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MILITARY MUNITIONS RESPONSE PROGRAM**

FINAL

**MRS-RANGES 43–48
INTERIM ACTION
TECHNICAL INFORMATION PAPER
VOLUME 1**

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**MRS-RANGES 43-48
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for
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MRS-Ranges 43–48
Interim Action
Technical Information Paper

CONTENTS

5	ACRONYMS AND ABBREVIATIONS.....	ix
6	DEFINITIONS AND TERMS	xi
7	CHAPTER 1 OVERVIEW	1-1
8	1.1 Interim Action Background	1-1
9	1.2 Purpose.....	1-2
10	1.3 Scope.....	1-2
11	CHAPTER 2 SITE BACKGROUND	2-1
12	2.1 Former Fort Ord.....	2-1
13	2.1.1 Location.....	2-1
14	2.1.2 History.....	2-1
15	2.1.3 Terrain	2-1
16	2.1.4 Vegetation	2-1
17	2.1.5 Geology	2-2
18	2.2 MRS-Ranges 43–48.....	2-2
19	2.2.1 Location.....	2-2
20	2.2.2 Description	2-2
21	2.2.3 Accessibility	2-3
22	2.2.4 Natural Resources	2-3
23	2.3 MEC History.....	2-4
24	2.3.1 Items Found or Used on Ranges in Site	2-4
25	2.3.2 Previous Site Investigations/Activities.....	2-5
26	CHAPTER 3 SURFACE REMOVAL	3-1
27	3.1 Grid Installation	3-1
28	3.2 Visual Surface Sweep	3-1
29	3.2.1 MEC Encountered.....	3-2
30	3.2.2 Debris Removed.....	3-11
31	3.3 Demolition Operations.....	3-12
32	CHAPTER 4 SITE PREPARATION	4-1
33	4.1 Range Target Identification and Path Clearance	4-1
34	4.2 Prescribed Burn.....	4-2
35	4.3 Vegetation Clearance	4-2
36	4.4 Target Removal.....	4-2
37	4.5 Geophysical Walk-Through.....	4-8
38	4.6 Grid and Border Marker Installation.....	4-8
39	4.7 Geophysical Transect Sampling	4-8
40	4.8 Seeding of QC/QA Items	4-9
41	CHAPTER 5 ANALOG REMOVAL	5-1
42	5.1 Instrumentation	5-1

FINAL

1	5.2	Detection and Removal.....	5-2
2	5.3	Analog Removal Results.....	5-3
3	5.3.1	MEC Encountered.....	5-3
4	5.3.2	Munitions Debris Removed.....	5-14
5	5.3.3	Recovery of QC Seeded Items.....	5-15
6	5.4	Areas Designated as Special-Case Areas and Non-Completed	
7		Areas.....	5-15
8	5.4.1	Special-Case Areas.....	5-15
9	5.4.2	Non-Completed Areas.....	5-15
10	CHAPTER 6	DIGITAL MAPPING OPERATIONS.....	6-1
11	6.1	Digital Geophysical Survey.....	6-1
12	6.1.1	Instrumentation.....	6-1
13	6.1.2	Data Collection.....	6-4
14	6.1.3	Data Downloading and Storage.....	6-4
15	6.1.4	Data Processing and Anomaly Selection for	
16		Geophysical Data.....	6-4
17	6.1.5	Data Delivery Schedule.....	6-7
18	6.2	Anomaly Reacquisition.....	6-7
19	6.3	Anomaly Excavations.....	6-8
20	6.3.1	Intrusive Investigation Results.....	6-8
21	6.3.2	Recovery of QC Seeded Items.....	6-13
22	6.4	QC of Digital Geophysical Operations.....	6-13
23	6.4.1	Data Acquisition.....	6-14
24	6.4.2	Data Processing.....	6-14
25	6.4.3	Anomaly Reacquisition.....	6-14
26	6.5	QA of Digital Geophysical Operations.....	6-15
27	CHAPTER 7	RANGE 45 SIFTING OPERATIONS.....	7-1
28	7.1	Preparation.....	7-1
29	7.2	Sifting Operations.....	7-3
30	7.2.1	Sifting.....	7-3
31	7.2.2	Sorting.....	7-5
32	7.3	Analog Removal.....	7-8
33	7.4	Digital Geophysical Operations.....	7-9
34	7.4.1	Range 45 Pad Deconstruction.....	7-10
35	7.5	Quality Control and Quality Assurance.....	7-11
36	7.6	Site Restoration.....	7-11
37	CHAPTER 8	SPECIAL-CASE AREAS AND NON-COMPLETED ACTIONS.....	8-1
38	8.1	Range 48.....	8-1
39	8.2	Range 47.....	8-1
40	8.3	Range 45 Trench.....	8-1
41	8.4	Range 44.....	8-2
42	8.5	Central Area Grids.....	8-2
43	8.6	East Side Grids with No Subsurface Removal.....	8-2
44	8.7	Subsurface Removal Commenced.....	8-2
45	8.8	East Side Grids with Partial Subsurface Removal.....	8-2

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

8.9	Bunker.....	8-2
8.10	Fenceline.....	8-3
CHAPTER 9	QUALITY CONTROL AND QUALITY ASSURANCE	9-1
9.1	Quality Control	9-1
9.2	Seeding of QC Items.....	9-1
9.2.1	Analog Removal Seeded Item Results	9-1
9.2.2	Digital Mapping Seeded Item Results.....	9-1
9.2.3	Sifting Operations Seeded Items Results	9-2
9.3	Analog QC: 10% Survey	9-2
9.4	QC of Backhoe Excavations	9-2
9.5	Quality Assurance.....	9-10
9.5.1	Seeding of QA Items	9-10
9.5.2	Analog QA Survey	9-10
9.5.3	Digital QA Survey.....	9-10
CHAPTER 10	ENVIRONMENTAL PROTECTION ACTIVITY SUMMARY	10-1
10.1	Minimizing Impacts on Species of Interest	10-1
10.1.1	Black Legless Lizard.....	10-2
10.1.2	Vegetation	10-2
10.2	Vegetation Clearance	10-4
10.3	Site Preservation and Restoration	10-5
CHAPTER 11	LESSONS LEARNED	11-1
11.1	EM61-MK2 Use over Asphalt.....	11-1
11.2	Quality Control Seeding Program.....	11-1
11.3	Backhoe Excavations	11-1
11.4	UXO Technicians Analog Locator QC Qualification Program	11-1
CHAPTER 12	COST AND ACCIDENT EXPOSURE DATA	12-1
12.1	Cost Data.....	12-1
12.2	Accident Exposure Data	12-2
CHAPTER 13	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	13-1
13.1	Summary	13-1
13.1.1	Surface Removal	13-1
13.1.2	Analog Removal.....	13-1
13.1.3	Digital Mapping	13-2
13.1.4	QC/QA	13-2
13.2	Conclusion	13-3
13.3	Recommendations.....	13-4
CHAPTER 14	REFERENCES	14-1

FINAL

1 APPENDIXES

2 A ITEMS ENCOUNTERED

3 Summary of Items Encountered..... A-1

4 Detail of MEC Encountered..... A-8

5 Detail of Suspected MEC Determined to be Munitions Debris..... A-61

6 Small Arms Encountered A-73

7 Summary of Munitions Debris and Range-Related Debris Removed A-76

8 B DETONATION REPORT

9 C WHITE PAPER: ADVANCED PROCESSING METHODS FOR

10 REDUCING ANOMALIES.

11 D GEOPHYSICAL DATA AND SUMMARY REPORTS

12 E DIGITAL MAPPING INTRUSIVE INVESTIGATION RESULTS

13 Maps.....E-1

14 Database ReportsE-155

15 F QUALITY ASSURANCE REPORT: DIGITAL GEOPHYSICAL

16 OPERATIONS

17 G QUALITY CONTROL AND QUALITY ASSURANCE INSPECTION

18 RESULTS

19 QC-3 Analog Inspection G-1

20 QA Analog Inspection G-13

21 QA Memos..... G-25

22 H NONCONFORMANCE REPORTS

23 I 2005 ANNUAL BIOLOGICAL MONITORING REPORT

24 J WHITE PAPER: EFFECTS OF ASPHALT ON EM-61-MK2

25 K FIELD VARIANCE FORMS

26 L COMMENTS AND RESPONSES

27 Comments on Draft.....L-1

28 Comments on Draft FinalL-15

29 MAPS

30 1-1 MRS-Ranges 43-48: Location 1-3

31 2-1 MRS-Ranges 43-48: Boundaries 2-12

32 2-2 MRS-Ranges 43-48: MEC Encountered during Previous Operations..... 2-13

33 3-1 MRS-Ranges 43-48 Interim Action: Surface Removal MEC

34 Encountered 3-13

35 4-1 MRS-Ranges 43-48 Interim Action: Range Target Removal Results 4-10

36 4-2 MRS-Ranges 43-48 Interim Action: Anomaly Density Estimate Based

37 On Geophysical Transect Sampling..... 4-11

1	5-1	MRS-Ranges 43-48 Interim Action: Analog Removal MEC	
2		Encountered	5-16
3	6-1	MRS-Ranges 43-48 Interim Action: Digital Mapping Survey Results	6-16
4	6-2	MRS-Ranges 43-48 Interim Action: Digital Mapping Anomaly	
5		Excavation Results.....	6-17
6	7-1	Range 45 Sifting Area: Location	7-13
7	7-2	Range 45 Grading and Sifting Operations.....	7-14
8	7-3	Range 45 Sifting and Sorting Areas: Exclusion Zones.....	7-15
9	7-4	Range 45 Sifting Area: Digital Mapping (Range 45 Grids and Range	
10		45 Decon) Anomaly Excavation Results	7-16
11	7-5	Range 45 Sifting Area: Analog Removal Results (Range 45 Grids and	
12		Range 45 Decon).....	7-17
13	7-6	Range 45 Sifting Area: Digital Survey (Range 45 Grids and Range 45	
14		Decon).....	7-18
15	8-1	MRS-Ranges 43-48 SCA and Non-Completed Area Actions	8-4
16	9-1	MRS-Ranges 43-48 Interim Action: QC Seeded Items Status, Analog	
17		Removal	9-11
18	9-2	MRS-Ranges 43-48 Interim Action: QC Seeded Items Status, Digital	
19		Mapping	9-12
20	9-3	MRS-Ranges 43-48 Interim Action: Grid Status.....	9-13
21	9-4	MRS-Ranges 43-48 Interim Action: Backhoe Excavation Locations	9-14

22 TABLES

23	2-1	Previous Use of and Items Previously Found on Ranges	2-4
24	2-2	Summary of Previous Site Investigations/Activities in Mrs-Ranges	
25		43-48	2-10
26	3-1	MEC Encountered during Surface Removal (by item).....	3-3
27	3-2	MEC Encountered during Surface Removal (by grid)	3-5
28	4-1	MEC Encountered during Range Target Path Clearance	4-4
29	4-2	MEC Encountered during Range Target Removal	4-6
30	5-1	MEC Encountered during Analog Removal (by item)	5-3
31	5-2	MEC Encountered during Analog Removal (by 1,000-foot grid)	5-6
32	6-1	MEC Encountered during Digital Mapping Anomaly Excavations (by	
33		item)	6-8
34	6-2	MEC Encountered during Digital Mapping Anomaly Excavations (by	
35		1,000-foot grid).....	6-10
36	7-1	MEC Encountered during Grade Stake Survey in Range 45 Sift Area	7-2
37	7-2	MEC Encountered during Sorting Operations in Range 45 Sift Area	7-6
38	7-3	MEC Encountered during Analog Removal in Range 45 Sift Area	7-8

1	7-4	MEC Encountered during Digital Mapping Anomaly Excavations in	
2		Range 45 Sift Area.....	7-10
3	7-5	MEC Encountered during Range 45 Pad Deconstruction.....	7-11
4	8-1	SCA Summary Table for Ranges 43-48 Interim Action.....	8-12
5	9-1	QC Seeded Item Results	9-3
6	12-1	Cost of Operations for Ranges 43-48 Interim Action (Surface and	
7		Subsurface Removal)	12-1
8	12-2	Cost of Operations for Ranges 43-48 Interim Action (Site Burn).....	12-2
9	12-2	Cost of Operations for Ranges 43-48 Interim Action (Debris Removal)	12-2
10			
11			

FINAL

ACRONYMS AND ABBREVIATIONS

μsec	microsecond
AAR	after-action report
APC	armored personnel carrier
AP-T	armor-piercing tracer
ARAR	applicable or relevant and appropriate requirement
AT	antitank
BGS	below ground surface
BIP	blow in place
BLM	Bureau of Land Management
BRAC	Base Realignment and Closure
CEHNC	U.S. Army Engineering and Support Center, Huntsville Division
DENR	Directorate of Environmental and Natural Resources
DQO	data quality objective
DMM	discarded military munitions
ESL	explosive storage location
FACT	FACT International, Inc.
FFA	federal facilities agreement
FP	false positive
FVF	field variance form
GPS	global positioning system
GUI	graphical user interface
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	high explosive
HEAT	high-explosive antitank
HMP	Installation-wide Multispecies Habitat Management Plan
IA	interim action
ID	identification
LAW	light antitank weapon
LE	low explosive
MD	munitions debris
MD-E	expended munitions debris
MD-F	munitions debris fragment
MEC	munitions and explosives of concern
MGFD	munition with the greatest fragmentation distance
MHE	mechanical handling equipment
mm	millimeter
MPPEH	material potentially presenting an explosive hazard

FINAL

MR RI/FS	remedial investigation / feasibility study
MRS	munitions response site
mV	millivolt
NCR	nonconformance report
OESS	ordnance and explosives safety specialist
PDA	personal digital assistant
PWP	programmatic work plan
QA	quality assurance
QC	quality control
RAO	remedial action objective
ROD	record of decision
RRD	range-related debris
RTK	real-time kinematic
SAA	small arms ammunition
SCA	special case area
SOP	standard operating procedure
SSWP	site-specific work plan
SUXOS	senior unexploded ordnance supervisor
TCRA	time-critical removal action
TIP	technical information paper
TP	target practice
USB	universal serial bus
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
UXOQCS	UXO QC specialist
WBS	work breakdown structure

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DEFINITIONS AND TERMS

analog removal area (ARA)	Surveyed area where vegetation or terrain prevents access by geophysical survey equipment, thus requiring anomaly detection with an analog instrument. Source: 1
anomaly	Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.). Source: 2
blow-in-place (BIP)	To destroy MEC, by use of explosives, in the location the item is encountered. Source: 3
consolidated detonation	To destroy MEC, by use of explosives, after carrying acceptable-to-move items a short distance to the location of other identified MEC awaiting demolition. Source: 1
cultural debris	Debris found on operational ranges or munitions response sites that is not related to munitions or range operations. It may be removed to facilitate a range clearance or munitions response. Such debris includes but is not limited to rebar, household items, fence posts, fence wire, and automobile parts and automobiles that were not associated with range targets. Source: 4
digital geophysical polygon	An area where geophysical data processors cannot distinguish individual anomalies within the data collected, thus requiring anomaly detection with an analog instrument. This could also occur after analog removal if the Schonstedt did not detect a clutter of nonferrous metals or if an identified cluster of small ferrous metal pieces was left in place to determine whether the EM-61 could “see through” the clutter, avoiding excessive, non-essential excavations during analog removal. Source: 1
digital geophysical survey	Process by which digital geophysical detection equipment is used to identify and record potential locations of military munitions and create a digital map of an area. Source: 1
discarded military munitions (DMM)	Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. Source: 5
grid	A subdivided work area in a site, usually 100 feet by 100 feet. Grids are surveyed and marked with wooden stakes before removal work begins in a site. Grids are numbered sequentially using an alpha-numeric system. Source: 1

FINAL

grid sampling	Geophysical investigation and excavation of selected anomalies over a percentage of a site to provide data for characterizing the site. Source: 1
Impact Area	8,000-acre area within the southwest portion of the former Fort Ord containing numerous firing ranges previously used for military training activities involving live ammunition. The Impact Area is bordered by Eucalyptus Road to the north, General Jim Moore Boulevard to the west, South Boundary Road to the south, and Barloy Canyon Road to the east. Source: 1
interim action	Quick action to protect human health and the environment from an imminent threat in the short term until development of a final remedial solution. For ordnance and explosives (OE) remediation at Ranges 43-48, this means implementing three components (vegetation clearance, OE remedial action, and OE detonation) while a final, basewide OE RI/FS is developed. Source: 6
magnetometer	An instrument measuring the strength of a magnetic field that is used to detect buried iron and other metal objects. Source: 1
material potentially presenting an explosive hazard (MPPEH)	Material potentially containing explosives or munitions (e.g. munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially contaminated with sufficient concentration of explosives to present an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions. Source: 4
military munitions	All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. Source: 7

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mortar	Mortars range from approximately 1 inch to 11 inches in diameter and can be filled with explosives, toxic chemicals, white phosphorous, or illumination flares. Mortars generally have thinner metal casing than projectiles but use the same types of fuzing and stabilization. Source: 8
munitions and explosives of concern (MEC)	Military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive hazard. Source: 9
munitions constituents	Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. Source: 5
munitions debris	Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal. Source: 4
munitions response	Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required. Source: 9
munitions response area (MRA)	Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples are former ranges and munitions burial areas. An MRA comprises one or more munitions response sites. Source: 9
munitions response site (MRS)	A discrete location within an MRA that is known to require a munitions response. Source: 9
non-completed area	For this site, an area in which MEC removal was not completed within the scope of work due to money or time constraints. This became necessary because higher-than-expected anomaly densities in Ranges 43-48 made it impossible to complete the subsurface removal over the entire site within the time and funding constraints of the contract. As a result, USACE prioritized the subsurface removal work in portions of Ranges 43-48 based on which areas most enhanced public and personnel safety and enabled reuse of the land. Source: 1
projectile	Object projected by an applied force and continuing in motion by its own inertia. Includes bullets, bombs, shells, grenades, guided missiles, and rockets. Source: 8
range-related debris	Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g., target debris, military munitions packaging, and crating material). Source: 4

special-case area (SCA)	An area in an MRS in which MEC removal cannot be completed within the scope of work due to metallic clutter or obstructions that compromise instrument performance or technician safety or because the removal process would cause a serious adverse impact to the habitat. Source: 1
subsurface removal	Removal of MEC located below the ground surface by using geophysical instruments to detect and identify possible locations of OE and then digging at those locations. Source: 1
surface removal	Removal of MEC from the ground by visually identifying items on the surface and using a magnetometer to detect items when the surface is covered by debris (e.g. wood chips, leaves). Source: 1
unexploded ordnance (UXO)	Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and remain unexploded whether by malfunction, design, or any other cause. Source: 7

Sources:

- 1: Nonstandard definitions developed to describe items, conditions, and procedures specific to Fort Ord Military Munitions Response Program
- 2: Engineering and Design – Ordnance and Explosives Response, EM 1110-1-4009, USACE (23 June 2000)
- 3: UXO Safety Education Program: Glossary of Terms, DENIX
- 4: Memorandum for the Assistant Chief of Staff for Installation Management: Munitions Response Terminology (21 April 2005)
- 5: 10 USC 2710(e)
- 6: Final Record of Decision, Interim Action for Ordnance Explosive Sites Ranges 43–48, Range 30A, and Site OE-16, Former Fort Ord, California (September 2002)
- 7: 10 USC 101(e)
- 8: Compendium of Department of Defense (DoD) Acronyms, Terms, and Definitions: The Interstate Technology and Regulatory Council (ITRC) Work Group (Unexploded Ordnance Team) (December 2000)
- 9: 32 CFR 179.3

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CHAPTER 1 OVERVIEW

1.1 INTERIM ACTION BACKGROUND

In 2002, the Army, as the lead agency, determined that an Interim Action (IA) was appropriate for three munitions response sites (MRSs) at the former Fort Ord: Ranges 43–48, MRS-16, and Range 30A (Figure 1-1). An IA was needed to protect human health from the imminent threat posed by munitions and explosives of concern (MEC) at these sites while the Army evaluated the overall cleanup needs of the former Fort Ord under the ongoing munitions response remedial investigation / feasibility study (MR RI/FS) program.

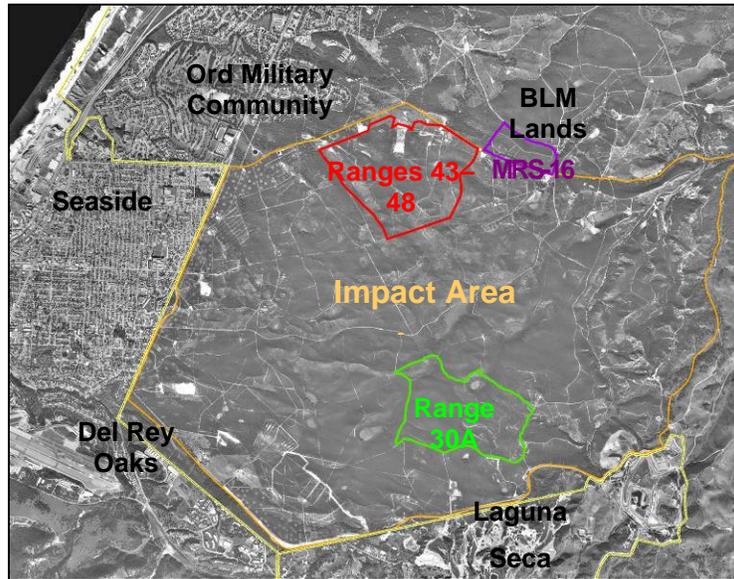


Figure 1-1—Ranges 43–48, MRS-16, and Range 30A needed an interim action because of their close proximity and increased accessibility to the public, the threat of trespassing, and most importantly, the highly dangerous MEC on or near the surface of the sites.

The Army issued a proposed plan [Ref. 1] identifying a prescribed burn, surface and subsurface removal, and detonation with engineering controls as the preferred alternatives for clearing vegetation, conducting a remedial action, and detonating MEC, respectively, at the three IA sites. The final selection of these alternatives was made in the IA Record of Decision (ROD) [Ref. 2].

Of the three IA sites, the Munitions Response Site at Ranges 43-48 (MRS-Ranges 43–48) was the highest priority because of its close proximity to homes and schools in the city of Seaside and the Ord Military Community (Map 1-1) and the sensitive types of MEC present on it.

A burn at MRS-Ranges 43–48 was scheduled in November 2002 but could not be conducted because the required meteorological and fire conditions did not occur. The rainy season began shortly thereafter, and the prescribed burn was postponed until 2003. In October 2003, the required meteorological and fire conditions materialized and the prescribed burn was conducted. The prescribed burn cleared most of the maritime chaparral vegetation covering the site, revealing thousands of MEC previously hidden by the thick brush. In addition, the burn jumped the fire line and burned nearly 1,100 additional acres south and southwest of MRS-Ranges 43-48, referred to as the Watkins Gate Burn Area. Surface MEC removal was conducted on that

1 additional burned acreage in a time-critical removal action (TCRA) from December 2003 to
2 March 2004 [Ref. 3].

3 **1.2 PURPOSE**

4 As the remedial action selected in the IA ROD, surface removal and subsurface removal
5 operations were conducted on MRS-Ranges 43–48 from November 2003 to December 2005 to
6 address the imminent threat to human health (public safety) or welfare or the environment posed
7 by the presence of MEC on the site. This technical information paper (TIP) summarizes and
8 provides the results of the surface and subsurface removal and related site activities.

9 The IA ROD Section 2.10 presents the interim remedial action objectives (RAOs) for Ranges
10 43-48: “Interim RAOs are to reduce risks to human health and the environment associated with
11 OE and comply with federal and state ARARs.”

12 **1.3 SCOPE**

13 The surface and subsurface removal entailed the following major site activities:

- 14 • Visually searching for and removing MEC from the surface (Chapter 3).
- 15 • Operating geophysical detection equipment to locate and remove MEC in the subsurface.
16 The subsurface removal work was divided into analog and digital operations.
 - 17 • The analog work involved detecting anomalies (metallic items potentially
18 representing MEC in the subsurface) with analog Schonstedt GA-52Cx
19 magnetometers and then digging each anomaly location until the source of the
20 anomaly was removed (Chapter 5).
 - 21 • The digital operations consisted of mapping the post-removal site conditions with
22 digital geophysical survey instruments, both the individually operated and towed-
23 array EM61-MK2 electro magnetometers and then investigating and resolving any
24 anomalies detected by the digital instruments (Chapter 6).
- 25 • Conducting quality control and quality assurance (QC/QA) inspections to ensure that
26 detectable items had been removed and that the IA was performed completely,
27 effectively, and in accordance with the Fort Ord programmatic work plan (PWP) and the
28 MRS-Ranges 43–48 site-specific work plan (SSWP) [Refs. 4 and 5] (Chapter 9).

29 Earlier subsurface removal work at the OE-15 Del Rey Oaks site and the MRS Seaside site
30 showed that a two-stage process using first analog and then digital instruments was effective in
31 this area. As a result of this experience, the Ranges 43-48 SSWP specified that subsurface
32 removal would involve (1) detecting and removing subsurface OE to depth with Schonstedt GA-
33 52Cx magnetometers (analog) and then (2) digitally mapping the post-removal conditions with
34 an EM61-MK2 metal detector or a G-858 magnetometer followed by investigating and resolving
35 any remaining items detected during the mapping process. As discussed in section 4.5 of this
36 TIP, the geophysical walkthrough demonstrated that for the conditions present at Ranges 43-48,
37 the EM61-MK2 provided better follow-up to the Schonstedt GA-52Cx than did the G-858.

1
2

CHAPTER 2 SITE BACKGROUND

3

2.1 FORMER FORT ORD

4

2.1.1 LOCATION

5 The former Fort Ord is located 80 miles south of San Francisco and occupies approximately
6 28,000 acres adjacent to Monterey Bay and the cities of Marina, Seaside, Sand City, Del Rey
7 Oaks, and Monterey (Map 1-1). State Highway 1 crosses the western section of Fort Ord,
8 separating the beachfront from most of the installation. Laguna Seca Recreational Area and the
9 Toro Regional Park border the former Fort Ord to the south and southeast, respectively, as well
10 as several small communities such as Toro Park Estates and San Benancio.

11

2.1.2 HISTORY

12 Fort Ord became a training installation in 1917 and was used to train Army infantry, cavalry, and
13 field artillery units for WWI and II, Korea, Vietnam, and Desert Storm. In 1991 the site was
14 included on the Base Realignment and Closure (BRAC) list and closed in 1994. Since the
15 BRAC listing and closure of Fort Ord, cleanup operations have been performed to address
16 explosive hazards and to prepare Fort Ord property to be transferred to federal, state, and local
17 agencies and the surrounding Monterey County communities.

18 Evidence of contaminated soil and groundwater at the former Fort Ord led to its placement on
19 the National Priorities List of Superfund Sites on 21 February 1990. A federal facility agreement
20 (FFA) signed in 1990 with the U.S. Environmental Protection Agency, the California
21 Department of Toxic Substances Control, and the California Regional Water Quality Control
22 Board established schedules for performing remedial investigations and feasibility studies. The
23 Army began its MR RI/FS in 1998, and signed an agreement in 2000 to evaluate MR in
24 accordance with the provisions of the FFA.

25

2.1.3 TERRAIN

26 The topography at the former Fort Ord is predominantly dune sand deposits with elevations
27 ranging from sea level to approximately 800 feet. The terrain in the western and northern
28 portion of the site slopes gently to the west and northwest, draining towards Monterey Bay. The
29 terrain in the southeastern portion of the site has well-defined, eastward-flowing drainage
30 channels situated within narrow canyons that slope moderately to steeply. Overall, the terrain at
31 the former Fort Ord includes flat areas, shallow grades, and moderate and steep slopes.

32

2.1.4 VEGETATION

33 The vegetation at the former Fort Ord includes 12,500 acres of maritime chaparral (mostly
34 located in the south-central portion of the site), 5,000 acres of oak woodlands, and 4,500 acres of
35 grasslands (mostly located in the southeastern and northern portions of the site). These habitats
36 include 22 plant and 22 wildlife species that are listed, proposed, or candidates for federal or
37 state listing as threatened or endangered species or as state species of special concern or are
38 listed by the California Native Plant Society [Ref. 6]. An installation-wide multispecies habitat
39 management plan (HMP) was developed to promote preservation, enhancement, and restoration
40 of habit and populations of these species while implementing a community-based reuse plan that
41 promotes economic recovery after closure of Fort Ord [Ref. 6].

FINAL

2.1.5 GEOLOGY

The most important issue concerning the geology at the former Fort Ord is the significant effects of the Santa Margarita Formation on the geophysical mapping process. Iron-cemented sandstone and magnetic concretions in this formation cause anomalies in the geophysical data. Generally, electromagnetic methods are less significantly affected by these concretions as compared to magnetic methods. When buried, the effects of concretions can range from minor to severe, depending on the soil overburden thickness and the concentration of the concretions.

2.2 MRS-RANGES 43–48

2.2.1 LOCATION

The MRS-Ranges 43–48 site is located in the north-central portion of the Impact Area at the former Fort Ord. The Impact Area is an 8,000-acre area covering the southwest portion of the base. The Impact Area served as the base's primary target area, as it contains numerous firing ranges that were used for weapons training activities involving munitions and explosives. MRS-Ranges 43–48 encompass all or most of seven firing ranges in the Impact Area.

The site is in close proximity to residential communities in the city of Seaside, the Ord Military Community, schools (Fitch Middle School, Marshall Elementary School, and Cypress Grove Charter High School [at Stilwell Elementary School location]), and recreational facilities (Bureau of Land Management [BLM] lands).

Map 1-1 shows the location of MRS-Ranges 43–48 relative to the Impact Area and the former Fort Ord and the close proximity of the site to the aforementioned residential communities, schools, and recreational lands.

2.2.2 DESCRIPTION

2.2.2.1 Size

As measured by on-site surveying performed by Central Coast Survey in 2003, the MRS-Ranges 43–48 IA site is approximately 499.5 acres. It was originally identified as a 555-acre site, as it contained what are now the Munitions Response Site at Monterey County Parcel 2 (MRS-MOCO.2) and the eastern portion of the Munitions Response Site at Seaside Parcel 4 (MRS-SEA.4), which together constituted approximately 72 acres planned for future development [Ref. 7].

During the IA RI/FS review, much of the current MRS-MOCO.2 and the eastern portion of MRS-SEA.4 were removed from the Ranges 43–48 IA site because their vegetation could be cut safely using mechanical methods [Ref. 7]. Later adjustments to the habitat and development boundaries of MRS-Ranges 43–48 and MRS-MOCO.2 returned some land to the Ranges 43–48 IA site, making the final Ranges 43–48 IA site 499.5 acres.

2.2.2.2 Reuse

Of the 499.5 acres in MRS-Ranges 43–48, 474.5 acres are designated as habitat reserve, containing portions of parcels E38, E39, E41, E42, and F1.13. The 25 acres of E40, consisting of Range 45 and a buffer surrounding it, are planned for future development.

2.2.2.3 Boundaries

Eucalyptus Road, a paved road open to the public, borders the site to the northeast. MRS-MOCO.2 and the eastern portion of MRS-SEA.4 bound the site to the north and northwest, respectively. Dirt fuel breaks — Evolution Road to the west, Broadway Avenue to the south, and Orion Road to the east — define the other site boundaries.

Map 2-1 illustrates the modifications made to the Ranges 43–48 site and reuse boundaries during the IA process and displays the current boundaries.

2.2.3 ACCESSIBILITY

Vehicle access on Eucalyptus Road is restricted by barriers (at the General Jim Moore Boulevard / Eucalyptus Road and Parker Flats Road / Eucalyptus Road intersections) and barricades marked with “road closed” signs (at the Parker Flats Cut Off / Eucalyptus Road intersection). (Throughout the IA, the public was restricted from accessing Eucalyptus Road from General Jim Moore Blvd to Parker Flats Road during field operation hours.)

Site-security measures include four-strand barbed-wire fence reinforced with concertina wire; locked chained-link gates with concertina wire on the bottom to block the access roads into the site; warning signs posted every 500 feet along the fences; and roving patrols. The original concertina wire 10 to 15 feet inside the site was removed as part of site preparation activities.

Although these site-security measures restrict access into the site, trespassing incidents have still occurred — and given the amount and types of MEC on the site, these incidents are considered extremely dangerous. In previous cases, children trespassed onto Range 45, picked up 40-millimeter (mm) practice grenades (projectiles), brought them home or to school, and threw them against walls. Fortunately, the projectiles were non-explosive, although items encountered on the surface can be live and cause property damage, serious injury, or even death when encountered.

2.2.4 NATURAL RESOURCES

The following subsection summarizes the vegetation and plant and animal species present on MRS-Ranges 43–48. Chapter 10 presents the biological report for MRS-Ranges 43–48, which details the environmental protection and site restoration activities performed on the site during the IA.

• Vegetation

Before the prescribed burn, most of MRS-Ranges 43–48 was covered by dense, 4-foot-to-5-foot-tall maritime chaparral. Over half of the maritime chaparral was between 20 to 25 years old, with the remaining consisting of almost-equal portions of 3-, 5-, 10-, and 15-year-old ages. Patches of annual grassland habitats (approximately 29 acres) existed along the site’s western and southern boundaries. Mineral soil covers the barren, 12-acre northern section of Range 45.

As of March 2005, 1½ years after the prescribed burn, the maritime chaparral is sparse with vegetation cover at approximately 10%. The regrowth is approximately 1 to 1½ feet tall.

• Plant Species

MRS-Ranges 43–48 is inhabited by several plant species listed in the HMP [Ref. 6] that are associated with maritime chaparral and are considered endangered, threatened, or rare by the

federal government or the state of California. These plant species include sand gilia, Seaside birdsbeak, sandmat manzanita, Monterey spineflower, and Monterey ceanothus.

• **Wildlife**

The HMP-listed wildlife inhabiting MRS-Ranges 43–48 includes the California black legless lizard.

No vernal pools exist on MRS-Ranges 43–48; therefore, the site likely does not contain any California tiger salamanders, which was listed as a threatened species under the federal Endangered Species Act during the IA in August 2004.

In November 2004, a western burrowing owl was observed on the west berm of Range 45.

2.3 MEC HISTORY

2.3.1 ITEMS PREVIOUSLY FOUND OR USED ON RANGES IN SITE

MRS-Ranges 43–48 contains all or most of seven firing ranges (Ranges 43, 44, 45, 46, 47, and 48 [there are two Range 43s in the site]) (Map 2-2), where training activities involving live ammunition occurred. Table 2-1 lists the prior use of these ranges and the items previously found or used on them before the IA as discussed in the IA RI/FS [Ref. 7] and two archives search reports [Refs. 8 and 9].

Table 2-1 — Previous Use of Ranges and Items Previously Found on Ranges

Range	Prior Range Use	Items Found or Used on Range ^a
43	Platoon live-fire course, mortar training	1) Grenades: hand, fragmentation 2) Mortars: 4.2-inches, high explosive (HE), white phosphorous (WP); 60mm, target practice (TP), illumination; 81mm HE, WP, TP, illumination 3) Projectiles: 37mm, low explosive (LE); 40mm grenade launcher, smoke, practice; 57mm, HE; 75mm, HE, shrapnel; 105mm smoke, HE; 155mm smoke 4) Rockets: 66mm, light antitank weapon (LAW) 5) Small arms
44	Antitank weapons	1) Mines: antipersonnel, practice 2) Missiles (Dragon guided): practice and high-explosive antitank (HEAT) 3) Projectiles: 37mm armor piercing (AP), 40mm, grenade, HE, practice; 84mm, HEAT; 90mm, recoilless rifle rounds, HEAT 4) Rockets: 35mm, LAW, subcaliber; 66mm, LAW, HEAT; 66mm incendiary
45	Grenade launcher	1) Grenades: hand, illumination, smoke, practice 2) Mortars: 60mm, HE, practice 3) Mines: antipersonnel, practice 4) Projectiles: 14.5mm subcaliber; 22mm subcaliber; 40mm grenade, practice, HE, smoke, illumination 5) Rockets: 35mm subcaliber; 66mm LAW (HEAT from Range 44); 66mm incendiary
46	Small arms	1) Small arms (pistols and rifles)
47	40mm grenades	1) Grenades: 40mm, HE

FINAL

1 Table 2-1 — Previous Use of Ranges and Items Previously Found on Ranges (cont)

Range	Prior Range Use	Items Found or Used on Range ^a
48	Weapons familiarization, sniper, mortar, machine gun	1) Grenades: hand, fragmentation; rifle, practice 2) Mines: antitank, practice; antipersonnel, practice 3) Missiles: Dragon guided, HEAT 4) Mortars: 4.2-inch, HE; 60mm, HE, TP, illumination; 81mm, HE, WP, TP, illumination; 5) Projectiles: 22mm subcaliber; 40mm grenade launcher, HE; 57mm, HE; 75mm, HE; 84mm, practice, HEAT; 105mm HE, smoke, illuminating; 155mm, smoke 6) Rockets: 2.36-inch, practice; 3.5-inch, practice; 35mm subcaliber, practice; 66mm LAW HEAT; 66mm incendiary 7) Signal: illumination 8) Small arms
^a Information based on IA RI/FS [Ref. 7] and historical documents [Refs. 8 and 9].		

2 **2.3.2 PREVIOUS SITE INVESTIGATIONS/ACTIVITIES**

3 The previous site investigations/activities in MRS-Ranges 43–48 includes grid sampling, the
 4 establishment of trails and fuel breaks, limited surface removals, a TCRA on the surface of the
 5 site, work in preparation of the prescribed burn, and the prescribed burn. The site
 6 investigations/activities and the amount of MEC encountered during them are described below,
 7 followed by a summary of the site investigations/activities in Table 2-2 (page 2-11).

8 Map 2-2 shows where items were found as well as the locations of the range fans, previously
 9 sampled or cleared grids, roads, and fuel breaks. The previously sampled 100-foot-by-100-foot
 10 grids are indicated within the 1,000-foot-by-1,000-foot grids used during the surface TCRA in
 11 2001, which are marked on the map with heavier lines.

12 **2.3.2.1 Range 44 Trail Sampling**

13 In April 1997, grid sampling was conducted with Schonstedt magnetometers to a 4-foot depth on
 14 a 15-foot-wide trail. This trail linked an approximately 5-acre area in and around Range 44
 15 subjected to soil characterization activities (the area contained over 20 metal targets that had
 16 been fired upon) to the Range 45 pad and an old dirt fuel break (later re-established as part of the
 17 Blue Line fuel break). The trail enabled personnel and equipment to access the soil
 18 characterization area safely [Ref. 10].

19 During the establishment of the Range 44 trail, no MEC was encountered. Munitions debris
 20 (remnants of functioned military munitions) removed from the trail consisted of seven
 21 illumination signals, a practice grenade, three 40mm M781 practice projectiles, a 60mm M83
 22 illumination projectile, and the motor from a 3.5-in M29 practice rocket [Ref. 10].

23 **2.3.2.2 Range 44 Grid Subsurface Removal**

24 In April 1997, a 4-foot removal was conducted with Schonstedt magnetometers on two 100-foot-
 25 by-100-foot grids in Range 44 (grids 05 A and 05 B) A total of 47 MEC were encountered, all
 26 on grid 05 B. The MEC consisted of one 40mm M386 high explosive (HE) projectile, 26 35mm
 27 M73 subcaliber practice rockets, and 20 66mm M72 high explosive antitank (HEAT) rockets.
 28 All items were found on the surface of the grids [Ref. 11].

FINAL

2.3.2.3 Range 44 Grid Sampling

In August 1997, sampling was performed on a grid in Range 44 that contained a target. No MEC items or munitions debris were encountered during this sampling activity [Ref. 11].

2.3.2.4 OE-15A Grid Sampling

In October 1997, twenty 100-foot-by-100-foot grids located in OE-15A (the five small arms ranges [Ranges 18, 19, 21, 39, and 46] located in the Impact Area) were sampled to determine the need and scope of future removal actions [Ref. 12]. Of the 20 sample grids, three were placed in Range 46 (grids G-1, G-2 and G-3).

Schonstedt magnetometers were used to investigate 100% of each sample grid. All anomalies detected were investigated to depth and resolved (excavations deeper than 4 feet were approved by the U.S. Army Corps of Engineers [USACE] OE safety specialist [OESS]).

No MEC was encountered during this grid sampling. Munitions debris removed from grids G-1 and G-2 consisted of eighty-eight 3.5-in M29 practice rockets and sixty-one 40mm M382 practice projectiles. No munitions debris was found in grid G-3 [Ref. 12].

2.3.2.5 OE-15B Grid Sampling

From October 1997 to February 1998, forty-one 100-foot-by-100-foot grids located in OE-15B (the areas along the perimeter of the Impact Area that are behind the firing ranges or between range fans) were sampled to determine the need and scope of future removal actions and to establish the types and distribution of MEC in the Impact Area [Ref. 13]. Of the 41 sample grids, two were placed in MRS-Ranges 43–48 (grids G-13 and G-14). Schonstedt magnetometers were used to investigate 100% of each sample grid.

Two MEC (an M222 Dragon guided missile and an 81mm M57 white phosphorus smoke projectile) and one munitions debris item (an 81mm M68 training projectile) were encountered in grid G-14. No items were found in grid G-13 [Ref. 13].

2.3.2.6 Evolution Road Fuel Break Reestablishment

From November 1997 to January 1998, fuel breaks inside the Impact Area were reestablished as part of a wildfire safety and control program. Vegetation clearance operations and a 4-foot removal with Schonstedt magnetometers were conducted to re-establish the fuel breaks [Ref. 13]. Fifty-three contiguous 15-foot-by-100-foot grids of the Evolution Road fuel break (originally named Maverick Road) form the western boundary of Ranges 43–48.

A total of 205 MEC and 118 munitions debris items were encountered on the portion of Evolution Road bordering Ranges 43–48. The MEC includes fifty-one 60mm M49 HE projectiles, forty-two 81mm M43 HE projectiles, eighteen 60mm M50 target practice projectiles, five 57mm M306 HE projectiles, a 4.2-in M3 series HE projectile, a 75mm M48 HE projectile, and an M18A1 antipersonnel claymore mine. The munitions debris included fifty-three 35mm M73 subcaliber practice rockets, fifty-two point detonating projectile fuzes, nine 81mm M43A1 target practice projectiles, and a 105mm M84 series smoke projectile [Ref. 13].

2.3.2.7 Blue Line Fuel Break Establishment

Between May and June 1998, as part of the Impact Area wildfire safety and control program, vegetation clearance operations and a 4-foot removal with Schonstedt magnetometers were conducted to establish the 30-foot-wide, 6-mile-long fuel break that runs along the interior of the

1 Impact Area [Ref. 13]. The Blue Line fuel break starts near the northernmost point of the Impact
2 Area and extends west towards the Seaside sites parallel to Eucalyptus Road. It then bends south
3 and runs parallel to General Jim Moore Boulevard before curving southeast at the Del Rey Oaks
4 sites and running parallel to South Boundary Road. The Blue Line fuel break ends at South
5 Boundary Road near York School. For the most part, the Blue Line fuel break also coincides
6 with the re-use boundary, named the “Blue Line”, that separates future development parcels from
7 the land planned as habitat reserve inside the Impact Area.

8 A total of 353 MEC and 151 munitions debris items were encountered on the 56 contiguous 30-
9 foot-by-100-foot grids of the Blue Line fuel break inside Ranges 43–48. The MEC included two
10 hundred and sixty-five 35mm M73 subcaliber practice rockets, thirty-four 66mm M74 TPA
11 incendiary rockets, six 84mm M136 HEAT projectiles, and six 40mm HE projectiles. The
12 munitions debris included forty M48 point detonating fuzes, twenty-seven 22mm M744
13 subcaliber projectiles, twenty-three 35mm M73 subcaliber practice rockets, eighteen 155mm
14 M116 smoke projectiles, sixteen 105mm M84 smoke projectiles, and eight 60mm M721
15 illuminating projectiles, and four 105mm M314 illuminating projectiles [Ref. 13].

16 **2.3.2.8 Impact Area Grid Sampling**

17 Between March and August 1999, two hundred thirteen 100-foot-by-100-foot grids in MRS-
18 MOCO.2, MRS-SEA.1–4, MRS-DRO.2, and MRS-MOCO.1 were sampled to determine the
19 need and scope of future removal actions. Six sample grids (G-6, G-13, G-20, G-22, G-24, and
20 G-26) were placed in the 25-acre southern section of MRS-MOCO.2, which is inside the Ranges
21 43–48 IA site. One hundred percent of each grid was investigated with a Schonstedt
22 magnetometer [Ref. 14].

23 Six MEC and 17 munitions debris items were encountered on the sample grids. The MEC items
24 consisted of one smoke grenade and one illuminating hand grenade found on grid G-6 and three
25 igniter tubes with primer and one hand grenade found on grid G-22. The munitions debris
26 consisted of three illuminating hand grenades and an illuminating signal in grid G-6; an M48
27 series point detonating fuze, a practice hand grenade, and a 35mm M73 subcaliber practice
28 rocket in grid G-20; a MK2 practice hand grenade and 2.36-inch M7 practice rocket in grid G-
29 22; two M48 series point detonating fuzes in grid G-24; and three M206A1 hand grenade fuzes,
30 two M48 series point detonating fuzes; and an M48 smoke hand grenade in grid G-26 [Ref. 14].

31 **2.3.2.9 Range 46 Lead-Contaminated Soil Remediation Project**

32 From April to August 1999, 4-foot removal operations with Schonstedt magnetometers were
33 conducted on nine grids around Range 46 to support efforts to remediate spent small arms
34 ammunition (SAA) and lead-contaminated soil around the range’s firing line. Of the 27 cleared
35 grids, all or a portion of nine were located in Ranges 43–48 (grids 23AP, 23AQ, 23AR, 23AS,
36 22AO, 22AP, 22AQ, 22AR, and 22AS) [Ref. 13].

37 No MEC was found on the nine grids (an AN-M8 smoke hand grenade was found in grid 23AR,
38 which is situated on the border of MRS-SEA.4 and Ranges 43–48; however, the item was found
39 on the MRS-SEA.4 side of the grid) [Ref. 13].

40 **2.3.2.10 Range 45 Safety Surface Removal**

41 Between April and October 1999, a surface removal was performed on the approximately
42 12-acre Range 45 area as an immediate safety action in response to trespassing incidents that
43 occurred at Range 44 and Range 45.

1 A total of 91 MEC and 1,552 munitions debris items were removed from the surface of Range
2 45. The MEC included 40 illuminating or smoke 40mm projectiles, 25 HE 40mm projectiles,
3 three 40mm M781 practice projectiles, eleven 35mm M73 subcaliber practice rockets, four
4 66mm M74 TPA incendiary rockets, three 22mm subcaliber M744 practice projectiles, three
5 illumination pyrotechnic mixtures, one ordnance component, and one M126 series ground
6 illumination signal. The munitions debris consisted entirely of 40mm M781 practice projectiles
7 [Ref. 11].

8 **2.3.2.11 Impact Area Fuel Break Maintenance**

9 Throughout 2001, 47 miles of old roads, trails, and fuel breaks that had been used regularly
10 during military training activities were restored to divide the Impact Area into fire-defensible
11 polygons [Ref. 15]. Surface removals were conducted on the 15-foot-wide sides of each fuel
12 break, and a 4-foot removal (with deeper excavations approved by the USACE OESS) was
13 performed with Schonstedt magnetometers on some of the fuel breaks' 15- to 20-foot-wide
14 centers.

15 The present fuel break roads surrounding Ranges 43–48 were established during this
16 maintenance work. A 15-foot-wide, surface-cleared fuel break was placed along the interior of
17 the paved Eucalyptus Road, inside the Impact Area. The 45-foot-wide Orion Road and
18 Broadway Avenue fuel breaks (collectively referred to as Pipeline Road at the time) were
19 established, as a subsurface removal was conducted on the 15-foot-wide centers of the dirt roads
20 and a surface removal was performed on the 15-foot-wide sides. For Evolution Road, a 30-foot-
21 wide surface cleared fuel break was added to the inside of the 15-foot-wide, subsurface-cleared
22 fuel break established in 1997 to 1998.

23 While no items were found on Eucalyptus Road fuel break, 14 MEC and 111 munitions debris
24 items were found on the Orion Road/Broadway Avenue fuel breaks and six MEC and 269
25 munitions debris items were found on the Evolution Road fuel break [Ref. 15].

26 The MEC encountered on the Orion Road/Broadway Avenue fuel breaks included six 57mm
27 M306 HE projectiles and six 81mm HE projectiles. The munitions debris included thirty mortar
28 fins from 81mm projectiles, nineteen point detonating fuzes, seventeen 81mm M43 series TP
29 projectiles, and eleven 60mm M83 series illuminating projectiles [Ref. 15].

30 The MEC encountered on the Evolution Road fuel break consisted of four 57mm M306 HE
31 projectiles, a 81mm M43 series HE projectile, and a 84mm M136 HEAT projectile. The
32 munitions debris included sixty-one rocket motors from 3.5-in and 66 mm rockets, fifty-nine
33 60mm M50 series TP projectiles, fifty-two 81mm M43 series HE projectiles, forty-three M48
34 point detonating fuzes, and nineteen 35mm M73 subcaliber practice rockets [Ref. 15].

35 **2.3.2.12 Surface TCRA**

36 From August to December 2001, a TCRA was performed over the former 555.8-acre Ranges 43–
37 48 site to remove MEC, munitions debris, and range-related debris (RRD) from the surface of
38 the site's open and accessible areas [Ref. 16]. Vegetation was not disturbed during this action.
39 The surface TCRA was required to address the imminent threat to public safety posed by the
40 site's accessibility and proximity to the public, the types and quantities of MEC known to be
41 present on the site, and the site's susceptibility to trespassing.

42 During the Ranges 43–48 TCRA, 2,334 MEC and 133 expended munitions debris items were
43 encountered on the surface of the site's open and accessible areas. The MEC included one

1 thousand seven hundred and forty-nine 35mm subcaliber M73 practice rockets, one hundred
2 sixty-seven 66mm M72 series HEAT rockets, ninety-four 84mm M136 HEAT projectiles, thirty-
3 four 40mm HE projectiles, twenty-five 66mm M74 TPA incendiary rockets, eighteen 60mm
4 M49 series HE projectiles, fourteen 90mm HE projectiles, and eleven M231 Dragon guided
5 missiles. The munitions debris included seventy-two 60mm M50 series TP projectiles, sixteen
6 57mm M306 series projectiles, fourteen 81mm M43 series projectiles, and sixteen rocket motors
7 from M222 Dragon guided missiles [Refs. 11 and 16].

8 **2.3.2.13 Preparatory Action**

9 From August to October 2002, fire prevention and control work was completed in preparation
10 for the Ranges 43–48 prescribed burn [Ref. 17]. This preparatory action entailed removing or
11 relocating debris on the site such as tires, wooden structures, and utility poles; cutting vegetation
12 around structures and utility poles that were not removed; cutting the brush and
13 pruning/removing trees around the site perimeter; and performing fire prevention work around
14 the Fitch Park housing area.

15 During the vegetation cutting along the site perimeter, ten MEC and two munitions debris items
16 were encountered. The MEC consisted of three 66mm M72 series HEAT rockets, two 57mm
17 M306 series HE projectiles, a 105mm M1 HE projectile, an 81mm M43 series practice
18 projectile, a 60mm M49 series HE projectile, a 40mm M386 HE projectile, and a 2.36-inch M6
19 HE rocket. The munitions debris consisted of a 57mm M306 series TP projectile and a 22mm
20 subcaliber M744 practice rocket [Ref. 17].

21 **2.3.2.14 Prescribed Burn**

22 In October 2003, a prescribed burn, the vegetation clearance alternative selected under the IA
23 ROD, was conducted on Ranges 43–48. The vegetation needed to be cleared from Ranges 43–
24 48 so MEC removal teams could safely operate geophysical detection instruments over the site
25 and locate and destroy the MEC on it. The prescribed burn cleared the vegetation from
26 approximately 95% of the site, revealing numerous MEC previously hidden by the brush
27 [Ref. 18].

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Table 2-2 — Summary of Previous Site Investigations/Activities in MRS-Ranges 43–48

Activity Date	Description/Purpose	Grids/ Partial Grids	Grid Size	Items Encountered (Qty)	
				MEC	MD-E
April 1997	Range 44 Trail Sampling. Grid sampling with Schonstedt magnetometers to 4-ft depth on 15-ft-wide trail in Range 44 to allow safe access for soil characterization activities and equipment.	11	15 ft by 100 ft ^a	0	13
April 1997	Range 44 Grid Subsurface Removal. Subsurface removal to 4-ft depth with Schonstedt magnetometers on Range 44 grids performed to establish duration and cost for a removal action in ranges ^b .	2	100 ft by 100 ft	47	0
August 1997	Range 44 Grid Sampling. Sampling performed with Schonstedt magnetometers on grid that contained a target in Range 44.	1	100 ft by 100 ft	0	0
October 1997	OE-15A Grid Sampling. 4-ft removal with Schonstedt magnetometers conducted over 100% of sample grids in Range 18, 19, 21, 39, and 46 (small arms ranges) to determine need and scope of future removal actions.	3	100 ft by 100 ft	0	145
October 1997	OE-15B Grid Sampling. 4-ft removal with Schonstedt magnetometers performed over 100% of sample grids located along the perimeter of Impact Area, behind or between firing ranges.	2	100 ft by 100 ft	2	1
November 1997–January 1998	Evolution Road Fuel Break. Vegetation clearance and 4-ft removal with Schonstedt magnetometers performed to establish Evolution Road fuel break (western Ranges 43–48 boundary previously known as Maverick Road).	53	30 ft by 100 ft	205	118
May–June 1998	Blue Line Fuel Break. Vegetation clearance and 4-ft removal with Schonstedt magnetometers performed to establish Blue Line fuel break (previously Maverick Road).	56	30 ft by 100 ft	353	151
March–August 1999	Impact Area Grid Sampling. 4-ft removal with Schonstedt magnetometers conducted over 100% of sample grids in DRO.2 MOCO.1, MOCO.2, and SEA.1–4 sites.	6	100 ft by 100 ft	4	17
April–August 1999	Range 46 Lead-Contaminated Soil Remediation. 4-ft removal with Schonstedt magnetometers in Range 46 during site preparation to support remediation of lead-contaminated soil and spent SAA.	9	100 ft by 100 ft	0	0

FINAL

1 Table 2-2 — Summary of Previous Site Investigations/Activities in MRS-Ranges 43–48 (cont)

Activity Date	Description/Purpose	Grids/ Partial Grids	Grid Size	Items Encountered (Qty)	
				MEC	MD-E
April–October 1999	Range 45 Safety Surface Removal. Surface removal performed over 11.5-acre portion of Range 45 as an immediate safety action in response to trespassing incidents at Ranges 44 and 45.	11	100 ft by 100 ft	88	1,552
February– August 2001	Fuel Break Maintenance. Surface and subsurface removals conducted to establish 45-ft-wide Orion Road/Broadway Avenue fuel breaks (formerly known as Pipeline Road).	62	45 ft by 100 ft	14	111
	Surface removal conducted to add 30-ft-wide fuel break along interior of Evolution Road.	52	30 ft by 100 ft	6	269
	Surface removal conducted to add 15-ft-wide fuel break along interior of Eucalyptus Road.	89	15 ft by 100 ft	0	0
August– December 2001	Surface TCRA. Visual surface removal conducted to locate and destroy MEC on surface of open, visible areas of site.	37	1,000 ft by 1,000 ft	2,334	133
August– October 2002	Preparatory Action. Removal/relocation of site debris and brush cutting and tree cutting/pruning around site perimeter in preparation of prescribed burn.	N/A	N/A	10	2
October 2003	Prescribed Burn. Prescribed burn conducted to clear vegetation in order to make site safe for removal crews to locate and destroy MEC.	N/A	N/A	0	0
^a Range 44 trail covered approximately 11 contiguous 100-ft sections. ^b Items were only encountered on the surface during this operation.					

FINAL

2

CHAPTER 3 SURFACE REMOVAL

A surface removal was selected in the IA ROD [Ref. 2] as a part of the action to remediate military munitions at MRS-Ranges 43–48. This surface removal entailed replacing/installing 1,000-foot-by-1,000-foot grid markers; identifying MEC on the ground surface of the site and removing and inspecting munitions debris and RRD 2 inches or larger; and detonating suspected MEC using engineering controls.

3.1 GRID INSTALLATION

Prior to the surface removal, Parsons' survey subcontractor, Central Coast Surveyors, replaced the 10-foot-long PVC pipes that marked the site's 1,000-foot-by-1,000-foot grids. Many of the original PVC pipes, which were installed for the 2001 surface TCRA, melted during the prescribed burn. An unexploded ordnance (UXO) specialist accompanied the surveyor to ensure that the route was clear of MEC and to check the areas with a Schonstedt magnetometer where the PVC pipes were to be placed.

3.2 VISUAL SURFACE SWEEP

Visual surface sweep teams searched the ground surface of Ranges 43-48 to identify MEC and remove all munitions debris and RRD 2 inches or larger.

The sweep teams generally consisted of 18 sweepers (non-UXO personnel who received Hazardous Waste Operations and Emergency Response [HAZWOPER] and MEC familiarization and safety training), three UXO specialists, and one UXO supervisor.

To search the site's surface, the sweepers lined up side-by-side and were spaced shoulder-to-shoulder up to 5 feet apart depending on the amount of MEC in an area. The sweepers carried buckets for collecting the munitions debris and RRD 2 inches or larger (Photograph 3-1).



Photograph 3-1 — Surface sweep teams identified MEC on the ground surface while collecting debris in their buckets.

1 The sweep team moved down the grid in an approximately 100-foot-wide line formation using
2 the grid stakes as the initial lane boundary and handheld global positioning systems (GPSs) to
3 help guide them. The person at the end of the line opposite the grid stakes marked the extent of
4 the sweep lane with flags, which were then used to guide the team's pass back up the grid. The
5 sweep team continued making passes up and down the grid until it was completed.

6 To minimize the potential for unswept areas, the sweep teams carried a GPS that recorded where
7 the teams walked. Track line maps were then generated from the data collected with the GPS,
8 and they were used to identify any areas not covered by the sweep teams.

9 As the sweep teams progressed, they visually searched the surface for MEC items, munitions
10 debris, and RRD. When a sweeper encountered an item suspected of being MEC, the team
11 stopped and a UXO specialist identified the item as potential MEC and marked the item's
12 location with a flag. The UXO supervisor then verified that the marked item was potentially
13 MEC, identified the item's location (coordinates) with a GPS, and recorded the item's
14 description and location in a personal digital assistant (PDA).

15 The sweepers picked up all munitions debris and RRD 2 inches or larger from the grids and
16 placed the debris in their buckets. The debris removed from the grids was then gathered at
17 designated temporary collection points inside the grids and inspected by UXO technicians for
18 energetic materials. Section 3.2.2 discusses the final disposition of the munitions debris and
19 RRD removed.

20 UXO technicians used a Schonstedt GA-52Cx magnetometer to locate items when the UXO
21 supervisor determined that the surface was obscured by burnt vegetation, thick layers of ash, or
22 other debris.

23 **3.2.1 MEC ENCOUNTERED**

24 During the visual surface sweep, teams encountered 4,563 MEC items (4,472 during the Ranges
25 43-48 removal action, 82 during scrap sorting associated with the Ranges 43-48 removal action,
26 and nine during visual surface sweep for demolition operations) and 411 expended munitions
27 debris (MD-E) items. The MEC encountered included more than 3,700 35mm M73 subcaliber
28 practice rockets and almost 600 HE projectiles (Photographs 3-2 and 3-3). The projectiles
29 included more than 200 57mm M306 series HE, more than fifty 60mm M49 series HE, seventy-
30 eight 40mm M381 HE, and thirteen 75mm M48 HE types. The other items found included
31 missiles, hand grenades, and illumination signals. The MEC items and suspected MEC items
32 (items later determined to be MD-E) were destroyed by detonation (Section 3.3).

33 Table 3-1 summarizes the surface MEC encountered by item and Table 3-2 lists the items by
34 grid. Map 3-1 shows where the MEC and MD-E were encountered. A detailed listing of each
35 item encountered has been included in Appendix A.



1
2 *Photographs 3-2 and 3-3 — The 4,472 MEC found on the surface of MRS-Ranges 43–48*
3 *included over 3,700 practice rockets(left) and nearly 600 HE projectiles like the 4.2-in, M3*
4 *series HE mortar pictured at the right.*

5
6 Table 3-1 — MEC Encountered during Surface Removal (by item)

Item Description	Qty
Cap, blasting, non-electric, M7	1
Cartridge, 40mm, prac, M781	2
Explosive, bulk, HE	2
Flare, parachute, trip, M48	1
Flare, surface, trip, M49 series	8
Fuze, grenade, hand, M204 series	1
Fuze, grenade, hand, prac, M228	1
Fuze, projectile, MTSQ, M772	1
Fuze, projectile, PD, M46	2
Fuze, projectile, PD, M48 series	5
Fuze, projectile, PD, M503 series	15
Fuze, projectile, PD, M52 series	2
Fuze, projectile, TSQ, M548	1
Grenade, hand, smoke, HC, AN-M8	2
Grenade, hand, smoke, M18 series	4
Grenade, hand, smoke, WP, M15	4
Igniter, bomb, WP, M23	1
Missile, guided, prac, M231 (Dragon)	1
Ordnance components	75
Projectile, 105mm, HE, M1	1
Projectile, 105mm, illum, M314 series	2
Projectile, 105mm, smoke, M84 series	1
Projectile, 14.5mm, subcal, prac, M181 series	3
Projectile, 155mm, HE, MK 1	1
Projectile, 22mm, subcal, prac, M744	4
Projectile, 25mm, subcal, M379	2
Projectile, 37mm, HE, M54	5

FINAL

Table 3-1 — MEC Encountered during Surface Removal (by item) (cont)

Item Description	Qty
Projectile, 37mm, HE, M63	1
Projectile, 4.2inch, mortar, smoke, WP, M328 series	1
Projectile, 40mm, cluster, white star, M585	3
Projectile, 40mm, HE, M381	72
Projectile, 40mm, HE, M383	12
Projectile, 40mm, HE, M384	3
Projectile, 40mm, HE, M397	1
Projectile, 40mm, HE, M406	8
Projectile, 40mm, HEDP, M430	2
Projectile, 40mm, HEDP, M433	2
Projectile, 40mm, parachute, illum, M583 series	6
Projectile, 40mm, parachute, star, M662	1
Projectile, 40mm, prac (model unknown)	14
Projectile, 40mm, prac, M382	2
Projectile, 40mm, smoke, M680 series	1
Projectile, 40mm, smoke, M713 series	6
Projectile, 57mm, HE, M306 series	236
Projectile, 57mm, HEAT, M307	3
Projectile, 60mm, mortar, HE, M49 series	56
Projectile, 60mm, mortar, illum, M83 series	2
Projectile, 60mm, mortar, prac, M50 series	1
Projectile, 75mm, HE, M309	17
Projectile, 75mm, HE, M41A1	1
Projectile, 75mm, HE, M48	32
Projectile, 75mm, HE, MK I	1
Projectile, 75mm, Shrapnel, MK I	1
Projectile, 81mm, mortar, HE, M362	32
Projectile, 81mm, mortar, HE, M374 series	1
Projectile, 81mm, mortar, HE, M43 series	9
Projectile, 81mm, mortar, smoke, WP, M375 series	1
Projectile, 84mm, HEAT, M136 series (AT-4)	28
Projectile, 90mm, HEAT, M348	3
Projectile, 90mm, HEAT, M371A1	5
Pyrotechnic mixture, illum	1
Pyrotechnic mixture, smoke	7
Rocket motors, M222/M223 (Dragon)	33
Rocket, 2.36inch, HEAT, M6	2
Rocket, 35mm, subcal, prac, M73	3,727
Rocket, 66mm, HEAT, M72 series	38
Rocket, 66mm, incen, TPA, M74	27
Signal, illum, aircraft, AN-M37 series	1
Signal, illum, AN-M43 series	1

FINAL

1 Table 3-1 — MEC Encountered during Surface Removal (by item) (cont)

Item Description	Qty
Signal, illum, ground, M125 series	5
Signal, illum, ground, M21A1	6
Signal, illum, M187	1
Simulator, projectile, airburst, M74 series	2
Grand Total	4,563

2 Table 3-2 — MEC Encountered during Surface Removal (by grid)

Grid	Item Description	Qty
B2G7	Projectile, 105mm, high explosive, M1	1
	Projectile, 155mm, high explosive, MK 1	1
	Projectile, 37mm, high explosive, M54	4
	Projectile, 57mm, high explosive, M306 series	6
	Projectile, 75mm, high explosive, M309	1
B2G7 Total		13
B2G7I8	Fuze, projectile, point detonating, M48 series	1
	Projectile, 57mm, high explosive, M306 series	1
B2G7I8 Total		2
B2G8	Projectile, 57mm, high explosive, M306 series	5
B2G8 Total		5
B2G8H4	Projectile, 57mm, high explosive, M306 series	1
B2G8H4 Total		1
B2H6	Projectile, 57mm, high explosive, M306 series	16
	Projectile, 60mm, mortar, high explosive, M49 series	16
	Projectile, 75mm, high explosive, M309	2
	Projectile, 81mm, mortar, high explosive, M362	14
B2H6 Total		48
B2H6H5	Fuze, projectile, point detonating, M48 series	2
	Projectile, 60mm, mortar, high explosive, M49 series	3
B2H6H5 Total		5
B2H7	Grenade, hand, smoke, white phosphorous, M15	2
	Ordnance Components	1
	Projectile, 40mm, high explosive, M381	2
	Projectile, 40mm, practice, M382	1
	Projectile, 57mm, high explosive, M306 series	4
	Projectile, 60mm, mortar, high explosive, M49 series	4
	Projectile, 81mm, mortar, high explosive, M362	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	1
B2H7 Total		16
B2H7D2	Grenade, hand, smoke, white phosphorous, M15	1
	Projectile, 57mm, high explosive antitank, M307	1
B2H7D2 Total		2
B2H8	Fuze, projectile, point detonating, M48 series	2
	Projectile, 37mm, high explosive, M54	1

FINAL

Table 3-2 — MEC Encountered during Surface Removal (by grid) (cont)

Grid	Item Description	Qty
	Projectile, 37mm, high explosive, M63	1
	Projectile, 57mm, high explosive, M306 series	45
	Projectile, 60mm, mortar, high explosive, M49 series	2
	Projectile, 75mm, high explosive, M309	5
	Projectile, 75mm, high explosive, M48	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	2
	Rocket, 35mm, subcaliber, practice, M73	2
	Signal, illumination, aircraft, AN-M37 series	1
B2H8 Total		62
B2H8A1	Projectile, 57mm, high explosive, M306 series	2
	Rocket motors, M222/M223 (Dragon)	1
B2H8A1 Total		3
B2H9	Projectile, 57mm, high explosive, M306 series	1
	Projectile, 60mm, mortar, high explosive, M49 series	1
	Projectile, 75mm, high explosive, M309	1
	Projectile, 75mm, high explosive, M48	1
	Projectile, 81mm, mortar, high explosive, M362	12
	Projectile, 81mm, mortar, high explosive, M374 series	1
	Rocket, 35mm, subcaliber, practice, M73	1
B2H9 Total		18
B2I0	Projectile, 60mm, mortar, high explosive, M49 series	1
B2I0 Total		1
B2I5	Igniter, bomb, white phosphorous, M23	1
	Projectile, 40mm, high explosive dual-purpose, M430	1
	Projectile, 40mm, high explosive, M383	1
	Projectile, 57mm, high explosive, M306 series	1
	Projectile, 60mm, mortar, high explosive, M49 series	8
	Projectile, 81mm, mortar, high explosive, M43 series	9
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	2
	Rocket, 35mm, subcaliber, practice, M73	3
B2I5 Total		26
B2I6	Flare, parachute, trip, M48	1
	Fuze, projectile, point detonating, M46	1
	Grenade, hand, smoke, M18 series	1
	Ordnance Components	7
	Projectile, 14.5mm, subcaliber, practice, M181 series	1
	Projectile, 25mm, subcaliber, M379	1
	Projectile, 40mm, smoke, M713 series	1
	Projectile, 57mm, high explosive, M306 series	36
	Projectile, 60mm, mortar, high explosive, M49 series	13
	Projectile, 60mm, mortar, practice, M50 series	1

FINAL

Table 3-2 — MEC Encountered during Surface Removal (by grid) (cont)

Grid	Item Description	Qty
	Projectile, 75mm, high explosive, M309	2
	Projectile, 75mm, high explosive, M41A1	1
	Projectile, 75mm, high explosive, M48	1
	Projectile, 81mm, mortar, high explosive, M362	3
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	2
	Rocket motors, M222/M223 (Dragon)	4
	Rocket, 35mm, subcaliber, practice, M73	3
	Signal, illumination, ground, M21A1	6
	Simulator, projectile, airburst, M74 series	1
B2I6 Total		86
B2I6D5	Projectile, 57mm, high explosive, M306 series	20
	Projectile, 75mm, high explosive, M48	19
B2I6D5 Total		39
B2I7	Fuze, projectile, point detonating, M503 series	15
	Ordnance Components	4
	Projectile, 57mm, high explosive, M306 series	85
	Projectile, 75mm, high explosive, M309	4
	Projectile, 75mm, high explosive, M48	5
	Projectile, 90mm, high explosive antitank, M371A1	1
	Rocket, 35mm, subcaliber, practice, M73	4
B2I7 Total		118
B2I8	Projectile, 57mm, high explosive, M306 series	10
	Projectile, 75mm, high explosive, M309	2
	Projectile, 75mm, high explosive, M48	5
	Projectile, 75mm, Shrapnel, MK I	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	6
	Projectile, 90mm, high explosive antitank, M348	3
	Projectile, 90mm, high explosive antitank, M371A1	2
	Pyrotechnic mixture, smoke	5
	Rocket, 35mm, subcaliber, practice, M73	3
	Rocket, 66mm, incendiary, TPA, M74	1
	Signal, illumination, ground, M125 series	1
B2I8 Total		39
B2I9	Ordnance Components	1
	Projectile, 105mm, smoke, M84 series	1
	Projectile, 40mm, high explosive dual-purpose, M433	2
	Projectile, 60mm, mortar, high explosive, M49 series	2
	Rocket, 35mm, subcaliber, practice, M73	5
B2I9 Total		11
B2J0	Grenade, hand, smoke, M18 series	1
	Projectile, 40mm, Practice, (model unknown)	1
	Projectile, 40mm, smoke, M713 series	5
	Projectile, 60mm, mortar, high explosive, M49 series	1

FINAL

Table 3-2 — MEC Encountered during Surface Removal (by grid) (cont)

Grid	Item Description	Qty
B2J0 Total		8
B2J4	Projectile, 40mm, high explosive, M383	1
	Rocket, 35mm, subcaliber, practice, M73	3
B2J4 Total		4
B2J5	Fuze, projectile, point detonating, M52 series	2
	Grenade, hand, smoke, HC, AN-M8	2
	Grenade, hand, smoke, white phosphorous, M15	1
	Projectile, 40mm, high explosive, M406	2
	Projectile, 60mm, mortar, high explosive, M49 series	2
	Projectile, 81mm, mortar, high explosive, M362	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	1
	Rocket motors, M222/M223 (Dragon)	2
B2J5 Total		68
B2J6	Ordnance Components	5
	Projectile, 4.2inch, mortar, smoke, white phosphorous, M328 series	1
	Projectile, 40mm, high explosive, M381	39
	Projectile, 40mm, high explosive, M383	4
	Projectile, 40mm, parachute, illumination, M583 series	4
	Projectile, 57mm, high explosive antitank, M307	2
	Projectile, 57mm, high explosive, M306 series	2
	Projectile, 60mm, mortar, high explosive, M49 series	2
	Projectile, 60mm, mortar, illumination, M83 series	2
	Projectile, 75mm, high explosive, MK I	1
	Projectile, 81mm, mortar, smoke, white phosphorous, M375 series	1
	Rocket motors, M222/M223 (Dragon)	1
	Rocket, 66mm, incendiary, TPA, M74	2
B2J6 Total		66
B2J7	Projectile, 105mm, illumination, M314 series	1
	Projectile, 40mm, high explosive, M381	12
	Projectile, 40mm, high explosive, M383	2
	Projectile, 40mm, parachute, star, M662	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	2
	Rocket, 66mm, incendiary, TPA, M74	8
B2J7 Total		26
B2J8	Ordnance Components	7
	Projectile, 105mm, illumination, M314 series	1
	Projectile, 22mm, subcaliber, practice, M744	1
	Projectile, 25mm, subcaliber, M379	1
	Projectile, 40mm, high explosive dual-purpose, M430	1
	Projectile, 40mm, high explosive, M381	4
	Projectile, 40mm, high explosive, M397	1
	Projectile, 40mm, high explosive, M406	3

FINAL

Table 3-2 — MEC Encountered during Surface Removal (by grid) (cont)

Grid	Item Description	Qty
	Projectile, 40mm, practice, M382	1
	Projectile, 84mm, high explosive antitank, M136 series (AT-4)	12
	Projectile, 90mm, high explosive antitank, M371A1	2
	Pyrotechnic mixture, smoke	2
	Rocket motors, M222/M223 (Dragon)	22
	Rocket, 35mm, subcaliber, practice, M73	674
	Rocket, 66mm, high explosive antitank, M72 series	12
	Rocket, 66mm, incendiary, TPA, M74	6
B2J8 Total		750
B2J9	Flare, surface, trip, M49 series	5
	Fuze, projectile, point detonating, M46	1
	Grenade, hand, smoke, M18 series	1
	Projectile, 40mm, high explosive, M383	1
	Projectile, 40mm, Practice, (model unknown)	5
	Projectile, 81mm, mortar, high explosive, M362	1
	Rocket, 35mm, subcaliber, practice, M73	1
	Rocket, 66mm, high explosive antitank, M72 series	1
B2J9 Total		16
C2A0	Projectile, 40mm, Practice, (model unknown)	2
	Signal, illumination, AN-M43 series	1
C2A0 Total		3
C2A5	Cap, blasting, non-electric, M7	1
	Projectile, 40mm, cluster, white star, M585	1
	Projectile, 40mm, high explosive, M383	1
	Projectile, 60mm, mortar, high explosive, M49 series	1
	Rocket, 2.36inch, high explosive antitank, M6	2
	Rocket, 35mm, subcaliber, practice, M73	1
C2A5 Total		7
C2A6	Projectile, 40mm, high explosive, M381	4
	Projectile, 40mm, high explosive, M383	1
	Projectile, 40mm, high explosive, M384	2
	Projectile, 40mm, Practice, (model unknown)	5
	Projectile, 57mm, high explosive, M306 series	1
C2A6 Total		13
C2A7	Ordnance Components	5
	Projectile, 14.5mm, subcaliber, practice, M181 series	1
	Projectile, 40mm, high explosive, M381	7
C2A7 Total		13
C2A7E8	Projectile, 14.5mm, subcaliber, practice, M181 series	1
	Rocket, 66mm, high explosive antitank, M72 series	1
C2A7E8 Total		2
C2A8	Fuze, grenade, hand, M204 series	1
	Fuze, projectile, mechanical time super quick, M772	1

FINAL

Table 3-2 — MEC Encountered during Surface Removal (by grid) (cont)

Grid	Item Description	Qty
	Fuze, projectile, time super quick, M548	1
	Ordnance Components	43
	Projectile, 40mm, cluster, white star, M585	2
	Projectile, 40mm, high explosive, M381	4
	Projectile, 40mm, high explosive, M383	1
	Projectile, 40mm, high explosive, M384	1
	Projectile, 40mm, high explosive, M406	3
	Projectile, 40mm, parachute, illumination, M583 series	1
	Projectile, 40mm, smoke, M680 series	1
	Pyrotechnic mixture, illumination	1
	Rocket motors, M222/M223 (Dragon)	2
	Rocket, 35mm, subcaliber, practice, M73	2,962
	Rocket, 66mm, high explosive antitank, M72 series	24
	Rocket, 66mm, incendiary, TPA, M74	10
	Signal, illumination, ground, M125 series	1
C2A8 Total		3,059
C2A9	Cartridge, 40mm, practice, M781	1
	Explosive, bulk, HE	2
	Flare, surface, trip, M49 series	1
	Fuze, grenade, hand, practice, M228	1
	Grenade, hand, smoke, M18 series	1
	Missile, guided, practice, M231 (Dragon)	1
	Projectile, 40mm, parachute, illumination, M583 series	1
	Rocket motors, M222/M223 (Dragon)	1
	Rocket, 35mm, subcaliber, practice, M73	4
	Signal, illumination, ground, M125 series	3
	Signal, illumination, M187	1
C2A9 Total		17
C2B7	Projectile, 22mm, subcaliber, practice, M744	3
C2B7 Total		3
C2B8	Flare, surface, trip, M49 series	2
	Ordnance Components	2
	Projectile, 40mm, Practice, (model unknown)	1
	Rocket, 35mm, subcaliber, practice, M73	4
	Simulator, projectile, airburst, M74 series	1
C2B8 Total		10
C2B9	Cartridge, 40mm, practice, M781	1
	Rocket, 35mm, subcaliber, practice, M73	2
C2B9 Total		3
Grand Total		4,563

FINAL

1 **3.2.2 DEBRIS REMOVED**

2 The surface sweep teams removed 49,084 pounds of munitions debris and 51,271 pounds of
3 RRD. The munitions debris and RRD were transported from the designated temporary collection
4 points on the grids (Photograph 3-4) to the Explosive Storage Location (ESL), where it was
5 sorted by metal type before going through a three-phase inspection process. First, qualified
6 UXO specialists visually checked the debris spread over the designated sorting area for MEC and
7 munitions debris. Any item identified as MEC was recorded in a PDA. MEC items were either
8 identified as acceptable to move and were then hand-carried to the locations of other suspected
9 MEC awaiting demolition on MRS-Ranges 43-48 or were identified as blow-in-place (BIP)
10 items too sensitive to move and thus detonated in the location where found, in accordance with
11 the demolition SOP of the PWP [Ref. 4].

12 The munitions debris and RRD were then collected in buckets and placed in a separate container
13 for the second step, in which qualified UXO specialists re-checked the recovered munitions
14 debris. Any MEC or energetic materials found in the collected munitions debris were removed
15 or destroyed in accordance with the demolition standard operating procedure (SOP) of the PWP
16 [Ref. 4]. The munitions debris and RRD then went through a third inspection step, with
17 qualified UXO specialists again removing any MEC or energetic materials found in the collected
18 munitions debris and destroying them in accordance with the demolition SOP of the PWP [Ref.
19 4]. After undergoing these three checks, the munitions debris and RRD were placed into a lock-
20 box storage bin until FACT International, Inc. (FACT) picked up the munitions debris and RRD
21 for transportation to their processing mill. The collection, transporting, and sorting procedures
22 were done in accordance with the SOP for material potentially presenting an explosive hazard
23 (MPPEH) [Ref. 19].

24 Before leaving the Fort Ord site, all munitions debris and RRD received the required inspections
25 (including an inspection by a qualified Army representative) and certifications, as outlined in the
26 MPPEH SOP.



27 *Photograph 3-4 — Nearly 50,000 pounds of munitions debris*
28 *were removed from the surface of MRS-Ranges 43–48.*

1 At FACT's processing mill, the munitions debris was inspected for energetic materials and
2 finally demilitarized via cutting, crushing, chopping, melting, or a combination thereof. Parsons
3 and FACT completed and maintained the appropriate chain of custody documentation to ensure
4 that the munitions debris could be tracked at all times.

5 **3.3 DEMOLITION OPERATIONS**

6 The MEC items and suspected MEC items (items later determined to be MD-E) were identified
7 as either acceptable or unacceptable to move based on their explosive filler, fuzing, and
8 condition (e.g., missing fuze, unfired). The unacceptable-to-move items were too sensitive to
9 move and thus detonated in the location where they were found (BIP). The acceptable-to-move
10 items were hand-carried a short distance to the locations of other identified MEC awaiting
11 demolition and then destroyed (referred to as a consolidated demolition shot). All items moved
12 were approved by the onsite USACE OESS in agreement with the USA Environmental Inc.
13 senior unexploded ordnance supervisor (SUXOS) and the onsite Parsons safety officer.

14 For both the BIP and consolidated demolition shots, an explosive charge was applied to the
15 item(s) to be detonated. For those demolition shots within 1,701 feet (the exclusion zone) of
16 Fitch Park or Eucalyptus Road, engineering controls were placed over the suspected MEC to
17 reduce the smoke, noise, and fragmentation from the blast. Finally, after all personnel cleared
18 the area, the explosive charge was initiated remotely, detonating and destroying the suspected
19 MEC. After observing the appropriate wait time, the item/items were inspected to determine the
20 final identification of the item/items and to clear the demolition site of remaining debris.

21 **Results**

22 Of the 4,976 items initially identified as MEC, 543 were determined to be too sensitive to move
23 and were thus blown in place. The other 4,433 items were moved to the location of a
24 consolidated demolition shot. Appendix B lists the types of ordnance detonated, the locations of
25 detonations, whether the detonations were of consolidated items or BIP items, and the dates of
26 the detonations. The results of the demolition operations determined that 4,563 items were
27 MEC; the other 413 were munitions debris.

FINAL

CHAPTER 4 SITE PREPARATION

Site preparation activities were conducted from September 2003 to July 2004 to ready MRS-Ranges 43-48 for the subsequent subsurface removal operations. This work included clearing access paths to range targets, performing a prescribed burn, cutting leftover burnt vegetation, target removal, conducting a geophysical walk-through, installing and surveying grid and border markers, performing a geophysical transect survey, and seeding QC/QA items.

4.1 RANGE TARGET IDENTIFICATION AND PATH CLEARANCE

Prior to the prescribed burn, the Army identified approximately 100 range targets at the site. These included 6-foot-tall metal silhouettes, 55-gallon drums, armored personnel carriers (APCs), cement-filled targets, dumpsters, tanks, and wheeled vehicles. These metallic items once served as targets for weapons training activities. Photographs 4-1 and 4-2 provide examples of the types of range targets identified on Ranges 43-48. Map 4-1 locates the targets.



Photographs 4-1 and 4-2 — This APC (left) and pickup truck (right) were two of over 100 range targets identified in Ranges 43-48; both were removed after the prescribed burn.

Target path clearance occurred during two timeframes: September and October 2003 (ending shortly before the prescribed burn) and in March and April 2004. Most of the targets were easily accessible from the fuel breaks and established dirt roads in the site. Other targets required short paths to be cleared (MEC removed from the surface and subsurface) from the existing roads to the target location. Map 4-1 shows the target removal paths. Technicians removed 189 MEC items and 88 MD-E items during target path clearance, as well as 4,310 pounds of munitions debris and 4,997 pounds of RRD (Appendix A) Appendix B lists the types of ordnance detonated, the locations of detonations, whether the detonations were of consolidated items or BIP items, and the dates of the detonations.

For the accessible range targets, a UXO escort identified the safest route from the existing road to the range target. For those targets requiring new paths, the UXO escorts cleared the paths by foraging the brush by hand and visually searching the surface while using a Schonstedt to detect any subsurface MEC.

1 **4.2 PRESCRIBED BURN**

2 A burn at MRS-Ranges 43–48 was scheduled in November 2002 but could not be conducted
3 because the required meteorological and fire conditions did not occur. The rainy season began
4 shortly thereafter, and the prescribed burn was postponed. In October 2003, the required
5 meteorological and fire conditions materialized and the prescribed burn was conducted. The
6 prescribed burn cleared most of the maritime chaparral vegetation covering MRS-Ranges 43–48,
7 revealing thousands of MEC previously hidden by the thick brush.

8 **4.3 VEGETATION CLEARANCE**

9 From November 2003 to July 2004, Timberline Environmental Services, Parsons’ site
10 preparation subcontractor, mechanically and manually cut the 28 acres of unburned brush and
11 also cut leftover standing burnt stems and branches from the surface-cleared grids (Photographs
12 4-3 and 4-4). This cutting made the site’s surface accessible for geophysical instrument
13 operators. Mechanical cutting was done with the TAZ; manual cutting was done with chainsaws
14 and string trimmers.

15 The 160 metal t-posts that identified habitat-monitoring transects within the site were
16 temporarily removed to allow the brushcutting. The t-posts were immediately replaced in the
17 same spot to maintain transect locations and data accuracy.



18
19 *Photographs 4-3 and 4-4 — The leftover burnt vegetation was mechanically and manually cut to*
20 *make the ground accessible for geophysical instrument operators.*

21 **4.4 TARGET REMOVAL**

22 Timberline Environmental Services, removed the targets from March 2004 to July 2004, driving
23 mechanical handling equipment (MHE) over the access route to reach the range targets. The
24 MHE was reinforced with steel and bullet-resistant glass to protect the equipment operator from
25 the unintentional detonation of a 75mm HE projectile (the most probable munition with the
26 greatest fragmentation distance [MGFD] identified for the site).

27 After reaching a range target, a UXO specialist checked inside the range target for MEC. The
28 MHE then placed the target on its side and the UXO specialist inspected the target’s underside
29 for MEC. The MHE then placed the target into an armored dump truck. Photographs 4-5 and
30 4-6 demonstrate the target inspection and removal process.

31 The armored dump truck then hauled the target from the area using the same access route to
32 return to the existing road. For multiple targets in close proximity to each other, the same access

1 route was used more than once when appropriate to minimize impacts to the environment. The
2 range targets were hauled to the Range 44 pad. In accordance with the SOP for MPPEH [Ref.
3 19], the range targets were inspected and then cut by Parsons' metal recycling subcontractor,
4 FACT, using a torch or MHE equipped with a large mechanical shear (Photographs 4-7 and 4-8).
5 FACT then picked up the sheared metal and transported it to their processing mill. Parsons and
6 FACT completed and maintained the appropriate chain of custody documentation to track the
7 metal scrap material at all times.



8
9 *Photographs 4-5 and 4-6 — UXO technicians inspect a range target (left) before it is picked up*
10 *by an armored excavator and loaded into an armored dump truck (right).*



11
12
13 *Photographs 4-7 and 4-8 — The range targets were cut by torch or a large mechanical shear.*

14 During range target removal activities, UXO technicians encountered 157 MEC items and 70
15 MD-E items. In addition, they removed 6,210 pounds of munitions debris and 27,700 pounds of
16 RRD. Table 4-1 lists the MEC encountered, and Map 4-1 displays the locations of the MEC and
17 MD-E encountered. Appendix B lists the types of ordnance detonated, the locations of
18 detonations, whether the detonations were of consolidated items or BIP items, and the dates of
19 the detonations.

Table 4-1 — MEC Encountered during Range Target Path Clearance

Grid	Item Description	Qty	Depth (inches bgs)
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	6
B2H8I6	Projectile, 57mm, HE, M306 series	1	6
B2H8I6	Projectile, 81mm, mortar, HE, M374 series	1	20
B2I9C2	Projectile, 75mm, HE, M48	1	8
B2I9B2	Projectile, 60mm, mortar, HE, M49 series	1	4
B2I9B2	Projectile, 60mm, mortar, HE, M49 series	1	4
B2I9B1	Projectile, 60mm, mortar, HE, M49 series	1	6
B2I8B0	Projectile, 60mm, mortar, HE, M49 series	1	3
B2I5I8	Projectile, 60mm, mortar, prac, M50 series	1	12
B2I5I7	Projectile, 60mm, mortar, prac, M50 series	1	1
B2I5I7	Projectile, 60mm, mortar, HE, M49 series	1	12
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	6
B2J5H3	Rocket, 35mm, subcal, practice, M73	3	18
B2I5I7	Projectile, 81mm, mortar, practice, M43 series	1	4
B2I5H7	Projectile, 14.5mm, subcal, practice, M181 series	1	0
B2H9G1	Fuze, projectile, PD, M52 series	1	0
B2I5I9	Projectile, 60mm, mortar, HE, M49 series	1	1
B2I5J9	Projectile, 60mm, mortar, HE, M49 series	1	12
B2I5J9	Projectile, 60mm, mortar, HE, M49 series	1	8
B2I5J9	Projectile, 81mm, mortar, practice, M43 series	1	8
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	12
B2I5J9	Projectile, 60mm, mortar, HE, M49 series	1	8
B2I8A4	Projectile, 57mm, HE, M306 series	1	2
B2I8A3	Projectile, 57mm, HE, M306 series	1	10
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	2
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	4
B2H8H8	Projectile, 60mm, mortar, HE, M49 series	1	3
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	6
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	8
B2I5I8	Projectile, 81mm, mortar, HE, M43 series	1	6
B2I5H7	Projectile, 60mm, mortar, HE, M49 series	1	12
B2I5I8	Projectile, 60mm, mortar, HE, M49 series	1	12
B2J5G1	Projectile, 40mm, HE, M406	1	3
B2J5E6	Projectile, 60mm, mortar, HE, M49 series	1	8
B2J5D5	Projectile, 60mm, mortar, HE, M49 series	1	8
B2J5D6	Projectile, 60mm, mortar, HE, M49 series	1	6
B2J5H2	Rocket, 35mm, subcal, practice, M73	1	0
B2J5G1	rocket, 35mm, subcal, practice, M73	1	12
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	2
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	4
B2J5D2	Projectile, 14.5mm, subcal, practice, M181 series	1	0
B2J4I0	Projectile, 22mm, subcal, practice, M744	1	3

FINAL

Table 4-1 — MEC Encountered during Range Target Path Clearance (cont)

Grid	Item Description	Qty	Depth (inches bgs)
B2J5D2	Projectile, 14.5mm, subcal, practice, M181 series	1	4
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	2
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	3
B2J5D1	Rocket, 35mm, subcal, practice, M73	1	3
B2J5D2	Projectile, 40mm, HE, M381	1	6
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	8
B2J5D2	Projectile, 14.5mm, subcal, practice, M181 series	1	4
B2J4I9	Projectile, 22mm, subcal, practice, M744	1	6
B2J5D2	Projectile, 14.5mm, subcal, practice, M181 series	1	4
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	2
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	4
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	4
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	3
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	6
B2J5H1	Projectile, 40mm, HE, M406	1	6
B2J5H1	Projectile, 22mm, subcal, practice, M744	1	6
B2J5H1	Projectile, 60mm, mortar, HE, M49 series	1	8
B2J5H1	Projectile, 40mm, HE, M383	1	3
B2J4H0	Projectile, 22mm, subcal, practice, M744	1	8
B2J5D6	Projectile, 60mm, mortar, HE, M49 series	1	12
B2I8B3	Projectile, 57mm, HE, M306 series	1	10
B2I8A3	Projectile, 57mm, HE, M306 series	1	6
B2I8B2	Projectile, 57mm, HE, M306 series	1	3
B2H6H6	Projectile, 4.2inch, mortar, HE, M3 series	1	32
B2J4H0	Rocket, 35mm, subcal, practice, M73	1	8
B2J5H1	Rocket, 35mm, subcal, practice, M73	1	4
B2J4H0	Projectile, 22mm, subcal, practice, M744	1	8
B2J5D5	Rocket, 35mm, subcal, practice, M73	1	2
B2J5D5	Projectile, 60mm, mortar, HE, M49 series	1	18
B2J4H0	Rocket, 35mm, subcal, practice, M73	1	8
B2J5D5	Projectile, 60mm, mortar, HE, M49 series	1	12
B2J4H0	Rocket, 35mm, subcal, practice, M73	1	3
B2J5H2	Projectile, 60mm, mortar, HE, M49 series	1	18
B2J5H1	Projectile, 40mm, HE, M406	1	5
B2I5H7	Projectile, 60mm, mortar, practice, M50 series	1	12
B2I5I6	Projectile, 60mm, mortar, practice, M50 series	1	8
B2J5H1	Projectile, 60mm, mortar, HE, M49 series	1	14
B2I5I7	Projectile, 60mm, mortar, HE, M49 series	1	8
B2I5H7	Projectile, 60mm, mortar, HE, M49 series	1	6
B2J5F3	Rocket, 66mm, HEAT, M72 series	1	0
B2J5G2	Rocket, 35mm, subcal, practice, M73	1	2
B2J5G3	Projectile, 22mm, subcal, practice, M744	1	2

FINAL

1

Table 4-1 — MEC Encountered during Range Target Path Clearance (cont)

Grid	Item Description	Qty	Depth (inches bgs)
B2I5I7	Projectile, 60mm, mortar, HE, M49 series	1	12
B2J5J2	Grenade, rifle, HEAT, M28	1	14
B2J5I1	Rocket, 2.36inch, HEAT, M6	1	12
B2J5J2	Rocket, 2.36inch, HEAT, M6	1	16
B2J5C3	Projectile, 40mm, HE, M381	1	3
B2J5C3	Rocket, 35mm, subcal, practice, M73	1	6
B2J4H0	Rocket, 35mm, subcal, practice, M73	1	1
B2J5D2	Rocket, 35mm, subcal, practice, M73	1	2
B2I5I7	Projectile, 60mm, mortar, HE, M49 series	1	6
B2J8	Rocket motors, M222/M223 (Dragon)	2	0
B2J8	Projectile, 90mm, HEAT, M371A1	1	0
B2J8	Rocket, 35mm, subcal, practice, M73	3	0
B2J8	Ordnance components	1	0
C2A9C9	Projectile, 40mm, smoke, M680 series	1	0
C2A8	Rocket, 66mm, HEAT, M72 series	4	0
C2A8	Ordnance components	2	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
C2A8	Projectile, 14.5mm, subcal, practice, M181 series	1	0
C2A8	Ordnance components	28	0
C2A8	Pyrotechnic mixture, smoke	1	0
C2A8	Projectile, 14.5mm, subcal, practice, M181 series	1	0
C2A8	Rocket, 35mm, subcal, practice, M73	36	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
C2A8	Ordnance components	1	0
B2J5J3	Ordnance components	1	0
B2J5A7	Ordnance components	1	0
B2I6	Projectile, 81mm, mortar, HE, M43 series	1	0
B2I5	Projectile, 81mm, mortar, HE, M43 series	2	0
Total		189	--

2

Table 4-2 — MEC Encountered during Range Target Removal

Grid	Item Description	Qty	Depth (inches bgs)
B2H6I8	Projectile, 81mm, mortar, HE, M43 series	1	1
B2H6I9	Projectile, 60mm, mortar, HE, M49 series	1	1
B2I5H5	Projectile, 60mm, mortar, HE, M49 series	2	0

FINAL

Table 4-2 — MEC Encountered during Range Target Removal (cont)

Grid	Item Description	Qty	Depth (inches bgs)
B2I6F2	Ordnance components	1	0
B2I6F2	Projectile, 60mm, mortar, HE, M49 series	1	1
B2I6F4	Explosive, bulk, HE	1	0
B2I6H1	Projectile, 60mm, mortar, HE, M49 series	1	1
B2I6H1	Projectile, 81mm, mortar, HE, M43 series	1	1
B2I6I4	Projectile, 60mm, mortar, HE, M49 series	1	0
B2I6I6	Projectile, 81mm, mortar, HE, M43 series	1	0
B2I6J3	Ordnance components	1	0
B2I6J3	Projectile, 57mm, HE, M306 series	6	0
B2I6J3	Projectile, 60mm, mortar, HE, M49 series	1	0
B2I6J3	Projectile, 81mm, mortar, HE, M43 series	6	0
B2I6J3	Projectile, 81mm, mortar, HE, M43 series	1	0
B2I6J4	Fuze, projectile, PD, M48 series	1	0
B2I6J4	Ordnance components	1	0
B2I6J4	Projectile, 57mm, HE, M306 series	37	0
B2I6J4	Rocket motors, M222/M223 (Dragon)	1	0
B2J5G3	Ordnance components	1	0
B2J8I5	Rocket motors, M222/M223 (Dragon)	5	0
B2J8I5	Rocket, 35mm, subcal, prac, M73	13	0
B2J8J8	Grenade, hand, smoke, M18 series	1	0
B2J8J8	Rocket, 35mm, subcal, prac, M73	1	0
C2A8	Ordnance components	4	1
C2A8	Ordnance components	2	1
C2A8	Ordnance components	3	0
C2A8	Ordnance components	1	1
C2A8	Ordnance components	1	1
C2A8	Ordnance components	1	1
C2A8	Ordnance components	2	1
C2A8	Ordnance components	2	1
C2A8	Ordnance components	2	1
C2A8	Ordnance components	2	1
C2A8	Projectile, 40mm, HE, M381	1	1
C2A8	Rocket, 35mm, subcal, prac, M73	21	1
C2A8	Rocket, 35mm, subcal, prac, M73	5	6
C2A8	Rocket, 35mm, subcal, prac, M73	1	1
C2A8	Rocket, 35mm, subcal, prac, M73	14	1
C2A8E6	Ordnance components	1	0
C2A8E6	Ordnance components	1	0
C2A8E6	Ordnance components	2	0
C2A8E6	Ordnance components	1	0
C2A8E7	Ordnance components	1	0

FINAL

Table 4-2 — MEC Encountered during Range Target Removal (cont)

Grid	Item Description	Qty	Depth (inches bgs)
C2A8E7	Ordnance components	1	0
C2A8E7	Ordnance components	1	0
Total		157	

4.5 GEOPHYSICAL WALK-THROUGH

The project geophysicist conducted a geophysical walk-through of the removal area to verify that the proposed plan would work on site. Of interest during the walk-through was determining which digital geophysical instrument would be the more appropriate technology for digitally mapping Ranges 43–48: the EM61-MK2 time-domain metal detector or the G-858 magnetometer.

The walk-through indicated that the EM61-MK2 would be the better instrument to map most of Ranges 43–48, based on the geophysical work conducted in 2003 on the adjacent MOCO.2 site, the site’s terrain and the possibility that Ranges 43–48 contained some MEC with nonferrous components. Unlike the G-858, the EM61-MK2 can detect nonferrous items, and the EM61-MK2 can detect ferrous items at a greater depth than the G-858 can. Because of these capabilities, the EM61-MK2 can detect grenade fuzes without the safety lever and safety pin attached and can detect certain illumination signals that the G-858 cannot.

4.6 GRID AND BORDER MARKER INSTALLATION

Central Coast Surveyors surveyed and installed 2,243 100-foot-by-100-foot and partial grids in MRS-Ranges 43–48. Wooden stakes marked the corners of each grid. The grid corners were placed on, or nearly even with, state plane coordinates, and each grid was marked with the appropriate grid number per the Fort Ord Master Grid System.

Borders were also surveyed and boundary stakes installed on the northern site border from the eastern boundary of MRS-SEA.4 to the Blue Line fuel break/Eucalyptus Road intersection and on the borders of the habitat and development areas.

A UXO specialist accompanied the surveyor to ensure that the route was clear of MEC and to check the areas where the stakes were placed with a Schonstedt magnetometer.

4.7 GEOPHYSICAL TRANSECT SAMPLING

Geophysical transect sampling conducted before analog removal or digital geophysical surveys in MRS-Ranges 43-48 used the EM61-MK2 to gather data along parallel paths through the site (transects) spaced approximately 100 feet apart to provide samples of the grids. In contrast to the digital geophysical surveys, which map and document the post-analog removal site conditions and accurately locate and identify subsurface anomalies potentially representing MEC, geophysical transect sampling provides a preview of conditions that analog removal teams and digital geophysical surveys will face. By showing the approximate locations of areas with high anomaly density, this sampling helped determine where to deploy teams and where anomaly density would make removal actions too time consuming, too expensive, or too damaging to the habitat to be within the scope of work.

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1 **4.8 SEEDING OF QC/QA ITEMS**

2 As a quality control (QC) check on the removal process (analog removal followed by digital
3 mapping), 121 blue-painted, inert ordnance items were seeded at various depths below ground
4 surface (bgs) before the analog removal and 123 before digital mapping (most at the same
5 locations as the seeded items placed before analog removal). The QC items buried included
6 MKII practice hand grenades, rifle grenades, various-sized projectiles, 3-inch MKI practice
7 mortars, and 35mm and 2.36-inch rockets. The most commonly seeded item was a simulated
8 37mm projectile, the smallest target MEC anticipated in the Impact Area. In addition, 125
9 simulated MEC items (steel rebar) were planted at various depths bgs as part of a quality
10 assurance (QA) check on the removal process used at this site (analog removal followed by
11 digital mapping).

FINAL

1 **CHAPTER 5**
2 **ANALOG REMOVAL**

3 From December 2003 to July 2005, 1,261 grids on 274.1 acres received analog removal to depth,
4 with 1,251 grids completed on 271.8 acres of MRS-Ranges 43–48. The analog removal
5 consisted of two major operations: 1) sweeping the ground surface with Schonstedt
6 magnetometers to detect and remove subsurface MEC and munitions debris and 2) identifying
7 special-case areas (SCAs).

8 **5.1 INSTRUMENTATION**

9 The geophysical detection instruments used for the analog removal were the Schonstedt
10 GA-52Cx magnetometer and the Handspring Visor PDA.

11 The Schonstedt is an approximately 2.5-pound, 42.3-inch-long, handheld analog magnetometer
12 capable of detecting buried ferrous metals (Photograph 5-1). The Schonstedt has two sensors
13 that are spaced approximately 20 inches apart. The top sensor is located near the middle of the
14 instrument; the bottom sensor is located near the instrument's tip. As the Schonstedt is swept
15 over the ground surface, both sensors measure the strength of the earth's magnetic field. When
16 the instrument passes over a ferrous object, the strength of the magnetic field measured by the
17 bottom sensor becomes greater than the top sensor. This causes the audio output signals of the
18 Schonstedt to increase, which alerts the UXO technician of potential MEC in the subsurface. For
19 targets buried vertically, the output signal is the loudest when the tip of the instrument is directly
20 over the top of the object; for targets buried horizontally, it is the loudest when the tip is over the
21 ends of the object.

22 The Schonstedt is powered by two 9-volt batteries that can supply around 40 hours of
23 intermittent use.

24 Overall, the Schonstedt has proven to be one of the best available instruments for detecting the
25 smaller, shallower items typically found at the former Fort Ord.



26
27 *Photographs 5-1 — The Schonstedt GA-52Cx magnetometer was the analog geophysical*
28 *detection instrument used to locate subsurface anomalies on MRS-Ranges 43–48.*

1 The Handspring Visor PDA is a small, handheld computer device used in the field to view and
2 input data (Photograph 5-2). This PDA runs on a 33MHz processor and has 8 MB of memory.
3 The systems used by Parsons include an optional backup module that plugs into the system's
4 expansion slot. A "HotSync" cradle links the system through universal serial bus (USB) ports to
5 a computer for sending and receiving data.

6 UXO removal teams used the PDA to record grid status; work hours; various forms (accident,
7 black legless lizard encounters, etc.); and description, location and quantities for MEC,
8 munitions debris, and RRD.



9
10 *Photograph 5-2 — The Handspring Visor PDA was used to record survey information, and*
11 *anomaly reacquisition and excavation results.*

12 **5.2 DETECTION AND REMOVAL**

13 From December 2003 to July 2005, 1,261 grids on 274.1 acres of MRS-Ranges 43–48 received
14 analog removal to depth, with 1,251 grids completed on 271.8 acres. Because of concerns for
15 the safety of UXO team members in the Range 45 area, analog removal in those grids took place
16 from May 2005 to October 2005 after completion of sifting operations (see Section 7.3). The
17 UXO teams laid ropes out to form 100-foot-by-3-foot search lanes. These lanes ensure that each
18 grid is searched completely. UXO technicians swept the Schonstedt back and forth over the
19 width of the lanes. When an anomaly was detected by the Schonstedt, it was excavated to depth:
20 the UXO team continued digging at the spot where the anomaly was detected until its source was
21 located and removed. Excavations that were too deep or too large for manual excavation were
22 excavated by the backhoe team for resolution.

23 When the UXO teams encountered an item suspected of being MEC, they recorded the item's
24 description and its location (based on estimated distance from the southwest grid corner stake)
25 with a PDA. The suspected MEC was then blown in place (if too sensitive to move) or moved to
26 a consolidated shot location (if transportable) in accordance with the demolition/treatment SOP
27 in Appendix G of the PWP [Ref. 4].

28 UXO teams removed all detectable ferrous and all visible, nonferrous munitions debris and RRD
29 that were 2 inches or larger in any dimension. The description of munitions debris items

(remnants from functioned military munitions) was recorded in a PDA if the type of military munition associated with the items was easily identifiable and it was not expected to be encountered in or is unusual for MRS-Ranges 43–48. All the munitions debris collected from each grid was inspected for explosive hazards, recorded in the PDAs by weight per grid, and then removed from the grid.

5.3 ANALOG REMOVAL RESULTS

5.3.1 MEC ENCOUNTERED

During the analog removal, UXO personnel encountered 3,242 MEC items (3,061 during Ranges 43-48 OE analog removal operations, 158 during analog removal backhoe work, 19 in support of preparation for demolition, and four in support of demolition operations) and 15,921 MD-E items (including 406 originally suspected to be MEC). Eighty-three munitions burial sites contained 276 of the MEC items, primarily M222/M223 Dragon rocket motors (59 each), M306 57mm HE projectiles (33 each), M73 35mm subcaliber practice rockets (29 each), and M10 hand grenade fuzes (29 each). The burial site at anomaly ID B2J6C6_d18622 (one of five burial sites on grid B2J6C6) contained 32 of the 33 M306 57mm HE projectiles along with eight M49 60mm HE mortar projectiles, five M43 81mm HE mortar projectiles, and 14 other MEC items. Table 5-1 summarizes the MEC encountered by item and Table 5-2 lists the items by grid. Map 5-1 shows where the MEC and MD-E were encountered (except for those items encountered in Range 45 after completing sifting operations, which are shown on Map 7-5) as well as the locations of the munitions burial sites. A detailed listing of each item encountered has been included as Appendix A. Appendix B lists the types of ordnance detonated, the locations of detonations, whether the detonations were of consolidated items or BIP items, and the dates of the detonations.

Table 5-1 — MEC Encountered during Analog Removal (by item)

Item Description	Qty
Cap, blasting, electric, M6	1
Cap, blasting, non-electric, M7	1
Cartridge case, 40mm	1
Cartridge, 40mm, practice, M382	1
Cartridge, 40mm, practice, M781	10
Cartridge, 75mm, blank, M337	1
Cartridge, ignition, M2 series	7
Charge, 0.25lb, demolition, TNT	1
Cord, detonating	1
Explosive, bulk, HE	8
Firing device, pressure, M1A1	1
Firing device, pull friction, M2	1
Firing device, pull, M1	1
Flare, surface, trip, M49 series	11
Fuse, time, blasting, M700	1
Fuze, bomb, nose, M103	1
Fuze, grenade, hand, M10 series	27
Fuze, grenade, hand, M204 series	3
Fuze, grenade, hand, M206 series	4

Table 5-1 — MEC Encountered during Analog Removal (by item) (cont)

Item Description	Qty
Fuze, grenade, hand, practice, M205 series	32
Fuze, mine, AT, practice, M604	4
Fuze, projectile, comb, M1907	1
Fuze, projectile, PD, M48 series	29
Fuze, projectile, PD, M503 series	5
Fuze, projectile, PD, M51 series	2
Fuze, projectile, PD, M52 series	7
Fuze, projectile, PD, M524 series	2
Fuze, projectile, PD, M53 series	1
Fuze, projectile, PD, M557	1
Fuze, projectile, time (fixed), M65	1
Fuze, projectile, TSQ, M55	14
Fuze, trench mortar, PD, MK VI	1
Grenade, hand, frag, M67	3
Grenade, hand, frag, MK II	2
Grenade, hand, illumination, MK I	15
Grenade, hand, practice, M69	1
Grenade, hand, practice, MK II	1
Grenade, hand, smoke, HC, AN-M8	2
Grenade, hand, smoke, M18 series	1
Grenade, hand, smoke, WP, M15	1
Grenade, rifle, AT, M9 series	3
Grenade, rifle, smoke, M22 series	12
Grenade, rifle, smoke, WP, M19A1	3
Ordnance components	252
Projectile, 105mm, smoke, M84 series	1
Projectile, 14.5mm, subcal, practice, M181 series	71
Projectile, 20mm, HE-I, M56A3	2
Projectile, 20mm, TP, M204	2
Projectile, 22mm, subcal, practice, M744	1,192
Projectile, 37mm, HE, M54	1
Projectile, 37mm, HE, M63	2
Projectile, 37mm, HE, MK II	1
Projectile, 37mm, LE, MK I	2
Projectile, 37mm, LE, MK II	2
Projectile, 37mm, TP, M63 MOD1	1
Projectile, 4.2inch, mortar, HE, M3 series	9
Projectile, 4.2inch, mortar, HE, M329 series	1
Projectile, 4.2inch, mortar, smoke, WP, M328 series	5
Projectile, 40mm, HE, M381	16
Projectile, 40mm, HE, M383	9
Projectile, 40mm, HE, M384	10
Projectile, 40mm, HE, M397	2
Projectile, 40mm, HE, M406	28

FINAL

Table 5-1 — MEC Encountered during Analog Removal (by item) (cont)

Item Description	Qty
Projectile, 40mm, HEDP, M430	2
Projectile, 40mm, HEDP, M433	7
Projectile, 40mm, parachute, illumination, M583 series	2
Projectile, 40mm, practice, M382	1
Projectile, 40mm, practice, M407A1	36
Projectile, 40mm, smoke, M713 series	2
Projectile, 50mm, mortar, type 89, Japanese NI	4
Projectile, 57mm, AP-T, M70	1
Projectile, 57mm, HE, M306 series	201
Projectile, 57mm, TP, M306 series	1
Projectile, 60mm, mortar, HE, M49 series	125
Projectile, 60mm, mortar, HE, M720	8
Projectile, 60mm, mortar, illumination, M721	3
Projectile, 60mm, mortar, illumination, M83 series	28
Projectile, 60mm, mortar, practice, M50 series	3
Projectile, 60mm, mortar, smoke, WP, M302	1
Projectile, 75mm, HE, M309	3
Projectile, 75mm, HE, M41A1	1
Projectile, 75mm, HE, M48	7
Projectile, 75mm, HE, MK I	8
Projectile, 75mm, shrapnel, MK I	6
Projectile, 76mm, HE, M352	6
Projectile, 81mm, mortar, Flare Shell, T-23	1
Projectile, 81mm, mortar, HE, M362	4
Projectile, 81mm, mortar, HE, M374 series	5
Projectile, 81mm, mortar, HE, M43 series	43
Projectile, 81mm, mortar, HE, M56	3
Projectile, 81mm, mortar, illumination, M301 series	10
Projectile, 81mm, mortar, illumination, M853A1	1
Projectile, 81mm, mortar, practice, M43 series	2
Projectile, 81mm, mortar, smoke, WP, M375 series	2
Projectile, 81mm, mortar, smoke, WP, M57 series	1
Projectile, 84mm, HEAT, M136 series (AT-4)	1
Propellant, 60mm, wafers, mortar	1
Propellant, rocket	1
Pyrotechnic mixture, illumination	10
Pyrotechnic mixture, smoke	7
Rocket motor, 2.36inch	5
Rocket motor, 3.5inch	2
Rocket motors, M222/M223 (Dragon)	102
Rocket, 2.36inch, HEAT, M6	7
Rocket, 35mm, subcal, practice, M73	716
Rocket, 66mm, HEAT, M72 series	6
Rocket, 66mm, incendiary, TPA, M74	1

FINAL

1 Table 5-1 — MEC Encountered during Analog Removal (by item) (cont)

Item Description	Qty
Signal, ground, rifle, parachute, M17 series	2
Signal, illumination, AN-M43 series	1
Signal, illumination, ground, M125 series	4
Signal, illumination, ground, M126 series	4
Signal, illumination, ground, parachute, rifle, M19 series	1
Signal, illumination, M51A1	1
Signal, smoke, ground, M166 series	1
Signal, smoke, ground, M62 series	1
Simulator, launching, AT, missile, M22	1
Simulator, projectile, airburst, M74 series	4
Total	3,242

2 Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
B2G7	Projectile, 57mm, HE, M306 series	7	0	0	7
	Projectile, 75mm, HE, MK I	1	0	0	1
	Projectile, 75mm, shrapnel, MK I	1	0	0	1
B2G7 Total					9
B2H6	Projectile, 60mm, mortar, HE, M49 series	3	0	0	3
	Projectile, 81mm, mortar, HE, M43 series	2	0	0	2
B2H6 Total					5
B2H8	Fuze, projectile, PD, M48 series	7	1	12	7
	Fuze, projectile, PD, M503 series	1	6	6	1
	Fuze, projectile, PD, M51 series	1	2	2	1
	Fuze, projectile, PD, M557	1	2	2	1
	Ordnance components	5	3	6	5
	Projectile, 40mm, HEDP, M433	3	2	3	3
	Projectile, 57mm, AP-T, M70	1	4	4	1
	Projectile, 57mm, HE, M306 series	37	0	18	37
	Projectile, 60mm, mortar, HE, M49 series	13	2	15	13
	Projectile, 60mm, mortar, HE, M720	4	1	3	4
	Projectile, 60mm, mortar, illumination, M83 series	1	8	8	1
	Projectile, 75mm, HE, M48	1	2	2	1
Projectile, 75mm, HE, MK I	4	0	0	4	
B2H8 Total					79
B2H9	Projectile, 57mm, HE, M306 series	2	6	6	2
	Projectile, 60mm, mortar, HE, M49 series	10	1	18	10
	Projectile, 60mm, mortar, illumination, M721	1	6	6	1
	Projectile, 60mm, mortar, illumination, M83 series	4	2	18	4
	Projectile, 60mm, mortar, smoke, WP, M302	1	18	18	1
	Projectile, 75mm, HE, M48	1	6	6	1
	Projectile, 81mm, mortar, HE, M374 series	2	24	24	2
	Projectile, 81mm, mortar, HE, M43 series	4	20	30	4
Projectile, 81mm, mortar, illumination, M301 series	1	24	24	1	

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 81mm, mortar, practice, M43 series	1	18	18	1
B2H9 Total					27
B2I0	Ordnance components	1	5	5	1
	Projectile, 4.2inch, mortar, HE, M3 series	1	2	2	1
	Projectile, 60mm, mortar, HE, M49 series	1	8	8	1
B2I0 Total					3
B2I5	Projectile, 4.2inch, mortar, smoke, WP, M328 series	1	1	1	1
	Projectile, 60mm, mortar, HE, M49 series	1	2	2	1
B2I5 Total					2
B2I7	Fuze, projectile, PD, M48 series	2	1	3	2
	Fuze, projectile, PD, M503 series	1	2	2	1
	Fuze, projectile, PD, M51 series	1	4	4	1
	Ordnance components	6	1	12	6
	Projectile, 57mm, HE, M306 series	38	0	12	38
	Projectile, 57mm, TP, M306 series	1	4	4	1
	Projectile, 60mm, mortar, HE, M49 series	6	6	12	6
	Projectile, 75mm, HE, M48	1	3	3	1
	Projectile, 75mm, shrapnel, MK I	2	4	4	2
	Projectile, 76mm, HE, M352	2	4	4	2
	Projectile, 81mm, mortar, illumination, M301 series	2	1	18	2
	Rocket motors, M222/M223 (Dragon)	7	1	9	7
Rocket, 35mm, subcal, practice, M73	6	2	12	6	
B2I7 Total					75
B2I8	explosive, bulk, HE	1	1	1	1
	Fuze, projectile, PD, M48 series	3	0	6	3
	Fuze, projectile, PD, M524 series	1	12	12	1
	Grenade, rifle, smoke, WP, M19A1	1	6	6	1
	Ordnance components	3	2	6	3
	Projectile, 105mm, smoke, M84 series	1	24	24	1
	Projectile, 37mm, LE, MK I	1	1	1	1
	Projectile, 40mm, HE, M383	2	4	6	2
	Projectile, 57mm, HE, M306 series	26	0	18	26
	Projectile, 60mm, mortar, HE, M49 series	5	4	12	5
	Projectile, 60mm, mortar, illumination, M83 series	2	3	12	2
	Projectile, 75mm, HE, M309	3	0	12	3
	Projectile, 75mm, HE, M48	1	1	1	1
	Projectile, 75mm, HE, MK I	3	8	14	3
	Projectile, 76mm, HE, M352	2	3	6	2
	Projectile, 81mm, mortar, Flare Shell, T-23	1	4	4	1
	Projectile, 81mm, mortar, HE, M374 series	2	24	24	2
	Pyrotechnic mixture, illumination	1	12	12	1
	Pyrotechnic mixture, smoke	2	12	24	2
	Rocket motors, M222/M223 (Dragon)	62	0	12	62
Rocket, 35mm, subcal, practice, M73	15	2	6	15	
B2I8 Total					138

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
B2I9	Explosive, bulk, HE	1	5	5	1
	Fuze, projectile, PD, M48 series	2	5	5	2
	Projectile, 40mm, HE, M381	1	1	1	1
	Projectile, 40mm, HE, M383	1	2	2	1
	Projectile, 40mm, HE, M384	1	6	6	1
	Projectile, 57mm, HE, M306 series	2	2	6	2
	Projectile, 60mm, mortar, HE, M49 series	12	3	18	12
	Projectile, 60mm, mortar, illumination, M83 series	1	6	6	1
	Projectile, 75mm, HE, M48	1	4	4	1
	Projectile, 81mm, mortar, HE, M362	3	8	18	3
	Projectile, 81mm, mortar, HE, M43 series	6	6	24	6
	Projectile, 81mm, mortar, HE, M56	1	10	10	1
	rocket, 35mm, subcal, practice, M73	2	10	10	2
B2I9 Total					34
B2J0	Projectile, 37mm, HE, M63	1	2	2	1
	Projectile, 4.2inch, mortar, HE, M3 series	1	6	6	1
	Projectile, 4.2inch, mortar, smoke, WP, M328 series	1	6	6	1
	Projectile, 60mm, mortar, HE, M49 series	24	1	15	24
	Projectile, 60mm, mortar, HE, M720	1	12	12	1
	Projectile, 81mm, mortar, HE, M43 series	9	6	24	9
	Projectile, 81mm, mortar, HE, M56	1	18	18	1
	Rocket, 2.36inch, HEAT, M6	1	12	12	1
	Signal, illumination, ground, M125 series	1	6	6	1
	Signal, smoke, ground, M62 series	1	30	30	1
B2J0 Total					41
B2J5	Fuze, grenade, hand, M206 series	1	0	0	1
	Fuze, projectile, PD, M48 series	1	4	4	1
	Fuze, projectile, PD, M52 series	1	0	0	1
	Grenade, hand, smoke, WP, M15	1	3	3	1
	Ordnance components	26	0	11	26
	Projectile, 37mm, HE, M63	1	6	6	1
	Projectile, 4.2inch, mortar, HE, M3 series	3	6	8	3
	Projectile, 4.2inch, mortar, smoke, WP, M328 series	2	4	12	2
	Projectile, 40mm, HE, M384	1	1	1	1
	Projectile, 60mm, mortar, HE, M49 series	10	1	19	10
	Projectile, 81mm, mortar, HE, M43 series	1	16	16	1
	Propellant, rocket	1	0	0	1
	Rocket motor, 3.5inch	1	2	2	1
	Rocket motors, M222/M223 (Dragon)	1	0	0	1
	Rocket, 2.36inch, HEAT, M6	3	14	20	3
Rocket, 35mm, subcal, practice, M73	7	0	6	7	
B2J5 Total					61
B2J6	Explosive, bulk, HE	3	2	100	3
	Fuse, time, blasting, M700	1	1	1	1
	Fuze, grenade, hand, M10 series	7	1	40	7

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Fuze, grenade, hand, M206 series	1	1	1	1
	Fuze, mine, AT, prac, M604	3	48	48	3
	Fuze, projectile, comb, M1907	1	3	3	1
	Fuze, projectile, PD, M48 series	3	3	8	3
	Fuze, projectile, PD, M52 series	4	1	15	4
	Grenade, hand, illumination, MK I	1	4	4	1
	Ordnance components	36	0	68	36
	Projectile, 4.2inch, mortar, HE, M3 series	3	4	12	3
	Projectile, 4.2inch, mortar, HE, M329 series	1	8	8	1
	Projectile, 40mm, HE, M381	2	1	10	2
	Projectile, 40mm, HE, M383	1	0	0	1
	Projectile, 40mm, HE, M384	2	1	2	2
	Projectile, 57mm, HE, M306 series	62	1	100	62
	Projectile, 60mm, mortar, HE, M49 series	11	1	120	11
	Projectile, 60mm, mortar, illumination, M83 series	1	2	2	1
	Projectile, 75mm, HE, M48	1	100	100	1
	Projectile, 75mm, shrapnel, MK I	1	48	48	1
	Projectile, 81mm, mortar, HE, M362	1	18	18	1
	Projectile, 81mm, mortar, HE, M43 series	9	2	120	9
	Projectile, 81mm, mortar, illumination, M301 series	1	6	6	1
	Projectile, 81mm, mortar, illumination, M853A1	1	24	24	1
	Projectile, 81mm, mortar, smoke, WP, M375 series	1	1	1	1
	Signal, illumination, M51A1	1	6	6	1
B2J6 Total					159
B2J7	Explosive, bulk, HE	1	1	1	1
	Firing device, pressure, M1A1	1	4	4	1
	Fuze, projectile, time (fixed), M65	1	3	3	1
	Grenade, hand, frag, M67	1	15	15	1
	Ordnance components	52	0	15	52
	Projectile, 22mm, subcal, practice, M744	4	15	15	4
	Projectile, 40mm, HE, M381	9	0	6	9
	Projectile, 40mm, HE, M383	3	1	3	3
	Projectile, 40mm, HE, M384	1	1	1	1
	Projectile, 40mm, HE, M406	12	1	4	12
	Projectile, 40mm, practice, M407A1	2	2	2	2
	Projectile, 40mm, smoke, M713 series	1	4	4	1
	Projectile, 57mm, HE, M306 series	9	0	6	9
	Projectile, 60mm, mortar, HE, M49 series	12	1	15	12
	Projectile, 60mm, mortar, HE, M720	2	6	12	2
	Projectile, 60mm, mortar, illumination, M721	1	12	12	1
	Projectile, 60mm, mortar, illumination, M83 series	3	4	10	3
	Projectile, 60mm, mortar, prac, M50 series	2	2	2	2
	Projectile, 76mm, HE, M352	2	3	6	2
	Projectile, 81mm, mortar, HE, M43 series	1	7	7	1
	Projectile, 81mm, mortar, illumination, M301 series	4	2	18	4

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 81mm, mortar, smoke, WP, M375 series	1	24	24	1
	Pyrotechnic mixture, smoke	1	6	6	1
	Rocket, 35mm, subcal, practice, M73	15	1	8	15
	Rocket, 66mm, incendiary, TPA, M74	1	2	2	1
B2J7 Total					142
B2J8	Explosive, bulk, HE	1	3	3	1
	Fuze, grenade, hand, practice, M205 series	1	1	1	1
	Fuze, projectile, PD, M48 series	3	1	12	3
	Ordnance components	16	1	14	16
	Projectile, 14.5mm, subcal, practice, M181 series	2	2	2	2
	Projectile, 22mm, subcal, practice, M744	20	1	12	20
	Projectile, 40mm, HE, M381	1	3	3	1
	Projectile, 40mm, HE, M383	1	6	6	1
	Projectile, 40mm, HE, M384	1	2	2	1
	Projectile, 57mm, HE, M306 series	6	5	12	6
	Projectile, 60mm, mortar, HE, M49 series	4	6	10	4
	Projectile, 60mm, mortar, illumination, M83 series	7	2	8	7
	Projectile, 84mm, HEAT, M136 series (AT-4)	1	4	4	1
	Pyrotechnic mixture, illumination	2	3	3	2
	Pyrotechnic mixture, smoke	1	6	6	1
	Rocket motors, M222/M223 (Dragon)	15	1	12	15
	Rocket, 35mm, subcal, practice, M73	250	1	24	250
	Rocket, 66mm, HEAT, M72 series	4	1	6	4
	Signal, ground, rifle, parachute, M17 series	2	4	10	2
B2J8 Total					338
B2J9	Cartridge case, 40mm	1	12	12	1
	Cartridge, 40mm, practice, M781	2	2	6	2
	Explosive, bulk, HE	1	12	12	1
	Flare, surface, trip, M49 series	3	2	4	3
	Fuze, projectile, PD, M48 series	1	4	4	1
	Fuze, projectile, PD, M524 series	1	1	1	1
	Grenade, hand, smoke, M18 series	1	8	8	1
	Grenade, rifle, AT, M9 series	1	4	4	1
	Ordnance components	12	0	24	12
	Projectile, 20mm, TP, M204	2	4	4	2
	Projectile, 22mm, subcal, practice, M744	5	3	12	5
	Projectile, 37mm, HE, M54	1	5	5	1
	Projectile, 4.2inch, mortar, smoke, WP, M328 series	1	8	8	1
	Projectile, 40mm, HE, M406	1	2	2	1
	Projectile, 40mm, parachute, illumin, M583 series	2	3	6	2
	Projectile, 40mm, smoke, M713 series	1	1	1	1
	Projectile, 60mm, mortar, illumination, M83 series	3	2	12	3
	Projectile, 75mm, HE, M41A1	1	12	12	1
	Projectile, 81mm, mortar, HE, M43 series	9	12	36	9
	Projectile, 81mm, mortar, HE, M56	1	24	24	1

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 81mm, mortar, illumination, M301 series	1	2	2	1
	pyrotechnic mixture, smoke	1	8	8	1
	Rocket, 35mm, subcal, practice, M73	24	1	18	24
	Signal, illum, ground, M126 series	1	48	48	1
B2J9 Total					77
C2A0	Cartridge, 40mm, practice, M781	2	0	1	2
	Fuze, grenade, hand, M204 series	2	0	2	2
	Grenade, hand, practice, MK II	1	6	6	1
	Signal, illumination, ground, M125 series	2	1	1	2
C2A0 Total					7
C2A4	Cap, blasting, electric, M6	1	8	8	1
	Cartridge, ignition, M2 series	1	5	5	1
	Firing device, pull friction, M2	1	2	2	1
	Firing device, pull, M1	1	4	4	1
	Fuze, grenade, hand, M10 series	5	6	6	5
	Fuze, grenade, hand, practice, M205 series	6	12	12	6
	Grenade, hand, frag, MK II	1	4	4	1
	Grenade, rifle, AT, M9 series	1	10	10	1
	Grenade, rifle, smoke, M22 series	3	4	12	3
	Projectile, 14.5mm, subcal, practice, M181 series	1	0	0	1
	Projectile, 22mm, subcal, practice, M744	1	7	7	1
	Projectile, 37mm, HE, MK II	1	4	4	1
	Projectile, 60mm, mortar, HE, M49 series	1	20	20	1
	Projectile, 75mm, HE, M48	1	11	11	1
	Pyrotechnic mixture, illumination	1	2	2	1
	Rocket motor, 3.5inch	1	6	6	1
	Rocket, 35mm, subcal, practice, M73	1	2	2	1
C2A4 Total					28
C2A5	Cartridge, ignition, M2 series	6	0	0	6
	Fuze, grenade, hand, M206 series	2	0	2	2
	Fuze, projectile, PD, M48 series	2	0	1	2
	Fuze, projectile, PD, M503 series	2	0	0	2
	Fuze, projectile, PD, M52 series	2	2	6	2
	Fuze, projectile, PD, M53 series	1	0	0	1
	Grenade, hand, smoke, HC, AN-M8	1	6	6	1
	Grenade, rifle, AT, M9 series	1	18	18	1
	Grenade, rifle, smoke, M22 series	9	0	38	9
	Ordnance components	6	0	6	6
	Projectile, 22mm, subcal, practice, M744	3	2	2	3
	Projectile, 4.2inch, mortar, HE, M3 series	1	6	6	1
	Projectile, 40mm, practice, M407A1	27	7	16	27
	Projectile, 57mm, HE, M306 series	4	2	6	4
	Projectile, 60mm, mortar, HE, M49 series	6	0	4	6
	Projectile, 81mm, mortar, HE, M43 series	2	6	12	2
Projectile, 81mm, mortar, smoke, WP, M57 series	1	1	1	1	

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Rocket motor, 2.36inch	5	4	6	5
	Rocket, 2.36inch, HEAT, M6	3	2	16	3
	Rocket, 35mm, subcal, practice, M73	2	0	0	2
	Signal, illumination, ground, M126 series	2	18	18	2
	Signal, smoke, ground, M166 series	1	6	6	1
C2A5 Total					89
C2A6	Fuze, mine, AT, prac, M604	1	3	3	1
	Fuze, projectile, PD, M503 series	1	4	4	1
	Ordnance components	19	0	4	19
	Projectile, 20mm, HE-I, M56A3	1	2	2	1
	Projectile, 40mm, HE, M381	2	0	2	2
	Projectile, 40mm, HE, M384	1	3	3	1
	Projectile, 40mm, HE, M397	1	0	0	1
	Projectile, 40mm, practice, M407A1	5	1	6	5
	Projectile, 57mm, HE, M306 series	6	2	24	6
	Projectile, 60mm, mortar, HE, M49 series	1	2	2	1
Projectile, 75mm, shrapnel, MK I	1	15	15	1	
C2A6 Total					39
C2A7	Cartridge, 40mm, practice, M781	1	4	4	1
	Fuze, grenade, hand, M10 series	1	1	1	1
	Grenade, rifle, smoke, WP, M19A1	1	2	2	1
	Ordnance components	28	1	16	28
	Projectile, 14.5mm, subcal, practice, M181 series	68	1	12	68
	Projectile, 22mm, subcal, practice, M744	1,062	0	36	1,062
	Projectile, 37mm, LE, MK I	1	3	3	1
	Projectile, 40mm, HE, M381	1	24	24	1
	Projectile, 40mm, HE, M384	1	1	1	1
	Projectile, 40mm, HE, M406	15	0	6	15
	Projectile, 40mm, HEDP, M433	4	10	10	4
	Projectile, 40mm, practice, M407A1	1	2	2	1
	Projectile, 57mm, HE, M306 series	1	6	6	1
	Projectile, 60mm, mortar, HE, M49 series	5	1	3	5
	Projectile, 60mm, mortar, HE, M720	1	5	5	1
	Projectile, 60mm, mortar, illumination, M721	1	6	6	1
	Projectile, 60mm, mortar, illumination, M83 series	5	4	14	5
	Projectile, 60mm, mortar, practice, M50 series	1	12	12	1
	Projectile, 81mm, mortar, illumination, M301 series	1	8	8	1
	Projectile, 81mm, mortar, practice, M43 series	1	7	7	1
	Pyrotechnic mixture, illumination	1	12	12	1
	Rocket, 35mm, subcal, practice, M73	4	1	5	4
	Signal, illumination, AN-M43 series	1	5	5	1
	Signal, illumination, ground, M125 series	1	5	5	1
Signal, illumination, ground, M126 series	1	12	12	1	
Simulator, projectile, airburst, M74 series	1	5	5	1	
C2A7 Total					1,209

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
C2A8	Cartridge, 75mm, blank, M337	1	48	48	1
	Flare, surface, trip, M49 series	2	6	24	2
	Fuze, bomb, nose, M103	1	2	2	1
	Fuze, projectile, PD, M48 series	4	48	48	4
	Fuze, projectile, TSQ, M55	14	2	8	14
	Fuze, trench mortar, PD, MK VI	1	5	5	1
	Grenade, hand, illumination, MK I	13	4	36	13
	Grenade, hand, practice, M69	1	1	1	1
	Grenade, rifle, smoke, WP, M19A1	1	36	36	1
	Ordnance components	29	1	48	29
	Projectile, 20mm, HE-I, M56A3	1	8	8	1
	Projectile, 22mm, subcal, practice, M744	13	2	6	13
	Projectile, 37mm, LE, MK II	2	8	8	2
	Projectile, 37mm, TP, M63 MOD1	1	1	1	1
	Projectile, 40mm, HE, M383	1	2	2	1
	Projectile, 40mm, HE, M397	1	1	1	1
	Projectile, 40mm, HEDP, M430	1	6	6	1
	Projectile, 50mm, mortar, type89, Japanese NI	2	1	24	2
	Projectile, 60mm, mortar, illumination, M83 series	1	12	12	1
	Projectile, 81mm, mortar, HE, M374 series	1	8	8	1
	Propellant, 60mm, wafers, mortar	1	48	48	1
	Pyrotechnic mixture, illumination	3	36	36	3
	Pyrotechnic mixture, smoke	1	10	10	1
	Rocket motors, M222/M223 (Dragon)	16	1	36	16
	Rocket, 35mm, subcal, practice, M73	338	1	48	338
	Rocket, 66mm, HEAT, M72 series	2	1	12	2
C2A8 Total					452
C2A9	Cap, blasting, non-electric, M7	1	1	1	1
	Cartridge, 40mm, practice, M781	2	0	2	2
	Charge, 0.25lb, demolition, TNT	1	36	36	1
	Flare, surface, trip, M49 series	2	12	12	2
	Fuze, grenade, hand, M10 series	14	5	6	14
	Fuze, grenade, hand, practice, M205 series	25	12	12	25
	Fuze, projectile, PD, M48 series	1	4	4	1
	Grenade, hand, smoke, HC, AN-M8	1	1	1	1
	Ordnance components	4	2	6	4
	Projectile, 22mm, subcal, practice, M744	4	3	6	4
	Projectile, 40mm, HEDP, M430	1	3	3	1
	Projectile, 40mm, practice, M382	1	4	4	1
	Pyrotechnic mixture, illumination	1	12	12	1
	Rocket motors, M222/M223 (Dragon)	1	1	1	1
	Rocket, 35mm, subcal, practice, M73	10	1	12	10
Signal, illumination, ground, parachute, rifle, M19 series	1	12	12	1	
C2A9 Total					70
C2B6	Projectile, 40mm, HE, M384	1	10	10	1

FINAL

Table 5-2 — MEC Encountered during Analog Removal (by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 57mm, HE, M306 series	1	96	96	1
C2B6 Total					2
C2B7	Fuze, grenade, hand, M204 series	1	1	1	1
	Ordnance components	4	1	6	4
	Projectile, 22mm, subcal, practice, M744	80	3	36	80
	Projectile, 40mm, HE, M384	1	3	3	1
	Projectile, 40mm, practice, M407A1	1	12	12	1
	Projectile, 75mm, shrapnel, MK I	1	4	4	1
C2B7 Total					88
C2B8	Cartridge, 40mm, practice, M781	1	6	6	1
	Flare, surface, trip, M49 series	4	2	36	4
	Grenade, hand, frag, MK II	1	36	36	1
	Grenade, hand, illumination, MK I	1	18	18	1
	Ordnance components	1	1	1	1
	Projectile, 50mm, mortar, type 89, Japanese NI	2	4	8	2
	Pyrotechnic mixture, illumination	1	6	6	1
	Rocket, 35mm, subcal, practice, M73	31	1	6	31
	Simulator, projectile, airburst, M74 series	3	48	48	3
C2B8 Total					45
C2B9	Cartridge, 40mm, practice, M382	1	2	2	1
	Cartridge, 40mm, practice, M781	2	2	3	2
	Cord, detonating	1	3	3	1
	Grenade, hand, frag, M67	2	0	6	2
	Ordnance components	4	48	48	4
	Pyrotechnic mixture, smoke	1	3	3	1
	Rocket, 35mm, subcal, practice, M73	11	12	12	11
	Simulator, launching, AT, missile, M22	1	48	48	1
C2B9 Total					23
Grand Total					3,242

5.3.2 MUNITIONS DEBRIS REMOVED

A total of 181,688 pounds of munitions debris were removed from MRS-Ranges 43-48 during the analog removal (179,488 pounds during Ranges 43-48 OE analog removal operations, 1,870 pounds during analog removal backhoe work, 60 pounds in support of preparation for demolition, and 270 pounds in support of demolition operations). In addition, 89,333 pounds of RRD were removed from MRS-Ranges 43-48 (55,475 pounds during Ranges 43-48 OE analog removal operations, 33,787 pounds during analog removal backhoe work, 10 pounds in support of preparation for demolition, and 61 pounds in support of demolition operations). In accordance with the SOP for the management and removal of MPPEH, the munitions debris removed from the grids was transported to the ESL, where it was sorted by metal type and stored for eventual release to Parsons' metal processing subcontractor, FACT. Before leaving the Fort Ord site, all munitions debris and RRD received the required inspections (including an inspection by a qualified Army representative) and certifications, as outlined in the MPPEH SOP [Ref. 19].

5.3.3 RECOVERY OF QC SEEDED ITEMS

The UXO teams recovered 98 of the 121 QC items during the analog removal. Of the 23 non-recovered items, 12 were determined to be non-detectable and 11 were missed by the analog removal process. The QC seeding results are further detailed in Chapter 9.

5.4 AREAS DESIGNATED AS SPECIAL-CASE AREAS AND NON-COMPLETED AREAS

The analog removal could not be completed in approximately 225.4 acres of MRS-Ranges 43-48.

5.4.1 SPECIAL- CASE AREAS

Ranges 44, 47, and 48, which contained most of the targets removed from the site, also contained most of the SCAs. The targets received heavy fire during weapons training activities, and the metallic debris left over from these training activities prevented the Schonstedt magnetometer from detecting individual anomalies, which potentially represent MEC in the subsurface. Removing the metallic clutter so that the Schonstedt can detect MEC requires an intensive removal effort such as scraping and sifting; however, contractual restrictions on time and funding precluded conducting such actions in some of these high-density areas.

5.4.2 NON-COMPLETED AREAS

The analog removal began on the northern portion of the site along Eucalyptus Road, near the firing points of the ranges encompassed by the site. As work progressed further south downrange, the anomaly densities (number of anomalies per grid) increased dramatically. Based on these higher-than-expected anomaly densities, it became evident that the subsurface removal could not be completed over the entire site within the time and funding constraints of the contract. As a result, USACE prioritized the subsurface removal work in portions of Ranges 43-48 based on which areas most enhanced public and personnel safety and enabled the land to be reused. The designated high-priority areas were as follows (listed in order of priority):

- 1) Areas within 1,000 feet of Eucalyptus Road for public safety.
- 2) Developmental areas (the Range 45 area).
- 3) Roads within the site as a safety measure for the public and future personnel working in the site.
- 4) The center portion of the site to establish an adequate exclusion zone around the developmental area.

The remaining portions of the Ranges 43-48, essentially the eastern side of the site and a small portion of the central area, received lower priority. Subsequently, the subsurface removal was either not completed or not conducted in these areas. These areas have been identified as non-completed areas.

The SCAs and non-completed areas in Ranges 43-48 and their recommended cleanup solutions are further detailed in Chapter 8.

1
2

CHAPTER 6 DIGITAL MAPPING OPERATIONS

3 From July 2004 to November 2005, digital mapping and excavation operations were conducted
4 over 1,249 grids covering 272.4 acres on MRS-Ranges 43-48. Because of high anomaly density,
5 digital mapping and excavation of many grids in the Range 45 area took place from April 2005
6 to November 2005 after completing sifting and analog operations (see Section 7.4).

7

6.1 DIGITAL GEOPHYSICAL SURVEY

8 Digital geophysical surveys mapped and documented the post-analog removal site conditions
9 and accurately located and identified any geophysical anomalies potentially representing MEC in
10 the subsurface. The digital geophysical surveys were conducted over all accessible portions of
11 Ranges 43-48 that were subjected to the analog removal.

12

6.1.1 INSTRUMENTATION

13 Four instruments were involved with the digital mapping of Ranges 43-48:

- 14 1) EM61-MK2 electromagnetometers
15 2) Leica SR530 real-time kinematic (RTK) GPSs
16 3) Dell Axim X5 PDAs
17 4) Handspring Visor PDAs

18

6.1.1.1 EM61-MK2

19 The EM61-MK2 is an ordnance detection instrument capable of detecting buried ferrous and
20 nonferrous metals while being relatively insensitive to nearby cultural interferences such as
21 asphalt, buildings, and fences.

22 The EM61-MK2 generates a pulsed primary magnetic field that induces eddy currents in the
23 subsurface. When the signal shuts off, the eddy currents decay and induce a secondary magnetic
24 field monitored by one or more receiving coils. Measurements are collected at a relatively long
25 time after the start of the decay so that the current induced in the ground has fully dissipated and
26 only the current in the metal is still producing a secondary magnetic field. The time-integrated
27 voltage induced in the receiving coil(s) by the secondary field is recorded on a portable data
28 logger connected to the instrument.

29 The EM61-MK2 uses a single transmitter coil and two concentric offset receiver coils, making
30 measurements at three time gates (216, 366, and 660 microseconds [μsec]) in the bottom receiver
31 coil and one (660 μsec) in the top receiver coil, or four time gates (216, 366, 666, and 1266 μsec)
32 in the bottom receiver coil. The dimensions of the coils are 1m by 0.5m. When mounted on a
33 wheel assembly (as an individually operated unit or as part of towed array system), the
34 transmitter coil and one receiver coil are located approximately 1.5 feet above ground and the
35 second receiver coil is located approximately 2.8 feet above ground.

36 EM61-MK2 surveys on Ranges 43-48 were done using two types of systems:

- 37 1) Individual EM61-MK2s mounted on wheeled carts that were pulled by over the ground
38 by instrument operators (Photograph 6-1) or

- 1 2) A towed-array system consisting of three EM61-MK2s linked together and placed on top
2 of a cart were pulled by a vehicle (Photograph 6-2).

3 Most of the EM61-MK2 surveys used the towed array, as it was well suited for the open, treeless
4 areas on most of the site. The towed array can collect three lines of data in one pass, whereas the
5 individually operated systems can collect only one line per pass.



6
7 *Photographs 6-1 and 6-2 — Individual and towed-array systems were used for the EM61-MK2*
8 *surveys on Ranges 43-48.*

9 **6.1.1.2 Leica SR530**

10 The Leica SR530 RTK, 24-channel, dual-frequency, survey GPS receiver was attached to the
11 digitals instruments (Photograph 6-3) or used on a survey rod for reacquisition. The RTK feature
12 allows the operator to receive real-time position coordinates with an accuracy level of 1 to 2
13 centimeters, although the ability to identify the actual data collection points accurately decreases
14 to approximately a few inches when the geophysical instrument is in constant motion (as it is
15 during survey operations). Corrections were transmitted to the SR530 from a base station GPS
16 set up at a control point near the center of the site.

17 The GPS antenna was positioned approximately 5.5 feet above the ground, 4 feet above the
18 bottom coils of the EM61-MK2 systems. On the removal area's steepest terrain (approximately
19 20°), the horizontal separation between the GPS antenna and ground location directly under the
20 center of the receiver coils was approximately 1.9 feet. These positional errors in steep areas
21 resulted in offsets in the selected anomaly locations down slope from the actual source item
22 location, but the reacquisition procedures compensated for these errors by searching the area
23 within 3 feet of the selected anomaly location.

24 **6.1.1.3 Dell Axim X5 PDA**

25 The Dell™ Axim™ X5 PDA can be connected to the GPS system and used to receive and display
26 GPS data during the course of the geophysical surveys (Photograph 6-4). The GPS data is
27 displayed on the PDA screen using ArcPad™, a mobile mapping and geographic information
28 system (GIS), and the field geophysicists use this data to determine when a survey area has been
29 completely covered. This PDA runs on an Intel® XScale™ 400-MHz processor and 64 MB of
30 memory. The positional data recorded on the Axim, which duplicated the positional data
31 recorded by the digital instruments' geophysical sensors, was processed and checked for quality
32 with the geophysical sensor data. The data was deleted weekly from the Axim to free up

1 memory for operation. The Dell Axim saw limited use on the Ranges 43-48 project because
2 most of the data was collected using a towed array system that records data on a laptop computer
3 and displays the tracklines on the screen in real time.
4



5 *Photograph 6-3 — A Leica GPS receiver attached to the digital survey instruments accurately*
6 *recorded the locations of data collection points. This enabled anomalous areas to be found*
7 *easily with the GPS later for verification and excavation.*
8



9
10 *Photograph 6-4 — Field geophysicists used the GPS data displayed on the Dell™ Axim™ X5*
11 *PDA to verify that a given area had been covered completely by the digital geophysical survey.*

12 **6.1.1.4 Handspring Visor PDA**

13 The Handspring Visor PDA is a small, handheld computer device used in the field to view and
14 input data (Photograph 5.2). This PDA runs on a 33-MHz processor and contains eight MB of
15 memory. The systems used by Parsons include an optional backup module that plugs into the
16 system's expansion slot. A "HotSync" cradle links the system through USB ports to a computer
17 for sending and receiving data.

1 This PDA was used by survey teams to record survey parameters, by reacquisition teams to
2 record the results of anomaly verifications, and by excavation teams to record the results of
3 anomaly excavations.

4 **6.1.2 DATA COLLECTION**

5 The geophysical survey teams consisted of a geophysical team leader and a geophysical
6 technician, who were both responsible for operating the geophysical, GPS, and PDA systems.
7 The teams surveyed 1,249 grids covering 272.4 acres. All surveys were performed using 2-foot
8 line spacing and a sampling rate of at least 10 readings per second. Map 6-1 displays the post-
9 analog removal site conditions indicated by the digital geophysical surveys (except for those
10 items encountered in Range 45 after completing sifting operations, which are shown on Map
11 7-4).

12 Areas underneath trees in addition to those portions of Ranges 43-48 that were inaccessible to
13 the analog removal — berms and the areas underneath and adjacent to structures, utility poles,
14 and fences — were not subjected to the digital mapping process.

15 Most of the EM61-MK2 data was collected using the “D” setting that collects data at three time
16 gates on the bottom coil and one on the top coil. However, per the guidance from the USACE
17 project geophysicist, the setting was changed to record all four channels from the bottom coil to
18 get a better measurement of the time decay constant over anomalies for future advanced
19 processing efforts. The first setting was used until approximately the end of March 2005, after
20 which the second setting was used for all data collection except for some data collected to finish
21 gridblocks that had been started with the “D” setting.

22 **6.1.3 DATA DOWNLOADING AND STORAGE**

23 The data from the geophysical instruments’ field data recorders was transferred at the end of
24 each workday to desktop computers and saved on the Parsons network, which was backed up
25 every night to safeguard the data. The Visor PDAs were “synchronized” at the end of each
26 workday, directly transferring all of the associated data into the geophysical database. The Axim
27 X5 PDAs did not require daily downloads, but files were deleted weekly to free up memory.

28 **6.1.4 DATA PROCESSING AND ANOMALY SELECTION FOR GEOPHYSICAL DATA**

29 The data collected during the geophysical surveys was preprocessed, processed, and analyzed,
30 and individual anomalies were then selected for investigation from this processed data.

31 **6.1.4.1 Preprocessing**

32 During the preprocessing phase, geophysicists compared the collected data to the field notes to
33 verify the geometry of a grid and the location of the surveyed grid corner stakes. The Parsons
34 geophysicists also reviewed the data to verify that data gaps were not present in the data set. In
35 addition, the geophysicists reviewed the field notes to determine whether any sources of
36 interference were present (e.g., trees, structures, fences, metal scrap) that might have affected the
37 data, and this information was entered into the project database.

38 **6.1.4.2 Processing**

39 After preprocessing, Parsons’ geophysicists analyzed the geophysical data using Geosoft® Oasis
40 montaj software. This software consists of a graphical user interface (GUI); a high-volume
41 database; and a cross-section of built-in data import, processing, analysis, visualization,

1 mapping, and integration capabilities. The Geosoft® platform allows a processor to edit maps
2 interactively, apply dynamic linking to maps, and track the map creation process. Visual data
3 links were used to connect data in the spreadsheet to profile and map views. The data were then
4 processed by applying Geosoft® executable functions, which control the entire data processing
5 sequence and environment. During processing, data corrections and filtering were performed on
6 the data as necessary.

7 Four processing steps were applied to all datasets:

- 8 1) Coordinates translation: Translation from geographic coordinates (latitude and
9 longitude) to the project coordinate system, NAD 83 California State Plane Zone 4 in
10 U.S. survey feet.
- 11 2) Latency correction: Data points were shifted by 0.2 seconds to 0.5 seconds, based on the
12 daily latency test, to accommodate different delays in data recording between the GPS
13 and geophysical sensor.
- 14 3) Leveling: The UX-detect drift correction Geosoft® executable function was applied to
15 each of the four EM61-MK2 data channels using a 100-point window width and
16 ignoring the lowest 10% and highest 30% to 50% of data values.
- 17 4) Filtering: A 12-point low-pass filter was applied to the third time gate data after
18 leveling.

19 Examples of filtering and corrections include removing data spikes, making latency corrections
20 (which compensate for time stamp delays in the data recorders), and leveling the data to a
21 common baseline. For both the individually operated and towed-array EM61-MK2s, the raw
22 data was leveled to bring the background to a common baseline value and allow consistent
23 anomaly selection. The QC geophysicist checked the results of the leveling to ensure that the
24 process was effective and did not eliminate any anomalies. Geophysical processing summary
25 reports accompanied each data delivery, describing the processing steps performed on the data.
26 A sample processing summary report is provided as Figure 6-1.

27 **6.1.4.3 Analysis**

28 After all processing steps were complete, raw data and filtered/processed data were plotted on
29 top of each other in profile form to view clearly how the filtering and processing steps affected
30 the raw data. Processed data were gridded and contoured to prepare for the anomaly selection
31 process.

32 Because background signals are generally between 1 to 3 units, targets were primarily selected
33 above a 3-millivolt (mV) threshold on channel 3 to differentiate anomalies that appeared to
34 represent metal objects (true positives) from instrument noise (false positives). Channel 3
35 corresponds to the 660 μ sec time gate on the bottom receiver for the EM61-MK2 using a bottom
36 and top receiver or the 666 μ sec time gate for the EM61-MK2 using only the bottom receiver
37 (see Section 6.1.1.1). This interval minimizes background noise while capturing the signal
38 before excessive decay.

39 The selected targets were stored in the database and displayed as symbols on a color contour
40 map. Areas where data processors could not discern individual anomalies, or where a single
41 anomaly extended beyond the 3-foot excavation team search radius, were selected as polygon

1 Data processors selected anomaly coordinates using the Geosoft interactive target selection GUI
2 and imported the coordinates into the project database. The anomaly coordinates were then
3 exported from the project database into Leica format files, and these files were loaded into the
4 GPS systems' memory cards to prepare for the anomaly reacquisition process.

5 In January 2005, an advanced processing method was developed for eliminating false-positive
6 anomalies based on characteristics other than their peak amplitude. The anomaly width (distance
7 between the points of half-peak amplitude on each side of the anomaly) and peak decay constant
8 (exponential rate of decay from data collected at 216 μ sec time gate to 660 μ sec time gate) were
9 calculated for each selected anomaly. All low-amplitude anomalies (peak amplitudes below
10 5 mV) were evaluated to determine whether their widths and decay constants were similar to
11 actual MEC and seed items found in Ranges 43-48 or placed in the ODDS seeded test sites at
12 Badger Flats. Low-amplitude anomalies with widths and decay constants meeting any of the
13 following criteria were eliminated.

- 14 • Width less than 1.7 feet.
- 15 • Decay constant greater than 1300 μ sec.
- 16 • Decay constant less than 730-210 X Width.

17 As a QC measure, at least 10% of the anomalies eliminated in each dataset were reselected and
18 investigated to ensure that the method was not eliminating anomalies of interest. Of 448
19 anomalies reselected, 388 were excavated, with no MEC or QC/QA seeded items found.
20 Reacquisition teams detected no 3-mV anomalies at the 60 anomalies not excavated.

21 The advanced processing method described above was approved by the USACE project
22 geophysicist on February 22, 2005. Appendix C presents the white paper that explains the
23 approach in detail. The method was applied to data processed after that date and to several
24 datasets collected before then that had not been reacquired. The method eliminated 3,561
25 anomalies (approximately 10% of anomalies subjected to the advanced processing).

26 The anomaly selection process resulted in 59,952 anomalies that needed to be resolved, of which
27 997 were polygon anomalies.

28 **6.1.5 DATA DELIVERY SCHEDULE**

29 Parsons maintained an average delivery schedule of three and five days for raw and processed
30 data, respectively.

31 **6.2 ANOMALY REACQUISITION**

32 Field reacquisition teams attempted to re-detect 59,800 of the 59,952 anomalies to determine
33 whether they needed to be intrusively investigated. Reacquisition was not attempted on the other
34 152 anomalies as they were in seven grids covering 1.6 acres in the hilly area in the southwest
35 portion of the site, which received lower priority from the USACE (see Sections 5.4.2 and 8.8).

36 For point anomalies, the field reacquisition team used the GPSs loaded with the anomaly
37 coordinates to guide them to the selected anomaly locations. Once the coordinates of each
38 anomaly were found, the team used an EM61-MK2 to perform a sweep within a 3-foot radius
39 around the anomaly location, and a static reading was observed at the anomaly peak. If the
40 anomaly was detected using the instrument, it was noted in the PDA reacquisition form. A
41 nonmetallic flag was then placed at the approximate anomaly location and marked with the

1 anomaly ID number. The reacquisition team then estimated the distance and azimuth from the
 2 initial reacquired point to the actual anomaly location and recorded this information in the PDA.

3 When the anomaly could not be reacquired with the geophysical instrument, a nonmetallic flag
 4 was placed at the anomaly's GPS coordinates, and it was marked with the anomaly ID number.
 5 The fact that the anomaly could not be reacquired was noted in the PDA.

6 For polygon anomalies, the four corners of the polygon were located using the RTK GPS and
 7 marked with a nonmetallic flag showing the anomaly ID. The polygon anomalies were not
 8 checked with the EM61-MK2 but were all assigned to excavation teams.

9 Of the 59,800 anomaly locations, 54,668 (approximately 93%) were successfully reacquired.
 10 The anomalies at the other 3,960 locations could not be re-detected and were designated as
 11 unsuccessfully reacquired.

12 **6.3 ANOMALY EXCAVATIONS**

13 UXO teams excavated 55,605 anomalies: the 54,668 successfully reacquired anomalies and 937
 14 of the unsuccessfully reacquired anomalies (approximately 24% of the 3,960 unsuccessfully
 15 reacquired anomalies). Field variance form (FVF) SEA013 changed the PWP to require
 16 excavating a minimum of 10% of the unsuccessfully reacquired anomalies, based on removal
 17 work in MRS-SEA.1-4.

18 Each selected anomaly was excavated where its signal was the strongest until it was resolved. If
 19 a suspected MEC item was encountered, the UXO teams used a PDA to record the item's
 20 description and location. If an anomaly produced munitions debris or RRD, the approximate
 21 weight of the total associated with the anomaly was recorded. Excavations that were too deep or
 22 too large for manual process were turned over to the backhoe team for resolution. After an
 23 anomaly was excavated, the UXO teams used an EM61-MK2 to check 3 feet around the flag that
 24 marked the initially recorded anomaly location, or throughout the polygon, to verify that no other
 25 anomalies remained around the excavated area. If the anomaly source was not removed, the
 26 excavated area was reinvestigated.

27 **6.3.1 INTRUSIVE INVESTIGATION RESULTS**

28 The anomaly excavations (including backhoe work) produced 409 MEC items, 34,711 pounds of
 29 munitions debris, and 7,100 pounds of RRD. Excavation results included two munitions burial
 30 sites, with the only MEC being 5 pounds of ordnance components at anomaly ID B2I8I5-0043.
 31 Table 6-1 summarizes the MEC encountered by item and Table 6-2 lists the items by grid. Map
 32 6-2 shows where the MEC items and MD-E were encountered as well as the munitions burial site
 33 locations (except for those items encountered in Range 45 after completing sifting operations,
 34 which are shown on Map 7-4). A detailed listing of each MEC item encountered has been
 35 included in Appendix A. Appendix B lists the types of ordnance detonated, the locations of
 36 detonations, whether the detonations were of consolidated items or BIP items, and the dates of
 37 the detonations.

38 Table 6-1 — MEC Encountered during Digital Mapping Anomaly Excavations (by item)

Item Description	Qty
Cartridge, 40mm, practice, M382	4
Cartridge, 40mm, practice, M781	10
Flare, surface, trip, M49 series	16

1 Table 6-1 — MEC Encountered during Digital Mapping Anomaly Excavations (by item) (cont)

Item Description	Qty
Fuze, projectile, MTSQ, M772	1
Fuze, projectile, PD, M46	1
Fuze, projectile, PD, M47	1
Fuze, projectile, PD, M48 series	1
Fuze, projectile, PD, M503 series	1
Fuze, projectile, PD, M53 series	2
Fuze, projectile, PTF, M84 series	1
Grenade, hand, illumination, MK I	3
Grenade, hand, smoke, HC, AN-M8	1
Grenade, rifle, smoke, M23 series	1
Ordnance components	32
Projectile, 105mm, HE, M1	1
Projectile, 14.5mm, subcaliber, practice, M181 series	4
Projectile, 155mm, HE, MK1	1
Projectile, 22mm, subcaliber, practice, M744	254
Projectile, 37mm, LE, MK I	1
Projectile, 4.2inch, mortar, smoke, WP, M328 series	1
Projectile, 40mm, HE, M381	1
Projectile, 40mm, HE, M386	4
Projectile, 40mm, HE, M406	1
Projectile, 40mm, practice, M382	1
Projectile, 40mm, practice, M407A1	3
Projectile, 40mm, smoke, M680 series	1
Projectile, 40mm, smoke, M713 series	3
Projectile, 57mm, HE, M306 series	3
Projectile, 60mm, mortar, HE, M49 series	17
Projectile, 60mm, mortar, HE, M720	2
Projectile, 60mm, mortar, illumination, M721	1
Projectile, 60mm, mortar, illumination, M83 series	2
Projectile, 81mm, mortar, Flare Shell, T-23	1
Projectile, 81mm, mortar, HE, M43 series	4
Projectile, 81mm, mortar, HE, M56	1
Projectile, 81mm, mortar, illumination, M301 series	1
Pyrotechnic mixture, illumination	2
Pyrotechnic mixture, smoke	1
Rocket motors, M222/M223 (Dragon)	10
Rocket, 2.36inch, smoke, HC, T27	1
Rocket, 35mm, subcaliber, practice, M73	10
Simulator, projectile, airburst, M74 series	2
Total	409

FINAL

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Table 6-2 — MEC Encountered during Digital Mapping Anomaly Excavations (by 1,000-ft grid)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
B2H8	Fuze, projectile, MTSQ, M772	1	10	10	1
	Fuze, projectile, PD, M48 series	1	6	6	1
	Fuze, projectile, PTF, M84 series	1	1	1	1
	Projectile, 60mm, mortar, HE, M49 series	2	10	12	2
	Projectile, 60mm, mortar, HE, M720	1	16	16	1
	Projectile, 60mm, mortar, illumination, M83 series	1	8	8	1
	Projectile, 81mm, mortar, HE, M43 series	1	24	24	1
B2H8 Total					8
B2H9	projo, 60mm, mortar, HE, M49 series	3	7	24	3
B2H9 Total					3
B2I0	Fuze, projectile, PD, M46	1	2	2	1
B2I0 Total					1
B2I7	Fuze, projectile, PD, M503 series	1	4	4	1
	Ordnance components	1	4	4	1
	Projectile, 60mm, mortar, HE, M49 series	1	12	12	1
	Rocket motors, M222/M223 (Dragon)	6	4	10	6
	Rocket, 35mm, subcal, practice, M73	1	2	2	1
B2I7 Total					10
B2I8	Ordnance components	1	2	4	1
B2I8 Total					1
B2I9	Fuze, projectile, PD, M47	1	4	4	1
	Projectile, 60mm, mortar, HE, M49 series	4	2	16	4
	Projectile, 60mm, mortar, HE, M720	1	12	12	1
B2I9 Total					6
B2J0	Cartridge, 40mm, practice, M781	5	2	6	5
	Projectile, 60mm, mortar, HE, M49 series	1	1	1	1
B2J0 Total					6
B2J5	Projectile, 40mm, HE, M406	1	6	6	1
	Projectile, 60mm, mortar, HE, M49 series	3	6	12	3
	Projectile, 81mm, mortar, HE, M43 series	1	18	18	1
	Rocket, 2.36inch, smoke, HC, T27	1	18	18	1
B2J5 Total					6
B2J6	Ordnance components	3	2	12	3
	Projectile, 4.2in, mortar, smoke, WP, M328 series	1	6	6	1
	Projectile, 40mm, prac, M407A1	1	1	1	1
	Projectile, 57mm, HE, M306 series	2	1	12	2
	Projectile, 81mm, mortar, illumination, M301 series	1	24	24	1
B2J6 Total					8
B2J7	Ordnance components	14	0	36	14
	Projectile, 40mm, HE, M386	3	2	3	3
	Projectile, 57mm, HE, M306 series	1	4	4	1
	Projectile, 60mm, mortar, HE, M49 series	1	12	12	1

FINAL

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Table 6-2 — MEC Encountered during Digital Mapping Anomaly Excavations
(by 1,000-ft grid) (cont)

Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 81mm, mortar, HE, M56	1	24	24	1
B2J7 Total					20
B2J8	Projectile, 105mm, HE, M1	1	42	42	1
	Projectile, 155mm, HE, MK 1	1	48	48	1
	Projectile, 22mm, subcal, practice, M744	23	3	18	23
	Projectile, 40mm, HE, M381	1	8	8	1
	Projectile, 40mm, prac, M382	1	2	2	1
	Projectile, 60mm, mortar, HE, M49 series	1	10	10	1
	Projectile, 60mm, mortar, illumination, M721	1	6	6	1
	Projectile, 60mm, mortar, illumination, M83 series	1	8	8	1
	Projectile, 81mm, mortar, flare shell, T-23	1	36	36	1
	Rocket motors, M222/M223 (Dragon)	3	1	6	3
Rocket, 35mm, subcal, practice, M73	5	1	4	5	
B2J8 Total					39
B2J9	Cartridge, 40mm, practice, M382	2	2	2	2
	Cartridge, 40mm, practice, M781	4	1	5	4
	Flare, surface, trip, M49 series	2	10	18	2
	Ordnance components	1	3	3	1
	Projectile, 22mm, subcal, practice, M744	7	2	12	7
	Projectile, 40mm, smoke, M713 series	1	6	6	1
	Projectile, 60mm, mortar, HE, M49 series	1	1	1	1
	Projectile, 81mm, mortar, HE, M43 series	2	16	30	2
	Pyrotechnic mixture, illumination	1	36	36	1
	Pyrotechnic mixture, smoke	1	2	2	1
	Rocket, 35mm, subcal, practice, M73	1	6	6	1
B2J9 Total					23
C2A4	Grenade, rifle, smoke, M23 series	1	15	15	1
C2A4 Total					1
C2A5	Grenade, hand, illum, MK I	3	1	1	3
C2A5 Total					3
C2A6	Fuze, projectile, PD, M53 series	2	4	4	2
	Ordnance components	1	2	2	1
	Projectile, 22mm, subcal, practice, M744	1	6	6	1
	Projectile, 40mm, practice, M407A1	1	6	6	1
C2A6 Total					5
C2A7	Ordnance components	5	1	24	5
	Projectile, 14.5mm, subcal, practice, M181 series	3	2	12	3
	Projectile, 22mm, subcal, practice, M744	203	3	30	203
	Projectile, 40mm, HE, M386	1	4	4	1
	Projectile, 40mm, practice, M407A1	1	2	2	1
Projectile, 40mm, smoke, M680 series	1	5	5	1	

FINAL

1 Table 6-2 — MEC Encountered during Digital Mapping Anomaly Excavations
 2 (by 1,000-ft grid) (cont)

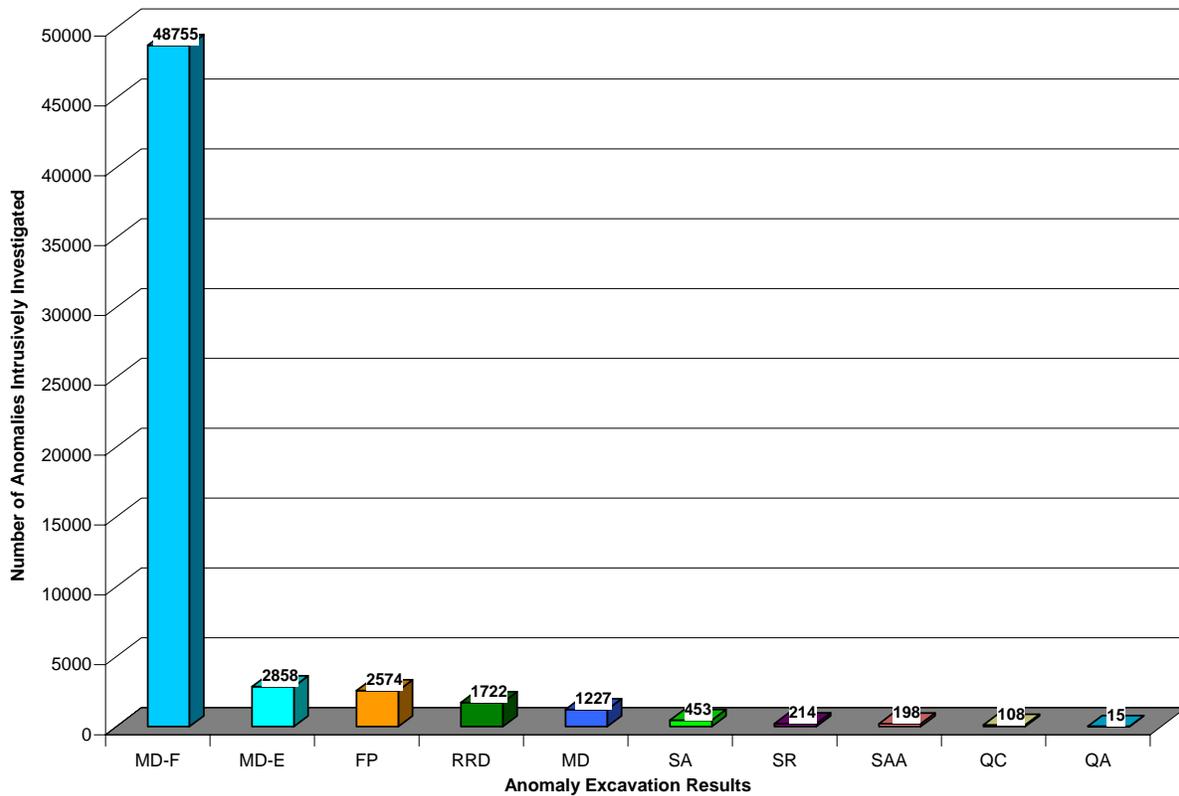
Grid	Item Description	Qty	Min Depth (inches bgs)	Max Depth (inches bgs)	Total
	Projectile, 40mm, smoke, M713 series	2	4	5	2
	Pyrotechnic mixture, illumination	1	4	4	1
C2A7 Total					217
C2A8	Flare, surface, trip, M49 series	4	6	24	4
	Ordnance components	5	2	6	5
	Projectile, 14.5mm, subcal, practice, M181 series	1	2	2	1
	Projectile, 22mm, subcal, practice, M744	8	2	12	8
	Rocket motors, M222/M223 (Dragon)	1	6	6	1
	Rocket, 35mm, subcal, practice, M73	3	4	6	3
C2A8 Total					22
C2A9	Cartridge, 40mm, practice, M382	2	1	8	2
	Flare, surface, trip, M49 series	6	2	7	6
C2A9 Total					8
C2B7	Ordnance components	1	0	0	1
	Projectile, 22mm, subcal, practice, M744	12	1	15	12
	Projectile, 37mm, LE, MK I	1	12	12	1
C2B7 Total					14
C2B8	Cartridge, 40mm, practice, M781	1	2	2	1
	Flare, surface, trip, M49 series	4	3	12	4
	Simulator, projectile, airburst, M74 series	2	1	2	2
C2B8 Total					7
C2B9	Grenade, hand, smoke, HC, AN-M8	1	84	84	1
C2B9 Total					1
Grand Total					409

3 The remaining 55,165 anomaly excavations where MEC was not found resulted in recovery of at
 4 least 58,124 items. (Recording of item weights rather than number of items results in
 5 underestimating the number of items.) The percentage breakdown of these recovered items is as
 6 follows:

- 7 • Approximately 86% of the anomalies were munitions debris and munitions debris
 8 fragments (MD-F).
- 9 • Approximately 5% of the anomalies were MD-E items.
- 10 • Approximately 4% indicated iron oxide and hot rocks (rocks containing ferrous material).
 11 These items are classified as false positives (FPs).
- 12 • Approximately 3% indicated were RRD such as wire, aluminum, and nails.
- 13 • Approximately 1% included separate acquisitions of the same anomaly (SA).
- 14 • Approximately 1% included small arms ammunition, QC seeds, and QA seeds.

15 Figure 6-2 shows the breakdown of the anomaly excavation results where MEC items were not
 16 found.

1 Appendix D shows the completed geophysical processing summary reports. Color contour maps
 2 dividing the removal area into smaller sets of grids over a series of 11- by 17-inch pages
 3 showing the processed digital geophysical data and the anomaly locations have been included as
 4 Appendix E. The database report of the excavation results for each anomaly follows the maps.



5
 6 Figure 6-2—Results for Digital Mapping Anomaly Excavations Not Producing MEC Items

7 **6.3.2 RECOVERY OF QC SEEDED ITEMS**

8 The UXO teams recovered 111 of the 123 QC items during the digital mapping operations.
 9 These 111 QC items were recovered at 108 excavation locations; two QC seeded items were
 10 recovered at each of three locations: B2J7C9-0021, C2A5A9-0002, and C2B9A3-0006. Of the
 11 12 non-recovered items, nine were determined to be non-detectable and three were missed by the
 12 digital mapping process. The QC seeding results are further detailed in Chapter 9.

13 **6.4 QC OF DIGITAL GEOPHYSICAL OPERATIONS**

14 Parsons' QC geophysicist monitored the digital geophysical fieldwork and data management to
 15 ensure that activities complied with all work plans and procedures. Parsons' QC geophysicist
 16 reviewed field forms, reacquisition results, and digital geophysical data deliverables. The
 17 following sections list the QC activities conducted during the data acquisition, data processing,
 18 and anomaly reacquisition procedures; Section 5.16 of the PWP details each of these QC
 19 activities [Ref. 4].

6.4.1 DATA ACQUISITION

Parsons' QC geophysicist observed the data acquisition process during periodic field audits to ensure that the team was performing the following activities:

- 1) Conducting static instrument tests with the geophysical instruments (FVF PWP015).
- 2) Conducting GPS position tests.
- 3) Conducting instrument lag tests.
- 4) Conducting standardization tests with the geophysical instruments.
- 5) Using appropriate measures to ensure sufficient data coverage (e.g., using the Dell™ Axim™ X5 PDA to view the coverage of a survey area).
- 6) Checking the quality of the GPS signal to ensure sufficiently accurate position information.
- 7) Using the appropriate data collection rate (10 samples per second with operator pulled system; 12 samples/sec. with towed array).
- 8) Checking the transfer of GPS information into the instrument data loggers.
- 9) Backing up the field forms on the PDA.
- 10) Reviewing data acquisition field forms prior to data processing for accuracy and completeness.

6.4.2 DATA PROCESSING

Parsons' QC geophysicist or a data processor who did not process the data performed QC checks on all raw and processed data deliveries.

The following aspects of the raw data deliveries were checked to ensure that they complied with data quality objectives (DQOs) and the project objectives described in the PWP and MRS-Ranges 43-48 SSWP [Refs. 4 and 5]:

- 1) Coordinate system and format
- 2) Survey coverage
- 3) Background noise levels
- 4) Down line data density
- 5) Data file format and headers

In addition to the items listed above, processed data deliveries were also checked for anomaly selections and the effect of all processing steps applied to the raw data to ensure that they conformed to the DQOs described in the PWP and MRS-Ranges 43-48 SSWP.

6.4.3 ANOMALY REACQUISITION

Parsons' QC geophysicist observed the anomaly reacquisition process during periodic field audits to ensure that the team was performing the following activities:

- 1) Nulling the instrument periodically to keep background responses at approximately 0 mV and to allow the reacquisition team to accurately report the instrument's response to an anomaly.
- 2) Moving pin flags to the peak of the anomaly.
- 3) Recording the reacquisition results and the distance and direction that flags were moved.
- 4) Checking the quality of the GPS signal to ensure that the positioning information was sufficiently accurate.
- 5) Storing the position of the flag located with the GPS.
- 6) Backing up the reacquisition results on the PDA.

After the PDAs were synchronized, the reacquisition results and occupied positions were compared with the initial survey data and anomaly selections. Parsons' QC geophysicist rechecked those anomalies that were significant during the initial survey but were not successfully reacquired. The positions stored by the reacquisition team were compared with the anomaly coordinates initially selected from the initial data; all discrepancies 2 feet or greater were investigated further by Parsons' QC geophysicist.

6.5 QA OF DIGITAL GEOPHYSICAL OPERATIONS

The USACE QA geophysicist reviewed 100% of the geophysical data file header and data processing summary reports and a random selection of geophysical data by mapping the sum channel (sum of the first three time gate responses after leveling) and superimposing the target picks. The USACE geophysicist also conducted digital geophysical mapping and excavations; All anomalies detected were immediately investigated by QA personnel. The USACE report detailing the digital QA activities and seeded item results is included as Appendix F.

FINAL

1
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CHAPTER 7 RANGE 45 SIFTING OPERATIONS

3 Range 45 is located in the north central portion of MRS-Ranges 43-48 (Map 7-1). It was
4 primarily used in training for the firing of HE 40mm grenades, practice 40mm grenades, and
5 illuminating 40mm grenades. Previous removal actions on the subject area encountered 120
6 MEC items, including 32 HE 40mm projectiles and over 1,500 expended 40mm projectiles.
7 These previous actions consist of a subsurface removal on twelve 30-foot-by-100-foot grids in
8 May and June 1998 to establish the Blue Line fuel break [Ref. 13]; a surface removal over the
9 subject area in April and May 1999 as an immediate safety action; a subsurface removal in April
10 1999 on one 100-foot-by-100-foot grid (grid G-13) as part of a sampling action in the Impact
11 Area [Ref. 12]; and a surface removal in August to December 2001 as part of a TCRA on
12 MRS-Ranges 43–48 [Ref. 16].

13 The presence of 40mm HE projectiles is significant because some types of this military munition
14 have an all-ways-acting fuze, which uses a counterweight/inertial-weight system that is
15 extremely sensitive to any movement if armed, presenting a hazard to UXO technicians. In
16 addition, an approximately 14-acre area in Range 45 was saturated with large amounts of
17 metallic clutter, which precluded efficient analog removal and geophysical detection of
18 individual anomalies that could be subsurface MEC. These factors, along with the fact that the
19 Range 45 sifting area is planned for future development as a firing range, were the bases for
20 designation of this 14-acre area as an SCA in accordance with Section 2.3.8.2 of the Ranges 43-
21 48 SSWP [Ref. 5].

22 This designation requires recommendation of a cleanup solution based on the amount of MEC in
23 the area and potential impacts to the habitat of the proposed cleanup solution. The solution
24 implemented involved scraping the top 2 feet of soil on the 14 acres, then sifting the stockpiled
25 soil to remove MEC and debris. The area exposed after scraping and sifting the soil received
26 analog removal in accordance with Section 2.3.8 of the Ranges 43-48 SSWP followed by digital
27 mapping, reacquisition, and anomaly excavation in accordance with Section 2.3.9 of the SSWP.
28 Because this soil was well below the original surface, it contained substantially fewer MEC and
29 debris items than other areas undergoing analog removal and digital excavation.

30 Scraping Range 45 was acceptable because it lies outside habitat areas and is planned for
31 development. The sifting operation is an effective field implementation of subsurface removal,
32 removing the greatest hazard of MEC at the subject area to the maximum extent practicable in
33 the safest manner possible. This is important in areas that, like Range 45, have high munitions
34 concentration and/or munitions known to be hazardous.

35

7.1 PREPARATION

36 In November and December 2004, a subcontractor surveyed and installed grade elevation
37 markers to help heavy equipment operators determine when they had achieved the proper
38 grading depth. After marking the grids, a berm along the western edge and a cliff face along the
39 eastern edge of the Range 45 sifting area were deconstructed using an armored excavator. Then,
40 using the grade stakes as a guide, an armored bulldozer pushed the top 2 feet of soil from the
41 existing grade approximately 200 feet into the center of the Range 45 sifting area. Once scraping
42 was complete, the surveyors checked to be sure that at least 2 feet of soil had been removed
43 throughout the SCA. Where surveyors found that less than 2 feet had been scraped, heavy

1 equipment operators scraped additional soil. Also, a digital walkabout across the scraped area
2 determined whether any "hot" spots with high debris densities remained. The three such areas
3 found received further scraping. During these activities, UXO technicians removed two MEC
4 items, listed in Table 7-1.

5 Table 7-1 — MEC Encountered during Grade Stake Survey in Range 45 Sift Area

Grid	Item Description	Qty	Depth (inches bgs)
C2A7A8	Projectile, 40mm, HE, M383	1	0
C2A7E9	Rocket, 66mm, incendiary, TPA, M74	1	0
Total		2	

6 The resulting soil stockpile, approximately 1,200 feet long, contained about 70,000 cubic yards and
7 extended from the southern to the northern end of the area (Photograph 7-1). Map 7-2 shows the
8 grading process at the Range 45 sift area.



9
10 *Photograph 7-1 — Bulldozing the top 2 feet of soil into the center of Range 45 allowed sifting the*
11 *stockpile to remove MEC and spoils from the soil.*

12 The most probable MGFDF for the Range 45 sifting area was an 81mm HE M43 series projectile,
13 based on finding this munition during the Range 45 sifting operation. The corresponding
14 minimum separation distance (MSD) or exclusion zone for this MGFDF is 1,395 feet (Map 7-3,
15 Zone B). The MGFDF had originally been a 40mm HE M383 projectile, with a 344-foot MSD,
16 based on the MEC encountered during previous removal actions in the subject area (Map 7-3,
17 Zone A).

18 Because of potential detonations of MEC, only equipment operators inside armored equipment
19 were authorized inside the exclusion zone during earth-moving activities (for example, grading,
20 berm deconstruction, trenching, loading soil into the sifter, and emptying debris containers to
21 spread the contents over the designated sorting area). While earth-moving activities were
22 conducted, the equipment operators remained inside the armored equipment at all times; all other
23 personnel remained outside the exclusion zone. UXO technicians maintained radio contact from

1 outside the exclusion zone in a location where they could observe the operations and escort
2 equipment operators when needed.

3 Based on the distance of the subject area and designated sorting areas to the closest residential
4 communities and access roads, the 1,395-foot exclusion zone did not include public areas.
5 Portions of Eucalyptus Road, which hikers, bikers, and joggers regularly use, fell within the
6 exclusion zones of the sifting area and the Range 42 and 44 pads, where the contents of the
7 debris containers were inspected for MEC and energetic materials; however, the road was closed
8 during sifting and sorting operations (Map 7-3, Zones B through G).

9 **7.2 SIFTING OPERATIONS**

10 **7.2.1 SIFTING**

11 Sifting began at the southern end of the stockpile and worked north until all soil in the stockpile
12 had been sifted, checked, and returned to the approximate contours before the area was scraped.
13 Map 7-2 shows the sifting process at the Range 45 sift area.

14 Per HNC-ED-CS-S-96-8, *Guide for Selection and Siting of Barricades for Selected Unexploded*
15 *Ordnance and Guidance for Blast and Fragmentation* (September 1996), the earth-moving
16 equipment used (a bulldozer, front-end loader, excavator, and tracked dump truck) were
17 sufficiently armored to protect the equipment operators from the blast and fragmentation from
18 unintentional detonation of an 81mm HE M43 series projectile. Photographs 7-2 and 7-3 show
19 examples of the armoring installed on the equipment.



20
21 *Photographs 7-2 and 7-3 — The armoring of heavy equipment such as the tracked dump truck*
22 *(left) and excavator (right) entailed reinforcing the operator cab with steel and with Lexan® or*
23 *bullet-resistant glass.*

24
25 The sifter passed soil through two screens, one with 1¼-inch openings and the other with ¾-inch
26 openings, to filter out debris, including any potential MEC (Photograph 7-4). A conveyor belt
27 attached to the sifter moved the clean soil to a nearby area where it was stored while the
28 munitions response process continued in the scraped area from which the soil was removed, after
29 which the sifted soil was returned to the scraped area.



1 *Photograph 7-4 — Conveyer belts in the background deposited debris into containers for*
2 *transportation to sorting areas, while the series of conveyers in the lower right of the photograph*
3 *carried sifted dirt to a storage area until it was used to restore the original contours of the*
4 *scraped area.*

5 Another conveyor belt moved the metallic debris sifted from the soil into storage bins, which
6 were hauled from the sifting site to a nearby sorting area. Section 7.2.2 describes operations at
7 the sorting area.

8 In mid-June 2005, one or more vandals trespassed into Ranges 43-48 at night by breaking
9 through the fence with heavy construction equipment stolen from a construction site outside the
10 former Fort Ord, started an armored front-end loader, used it to knock over the electrical control
11 trailer of the mechanical sifter and conveyors and to crush a pickup truck, and then drove the
12 loader into a reservoir. The control trailer was wrecked. The loader, used to deposit soil onto
13 the sifter, required extensive repairs.

14 The vandalism delayed sifting operations for six weeks. While equipment was being fixed or
15 replaced, the Army focused on analog removal and digital mapping, reacquisition, and excavation
16 of the MEC from the soil exposed after scraping and sifting the southern half of Range 45. After
17 getting the equipment working again, sifting continued in the northern part of the area. Once all
18 sifting was done, UXO removal crews performed analog removal followed by digital mapping,
19 reacquisition, and excavation of anomalies in the grids in the northern part of the sift area.

20 As a result of the incident, the Army added more security around the site, including additional
21 patrols by a private security firm, First Alarm.

1 **7.2.2 SORTING**

2 Debris not passing through the 1/4-inch and 3/4-inch screens of the sifter was collected in
3 containers and transported by an armored, tracked dump truck to the designated sorting and
4 inspection area. The designated sorting area was initially located at the asphalt Range 44 pad.
5 When the Range 45 sifting area exclusion zone expanded to 1,395 feet with the discovery of the
6 81mm HE M43 series projectile, the exclusion zones of the sifting area and the Range 44 sorting
7 area intersected (Map 7-3, Zones B and C), so the designated sorting area was relocated to the
8 Range 42 pad (Map 7-3, Zone D).

9 After the armored, tracked dump truck delivered the debris containers to the designated sorting
10 area (Zone G provided a safety measure during transportation to the Range 42 pad; see Map 7-3),
11 the armored excavator tipped the debris containers onto their sides. After removing the emptied
12 container, the excavator or other armored equipment spread the debris for visual inspection and
13 sorting (Photograph 7-5). The 1,395-foot exclusion zone remained in effect until completing the
14 debris spreading (Map 7-3, Zone D). After spreading, a 344-foot exclusion zone provided an
15 additional safety measure because the sensitive fuzing of the 40mm HE M383 projectile made it
16 necessary to protect essential personnel working in MRS-Ranges 43-48 from the potential,
17 unintentional detonation of this munition (Map 7-3, Zone E).



18
19 *Photograph 7-5 — Debris sifted from Range 45 awaiting inspection and sorting.*

20 UXO technicians checked the debris for MEC and energetic material following the three-step
21 inspection described following Table 7-2. During each step, security was in place and containers
22 were labeled appropriately to ensure continuity of the inspection process.

23 During the sorting of the excavated soil, 1,086 MEC items were encountered (1,081 during
24 sifting/sorting and five during activities to support demolition operations), including 102 HE
25 40mm projectiles, 102 practice 35mm rockets, and 46 hand grenades, as well as 3,432 MD-E
26 items (23 of which were originally suspected to be MEC). Table 7-2 lists the MEC encountered.

Appendix A lists the MEC items and how they were treated. Appendix B lists the types of ordnance detonated, the locations of detonations, whether the detonations were of consolidated items or BIP items, and the dates of the detonations. Not counting hard targets, sifting operations recovered 139,259 pounds of munitions debris and RRD, as measured at the FACT processing mill, including 5,383 pounds of munitions debris and 2,963 pounds of RRD recovered during analog and digital subsurface removal of the excavated areas. MEC, munitions debris, RRD, and seed items removed during the sifting process were unavoidably commingled and therefore cannot be associated with a specific location or depth.

Table 7-2 — MEC Encountered during Sorting Operations in Range 45 Sift Area

Item Description	Qty
Base, coupling, firing device	227
Cartridge, 20mm, TP-T, M220	3
Cartridge, 40mm, practice, M382	1
Cartridge, 40mm, practice, M385	2
Cartridge, 40mm, practice, M781	14
Flare, parachute, trip, M48	1
Flare, surface, trip, M49 series	36
Fuze, bomb, nose, M103	1
Fuze, grenade, hand, M10 series	2
Fuze, mine, AT, practice, M604	2
Fuze, projectile, PD, M48 series	1
Fuze, trench mortar, PD, MK VI	1
Grenade, hand, illumination, MK I	44
Grenade, hand, practice, MK II	1
Grenade, hand, smoke, M18 series	1
Mine, APERS, M18A1 (Claymore)	1
Ordnance components	254
Projectile, 14.5mm, subcaliber, practice, M181 series	48
Projectile, 20mm, HE-I, M56A3	1
Projectile, 20mm, practice, MK105	1
Projectile, 22mm, subcal, practice, M744	92
Projectile, 25mm, subcal, M379	1
Projectile, 37mm, LE, MK I	2
Projectile, 40mm, cluster, white star, M585	12
Projectile, 40mm, HE, M381	45
Projectile, 40mm, HE, M383	18
Projectile, 40mm, HE, M384	8
Projectile, 40mm, HE, M386	14
Projectile, 40mm, HE, M397	7
Projectile, 40mm, HE, M406	9
Projectile, 40mm, HEDP, M430	1
Projectile, 40mm, parachute, illumination, M583 series	8
Projectile, 40mm, parachute, star, M662	1
Projectile, 40mm, practice, M407A1	47
Projectile, 40mm, smoke, M680 series	4

FINAL

1 Table 7-2 — MEC Encountered during Sorting Operations in Range 45 Sift Area (cont)

Item Description	Qty
Projectile, 40mm, smoke, M713 series	11
Projectile, 60mm, mortar, HE, M49 series	6
Projectile, 60mm, mortar, HE, M720	1
Projectile, 60mm, mortar, illumination, M83 series	6
Projectile, 81mm, mortar, HE, M43 series	1
Projectile, civilian, CS (model unknown)	2
Pyrotechnic mixture, illumination	3
Rocket motors, M222/M223 (Dragon)	1
Rocket, 35mm, subcaliber, practice, M73	102
Signal, ground, rifle, parachute, M17 series	4
Signal, illumination, ground, parachute, rifle, M19 series	3
Simulator, projectile, airburst, M74 series	35
Total	1,086

2 As the first step of the inspection process, qualified UXO specialists visually checked the debris
 3 spread out over the designated sorting area. Any item identified as MEC was recorded in a PDA.
 4 MEC was identified as acceptable to move and was then hand-carried to the locations of other
 5 suspected MEC on MRS-Ranges 43-48 awaiting demolition, or was identified as a BIP item. All
 6 identified BIP items were safely moved with armored equipment to a safe holding area for later
 7 demolition in accordance with the demolition SOP of the PWP [Ref. 4].

8 All debris recovered was collected in buckets and placed in a separate container for a second
 9 check of the recovered munitions debris by qualified UXO specialists. Any MEC or energetic
 10 materials found in the collected debris were removed or destroyed in accordance with the
 11 demolition SOP of the PWP [Ref. 4]. The munitions debris then went through a third inspection
 12 by qualified UXO specialists who again removed any MEC or energetic materials found in the
 13 collected debris and destroyed them in accordance with the demolition SOP of the PWP [Ref. 4].

14 A Parsons UXO QC specialist and the USACE safety specialist inspected at minimum 10% of
 15 the munitions debris subjected to the three-step process and certified the munitions debris in
 16 accordance with the SOP for the removal and management of MPPEH [Ref. 19].

17 After munitions debris and RRD received the three-step inspection, Parsons QC inspection, and
 18 USACE QA inspections, it was placed in a lockbox and stored for eventual release to the metal
 19 processing subcontractor, FACT, in accordance with the MPPEH SOP [Ref. 19]. Before leaving
 20 the Fort Ord site, all munitions debris and RRD received the required inspections (including an
 21 inspection by a qualified Army representative) and certifications, as outlined in the MPPEH
 22 SOP.

23 Any soil left after the debris inspection/certification process was thoroughly investigated by
 24 UXO technicians and returned to the Range 45 sifting area.

25 After sifting the stockpile in the southern portion of Range 45, both analog and digital removals
 26 were performed on the scraped grids, as described in Sections 7.3 and 7.4. After completing
 27 analog and digital removal followed by QC/QA of the exposed grids in the southern portion, the
 28 stockpile on the northern end was sifted, with the sifted soils being placed directly onto the grids
 29 in the southern portion that had been completed. Once the entire stockpile had been sifted and

FINAL

1 moved, the northern grids were subjected to the full removal process, through QC/QA, followed
2 by soil replacement.

3 After scraping, sifting, and sorting, the survey crews returned and marked 100-foot-by-100-foot
4 grids over the soil exposed by scraping in the Range 45 area using wooden stakes to mark the
5 corners of each grid, which were placed on, or nearly even with, state plane coordinates. Each
6 grid was identified by its southwestern corner stake and connected to the Fort Ord master grid
7 system to facilitate accurate and complete analog removal operations.

8 **7.3 ANALOG REMOVAL**

9 From May 2005 to October 2005, analog removal to depth was performed on the scraped areas
10 and in the area where the excavated soil had been stockpiled, in accordance with the procedures
11 described in the Ranges 43-48 SSWP [Ref. 5]. Technicians used Schonstedt GA-52Cx
12 magnetometers in 3-foot-wide lanes to detect subsurface ferrous metal objects. Excavations at
13 the locations of detected anomalies continued until the objects were removed or identified, with
14 no maximum depth of investigation. Excavations that were too deep or too large for manual
15 excavation were turned over to the backhoe team for resolution.

16 Analog operations in the Range 45 grids removed 44 MEC and 336 MD-E items (one of which
17 was originally suspected to be MEC) and recovered 2,554 pounds of munitions debris and 2,170
18 pounds of RRD. These numbers are lower than for nearby similarly sized areas because this soil
19 had been under the 2-foot layer of soil that was scraped and sifted due to high density of debris
20 and MEC. Forty-three munitions burial areas accounted for six of the MEC items; all six were
21 M74 airburst simulator projectiles in grid C2A7I0. Table 7-3 lists the MEC encountered in the
22 Range 45 grids during the analog removal. Map 7-5 shows where the MEC and MD-E items
23 were encountered and the locations of the munitions burial sites. A detailed listing of MEC and
24 MD-E items encountered has been included in Appendix A. Appendix B lists the types of
25 ordnance detonated, the locations of detonations, whether the detonations were of consolidated
26 items or BIP items, and the dates of the detonations.

27 Table 7-3 — MEC Encountered during Analog Removal in Range 45 Sift Area

Grid	Item Description	Qty	Minimum Depth (inches bgs)	Maximum Depth (inches bgs)
C2A7C9	Projectile, 22mm, subcaliber, practice, M744	1	4	4
C2A7E0	Projectile, 40mm, HEDP, M430	1	4	4
C2A7F8	Projectile, 22mm, subcaliber, practice, M744	2	4	4
C2A7H0	Cap, blasting, electric, M6	1	5	5
C2A7H0	Grenade, hand, illumination, MK I	1	2	2
C2A7H0	Projectile, 60mm, mortar, HE, M49 series	1	1	1
C2A7I0	Flare, parachute, trip, M48	1	24	24
C2A7I0	Grenade, rifle, smoke, WP, M19A1	2	24	24
C2A7I0	Simulator, projectile, airburst, M74 series	7	24	36
C2A7J0	Grenade, hand, illumination, MK I	1	4	4
C2A7J0	Rocket, 35mm, subcaliber, practice, M73	1	6	6
C2A8A1	Projectile, 40mm, HE, M386	1	12	12

1 Table 7-3 — MEC Encountered during Analog Removal in Range 45 Sift Area (cont)

Grid	Item Description	Qty	Minimum Depth (inches bgs)	Maximum Depth (inches bgs)
C2A8A1	Projectile, 81mm, mortar, HE, M43 series	1	8	8
C2A8A2	Rocket, 35mm, subcaliber, practice, M73	1	2	2
C2A8C2	Ordnance components	1	6	6
C2A8C2	Projectile, 40mm, HE, M381	2	6	6
C2A8C2	Rocket, 35mm, subcaliber, practice, M73	1	12	12
C2A8D1	Rocket, 35mm, subcaliber, practice, M73	1	12	12
C2A8D2	Ordnance components	1	6	6
C2A8F1	Fuze, grenade, hand, M10 series	1	2	2
C2A8F1	Grenade, hand, smoke, WP, M15	2	48	48
C2A8F1	Ordnance components	1	48	48
C2A8F1	Projectile, 40mm, practice, M407A1	1	0	0
C2A8F1	Projectile, 60mm, mortar, HE, M49 series	1	8	8
C2A8F2	Grenade, hand, smoke, WP, M15	1	14	14
C2A8G2	Ordnance components	1	3	3
C2A8H1	Projectile, 40mm, HEDP, M430	2	1	1
C2B7A0	Grenade, hand, frag, MK II	1	1	1
C2B7A0	Signal, illumination, M187	1	1	1
C2B7B9	Projectile, 60mm, mortar, HE, M49 series	1	2	2
C2B8B1	Grenade, hand, frag, MK II	1	4	4
C2B8B1	Grenade, hand, illumination, MK I	1	10	10
C2B8B1	Grenade, hand, practice, MK II	1	12	12
Total		44		

2 **7.4 DIGITAL GEOPHYSICAL OPERATIONS**

3 Digital geophysical mapping used the procedures described in Chapter 6 of this document. The
 4 digital geophysical surveys were done with a towed array of three EM61-MK2 sensors on most of
 5 Range 45, although some steep or previously excavated areas required use of a single, hand-
 6 pulled EM61-MK2 sensor. Map 7-6 shows the EM61-MK2 data collected.

7 Digital mapping, reacquisition, and excavation operations in the Range 45 grids removed 33
 8 MEC and 69 MD-E items (two of which were originally suspected to be MEC) and recovered
 9 2,749 pounds of munitions debris and 400 pounds of RRD. These numbers are lower than for
 10 nearby similarly sized areas because this soil had been under the 2-foot layer of soil that was
 11 scraped and sifted due to high density of debris and MEC. Table 7-4 lists the MEC encountered
 12 in the Range 45 grids. Map 7-4 shows where the MEC items were encountered. A detailed
 13 listing of items encountered has been included as Appendix A. Appendix B lists the types of
 14 ordnance detonated, the locations of detonations, whether the detonations were of consolidated
 15 items or BIP items, and the dates of the detonations.

FINAL

1 Table 7-4 — MEC Encountered during Digital Mapping Anomaly Excavations in Range 45 Sift Area

Grid	Anomaly ID	Item Description	Qty	Minimum Depth (inches bgs)	Maximum Depth (inches bgs)
B2J7J0	B2J7J0-BA-0525	Projectile, 60mm, mortar, illum, M83 series	1	1	1
B2J7J9	B2J7J9-0021	Projectile, 40mm, HE, M397	1	5	5
B2J7J9	B2J7J9-BA-0510	Projectile, 81mm, mortar, HE, M43 series	1	12	12
B2J7J9	B2J7J9-BA-0511	Rocket, 35mm, subcal, practice, M73	1	2	2
B2J8J1	B2J8J1-BA-0514	Rocket, 35mm, subcal, practice, M73	1	2	2
B2J8J1	B2J8J1-BA-0534	Rocket, 35mm, subcal, practice, M73	1	3	3
B2J8J2	B2J8J2-BA-0013	Projectile, 40mm, HE, M381	1	0	0
C2A7A0	C2A7A0-BA-0513	Ordnance components	1	1	1
C2A7A0	C2A7A0-BA-0529	Projectile, 40mm, HE, M397	1	4	4
C2A7A0	C2A7A0-BA-0530	Projectile, 40mm, HE, M381	1	8	8
C2A7F8	C2A7F8-0023	Projectile, 40mm, HE, M381	1	3	3
C2A7F8	C2A7F8-0023	Projectile, 40mm, practice, M407A1	1	3	3
C2A7H9	C2A7H9-0019	Projectile, 60mm, mortar, HE, M49 series	1	12	12
C2A7I0	C2A7I0-0056	Projectile, 60mm, mortar, illum, M83 series	1	48	48
C2A7J0	C2A7J0-0001	Cartridge case, 40mm	1	3	3
C2A8A1	C2A8A1-BA-0516	Ordnance components	1	6	6
C2A8A1	C2A8A1-BA-0516	Projectile, 40mm, practice, M382	1	2	2
C2A8C2	C2A8C2-0015	Projectile, 40mm, HE, M406	1	7	7
C2A8D2	C2A8D2-0028	Projectile, 40mm, practice, M407A1	1	6	6
C2A8E1	C2A8E1-0073	Projectile, 40mm, smoke, M680 series	1	6	6
C2A8E1	C2A8E1-0074	Projectile, 40mm, HEDP, M430	1	6	6
C2A8H1	C2A8H1-0009	Flare, surface, trip, M49 series	1	6	6
C2A8J1	C2A8J1-0055	Flare, surface, trip, M49 series	1	4	4
C2B7B0	C2B7B0-0008	Flare, surface, trip, M49 series	1	6	6
C2B7B0	C2B7B0-0009	Simulator, projectile, airburst, M74 series	1	3	3
C2B7B0	C2B7B0-0015	Flare, surface, trip, M49 series	1	4	4
C2B7B0	C2B7B0-0035	Simulator, projectile, airburst, M74 series	2	6	6
C2B7B8	C2B7B8-0020	Flare, surface, trip, M49 series	1	6	6
C2B7B9	C2B7B9-0022	Flare, surface, trip, M49 series	1	6	6
C2B7B9	C2B7B9-0027	Flare, surface, trip, M49 series	1	6	6
C2B8B1	C2B8B1-0007	Flare, surface, trip, M49 series	1	6	6
C2B8B1	C2B8B1-0042	Flare, surface, trip, M49 series	1	10	10
Total			33		

2 **7.4.1 RANGE 45 PAD DECONSTRUCTION**

3 After finishing the sifting operation and before the sifted soil piled north of the Range 45 pad
 4 was spread across the scraped area, an armored excavator removed the Range 45 pad asphalt and
 5 base. This debris was taken to the Range 46 pad area and sifted to remove any MEC or
 6 munitions debris before the debris was sent offsite. After deconstruction, analog and digital

FINAL

1 removal operations were performed during October and November 2005 in accordance with the
2 Ranges 43-48 SSWP on approximately 1.7 acres in eight grids of the Range 45 pad area.

3 Technicians encountered three MEC items during analog removal and one MEC item during
4 digital operations (Table 7-5). Maps 7-4 and 7-5 show where the MEC items were encountered
5 during the digital and analog operations, respectively. During deconstruction, 80 pounds of
6 munitions debris and 393 pounds of RRD were also taken from the pad area. A detailed listing
7 of items encountered has been included as Appendix A. Appendix B lists the types of ordnance
8 detonated, the locations of detonations, whether the detonations were of consolidated items or
9 BIP items, and the dates of the detonations.

10 Table 7-5 — MEC Encountered during Range 45 Pad Deconstruction

Grid	Anomaly ID	Dig Type	Item Description	Qty	Depth (inches bgs)
C2B7C8	N/A	Analog Removal	Grenade, hand, illum, MK I	1	14
C2B8C1	N/A	Analog Removal	Flare, surface, trip, M49 series	1	4
C2B7C0	N/A	Analog Removal	Grenade, hand, illum, MK I	1	3
C2B7D9	C2B7D9-0002	Digital Excavation	Flare, surface, trip, M49 series	1	6
Total				4	

11 7.5 QUALITY CONTROL AND QUALITY ASSURANCE

12 The Parsons QC manager and personnel performed daily checks on sifting equipment for
13 maintenance and for screen serviceability. They also inspected sifted soils to ensure that no
14 debris larger than the target-size munitions passed through the sifting screens, checked sifting
15 spoils, and checked for compliance with proper earth moving procedures and sorting operations.
16 The QC audits were conducted when operations had stopped.

17 Five QC seed items were placed in the stockpile. All five were recovered, although one of the
18 seed items was missed during sifting operations. This item was recovered during the subsequent
19 removal operations (see Chapter 9 for details). The depths of these seed items were not recorded
20 because of their placement in the stockpile.

21 After sifting the stockpile in the southern portion of Range 45 and performing both analog and
22 digital removals on the exposed grids, the grids were subjected to the QC/QA process. On
23 completion of the exposed grids in the southern portion, the stockpile on the northern end was
24 sifted, with the sifted soils placed directly onto the grids in the southern portion that had been
25 completed, including QC/QA. Once the stockpile had been sifted and moved, the northern grids
26 were subjected to the full removal and QC/QA process. Chapter 9 details the QC procedures.

27 Five grids containing target boxes (C2B7A0, C2B8A1, C2A7H0, C2A8H1, and C23A8H2) were
28 noted and left in “to be determined” (TBD) status per USACE directive.

29 Contractor and government quality inspections were completed in November 2005.

30 7.6 SITE RESTORATION

31 After contractor QC and government QA personnel inspected the Range 45 area, much of the
32 sifted soil was returned to the scraped areas. Because the area is slated for development and
33 therefore much of the soil will be removed then, recreating the original configuration of the site
34 was deemed unnecessary. Weed-free straw blown and crimped into the soil provide erosion

1 control over the disturbed area. The Parsons field biologist performed oversight and guidance of
2 the site restoration process along with limited seed gathering to create a seed bank for reseeding
3 rare annual plants. The Fort Ord BRAC wildlife biologist monitored implementation of HMP
4 requirements and conducted final inspection of the site restoration.

FINAL

1 **CHAPTER 8**
2 **SPECIAL-CASE AREAS AND NON-COMPLETED AREAS**

3 The portions of the MRS-Ranges 43-48 removal area that have been designated as SCAs and
4 non-completed areas should be evaluated before future action. The following sections describe
5 each area, explain why the area received SCA or non-completed designation, and recommend
6 follow-up action. Table 8-1 lists the grids included in each area and summarizes the reasons for
7 the designations along with associated precautions and recommendations. Map 8-1 shows the
8 locations of the SCAs and non-completed areas.

9 As discussed in Section 4.5, geophysical transect sampling conducted before performing analog
10 removal or digital geophysical surveys provided samples of the grids to provide a preview of
11 conditions. By showing the approximate locations of areas with high anomaly density, this
12 sampling helped determine where to deploy survey teams and where anomaly density would
13 make removal actions too time consuming, too expensive, or too damaging to the habitat to be
14 within the scope of work. Three such high-density areas were among the SCAs in MRS-Ranges
15 43-48: Ranges 44, 47, and 48.

16 **8.1 RANGE 48**

17 This nearly 139-acre SCA includes 656 grids in the western portion of MRS-Ranges 43-48.
18 Numerous targets and dense munitions debris resulting from heavy range use will require
19 intensive removal efforts. Such actions exceeded the scope of funding and available time in this
20 contract. Based on transect sampling in the area, recommended follow-up actions include a
21 combined approach using a dual-tool method with multiple areas requiring significant excavation
22 in combination with mechanical sifting (or remote control). Potential impacts to the habitat
23 would need to be evaluated and considered before performing such actions. For example,
24 extensive erosion control with environmental restoration may be necessary.

25 **8.2 RANGE 47**

26 The 66 grids of this former 40mm range encompass just over 15 acres. Heavy saturation of this
27 SCA with munitions and RRD will require intensive removal efforts that exceed the scope of this
28 contract. Recommended follow-up actions include excavation in combination with mechanical
29 sifting (or remote control) followed by digital survey. Potential impacts to the habitat would
30 need to be evaluated and considered before performing such actions. For example, erosion
31 control and environmental restoration may be necessary.

32 **8.3 RANGE 45 TRENCH**

33 Five grids on 1.2 acres in the Range 45 SCA contain a target box trench with pop-up targets
34 lying below the depth of the scraping and sifting operation. USACE guidance was to leave the
35 trench and targets in place because excavation and removal would have exceeded the scope of
36 the current contract. The recommended action is to use a backhoe or other earthmoving
37 machinery to excavate the trench in accordance with the backhoe SOP in Appendix G of the
38 PWP [Ref. 4], and then perform a subsurface MEC removal followed by QC/QA inspections. If
39 no follow-on removal action is taken, construction support should be required for any intrusive
40 actions in the area of the target trenches.

1 **8.4 RANGE 44**

2 This former antitank/antiarmor range includes approximately 82 grids covering almost 19 acres
3 in Range 44. Because of heavy amounts of debris from targets and ammunition, removal would
4 take more time and funding than in this contract's scope. Recommended action includes a
5 combined approach using dual-tool method with localized mechanical sifting (or remote control).
6 Potential impacts to the habitat would need to be evaluated and considered before performing
7 such actions. For example, limited erosion control and environmental restoration may be
8 necessary.

9 **8.5 CENTRAL AREA GRIDS**

10 This area, composed of 37 grids scattered within the southern portion of the interior of Ranges
11 43-48 totaling approximately 8.5 acres, received no analog or digital removal. It received a
12 lower-priority from the USACE due to time and funding limitations of the contractual scope.
13 Recommended follow-up action involves performing subsurface MEC removal followed by
14 QC/QA inspections.

15 **8.6 EAST SIDE GRIDS WITH NO SUBSURFACE REMOVAL**

16 Although this area of 212 grids on approximately 46 acres contains no range fan, it is an
17 extension beyond the Range 43 fan and as a result contains munitions debris. USACE gave it a
18 lower priority due to time and funding limitations of the contractual scope, and the area therefore
19 received surface removal but no subsurface removal operations. Recommended follow-up action
20 involves performing subsurface MEC removal followed by QC/QA inspections.

21 **8.7 SUBSURFACE REMOVAL COMMENCED**

22 Two grids among the Central Area Grids (B2I9F1 and B2I9E1) and one among the East Side
23 Grids with No Surface Removal (B2J9A8) received analog removal but no digital operations.
24 Totalling 0.7 acres, these grids received a lower priority from the USACE due to time and
25 monetary limitations of the contractual scope. Recommended follow-up action involves
26 performing subsurface MEC removal followed by QC/QA inspections.

27 **8.8 EAST SIDE GRIDS WITH PARTIAL SUBSURFACE REMOVAL**

28 The USACE gave seven grids (1.6 acres, among the East Side Grids with No Surface Removal)
29 lower priority due to time and monetary limitations of the contractual scope. These grids
30 received analog removal and digital survey but no reacquisition or digital anomaly investigation
31 and no QC or QA. Because anomalies have been selected, the recommended action is to perform
32 reacquisition and excavation on the seven grids followed by QC and QA inspections.

33 **8.9 BUNKER**

34 This concrete observation bunker (approximately 80 feet long, 30 feet wide, and up to 12 feet
35 high) protected observers checking the accuracy and effects of HE artillery rounds impacting the
36 ground. Affecting 0.7 acres, it was built on a hillside within grids B2H8G0, B2H8F0, B2H9F1,
37 and B2H9G1. Analog and digital removal operations were performed as close to the structure as
38 possible in grids B2H8G0, B2H8F0, and B2H9F1 until the steel rebar interfered with the
39 instruments. Grid B2H9G1 received surface removal only. Analog removal was performed up
40 to approximately 10 to 20 feet from the bunker; digital operations using the EM-61 got within 65

1 feet north of bunker and 15 feet to the south and west. The east end is in grid B2H9G1, and
2 could probably be cleared to within 10 to 20 feet as well. Recommended action would involve
3 removing the bunker, then performing subsurface MEC removal followed by QC/QA inspections
4 over the entirety of the four affected grids to ensure that the grids have received removal
5 operations.

6 **8.10 FENCELINE**

7 This 3.5-acre area runs approximately 2,000 linear feet along Eucalyptus Road and includes 28
8 grids or partial grids in a buffer extending 25 feet in from the fence line. The metallic fence
9 interfered with the analog and digital instruments in areas within 5 to 15 feet of the fence.
10 Recommended action includes removing the fence along Eucalyptus Road and subjecting the 25-
11 foot-wide corridor inside the site boundary to subsurface MEC removal and QC/QA inspection.
12 During this work, site security measures would need to be implemented (e.g., temporary fences,
13 barriers, and/or security patrols) to maintain public safety.

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FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
Range 47	C2A6F3, C2A6E4, C2A6D5, C2A6D6, C2A6D7, C2A6D8, C2A6D9, C2A6C5, C2A6C6, C2A6C7, C2A6C8, C2A6C9, C2A6C0, C2A6B4, C2A6B5, C2A6B6, C2A6B7, C2A6B8, C2A6B9, C2A6B0, C2A7B1, C2A7B2, C2A6A4, C2A6A5, C2A6A6, C2A6A7, C2A6A8, C2A6A9, C2A6A0, C2A7A1, C2A7A2, C2A7A3, C2A7A4, C2A7A5, B2J6J5, B2J6J6, B2J6J7, B2J6J8, B2J6J9, B2J6J0, B2J7J1, B2J7J2, B2J7J3, B2J7J4, B2J7J5, B2J6I6, B2J6I7, B2J6I8, B2J6I9, B2J6I0, B2J7I1, B2J7I2, B2J7I3, B2J7I4, B2J6H8, B2J6H9, B2J6H0, B2J7H1, B2J7H2, B2J7H3, B2J6G0, B2J7G1, B2J7G2, B2J7G3, B2J7F1, B2J7F2, B2J7F3, B2J7E2	The decision to designate this area as an SCA was based on the high density of subsurface anomalies and the need to sift the area.	Access is restricted – enter this area only with an authorized UXO escort. Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	40mm grenades were used in this range and continue to present a hazard.	Sift area to depth of 2 feet followed by digital survey. Potential impacts to habitat would need to be evaluated and considered before performing such actions.
Range 45 Trench	C2B7A0, C2B8A1, C2A7H0, C2A8H1, C2A8H2	The decision to designate this area as an SCA was based on instrument interference and because the probability of subsurface MEC was considered low.	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	Investigations detected buried target boxes and associated materials that were not removed under this action. These materials may have masked the presence of additional MEC in the area.	The remaining anomalies are suspected to be related to buried target boxes; therefore, future development should include construction support in these grids.
Range 44	C2A8G6, C2A8G7, C2A8F5, C2A8F6, C2A8F7, C2A8E5, C2A8E6, C2A8E7, C2A8E8, C2A8D4, C2A8D5, C2A8D6, C2A8D7, C2A8D8, C2A8C4, C2A8C5, C2A8C6, C2A8C7, C2A8B5, C2A8B6, C2A8B7, C2A8A5, C2A8A6, C2A8A7, B2J8J4, B2J8J5, B2J8J6, B2J8J7, B2J8I4, B2J8I5, B2J8I6, B2J8H3, B2J8H4, B2J8H5, B2J8H6, B2J8G3, B2J8G4, B2J8G5, B2J8G6, B2J8F3, B2J8F4, B2J8F5, B2J8F6, B2J8F9, B2J8E9, B2J8E0, B2J8D9, B2J8D0, B2J8C9, B2J8C0, B2I8I1, B2I8I2, B2I8I3, B2I7H9, B2I7H0, B2I8H1, B2I8H2, B2I7G9, B2I7G0, B2I8G1, B2I8G2, B2I7F0, B2I8F1, B2I8F2, B2I8E1, B2I8E2,	The decision to designate this area as an SCA was based on the high density of surface debris (i.e., antitank rockets and 35mm sub cal) and high density of subsurface	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	No subsurface removal work was conducted, yet MEC was found during the surface removal of this area and in the subsurface of adjacent areas and is suspected to exist in	Although surface removal was accomplished previously, surface removal is recommended in this area due to soil erosion. If removal to depth is considered, the follow-up actions include a combined approach using dual-tool

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	B218F6, B218F7, B218F8, B218E5, B218E6, B218E7, B218E8, B218D6, B218D7, B218C4, B218C5, B218C6, B218C7, B218B5, B218B6, B218B7	anomalies.		the subsurface of this area as well.	method with localized mechanical sifting (or remote control). Potential impacts to habitat would need to be evaluated and considered before performing such actions.
Central Area Grids	B2J7G4, B2J7C4, B2J7C5, B2J7C6, B2J7C8, B2J8C3, B2J7B2, B2J7B3, B2J7B8, B2J8B3, B2J8A3, B2J7J9, B2J7I9, B2I8I4, B2I8H3, B2I8H4, B2I8H5, B2I8H6, B2I8H7, B2I8H8, B2I8G7, B2I8G8, B2I8G9, B2I8F3, B2I8F4, B2I8F5, B2I8F0, B2I8E3, B2I8E4, B2I9D2, B2I8C8, B2I8C9, B2I8C0, B2I9C1, B2I8B4, B2I8B8, B2I8B9	This area is designated as a non-completed area.	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	No subsurface removal work was conducted, yet MEC was found during the surface removal of this area and in the subsurface of adjacent areas and is suspected to exist in this area as well.	If removal to depth is considered, perform subsurface MEC removal followed by QC/QA inspections. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.
East Side Grids with No Subsurface Removal	B2J0G1, B2J0G2, B2J0G3, B2J0F1, B2J0F2, B2J0F3, B2J0F4, B2J0F5, B2J0E4, B2J0E5, B2J0D4, B2J0D5, B2J9B8, B2J9B9, B2J9B0, B2J9A9, B2J9A0, B2I9J6, B2I9J7, B2I9J8, B2I9J9, B2I9J0, B2I9I6, B2I9I7, B2I9I8, B2I9I9, B2I9I0, B2I9H6, B2I9H7, B2I9H8, B2I9H9, B2I9H0, B2I0H1, B2I0H3, B2I0H4, B2I0H5, B2I0H6, B2I0H7, B2I9G6, B2I9G7, B2I9G8, B2I9G9, B2I9G0, B2I0G1, B2I0G4, B2I0G5, B2I0G6, B2I0G7, B2I9F5, B2I9F6, B2I9F7, B2I9F8, B2I9F9, B2I9F0, B2I0F1, B2I0F4, B2I0F5, B2I0F6, B2I0F7, B2I9E5, B2I9E6, B2I9E7, B2I9E8, B2I9E9, B2I9E0, B2I0E1, B2I0E2, B2I0E4, B2I0E5, B2I0E6, B2I0E7, B2I9D5, B2I9D6, B2I9D7, B2I9D8, B2I9D9, B2I9D0, B2I0D1, B2I0D2, B2I0D4, B2I0D5, B2I0D6, B2I0D7, B2I9C4, B2I9C5, B2I9C6, B2I9C7, B2I9C8, B2I9C9, B2I9C0,	The decision to designate this area as an SCA was based on the reduced risk after surface removal was completed.	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	No subsurface removal work was conducted, yet MEC was found during the surface removal of this area and in the subsurface of adjacent areas and is suspected to exist in this area as well.	If removal to depth is considered, perform subsurface MEC removal followed by QC/QA inspections. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	B2I0C1, B2I0C2, B2I0C5, B2I0C6, B2I9B3, B2I9B4, B2I9B5, B2I9B6, B2I9B7, B2I9B8, B2I9B9, B2I9B0, B2I0B1, B2I0B2, B2I0B3, B2I0B5, B2I0B6, B2I9A1, B2I9A2, B2I9A3, B2I9A4, B2I9A5, B2I9A6, B2I9A7, B2I9A8, B2I9A9, B2I9A0, B2I0A1, B2I0A2, B2I0A3, B2H8J9, B2H8J0, B2H9J1, B2H9J2, B2H9J3, B2H9J4, B2H9J5, B2H9J6, B2H9J7, B2H9J8, B2H9J9, B2H9J0, B2H0J1, B2H0J2, B2H0J3, B2H8I9, B2H8I0, B2H9I1, B2H9I2, B2H9I3, B2H9I4, B2H9I5, B2H9I6, B2H9I7, B2H9I8, B2H9I9, B2H9I0, B2H0I1, B2H0I2, B2H0I3, B2H8H0, B2H9H1, B2H9H2, B2H9H3, B2H9H4, B2H9H5, B2H9H6, B2H9H7, B2H9H8, B2H9H9, B2H9H0, B2H0H1, B2H0H2, B2H0H3, B2H0H4, B2H9G2, B2H9G3, B2H9G4, B2H9G5, B2H9G6, B2H9G7, B2H9G8, B2H9G9, B2H9G0, B2H0G1, B2H0G2, B2H0G3, B2H0G4, B2H9F2, B2H9F3, B2H9F4, B2H9F5, B2H9F6, B2H9F7, B2H9F8, B2H9F9, B2H9F0, B2H0F1, B2H0F2, B2H0F3, B2H9E3, B2H9E4, B2H9E5, B2H9E6, B2H9E7, B2H9E8, B2H9E9, B2H9E0, B2H0E1, B2H0E2, B2H0E3, B2H9D9, B2H9D0, B2H0D1, B2H0D2, B2H9C9, B2H9C0, B2H0C1, B2H0C2				
Subsurface Removal Commenced	B2J9A8, B2I9F1, B2I9E1	The decision to designate this area as an SCA was based on the reduced risk after surface removal was completed.	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	Subsurface removal work was begun but not completed in these grids. There is no easy way to differentiate completed areas of the grid from incomplete areas.	If removal to depth is considered, perform subsurface MEC removal followed by QC/QA inspections. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.
East Side Grids with	B2J0E2, B2J0E3, B2J0D2, B2J0D3, B2J0C5, B2J0B5,	The decision to designate this area as	Do not excavate or otherwise intrude	Subsurface removal work was begun but	Because digital survey was conducted and anomalies

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
Partial Subsurface Removal	B2J0A5	an SCA was based on the reduced risk after surface removal was completed.	below the soil surface without an authorized UXO escort.	not completed in these grids. There is no easy way to differentiate completed areas of the grid from incomplete areas.	selected, perform reacquisition and excavation on the seven grids followed by QC/QA inspections. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.
Bunker	B2H8G0, B2H9G1, B2H8F0, B2H9F1	The decision to designate this area as an SCA was based on instrument interference and because the probability of subsurface MEC was considered low.	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	Subsurface removal work was begun but not completed in this area. Interference with detection instruments occurred as they approached the concrete structure; therefore, additional items may still be present in the soil adjacent to the bunker.	If removal to depth is considered, remove the bunker, and then perform subsurface MEC removal followed by QC/QA inspections over the entirety of the three affected grids to ensure that the grids have received removal operations. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.
Fenceline	C2B9C8, C2B9C9, C2B9B9, C2B9B0, C2B9A0, C2B0A1, C2B0A2, C2A0J2, C2A0J3, C2A0J4, C2A0I3, C2A0I4, C2A0I5, C2A0H5, C2A0H6, C2A0H7, C2A0G7, C2A0G8, C2A0F8, C2A0F9,	The decision to designate this area as an SCA was based on	Do not excavate or otherwise intrude below the soil	Subsurface removal work was begun but not completed in this	If removal to depth is considered, remove the fence along Eucalyptus

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	C2A0F0, C2A0E0, C3A1E1, C3A1D1, C3A1D2, C3A1D3, C3A1C3, C3A1C4	instrument interference and because the probability of subsurface MEC was considered low.	surface without an authorized UXO escort.	area. Interference with detection instruments occurred as they approached the metallic fence; therefore, additional items may still be present in the soil adjacent to the fence.	Road and subject a 25-ft-wide corridor inside the site boundary to subsurface MEC removal and QC/QA inspection. During this work, site security measures need to be implemented (e.g., temporary fences, barriers, and/or security patrols) to maintain public safety. If removal to depth is not a viable option, then access should be limited to workers trained in MEC recognition or with UXO escort.
Range 48	C2A4C0, C2A5C1, C2A4B8, C2A4B9, C2A4B0, C2A4A6, C2A4A7, C2A4A8, C2A4A9, B2J4J6, B2J4J7, B2J4J8, B2J4J9, B2J4J0, B2J5J1, B2J5J2, B2J5J7, B2J4I7, B2J4I8, B2J4I9, B2J4I0, B2J5I1, B2J5I2, B2J5I3, B2J5I7, B2J5I8, B2J5I9, B2J4H8, B2J4H9, B2J4H0, B2J5H1, B2J5H2, B2J5H3, B2J5H4, B2J5H6, B2J5H7, B2J5H8, B2J5H9, B2J4G9, B2J4G0, B2J5G1, B2J5G2, B2J5G3, B2J5G4, B2J5G5, B2J5G6, B2J5G7, B2J5G8, B2J5G9, B2J4F9, B2J4F0, B2J5F1, B2J5F2, B2J5F3, B2J5F4, B2J5F5, B2J5F6, B2J5F7, B2J5F8, B2J4E0, B2J5E1, B2J5E2, B2J5E3, B2J5E4, B2J5E5, B2J5E6, B2J5E7, B2J5E8, B2J5E9, B2J5E0, B2J5D1, B2J5D2, B2J5D3, B2J5D4, B2J5D5, B2J5D6, B2J5D7, B2J5D8, B2J5D9, B2J5D0, B2J6D1, B2J6D2, B2J5C2, B2J5C3, B2J5C4, B2J5C5, B2J5C6, B2J5C7, B2J5C8, B2J5C9, B2J5C0, B2J6C1, B2J6C2, B2J6C3, B2J6C4, B2J5B2, B2J5B3, B2J5B4, B2J5B5, B2J5B6, B2J5B7, B2J5B8, B2J5B9, B2J5B0, B2J6B1, B2J6B2,	The decision to treat this area as an SCA was made early in the project based on the amount of MEC and debris found during the early phases of work (both surface and subsurface removals) compared to other areas that were considered more hazardous. Removal to depth in this area would have	Do not excavate or otherwise intrude below the soil surface without an authorized UXO escort.	No subsurface removal work was conducted, yet MEC was found during the surface removal of this area and in the subsurface of adjacent areas and is suspected to exist in the subsurface of this area as well.	If removal to depth is considered, use a dual-tool method, with multiple areas requiring significant excavation in combination with mechanical sifting (or remote control). Potential impacts to habitat would need to be evaluated and considered before performing such actions. If removal to depth is not a viable option, then access should be limited to

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	B2J6B3, B2J6B4, B2J6B5, B2J6B6, B2J5A3, B2J5A4, B2J5A5, B2J5A6, B2J5A7, B2J5A8, B2J5A9, B2J5A0, B2J6A1, B2J6A2, B2J6A3, B2J6A4, B2J6A5, B2J6A6, B2J6A7, B2J6A8, B2I5J4, B2I5J5, B2I5J6, B2I5J7, B2I5J8, B2I5J9, B2I5J0, B2I6J1, B2I6J2, B2I6J3, B2I6J4, B2I6J5, B2I6J6, B2I6J7, B2I6J8, B2I6J9, B2I6J0, B2I5I4, B2I5I5, B2I5I6, B2I5I7, B2I5I8, B2I5I9, B2I5I0, B2I6I1, B2I6I2, B2I6I3, B2I6I4, B2I6I5, B2I6I6, B2I6I7, B2I6I8, B2I6I9, B2I6I0, B2I7I1, B2I5H5, B2I5H6, B2I5H7, B2I5H8, B2I5H9, B2I5H0, B2I6H1, B2I6H2, B2I6H3, B2I6H4, B2I6H5, B2I6H6, B2I6H7, B2I6H8, B2I6H9, B2I6H0, B2I7H1, B2I7H2, B2I7H3, B2I5G6, B2I5G7, B2I5G8, B2I5G9, B2I5G0, B2I6G1, B2I6G2, B2I6G3, B2I6G4, B2I6G5, B2I6G6, B2I6G7, B2I6G8, B2I6G9, B2I6G0, B2I7G1, B2I7G2, B2I7G3, B2I7G4, B2I5F6, B2I5F7, B2I5F8, B2I5F9, B2I5F0, B2I6F1, B2I6F2, B2I6F3, B2I6F4, B2I6F5, B2I6F6, B2I6F7, B2I6F8, B2I6F9, B2I6F0, B2I7F1, B2I7F2, B2I7F3, B2I7F4, B2I7F5, B2I7F6, B2I5E7, B2I5E8, B2I5E9, B2I5E0, B2I6E1, B2I6E2, B2I6E3, B2I6E4, B2I6E5, B2I6E6, B2I6E7, B2I6E8, B2I6E9, B2I6E0, B2I7E1, B2I7E2, B2I7E3, B2I7E4, B2I7E5, B2I7E6, B2I7E7, B2I5D8, B2I5D9, B2I5D0, B2I6D1, B2I6D2, B2I6D3, B2I6D4, B2I6D5, B2I6D6, B2I6D7, B2I6D8, B2I6D9, B2I6D0, B2I7D1, B2I7D2, B2I7D3, B2I7D4, B2I7D5, B2I7D6, B2I7D7, B2I7D8, B2I7D9, B2I5C9, B2I5C0, B2I6C1, B2I6C2, B2I6C3, B2I6C4, B2I6C5, B2I6C6, B2I6C7, B2I6C8, B2I6C9, B2I6C0, B2I7C1, B2I7C2, B2I7C3, B2I7C4, B2I7C5, B2I7C6, B2I7C7, B2I7C8, B2I7C9, B2I7C0, B2I6B1, B2I6B2, B2I6B3, B2I6B4, B2I6B5, B2I6B6, B2I6B7, B2I6B8, B2I6B9, B2I6B0, B2I7B1, B2I7B2, B2I7B3, B2I7B4, B2I7B5, B2I7B6, B2I7B7, B2I7B8, B2I7B9, B2I7B0, B2I8B1, B2I6A1, B2I6A2, B2I6A3, B2I6A4, B2I6A5, B2I6A6, B2I6A7, B2I6A8, B2I6A9, B2I6A0, B2I7A1, B2I7A2, B2I7A3, B2I7A4, B2I7A5, B2I7A6, B2I7A7, B2I7A8, B2I7A9, B2I7A0, B2I8A1, B2I8A2, B2H6J2, B2H6J3, B2H6J4, B2H6J5, B2H6J6, B2H6J7, B2H6J8, B2H6J9, B2H6J0, B2H7J1, B2H7J2, B2H7J3, B2H7J4, B2H7J5, B2H7J6, B2H7J7, B2H7J8, B2H7J9, B2H7J0, B2H8J1, B2H8J2, B2H6I3, B2H6I4, B2H6I5,	exhausted the contract capacity at the expense of other, more hazardous areas.			workers trained in MEC recognition or with UXO escort.

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	B2H616, B2H617, B2H618, B2H619, B2H610, B2H711, B2H712, B2H713, B2H714, B2H715, B2H716, B2H717, B2H718, B2H719, B2H710, B2H811, B2H812, B2H814, B2H6H4, B2H6H5, B2H6H6, B2H6H7, B2H6H8, B2H6H9, B2H6H0, B2H7H1, B2H7H2, B2H7H3, B2H7H4, B2H7H5, B2H7H6, B2H7H7, B2H7H8, B2H7H9, B2H7H0, B2H8H1, B2H8H2, B2H8H4, B2H8H5, B2H8H6, B2H6G6, B2H6G7, B2H6G8, B2H6G9, B2H6G0, B2H7G1, B2H7G2, B2H7G3, B2H7G4, B2H7G5, B2H7G6, B2H7G7, B2H7G8, B2H7G9, B2H7G0, B2H8G1, B2H8G2, B2H8G3, B2H8G4, B2H8G5, B2H8G6, B2H8G7, B2H8G8, B2H6F7, B2H6F8, B2H6F9, B2H6F0, B2H7F1, B2H7F2, B2H7F3, B2H7F4, B2H7F5, B2H7F6, B2H7F7, B2H7F8, B2H7F9, B2H7F0, B2H8F1, B2H8F2, B2H8F3, B2H8F4, B2H8F5, B2H8F6, B2H8F7, B2H8F8, B2H6E8, B2H6E9, B2H6E0, B2H7E1, B2H7E2, B2H7E3, B2H7E4, B2H7E5, B2H7E6, B2H7E7, B2H7E8, B2H7E9, B2H7E0, B2H8E1, B2H8E2, B2H8E3, B2H8E4, B2H8E5, B2H8E6, B2H8E7, B2H8E8, B2H8E9, B2H6D9, B2H6D0, B2H7D1, B2H7D2, B2H7D3, B2H7D4, B2H7D5, B2H7D6, B2H7D7, B2H7D8, B2H7D9, B2H7D0, B2H8D1, B2H8D2, B2H8D3, B2H8D4, B2H8D5, B2H8D6, B2H8D7, B2H8D8, B2H8D9, B2H8D0, B2H9D1, B2H6C9, B2H6C0, B2H7C1, B2H7C2, B2H7C3, B2H7C4, B2H7C5, B2H7C6, B2H7C7, B2H7C8, B2H7C9, B2H7C0, B2H8C1, B2H8C2, B2H8C3, B2H8C4, B2H8C5, B2H8C6, B2H8C7, B2H8C8, B2H8C9, B2H8C0, B2H9C1, B2H9C2, B2H9C3, B2H9C4, B2H9C5, B2H9C6, B2H9C7, B2H6B0, B2H7B1, B2H7B2, B2H7B3, B2H7B4, B2H7B5, B2H7B6, B2H7B7, B2H7B8, B2H7B9, B2H7B0, B2H8B1, B2H8B2, B2H8B3, B2H8B4, B2H8B5, B2H8B6, B2H8B7, B2H8B8, B2H8B9, B2H8B0, B2H9B1, B2H9B2, B2H9B3, B2H9B4, B2H9B5, B2H9B6, B2H9B7, B2H7A1, B2H7A2, B2H7A3, B2H7A4, B2H7A5, B2H7A6, B2H7A7, B2H7A8, B2H7A9, B2H7A0, B2H8A1, B2H8A2, B2H8A3, B2H8A4, B2H8A5, B2H8A6, B2H8A7, B2H8A8, B2H8A9, B2H8A0, B2H9A1, B2H9A2, B2H9A3, B2H9A4, B2H9A5, B2H9A6,				

FINAL

Table 8-1 — SCA Summary Table for Ranges 43-48 Interim Action (cont)

SCA / Non-Completed Area Name	Grids	Reason for SCA	Precautions	Rationale	Recommendation
	B2H9A7, B2G7J2, B2G7J3, B2G7J4, B2G7J5, B2G7J6, B2G7J7, B2G7J8, B2G7J9, B2G7J0, B2G8J1, B2G8J2, B2G8J3, B2G8J4, B2G8J5, B2G8J6, B2G8J7, B2G8J8, B2G8J9, B2G8J0, B2G9J1, B2G9J2, B2G9J3, B2G9J4, B2G7I2, B2G7I3, B2G7I4, B2G7I5, B2G7I6, B2G7I7, B2G7I8, B2G7I9, B2G7I0, B2G8I1, B2G8I2, B2G8I3, B2G8I4, B2G8I5, B2G8I6, B2G8I7, B2G8I8, B2G8I9, B2G8I0, B2G9I1, B2G7H3, B2G7H4, B2G7H5, B2G7H6, B2G7H7, B2G7H8, B2G7H9, B2G7H0, B2G8H1, B2G8H2, B2G8H3, B2G8H4, B2G8H5, B2G8H6, B2G8H7, B2G8H8, B2G7G3, B2G7G4, B2G7G5, B2G7G6, B2G7G7, B2G7G8, B2G7G9, B2G7G0, B2G8G1, B2G8G2, B2G8G3, B2G8G4, B2G8G5, B2G7F4, B2G7F5, B2G7F6, B2G7F7, B2G7F8, B2G7F9, B2G7F0, B2G8F1, B2G8F2, B2G7E4, B2G7E5, B2G7E6, B2G7E7, B2G7E8, B2G7E9, B2G7D4, B2G7D5, B2G7D6				

FINAL

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CHAPTER 9 QUALITY CONTROL AND QUALITY ASSURANCE

3

9.1 QUALITY CONTROL

4 The QC process for Ranges 43-48 entailed performing a 10% analog QC survey with a
5 Schonstedt magnetometer and daily field audits of analog removal, digital geophysical survey,
6 digital anomaly excavations, backhoe excavations, and sifting operations. The QC process also
7 included daily audits of the data generated from the analog removal, digital geophysical surveys,
8 digital anomaly excavations, and sifting operations. QC documentation was electronically filed
9 in the field on PDAs, then stored in the database. Appendix G provides QC inspection results.

10 During the QC/QA inspections, if an MEC or MEC-like item that was large enough to represent
11 a 37mm projectile (or larger) was encountered, the QC/QA inspectors failed the grid where the
12 item was found. This pass-fail criterion was based on the smallest detectable MEC expected,
13 which was a 37mm projectile. Any grid failure or any other QC issue was addressed by a
14 nonconformance report (NCR), which describes the issue, lists the cause, and recommends a
15 corrective action.

16

9.2 SEEDING OF QC ITEMS

17

9.2.1 ANALOG REMOVAL SEEDED ITEM RESULTS

18 As a QC check on the analog removal process, 121 blue-painted, inert ordnance items were
19 planted at various locations and depths bgs before the analog removal. Of the 121 QC seeds
20 planted, 98 were recovered by the analog removal process. Of the 23 non-recovered items, 12
21 were determined to be non-detectable and 11 were missed by the removal process. Non-
22 detectable seeds are seed items that were placed and checked by the QC department and were
23 detectable at the time they were placed, but changes in environmental or electromagnetic
24 conditions resulting from removal activities in nearby large debris fields affected signals from
25 seed items (QC seeds and QA seeds). Once a team completed a grid and a seed item was not
26 recovered, QC personnel (accompanied by the SUXOS) would recheck the seed item to verify
27 whether it was detectable or not. NCRs were issued for the 11 missed QC seeded items as
28 shown in the comments section of Table 9-1. NCRs from this removal action are included as
29 Appendix H. The status of the QC seeded items are listed and displayed in Table 9-1. Map 9-1
30 displays the QC seeded item results for analog operations.

31

9.2.2 DIGITAL MAPPING SEEDED ITEM RESULTS

32 As a QC check on the digital survey and removal process, 123 blue-painted, inert ordnance items
33 were planted at various locations and depths bgs before the digital survey. Of the 123 QC seeds
34 planted, 111 were recovered by the digital removal process. Of the 12 non-recovered items, nine
35 were determined to be non-detectable and three were missed by the digital survey and removal
36 process. Once a team completed a grid and a seed item was not recovered, QC personnel
37 (accompanied by the SUXOS) would recheck the seed item to verify whether it was detectable or
38 not. NCRs were issued for the three missed QC seeded items as shown in the comments section
39 of Table 9-1. NCRs from this removal action are included as Appendix H. The status of the QC
40 seeded items are listed and displayed in Table 9-1. Map 9-2 displays the QC seeded item results
41 for digital operations.

FINAL

1 **9.2.3 SIFTING OPERATIONS SEEDED ITEMS RESULTS**

2 FIVE QC seed items were placed at various locations in the soil stockpile of the Range 45 sift
3 operation. Table 9-1 shows the location and description of these items. All five of the QC seed
4 items were recovered; however, one QC seed was not recovered during the sifting operation but
5 during the subsequent digital removal operation. This seed item was recovered 35 feet east and
6 722 feet north of its original location during digital excavations in the Range 45 area.

7 **9.3 ANALOG QC: 10% SURVEY**

8 Parsons' UXO QC specialist (UXOQCS) inspected at a minimum 10% of each completed grid
9 and partial grid with a Schonstedt G52Cx magnetometer.

10 During the QC-3 inspections, a grenade, hand, MKII, practice (expended) was found 8 inches
11 bgs in grid C2B7D7. This MD-E item was sufficient in size to constitute a grid failure (NCR
12 142). During the digital survey, the items response was 2.59 mV, which is below the 3 mV
13 threshold and therefore was not selected for digital excavation. The recommended corrective
14 action was for the analog removal to be performed over the entire grid again. The second analog
15 removal action encountered no MEC or munitions debris. On completion of the second analog
16 removal, a second analog QC check found no MEC or MEC-like items.

17 No MEC or MEC-like items were found in the other 1,207 grids/partial grids.

18 Parsons' UXOQC passed the 1,208 grids where the analog removal and digital mapping were
19 completed. Because they contain SCAs and their status is TBD or they have not been accepted
20 by Parsons QC, 1,100 grids did not qualify for the QC/QA process. Map 9-3 displays the status
21 (QC accepted or TBD) of the grids in Ranges 43-48. Appendix G list the QC-passed and TBD
22 grids.

23 **9.4 QC OF BACKHOE EXCAVATIONS**

24 Parson's UXOQCS inspected all backhoe excavations to ensure all munitions debris were
25 removed from the excavation site.

26 On completion of a backhoe excavation, the UXOQC personnel would inspect the excavation
27 site with the same type of geophysical survey equipment used by the excavation team
28 (Schonstedt or EM61-MK2). Once the backhoe excavation site was inspected and determined to
29 be free of munitions debris, the UXOQC personnel would then use a Leica SR530 RTK-
30 corrected GPS and a Pocket PC loaded with ArcPad, a mobile mapping and GIS program, to
31 walk the perimeter of the excavation recording the exact location of the backhoe excavation.
32 Map 9-4 displays the locations of the backhoe excavations.

33 During the analog QC inspection of a backhoe (special request) excavation, a MK II practice
34 hand grenade was found on the surface at the base of the sifted spoils pile in grid C2A9F2. This
35 item was sufficient in size to constitute a grid failure (NCR 141). As the recommended
36 corrective action, all screened debris at this excavation site was visually and physically re-
37 checked, and team leaders were reminded and directed to physically check spoils. If a high
38 saturation of metal in the spoil piles (links, clips, etc) would preclude the use of the Schonstedt,
39 the spoil piles were physically inspected using the raking technique.

FINAL

Table 9-1 — QC Seeded Item Results

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
B2H8G9	Projectile, 37mm, low explosive, MK I (inert)	8	Recovered	Recovered	
B2H8I7	Projectile, 60mm, mortar, practice, M50 series	13	Recovered	Recovered	
B2I0F2	Projectile, 60mm, mortar, practice, M50 series	12	Recovered	Recovered	
B2I0J2	Projectile, 57mm, armor piercing tracer, M70	16	Recovered	Recovered	
B2I7E9	Projectile, 37mm, armor piercing tracer, M51 series	11	Recovered	Non-recovered	NCR # 153 - Digital excavation
B2I7I7	Projectile, 37mm, armor piercing tracer, M51 series	12	Non-detectable	Recovered	Analog - No NCR - Not detectable - Verified by QC and USA SUXOS
B2I8A0	Projectile, 60mm, mortar, practice, M50 series	13	Recovered	Recovered	
B2I8A0	Rocket, 35mm, subcaliber, practice, M73	9	Recovered	Recovered	
B2I8A0	Rocket, 35mm, subcaliber, practice, M73	7	Recovered	Recovered	
B2I8A4	Projectile, 37mm, low explosive, MK I (inert)	15	Recovered	Non-detectable	Digital - Non-detectable; this item was placed at 15" and below the M-11(8"), once the excavation team removed the M-11 and checked the dig hole the 37mm was not detectable with the EM-61.
B2I8A4	Grenade, rifle, antitank, practice, M11 series	8	Recovered	Recovered	
B2I8A8	Projectile, 37mm, armor piercing tracer, M51 series	10	Non-detectable	Recovered	No NCR - Not detectable - Verified by QC and USA SUXOS
B2I8G4	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
B2I8J4	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
B2I9F1	Projectile, 37mm, armor piercing tracer, M51 series	11	Not worked by analog	Recovered	This item was actually in grid B2I9F1 and was flagged with F2 anomalies as it was place within the overlap area (3ft) of adjacent grid.
B2I9G4	Projectile, 37mm, armor piercing tracer, M51 series	12	Recovered	Recovered	
B2I9I1	Projectile, 37mm, armor piercing tracer, M51 series	11	Recovered	Recovered	
B2I9J1	Projectile, 37mm, armor piercing tracer, M51 series	9	Non-recovered	Non-detectable	Analog - NCR # 145; Digital - Non-detectable; verified by Geo QC at 0 mV.
B2I9J3	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
B2J0C6	Projectile, 81mm, mortar, practice, M43 series	20	Recovered	Recovered	
B2J0H2	Projectile, 84mm, HEAT, target practice, FFV 552	16	Non-detectable	Recovered	Analog - Not detectable - No NCR
B2J4J8	Grenade, hand, practice, M69	12	Recovered (not used for QC of digital mapping)	N/A	Placed once and returned to QC by team
B2J5I4	Rocket, 35mm, subcaliber, practice, M73	8	Recovered	Recovered	
B2J6C8	Projectile, 60mm, mortar, practice, M50 series	11	Recovered	Recovered	Also found by UXO-10 on 11/08/04 while performing overlap lane in adjacent grid.
B2J6D3	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
B2J6H2	Grenade, hand, practice, M69	10	Non-recovered	Recovered	Analog - Detectable; NCR #132
B2J7A4	Projectile, 37mm, low explosive, MK I (inert)	7	Non-recovered	Recovered	Analog - Detectable; NCR #134
B2J7B5	Grenade, rifle, antitank, practice, M11 series	12	Non-detectable	Non-detectable	Not able to find item, possible GPS error, if item is offset is most likely in B2J7C5, Item not detected by digital survey.
B2J7C9	Projectile, 60mm, mortar, practice, M50 series	16	Non-recovered	Recovered	Analog - Detectable; NCR #149
B2J7C9	Rocket, 35mm, subcaliber, practice, M73	8	Non-recovered	Recovered	Analog - Detectable; NCR #149
B2J7F6	Projectile, 57mm, armor piercing tracer, M70	19	Recovered	Recovered	
B2J7I9	Rocket, 3.5inch, practice, M29 series	11	Recovered	Recovered	
B2J7J6	Rocket, 35mm, subcaliber, practice, M73	7	Recovered	Recovered	
B2J7J9	Projectile, 60mm, mortar, practice, M50 series		Recovered (not used for QC of digital mapping)	N/A	Sift item
B2J7J9	Grenade, hand, training, MK1A1		Recovered (not used for QC of digital mapping)	N/A	Sift item

FINAL

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
B2J8A8	Projectile, 37mm, armor piercing tracer, M51 series	9	Recovered	Recovered	
B2J8B6	Projectile, 37mm, armor piercing tracer, M51 series	8	Recovered	Recovered	
B2J8H0	Projectile, 37mm, low explosive, MK I (inert)	11	Non-recovered	Non-recovered	Analog - Detectable, NCR #146; Digital - NCR#154 & NCR#155
B2J8H2	Projectile, 81mm, mortar, practice, M43 series	15	Non-recovered	Recovered	Analog - Detectable; NCR #133
B2J8H7	Projectile, 75mm, shrapnel, MK I	15	Non-recovered	Recovered	Analog - Detectable; NCR #143
B2J9B6	Projectile, 37mm, armor piercing tracer, M51 series	7	Recovered	Recovered	
B2J9B6	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
B2J9C1	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
B2J9D9	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	14	Recovered	Recovered	
B2J9H8	Projectile, 37mm, armor piercing tracer, M51 series	14	Recovered	Recovered	
B2J9I4	Rocket, 35mm, subcaliber, practice, M73	6	Recovered	Recovered	
B2J9I4	Rocket, 35mm, subcaliber, practice, M73	8	Recovered	Recovered	
B3J1J2	Projectile, 60mm, mortar, illumination, M83 series (Body)	7	Recovered	Recovered	
C2A0A2	Projectile, 60mm, mortar, illumination, M83 series (Complete)	8	Recovered	Recovered	Found by UXO-7 on 05/05/04 also while performing overlap lane in adjacent grid.
C2A0C7	Grenade, hand, prac, MK II	13	Recovered	Recovered	
C2A0C9	Grenade, hand, practice, MK II	12	Recovered	Recovered	
C2A0D6	Projectile, 37mm, armor piercing tracer, M51 series	11	Recovered	Recovered	
C2A0D8	Projectile, 60mm, mortar, illumination, M83 series (Tail Fins)	15	Recovered	Recovered	
C2A0D8	Projectile, 60mm, mortar, illumination, M83 series (Body)	21	Recovered	Recovered	
C2A0D9	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
C2A0F3	Projectile, 57mm, armor piercing tracer, M70	12	Recovered	Recovered	
C2A0F5	Grenade, hand, practice, M69	12	Non-recovered	Recovered	Analog - Detectable; NCR #130
C2A0F5	Grenade, hand, training, MK1A1	8	Recovered	Recovered	

FINAL

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
C2A0F7	Projectile, 37mm, armor piercing tracer, M51 series	12	Recovered	Recovered	
C2A0F8	Projectile, 75mm, shrapnel, MK I	11	Recovered	Recovered	
C2A0H3	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	8	Recovered	Recovered	
C2A0H6	Projectile, 37mm, armor piercing tracer, M51 series	12	Non-recovered	Recovered	Analog - Detectable; NCR #130
C2A0I1	Projectile, 81mm, mortar, practice, M43 series	12	Recovered	Recovered	
C2A0J1	Projectile, 37mm, armor piercing tracer, M51 series	14	Recovered	Non-detectable	Digital - No NCR - Non-detectable. Non-recovered by digital survey; The survey data showed a response of 2.46mV. The QC check verified response of 2.0mV.
C2A5A6	Projectile, 37mm, armor piercing tracer, M51 series	16	Recovered	Recovered	Also found by UXO 2 on 5/17/04 while performing overlap lane in adjacent grid (B2J5J6).
C2A5A9	Rocket, 35mm, subcaliber, practice, M73	6	Recovered	Recovered	
C2A5A9	Projectile, 81mm, mortar, practice, M43 series	14	Recovered	Recovered	
C2A5C0	Rocket, 35mm, subcaliber, practice, M73	10	Recovered	Non-detectable	No NCR - Verified by Geo QC.
C2A5D1	Rocket, 35mm, subcaliber, practice, M73	8	Recovered	Non-detectable	No NCR - Not detectable; anomaly selected at this location was frag; item was not detectable due to placement after analog removal. Grid was digitally surveyed prior to QC verification of seed replacement by UXO team.
C2A5D4	Projectile, 81mm, mortar, practice, M43 series	18	Recovered	Recovered	
C2A5D9	Rocket, 35mm, subcaliber, practice, M73	8	Non-detectable	Non-detectable	Analog - Not detectable, No NCR; Digital - Detectable; NCR #147; Item is in a geo poly# c2a5d9-0018; post excavation QC check resulted in a 4-mV response.
C2A5F9	Signal, illumination, ground, parachute, rifle, M19 series	8	Recovered	Recovered	
C2A6B2	Grenade, hand, practice, MK II	8	Recovered	Recovered	
C2A6E3	Projectile, 37mm, armor piercing tracer, M51 series	14	Recovered	Recovered	

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
C2A6E7	Signal, illumination, ground, parachute, rifle, M19 series	10	Non-recovered	Recovered	Analog - NCR #131 (NCR describes this as a M22 rifle grenade)
C2A6F4	Rocket, 35mm, subcaliber, practice, M73	10	Non-detectable	Non-detectable	Analog - Not detectable - No NCR; DIGITAL - Not detectable; post excavation QC check resulted in a 2-mV response.
C2A6H3	Rocket, 35mm, subcaliber, practice, M73	8	Recovered	Recovered	
C2A6H7	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	20	N/A	Recovered	Placed after analog clearance
C2A7B3	Projectile, 81mm, mortar, practice, M43 series	19	Recovered	Recovered	
C2A7B9	Projectile, 40mm, practice, M385		Recovered (not used for QC of digital mapping)	N/A	Sift item
C2A7C1	Projectile, 81mm, mortar, illumination, M301 series	13	Recovered	Recovered	
C2A7F1	Rocket, 35mm, subcaliber, practice, M73	10	Recovered	Non-detectable	Digital - Not detectable - No NCR - post excavation QC check resulted in a 2.6-mV response; no anomaly selected by processors.
C2A7F5	Projectile, 75mm, shrapnel, MK I	12	Recovered	Recovered	
C2A7G0	Projectile, 40mm, practice, M385	12	Recovered (not used for QC of digital mapping)	N/A	Sift item found by digital excavation at N-2122655; E-5742410
C2A7G0	Projectile, 40mm, practice, M385		Recovered (not used for QC of digital mapping)	N/A	Sift item
C2A7G7	Rocket, 35mm, subcaliber, practice, M73	6	Recovered	Recovered	
C2A7G9	Projectile, 40mm, practice, M385	7	Non-detectable	Recovered	Analog - Not detectable - No NCR
C2A7H5	Rocket, 35mm, subcaliber, practice, M73	6	Recovered	Recovered	
C2A7H7	Rocket, 35mm, subcaliber, practice, M73	8	Recovered	Recovered	
C2A7H9	Projectile, 40mm, practice, M385	6	Non-detectable	Recovered	Analog - Not detectable - No NCR
C2A7I0	Projectile, 40mm, practice, M385	8	Non-detectable	Recovered	Analog - Not detectable - No NCR

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
C2A7J2	Projectile, 60mm, mortar, illumination, M83 series (Body)	16	Recovered	Recovered	
C2A7J9	Projectile, 37mm, armor piercing tracer, M51 series	10	Recovered	Recovered	
C2A8B9	Projectile, 60mm, mortar, practice, M50 series	22	Recovered	Non-recovered	Digital - NCR #148; post excavation QC check resulted in a 4-mV response.
C2A8B9	Projectile, 75mm, shrapnel, MK I	13	Recovered	Recovered	
C2A8G3	Projectile, 37mm, low explosive, MK I (inert)	13	Non-detectable	Recovered	Analog - Not detectable - No NCR
C2A8I3	Projectile, 37mm, low explosive, MK I (inert)	12	Non-detectable	Pulled by QC	Analog - No NCR; Digital - QC checked before Geo 1 had a chance to verify dig results.
C2A8I5	Grenade, rifle, antitank, practice, M11 series	12	Recovered	Recovered	
C2A8I5	Projectile, 37mm, armor piercing tracer, M51 series	11	Recovered	Recovered	
C2A9A6	Projectile, 75mm, shrapnel, MK I	12	Recovered	Recovered	
C2A9A8	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	20	Recovered	Recovered	
C2A9D4	Projectile, 81mm, mortar, practice, M43 series	12	Recovered	Recovered	
C2A9D9	Projectile, 81mm, mortar, practice, M43 series	12	Recovered	Recovered	
C2A9E1	Rocket, 2.36inch, practice, M7	12	Recovered	Recovered	
C2A9H8	Projectile, 37mm, armor piercing tracer, M51 series	14	Non-detectable	Recovered	Analog - Not detectable - No NCR
C2A9J2	Projectile, 90mm, armor piercing tracer, M77	24	Recovered	Recovered	
C2A9J8	Projectile, 37mm, low explosive, MK I (inert)	12	N/A	Recovered	Placed for Digital only - asphalt
C2A9J8	Projectile, 37mm, armor piercing tracer, M51 series	11	N/A	Recovered	Placed for Digital only - asphalt
C2B0A1	Grenade, rifle, antitank, practice, M29	15	Recovered	Recovered	
C2B6C7	Grenade, hand, practice, M69	6	N/A	Recovered	Replaced with M69-03
C2B6C7	Grenade, hand, practice, M69	6	Recovered (not used for QC of digital mapping)	N/A	Analog team returned item to QC
C2B6D0	Projectile, 60mm, mortar, illumination, M83 series (complete)	4	Recovered	Recovered	
C2B7D6	Grenade, hand, practice, M69	4	Recovered	Recovered	
C2B7E1	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	18	Recovered	Recovered	

FINAL

Table 9-1 — QC Seeded Item Results (cont)

Grid	Seeded Item Description	Depth (inches bgs)	Result Analog	Result Digital	Comments
C2B7E3	Projectile, 60mm, mortar, practice, M50 series	12	Recovered	Recovered	
C2B7F4	Projectile, 37mm, armor piercing tracer, M51 series	5	Recovered	Recovered	
C2B7F7	Projectile, 81mm, mortar, illumination, M301 series (body)	6	Recovered	Recovered	
C2B8B9	Grenade, hand, training, MK1A1	4	Recovered	Recovered	
C2B8C8	Projectile, 37mm, armor piercing tracer, M51 series	7	Recovered	Recovered	
C2B8D0	Projectile, 3inch, trench mortar, practice, MK I (Stokes)	4	Recovered	Recovered	
C2B9A3	Projectile, 60mm, mortar, illumination, M83 series (body)	12	Recovered	Recovered	
C2B9A3	Projectile, 60mm, mortar, illumination, M83 series (tail fins)	6	Recovered	Recovered	
C2B9B0	Grenade, hand, prac, MK II	10	Recovered	Recovered	
C2B9B1	Projectile, 81mm, mortar, practice, M43 series	12	Recovered	Recovered	
C2B9B4	Projectile, 37mm, armor piercing tracer, M51 series	8	Recovered	Recovered	
C2B9C3	Grenade, hand, practice, M69	6	Recovered	Recovered	
C2B9C6	Grenade, rifle, smoke, M22 series	4	Recovered	Recovered	
C3A1B1	Projectile, 60mm, mortar, illumination, M83 series (tail fins)	11	Recovered	Recovered	
C3A1B3	Projectile, 37mm, armor piercing tracer, M51 series	11	Recovered	Recovered	
C3A1B3	Grenade, hand, practice, M69	12	Recovered	Recovered	
C3A1D1	Projectile, 81mm, mortar, illumination, M301 series	9	Recovered	Recovered	

FINAL

1 **9.5 QUALITY ASSURANCE**

2 **9.5.1 SEEDING OF QA ITEMS**

3 The statuses of the QA seeded items are in Table 1 of the digital QA report, which is included in
4 Appendix F of this TIP.

5 **9.5.2 ANALOG QA SURVEY**

6 The government rechecked at least 10% of the 1,208 completed grids and partial grids passed by
7 Parsons' UXOQC with a Schonstedt magnetometer and found no MEC. Analog QA was not
8 performed in the grids containing SCAs. Appendix G lists the QA passed and TBD grids and
9 contains copies of the QA acceptance documents.

10 **9.5.3 DIGITAL QA SURVEY**

11 The USACE project geophysicist conducted independent digital geophysical surveys with an
12 EM61-MK2, interpreted the data collected, and selected anomalies for the USACE OESS to
13 intrusively investigate. The results of these activities can be found in the digital QA report,
14 included as Appendix F.

FINAL

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CHAPTER 10 ENVIRONMENTAL PROTECTION ACTIVITY SUMMARY

3 The HMP designates most of the Ranges 43-48 IA site as habitat reserve. This chapter
4 summarizes the habitat protection and site restoration measures implemented to reduce impacts
5 on natural resources in accordance with HMP requirements.

6 The primary vegetation type in the Ranges 43-48 site is central maritime chaparral with patches,
7 of annual grasslands along the site's west, east, and south boundaries. Central maritime
8 chaparral is a protected vegetation type under the HMP [Ref. 6] because of its association with
9 significant numbers of rare, threatened, and endangered species.

10 The Parsons field biologist conducted a preliminary environmental survey of the sites to identify
11 locations of sensitive species and provided training for field personnel on habitat and the plant
12 and animal species within it. During field activities, the Parsons field biologist maintained a
13 strong presence in the field to assist personnel with environmental issues, to ensure compliance
14 with the HMP and with environmental directives. Duties also included accompanying the DENR
15 natural resources specialist and the USACE QA manager to monitor implementation of
16 environmental mitigation measures and the impact of field activities.

17

10.1 MINIMIZING IMPACTS ON SPECIES OF INTEREST

18 The HMP identifies rare, threatened, or endangered species and habitats designated for
19 protection and future management before, during, and after munitions removal and other clean-
20 up-related operations. It also outlines mitigation measures necessary if Army-related munitions
21 cleanup activities have significantly impacted these rare species and habitats.

22 Species of interest include a variety of central maritime chaparral inhabitants. The black legless
23 lizard (*Anneilla pulchra nigra*) occurs on the Ranges 43-48 site, as do HMP-listed plant species
24 such as sand gilia (*Gilia tenuiflora ssp. arenaria*), seaside bird's beak (*Cordylanthus rigidus ssp.*
25 *littoralis*), Monterey spineflower (*Chorizanthe pungens var. pungens*), sandmat manzanita
26 (*Arctostaphylos pumila*), Monterey ceanothus (*Ceanothus cuneatus var. rigidus*), and
27 Eastwood's golden fleece (*Ericameria fasciculata*).

28 Munitions removal activities followed the mitigation measures listed in Chapter 3 of the HMP
29 [Ref. 6]:

- 30
- 31 1) Minimize disturbance associated with munitions removal by restricting impacts to the
32 smallest area possible; place staging areas, access roads, and facilities to avoid HMP-
33 listed species wherever possible; use existing roads wherever possible, and limit off-road
34 vehicles to the greatest extent practicable.
 - 35 2) Where feasible, avoid populations of sand gilia and seaside bird's beak, particularly in
36 the growing season prior to seed set. Fence or flag known populations.
 - 37 3) Educate work crews about the location and identification of HMP plant and animal
38 species. Conduct environmental training of all incoming field personnel.

39 The following additional measures were observed:

- 40
- 1) Train workers on topsoil replacement during digs to attempt to minimize impacts by
preserving as much of the seed bank as possible.

1 2) Salvage mature seed of sand gilia, Monterey spineflower, and seaside bird's beak during
2 seedset in a few acres where large excavations (greater than 10 square feet) were
3 performed within populations of these plants. The salvaged seed was broadcast back
4 onto the sites following completion of the digs.

5 Parsons minimized disturbances to areas with sensitive species as much as possible without
6 significantly disrupting removal activities.

7 **10.1.1 BLACK LEGLESS LIZARD**

8 The black legless lizard (Photograph 10-1), a species of concern in California, inhabits loose
9 sandy soils in maritime chaparral, coast scrub sand dunes, and other coastal areas with native
10 vegetation. Field operations followed protocols for protecting this species and for recording
11 encounters to contribute to the future management and protection of the species [Ref. 6]. In
12 2004, the Parsons field biologist and UXO technicians recorded 128 encounters with black
13 legless lizards during operations in Ranges 43-48, with another 30 during 2005. Of these, four
14 lizards were dead and 12 were injured, with injuries ranging from tail autotomy to potentially
15 mortal damage. Living lizards encountered were relocated as close as possible to the discovery
16 site (generally within 15 to 20 feet) in sheltered locations where they would not be disturbed by
17 further work.



18 *Photograph 10-1 — The black legless lizard lives a mostly subterranean life in dunes around*
19 *Monterey Bay characterized by warmth, moisture, loose sand, and plant cover.*

21 **10.1.2 VEGETATION**

22 Before backhoe excavations, the Parsons field biologist checked the site to ensure minimal
23 disturbance of protected species and to enforce procedural compliance. The biologist also

1 provided field operations guidance on the growing, flowering, and seeding schedules of
2 protected species and on resultant suspensions of field work.

3 Annual surveys examine trends in recovery of health and diversity of rare habitats such as
4 maritime chaparral following cleanup activities, as on Range 43-48. The 2005 survey collected
5 data for three rare annual species: sand gilia, seaside bird's beak, and Monterey spineflower, as
6 well as observations on other species such as sandmat manzanita, Monterey ceanothus, and
7 Eastwood's golden fleece. The surveys confirm that abundance of all HMP shrubs was high
8 enough to ensure continuing robust populations.

9 Habitat monitoring at Ranges 43-48 will continue through 2008 to monitor species diversity
10 within the habitat reserve portion of the site.

11 **10.1.2.1 Sand Gilia**

12 In 2005, sand gilia (Photograph 10-2) was present in 287 acres of Ranges 43-48, approximately
13 58% of the site area – a 19% increase over the 2004 presence on 193 acres. The number of sand
14 gilia plants counted in 2005 was 284,380, compared with 66,328 plants observed in 2004.
15 Increased rainfall in 2005 is likely the major contributor to the increase in number and density of
16 sand gilia plants. The 2005 monitoring report details the survey procedures and findings
17 (Appendix I).



18
19
20 *Photograph 10-2 — Sand gilia, which blooms in the spring, prefers dry, open, sandy areas.*

21 **10.1.2.2 Seaside Bird's Beak**

22 Seaside bird's beak (Photograph 10-3) was present in 63 acres on Ranges 43-48 in 2005,
23 approximately 12% of the total site area, compared to the occupied area of 18 acres in 2004. The
24 number of seaside bird's beak plants counted in 2005 was 68,774, approximately a 20-fold
25 increase over the 3,317 plants reported in 2004. Again, increased rainfall probably accounts for
26 much of the increase in numbers and density. The 2005 monitoring report details the survey
27 procedures and findings for seaside bird's beak (Appendix I).



1
2 *Photograph 10-3 — California classifies seaside bird's beak as an endangered species*

3 **10.1.2.3 Monterey Spineflower**

4 Monterey spineflower (Photograph 10-4) is known to be widespread on Fort Ord, often occurring
5 at high densities. Both the original baseline survey for Fort Ord completed in 1992 [Ref. 6], and
6 the recent 2004 spineflower survey conducted after the 2003 prescribed burn on Range 43-48
7 indicate a large number of plants and large areal coverage. Coverage in 2005 increased to about
8 330 acres, from 294 acres the previous year. These similar numbers provide evidence that the
9 species may depend less on rainfall for germination than either sand gilia or seaside bird's beak.
10 The 2005 monitoring report details the survey procedures and findings for Monterey spineflower
11 (Appendix I).



12
13 *Photograph 10-4 — Monterey spineflower grows in sandy coastal areas from Monterey to San*
14 *Francisco.*

15 **10.2 VEGETATION CLEARANCE**

16 To increase safety for UXO technicians and to facilitate the subsurface removal of OE (which
17 included particularly hazardous munitions such as 40mm HE projectiles), a prescribed burn was

1 performed on the Ranges 43-48 IA site. This action improved visibility and access for crews
2 while increasing seed propagation of maritime chaparral vegetation. Incompletely burned areas
3 and brush skeletons in burned areas were subject to cutting using mechanical equipment (e.g.,
4 TAZ[®]) and/or manual equipment (e.g., chainsaws, loppers, and weed whackers), as necessary, so
5 that geophysical instrument operators could access the ground.

6 **10.3 SITE PRESERVATION AND RESTORATION**

7 The Parsons field biologist assessed the need for any site restoration and coordinated the work.
8 Depending on the type of soil and whether rare plant species were present, technicians
9 supervised by the Parsons field biologist removed and stockpiled the top three to four inches of
10 soil before backhoe excavations to maintain a seed bank of rare annual plants. They replaced the
11 stockpiled soil after removal and backfilling operations. All removal activities were monitored
12 to minimize impacts to HMP-listed species to the greatest extent feasible.

13 Mechanical equipment was used to return the sifted soil piled up on the Range 45 pad to the
14 scraped area. During all grading, transportation, and sifting operations, dust levels were
15 monitored and abatement measures were implemented if needed. Vehicle access throughout
16 Ranges 43-48 was restricted to the existing roads and fuel breaks as much as possible, except
17 during mechanical brush removal and when using the towed array to perform digital geophysical
18 surveys.

19 Scraping and other extensive disturbances on Range 45 were acceptable because the site lies outside
20 habitat areas and is planned for development. Erosion control measures included weed-free straw
21 blown and crimped into the soil over the entire 14 acres of disturbed area on the Range 45 site.
22 Also, in the eastern section of Ranges 43-48, encompassing about 1½ acres, a large-target
23 complex required extensive backhoe excavations, leaving the entire area disturbed and barren.
24 Under supervision by the Parsons field biologist, field personnel blew and crimped in straw for
25 site restoration and erosion control.

26 The field biologist performed informal follow-up monitoring of the Ranges 43-48 site for erosion
27 or invasive weed problems throughout the surface and subsurface MEC removal, as well as
28 leading the annual vegetation surveys in 2004 and 2005.

FINAL

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CHAPTER 11 LESSONS LEARNED

3

11.1 EM61-MK2 USE OVER ASPHALT

4 Observations during operations at the MRS-MOCO.2 and MRS-SEA.1-4 indicated that the
5 EM61-MK2 could be effective on paved areas.

6 In late 2004, the EM61-MK2 was tested over a 40-foot-by-40-foot grid in the northeast corner of
7 the Parsons compound parking lot at the former Fort Ord. Three inert 37mm projectiles were
8 buried under existing 3-inch-thick asphalt paving, and three were buried in an adjacent dirt area.
9 An EM61-MK2 cart was pushed over the test grid to collect three sets of geophysical data: a
10 control set before the items were buried, a second set with the items buried 12 inches bgs, and a
11 third set with the test items buried 18 inches bgs. The asphalt did not significantly affect the
12 ability of the EM61-MK2 to detect subsurface metallic items. A white paper detailing this
13 EM61-MK2 asphalt test has been included as Appendix J. The FVF amending the MRS-Ranges
14 43-48 SSWP to authorize use of the EM61-MK2 in asphalt areas is reproduced in Appendix K.

15 In Ranges 43-48, three QC seed items (one 37mm, LE, one 37mm AP-T and one Mk I practice
16 grenade) were placed below asphalt in two grids (C2A9J8 and C2B9A8), and all three seed items
17 were detected and removed by the digital removal process.

18

11.2 QUALITY CONTROL SEEDING PROGRAM

19 The removal process used on the Ranges 43-48 site was an analog removal using the Schonstedt
20 GA52Cx flux gate magnetometer followed by a 100% digital geophysical mapping survey and
21 excavation of selected digital anomalies. QC acceptance procedures were conducted after all
22 removal procedures were completed (analog then digital). Implementing a QC seeding program
23 not only provides data on final removal effectiveness but also provides feedback on the
24 effectiveness of each individual process. This feedback is essential in monitoring the
25 effectiveness of the first removal process (analog in this instance).

26

11.3 BACKHOE EXCAVATIONS

27 On completion of a backhoe excavation, the UXOQC personnel would perform an inspection of
28 the excavation site using the same type of geophysical survey equipment used by the excavation
29 team (Schonstedt or EM61-MK2). Once the backhoe excavation site was inspected and
30 determined to be free of munitions debris, the UXOQC personnel would then use a Leica SR530
31 RTK-corrected GPS and a Pocket PC loaded with ArcPad, a mobile mapping and geographic
32 information system (GIS) program, to walk the perimeter of the excavation recording the exact
33 location of the backhoe excavation. This procedure provided a shape file to the digital
34 geophysical data processors so that they could avoid selecting the excavation as anomaly target.
35 Most backhoe excavation sites will respond as large clusters of anomalous matter because the
36 soil used to back fill the excavations site will contain small pieces of metallic debris even though
37 it has been run through a screen. Using this method eliminated the possibility of duplicating large
38 excavations unnecessarily.

39

11.4 UXO TECHNICIANS ANALOG LOCATOR QC QUALIFICATION PROGRAM

40 The Parsons Fort Ord QC Department developed a UXO Technicians Analog Locator QC
41 Qualification Program. This program ensured that all UXO Technicians on the job site or new

1 technicians entering the job site were not only proficient with using the Schonstedt GA52Cx
2 magnetometer but were also informed and educated on the procedures and criteria for the Fort
3 Ord specific removal operations. This training enabled the QC staff to explain the site-specific
4 peculiarities of the Ranges 43-48 removal processes as well as observe and train, or correct when
5 necessary any technical inconsistencies with the military munitions removal processes.

FINAL

CHAPTER 12
COST AND ACCIDENT EXPOSURE DATA

12.1 COST DATA

The operations described by this document were performed and associated costs incurred under task order 0004, contract DACA05-00-D-003. Table 12-1 shows the breakdown of the costs (by work breakdown structure [WBS] element) for the surface and subsurface removal components of the Ranges 43-48 IA.

Table 12-1 — Cost of Operations for Ranges 43-48 Interim Action
(Surface and Subsurface Removal)

WBS Code	WBS Element	Cost
1.3.36.2.03	Site specific investigation (2003)	\$46,175
1.3.36.4	GIS (2003)	\$306,636
1.3.36.5.03	Build towed array	\$29,357
1.3.36.5.05	Quality control	\$483,838
1.3.36.5.06	Range residue removal	\$813,702
1.3.36.5.08	Site management and support (2003)	\$1,330,839
1.3.36.5.11	Border survey (2003)	\$13,705
1.3.36.5.13	Digital survey	\$507,297
1.3.36.5.14	Visual surface clearance removal	\$1,277,774
1.3.36.5.17	Site security – OE removal burn (2003)	\$103,184
1.3.36.5.21	Location survey mapping – grid survey (2003)	\$96,326
1.3.36.5.22	Manual vegetation clearance	\$322,690
1.3.36.5.32	Mechanical vegetation clearance	\$521,221
1.3.36.5.52	Site erosion control	\$41,276
1.3.36.5.23	Reacquire anomalies	\$172,669
1.3.36.5.24	SCA surface removal	\$6,481
1.3.36.5.34	Analog removal	\$9,266,427
1.3.36.5.44	Digital excavations	\$2,318,880
1.3.36.5.54	Target removals – OE	\$238,748
1.3.36.5.64	Sifting and backfill	\$2,217,379
1.3.36.5.74	Demolition operations	\$292,282
1.3.36.5.84	Range 45 pad	\$160,616
1.3.36.6.01	AAR – OE removal	\$131,929
Subtotal		\$20,699,430

FINAL

1 Table 12-2 — Cost of Operations for Ranges 43-48 Interim Action
 2 (Site Burn)*

WBS Code	WBS Element	Cost
1.3.36.7.02	Site Burn (2002)	\$0
1.3.36.7.03	Site Burn (2003)	\$2,477,995
1.3.36.5.07	Burn Site Security (2003)	\$76,642
1.3.36.6.02	AAR – Burn (2003)	\$17,394
1.3.36.8.02	Burn Monitoring (2002)	\$0
1.3.36.8.03	Burn Monitoring (2003)	\$463,710
1.3.36.8.04	Burn Air Report	\$13,223
Subtotal		\$3,048,964

3 *These costs were reported in the *MRS Ranges 43-48 Prescribed Burn After-Action*
 4 *Report*, Parsons, May 2004.

5 Table 12-3 — Cost of Operations for Ranges 43-48 Interim Action
 6 (Debris Removal)*

WBS Code	WBS Element	Cost
1.3.36.5.16	Debris removal, disposal, support	\$98,555
1.3.36.6.03	TIP – Debris Removal	\$6,513
Subtotal		\$105,068

7 *These costs were reported in *MRS-Ranges 43-48 and MRS-Moco.2 Technical Letter:*
 8 *Range-Related Debris Removal*, Parsons, July 2004.

9 The total cost for operations during the Ranges 43-48 interim action was \$23,856,712.

10 12.2 ACCIDENT EXPOSURE DATA

11 There were no recordable accidents or injuries associated with the Ranges 43-48 IA.

FINAL

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CHAPTER 13 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

3

13.1 SUMMARY

4 From October 2003 to December 2005, the Army conducted an interim action on the
5 approximately 499.5-acre Ranges 43-48 site to protect human health from the imminent threat
6 posed by MEC at the site while the Army evaluated the overall cleanup needs of the former Fort
7 Ord under the ongoing MR RI/FS program. The IA entailed conducting a surface removal and
8 subsurface removal on the site. The surface and subsurface removal involved the following
9 major site activities:

- 10 1) Visually searching for and removing MEC from the surface.
- 11 2) Performing an analog subsurface removal. The analog removal work involved detecting
12 anomalies in the subsurface with analog Schonstedt GA-52Cx magnetometers and then
13 digging each anomaly location until the source of the anomaly was removed.
- 14 3) Conducting digital mapping operations. The digital mapping operations consisted of
15 mapping the post-removal site conditions with digital geophysical survey instruments,
16 and then investigating and resolving any anomalies detected by the digital instruments.
- 17 4) Conducting QC/QA inspections to ensure that detectable items had been removed and
18 that the IA was performed completely, effectively, and in accordance with the Fort Ord
19 PWP and the MRS-Ranges 43–48 SSWP [Refs. 4 and 5].

20

13.1.1 SURFACE REMOVAL

21 The surface removal was conducted from November 2003 to February 2004 following the
22 prescribed burn of October 2003. Visual surface sweep teams searched the ground surface to
23 identify MEC and remove all munitions debris and RRD 2 inches or larger. The surface
24 removal was completed over the entire site and produced 4,563 MEC and 411 MD-E items as
25 well as 49,084 pounds of munitions debris and 51,271 pounds of RRD. The MEC and suspected
26 MEC (items later determined to be MD-E) were detonated with engineering controls.

27

13.1.2 ANALOG REMOVAL

28 To prepare the site for the analog removal, armored MHE accessed, cleared paths, and hauled
29 away approximately 100 range targets from the site. The range targets included 6-foot-tall metal
30 silhouettes, 55-gallon drums, APCs, cement-filled targets, dumpsters, tanks, and wheeled
31 vehicles. During the range target removal and target path clearance activities, 346 MEC items
32 and 158 MD-E items were encountered, along with 10,520 pounds of munitions debris and
33 32,697 pounds of RRD. The MEC and suspected MEC items later determined to be MD-E were
34 detonated with engineering controls.

35 From December 2003 to July 2005, 1,261 grids on 274.1 acres of MRS-Ranges 43–48 received
36 analog removal to depth, with 1,251 grids completed on 271.8 acres. UXO teams used
37 Schonstedt magnetometers to detect subsurface anomalies and excavated all detected anomalies
38 until their sources were removed. The analog removal recovered 3,242 MEC items and 15,921
39 MD-E items (including 406 originally suspected to be MEC), and approximately 181,688 pounds
40 of munitions debris and 89,333 pounds of RRD.

1 The UXO teams recovered 98 of the 121 QC items during the analog removal. Of the 23
2 non-recovered items, 12 were determined to be non-detectable and 11 were missed by the analog
3 removal process. NCRs were issued for the 11 missed QC seeded items.

4 The subsurface removal work could not be completed in approximately 227.7 acres of MRS-
5 Ranges 43-48 due to funding and time constraints. Ranges 44, 47, and 48 include the majority of
6 the SCAs that are pending completion. These ranges were designated SCAs because heavy
7 metallic debris left over from training activities prevented the Schonstedt magnetometers from
8 detecting individual anomalies. The eastern side of the MRS and a small portion of the central
9 area are non-completed areas that received lower priority from the USACE because higher-than-
10 expected anomaly densities in the MRS slowed the removal process and increased its cost.
11 Areas that affected public safety, personnel safety, and land reuse received higher priority.

12 One of the SCAs that the Army was able to clear was Range 45, an approximately 14-acre
13 former grenade range. The Army scraped off the top 2 feet of soil, which removed most of the
14 metallic debris in Range 45. The Army was able to excavate Range 45 because it lies outside
15 habitat areas and is planned for development. The excavated soil was run through a mechanical
16 sifter that passed the soil through two screens to filter the metallic debris from the soil. The sifter
17 then moved the clean soil to an asphalt area where it was temporarily stored until removal work was
18 completed on the site. Meanwhile, the metallic debris was taken to a sorting area, where it was
19 inspected for MEC. After the ground was scraped and the excavated soil sifted, MEC removal
20 crews were able to search for MEC in the subsurface of the scraped area using analog and then
21 digital geophysical detection instruments. After finishing the sifting operation, the asphalt Range
22 45 pad and its base were deconstructed. The debris sorting, subsurface removal work, and pad
23 deconstruction removed 1,169 MEC items and 3,853 MD-E items (including 26 originally
24 suspected to be MEC). This work also recovered 139,259 pounds of munitions debris and RRD,
25 as measured at the FACT processing mill, including 5,383 pounds of munitions debris and 2,963
26 pounds of RRD recovered during analog and digital subsurface removal of the excavated areas.

27 **13.1.3 DIGITAL MAPPING**

28 A combination of individually operated and towed-array EM61-MK2 electromagnetic metal
29 detectors were used to map the post-removal site conditions. The digital mapping indicated
30 59,800 anomaly locations requiring investigation. After verifying whether the areas were
31 anomalous, the UXO teams excavated 55,605 anomalies.

32 The anomaly excavations on Ranges 43-48 produced 409 MEC items, 34,711 pounds of
33 munitions debris, and 7,100 pounds of RRD.

34 The UXO teams recovered 111 of the 123 QC items during the digital mapping operations. Of
35 the 12 non-recovered items, nine were determined to be non-detectable and three were missed by
36 the digital mapping process. NCRs were issued for the three missed QC seeded items.

37 **13.1.4 QC/QA**

38 Parsons' UXOQCS inspected, at a minimum, 10% of each completed grid and partial grid with a
39 Schonstedt GA-52Cx magnetometer (this is referred to as a QC-3 inspection).

40 During the QC-3 inspections, the only MEC or MEC-like item found was an expended MKII
41 practice hand grenade, which was encountered 8 inches bgs in grid C2B7D7. This item was
42 sufficient in size to constitute a grid failure. The recommended corrective action was for the
43 analog removal to be performed over the entire grid again. During the corrective analog removal

1 action, no MEC or munitions debris was encountered. On completion of the corrective analog
2 removal action, Parsons' UXOQCS re-inspected the grid and found no MEC or MEC-like items.

3 No MEC or MEC-like items were found in the other 1,207 grids/partial grids outside grid
4 C2B7D7. Parsons' UXOQC passed the 1208 grids where the analog removal and digital
5 mapping were completed. Because they contain SCAs and their status is TBD or they have not
6 been accepted by Parsons QC, 1,100 grids did not qualify for the QC/QA process.

7 **13.2 CONCLUSION**

8 As the remedial actions selected in the IA ROD, surface removal and subsurface removal were
9 conducted on the 499.5-acre MRS-Ranges 43-48 site from November 2003 to December 2005.
10 The surface removal specified in the approved MRS-Ranges 43-48 SSWP [Ref. 5] has been
11 completed over the entire site, and the subsurface removal has been conducted to the maximum
12 capability of the technologies and instruments used in all portions of the site that could be
13 completed within the environmental constraints and the funding and time constraints of the
14 contract. Based on the results of this IA, the imminent threat posed to the public by the presence
15 of MEC on this site has been significantly mitigated.

16 Visual surface sweep teams searched the ground surface, and they identified and destroyed (by
17 detonation) all MEC visible on the surface and removed all munitions debris and RRD 2 inches
18 or larger.

19 Schonstedt magnetometers (analog) were used to locate subsurface anomalies, and all anomalies
20 detected were excavated until their sources were removed. The analog removal was completed
21 over 271.8 acres of the MRS, including the most accessible portions of the site — the areas
22 within 1,000 feet of Eucalyptus Road. Almost all of the areas where analog removal was
23 completed were digitally mapped using the EM61-MK2, and all anomalies potentially
24 representing MEC in the subsurface were intrusively investigated. All MEC items found during
25 the subsurface removal operations were destroyed by detonation.

26 Analog QC inspections were then conducted. At least 10% of each of the 1,208 completed grids
27 was checked with a Schonstedt magnetometer, and no MEC items were found. Overall, Parsons'
28 UXOQC passed 1,208 of the 2,308 grids/partial grids on the Ranges 43-48 site; the status of the
29 other 1,100 grids is pending the completion of removal work in SCAs and non-completed areas.

30 Analog and digital QA inspections followed the QC inspections. The government checked at
31 least 10% of each of the grids passed by Parsons' UXOQC with a Schonstedt magnetometer and
32 found no MEC items.

33 Approximately 227.2 acres of the removal area have been designated SCAs or non-completed
34 areas. The immediate threat posed to the public by these SCAs has been significantly mitigated
35 because the MEC on the ground surface of these areas was removed during the surface removal.
36 Any remaining MEC items in the SCAs and non-completed areas are located below the ground
37 surface.

38 The IA ROD states that the interim RAOs for the Ranges 43-48 removal action are to reduce
39 risks to human health and the environment associated with ordnance and explosives and to
40 comply with federal and state ARARs [Ref. 2]. The IA ROD selected surface and subsurface
41 MEC removal as the interim remedy, while the specific technical approach for subsurface
42 removal (removal depth) was deferred to the site-specific work plan. The final Ranges 43-48
43 Site Specific Work Plan (SSWP), Former Fort Ord, August 2003, identified the MEC removal

1 process to be implemented in MRS-Ranges 43-48 as surface removal, followed by detection and
2 investigation of subsurface anomalies, followed by QC. The SSWP also provided that “portions
3 of the site where this approach cannot be implemented will be delineated as special-case areas
4 and addressed in the future” (Sec.1.5.1). This anticipated that subsurface removal might not be
5 feasible using the general subsurface removal technique in areas with high anomaly density,
6 which the MR BCT recognized at the time of the work plan development. The process for
7 delineating and addressing these areas is further discussed in Sec. 2.3.8.2 of the Final SSWP.

8 The interim remedial action at Ranges 43-48 did not accomplish the Interim Action ROD
9 selected remedy in some parts of the site. In some areas, only surface removal was completed.
10 (See Chapter 8 for a listing and discussion of these areas.) Although the risks were substantially
11 reduced by completing surface MEC removal, these areas are not protective for unrestricted
12 reuse. Site security measures (fences, signs, perimeter controls, etc.) will remain in place to
13 provide continuing protection, and these areas will be further evaluated and addressed in a
14 subsequent CERCLA decision document. In a separate document, U.S. Army Corps of
15 Engineers, Sacramento District will outline safety precautions required for any interim use.

16 **13.3 RECOMMENDATIONS**

17 The basewide MR RI/FS program should evaluate the remaining explosive risks and the IA work
18 completed at MRS-Ranges 43-48. This evaluation should include future reuse of and activities
19 in the SCAs and non-completed areas.

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CHAPTER 14
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