explosives Safety Submission
FCR	Field Change Request
FMC	Fort McClellan
ft	feet
GIS	Geographic Information System
HTRW	Hazardous, Toxic, and Radioactive Waste
Hz	hertz
IAW	in accordance with
JPA	Anniston-Calhoun County FMC Joint Powers Authority
kHz	kilohertz
mm	millimeter
MPM	Most Probable Munition
MSD	Minimum Separation Distance
OE	Ordnance and Explosives
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
SI	Site Inspection
SOP	Standard Operating Procedures
SUXOS	Senior Unexploded Ordnance Supervisor
TDEM	Time Domain Electromagnetics
USATCES	United States Army Technical Center for Explosives Safety
USDOT	United States Department of Transportation
USRADS	Ultrasonic Ranging and Data System
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Site Safety and Health Officer
WP	White Phosphorous

1.0 Introduction

1.1 Purpose and Scope

1.1.1 The purpose of this project was to complete a removal action of all OE (unexploded ordnance [UXO] and inert ordnance) from the M2 Parcel at Fort McClellan (FMC), Alabama. This clearance was designed to be a final removal action prior to transfer of the M2 Parcel to the Anniston-Calhoun County Fort McClellan (FMC) Joint Powers Authority (JPA) for possible commercial development.

1.1.2 The scope of services included work plan preparation, Explosive Safety Submission (ESS) preparation, location surveys and mapping, UXO removal, turn-in of inert ordnance and metallic debris, quality control, and preparation of this document, the Ordnance and Explosives Removal Action Report. Draft and Final work plans were reviewed by the U.S. Army Engineering and Support Center, Huntsville; Fort McClellan; U.S. Fish and Wildlife Service; Alabama Department of Environmental Management (ADEM); and Environmental Protection Agency (EPA, Region 4). The final work plan was approved by the Engineering and Support Center, Huntsville. The ESS was reviewed by the U. S. Army Technical Center for Explosives Safety (USATCES) and the Department of Defense Explosives Safety Board (DDESB). Final approval was received from the DDESB on 26 July, 2000. A copy of the approval memorandum is included in Appendix K.

1.2 Authorization

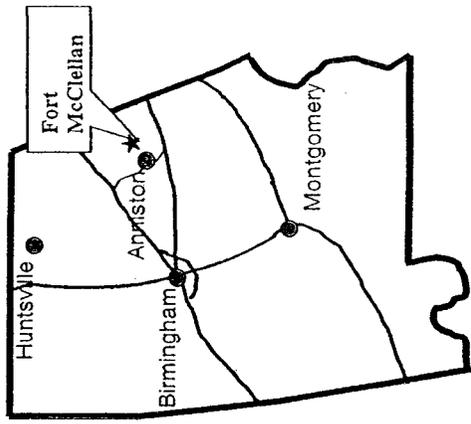
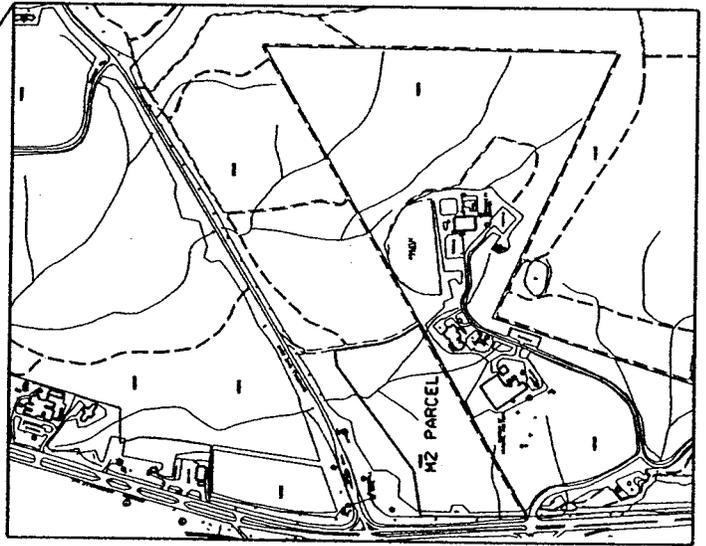
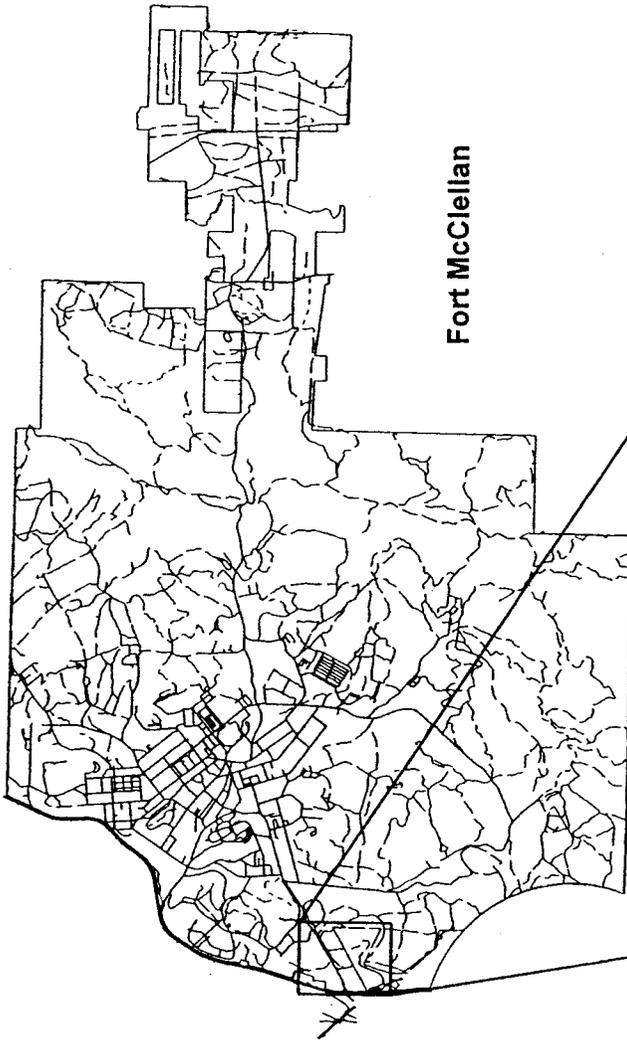
This project was authorized on 31 March 2000 as Delivery Order 0005, under Contract DACA87-99-D-0010, Ordnance and Explosives Response at Fort McClellan, Alabama.

1.3 Site Location

The M2 Parcel consists of approximately 22 acres and is located on the western boundary of Fort McClellan just south of the Summerall Gate Road. Figure 1- 1 shows the location of Fort McClellan and the M2 parcel within Fort McClellan. Figure 1-2 shows a close up of the M2 Parcel, the exclusion zone around the site, and surrounding features.

1.4 OE Background

1.4.1 The M2 Parcel had been identified as part of a much larger undocumented training area. Although the full extent of the training area had not been delineated, other site investigations determined that the potential presence of OE extends east from the Summerall Gate along the proposed route of the Eastern Bypass as well as encompassing the M2 Parcel. The potential OE that was suspected to be on the M2 Parcel and its associated hazards are identified in Table 1-1. No evidence of Chemical Warfare Material (CWM) has been associated with the M2 Parcel (and none was found during the removal action).



ALABAMA

NORTH

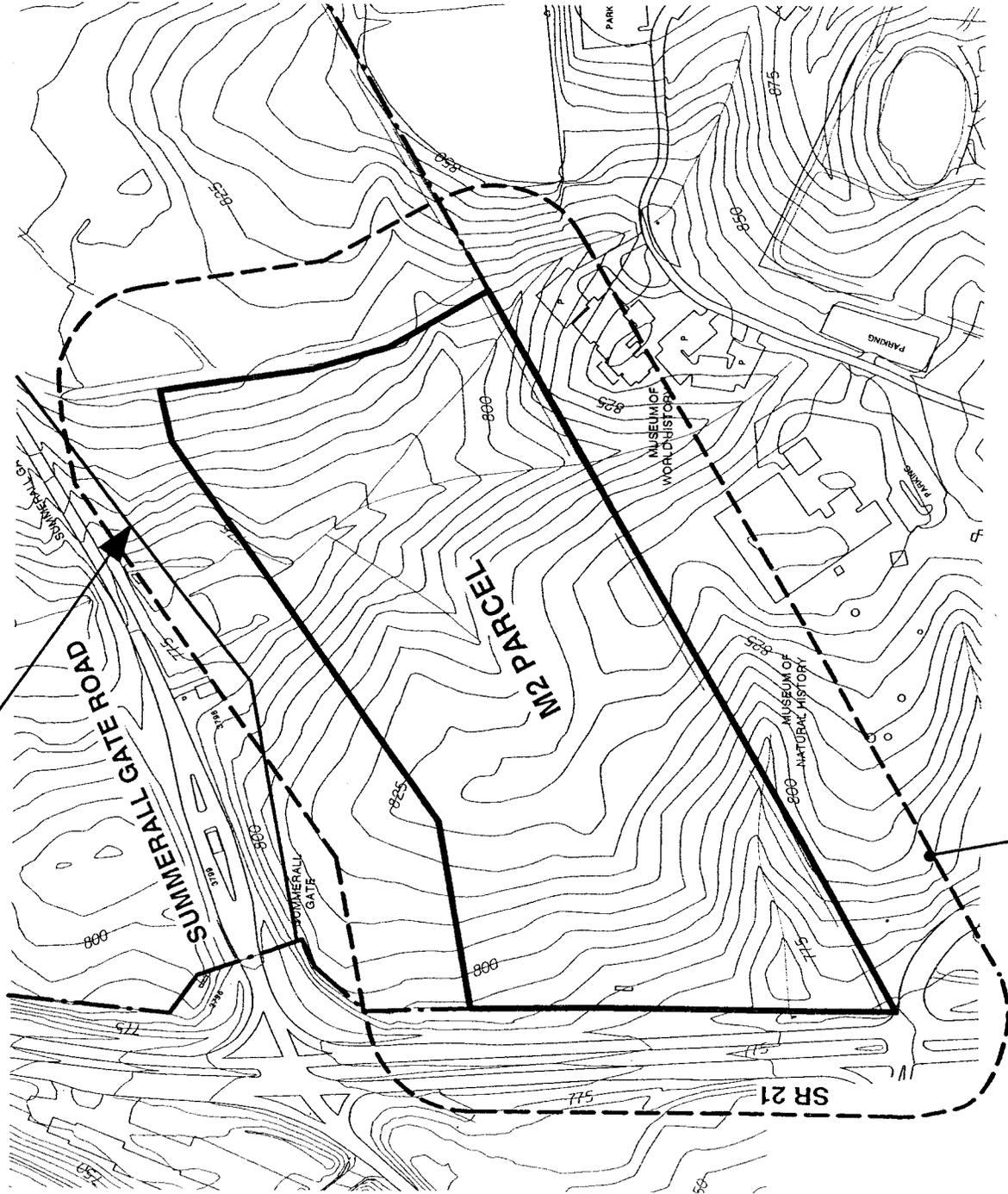
FIGURE 1-1

LOCATION OF M-2 PARCEL
 U.S. ARMY ENGINEERING
 AND SUPPORT CENTER
 HUNTSVILLE, ALABAMA
 CONTRACT No DACA87-99-D-0010
 FORT McCLELLAN, ALABAMA



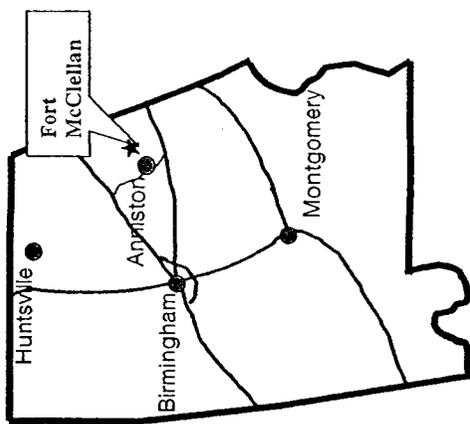
FOSTER WHEELER
 ENVIRONMENTAL CORPORATION

PROPOSED EASTERN BYPASS
RIGHT OF WAY

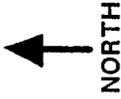


200 FT EXCLUSION ZONE

— M-2 Parcel Boundary
- - - Installation Boundary



ALABAMA



0' 100' 200' 300' 400'

FIGURE 1-2

M-2 Parcel Site Map

U.S. ARMY ENGINEERING
AND SUPPORT CENTER

HUNTSVILLE, ALABAMA

CONTRACT No DACA87-99-D-0010

FORT MCCLELLAN, ALABAMA



FOSTER WHEELER
ENVIRONMENTAL CORPORATION

Table 1-1. Potential OE at M2 Parcel

MUNITION/COMPONENT	EXPLOSIVE/INCENDIARY HAZARD	CALCULATED PENETRATION DEPTH
M15 WP Hand Grenades	15 oz. White Phosphorus filler, detonating fuze, 13.5g tetryl burster	Surface
60mm practice mortars (M69)	None	4 inches
Rifle (Burning type) Smoke grenades	Smoke filler, Incendiary	4 inches
2.36 inch practice rocket	None	10 inches
Rocket propelled ground Signals (slap flares)	Small explosive charge	3 inches
Surface trip flares (M48)	75 grain propelling charge, explosive	Surface
Practice hand grenades (MK II)	28.35 g black powder, explosive	Surface
Mine Activator, practice (M1)	Small explosive charge	Surface
Mine, anti-personnel, practice (M8)	11 g black powder, explosive	Surface

1.4.2 IT Corporation recently completed a site investigation (SI) of the M2 Parcel to determine whether chemical constituents are present at the M2 parcel and if present, whether the concentrations would present an unacceptable risk to human health or the environment. Following the collection and analysis of surface and subsurface soil, surface water, and sediment samples, IT concluded that there were no metals or organic compounds present in site media that posed an unacceptable risk to human health and the environment.

1.4.3 The US Army Corps of Engineers, St. Louis District, compiled an Archives Search Report (ASR) in 1996. The ASR was prepared by reviewing available records and reports documenting the history of the site. Historical information pertaining to site operations, including a listing of site investigations conducted before 1996, is contained within this document. In 1998, the U.S. Army Corps of Engineers, St. Louis District, revised the ASR to include suspect CWM areas. The ASR was finalized in July 1999.

1.4.4 The Final Archives Search Report (prepared by the US Army Corps of Engineers, St. Louis District) presented the findings of the site inspection and evaluation of potential ordnance and explosives occurrence at former Fort McClellan. Numerous areas suspected of being used for chemical warfare training or chemical warfare material storage were inspected. No indication of OE training, chemical training or chemical materiel storage was noted in the document to be within the boundaries of the M2 Parcel.

1.4.5 Barge, Waggoner, Sumner and Cannon, Inc. conducted an Environmental Assessment (EA) for the Alabama Department of Transportation (ALDOT) in August 1998. This document identified the economic and environmental impacts of the proposed eastern bypass and evaluated right-of-way alternatives for the bypass. A Finding of No Significant Impact was finalized in December 1999. The corridor of study for the proposed eastern bypass also encompassed the M2 Parcel. Threatened and endangered species were not anticipated within the M2 Parcel. Isolated wetlands associated with streams were described in three separate areas within the right-of-way, none of which is located in the M2 Parcel.

1.4.6 An Historical Aerial Photography Investigation of the Fort McClellan East By-Pass Study Area (1998) was prepared by Oak Ridge National Laboratory (ORNL) for the US Army Engineering and Support Center, Huntsville. It provided an analysis of land usage over a span of more than 50 years and potential areas of OE occurrence. Part of the M2 Parcel was included in the photographic coverage investigated by ORNL. There were also anomalies identified in photographic coverage overlapping the M2 Parcel that were recommended for further investigation.

1.4.7 Environmental Science & Engineering completed an Environmental Baseline Survey of Fort McClellan for the U.S. Army Environmental Center, Aberdeen, Maryland, in 1998. The document summarized the current environmental condition of Fort McClellan property. No environmental concerns were identified at the site of the M2 parcel.

1.4.8 Zapata Engineering conducted a non-intrusive ground reconnaissance in August 1998. The purpose of the ground reconnaissance was to resolve anomalies resulting from the Historical Aerial Photography Investigation and to visually identify areas of possible OE occurrence, which may not have been previously characterized within the proposed eastern bypass right-of-way. As documented in Zapata Engineering's Ground Reconnaissance Trip Report dated September 1998, no evidence of ordnance impact areas were identified within the areas in and adjacent to the M2 Parcel. However, several areas revealed evidence of possible training activities and were identified as potential sample locations. The most notable locations were in the northern portion of the proposed eastern bypass right-of-way, near Summerall Gate. In particular, possible training areas were located north and south of Summerall Gate Road, approximately 200 to 300 yards inside the installation boundary. These areas adjoin and overlap the M2 Parcel.

1.4.9 In February of 1999, Zapata Engineering conducted a geophysical survey of six areas encompassing 8.56 acres in and adjacent to the M2 Parcel. Approximately half of the geophysical data collected in Area 6 overlaps the M2 Parcel. Several subsurface anomalies were identified as potential OE. The complete geophysical report is located in Appendix B.1 of the Eastern Bypass EE/CA (April 2000).

1.4.10 In May of 1999, intrusive sampling was conducted in several of the areas previously mapped by geophysics. Several OE items used for training were found in sampling grids near the M2 Parcel. The items found included 60mm practice mortars, expended smoke rifle grenades, expended rocket propelled ground signals (slap flares), expended practice anti-personnel mines (M8), expended ground trip flares (M48), and an unexpended M1 mine activator. No intrusive sampling was performed within the M2 Parcel.

1.4.11 In February of 2000, Mr. Hank Hubbard, a safety specialist with the U.S. Army Corps of Engineers, Engineering Support Center, Huntsville (CEHNC), performed visual ground reconnaissance within and adjacent to the M2 Parcel, identifying the remains of a White Phosphorus hand grenade on the ground surface, approximately 250 ft north of the M2 Parcel.

1.4.12 Currently EODT, Inc. is performing a one-foot clearance over the proposed footprint of the Eastern Bypass to support pre-construction activities. Expended rifle smoke grenades and smoke grenades were found in grids adjoining the M2 Parcel on the northern boundary.

1.4.13 An Engineering Evaluation/Cost Analysis (EE/CA) study of the M2 Parcel was performed by the Engineering and Support Center, Huntsville, in April, 2000. Based on the findings and results of previous investigations in the vicinity of the site, and anticipated future use of the site, removal action alternatives were developed and evaluated. Surface and Subsurface Clearance to Depth with Land Use Controls was selected as the recommended alternative, "clearance to depth" requiring the removal of potential OE items regardless of depth.

1.4.14 On April 10th, copies of the Engineering Evaluation/Cost Analysis (EE/CA) for the M2 Parcel were placed in the information repositories for a 30-day public review. On Wednesday, May 10, 2000, the Anniston/Oxford community had the opportunity to discuss their comments and ask questions on the proposed action. The date and time of the public meeting was advertised the week prior to the meeting in the Anniston Star Press.

1.4.15 Representatives of the US Army Engineering and Support Center - Huntsville, the Fort McClellan Transition Force, the US Environmental Protection Agency, the Alabama Department of Environmental Management, the Joint Powers Authority, and the US Army Corps of Engineers Mobile District were available to answer questions and respond to comments during this time period. A formal presentation was not made. Posters containing maps and information about the project were displayed for review.

1.4.16 Responses to written comments received from the public prior to the meeting were included in Appendix G of the Final EE/CA (May 2000). In addition, a formal response to each written public comment was mailed directly to the individual making the comment. Copies of the EE/CA document are available at the Anniston Calhoun County

Public Library in Anniston, Alabama and the Houston Cole Library, located at Jacksonville State University, Jacksonville, Alabama.

1.4.17 An Action Memorandum approving the selected alternative was signed by Glynn D. Ryan, BRAC Site Manager, on 4 August, 2000.

1.4.18 Following the approval of the recommended alternative, a (1) site-specific work plan (M2 Parcel Ordnance and Explosives Removal Action Work Plan) and (2) an explosives safety submission (ESS) (Explosives Safety Submission M2 Parcel Ordnance and Explosives Removal Action) for implementing the selected alternative at the M2 parcel were prepared by Foster Wheeler Environmental. Following approval of the site-specific work plan, onsite activities were initiated May 22, 2000.

1.4.19 The purpose of the ESS is to ensure that all applicable DOD and Army regulations regarding safe and secure handling of ordnance are followed. Intrusive operations may not begin until the ESS has been reviewed by the U.S. Army Technical Center for Explosives Safety (USATCES) and received final approval of the Department of Defense Explosives Safety Board (DDESB). The ESS received final approval of the DDESB on 26 July, 2000 (Appendix K contains a copy of the approval memorandum).

2.0 Discussion

Field work began on May 22, 2000 with the start of brush clearance activities and was completed the week of September 18, 2000. In all, seventy-two grids of 100 ft x 100 ft and 31 partial grids were cleared of OE in accordance with the approved removal alternative *Surface Clearance and Subsurface Clearance to Depth* (Clearance to depth means removal of potential OE regardless of depth). The total area cleared was approximately 22 acres. All field activities including site preparation (brush clearance and location surveys), geophysical surveying, anomaly reacquisition, and intrusive operations are described in this section. Quality Control and Quality Assurance are discussed in the next section.

2.1 Site Preparation Activities

2.1.1 Brush Clearance

2.1.1.1 Brush clearance began May 23, 2000 and was completed June 12, 2000. Brush clearance was necessary to prepare the site for subsequent phases of work including the geophysical survey, reacquisition, and intrusive OE removal activities. More specifically, the clearance was required to allow the survey operators to safely and efficiently move through and across the site all the while allowing the detector instrument to pass directly over the area being surveyed. This required the removal of brush, vines, and small trees (3 inches and less) to within 4 inches of the ground (to prevent risk of tripping) and the removal of hanging limbs and vines to provide a minimum 8-foot overhead clearance. The latter was required to provide clearance for the transmitting antenna centered above the operator's head.

2.1.1.2 A UXO specialist provided anomaly avoidance services during the brush cutting operation. The specialist proceeded ahead of the brush team, checking the surface visually and with a magnetic locator instrument (Schonstedt 52 CX), for suspect UXO items. No UXO items were found during the brush cutting operation. Every effort was made to minimize the size and number of trees removed. Trees selected for removal were marked by Foster Wheeler Environmental employees and then inspected by representatives of Consolidated Publishing (interested property purchaser) prior to removal.

2.1.1.3 Brush clearance was performed by a local subcontractor, Burford's Tree Surgeons, using a combination of mechanized equipment (tractors with cutters, wood chippers) and power hand saws. The operation took 12 work-days and was completed over a period of three calendar weeks.

2.1.2 Location Survey

2.1.2.1 A location survey was performed during the week of June 5, 2000. The purpose of the survey was to locate the corners of the M2 Parcel boundaries and to locate contiguous 100 ft x 100 ft grids for subsequent geophysical surveying. The parcel boundary corners

and the four corners of each grid were located to the nearest 1.0 ft. The survey was performed by Sain Associates, of Birmingham, Alabama.

2.1.2.2 Grid-naming nomenclature consisted of alphabetical row (A to G) and numerical column (0 to 17) designations, starting at the southwest corner of the M2 Parcel. One hundred and three (103) grids were marked starting with A0 and ending with G-17. Of these 103 grids, seventy-two (72) are completely within the site boundaries. The remaining 31 grids are along the perimeter of the M2 Parcel and have the site boundaries passing through each one.

2.2 Geophysical Surveying and Anomaly Reacquisition

2.2.1 Field Effort

2.2.1.1 The geophysical surveying and anomaly reacquisition process began June 7 and was completed 29 August. Surveying was performed on a total of 103 grids (72 full 100 X 100 ft grids and 31 partial grids) plus two ditch areas (Ditch A located within E13, F13, and G13 and Ditch B located within A3, A4, B4, and B5).

2.2.1.2 The M2 parcel work plan stated that geophysical surveys would be completed on 200 ft x 200 ft grids. However, in setting up for the surveys, it was determined that due to the terrain conditions and the number of trees, more optimum positioning data would be achievable with smaller setups. Since the site had been surveyed (civil location survey) into 100 x 100 ft grids, geophysical surveys were completed on 100 x 100 ft grids. The work plan was not revised to reflect this change. Setting the USRADS up on 100 x 100 ft grids meant having to reset the USRADS after completing each 100 ft x 100 ft grid. The setups are time consuming and therefore had a negative impact on survey production rates. The CEHNC senior geophysicist inspected the operation on June 22 and recommended a return to the larger (200 ft x 200 ft) setups. Only the ChemRad team was able to set up on the larger areas. The ChemRad team was using a later generation USRADS that was capable of covering a larger area than the USRADS used by the Foster Wheeler Team. Although USRADS were set up on larger areas, the geophysical surveys were still performed on the 100 ft x 100 ft grid sizes.

2.2.1.3 The purpose of the geophysical surveys was to locate subsurface metallic items considered to have the potential of being ordnance-related items. The surveys were conducted by two three-man teams, one consisting of Foster Wheeler Environmental Corporation (FW) technicians and the other consisting of ChemRad (geophysical survey subcontractor) technicians. In accordance with the M2 Parcel work plan, the USRADS (Ultra-Sonic Ranging and Detection System) navigation system coupled with the Geonics EM-61 detector was used to perform the surveys.

2.2.1.4 The survey results were corrected for time lag and the bias eliminated from the top and bottom coils daily at the project site and then electronically transmitted to the Foster Wheeler Environmental Central Processing Facility in Lakewood, CO for further

processing, discrimination and development of reacquisition dig sheets. Databases were developed for the processed data and are included on the attached Compact Disk (CD) included with Appendix A.

2.2.1.5 The processed EM61 data was generated on individual (by grid) color-coded maps to show the strength and locations of anomalies selected for reacquisition. The anomaly maps are included in Appendix A along with a color-coded map of the entire parcel.

2.2.1.6 The purpose of reacquisition was to mark for investigation, those anomalies thought to have the greatest potential to be OE items. The reacquisition phase was performed by Foster Wheeler Environmental technicians. In accordance with the work plan, anomalies were reacquired using the same system used to perform the surveys: the USRADS (Ultra-Sonic Ranging and Detection System) navigation system coupled with the Geonics EM-61 detector.

2.2.1.7 Initially, reacquisition was performed by one three-man team, however, a second three-man team was added on August 5 to reduce the remaining reacquisition schedule. Overall, a total of 3350 anomalies, or an average of 33 anomalies/grid were reacquired.

2.2.2 Line Spacing

2.2.2.1 Our past experience, based on testing performed under various conditions (climate, topography, vegetation, cultural features, etc.) by Foster Wheeler geophysicists at various other sites, has shown that to ensure adequate coverage and sample density for the detection of small targets (e.g., slap flares, practice hand grenades, etc.) with a high degree of confidence, the requisite sample density is approximately 2-3 measurements per square foot (ft). This density is consistent with a line spacing of approximately 2 ft and a station spacing of approximately 0.25 to 0.5 ft with the EM61. Increased line and/or station spacing can significantly increase the acreage that can be surveyed by a geophysical team in a given time frame; however, the likelihood of detecting smaller items decreases drastically for any increase in these parameters.

2.2.2.2. In order to provide more quantitative information on the line spacing parameter for the objectives of the M2 Parcel survey, a "walk-away" test was performed. In a walk-away test, the instrument is moved laterally away from a target and the relationship between the signal intensity and the lateral distance from the target is analyzed. The primary test objective was to acquire information for the estimation of the data acquisition line spacing parameter. Secondary test objectives included acquiring information on the signal intensity/geometry for data interpretation purposes. To perform the test, an inert hand grenade was buried below the ground surface (3 inches from ground surface to center of hand grenade) and the center of the EM61 coil was moved away from the grenade to obtain quantitative data on the response characteristics. These data exhibited that at a distance of 0.75 meters from the center of the coil (1 meter in width), the response was approximately 2 mV above the local background. However, due to the rough terrain and numerous obstacles (e.g., trees) at the M2 parcel, which cause short-term deviations in the attempted data acquisition path, the line spacing was

set at 0.60-0.75 meters (0.40-0.25 meter coil overlap on adjacent lines) to account for these potential deviations. At this line spacing, the response from the hand grenade was 7-10 mV above the local background. The maximum signal intensity (center of coil directly over target) was 14 mV above the local background.

2.2.3 Grid Sizes

The size of the investigation grids (1/4 acre) was selected based on the rugged terrain and obstacles present at the M2 parcel and their adverse affect on the data acquisition process and positioning instrumentation. In addition, the area was segmented into survey grids for "bookkeeping" purposes as requested in the client's SOW for the project.

2.2.4 Target Objectives

Due to the nature of training that is suspected to have occurred on the M2 Parcel, OE training items were expected to be found on the ground surface or within the top eighteen inches of the subsurface. Potential items that were anticipated included: WP hand grenades, 60mm practice mortars (M69), Rifle smoke grenades (burning type), 2.36-inch practice rockets, rocket propelled ground signals (slap flares), surface trip flares (M48), practice hand grenades (MK II), practice mine activators (M1), and practice anti-personnel mines (M8). See Table 1-1 in section 1 for additional details concerning the Potential OE items that were anticipated. The anticipated depth of the training items anticipated was less than eighteen inches below the ground surface.

2.2.5 Data Processing and Analysis

The data were processed and analyzed in concurrence with the general processing/analysis sequence portrayed in the General Site-Wide Work Plan. Target selection criteria were based on the smallest OE objectives of interest at the site. The selection of a target was based on the relationships between the signal intensities of Channel 1, 2, and 4, data acquisition path geometry, surrounding background characteristics, and the areal shape of the potential target. In general, signal intensity peaks separated by more than a 1 meter distance were selected as individual targets unless the characteristics of the target (shape, signal intensity, and horizontal gradient) indicated a singular target.

2.2.5.1 For undiscriminated grids, all potential metal targets were selected except those interpreted to be utilities. For discriminated grids, discrimination was based on the analysis of the excavation results from the undiscriminated grids, as well as the initial investigation of the discriminated grids. After the analysis of the excavation results from the first several discriminated grids, the discrimination protocol remained constant for the remaining grids that were discriminated. Discriminated grids contained priority (p) and validation (v) targets. Twenty percent of the validation targets were excavated to exhibit the repeatability of the discrimination process. Validation targets that were excavated were termed quality (q) targets in the Microsoft Access database. The results for the undiscriminated and discriminated grids are presented in the Microsoft Access database included on the attached compact disk (CD) in Appendix A.

2.2.5.2 The final discrimination criteria were based on the analysis of the walkaway test, excavation results from the undiscriminated grids, and the investigation of the excavation results from the initial discrimination grids (F16/17, F9-F13, C9, C10, D9, D10).

Overall, the final discrimination criteria used were conservative based on the evaluation of the excavation results from those grids that were initially discriminated. For this specific interpretation the definition of conservative can be summarized as follows:

If there was uncertainty in the application of the discrimination criteria (reviewed below) due to one or more of the data characteristics (e.g., signal intensity, acquisition path geometry, anomaly shape, influence of surrounding anomalies) being inconclusive, the target was selected for excavation.

2.2.5.3 A combination of signal intensity relationships, acquisition path geometry, and subsequent 2D shape of the anomaly (including other anomalies in close proximity e.g., debris areas) were used to select targets in grids that were discriminated. Discriminated grids contain priority (p) and validation (v) targets. 20 % of the validation targets were randomly selected (random number function in MS Excel) to exhibit the repeatability of the discrimination process. Validation targets that were excavated are termed quality (q) targets in the Microsoft Access database.

2.2.5.4 While it is not possible in all cases to exactly quantify the discrimination criteria due to the complex interrelationships between the data characteristics (signal intensity, acquisition path geometry, anomaly shape, influence of surrounding anomalies) and the influence of the site characteristics (topography, vegetation, cultural features), the following general guidelines were implemented during the discrimination process to select priority (p) targets for excavation:

- Channel 2 signal intensity > 7 mV above the local background
- Anomaly apparent on minimum of two adjacent data acquisition transects (the determination of “apparent” is a signal intensity at anomaly edges exceeding ~ 2mV above the local background average). If apparent on more than two data acquisition lines then Channel 2 signal intensity criteria decreased to ~ 5 mV. If apparent on more than three data acquisition lines then Channel 2 signal intensity decreased to ~ 3 mV.
- Distance between adjacent transect < ~ 3.3 ft. If > 3.3 ft then Channel 2 signal intensity decreased to ~ 5 mV.
- Ratio between minor and major axes of anomaly from ~ 0.5-1.5; edges of anomaly exhibit defined trend(s) and lack sinuosity
- Minimum interference from adjacent anomalies. Where interference from other anomalies is present (e.g., debris area), Channel 2 signal intensity decreased to ~ 5 mV.

- At the time the grid was discriminated, previous excavation information from areas and anomalies exhibiting similar data characteristics, especially in debris areas (broad, orange colors on color-coded images).

2.2.5.5 When comparing anomaly characteristics and excavation results, the signal intensity data should be viewed with the acquisition line path as a color-coded and/or contoured image at an appropriate color/contour interval (not greater than 2 mV). The signal intensity values should be acquired from the processed data files for each grid (xyz file extension) that accompany this report on a CD-ROM. The signal intensity values for Channel 1 and 2 in the MS Access database in some cases represent filtered values, and caution should be used when performing analyses (e.g., comparison with excavation information) with these filtered data values.

2.3 OE Intrusive Operations

2.3.1 OE intrusive operations started on Monday, August 7, 2000 and were completed over a four-week period, ending on Thursday, August 31, 2000. The purpose of the intrusive operations was to remove all OE items, the most important being unexploded ordnance (UXO) items. Intrusive operations were performed by the Foster Wheeler Environmental UXO subcontractor USA Environmental (USA). For the first two weeks of operations, the activities were performed by one 7-man team consisting of six UXO Technician II's and one Senior UXO Supervisor (SUXOS). Two USA teams performed intrusive operations during weeks three and four. The second team consisted of six UXO Technician II's and one UXO Technician III (supervisor). FW provided the UXO Safety Officer (UXOSO) and the UXO Quality Control Specialist (UXOQCS).

2.3.2 An evaluation of the first two weeks of intrusive operations indicated that productivity, as measured by the number of grids completed per day, was not high enough to permit completion within schedule. This was thought to primarily be due to the number of anomalies being investigated, the amount of metallic non-OE debris being encountered, and the difficulty of digging in the subsurface due to the hard clay/soil and root conditions. To increase the productivity rate a second team was mobilized to complete intrusive operations. The second team started on Sunday, August 20.

2.3.3 Because of public safety concerns, it was necessary to limit intrusive operations within 200 ft of the public to times that public access could be restricted without causing excess inconvenience to the public. Operations in grids located along the western boundary of the site adjacent to Highway 21 and the first row of grids (the A row) bordering the southern boundary of the site adjacent to the museums of Natural History and World History were affected. Intrusive operations within the grids located along the western boundary of the M2 Parcel adjacent to Highway 21 were not permitted until arrangements could be made to close the highway and detour vehicles. The Fort McClellan Transition Force Operations coordinated this requirement with the Alabama Department of Transportation. On Sunday, August 20, the Anniston Police Department closed both north and south-bound lanes of the highway from 6 AM to 4 PM to permit

intrusive operations within the grids. Intrusive operations were completed within all 18 grids. Because grids located in the far southwest corner were also within 200 ft of the entrance to the museums located south of the M2 Parcel, the entrance was also blocked to traffic during the intrusive operations. Intrusive operations in other grids located along the southern border of the M2 parcel and within 200 ft of the museums were timed to occur in the early morning prior to workers and visitors arriving at the museums. The museum director was present at the coordination meeting held earlier to discuss the required closures, wherein it was agreed that intrusive operations affecting the museums would be conducted prior to museum personnel arriving for work each day. During the time that intrusive operations were in progress in the grids involved, project personnel watched for traffic coming into the area and operations were terminated when the first vehicle came into the museum area.

2.3.4 Items recovered during the intrusive operations were classified as follows:

- OE Debris (Ordnance and Explosives Debris)
- UXO (Unexploded Ordnance)
- Practice Ordnance
- Small Arms
- Non OE Scrap

2.3.4.1 The distribution of recovered items is presented below. For each classification, the number of investigated anomalies that resulted in recovery of the listed item is shown. A review of the data shows that OE/OE-related material (UXO, Practice Ordnance, and OE Debris) was recovered at less than 1-percent of the anomalies investigated and that non-OE related materials (small arms and non-OE scrap) were collected at over 99-percent of the anomalies investigated. Figure 2-1 shows the M2 parcel and the locations at which OE and non-OE items were located. Appendix B contains tables that list for each grid, the description of items found during the initial intrusive investigation and subsequent anomaly reinvestigations (i.e., QC checks).

Items Recovered	Number of Anomalies	Percentage of Total Items
UXO	1	.03%
Practice Ordnance	2	.05%
OE Debris	26	.65%
Small Arms	419	10.5%
Non-OE Scrap	3537	88.8%

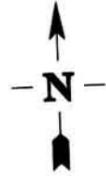
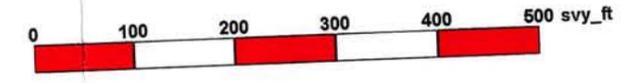
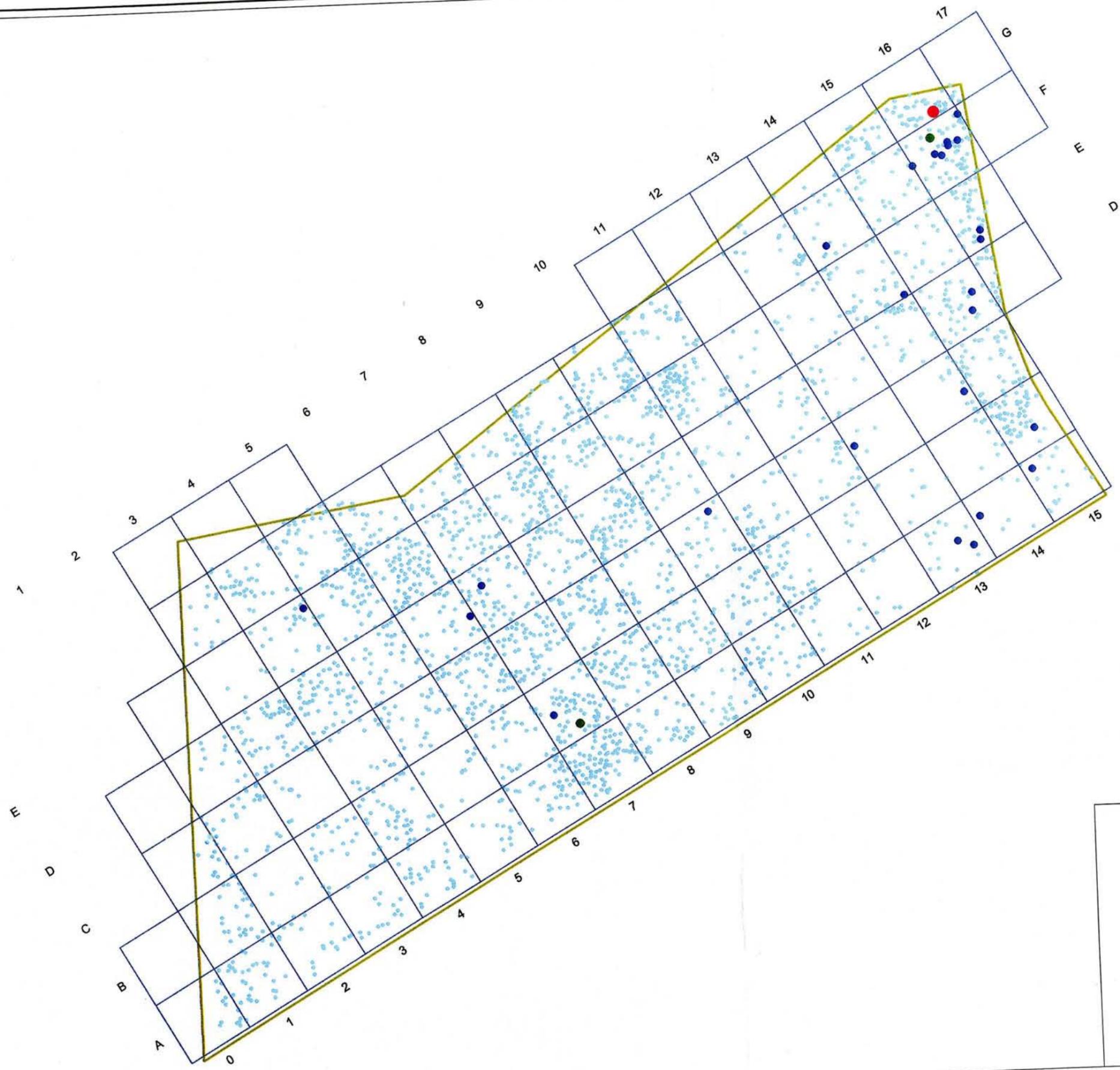
2.3.4.2 UXO. The one recovered UXO item was an M-15 white phosphorous hand grenade found in Grid G16 (Anomaly # 22). No white phosphorous was found in the grenade. The item was subsequently transported to Range 18 and destroyed. Figure 2-1 shows the location of the UXO item found in the far northeast corner of the site.

2.3.4.3 Practice Ordnance. The two practice ordnance items consisted of one (1) M-1 practice anti-tank land mine found in Grid F16 (Anomaly 33) and one (1) empty training grenade found in Grid B07 (Anomaly 13). Because it was suspected to possibly contain a

spotting charge, the practice land mine was destroyed on site at Grid F16. Figure 2-1 shows the locations of the practice ordnance items. The practice land mine was found in the far northeast corner in the same general vicinity as the UXO item.

2.3.4.4 OE Debris. OE debris primarily consisted of expended portions of rifle grenades, slap and rifle flares, and parts of hand grenades. Approximately 12 pounds of OE debris were recovered and transported to the EODT, Inc. secure waste processing area where it will receive a final inspection to certify it free of explosives prior to final disposal. Figure 2-1 shows the locations of the OE debris items found.

2.3.4.5 Small Arms. Small arms are ammunition that consists of cartridges and shells used in rifles, pistols, machine guns, and shotguns. The small arms found on the M2 Parcel consisted of .30 caliber cartridges, both expended and unexpended. The unexpended small arms were turned into the Ammunition Supply Point (ASP, operated by the Alabama National Guard) for salvage/recycle/disposal.



LEGEND

- UXO
- Practice Ordnance
- OE Debris
- Non OE Scrap

FIGURE 2-1
 ORDNANCE AND EXPLOSIVES (OE)
 AND NON-OE MATERIALS RECOVERED AT M2 PARCEL
 U.S. ARMY ENGINEERING AND SUPPORT CENTER
 Huntsville, Alabama
 Contract No. DACA87-99-D-0010
 Fort McClellan, Alabama



Foster Wheeler
 Environmental Corporation

2.3.4.6 Non OE Scrap. The Non-OE scrap consisted of cultural metal debris including multiple nails, horseshoes, wire, pipes, tools, sheet metal, cans, metal re-bar, and other miscellaneous metal debris. In all, approximately 1465 pounds of non-OE scrap were recovered. Figure 2-1 shows that non-OE scrap was ubiquitous across the site.

2.3.5 Consistent with the type of training exercises thought to have occurred at the site, greater than 99-percent of the items recovered were within 18 inches of the ground surface, and more than 95-percent were at a depth less than 6 inches. There were several items found deeper including a steel shovel at 2.5 to 3 ft (Grid B-14, Anomaly 4) and an expended smoke rifle grenade at 2.5 ft (Grid F16, Anomaly 46). The range of depths at which the items discussed above were recovered is presented below:

Items Recovered	Surface to 6 Inch Depth	>6 to 12 Inch Depth	>12 to 18 Inch Depth	>18 to 24 Inch Depth	>24 to 36 Inch Depth
UXO	100%	--		--	--
Practice Ordnance	100%	--	--	--	--
OE Debris	96%	--	--	--	4%
Small Arms	97%	3%	--	--	--
Non-OE Scrap	95%	4.5%	<1%	<1%	<1%

2.3.6 The white phosphorus hand grenade and the practice anti-tank land mine were both destroyed by Foster Wheeler Environmental UXO specialists. Because of a high fire index and abundance of fuel (i.e., vegetation) in the area, the hand grenade was transported by Foster Wheeler UXO-qualified technicians to Range 18 for disposal. The item was disposed of by open detonation. The practice anti-tank land mine considered to possibly contain a spotting charge was vented with a perforator charge onsite at Grid F16 where it was located.

2.3.7 Tables B-1, B-2, and B-3 in Appendix B lists for each grid, the description of items found during the initial intrusive investigations (B-1), the first QC check (B-2) and the second QC check (B-3). Each table lists grid number, anomaly number, general description, object description, and depth. Additional information is included on the data CD included in Appendix A.

3.0 Tests

3.1 Quality Control

3.0.1 In accordance with the work plan, Foster Wheeler Environmental performed quality control (QC) on 100-percent of the grids that were surveyed and intrusively investigated. During the initial intrusive investigation and the follow-up QC investigations, the dig teams continuously encountered excessive and scattered cultural electromagnetic conductive debris (e.g., nails, horseshoes, wire, metal tools, and more). After removal of the debris, continued investigation of the anomaly location would only yield more cultural debris. This situation was often repeated throughout the site.

3.0.2 To provide assurance that anomaly reacquisition was being performed in compliance with the M2 Parcel work plan and the standard procedures contained within the plan, the UXO Quality Control Specialist (QCS) performed surveillance checks of the teams as they located anomalies and placed the pin flags marking the anomaly location. The QCS recorded his observations and/or conclusions on the Surveillance Form. The surveillance checks verified that the reacquisition process was being performed in accordance with the M2 Parcel work plan procedures. (Surveillance Forms are included in Appendix C, Quality Control Documentation).

3.0.3 On August 8, the reacquisition team observed that many of the excavations being performed at Grid E11 were not located near the flags and notified the Foster Wheeler UXO QC Specialist (UXOQCS). The UXOQCS investigated the grid and confirmed that there were still some hits at the flags or within 3 feet of the flags. Concerned that ineffective digging may have taken place at Grid E11, the UXOQCS conducted a test on August 9. The test was conducted using the hand-held EM 61 and the Whites locator on 10 randomly selected anomalies in Grid E11. The test was conducted in order to determine whether any further anomalies existed adjacent to the flags and whether or not OE items were missed. Based on the results of the test, the UXOQCS concluded that the dig teams were detecting and removing the targeted items adjacent to the flags and were leaving only non-OE scrap, and concluded further that the dig teams were performing at the required level. The observations and tests were reported in Surveillance Forms for August 8 and 9, included in Appendix C, Quality Control Documentation.

3.0.4 The M2 Parcel work plan states that the hand-held EM 61 will be used to screen the excavations to verify that there are no additional anomalies present. This occurs after the anomaly already has been located (reacquired) with the hand-held EM 61 and the anomaly flag has been placed to pinpoint the target. A field change was implemented August 12, 2000 to allow the use of the White's Metal Detector as a suitable and approved substitute for "clearing" the holes. The rationale is included in the Surveillance Form (8/10/00) included in Appendix C Quality Control Documentation and in the approved Field Change Request (FCR) included in Appendix J. The change was implemented to effect only the "clearance" of holes and not the reacquisition of anomalies and because the excavation (dig) teams were not all trained in the use of the

hand-held EM 61 instrument. All grids intrusively investigated or reinvestigated after August 12 were subject to this change.

3.1.1 Grids A3-15, B3-15, C4-15, D4-16, E5-16, F5-17, G11-17, Ditch A, and Ditch B

In accordance with the approved M2 Parcel work plan, the results of all (100%) anomalies investigated were reviewed by the Foster Wheeler geophysicists to determine if the item recovered was consistent with the geophysical signature recorded during the Geophysical survey (i.e., was the item description consistent with the size, mass, and/or depth expected). Dig teams returned to anomaly locations when detailed descriptions of the excavated items on the dig sheets did not match the signal. In some instances the data recorded by the dig teams were not sufficiently detailed for the geophysicist to conclude that the correct items had been found. As an example, the site was heavily covered with cultural metal debris (nails, horseshoes, wire, metal tools, and more), and a finding of nails was often reported as “nail” or “nails” without describing the size and/or the number of nails. Without sufficient evidence that the anomaly had been well and truly excavated, the geophysicist was conservative and assumed the anomaly had not been completely identified and removed.

3.1.1.1 This evaluation process resulted in approximately 25-percent of the anomalies being reinvestigated. Findings during this reinvestigation process consisted of Non-OE scrap (96%), OE debris (0.3%), small arms (<4%), and one (1) “practice ordnance” item.

3.1.1.2 It was during this reinvestigation of anomalies that the practice anti-tank land mine (Grid F16, Anomaly 33) was discovered. Because of this finding, Foster Wheeler Environmental decided to re-survey Grid F16 to confirm the accuracy of the original survey results. The geophysical data from the resurvey were reviewed by the geophysicist and determined to be consistent with the original survey. No further investigation of the grid was considered necessary. The reinvestigated anomalies are fully indicated and recorded in the database CD included in Appendix A. Table B-2 in Appendix B lists the findings by grid number and anomaly ID.

3.1.1.3 Despite thorough exploration during the initial Quality Control excavation activities, there were still a few discrepancies between anomaly strength and size and the descriptions of the excavated items. As a result, after close review, certain anomalies were selected for a third investigation. However, based on what was found during the anomaly excavations, including the reinvestigated anomalies, the evidence suggested that continued investigations would not result in the finding of any potentially dangerous OE items. More than likely further excavation would result in the recovery of additional cultural metal debris. Based on this conclusion, the final QC check was limited to those anomalies that were of sufficient size (65 mV and larger) and surface area (visible on at least two lines) that they warranted a third investigation. These were referred to as “priority” rechecks. One hundred and sixty-one (161) priority rechecks were identified. Of these, 144 were investigated.

3.1.1.4 During this third attempt to identify the anomalies, generally excavated items of appropriate size and surface area were uncovered to validate the reinvestigation. Findings were limited to Non-OE scrap (cultural metal debris) and small arms. No OE debris, UXO, or practice ordnance items were found during this final recheck. The reinvestigated anomalies are fully indicated and recorded in the database CD included in Appendix A. Table B-3 in Appendix B lists the findings by grid number and anomaly ID.

3.1.1.5 Seven of the priority rechecks that were not investigated were within grids located along the western boundary of the site, within 200 ft of the highway. These grids already had passed both quality control checks by Foster Wheeler Environmental and quality assurance checks by the CEHNC on Sunday, August 20, the same day that the intrusive investigations were conducted. As explained earlier (Section 2), because of proximity to the public, it was necessary to temporarily close the highway to traffic on the day these grids were intrusively investigated (Sunday, August 20). In order to prevent a second closing of the road at a later date, causing further inconvenience to the public, both quality control checks by Foster Wheeler and quality assurance checks by the CEHNC Safety Representative were completed the same day (see discussion below). The remaining ten priority rechecks that were not investigated were anomalies that, based on the cumulative findings of non-OE scrap between the initial and first reinvestigation (first QC check), did not justify further investigation.

3.1.2 Grids A0-2, B0-2, C1-3, D1-3, E2-4, F3-4, G3-5

QC of grids located within the 200 ft distance of the highway was performed differently. In order to prevent a second closing of the highway at a later date, both Foster Wheeler Environmental QC and CEHNC QA were performed on August 20 during the road closure. The QC was performed by the Foster Wheeler Environmental UXO Quality Control Specialist (UXOQCS). QC of the excavations was performed by sweeping the excavations within each grid with a Schonstedt 52 CX Magnetic Locator instrument to determine if any potential OE items remained. Initially 100-percent of the holes within each grid were checked. However, due to the success of the checks, the number of holes checked was reduced to approximately 75-percent within each grid. All grids passed the QC process. The CEHNC onsite safety representative investigated up to 30% of the open (i.e., non-excavated) area within each grid using a Schonstedt 52 CX Magnetic Locator instrument. All grids passed the CEHNC QA process. Site QC documentation is included in Appendix C.

3.2 CEHNC Quality Assurance

The Senior Geophysicist for the CEHNC performed geophysical quality assurance testing on six grids (C7, C15, D7, F15, G16, and G17) following completion of removal activities and quality control checks by Foster Wheeler. The QA report (Quality Assurance Audit Evaluation) prepared by the CEHNC senior geophysicist includes the methods, findings and conclusions of the audit, and is included in Appendix H.

3.2.1 On 1 September CEHNC geophysicists conducted a geophysical QA on grids F15, G16, and G17. The QA was performed using the same type of equipment and instruments used by Foster Wheeler Environmental to survey and reacquire anomalies, the USRADS for navigation and an EM-61 to detect anomalies and an EM 61 Hand-Held (HH) for reacquisition. The grids passed the CEHNC QA process.

3.2.2 On 14 September, CEHNC performed additional geophysical QA on grids C7, D7, and C15. An independent CEHNC contractor using a GEM3 detector under direction of the CEHNC Senior Geophysicist performed this QA task. The GEM3 detector is a frequency domain electromagnetic instrument that can operate over a bandwidth of 300Hz to 24 kHz. These grids also passed the CEHNC QA process.

3.2.3 The on-site CEHNC Safety Representative also performed QA of each grid. This consisted of surveying a portion of the open area (i.e., non-excavated areas) within each grid with a Schonstedt 52CX Magnetic Locator and a Whites Spectrum XLT metal detector. Each instrument received an equipment functional test prior to use each day. The field test pit was located behind the Foster Wheeler Environmental office trailer. Items located in the test pit consisted of a MKII hand grenade at 2- ft bgs and an inert 75mm projectile at 4-ft bgs. Both instruments were able to locate the MKII hand grenade. The Schonstedt 52CX Magnetic Locator was also able to locate the inert 75mm projectile. For all grids except those located along the highway and within 200 foot distance of the road, approximately 10 to 15-percent of the open area was surveyed by the CEHNC on-site Safety Representative. The standard CEHNC Quality Assurance Check is 10-percent of each grid or 10-percent check of the overall project. In this highly visible removal action, the CEHNC on-site Safety Representative performed more than the standard QA check in all grids. In areas that had a high concentration of ferrous contacts the on-site Safety Representative investigated all anomalies encountered to ensure that no ordnance items were missed. Additionally, the fact that the road had to be closed to perform the removal action and the quality control/quality assurance checks, the on-site Safety Representative surveyed up to 30-percent of the open areas to ensure that the area had been as thoroughly cleared as physically possible. There were no ordnance items found during the QA check. Anomalies investigated during the QA were identified as nails, several can lids, hot rocks and small pieces of non-OE metal. All of the grids surveyed by the CEHNC on-site Safety Representative passed the QA survey. Completed and signed CEHNC Form 948's certifying QA passage of each grid are included in Appendix C.

4.0 Documentation

4.1 Geophysical Survey Map

A map of the M2 Parcel including the EM61 data and the 100 x 100 ft grids superimposed over the site is included in Appendix A.

4.2 Reacquisition Sheets (Dig Sheets)

Anomalies selected for reacquisition are listed in the intrusive investigation results tabulated in Appendix B and are included on the attached CD in Appendix A.

4.3 Grid Maps

To facilitate the reacquisition process, color-coded anomaly maps were prepared for each grid. These maps were prepared using Oasis Montaj software and provided locations for each anomaly. The maps are included in Appendix A.

4.4 Site QC Documentation

Site QC documentation, including the CEHNC Form 948 are included in Appendix C.

4.5 Site Safety Documentation

Site safety records including incident reports on two subcontractor personnel are included in Appendix D.

4.6 OE and Non-OE Scrap Disposal

Approximately 60 pounds of OE-related scrap and 1410 pounds of non-OE scrap have been removed from the site. The OE scrap was inspected, containerized and transported to the secure EODT, Inc. waste processing area where it will receive a final inspection to certify it free of explosives prior to final disposal. Eight (8) unexpended .30 caliber rifle cartridges were found intact at grid E6 (anomaly 29) and turned into the Ammunition Supply Point (ASP, operated by the Alabama National Guard) for salvage, recycle, or disposal. Documentation for the disposal of scrap removed from the M2 parcel is included in Appendix E.

4.7 Daily Site Activity Reports

Daily activities reports are included in Appendix F.

4.8 Photographs

Selective site photographs are included in Appendix G.

4.9 Financial Breakdown

Costs to accomplish the M2 Parcel removal action, including labor categories and number of labor hours, materials, subcontracts, and travel costs have been summarized for each task. These are presented in Appendix I.

5.0 Summary

5.1 An ordnance and explosives (OE) removal action was performed on the 22-acre M2 Parcel at Fort McClellan in preparation for transfer of the property to the Anniston-Calhoun County Fort McClellan (FMC) Joint Powers Authority (JPA) for commercial development. The field work began 22 May, 2000 and was completed the week of 18 September, 2000. The work was performed by Foster Wheeler Environmental and approved subcontractors in accordance with approved work plans. The action completed the removal action alternative of *Surface Clearance and Subsurface Clearance to Depth*, as approved in the final Action Memorandum.

5.2 The work was completed in sequential stages of site preparation (brush clearing), digital geophysical survey and mapping, and OE removal. Intrusive investigation of anomalies resulted in the excavation of one UXO item (white phosphorous hand grenade), two practice ordnance items (practice anti-tank land mine and practice training grenade), OE debris, small arms (mostly .30 caliber) and Non-OE scrap (cultural metal). OE/OE-related materials (UXO, Practice Ordnance, and OE Debris) were recovered at less than 1-percent of the anomalies investigated, whereas non-OE related materials (small arms and metallic scrap) were collected at over 99-percent of the anomalies investigated. Locations of the materials were presented in Figure 2-1. More than 99-percent of the items recovered were within 18 inches of the ground surface. More than 95-percent were within the first 6 inches of the ground surface. These depths are consistent with the type of training exercises thought to have occurred at the site.

5.3 The recovered UXO item (M-15 white phosphorous hand grenade) was found in the northeast corner of the site (Grid G16). The two practice ordnance items consisted of an M-1 practice anti-tank land mine, also found in the northeast corner of the site (Grid F16) and an empty training grenade found in Grid B07. Both the UXO item and the M-1 practice anti-tank land mine, suspected to possibly contain a spotting charge, were destroyed by UXO-qualified specialists. Figure 2-1 shows the locations of the recovered UXO and practice ordnance items.

5.4 It was the objective of this removal action to remove all OE present at the site; however, it must be recognized and understood that complete and total assurance that all OE items have been removed is not possible. As a result, some residual risk may still remain within the boundaries of the M2 Parcel.

6.0 References

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