

**Draft**  
**Site Evaluation Results and Work Plan**  
**for Additional Investigation**  
**Basewide Range Assessment Investigation**  
**Units 25 and 28**  
**Former Fort Ord**  
**Monterey County, California**

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## ***Table of Contents***

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List of Tables .....	ii
List of Figures.....	ii
Acronyms and Abbreviations .....	iii
1.0 Introduction.....	1
2.0 Site Background.....	2
2.1 Former Range Uses .....	3
2.1.1 Unit 25.....	3
2.1.2 Unit 28.....	4
3.0 Site Work .....	4
3.1 Remedial Investigation/Feasibility Study .....	4
3.2 Basewide Range Assessment .....	5
3.2.1 Unit 25.....	6
3.2.2 Unit 28.....	6
3.3 Previous Remedial Actions .....	7
3.3.1 Site 39 Inland Ranges.....	7
3.3.2 Surface MEC Removal Action.....	7
3.3.2.1 Mortar Alley Time Critical Removal Action.....	8
3.3.2.2 Removal Action in Support of the Track 3 Record of Decision.....	8
4.0 Site Reconnaissance following MEC Removal .....	9
5.0 Decision Rules .....	10
6.0 Conclusions and Recommendations Regarding Units 25 and 28 .....	11
6.1 Conclusions Regarding Units 25 and 28.....	11
6.2 Recommendations for Units 25 and 28.....	13
6.3 Proposed Sampling.....	14
6.4 Laboratory Analyses .....	14
6.5 Reporting.....	15
7.0 References.....	15

## ***List of Tables***

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Table 1	BRA Summary
Table 2	Basis for Unit 25 Proposed Sample Locations
Table 3	Basis for Unit 28 Proposed Sample Locations

## ***List of Figures***

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Figure 1	Location Map
Figure 2	Unit 25 and Unit 28 Generalized MEC Areas
Figure 3	Unit 25 MEC/MD, Site Features, and Proposed Sample Locations
Figure 4	Unit 28 MEC/MD, Site Features, and Proposed Sample Locations

## ***Acronyms and Abbreviations***

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BRA	Basewide Range Assessment
BRAWP	Basewide Range Assessment Work Plan
CBRAR	<i>Final Comprehensive Basewide Range Assessment Report, Former Fort Ord, California, Revision 2</i>
COC	contaminants of concern
Gilbane	Gilbane Federal
HA	Historical Area
HE	high explosive
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
KEMRON	KEMRON Environmental Services, Inc.
mg/kg	milligrams per kilogram
mm	millimeter
MD	munitions debris
MEC	munitions and explosives of concern
MRA	munitions response area
MMRP	military munitions response program
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RPD	relative percent difference
Shaw	Shaw Environmental, Inc.
Site 39 QAPP	<i>Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix B, Soil Sampling, Basewide Range Assessment</i>
Site 39 RACR	<i>Final Remedial Action Completion Report Site 39 Inland Ranges Habitat Reserve, Former Fort Ord, California</i>
Site 39 ROD Amendment	<i>Final Record of Decision Amendment, Site 39, Former Fort Ord, California</i>
SOP	Standard Operating Procedures
TCRA	time-critical removal action
Track 3 RI/FS	<i>Final Track 3 Impact Area Munitions Response Area, Munitions Response, Remedial Investigation/Feasibility Study</i>
TNT	2,4,6-trinitrotoluene
USACE	United States Army Corps of Engineers

## 1.0 Introduction

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This document presents a site-specific work plan to evaluate metals and explosive residues in soil at Units 25 and 28 as part of the Basewide Range Assessment (BRA) being performed at the former Fort Ord in Monterey County, California. The BRA evaluation at Units 25 and 28 is being conducted by KEMRON Environmental Services, Inc. (KEMRON) and Gilbane Federal (Gilbane) for the U.S. Army Corps of Engineers (USACE) under the Worldwide Environmental Remediation Services contract number W912DY-10-D-0027, Task Order CM01.

The BRA investigation program is being conducted to evaluate the potential presence of contaminants of concern (COCs) at known or suspected small arms ranges, multi-use ranges, and military munitions training areas within the former Fort Ord in accordance with the requirements of the *Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix B, Soil Sampling, Basewide Range Assessment* (Site 39 QAPP; KEMRON, 2016b), the *Draft Final Basewide Range Assessment Work Plan* (BRAWP; Harding ESE/IT, 2001), and the *Final Record of Decision Amendment, Site 39, Former Fort Ord, California* (Site 39 ROD Amendment; Army, 2009).

- The BRAWP (Harding ESE/IT, 2001) describes the specific data collection methods, evaluation processes, and decision criteria to be used for determination of site status regarding potentially contaminated soil; that is, where the soil sampling will be conducted, if necessary, and why.
- The Site 39 QAPP (KEMRON, 2016b) establishes the plan to evaluate the potential presence of COCs; that is, how the soil sampling will be conducted and the samples analyzed.
- The Site 39 ROD Amendment (Army, 2009) specifies the threshold concentrations of metals and explosives (HMX, RDX, and TNT) residues for applicable remediation.

The objective of the BRA investigation is to evaluate whether the COCs specified in the Site 39 ROD Amendment, which include antimony; copper; lead; and the explosive compounds 2,4,6-trinitrotoluene (TNT); hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) are present in soil at concentrations requiring additional characterization and/or remediation to meet established standards for protection of human health

and the environment. Previous evaluations at Fort Ord have indicated that lead is the most commonly encountered metal COC and elevated concentrations of antimony and copper are only found in the presence of elevated lead. Therefore, lead is used at Fort Ord as the indicator compound for elevated concentrations of metals COCs. Lead is the only metal analyzed during initial site investigation. All three explosive compounds discussed above are analyzed where appropriate during the initial site investigation.

This Work Plan (1) presents a summary of the known historical uses of Units 25 and 28, (2) a summary of previous site evaluations performed at Units 25 and 28 that served as input to the BRA program, (3) discusses the results of the site-specific reconnaissance conducted in Units 25 and 28 in support of the BRA investigation program, (4) relates historical and recent work to evaluation criteria established in applicable work plans and decision documents, (5) and provides conclusions and recommendations related to the status of potential COCs in soil within Units 25 and 28.

## **2.0 Site Background**

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Units 25 and 28 are subareas of Site 39 ([Figure 1](#)). Site 39 is comprised of the approximately 8,000-acre former historical Impact Area that was the location of the Fort Ord Range Complex and adjoining similar use areas and encompasses an area bounded 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. Site 39 was designated to address the soil contamination component of the historical Impact Area. The Impact Area Munitions Response Area (MRA) is a 6,560-acre subarea within Site 39 that was designated for the purposes of the Fort Ord Military Munitions Response Program (MMRP) to address munitions and explosives of concern (MEC), specifically munitions larger than .50 caliber, known or suspected to be present. The Impact Area MRA includes a large number of ranges that have various historical uses, designs, and characteristics. The types of munitions that have been used during training activities within the Impact Area MRA include hand grenades, mortars, rockets, mines, artillery projectiles, and small arms. Training activities at the Impact Area MRA ceased after the closure of Fort Ord in 1994 (MACTEC, 2007). [Figure 2](#) depicts generalized MEC areas that overlap Units 25 and 28 as

described in the *Final Track 3 Impact Area Munitions Response Area, Munitions Response, Remedial Investigation/Feasibility Study* (Track 3 RI/FS; MACTEC, 2007).

Unit 25 is 97 acres located within the southeastern portion of the Impact Area MRA (Figure 1) and is composed of mostly flat terrain with steep slopes near Impossible Canyon Road. Impossible Canyon Road, which lies at the bottom of Impossible Canyon, marks the eastern boundary of Unit 25. Elevation ranges from approximately 570 feet in the northern section adjacent to Impossible Canyon to approximately 805 feet in the central section of the unit.

Unit 28 is approximately 102 acres located within the northeastern portion of the Impact Area MRA (Figure 1) and is composed of steep, rocky terrain with well-developed drainages. Elevation ranges from approximately 280 feet in the northern section to approximately 640 feet in the southern section. A ridgeline bisects the unit in a northeasterly to southwesterly direction. Impossible Canyon Road, which lies at the bottom of Impossible Canyon, marks the eastern boundary of Unit 28.

## 2.1 Former Range Uses

Historical use of the ranges or historical areas (HAs) that lie within or overlap Unit 25 – HAs 68 and 70 (Figure 3) – and Unit 28 – HA 36, Combat in Cities, and the Rifle Grenade Range (Figure 4) – is summarized in Sections 2.1.1 and 2.1.2 as well as on Table 1. Detailed background information regarding former range use is presented in the Track 3 RI/FS (MACTEC, 2007) and the *Final Comprehensive Basewide Range Assessment Report, Former Fort Ord, California, Revision 2* (CBRAR; Shaw Environmental, Inc. [Shaw], 2012).

### 2.1.1 Unit 25

**HA 68** – The footprint of HA 68 as indicated in historical documents overlaps a portion of the southern central Impact Area MRA and includes the southernmost portion of Unit 25 (Figure 3). The exact use of HA 68, also known as Range 68, is unconfirmed. It was identified as “Sub Mach DSMTD” (or submachine gun dismantled) on a 1956 Range Construction Priority Map, but is not documented elsewhere. The range was intended to be used for small arms training. It is unknown whether this range was actually constructed (Shaw, 2012).

**HA 70** – This range is identified as Small Arms Firing Course on the circa 1954 training map and on the 1958 training facilities map. The firing course was not shown on any of the other available historical range maps. The footprint of HA 70 (Figure 3) encompasses approximately the northern third of Unit 25 (Shaw, 2012).

### 2.1.2 Unit 28

**HA 36** – HA 36 – also known as Range 36, Fragmentation Hand Grenade Range, and HE Hand Grenade Range – was used as a hand grenade range from as early as 1966 through 1993. The range footprint includes a portion in the north-central part of Unit 28 (Figure 4). Historical documents indicate that range use included fragmentation grenades, Claymore anti-personnel mines, C4, and TNT. The primary use area is bounded on the south by a berm and on the north by a concrete blast wall. The south face of the blast wall is heavily pitted from the impact of blast fragments and the central portion of the range contains abundant grenade fragments (Shaw, 2012).

**Combat in Cities** – Combat in Cities was identified on a 1953 training map. The footprint of the Combat in Cities Range as indicated in historical documents overlaps the northeastern portion of Unit 28 (Figure 4). It was used for small arms training (MACTEC, 2007).

**Rifle Grenade Range** – The footprint of the rifle grenade range overlaps the central portion of Unit 28 (Figure 4). It was identified on training maps from 1953 through 1958 and was used to fire a combination of practice, high explosive (HE), and smoke rifle-propelled grenades (MACTEC, 2007).

## 3.0 Site Work

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### 3.1 Remedial Investigation/Feasibility Study

The Track 3 RI/FS was prepared in 2007 to describe Site 39 conditions and nature and extent of MEC based on the available data, including areas overlapping Units 25 and 28 (MACTEC, 2007) (Figure 2). These areas are considered approximate and may either overestimate or underestimate the area in which MEC may be found and include the following.

- Area of “HE/Practice Mortars” completely encompasses Unit 25 and the southern portion of Unit 28 where concentrations of practice, HE, and illumination mortars were identified.
- “Mortar Alley” encompasses the majority of Unit 25 where higher density concentrations of practice, HE, and illumination mortars were identified.
- Area of “Hand Grenades” in the central portion of Unit 28 (corresponds to the approximate location of Range 36) where a live hand grenade range was located.
- Area of “Rifle Grenades” encompasses the northern portion of Unit 28. Rifle grenade ranges were located in the northeastern portion of the historical Impact Area in the 1950s and late 1960s.
- Area of “40mm projectiles” completely encompasses Unit 25 and the southern portion of Unit 28 where practice and HE 40 millimeter (mm) projectiles were authorized for use. It is expected that the greatest concentrations of 40mm MEC and munitions debris (MD) would be associated with targets.
- A large area of “75mm projectiles” completely encompasses Unit 25 and the southern portion of Unit 28.
- Area of “37mm projectiles” in the central portion of Unit 28 where 37mm projectiles were detected.
- Area of “3.5-inch practice rockets” in the southern half of Unit 28 and northern portion of Unit 25.

### **3.2 Basewide Range Assessment**

Previous investigations of the ranges that lie within or overlap Unit 25 – HAs 68 and 70 (Figure 3) – and Unit 28 – HA 36, Combat in Cities, and the Rifle Grenade Range (Figure 4) – were performed as part of the BRA program that was established to identify the locations and historical uses of former ranges at Fort Ord and to provide the framework for the range evaluation process. The CBRAR (Shaw, 2012) summarizes previously completed BRA investigations, site status determinations, and recommendations regarding sites where investigation was still planned or in progress at the time of publication. Previous evaluations of the historical ranges associated with Units 25 and 28 are briefly summarized in Sections 3.2.1 and 3.2.2.



### 3.2.1 Unit 25

**HA 68** – Site reconnaissance at HA 68 was conducted in October 2001, but was limited by dense vegetation and safety concerns associated with the potential presence of MEC. MD and small arms ammunition was discovered during the site walk. Sampling was selected for suspect areas and was evaluated for the presence of lead, antimony, copper, and explosives; however, no soil sampling was conducted within Unit 25 (Shaw, 2012).

**HA 70** – Data from an initial site visit by Harding Lawson Associates in March 1999 indicated small arms use in the area. This area was also mapped as part of site reconnaissance conducted in October 2001. Expended blank small arms casings, one signal flare (model not identified), one fin from an 81mm mortar, one illumination mortar (model not identified), one mortar projectile fuze, one 75mm projectile, one M60 igniter, one M20 anti-tank practice mine, one M21 antitank practice mine, and one 40mm practice grenade were identified during the site visit. Two fighting positions were mapped; however, no evidence of targets or range features was identified. Additional items identified during the site visit included six range-related debris items and concertina wire. Access to the site was limited mostly to roads and trails due to dense vegetation and steep terrain. No further action was recommended based on the reconnaissance. However, it was suggested that re-evaluation may be required following removal of MEC items. No sampling for metals or explosives was conducted (Shaw, 2012).

### 3.2.2 Unit 28

**HA 36** – HA 36 is located along Riso Ridge south of Eucalyptus Road, immediately adjacent to Unit 28 (Figure 4), and was used as a Fragmentation Hand Grenade Range. The primary use area is bounded on the south by a berm and on the north by a concrete blast wall. HA 36 is approximately 0.8 acre (ITSI Gilbane, 2014). Site characterization sampling was conducted in 2003 and 2006. The investigations showed 19 locations with concentrations of RDX, HMX, or TNT above screening levels. A remedial action was conducted in 2010 to remove the contaminated soil as described in the *Final Remedial Action Completion Report Site 39 Inland Ranges Habitat Reserve, Former Fort Ord, California* (Site 39 RACR; ITSI Gilbane, 2014) and summarized in Section 3.3. The CBRAR recommended “No further BRA action” subsequent to the remediation (Shaw, 2012).

**Combat in Cities** – The Combat in Cities range fan encompasses a variety of HAs (Figure 4). The Combat in Cities training area was discussed in the CBRAR only in relation to HA-75 and HA-35A (Shaw, 2012). However, the HA-75 and HA-35A do not overlap Unit 28. Therefore, the portion of the Combat in Cities range fan that overlaps Unit 28 was not included in the CBRAR evaluation. It has not been previously investigated other than MEC removal actions discussed in Section 3.4.2.2.

**Rifle Grenade Range** – Previous investigations, other than the MEC removal action discussed below, were not identified for the Rifle Grenade Range that overlaps Unit 28.

### **3.3 Previous Remedial Actions**

#### ***3.3.1 Site 39 Inland Ranges***

The Site 39 RACR describes the soil remedial action completed to address the soil contamination component of the 8,000-acre historical Impact Area (ITSI Gilbane, 2014). The area associated with Unit 28, HA 36, was discussed in the Site 39 RACR (Figure 4). A remedial action was conducted from January to March of 2010 to excavate soil to achieve compliance with requirements set forth in the Site 39 ROD Amendment (Army, 2009).

Approximately 2,620 cubic yards of soil were excavated from HA 36 from an approximate area of 0.52 acre, with an excavation depth ranging from 1 to 9.5 ft. Based on confirmation sampling, the remedial action objectives were achieved and no additional excavation was required (ITSI Gilbane, 2014).

No soil remedial actions have been conducted within Unit 25.

#### ***3.3.2 Surface MEC Removal Action***

Data from MEC removal actions were reviewed and combined with other historical data to identify former site use and indicate areas of potential lead and explosive compound contamination in soil. MEC and MD removal data such as munitions types, locations, and densities generated during removal operations were used to supplement selection of sampling locations as described in Section 6.3. A summary of MEC removal activities performed in Units 25 and 28 is presented in the following subsections.

### **3.3.2.1 Mortar Alley Time Critical Removal Action**

The time critical removal action (TCRA) at Mortar Alley was conducted in November and December 2001. The surface removal was performed without the use of geophysical equipment and no vegetation was removed. The field crews walked open areas and trails visually searching for MEC and MD. Only areas that were relatively clear of vegetation were searched. The field crews used personal digital assistants and global positioning systems to record site data, navigate the site, and record the locations of any MEC and MD observed. The surface removal operations covered approximately 50% of the 26-acre site. MEC items found and removed included 4.2-inch and 81mm HE mortars, an HE 40mm grenade, and a 75mm shrapnel projectile. MD found and removed consisted predominantly of 81mm practice mortars and several 60mm practice mortars (Parsons, 2002).

### **3.3.2.2 Removal Action in Support of the Track 3 Record of Decision**

Removal of MEC within the Impact Area MRA is performed under the *Final Record of Decision, Impact Area Munitions Response Area, Track 3 Munitions Response Site* (Army, 2008). Surface removal of MEC and MD within the Units 25 and 28 was completed in July 2016 after removal of vegetation to allow access. The Technical Memorandums detailing these removal efforts are currently being developed; however, a brief summary of the findings is provided below. [Figures 3](#) and [4](#) illustrate the locations of MEC identified and relative density of MD encountered within site grids.

#### **Unit 25 MEC/MD**

Remedial activities associated with Unit 25 have been completed as described in the *Final Site-Specific Work Plan, Munitions and Explosives of Concern, Remedial Action MRS-BLM Units 25 and 31, Former Fort Ord, California* (KEMRON, 2016c) and associated field work variances.

A total of 306 MEC items were recovered within Unit 25 including rifle grenades; 4.2-inch mortars; 37mm, 40mm, 60mm, 75mm, 81mm, and 105mm projectiles; 2.35-inch rockets; pyrotechnics. The highest concentration of items was through the southern portion of the site ([Figure 3](#)).

The concentration of MD per grid ranged from 0 pounds to more than 700 pounds.

- 56% of site grids contained between 0 and 100 pounds of MD.
- 30% contained between 101 and 200 pounds.
- 10% contained between 201 and 300 pounds.
- 4% contained greater than 300 pounds.

### **Unit 28 MEC/MD**

Remedial activities associated with Unit 28 have been completed as described in the *Final Site-Specific Work Plan, Munitions and Explosives of Concern, Remedial Action MRS-BLM Unit 28, Former Fort Ord, California* (KEMRON, 2016a) and associated field work variances.

A total of 219 MEC items were recovered within Unit 28 including hand grenades; rifle grenades; 4.2-inch mortars; 37mm, 40mm, 57mm, 60mm, 75mm, and 81mm projectiles; 2.36-inch and 3.5-inch rockets. The highest concentration of items was in the southernmost portion of the site (Figure 4).

The concentration of MD per grid ranged from 0 pounds to more than 1,400 pounds.

- 90% of site grids contained between 0 and 100 pounds of MD.
- 6% contained between 101 and 200 pounds.
- 2% contained between 201 and 300 pounds.
- 2% contained greater than 300 pounds.

## **4.0 Site Reconnaissance following MEC Removal**

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Site reconnaissance of Units 25 and 28 was performed in accordance with BRA program protocols specified in the BRAWP (Harding ESE/IT, 2001) and the Site 39 QAPP (KEMRON, 2016b) to evaluate site conditions in areas that were not previously accessible due to dense vegetation. Reconnaissance activities were completed on August 2, 2017.

The BRA evaluation of Units 25 and 28 included review of historical documentation regarding former site use, review of information regarding munitions use acquired during the MEC/MD

removal actions, and detailed site reconnaissance to identify suspect site features and areas where elevated concentrations of COCs were most likely to be found. The reconnaissance team followed a meandering path throughout the units to correlate existing data with observable site features and to identify additional indicators of potential elevated COCs such as berms, targets, soil mounds, craters, potential firing locations, bullet accumulation areas, and other suspect physical characteristics.

Resulting data was then integrated to identify suspect locations where elevated concentrations of COCs are most likely to be present and where sampling and analyses is appropriate. Conclusions regarding site conditions, proposed sample locations, and site recommendations are described in [Section 6.0](#) of this Work Plan.

No significant accumulations of bullets, bullet fragments, or other materials or physical features that typically indicate potentially elevated metals COCs were identified within Units 25 and 28 during MEC removal actions or subsequent BRA site reconnaissance. Physical features observed within Unit 25 included targets, soil mounds, craters, and a trench that may have been used as a firing point. Physical features observed within Unit 28 included targets, soil mounds, craters, and metal debris.

## **5.0 Decision Rules**

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BRA program-specific decision rules described in the BRAWP (Harding ESE/IT, 2001) for determining whether soil sampling should be performed based on site conditions observed during site reconnaissance and evaluation of site data includes the following.

- If the results of the site reconnaissance indicate the potential for COCs to be present, site investigation soil samples will be collected.
- If samples are collected and results indicate concentrations are at or below screening levels, no further investigation will be recommended.
- If samples are collected and results indicate concentrations above cleanup levels, the site will be recommended for further characterization.

The Site 39 QAPP (KEMRON, 2016b) also specifies soil sampling criteria that must be taken into consideration including:

- Sampling will focus on “worst-case” locations – that is, locations most likely to exhibit elevated concentrations of COCs – that have been determined by a combination of field reconnaissance, historical range use, and Site 39 ROD Amendment (Army, 2009) requirements.
- Seven-point incremental samples are considered sufficient to provide an initial characterization of the sample locations. The seven-point incremental samples will provide a statistically representative sample of the “worst-case” locations within the Units, or portions of Units, of Site 39 not previously investigated.
- Samples will be processed and analyzed in the laboratory as described in Section 6.4.
- If reported concentrations of lead and/or explosives exceed the Site 39 ROD Amendment (Army, 2009) criteria for any sample location, step-down samples (vertical) and step-out (horizontal) will be collected as described in Section 6.3.

## **6.0 Conclusions and Recommendations Regarding Units 25 and 28**

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Conclusions regarding former site use and current conditions are based on the following.

- Review of historical site use maps and other available documentation.
- MEC and MD removal data such as munitions types, locations, and densities generated during removal operations.
- Identification of physical site features associated with range use such as targets, suspected targets, soil mounds, impact berms, craters, bullet accumulations, firing points and other disturbed areas identified during the BRA site reconnaissance performed in 2017.

### **6.1 Conclusions Regarding Units 25 and 28**

A review of historical documentation identified the locations of ranges that lie within or overlap Unit 25 – HAs 68 and 70 (Figure 3) – and Unit 28 – HA 36, Combat in Cities, and the Rifle Grenade Range (Figure 4). Evidence of range use identified during MEC and MD surface removal activity and the subsequent site reconnaissance performed in 2017 includes the presence of suspect site features and types of MEC and MD that indicate elevated concentrations of COCs

may potentially be present and soil sampling should be performed to evaluate concentrations of potential COCs at suspect locations.

Abundant MD accumulations and evidence of munitions impact were observed throughout portions of Units 25 and 28, particularly in proximity to known former target locations. Additional target areas were also identified based on MEC removal data and observations made during BRA field reconnaissance. It is also notable that a significant lack of bullets and bullet fragments were observed within Units 25 and 28 by MEC removal technicians and BRA reconnaissance personnel, including areas within former range footprints and known target locations.

Although the associated historical range names imply former site uses that typically correspond with significant accumulations of bullets or bullet fragments as observed elsewhere at former Fort Ord ranges, that was not the case within Units 25 and 28. Although it is presumed that bullets were fired throughout several of the ranges and possibly throughout all of Units 25 and 28, no areas of significant bullet or lead fragment accumulations were identified. Based on available data and site observations, it appears that the dominant historical site uses within Units 25 and 28 were related to use of larger munitions items (e.g. grenades, artillery projectiles, and mortar projectiles).

The evaluation identified the following conditions to be considered relative to Units 25 and 28 status determination:

- No significant accumulations of bullets or bullet fragments were identified in Units 25 and 28.
- Based on available data and site observations, it appears that historical uses within Units 25 and 28 were mainly related to use of larger munitions items.
  - A total of 306 MEC items were recovered within Unit 25 including rifle grenades; 4.2-inch mortars; 37mm, 40mm, 60mm, 75mm, 81mm, and 105mm, projectiles; 2.35-inch rockets; pyrotechnics. The highest concentration of items was in the southern portion of the site ([Figure 3](#)).
  - Physical features typically associated with elevated concentrations of COCs or accumulations of materials potentially contributing to the presence of elevated

COCs such targets, soil mounds, craters, and a trench that may have been used as a firing point were identified throughout Unit 25 (Figure 3).

- A total of 219 MEC items were recovered within Unit 28 including hand grenades; rifle grenades; 4.2-inch mortars; 37mm, 40mm, 57mm, 60mm, 75mm, and 81mm projectiles; 2.36-inch and 3.5-inch rockets. The highest concentration of items was in the southernmost portion of the site (Figure 4).
- Physical features typically associated with elevated concentrations of COCs or accumulations of materials potentially contributing to the presence of elevated COCs such as targets, soil mounds, craters, and metal debris were identified throughout Unit 28 (Figure 4).

## 6.2 Recommendations for Units 25 and 28

Based on results of data evaluation and comparison of site conditions to the BRA evaluation criteria and Site 39 ROD Amendment requirements, soil sampling and analyses for lead and explosives (HMX, RDX, and TNT) is recommended in Units 25 and 28. Proposed sample locations were selected as the potential “worst-case” scenarios in accordance with BRA program criteria.

Proposed sample locations for Unit 25 are illustrated on Figure 3 and the basis for selection of each location is summarized in Table 2.

- Explosives analyses are recommended at 12 locations.
- Although no significant accumulations of bullets or bullet fragments were identified, lead analyses are recommended at 5 locations that include known former target locations and suspected firing points to provide additional data pertaining to potential elevated lead concentrations.

Proposed sample locations for Unit 28 are illustrated on Figure 4 and the basis for selection of each location is summarized in Table 3.

- Explosives analyses are recommended at 9 locations.
- Although no significant accumulations of bullets or bullet fragments were identified, lead analyses are recommended at 5 locations that include known former target locations to provide additional data pertaining to potential elevated lead concentrations.



### **6.3 Proposed Sampling**

Sampling, analyses, data validation and other applicable investigative processes to be implemented, which are summarized in subsequent sections of this work plan, will be performed in accordance with the Site 39 QAPP. Specifically, soil samples will be collected from each proposed location using the seven-point wheel pattern described in U.S. Army Cold Regions Research and Engineering Laboratory, Special Report 96-15 September 1996, *Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosives-Contaminated Sites*. Seven soil increments will be collected from an area approximately 4 feet in diameter that will be combined into a single bulk sample for later processing and analysis by the laboratory.

Field duplicate samples will be collected at a 10 percent frequency to examine field sampling procedures for errors and matrix spike/matrix spike duplicates will be collected at a frequency of 5 percent to examine laboratory accuracy. In accordance with Worksheets 11 and 17 of the Site 39 QAPP, samples will be collected at the surface, at a depth of 1 foot, and a depth of 2 feet. Only surface samples will be initially analyzed. If COCs are detected in surface samples at concentrations that exceed the thresholds specified in the Site 39 ROD Amendment (a range-wide weighted average of 225 mg/kg for lead, 5.9 mg/kg for TNT, 3.1 mg/kg RDX, and 2.7 mg/kg for HMX), then the deeper samples will be analyzed and corresponding step-out samples will be collected in the four cardinal directions (4 step-out locations) from the initial location as specified in the Site 39 QAPP (Worksheets 11 and 17) to evaluate whether the elevated COCs may be more laterally extensive or extend deeper.

### **6.4 Laboratory Analyses**

Samples submitted for explosives (HMX, RDX, and TNT) will be analyzed using Method 8330B. Samples submitted for lead will be analyzed using Method 6010C. Applicable laboratory sample processing will be performed in accordance with the protocol specified in the Site 39 QAPP (Worksheets 12, 15, 17 and 23-28). In order to obtain analytical results that accurately reflect and are representative of worst-case scenario sample locations, each incremental sample will be processed per ER-0918, *Evaluation of Sampling and Sample Preparation Modifications*

*for Soil Containing Metallic Residue* (USACE Engineer Research and Development Center, 2012). The processing has been modified for metals based upon USACE experience. Modifications for metals include drying and sieving down to 0.25 mm (60 mesh sieve). To prevent cross-contamination between samples due to lead smearing, the grinding step will be excluded. The laboratory will perform Gy's method (commonly referred to as slabcake subsampling) and increase the digestion mass to 5 grams. All fractions of the samples will be archived (sieved and unsieved) until the relative percent difference (RPD) between field duplicates can be assessed. If RPDs are problematic, the sample processing methodology will be reevaluated. Samples collected for explosives analysis using EPA Method 8330B will be processed as per that method's Appendix A. Sample aliquots will be processed together until the procedure differs between metals and explosives.

## 6.5 Reporting

The results of sampling and analyses will be presented in a report that will discuss details of the investigation, an evaluation of site conditions, and present appropriate recommendations regarding site status and subsequent additional characterization and/or remediation, if needed. Specific variations or deviations from Site 39 QAPP protocols, if any, will be described in detail within the text of the report.

## 7.0 References

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*Note: Numbers in brackets identify the corresponding Administrative Record reference ID.*

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## ***Tables***

**Table 1. BRA Summary  
Units 25 and 28 Evaluation Results and Work Plan  
Basewide Range Assessment  
Former Fort Ord, California**

<b>Unit</b>	<b>Range Number</b>	<b>Historical Area Number</b>	<b>Range Name(s)</b>	<b>BRA Recommendation<sup>1</sup></b>
28	36	36	Fragmentation Hand Grenade Range, HE Hand Grenade Range	No further BRA action
25	68	68	“Sub Mach Gun DSMTD” (or submachine gun dismounted)	No further BRA action
25	70	70	Small Arms Firing Course	Reconnaissance/sampling after MEC removal
28	Not Applicable	Not Applicable	Combat in Cities	Not Applicable
28	Not Applicable	Not Applicable	Rifle Grenade Range	Not Applicable

<sup>1</sup> Recommendations/status designations in the *Final Comprehensive Basewide Range Assessment Report* (Shaw, 2012).

**Table 2. Basis for Unit 25 Proposed Sampling Locations  
Unit 25 Evaluation Results and Work Plan  
Basewide Range Assessment  
Former Fort Ord, California**

<b>Unit</b>	<b>Proposed Location</b>	<b>Proposed Analyses*</b>	<b>Basis for Sampling</b>
25	25-1	TNT/RDX/HMX	High density of MD; proximity to multiple low explosive projectiles
25	25-2	TNT/RDX/HMX, Lead	Former target area
25	25-3	TNT/RDX/HMX, Lead	Former target area
25	25-4	TNT/RDX/HMX, Lead	High density of MD; former target area
25	25-5	TNT/RDX/HMX, Lead	High density of MD; former target area
25	25-6	TNT/RDX/HMX	Highest MD density grid
25	25-7	TNT/RDX/HMX	High density of MD; proximity to multiple craters
25	25-8	TNT/RDX/HMX	High density of MEC and MD
25	25-9	TNT/RDX/HMX	High density of MEC and MD; proximity to multiple craters
25	25-10	TNT/RDX/HMX	Proximity to multiple craters
25	25-11	TNT/RDX/HMX, Lead	High density of MD; proximity to trench that may have been used as a firing point
25	25-12	TNT/RDX/HMX	High density of MEC and MD

\* Analytical/preparatory methods 8330B for TNT/RDX/HMX and 6010C for lead as specified in the Site 39 QAPP, Appendix B, Worksheet 19.

The analytes are selected based on specifications in the Site 39 ROD Amendment.

**Table 3. Basis for Unit 28 Proposed Sampling Locations  
Unit 28 Evaluation Results and Work Plan  
Basewide Range Assessment  
Former Fort Ord, California**

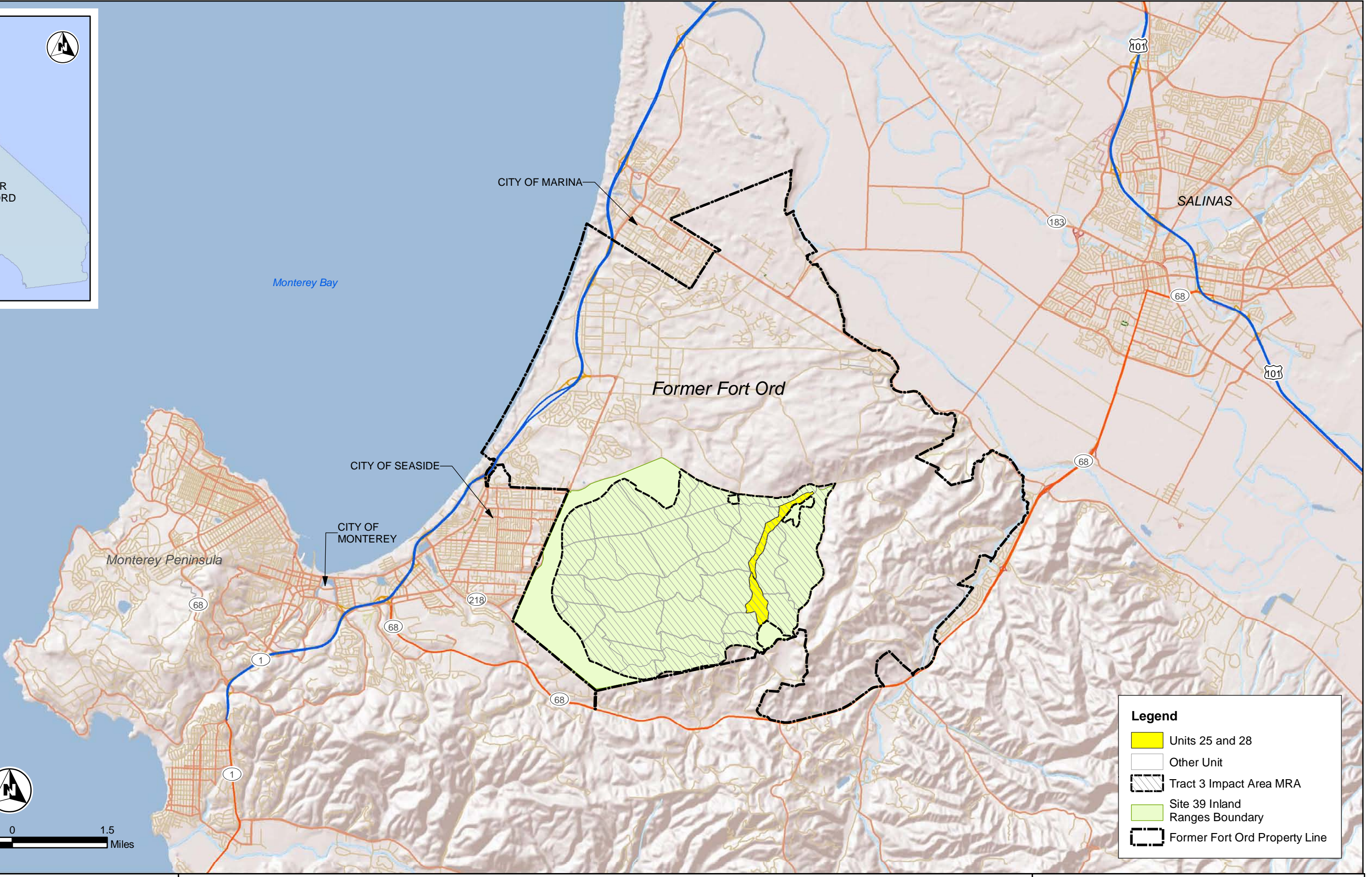
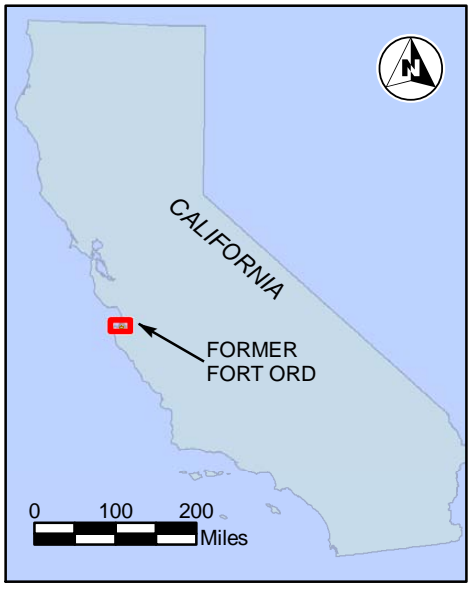
<b>Unit</b>	<b>Proposed Location</b>	<b>Proposed Analyses*</b>	<b>Basis for Sampling</b>
28	28-1	TNT/RDX/HMX	Proximity to former soil remediation area; multiple hand grenades
28	28-2	TNT/RDX/HMX	Proximity to former soil remediation area; multiple hand grenades
28	28-3	TNT/RDX/HMX, Lead	Former target area
28	28-4	TNT/RDX/HMX	Highest MD density grid
28	28-5	TNT/RDX/HMX, Lead	Former target area
28	28-6	TNT/RDX/HMX	High density of MEC and MD
28	28-7	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD
28	28-8	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD
28	28-9	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD

\* Analytical/preparatory methods 8330B for TNT/RDX/HMX and 6010C for lead as specified in the Site 39 QAPP, Appendix B, Worksheet 19.

The analytes are selected based on specifications in the Site 39 ROD Amendment.

## *Figures*

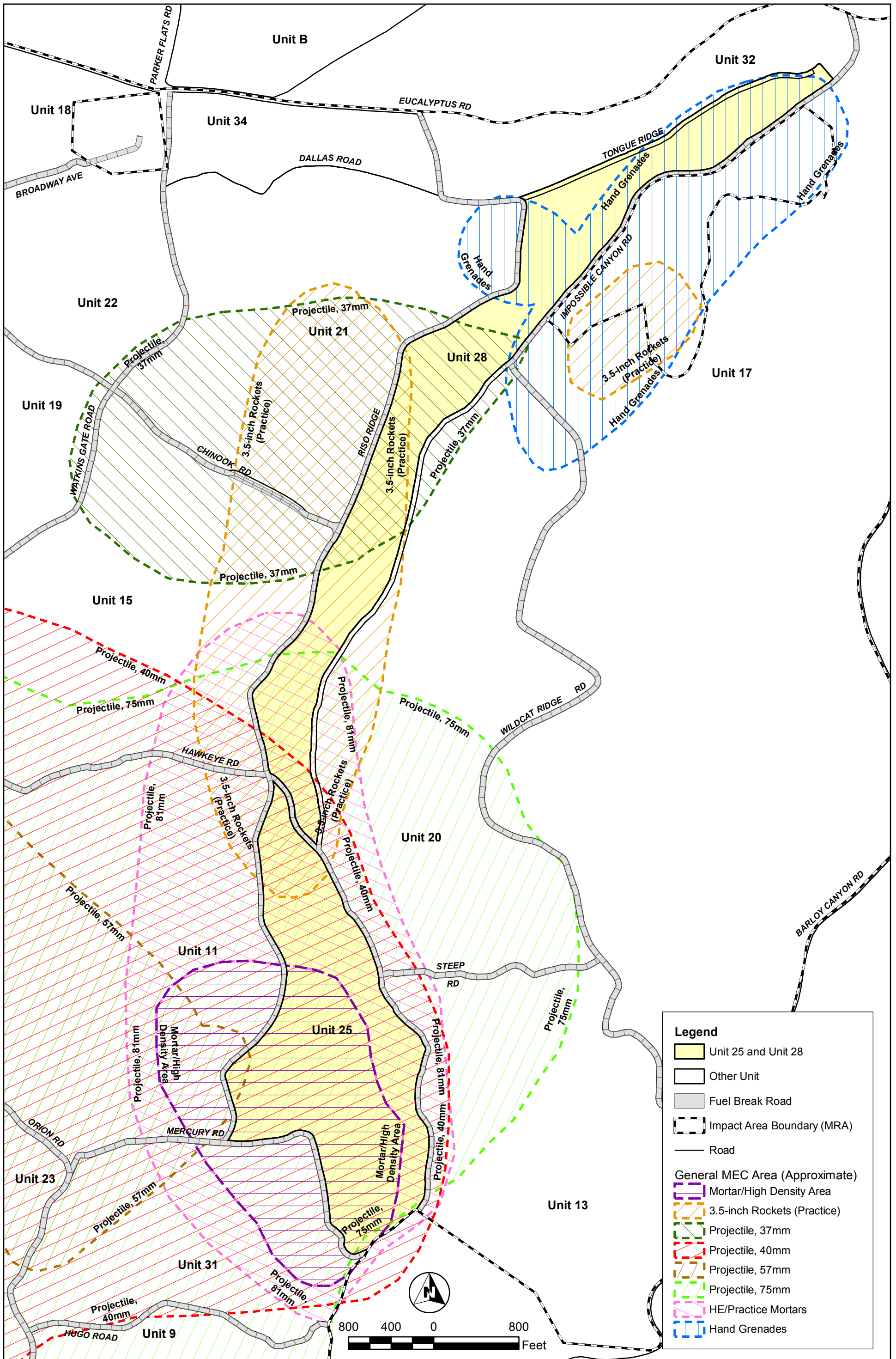




**Site Evaluation Results and Work Plan for Additional Investigation  
 Basewide Range Assessment Investigation Units 25 and 28  
 Former Fort Ord, California**

**Figure 1**  
 Location Map





**Legend**

- Unit 25 and Unit 28
- Other Unit
- Fuel Break Road
- Impact Area Boundary (MRA)
- Road

**General MEC Area (Approximate)**

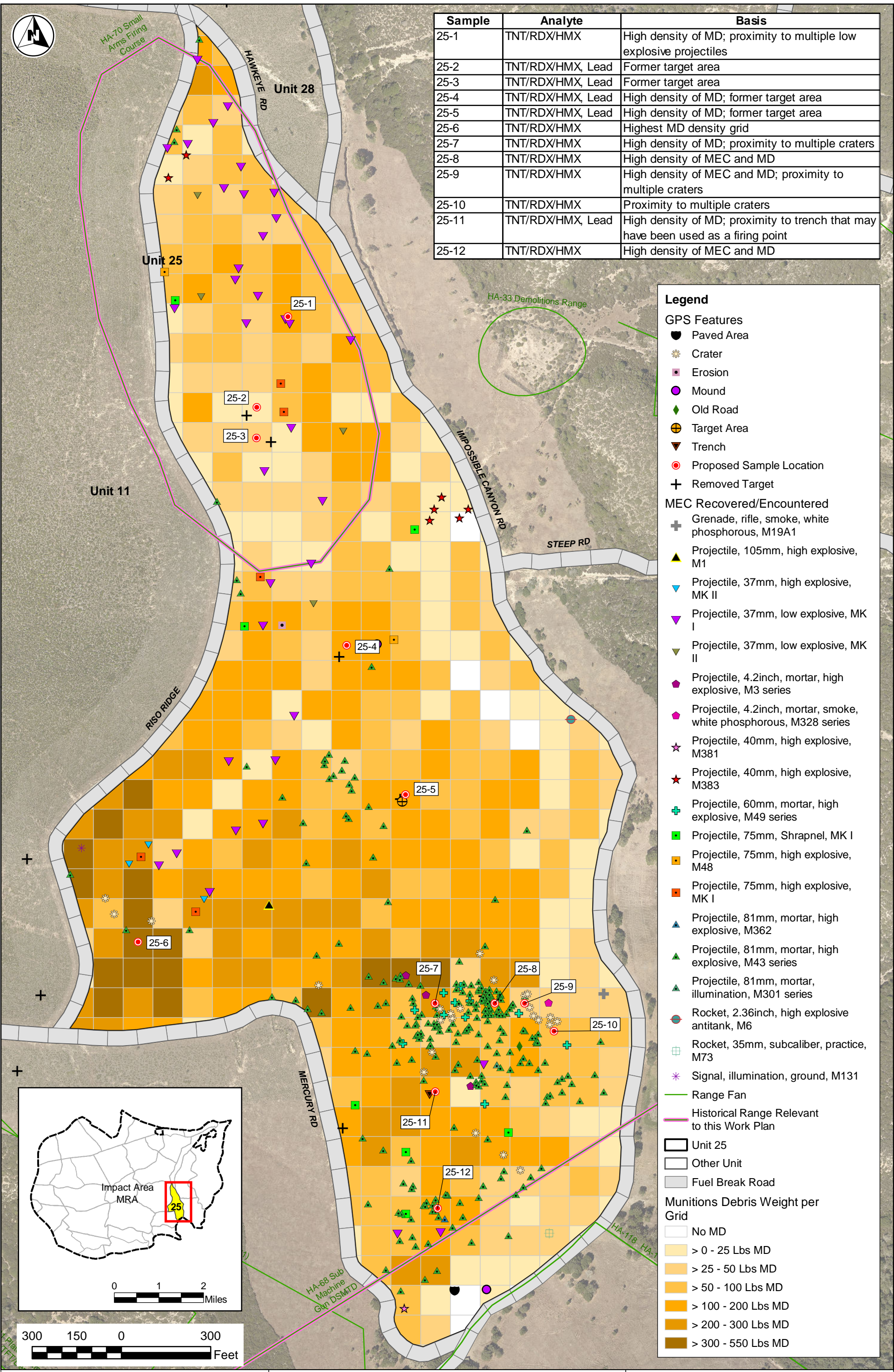
- Mortar/High Density Area
- 3.5-inch Rockets (Practice)
- Projectile, 37mm
- Projectile, 40mm
- Projectile, 57mm
- Projectile, 75mm
- HE/Practice Mortars
- Hand Grenades

**Site Evaluation Results and Work Plan for Additional Investigation Basewide Range Assessment Investigation Units 25 and 28**  
Former Fort Ord, California

**Figure 2**  
Unit 25 and Unit 28 Generalized MEC Areas



Sample	Analyte	Basis
25-1	TNT/RDX/HMX	High density of MD; proximity to multiple low explosive projectiles
25-2	TNT/RDX/HMX, Lead	Former target area
25-3	TNT/RDX/HMX, Lead	Former target area
25-4	TNT/RDX/HMX, Lead	High density of MD; former target area
25-5	TNT/RDX/HMX, Lead	High density of MD; former target area
25-6	TNT/RDX/HMX	Highest MD density grid
25-7	TNT/RDX/HMX	High density of MD; proximity to multiple craters
25-8	TNT/RDX/HMX	High density of MEC and MD
25-9	TNT/RDX/HMX	High density of MEC and MD; proximity to multiple craters
25-10	TNT/RDX/HMX	Proximity to multiple craters
25-11	TNT/RDX/HMX, Lead	High density of MD; proximity to trench that may have been used as a firing point
25-12	TNT/RDX/HMX	High density of MEC and MD



**Legend**

**GPS Features**

- Paved Area
- ☼ Crater
- Erosion
- Mound
- ◆ Old Road
- ⊕ Target Area
- ▼ Trench
- Proposed Sample Location
- ⊕ Removed Target

**MEC Recovered/Encountered**

- ⊕ Grenade, rifle, smoke, white phosphorous, M19A1
- ▲ Projectile, 105mm, high explosive, M1
- ▼ Projectile, 37mm, high explosive, MK II
- ▼ Projectile, 37mm, low explosive, MK I
- ▼ Projectile, 37mm, low explosive, MK II
- ◆ Projectile, 4.2inch, mortar, high explosive, M3 series
- ◆ Projectile, 4.2inch, mortar, smoke, white phosphorous, M328 series
- ★ Projectile, 40mm, high explosive, M381
- ★ Projectile, 40mm, high explosive, M383
- ⊕ Projectile, 60mm, mortar, high explosive, M49 series
- Projectile, 75mm, Shrapnel, MK I
- Projectile, 75mm, high explosive, M48
- Projectile, 75mm, high explosive, MK I
- ▲ Projectile, 81mm, mortar, high explosive, M362
- ▲ Projectile, 81mm, mortar, high explosive, M43 series
- ▲ Projectile, 81mm, mortar, illumination, M301 series
- Rocket, 2.36inch, high explosive antitank, M6
- ⊕ Rocket, 35mm, subcaliber, practice, M73
- ✱ Signal, illumination, ground, M131

**Range Fan**

- Range Fan
- Historical Range Relevant to this Work Plan

**Units**

- Unit 25
- Other Unit
- ▬ Fuel Break Road

**Munitions Debris Weight per Grid**

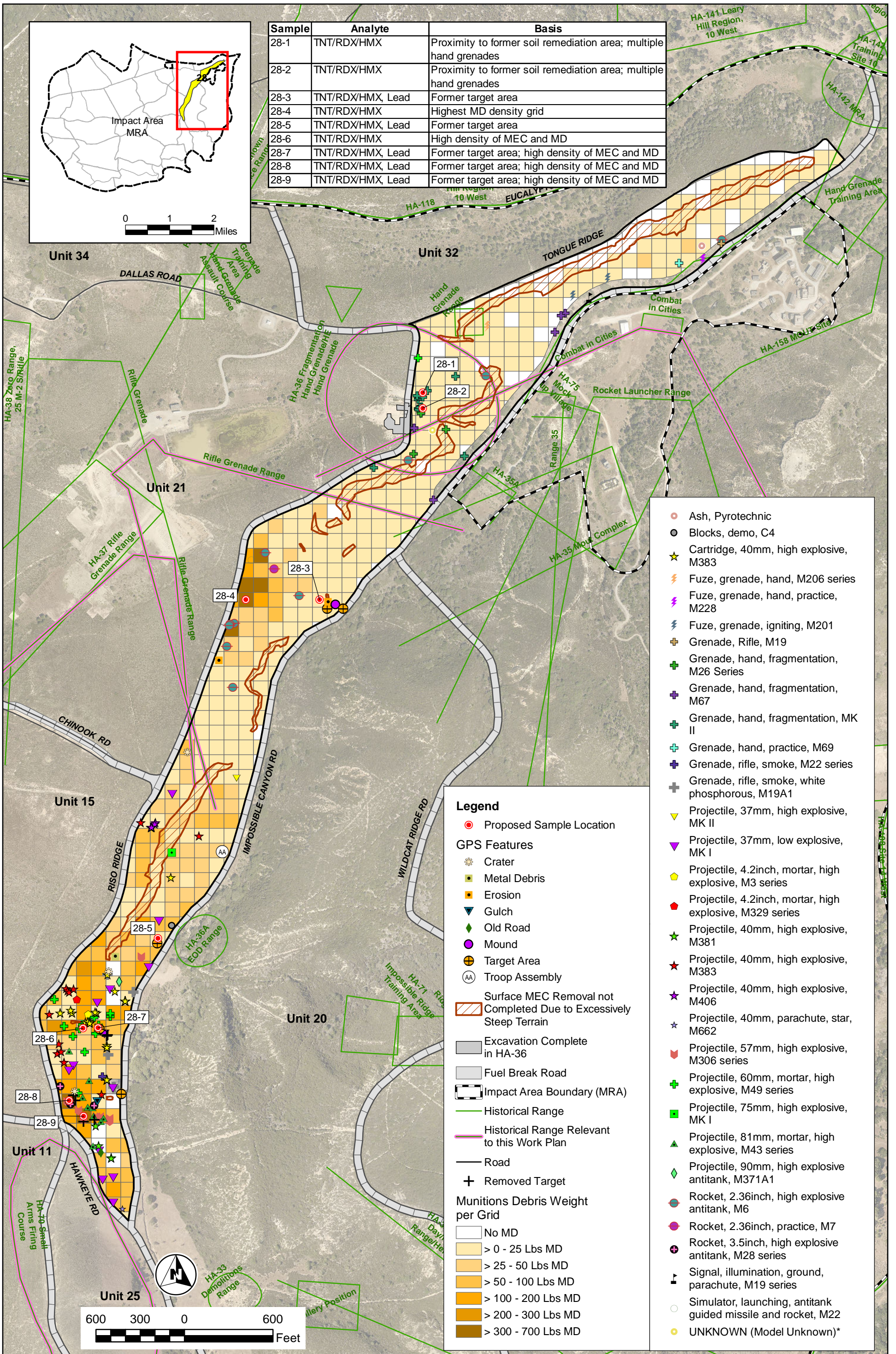
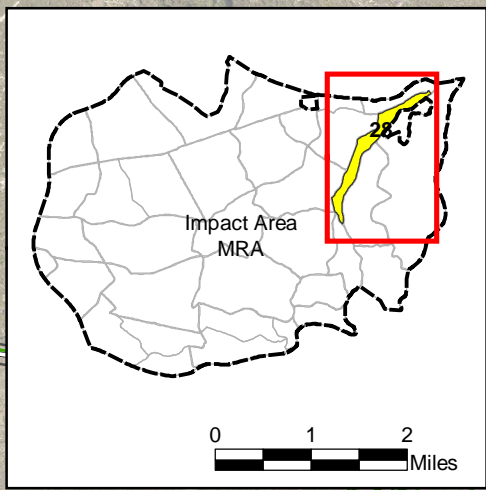
- No MD
- > 0 - 25 Lbs MD
- > 25 - 50 Lbs MD
- > 50 - 100 Lbs MD
- > 100 - 200 Lbs MD
- > 200 - 300 Lbs MD
- > 300 - 550 Lbs MD

**Site Evaluation Results and Work Plan for Additional Investigation Basewide Range Assessment Investigation Units 25 and 28**  
Former Fort Ord, California

**Figure 3**  
Unit 25 MEC/MD, Site Features, and Proposed Sample Locations



Sample	Analyte	Basis
28-1	TNT/RDX/HMX	Proximity to former soil remediation area; multiple hand grenades
28-2	TNT/RDX/HMX	Proximity to former soil remediation area; multiple hand grenades
28-3	TNT/RDX/HMX, Lead	Former target area
28-4	TNT/RDX/HMX	Highest MD density grid
28-5	TNT/RDX/HMX, Lead	Former target area
28-6	TNT/RDX/HMX	High density of MEC and MD
28-7	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD
28-8	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD
28-9	TNT/RDX/HMX, Lead	Former target area; high density of MEC and MD



**Site Evaluation Results and Work Plan for Additional Investigation**  
**Basewide Range Assessment Investigation Units 25 and 28**  
 Former Fort Ord, California

**Figure 4**  
 Unit 28 MEC/MD, Site Features, and Proposed Sample Locations

