Final
Track 3 Impact Area Munitions Response Area Munitions Response Remedial Investigation/Feasibility Study Former Fort Ord, California

Volume 2 of 2

Feasibility Study

Prepared for

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ACRONYM LIST

A

ARARs	Applicable or Relevant and Appropriate Requirements
Army	U. S. Department of the Army
ATSDR	Agency for Toxic Substances and Disease Registry

B

bgs	below ground surface
BLM	Bureau of Land Management
BO	Biological and Conference Opinion
BRA	Basewide Range Assessment
BRAC	Base Realignment and Closure
BCT	Base Realignment and Closure Cleanup Team

C

Cal/EPA	California Environmental Protection Agency
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMC	Central Maritime Chaparral
CSUMB	California State University Monterey Bay
CTT	Closed, transferring, or transferred

D

DDESB	Department of Defense Explosives Safety Board
DID	Data Item Description
DoD	Department of Defense
DOI	Department of Interior
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control

E

EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESA	Endangered Species Act

F

FFA	Federal Facility Agreement
FORA	Fort Ord Reuse Authority
FS	Feasibility Study

G

GPS	Global Positioning System

H

Harding ESE	formerly known as Harding Lawson Associates (HLA)
HCP	Habitat Conservation Plan
HLA	Harding Lawson Associates
HMP	Habitat Management Plan
HTW	Hazardous Toxic Waste

L

LTM	Long-term management
LUCI	Land Use Control Implementation
LUCI RD/RAWP	Land Use Control Implementation Remedial Design/Remedial Action Work Plan

M

MACTEC	MACTEC Engineering and Consulting, Inc. (formerly Harding ESE)
MEC	Munitions and Explosives of Concern
MOCO	Monterey County
MOUT	Military Operations in Urban Terrain
MPC	Monterey Peninsula College
MR	Munitions Response
MRA	Munitions Response Area
MRS	Munitions Response Site

N

NCP	National Contingency Plan
NPV	net present value

O

ODDS	Ordnance Detection and Discrimination Study
OE	Ordnance and Explosives
OMB	Office of Management and Budget
OSWER	Office of Solid Waste & Emergency Response

P

Parsons	Parsons Infrastructure & Technology Group Inc.

Q

QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QC/QA	Quality Control/Quality Assurance

R

RA	Risk Assessment
RAWP	Remedial Action Work Plan
RAO	Remedial Action Objectives
RD	Remedial Design

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision

S

SOPs	Standard Operating Procedure(s)
SOW	Scope of Work

T

TBCs	To Be Considered Requirement(s)
TRC	Technical Review Committee

U

USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Department of the Interior, Fish and Wildlife Service
UXO	Unexploded Ordnance

1.0 INTRODUCTION

This volume of the Track 3 Impact Area Munitions Response Area (MRA), Munitions Response Remedial Investigation/Feasibility Study (RI/FS; Track 3 Impact Area MRA RI/FS) report presents the Feasibility Study that identifies and selects a preferred remedial alternative to address Munitions and Explosives of Concern (MEC) risks at the portion of the Impact Area MRA that is currently designated for transfer to Bureau of Land Management (BLM) as Habitat Reserve in the *Installation-Wide Multispecies Habitat Management Plan* (HMP; *USACE, 1997*) and additional requirements (*USACE, 2005; USFWS, 1999, 2002, 2005; BLM, Army; 2004; Zander, 2002; 2007*) (Plates 1 and 2; RI, Volume I). Track 3 Sites are those areas where (1) MEC are suspected or known to exist, but investigations are not yet complete or need to be initiated, or (2) any suspected or known areas identified in the future. The Impact Area MRA qualifies as a Track 3 site because MEC exist and actions have not been completed. The results of this Feasibility Study will be used to support the Track 3 Impact Area MRA RI/FS Proposed Plan and Record of Decision (ROD) that will document the results of the Remedial Investigation and Risk Assessment (RI and RA; Volume I) and this Feasibility Study (FS; Volume II). This Final report was revised based on comments received on the draft final report. The comments and associated responses are provided in Appendix F of the RI (Volume I).

1.1 Purpose and Objectives

The purpose of this FS is to develop and select remedial alternatives to address potential MEC risks at the Track 3 Impact Area Munitions Response Area (Impact Area MRA). As described in the RI (Volume I; Section 1.1), the MR RI/FS only addresses the physical or explosive risk from MEC to humans. Based on many years of site experience, the presence of MEC in the Impact Area MRA does not appear to be a concern in terms of physical risks to ecological receptors. Several iterations of biological resource evaluations and many years of monitoring show that the ecological environment in the Impact Area MRA is healthy and thriving. The U.S. Department of the Interior, Fish and Wildlife Service (USFWS) has designated the entire Impact Area MRA as critical habitat necessary for the continued existence of Monterey spineflower, a federally threatened annual plant. Potential human health and ecological risks related to any soil contamination from small arms and military munitions ranges are being addressed under the Basewide Range Assessment (*Shaw/MACTEC, 2006*) and the Site 39 Feasibility Study Addendum (*MACTEC, 2007*). The objectives of this FS are to describe the process used to develop, evaluate, compare and select a preferred alternative that will meet the Remedial Action Objectives (RAOs) based on the results of the RI and RA (Volume I) for this area as shown on Figure 1.

1.2 Report Organization

This FS report is organized as follows:

Section 1.0: Introduction—Describes the purpose and objectives of the Impact Area MRA FS process and report organization.

Section 2.0: Remedial Approach—Defines the Impact Area MRA for which remedial alternatives will be developed in the FS, and describes the RAOs; the application of risk assessment results; potential Applicable or Relevant and Appropriate Requirements (ARARs); land use control guidelines that will be applied in the development of remedial alternatives; and ongoing and future MEC-related activities at the former Fort Ord that are components of the Army's basewide efforts under the Army's Munitions

Response (MR) Site Security Program to promote MEC safety because of Fort Ord's history as a military base.

Section 3.0: Identification of Applicable Response Actions—Identifies the range of applicable response actions for MEC risk management at the Impact Area MRA that include no further action; land use controls; and MEC remediation.

Section 4.0: Development of Remedial Alternatives—Describes the Long Term Management Measures specific to implementation and management of the remedial alternatives selected for the Impact Area MRA; identifies the response action components considered in the development of remedial alternatives as shown on Figure 1; describes the four potential remedial alternatives developed for the Impact Area MRA; and identifies potential ARARs associated with their implementation.

Section 5.0: Evaluation and Comparison of Remedial Alternatives—Presents the nine Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) evaluation criteria specified in the U.S. Environmental Protection Agency's (EPA's) RI/FS Guidance (*EPA, 1989*), and the evaluation and comparison of the four remedial alternatives developed for the Impact Area MRA.

Section 6.0: Selection of Preferred Remedial Alternative—Identifies the preferred remedial alternative for the Impact Area MRA based on the evaluation and comparison of alternatives, and provides the rationale for its selection.

Section 7.0: Approval Process—Describes the approval process for documenting the preferred alternative for implementation at the Impact Area MRA in the RI/FS Proposed Plan and ROD.

Section 8.0: References—Provides a list of references to pertinent documents cited in this report.

2.0 REMEDIAL APPROACH

This section describes the general remedial approach applied at the Impact Area MRA, including (1) how the results of the RI and RA are used to define the area for which remedial alternatives are developed; (2) the RAOs, potential ARARs, and land use control guidelines that will be considered in the development and analysis of remedial alternatives; and (3) Long Term Management Measures that will be applied to implement and manage the remedial alternatives selected for the Impact Area MRA.

The RI/FS process as outlined in the EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (*EPA, 1989*) (EPA's RI/FS Guidance) represents the methodology that the Superfund program has established for characterizing the nature and extent of risk posed by contaminated sites and for evaluating potential remedial options. This FS was prepared based on the process outlined in the Guidance; however, it was adapted to fit the unique circumstances of the Impact Area MRA as described below.

Remedial Investigation

The general premise of the RI process is that contamination exists at a site for which an initial investigation is required to define the nature and extent of the contamination. For the Impact Area MRA being evaluated in this RI/FS, however, MEC is known to be present as described in the RI and defined under Track 3, but the majority of the area is inaccessible for MEC investigations due to the presence of dense vegetation that prevents the safe operation of MEC investigation or removal equipment. Therefore, the purpose of the RI in this case was to evaluate the available data from MEC investigations and removal actions already conducted in the Impact Area MRA, and verify adequate MEC-related data was available to perform the subsequent RA and FS. The RI determined adequate MEC-related data was available to perform the subsequent RA and FS for the Impact Area MRA.

Risk Assessment

The general premise of the RA process is that contamination exists at a site at concentrations that can be compared to risk-based levels considered protective of human health and the environment. In order to quantify potentially remaining risks, protective risk-based levels are typically translated into site-wide cleanup levels. A range of remedial alternatives are then developed and compared in the FS based on their ability to achieve the site-wide cleanup levels and other RAOs. For the Impact Area MRA being evaluated in this RI/FS, site-wide cleanup levels cannot be developed to quantify potentially remaining MEC risks. In this case, a unique Fort Ord Ordnance and Explosives Risk Assessment Protocol (protocol; *Malcolm Pirnie, 2002*) was developed to estimate potential MEC risks (Overall MEC Risk Scores) for each receptor expected to be present at Munitions Response Sites or Areas (MRSs or MRAs) at the former Fort Ord. This protocol was applied to the Impact Area MRA as described in the RA (Section 4.0; Volume I), and potential MEC risks both prior to (Baseline MEC Risks) and during reuse (After Action MEC Risks) of the Impact Area MRA were estimated for different receptor groups (e.g., surface reusers such as visitors or habitat monitors, and those reusers that would be expected to intrude below ground surface such as construction workers and habitat workers) expected to be present based on hypothetical assumptions presented in the RI and RA. After remedial actions have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, and will be considered in verifying the appropriateness of Land Use Controls selected for implementation.

As described in the RI (Volume I; Section 1.1), the MR RI/FS only addresses the physical or explosive risk from MEC. Potential human health and ecological risks related to any soil contamination from small arms and military munitions ranges are being addressed under the Basewide Range Assessment (*Shaw/MACTEC, 2006*) and the Site 39 Feasibility Study Addendum (*MACTEC, 2007*).

Feasibility Study

The general premise of the FS process is that a range of remedial alternatives can be developed, evaluated, and compared based on their ability to achieve site-wide cleanup levels and other RAOs. For the Impact Area MRA being evaluated in this RI/FS, potential After Action MEC Risks were estimated in the RA for each of a range of site-specific reuse receptors, rather than on a site-wide basis. Therefore, the remedial alternatives evaluated in this FS were developed to provide overlapping management of potentially remaining MEC risks for the range of reuse receptors anticipated to be present at the Impact Area MRA after MEC remedial actions are implemented.

2.1 Definition of Impact Area MRA

The Impact Area MRA addressed in this FS is the portion of the Impact Area that is currently designated for transfer to Bureau of Land Management (BLM) as Habitat Reserve in the *Installation-Wide Multispecies Habitat Management Plan* (HMP; *USACE, 1997*) and additional requirements (*USACE, 2005; USFWS, 1999, 2002, 2005; BLM, Army; 2004; Zander, 2002; 2007*), including the Eucalyptus Fire Area and the Watkins Gate Burn Area (Plate 2). Range 30A and a portion of Ranges 43 through 48 are included within the boundaries of the Impact Area MRA (Plate 2). These ranges were previously identified for Interim Action in the Interim Action Record of Decision (*Army, 2002*). Because these sites are part of the Impact Area MRA they are being re-evaluated as part of this RI/FS, and decisions made as part of this evaluation will act as the final remedial decisions for these ranges.

This Final report was revised based on comments received on the draft final report. The comments and associated responses are provided in Appendix F to the RI (Volume I). This RI/FS addresses only the physical hazards to humans from MEC. The chemical hazards are being addressed under the Basewide Range Assessment (BRA) (*Shaw/MACTEC, 2006*) and Site 39 Ranges Feasibility Study (*MACTEC, 2007*).

The Impact Area MRA is located in the southwestern portion of the former Fort Ord, and covers approximately 6,560 acres of the 8,000 acre historical Impact Area that is currently designated for transfer to BLM as Habitat Reserve. The Impact Area MRA is within the former Fort Ord Impact Area and was previously the location of the Fort Ord Range Complex, which was used for live fire training exercises with a variety of weapons. The Impact Area MRA includes all of MRS-BLM, and a portion of MRS-Ranges 43 through 48. The Eucalyptus Fire Area (367 acres) and Watkins Gate Burn Area (1,005 acres) are parts of MRS-BLM.

Areas of the historical Impact Area that are identified for development include MRS-15 SEA 01 through 04; MRS-15 DRO 01, DRO 01A, DRO 02, and DRO 02A; MRS-15 MOCO 01 and 02; MRS-46; MRS-47; the Monterey Peninsula College (MPC) designated portions of MRS-Ranges 43 though 48 including a small development portion and area designated as Habitat Reserve; BLM Headquarters (MRS-35) including Parcel F1.12; and the Military Operations Urban Terrain (MOUT) (MRS-28). These areas are not evaluated in this RI/FS.

As described in the RI, the Impact Area MRA is entirely within the natural resources management area described in the HMP as "habitat reserve" areas. The HMP was prepared in accordance with the U.S. Fish and Wildlife Service (USFWS) Biological Opinions (*USFWS, 1993, 1997a, b*). Changes to the HMP have also been documented since it was published, including additional Biological Opinions (*USFWS, 1999, 2002, 2005*), an Assessment (*Zander, 2002*), a Memorandum of Understanding (*BLM, Army, 2004*), a *Revised Attachment A Habitat Management Plan Map* (*USACE, 2005*), and additional requirements anticipated during reuse described in the *Draft Installation-Wide Multispecies Habitat Conservation Plan for Former Fort Ord, California* (HCP; *Zander, 2007*). The HMP and these additional requirements establish the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival, and describe land use, conservation, management, and habitat monitoring requirements for target species within habitat reserve areas that comprise the Impact Area MRA, as well as development areas. Habitat management in the Impact Area MRA is essential to the protection and management of habitat reserve species, and is vital to the reuse of the former Fort Ord because it balances the species losses in other areas of the former Fort Ord that are designated for development.

Plate 5 shows the Fort Ord plant communities that are present within the Track 3 Impact Area MRA. The dominant community is the central maritime chaparral that covers about 6,066 acres of the Impact Area MRA. Other communities include the inland coast woodland community that comprises about 199 acres of the site, the grassland community (about 256 acres), and the wetland community that comprises about 24 acres of the site. A small portion of the site has been developed. Listed species present in the Impact Area MRA include the California tiger salamander (*Ambystoma californiense*), sand gilia (*Gilia tenuiflora* ssp. *arenaria*), California goldfields (*Lasthenia conjugens*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), and Seaside bird's beak (*Cordylanthus rigidus* var. *litteralis*) including critical habitat designated for Monterey spineflower.

Among the more than 260 vertebrates known to occur or potentially occur at the former Fort Ord some are considered special-status species, as documented in the Fort Ord *Draft Basewide Biological Inventory, Fort Ord, California*, dated December 8, 1992. These wildlife species, in addition to plant species and native biological communities, are collectively called special status natural resources. They receive various levels of protection under local, state, or federal laws, regulations, and codes. The closure and disposal of former Fort Ord is considered a major federal action that could affect several species of concern and other rare species listed by the California Department of Fish and Game and/or the California Native Plant Society or listed as threatened or endangered under the federal Endangered Species Act (ESA). The U.S. Department of the Interior, Fish and Wildlife Service (USFWS) final Biological Opinion for the Disposal and Reuse of Fort Ord (*USFWS, 1993*) required that a HMP be developed and implemented to reduce the incidental take of listed species and loss of habitat that supports these species.

Other subsequent biological opinions (*USFWS, 1999, 2002, 2005)* addressed reasonable and prudent measures to mitigate impacts to listed species and critical habitat for species such as the California tiger salamander, California goldfields, and Monterey spineflower. The HMP, the Biological Opinions mentioned above, as well as an Assessment (*Zander, 2002*), a Memorandum of Understanding (*BLM/Army, 2004*), and a *Revised Attachment A Habitat Management Plan Map* (*USACE, 2005*) establish the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival.

Within the Impact Area MRA, fuel breaks, access roads, and trails have been cleared of vegetation and/or MEC over time, with varying degrees of vegetation regrowth, ground surface accessibility, and extent of MEC removal (Plate 2). These fuel breaks and roads are essential to habitat reserve management and maintenance activities and accessibility for fire fighting activities. In addition, site security measures are

in place to limit access to the Impact Area MRA, including maintenance of existing 4-strand barbed wire perimeter fence with signs, and periodic safety patrols of the perimeter.

The currently identified future recipient of the Impact Area MRA property is BLM. A habitat conservation plan (HCP) for the former Fort Ord is being developed in coordination with BLM, the Fort Ord Reuse Authority (FORA), and other property recipients. The *Draft Installation-Wide Multispecies Habitat Conservation Plan* (Draft HCP; *Zander, 2007*) currently identifies the following reuse activities anticipated to occur within the Impact Area MRA:

- Route, road, and trail management and maintenance;
- Habitat enhancement;
- Fuel Break construction and management;
- Use of administrative areas;
- Habitat monitoring;
- Educational programs;
- Species specific monitors and habitat enhancement; and
- Recreational access on established routes.

2.2 Definition of Remedial Action Objectives

The primary remedial action objectives (RAOs) for the Impact Area MRA consistent with EPA's RI/FS Guidance (*EPA, 1989*) are to achieve the EPA's threshold criteria of "Overall Protection of Human Health and the Environment" and "Compliance with ARARs". These RAOs include supporting the reuse of the Impact Area MRA as a habitat reserve in compliance with guidelines and requirements for habitat reserve management and monitoring set forth in the HMP, Biological Opinions, and additional documents discussed above (*USACE, 1997, 2005; USFWS, 1999, 2002, 2005*; *BLM, Army, 2004; Zander, 2002; 2007*).

As described in EPA's *Land Use in the CERCLA Remedy Selection Process* (*EPA, 2000b*), "Remedial action objectives provide the foundation upon which remedial cleanup alternatives are developed. In general, remedial action objectives should be developed in order to develop alternatives that would achieve cleanup levels associated with the reasonably anticipated future land use over as much of the site as possible. EPA's remedy selection expectations described in section 300.43.0 (a) (l) (iii) of the National Contingency Plan (NCP) should also be considered when developing remedial action objectives. Where practicable, EPA expects to treat principal threats, to use engineering controls such as containment for low-level threats, to use institutional controls to supplement engineering controls…."

In keeping with EPA's expectations above, based on the planned reuse of the Impact Area MRA as habitat reserve as described in the RI (Volume I), the Army intends to (1) treat the principal threats at the Impact Area MRA (i.e., conduct MEC remedial actions), and (2) consider institutional controls (herein referred to as Land Use Controls) in the development of remedial alternatives for managing any potentially remaining MEC risks after treatment of principal threats.

These RAOs will be achieved through development of alternatives for the Impact Area MRA that (1) apply the results of the risk assessment to guide selection of risk management measures to mitigate potentially remaining MEC risks, and (2) comply with ARARs and other guidelines. A discussion of these components and their consideration in the development of remedial alternatives for the Impact Area MRA is presented below.

2.2.1 Application of Risk Assessment Results

As part of the basewide MR RI/FS process for the former Fort Ord, the Army is required to conduct a MEC risk assessment as part of the RI/FS process for munitions response sites (MRSs) at the former Fort Ord. According to CERCLA, the results of the risk assessment should help establish acceptable remediation goals (e.g., cleanup levels) for use in developing remedial alternatives during the FS. Section 4.0 of the RI (Volume I) presents the results of the MEC risk assessment that addresses the explosive hazards associated with MEC in the Impact Area MRA. It also provides a summary of the status of the assessment of chemical risks to human health and the environment. The risks associated with chemical hazards to human health and the environment are being addressed under the Basewide Range Assessment (BRA) program (*Shaw/MACTEC, 2006*) and Site 39 Ranges Feasibility Study (*MACTEC, 2007*), which are components of the Hazardous Toxic Waste (HTW) RI/FS program, separate from the Munitions Response RI/FS program. The explosive risks to plants and animals were not addressed in the Fort Ord Ordnance and Explosives Risk Assessment Protocol. The Army has been evaluating and managing the habitat at the former Fort Ord, as well as investigation and cleaning up MEC, since the base was listed for closure in the early 1990s. Based on many years of site experience, the presence of MEC in the Impact Area MRA does not appear to be a concern in terms of physical risks to ecological receptors. Several iterations of biological resource evaluations and many years of habitat monitoring show that the ecological environment is healthy and thriving. The site was used as a multi-range impact area for over 80 years, yet it still supports high diversity of plants and animals, including species considered rare, threatened and endangered. Based on Base Realignment and Closure Cleanup Team (BCT) concurrence, the explosive risks to plants and animals were not specifically addressed in the Track 3 RI/FS. The potential risks to the environment from explosive hazards associated with MEC in the Impact Area MRA will be addressed through compliance with ARARs and measures described above and in Section 3.0 that are considered protective of biological resources.

The MEC risk assessments for Fort Ord provide a qualitative description of the potential risks of a receptor encountering a MEC item. Because the nature of these types of risk assessments is largely qualitative, a specific protocol was developed to evaluate potential current and future MEC risks at Fort Ord. The Fort Ord Ordnance and Explosives Risk Assessment Protocol (protocol) (*Malcolm Pirnie, 2002*) was developed through the combined effort of the Army, Department of Toxic Substances Control (DTSC), and EPA, and allows for a comparative review of potential MEC risks at impacted sites. Unlike typical risk assessments that evaluate potential exposures to hazardous substances in environmental media, the protocol does not calculate a numerical probability of adverse effects or a hazard index. Rather, it relies on an *a priori* assumption that any encounter with MEC will result in an adverse effect, and provides a qualitative description of the risk based on the likelihood of encountering a MEC item combined with the potential of the item to cause a serious injury if detonated. Unlike standard risk assessments for evaluating hazardous substances, the protocol does not provide input into the development of cleanup levels or remedial objectives. Rather, these qualitative overall MEC Risk Scores are used in this FS to guide the comparative evaluation of various remedial alternatives as described in Section 5.0.

The output of the risk assessment consists of an overall MEC Risk Score designated by the letters A through E, with A representing the lowest risk and E representing the highest risk, for each potential receptor as follows:

Overall MEC Risk Score	A	B	C	D	E
	Lowest	Low	Medium	High	Highest

The proposed reuses for the Impact Area MRA are discussed in the RI (Volume I, Section 2.2.3.3), and include native habitat for ecological species, and non-motorized recreational uses (hiking, biking, and equestrian). Receptors expected to be associated with the planned reuses have been divided into five main groups (described in Section 4.0 and summarized on Table 4.1 of the RI; Volume I) which include (1) trespassers, (2) surface only receptors, (3) shallow intruding receptors, (4) deeper intruding receptors, and (5) construction workers. A description of each receptor evaluated in the Impact Area MRA risk assessment, and the associated activities and exposure assumptions is presented in Table 4.1 of the RI (Volume I).

For the Impact Area MRA Risk Assessment (RA; Section 4.0, Volume I), both "Baseline" (prior to MEC removal) and "After Action" (after MEC removal) reuse conditions were evaluated. Overall potential MEC Risk Scores were developed for the MRA for the baseline scenarios and after-action reuse scenarios and multiple anticipated "receptors" assumed to be present at the MRA.

The RA for the Impact Area MRA assumed two different MEC removal actions could be implemented to address potential MEC risks: (1) a technology-aided surface MEC removal (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible), and (2) a subsurface MEC removal (to depths at which MEC is found). In general, the results of the RA indicated MEC removal actions would decrease the overall MEC risks for the majority of the receptors evaluated to varying degrees depending on (a) the type of removal action implemented (i.e., surface versus subsurface MEC removals), and (b) whether the receptor was assumed to intrude below ground surface (bgs), and to what depth (e.g., surface only, to a depth of 1 foot bgs, deeper than 1 foot bgs). The following conclusions can be made based on the results of the risk assessment (Section 4.0; Volume I):

- The potential Baseline MEC Risks for all receptors are highest risk (E). This score is based on the types and densities of MEC removed during the MRS-Ranges 43 through 48 Interim Action. The use of this data is considered conservative because it is expected that areas between range fans throughout the Impact Area MRA will have lower MEC densities than were present within MRS-Ranges 43 through 48.

- The potential After Action MEC Risks associated with a technology-aided surface MEC removal (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible) are highest risk (E) for all intruding receptors and a medium risk (C) for surface only receptors. It was assumed that all MEC encountered on the surface would be removed.

- The potential After Action MEC Risks associated with a subsurface MEC removal for all receptors intruding below 1 foot remain highest risk (E). For shallow intruding receptors (those intruding less than 1 foot) and surface only receptors, the risk is lowest (A). It was assumed that all MEC encountered and detected on the surface and below ground surface would be removed. However, based on the potential limitations of the detection equipment and procedures, it would not be possible to verify that all MEC items were removed to all depths. Therefore, for the subsurface MEC removal scenario, the risk assessment assumed nearly all items would be removed in the top 1 foot below ground surface, and some MEC would remain below a depth of 1 foot below ground surface.

Based on the risk assessment, it is anticipated that unrestricted use that would allow unrestricted intrusive activities will be unacceptable after conducting either surface or subsurface MEC removals. Note that a potential residential receptor that could be expected to have intrusive activities as deep as 4 to 5 feet would have similar risk scores as a construction worker (potential After Action MEC Risk is E). Therefore, an unrestricted land use, typically represented by a residential exposure scenario by the regulatory agencies, would be prohibited. Appropriate land use controls would be necessary for proper management of any potential residual MEC risks. As described in Section 2.2, the objective of the remedial alternatives evaluation presented in this FS is to support the reuse of the Impact Area MRA as a habitat reserve. The HMP and additional requirements designate the entirety of the Impact Area MRA as a Natural Resource Management Area, and the Fort Ord Reuse Plan (as updated) designates the entirety of the Impact Area MRA as a Habitat Reserve.

Although surface and subsurface MEC removals would result in eliminating many MEC items from the site and reducing the possibility of future exposures, it would not be possible to verify all MEC items were removed to all depths. Therefore, a possibility would remain that an intruding receptor could encounter a MEC item. The results of the risk assessment indicate that potential After Action MEC Risk scores would remain in the high range for those receptors conducting intrusive activities. Therefore, land use controls will be evaluated as part of remedial alternatives to support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management). These land use controls will allow for proper management of the habitat reserve as described in the HMP and additional requirements.

As described in the EPA's guidance *Handbook on the Management of Ordnance and Explosives at Closed, Transferring, and Transferred Ranges and Other Sites* (*EPA, 2002*), if MEC is potentially present at a site or area, and in this case, potential MEC risks are estimated as requiring a response action, the response action may include: (1) institutional controls; (2) MEC-related monitoring; (3) containment of MEC (i.e., physical barriers); or (4) MEC removal or treatment. The following sections describe potential ARARs and other guidance considered in the development and evaluation of remedial alternatives for the potential response actions to address the presence of MEC and associated potential MEC risks estimated in the RA for the Impact Area MRA.

2.2.2 Potential Applicable or Relevant and Appropriate Requirements (ARARs)

This section presents a general description and analysis of ARARs. Potential federal and state ARARs that may be pertinent to implementation of the remedial alternatives developed and retained for analysis for the Impact Area MRA are presented in Table 1. For each of the remedial alternatives described in Section 4.0, their compliance with ARARs are evaluated and compared in Section 5.0.

Section 121 of CERCLA requires that site cleanups comply with federal and state laws that are "applicable or relevant and appropriate requirements" (ARARs). Under CERCLA Section 121(d)(2), the

federal ARARs for a remedial action could include requirements under any of the federal environmental laws. State ARARs include promulgated requirements under state environmental or facility siting laws that are more stringent than federal ARARs, and that have been identified in a timely manner, pursuant to 40 Code of Federal Regulations (CFR) Part 300.400(g)(4). A requirement may be either "applicable" or "relevant and appropriate".

2.2.2.1 Types of ARARs

In general, ARARs that govern actions at CERCLA sites fall into three broad categories based upon the chemical contamination present, site characteristics, and alternatives proposed for cleanup (*EPA, 1993*). These three categories (chemical-specific, location-specific, and action-specific) and additional "To-Be-Considered" requirements are described below.

Chemical-Specific ARARs

Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials with certain chemical or physical characteristics or that contain specified chemical compounds. These requirements generally set health or risk-based concentration limits or discharge limits for specific hazardous substances by media. Chemical-specific ARARs are triggered by the specific chemical contaminants found at a particular site. Examples of potential chemical-specific ARARs are effluent limitations, emission limitations, drinking water standards, and hazardous waste characteristics identified for specific chemicals and compounds. A more stringent standard, requirement, criterion, or limitation promulgated pursuant to a state environmental statute and identified in a timely manner is also a potential ARAR.

Location-Specific ARARs

Location-specific ARARs govern activities in certain environmentally sensitive areas. These requirements are triggered by the particular location and the proposed activity at the site. An example of a location-specific ARAR is compliance with the Endangered Species Act of 1973, as amended, to avoid sensitive ecosystems or habitats. Location-specific ARARs also focus on wetland or floodplain protection areas, or archaeologically significant areas.

Action-Specific ARARs

Action-specific ARARs are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities. An example might be a state Air Quality Management Authority that sets limitations on fugitive dust generated during grading and excavation activities during remedial actions.

To Be Considered Requirements (TBCs) and Policies

To Be Considered Requirements (TBCs) and other policies, the final class of requirements considered by EPA during the development of ARARs, are non-promulgated advisories, policies, or guidance documents issued by federal or state governments. They do not have the status of ARARs, and are not legally binding, but may be considered in determining the necessary cleanup levels or actions to protect human health and the environment.

2.2.2.2 Definition of ARARs

"Applicable" requirements are defined as those cleanup or control standards, or other substantive environmental protection requirements, criteria, or limitations, promulgated under federal or state laws. Applicable requirements are identified on a site-specific basis by determination of whether the jurisdictional prerequisite of a requirement fully addresses the circumstances at the site or the proposed remedial activity. All pertinent jurisdictional prerequisites must be met for the requirement to be applicable. These jurisdictional prerequisites are as follows:

- The party must be subject to the law;
- The substances or activities must fall under the authority of the law;
- The law must be in effect at the time the activities occur;
- The statute or regulation requires, limits, or protects the types of activities; and
- A requirement is applicable if the specific terms (or jurisdictional prerequisites) of the statute or regulation directly addresses the circumstances at the site.

"Relevant and appropriate" requirements refer to those cleanup standards, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, that while not necessarily applicable, address problems or situations sufficiently similar to those encountered at the CERCLA site, and whose use is well suited to the particular site (*EPA, 1993*). The relevance and appropriateness of a requirement can be judged by comparing a number of factors including the characteristics of the remedial action, the items in question, or the physical circumstances of the site, with those addressed in the requirement. If there is sufficient similarity between the requirements and the circumstances at the site, determination of the requirement as relevant and appropriate may be made.

Determining whether a requirement is both relevant and appropriate is a two-step process. First, to determine relevance, a comparison is made between the response action, location, or chemicals covered by the requirement and related conditions at the site, release, or potential remedy. A requirement is relevant if it generally pertains to these conditions. Second, to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the items, the characteristics of the site, the circumstances of the release, and the proposed response action. The requirement is appropriate if, based on such comparison, its use is well suited to the particular site. The facility must comply with the substantive elements of requirements that are determined to be both relevant and appropriate.

2.2.2.3 Application of ARARs at Former Fort Ord

CERCLA Section 121(d) allows the selection of alternatives that will not attain ARAR status if any of six conditions for a waiver of ARARs exists. However, the selected alternative must be protective even if an ARAR is waived. Only five of the conditions for a waiver may apply to a Department of Defense (DoD) site. The conditions for a waiver are as follows:

- The action selected is only part of a total response action that will attain the required level or standard of control when completed;

- Compliance with the designated requirement at that site will result in greater risk to human health and the environment (e.g., worker safety) than alternative options;

- Compliance with the designated requirement is technically impracticable from an engineering perspective;

- The action selected will result in a standard of performance that is equivalent to an applicable requirement through the use of another method or approach;

- A state requirement has not been equitably applied in similar circumstances on other remedial actions within the state; and

- A fund-financed remedial action does not provide a balance between available monies and the need for protection of human health and the environment at sites where the need is more immediate (not applicable to DoD sites).

In addition to ARARs being classified into three broad categories (i.e., chemical-specific, location-specific, and action-specific), each ARAR is also noted by the action that may be taken at the former Fort Ord in the process of implementing the potential remedial alternatives. Thus, during remediation of an area ARARs may pertain to activities that involve site preparation such as clearance of vegetation, grubbing, grading; and/or excavation or other intrusive activities. In many cases, an ARAR will pertain to more than one type of action stated above.

In determining whether a requirement is pertinent to MEC at the former Fort Ord, potential ARARs are initially screened for applicability. If determined not to be applicable, the requirement is then reviewed for both relevance and appropriateness. Requirements that are considered to be relevant and appropriate command the same importance as applicable requirements.

2.2.2.4 Land Use Control Guidelines

The following guidelines set forth by the EPA, DoD, and DTSC (a part of California Environmental Protection Agency (Cal/EPA)) that are relevant to potential Land Use Controls that may be selected for the Impact Area MRA will be considered in the development and implementation of remedial alternatives.

As described in the *Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges* (*EPA/DoD, 2000*):

- Land use controls must be clearly defined, established in conjunction with affected parties, and enforceable.

- Land use controls will be considered as part of the development and evaluation of alternatives for a given Closed, Transferring, or Transferred (CTT) range.

- DoD (the Army) will conduct periodic reviews to ensure the long-term effectiveness of response actions, including Land Use Controls.

In addition, EPA/DoD guidelines specifically address the requirement for institutional controls (Land Use Controls) when MEC contamination has been or may still be on the site as follows:

> "Property transfer records shall detail past munitions and explosive contamination and decontamination efforts; provide requisite residual contamination information; and advise the user not to excavate or drill in a residual contamination area without a metal detection survey."

The EPA policy *Institutional Controls and Transfer of Real Property under CERCLA Section 120 (h)(3)(A), (B), or (C) (EPA, 2000a)* requires the responsible agency to perform the following activities:

- "Monitor the institutional controls' effectiveness and integrity.
- Report the results of such monitoring, including notice of violation or failure of control to the appropriate EPA and/or State regulator, local or Tribal government, and designated party or entity responsible for enforcement.
- Enforce the institutional controls should a violation or failure of controls occur."

In addition, the policy states that "In order to ensure long-term protection of human health and safety in the presence of potential explosive hazards, institutional controls must be enforceable against whomever may gain ownership or control of the property in the future."

In 1987, DTSC developed policy recommending the use of Land Use Covenants based on statutory authority in the California Health and Safety Code (Chapters 6.5, 6.8 and 6.85) and the California Civil Code, Section 1471, which allows an owner of property to enter into environmental restrictions due to the presence of hazardous materials, hazardous wastes or constituents, or hazardous substances that will remain at the property at levels which are not suitable for unrestricted use of the land. In April 2003, DTSC adopted regulations to add Section 67391.1—Requirements for Land Use Covenants—to Title 22, Division 4.5, Chapter 39, of the California Code of Regulations.

These regulations specify that a Land Use Covenant imposing appropriate limitations on land use shall be executed and recorded at a county recorder's office so that they will be found during a title search of county records. The Land Use Covenant regulations require DTSC to clearly set forth and define land use limitations or covenants in a remedy selection or response action decision document prior to approving or concurring with a response action, and that the decision document must also include an implementation and enforcement plan.

Land Use Covenants are proprietary controls, agreed to by property owners, to allow ongoing use of the property as long as the cleanup remedy is not compromised by current or future development. Land Use Covenants include written instruments and agreements restricting land uses, easements, servitudes, covenants and land use restrictions, i.e., they are non-engineering mechanisms to restrict activities and site access to limit exposure pathways of human and environmental receptors to prevent exposure to contaminants. Land Use Covenants "run with the land", i.e., they are binding on current and subsequent property owners, and remain in effect until they are formally removed or modified, pursuant to the California Health and Safety Code, sections 25233, 25234, and 25398.7. These regulations certify that DTSC may later modify or terminate Land Use Covenants if it is determined such modification or termination is protective of public health and safety and the environment.

For sites requiring Land Use Covenants, DTSC policy and Title 22, Division 4.5, Chapter 39, Section 67391.1 require that the property owner enter into a Land Use Covenant Agreement to ensure that the state will have authority to implement, monitor, and enforce protective restrictions. Restrictions agreed to in Land Use Covenants are typically intended to do the following:

- Prevent inappropriate land use on property containing residual contamination or the surrounding property;
- Guarantee that information about property containing residual contamination is available to local governments and the public;
- Disclose to real estate transactions participants (buyers, sellers, lending institutions, brokers, title companies) that the property in question contains residual contamination;
- Ensure that long-term mitigation measures or monitoring requirements are carried out and maintained;
- Ensure that the integrity and stability of the remedy is maintained;
- Ensure that subsequent property owners or lessees have a duty to assume responsibility for any requirements or restrictions pertaining to residual contamination when they take over the property;
- Ensure that DTSC will be contacted prior to change in land use or the cleanup remedy; and
- Ensure that only DTSC can terminate or modify the remedy (land use covenant per DTSC policy).

However, because the Impact Area MRA is a federal property owned by the Army, land use controls will be specified in the property transfer document or letter of transfer—a vehicle similar to the deed of property. The Army intends that this will comply with Title 22, Division 4.5, Chapter 39, Section 67391.1(e)(2), and will assure that a mechanism is in place to ensure that future land use will be compatible with the MEC risks my remain after MEC remediation. In addition, because the property will remain in the control of a federal agency, the land use covenant described in Title 22, Division 4.5, Chapter 39, Section 67391.1(h) does not apply that states that responsible parties, facility owners or operators, or project proponents involved in land use covenants to pay all costs associated with the administration of such controls.

2.3 Ongoing and Future MEC-Related Activities

This section describes ongoing and future MEC-related activities at the former Fort Ord that are components of the Army's basewide efforts to promote MEC safety because of Fort Ord's history as a military base. The Army's *Munitions Response Site Security Program* (*Army, 2005*) describes many of these efforts. Section 4.1 describes the Long Term Management Measures that are specific to implementation and management of the remedial alternatives selected for the Impact Area MRA.

Five-Year Review

A review of the basewide MR RI/FS sites will be conducted within 5 years after implementation of the selected remedy(s) in accordance with CERCLA. The purpose of the five-year review is to determine whether the remedy at a site continues to be protective of human health and the environment after a period of 5 years from the time the remedy was implemented (or from the time of a previous five-year review). The methods, findings, and conclusions of the five-year review are documented in a Five-Year Review report. In addition, the Five-Year Review report documents provide newly identified site-related data or issues that are identified during the review, and the report identifies recommendations to address them as appropriate. The second basewide Five-Year Review for the former Fort Ord will be conducted in 2007, and the next review in 2012.

Deed Notice

A notice on the deed or property transfer document will be included when transferring any former Fort Ord property and will identify pertinent site conditions related to military munitions use, munitions responses implemented, potentially remaining MEC risks if any, and any potential risk mitigation requirements.

MEC Incident Reporting

There is a potential for MEC to be present on the former Fort Ord because military munitions were used throughout its history. In the event MEC is discovered by a future user of former Fort Ord land, a process has been developed for reporting such finds to an appropriate local law enforcement agency. The local law enforcement agency will arrange a response by Unexploded Ordnance (UXO)-Qualified Personnel, who will promptly be dispatched to dispose of any discovered MEC. This process is documented and must be acknowledged by the future grantee, its successors or assigns. A "Safety Alert" pamphlet and incident reporting instructions are provided to property users.

MEC Recognition and Safety Training

The Army offers "MEC recognition and safety training" to anyone conducting ground disturbance activities (e.g., digging holes, excavating trenches, repairing underground utilities, etc.) at the former Fort Ord. The training is a 30-minute session conducted by the Army or the Army's representative, and includes a lecture on what type of MEC might be found and the procedures to follow if something is found. The "Safety Alert" brochure is also distributed. Trained construction personnel will contact an appropriate local law enforcement agency if a potential military munitions item is encountered. The local law enforcement agency will then arrange a response by UXO-Qualified Personnel. The following are some of the organizations that have received MEC recognition and safety training: California State University Monterey Bay (CSUMB), U.S. Army Corps of Engineers (USACE) contractors, Pacific Gas & Electric, Pacific Bell, and the Bureau of Land Management. MEC recognition and safety training can be scheduled by contacting the Fort Ord Base Realignment and Closure (BRAC) office at (831) 242-7919.

School Education

Since 1997, the former Fort Ord has had a MEC Safety Education Program that is offered to local schools annually. The objective of this program is to provide school-age children with the ability to recognize the visible attributes of various MEC items likely to exist on the former Fort Ord, associate danger with MEC items and former Fort Ord MEC areas, and understand the actions to be taken when a possible item is observed. This program has a three-tiered approach that includes (1) distribution of the "Safety Alert" to organizations and agencies who provide information to the local community; (2) a 1-hour MEC safety presentation for local elementary and middle schools for 5^{th}, 6^{th}, and 7^{th} grade students; and (3) distribution of the "Safety Alert" to parents of children in the local schools, as well as inclusion in related subject presentations (environmental and earth sciences) to high school students. Representatives from the Army conduct the MEC safety presentation.

Community Involvement

The Army is committed to develop opportunities to assist community members in understanding and participating in the cleanup decision-making process at the former Fort Ord. The Army holds public meetings, Community Involvement Workshops, Technical Review Committee (TRC) meetings, and open houses and conducts public information sessions through booths or tables at local community events. The

Army provides public and media tours of former Fort Ord cleanup activities, distributes fact sheets, and makes presentations to special interest and community groups as necessary to address specific community concerns or explain significant cleanup activities. The Army also maintains document repositories available to the public including the administrative record and information repositories at local libraries. Additionally, the Army administers a public environmental cleanup web site (www.fortordcleanup.com), maintains a community relations mailing list, mails monthly cleanup updates, and regularly assesses community interest and information source preferences. The web site provides background information, a description of current activities, documents available for public comment, maps, notices, and agendas for upcoming public meetings. The monthly cleanup update includes information on recent cleanup activities, recently published documents and fact sheets, and is mailed to those who have requested to be on the community relations mailing list and distributed at community involvement events. Community involvement activities are documented in the Fort Ord Community Relations Plan that is updated annually. The Fort Ord cleanup outreach program continues to look for ways to increase accessibility, provide opportunities for the public to learn about the cleanup and provide a variety of ways for the public to participate. Various outreach events and community participation (attendance) are included in the Community Involvement Record in the Fort Ord Community Relations Plan. In addition, the Fort Ord newsletters are regularly distributed to businesses and residences in the surrounding Fort Ord communities including churches, schools, restaurants, and grocery stores.

Local Ordinances

Some local jurisdictions have established ordinances to monitor or control intrusive activities in specified areas of the former Fort Ord to manage risks of encountering potential MEC related to potential and planned development. These ordinances are not relevant within the Impact Area MRA where the land remains within federal control.

3.0 IDENTIFICATION OF APPLICABLE RESPONSE ACTIONS

This section describes the applicable response actions that could mitigate and manage potentially remaining MEC risks at the Impact Area MRA, including:

- No Further Action—Is a baseline for comparison and does not assume a protective and ARAR-compliant state for the designated reuse.
- Land Use Controls—Assumes the MEC risks at the reuse area can be managed through implementation of controls on the designated reuse.
- MEC Remediation—Assumes the MEC risks at the reuse area cannot be adequately managed through implementation of controls on the designated reuse; therefore, MEC remediation should be implemented.

The individual components of the response actions described herein will be developed into remedial alternatives as described in Section 4.0.

3.1 No Further Action

The No Further Action Alternative is provided, as required under CERCLA and the National Contingency Plan (NCP), as a baseline for comparison to the other proposed remedial alternatives. This alternative assumes no further action would be taken related to MEC at the Impact Area MRA.

3.2 Land Use Controls

The Land Use Controls that are potentially applicable for the Impact Area MRA are described in the following sections. If selected as part of the remedy for the Impact Area MRA, these Land Use Controls will be implemented in accordance with the guidelines presented in Section 2.2.2.4 (Land Use Control Guidelines), and will be described in further detail in the Land Use Control Implementation Remedial Design/Remedial Action Work Plan (LUCI RD/RAWP). Under the Federal Facility Agreement (FFA) between the Army, EPA, and DTSC, a schedule for preparation of the LUCI RD/RAWP for the Impact Area MRA will be submitted within 21 days of signature of the ROD. Land use controls will be recorded at a county recorder's office.

The following Land Use Controls that will be considered for the Impact Area MRA are described below:

- Property Transfer Documentation;
- MEC Recognition and Safety Training;
- Construction Monitoring/UXO-Qualified Personnel Support; and
- Access Management Measures.

3.2.1 Property Transfer Documentation

Restrictions or conditions on the property specified in property transfer documentation may be appropriate if placing controls on, or limits to, property use would prevent or limit exposure to potentially remaining MEC risks at the Impact Area MRA during reuse. Specific types of restrictions would vary depending on the conditions, potential MEC risks, and anticipated future land use. The Army will follow appropriate federal property management regulations. The property transfer document would identify who would be responsible for implementation, monitoring, reporting, and enforcement. If selected for implementation at the Impact Area MRA, the restrictions identified in the ROD would be described in further detail in the LUCI RD/RAWP.

Property transfer document restrictions regarding potential MEC risks at the Impact Area MRA would establish the appropriate restriction that indicates:

- Specified reuses evaluated in the RA that were designated and approved at the time the Army transfers the property must be maintained by all property owners. Unrestricted land use, typically represented by a residential exposure scenario by the regulatory agencies, would be prohibited.

- Potential MEC risks may significantly increase if changes in the designated and approved reuse are implemented.

- Any modifications to these restrictions must be approved by the project team (the Army, EPA, and DTSC; a part of Cal/EPA) prior to implementation.

At the time of the five-year review, the Army or Army's representatives, in consultation with the property users and regulatory agencies, would assess whether the restrictions continue to be protective or require modifications.

3.2.2 MEC Recognition and Safety Training

For the Impact Area MRA, some digging or underground "intrusive" activities are planned for the proposed reuses. Personnel involved in conducting reuse activities at the Impact Area MRA would be required to attend the "MEC recognition and safety training" to increase their awareness of and ability to identify MEC items. Prior to planned intrusive activities, the landowner would be required to notify the Army or Army's representatives and arrange for MEC recognition and safety training to be provided to all workers performing intrusive activities. If selected for implementation at the Impact Area MRA, this training would be described in further detail in the LUCI RD/RAWP. At the time of each five-year review, the Army or Army's representatives would assess the status of the training program and document any recommendations or modifications to the program as described in the LUCI RD/RAWP.

3.2.3 Construction Monitoring/UXO-Qualified Personnel Support

Construction monitoring would be performed by UXO-Qualified Personnel during any intrusive or ground-disturbing construction activities at the Impact Area MRA to address potential MEC risks the to construction personnel. Construction monitoring would be arranged during the construction planning stages of the project prior to the start of any intrusive activities. For the purposes of this FS, it is assumed that two UXO-Qualified Personnel would be available to provide the UXO support. UXO-Qualified Personnel would monitor construction activities for the potential presence of MEC during any intrusive activities. If evidence of MEC is found during intrusive construction activities, the work would cease; a process has been developed for reporting such finds to an appropriate local law enforcement agency. The

local law enforcement agency would promptly dispatch or arrange a response by UXO-Qualified Personnel (e.g., an Explosive Ordnance Disposal [EOD] unit).

For the purposes of this FS, it is assumed that the two UXO-Qualified Personnel would be available on a full time basis to provide other UXO support as necessary, in addition to construction monitoring, during reuse of the Impact Area MRA.

Any MEC-related data that may be discovered during construction monitoring would be reported by the Army under the annual monitoring program, and the monitoring results would be presented in a five-year review report. If selected for implementation at the Impact Area MRA, the level of effort involved in conducting construction monitoring would be determined on a case-by-case basis depending on site conditions, and would be described in further detail in the LUCI RD/RAWP.

As part of annual monitoring and five-year review reporting, after the reuse is established, a review of any MEC-related data collected would be performed and documented for assessment by the project team (the Army, EPA, and DTSC; a part of Cal/EPA) to determine the status of the construction monitoring program based on the established reuse for each area. At the time of each five-year review, the Army or Army's representatives would assess the status of the construction monitoring program and document any recommendations or modifications to the program as described in the LUCI RD/RAWP.

3.2.4 Access Management Measures

Access management measures could include (1) maintenance of existing measures at the Impact Area MRA, or (2) implementation of additional measures. The *Munitions Response Site Security Program* and yearly updates (*Army, 2005*) provide information about different types of site security measures that are or will be implemented and maintained at the former Fort Ord. Site security will continue as an Army function until the property is transferred. The site security program is updated as necessary to reflect any additional security measures that may be needed in the future to ensure the safety of nearby populations. The site security program will be modified as necessary due to changes in the nearby human populations. If selected as part of a remedy, such site security measures will continue to be implemented after property transfer until the measures are no longer needed.

For the Impact Area MRA, the following access management measures may be applicable:

- **Fencing and Signs** would be selected and constructed and/or existing fencing would be maintained based on reuse and the potential for MEC risks. For the purposes of this FS, it is assumed that existing fencing surrounding the Impact Area MRA (4-strand barbed wire fence w/concertina wire in some portions) and signs would be maintained, and vegetation would be mowed along the fence line. Temporary fencing may be constructed and maintained as necessary for public safety for the duration of the MEC removal around the perimeter of each of the areas where MEC remedial actions would be conducted each year using the phased approach described in Section 3.3.1. The design of the perimeter fence may be modified based on site-specific considerations.

- **Law Enforcement Security Patrols** would be employed by either private or governmental entities to maintain and control access restrictions, and monitor and discourage trespassing into areas potentially containing MEC risks. For the purposes of this FS, it is assumed one-third of a full time-equivalent of a law enforcement ranger would be employed during reuse of the Impact Area MRA.

- **Fire Suppression Helicopter Support** would be provided as necessary for select future HMP/HCP prescribed burns where subsurface MEC risks cannot be otherwise mitigated. MEC remaining in the

subsurface may pose a risk to fire-fighters trying to suppress spot fires in some cases. For the purposes of this FS, it is assumed a helicopter would be provided onsite during select prescribed burns to extinguish spot fires that may occur during prescribed burns in areas where subsurface MEC risk cannot be mitigated by other methods through planning.

If selected for implementation at the Impact Area MRA, these measures would be described in further detail in the LUCI RD/RAWP. At the time of each five-year review, the Army or Army's representatives would assess the status of the measures and document any recommendations or modifications to the program as described in the LUCI RD/RAWP.

3.3 MEC Remediation

MEC Remediation includes the following components:

- **Vegetation Clearance** involves conducting site preparation procedures to clear vegetation to allow for MEC investigation and removal, and to provide the required ground surface visibility for the safety of MEC workers.

- **MEC Remedial Action** involves using the best appropriate practices and/or technologies available for MEC detection and removal (remediation), and MEC detonation using Department of Defense Explosives Safety Board (DDESB)-approved MEC procedures in areas where explosives MEC items are identified during remedial activities and require disposal.

Descriptions and applicable methods for implementation of MEC remediation are described below. If selected for implementation at the Impact Area MRA, a site-specific work plan outlining planned (1) vegetation clearance methods (prescribed burning), (2) MEC removal methodologies, and (3) habitat monitoring protocols would be available for regulatory agency and public review.

3.3.1 Vegetation Clearance Via Prescribed Burning

The Impact Area MRA is densely vegetated; therefore, in order to provide safe access for workers to conduct MEC removals, vegetation clearance is required as a first step. The *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (HMP; *USACE, 1997*) presented the boundaries of habitat reserve areas and describes land use, conservation, management, and habitat monitoring requirements for target species within the Impact Area MRA, and was prepared in accordance with the U.S. Fish and Wildlife Service (USFWS) Biological Opinions (*USFWS, 1997a, b*). Changes to requirements of the HMP have also been documented since it was published, including additional Biological Opinions (*USFWS, 1999, 2002, 2005*), a Memorandum of Understanding (*BLM, Army, 2004*), an Assessment (*Zander, 2002*), and a *Revised Attachment A Habitat Management Plan Map* (*USACE, 2005*), and additional requirements anticipated during reuse (*Zander, 2007*). The HMP and these additional requirements establish the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival.

These requirements were considered in the evaluation of vegetation clearance alternatives that are described and evaluated in the *Evaluation of Vegetation Clearance Methods Technical Memorandum, Ordnance and Explosives Remedial Investigation/Feasibility Study, Former Fort Ord, California* (Vegetation Clearance Technical Memorandum; *Harding ESE, 2002*). Table 12 of the Vegetation Clearance Technical Memorandum presents a matrix of vegetation clearance methods that should be retained for further consideration for the range of different plant communities (or types of vegetation) found at the former Fort Ord.

The selection of vegetation clearance methods depends on (1) the type and density of vegetation and MEC present, and (2) the planned reuse of the site. Methods of vegetation clearance for different plant communities at the former Fort Ord were evaluated for the Impact Area MRA. The Impact Area MRA is designated habitat reserve, and is primarily covered by Central Maritime Chaparral (CMC). The Vegetation Clearance Technical Memorandum evaluated several vegetation clearance methods that may be applicable in CMC and Coastal Scrub communities, and identified prescribed burning as the only method readily available for use in CMC and Coastal Scrub communities. Other vegetation clearance methods were evaluated, but their use is allowable on a limited basis only, or further study is required. "Crush and burn" methods may be applicable, but would require further study. Manual and mechanical cutting are applicable for up to 50 acres of unburned CMC in polygons located in habitat reserve areas; widespread use of cutting in habitat reserve containing CMC is unacceptable because it has not been shown to support successful recovery of the rare habitat. These methods will be retained for further consideration on a limited basis depending on area-specific conditions identified in the work plan for each area. Prescribed burning has been demonstrated to achieve the vegetation clearance goal of removing the vegetation to successfully facilitate follow-on MEC removal in compliance with the HMP.

The Army has also considered the potential implementation of mechanical vegetation clearance followed by MEC removal, and then prescribed burning, in order to be able to implement MEC removals without first conducting a prescribed burn. Dense vegetation with potentially high densities of high explosive MEC on the ground surface may make it difficult for the mechanical clearance equipment to safely access the area and to cut the vegetation. In addition, there is insufficient data at this time to determine whether this methodology could be implemented successfully and in compliance with HMP requirements and ARARs. It has not been shown that recovery of CMC habitat and sensitive species would be successful after implementing this methodology. Therefore, this potential option is not considered further at this time for the purposes of this FS.

For the purposes of this FS and costing remedial alternatives, in accordance with the HMP that specifies requirements for implementation of prescribed burning in habitat reserve areas, it is assumed:

- Prescribed burns would be conducted in stages and consist of several small burns, approximately 100 acres in size (actual size could be more or less than 100 acres depending on site-specific characteristics) over several days rather than one large burn. A site-specific work plan will be prepared prior to each phase of work, including a burn plan. This burn plan will describe the locations and widths of temporary and permanent fuel breaks, and the number and size of burns that are planned for the year.

- Each contiguous prescribed burned area would not exceed 400 acres (separated by a minimum of 25 acres to allow a mosaic pattern consisting of difference age classes of vegetation) as specified under the HMP, unless specifically coordinated with USFWS; under the HMP, no more than 800 acres would be allowed to be prescribed burned in any given year.

- Prescribed burning (followed by MEC remedial action) would be implemented not to exceed 800 acres of the 6,560-acre Impact Area MRA per year.

- Manual and/or mechanical cutting of unburned vegetation may be conducted as necessary, but would not exceed 50 acres in each polygon, unless specifically coordinated with USFWS.

- Manual and/or mechanical cutting of burned vegetation may be conducted.

The following section describes the general procedures for prescribed burning as it would be implemented within the Impact Area MRA.

3.3.1.1 Description of Prescribed Burning for Impact Area MRA

The major elements of conducting prescribed burning within the Impact Area MRA for the purposes of vegetation clearance prior to MEC remedial actions are described below according to the parameters of discussion described in the Vegetation Clearance Technical Memorandum (*Harding ESE, 2002*).

How the Method is Carried Out in the Field

The major elements of prescribed burning include:

- Preparation of a burn prescription/burn plan outlining the objectives of the burn, burn area, and the range of environmental conditions under which the burn will be conducted; workforce and equipment resources required to ignite, manage and contain the fire; and communication procedures;
- Site preparation, including establishment and maintenance of containment lines;
- Conducting the burn within the range of environmental conditions established in the burn prescription; and
- Follow-up operations to ensure that the fire is fully contained.

Based on past experience and habitat conservation considerations, it is anticipated that prescribed burns would be conducted in stages and consist of several small burns, approximately 100 acres in size (actual size could be more or less than 100 acres depending on site-specific considerations) over several days rather than one large burn. Each contiguous prescribed burn area would not exceed 400 acres (separated by a minimum of 25 acres to allow a mosaic pattern consisting of different age classes of vegetation) unless specifically coordinated with USFWS; under the HMP, no more than 800 acres would be allowed to be prescribed burned in any given year.

Regularly-maintained roads and fuelbreaks that are accessible by vehicles and fire management equipment currently divide the site into several sections (300 to 500 acres in size). These sections would be further divided by utilizing established roads and trails to the extent possible that can be expanded as temporary fuel breaks (instead of creating brand new fuel breaks through thick vegetation that would involve higher level of effort and potential avoidable habitat impacts). The sizes of the burn areas are contingent on many factors, the most important being the location and condition of major fuelbreaks (well maintained, substantial fuel breaks where a fire could be held from spreading past that location). Other factors considered are topography, slope aspect, fuel type, fuel loading, fire behavior, and the proximity of urban/wildfire interface. The actual size and configuration of burn areas would be determined by the Army fire department in charge. The fire department would determine these parameters to minimize the size and duration of each burn, to best maintain control of the burn, to minimize smoke impacts, to be able to execute the burn within the narrow meteorological window, minding also explosives safety and other technical and practical considerations. The fire department would select areas to strategically create a buffer between the Impact Area MRA and the surrounding communities to protect the communities from any potential wildfire or fire hazard. Proposed burn areas, containment lines, and supporting rationale would be described in site-specific implementation work plans (anticipated to be prepared for each year of planned cleanup work) that would be submitted for DTSC review and EPA concurrence.

Potential Impacts to the Public

It is anticipated that the prescribed burns will be conducted in stages and consist of several small burns (approximately 100-acre units over several days) rather than one large burn. Each contiguous prescribed burned area will not exceed 400 acres (separated by a minimum of 25 acres to allow a mosaic pattern consisting of difference age classes of vegetation) as specified under the HMP, unless specifically coordinated with USFWS; under the HMP, no more than 800 acres would be allowed to be prescribed burned in any given year. A site-specific work plan will be prepared prior to each phase of work. The implementation plan will include a burn plan. This burn plan will describe the locations and widths of temporary and permanent fuel breaks, and the number and size of burns that are planned for the year. Each burn plan would outline a range of environmental conditions under which the burn will be conducted, developed with the goals of conducting a fully contained burn and minimizing smoke impacts to the community.

The Army will provide public notification of planned prescribed burns. A prescribed burn will be started only when optimum burn conditions are confirmed. Mobilization of fire management personnel and equipment, and public notification, will occur when optimum burn conditions are reasonably expected. Once mobilized, fire and management personnel, equipment, and supplies may be in place and standing by for several days. Because the Army will be waiting for appropriate atmospheric conditions rather than trying to anticipate them, the Army will not know conclusively until moments before the fire is lit that the burn will occur that particular day. In addition, multiple burn events may be conducted over a period of several days that could be interrupted by one or more days of no burning. Through community notification, the public will be advised of reasonable precautions they can take to minimize exposure to smoke from prescribed burns, such as staying indoors with doors and windows closed, and limiting outdoor activity when smoke is present.

The Army will notify the community before the day of burning, and the notification will continue until the end of the prescribed burn. Notification could include several avenues of communication such as posters/flyers, telephone calls and announcements in local newspapers, telephone hotline and websites. The audience and manner of public notification will be specified in the prescribed burn plan.

Prescribed burns may cause some smoke impacts under most meteorological conditions; however, development of the burn prescription would include assessment of meteorological conditions and design of the prescription to minimize potential impacts to the public. Prior public notification and smoke management while conducting the burn would minimize potential impacts from smoke.

Health impacts from short-term exposure to smoke from prescribed burns are temporary based on the results of air monitoring conducted during the prescribed burn in 2003, and an independent analysis of the results conducted by Agency for Toxic Substances and Disease Registry (ATSDR). The Army and regulatory agencies believe these health risks need to be balanced with health and safety risks to MEC removal workers. Conducting a prescribed burn within the Impact Area MRA is not expected to have significant adverse impacts on the public. The prescribed burn would be conducted under optimal climatic conditions to minimize smoke and control the burn within its intended boundaries.

An assessment of MEC-related air emissions that may be associated with a burn was conducted in the *Technical Memorandum, Air Emissions from Incidental Ordnance Detonation During a Prescribed Burn on Ranges 43 through 48, Former Fort Ord, California* (Air Emissions Tech Memo; *Harding ESE, 2001*), which indicated air pollutant emissions from incidental MEC detonation during a prescribed burn in Ranges 43 through 48 within the Impact Area MRA would be minor compared to emissions

contributed directly by biomass burning, and would result in pollutant concentrations well below health-protective regulatory screening levels.

The Army conducted extensive air monitoring during the Ranges 43-48 prescribed burn in October 2003 (*Harding ESE, 2004*). The prescribed burn jumped the containment lines and burned nearly 1,500 acres (including the 500-acre Ranges 43-48 site). Air monitoring samples were collected at fourteen (14) locations at and surrounding the Ranges 43-48 site. Based on the analysis of the air monitoring results, munitions-related chemicals (i.e., explosive residues) were not detected in air samples. In addition, the ATSDR conducted an independent evaluation of the air monitoring results, and concluded emissions from the burn posed "no apparent public health hazard" (*ATSDR, 2005*).

Community notification and smoke management would minimize potential impacts from smoke. The short duration and repetitive nature of these burn events may produce a significant time and travel burden on those attempting to relocate, return, and then relocate several times within days or weeks. For these reasons, the Army has determined it is not possible to implement an effective temporary voluntary relocation program for the community during prescribed burns in the Impact Area MRA. Through community notification, the public will be advised of reasonable precautions they can take to minimize exposure to smoke from prescribed burns, such as staying indoors with doors and windows closed, and limiting outdoor activity when smoke is present.

The possibility of incidental MEC detonation exists for any vegetation clearance method. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health.

Worker Safety

Burning of vegetation would be conducted using aerial methods (e.g., via helicopter), which would isolate workers from direct exposure to UXO that is potentially present in areas being cleared. Although some ground crews would be present in fuel break areas, and air sampling or meteorological stations may be placed and maintained near the prescribed burn area, development and implementation of a health and safety plan for workers would mitigate worker exposure to injury. The health and safety plan will identify appropriate separation distances for workers.

In the case of accidental detonation of UXO, prescribed burn workers would not be likely to be exposed to flying fragments or blast debris depending on distance to and the type and size of the UXO. In general, the possibility of incidental MEC detonation exists for any vegetation clearance method. The burn would be conducted by personnel located outside the burn area containing UXO, which would minimize exposure.

Duration of the Vegetation Clearance Method

For a typical prescribed burn within the Impact Area MRA, vegetation clearance using prescribed burning would include preparing for and conducting the burn, conducting air monitoring and follow-up monitoring for fire safety. To minimize the size and duration of burn events, multiple events may be conducted over a period of several days that includes one or more days when no burning will be

conducted. The Army anticipates that during each mobilization, a contiguous area of up to 400 acres would be burned. Planned prescribed burns will not exceed 800 acres per year.

Erosion

Vegetation clearance using prescribed burning may result in some surface disturbance or erosion on slopes in the short term, since fire reduces most of the vegetation to bare mineral soil. However, revegetation of burned areas is likely to proceed rapidly following the start of the next rain season, thus minimizing further erosion potential. In the long term, burning would have a beneficial impact on the health and growth of the plants and their stability.

Impacts to Protected and Other Natural Resources

Burning would have beneficial impacts on rare, threatened and endangered species because chaparral communities have evolved to be dependent on fire for its health and functioning. Research indicates chaparral vegetation cleared by burning not only recovers, but also flourishes and provides an opportunity for a greater diversity of native plants to grow. Plants and animals in the Impact Area MRA have survived, become dependent on, and adapted to a cycle of occasional fire that recycles nutrients and exposes minerals in the soil while stimulating the germination of seeds that accumulate in between fires. This natural succession allows the plant community to rejuvenate itself and enhances the natural diversity of the unique habitat containing rare, threatened and endangered plants at the Impact Area MRA. Based on observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord (conducted under the HMP monitoring program) burning is supported as the primary method for vegetation clearance for the following reasons:

- Seedlings of HMP shrubs were common in burned areas after clearance activities. An evaluation indicated HMP shrub regeneration occurred in densities over 3,000 seedlings per acre after burning (as compared to only 29 seedlings per acre occurred after cutting).

- Species diversity is generally higher in burned areas.

- More native herbaceous species were observed in burned areas.

In addition, because the chaparral habitat contains protected species at the Impact Area MRA, resource management measures are required by the USFWS as detailed in Biological and Conference Opinion (BO), memoranda, and other correspondence between USFWS and the Army (*USFWS, 1999, 2001, 2002, 2005*; *Army, 1998, 2000*) and in accordance with the HMP (*USACE, 1997*). The intent of the USFWS is that "the Army would primarily use prescribed fire to clear vegetation in support of Ordnance and Explosives (OE) removal actions in areas designated as habitat reserves [and] . . . to preserve, protect, and enhance populations and habitat of listed species and to protect candidate and sensitive species to the extent needed to preclude the need for future listings." Consequently, methods of vegetation clearance in CMC that do not involve burning are not consistent with the habitat and species preservation and protection goals of the HMP (*USFWS, 2001*).

Use at Fort Ord or Other Sites and Under What Conditions

Prescribed burning has been used extensively at former Fort Ord for decades because of military training activities, and has also been used to clear vegetation from munitions response sites/areas (MRSs/MRAs) similar to and within the Impact Area MRA to support removal actions at the former Fort Ord since 1994. Prescribed burns are conducted in close coordination with federal, state, and local regulatory agencies.

Prescribed burns consist of using fire under optimal climatic conditions to clear vegetation from MRSs/MRAs, and are the primary vegetation clearance method for CMC habitat that exists within the Impact Area MRA.

It is anticipated that temporary fuel breaks will be cut and surface cleared around each burn unit prior to burning. In addition, safety set back distances will be identified that will protect the public during vegetation clearance activities. The details of these measures will be documented in the site-specific implementation work plan.

There is a risk of escaped fires or wildfires involved in burning vegetation. Of nine prescribed burns conducted at the former Fort Ord since 1994, two prescribed burns (1997 and 2003) escaped and became wildfires. However, the majority of prescribed burns were successfully conducted without becoming a wildfire, and fire mitigation techniques and personnel are in place under the burn prescription to prevent and address such instances.

Availability of Equipment and Personnel

Prescribed burning has been used extensively at the former Fort Ord and the equipment and personnel necessary to implement burning would be available for use at the Impact Area MRA.

Deposition of Vegetation

Depending on the provisions of the burn prescription and the occurrence of suitable conditions, the burn would clear or consume the majority of top growth on shrubs, consume the leaf litter, and burn a portion of the standing woody stems. The extent to which woody material would be consumed is directly related to fuel moisture and ambient conditions at the time of the burn. Under relatively cool, moist conditions, very little woody material would be consumed. Under low-humidity, low-fuel moisture conditions, woody vegetation up to 2 inches in diameter may burn.

Visibility of Ground Surface

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of MEC detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance would be achievable using burning. Fire clears the vegetation and leaves the range in a condition that typically provides MEC removal workers with a clear, unobstructed view of the ground surface. Manual and/or mechanical cutting of burned vegetation may be conducted if necessary to conduct munitions response actions (e.g., MEC removals).

Level of Effort in Terms of Personnel

Prior to the burn, Army personnel will ensure the public is informed of the planned burn through a notice in a local newspaper and/or other avenues of communication that would be described in the burn plan. In addition, vegetation clearance and UXO-Qualified Personnel would clear and maintain fuel breaks surrounding the burn area and form a containment line. An air monitoring program would be developed and implemented. Any air samples collected would be analyzed offsite. In addition, meteorological profiling would be conducted prior to and during the burn. Prescribed burning would be conducted using aerial methods (such as an operator to pilot a helicopter equipped with a torch to initiate the burn). Fire suppressant crews would stand by during the burn and emergency fire crews from local jurisdictions would be on notice in case the fire traveled in an unplanned direction. After the burn was completed the site will be monitored for fire safety until all operations are completed and fire crew is demobilized. Site-specific procedures would be detailed in prescribed burn plans.

3.3.2 MEC Remedial Action

After vegetation clearance is performed via prescribed burning as described in Section 3.3.1, MEC remedial action would be implemented in the burned area, and would include the following four components described below: (1) MEC Removal; (2) MEC Detonation; (3) Digital Mapping of Anomalies; and (4) Post-Remediation Habitat Monitoring. These remedial actions would be conducted in stages. A site-specific work plan would be developed for each phase of work outlining protocols for implementation of the first three components [(1) through (3)] and would be available for regulatory agency and public review.

3.3.2.1 MEC Removal

Based on the site characteristics and planned reuses of the Impact Area MRA described in the RI and RA (Volume I), MEC Removals at the Impact Area MRA would consist of identifying, investigating and removing MEC found under one of the following scenarios. Specific procedures would be described in the site-specific work plans that would be available for regulatory agency and public review:

- Technology-Aided Surface MEC Removal – Identify and remove MEC detected on the ground surface (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible).

- Subsurface MEC Removal – Identify, investigate, and remove MEC / Anomalies detected on the surface and in the subsurface to the depths found.

After vegetation clearance is performed via prescribed burning, UXO-Qualified Personnel would walk the site and conduct MEC removals. MEC and any other anomalies identified visually or using the detection equipment would be investigated, and if MEC was found, it would be detonated using DDESB-approved detonation procedures described in Section 3.3.2.2.

3.3.2.1.1 Technology-Aided Surface MEC Removal

This methodology would consist of a visual search of the ground surface and investigation and removal of any MEC. Munitions debris or range-related debris (anticipated to be 2-inches in diameter or larger; however, detailed specifications would be identified in the site-specific work plan) that is found on the ground surface may also be removed. MEC detection instruments would be available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible. The site-specific work plans outlining planned MEC removal protocols would be available for regulatory agency and public review.

After MEC removal is conducted, quality control and quality assurance activities would be implemented.

3.3.2.1.2 Subsurface MEC Removal

This methodology would consist of identification of MEC (conduct a visual search and operate MEC detection equipment to locate subsurface items) and investigation and removal of any MEC. Munitions debris and range-related debris (anticipated to be 2-inches in diameter or larger; however, detailed specifications would be identified in the site-specific work plan) that is found/detected during the process may also be removed.

Subsurface MEC removal depths would be determined based on (1) the type of MEC, (2) the typical depth the type of MEC is found, and (3) the capabilities of the geophysical detection equipment selected as best suited for site conditions. The site-specific work plans outlining planned MEC removal protocols would be available for regulatory agency and public review.

Within areas that may be selected for subsurface MEC removal, there may be areas that contain significant amounts of MEC and/or metallic debris that preclude the use of typical methods of removal (e.g., 'mag and dig'). These areas may require large-scale excavations to remove the MEC present in the subsurface. The HMP and associated biological opinions currently limit the amount of temporary habitat destruction to 75 acres (*USACE, 2005; USFWS, 1999, 2002, 2005; BLM, Army; 2004; Zander, 2002; 2007*). The Army is required to ensure that habitat and species within any large-scale excavations recover. The impacted areas must be monitored in accordance with the HMP and biological opinions to determine if the HMP success criteria have been achieved. It may be necessary to conduct active habitat restoration as a corrective action in order to meet the requirements of the HMP. Depending on the size of these large-scale excavations, it may also be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act.

Based on a review of currently available MEC-related data, an estimated total of approximately 320 acres of the Impact Area MRA could contain significant amounts of MEC and/or metallic debris and may require large-scale excavations to remove the MEC present in the subsurface (Plate 5, RI; Volume I). For the purpose of this FS, this effort is assumed to include sifting the top 2-foot layer of soil.

A digital geophysical survey ("digital mapping") would also be performed using the best appropriate technology to provide a record of anomalies identified during the survey (see Section 3.3.2.3). Anomalies identified during the survey would be investigated or resolved.

After the MEC removals are conducted, quality control and quality assurance procedures would be implemented.

3.3.2.2 MEC Detonation

Detonation with Engineering Controls is considered the safest method for MEC detonation because it minimizes direct exposure of workers to MEC, and is assumed to be the method applied during MEC removal actions at the Impact Area MRA. Any explosive items identified would be detonated using DDESB-approved MEC detonation procedures that would be described in the implementation work plan. The Army is currently evaluating the need for any potential modifications to current detonation with engineering controls procedures for use at the former Fort Ord.

The Detonation with Engineering Controls technology consists of applying detonating charges to single or consolidated MEC items, and applying engineering controls (covering the MEC with tamped dirt, sandbags, contained water, or other materials) prior to detonation to control the blast and any fragmentation, emissions, or noise that would be associated with the detonation. This method was demonstrated to be effective during the Ranges 43-48 Interim Action within the Impact Area MRA, and would be applicable and well suited for detonations in this area because it can be performed in any location MEC is found during MEC removal actions.

The Detonation Chamber technology was also considered. This consists of operation of a blast chamber for transportable MEC items. The Donovan Chamber is the only type of blast chamber approved for use by the DDESB, and is a detonation containment device capable of withstanding multiple detonations. Detonation of transportable MEC items using this method would reduce noise and emissions, contain

fragmentation, and reduce fire risks associated with detonations. However, application of this technology would require handling and transfer of MEC by UXO-Qualified Personnel over the 6,560 total acres of land found at the Impact Area MRA to temporary chamber locations immediately within access of the area being cleared. Due to its limited application to a small percentage of the anticipated MEC items, and the technical and safety constraints involved in transporting the chamber or transporting MEC items to the chamber, it is not considered further for use at the Impact Area MRA

3.3.2.3 Digital Mapping of Anomalies

After conducting MEC removals on the surface, digital mapping would be performed using the best appropriate technology, and would digitally record and locate anomalies identified during the survey. A map of the anomalies would be included in the after-action report to assist future property users in identifying areas with specific MEC safety support requirements for surface or subsurface activities and to assist in land management decision making. Digital mapping would require manual and/or mechanical cutting of the burned vegetation in order to provide access to the digital geophysical equipment. Digital geophysical detection equipment and associated Standard Operating Procedures (SOPs) would be determined in the implementation work plan based on site conditions and according to USACE Data Item Description (DIDs), site-specific Quality Control (QC) criteria (which can be considered Data Quality Objectives [DQOs]), and in accordance with the *Ordnance Detection and Discrimination Study for Fort Ord* (*Parsons, 2002a*) and other guidance. Digital mapping in some areas may not be implementable based on site conditions such as difficult terrain that prevent equipment access or operation; these areas would be documented in the After-Action report and digital mapping records.

3.3.2.4 Post-Remediation Habitat Monitoring

The HMP requires habitat monitoring be conducted following MEC remedial action to assess the recovery of HMP species. Baseline monitoring would be conducted in each area where MEC remedial action is planned. Follow-up monitoring would then be conducted in accordance with the Vegetation Monitoring Plan and Wetland Monitoring and Restoration Plan (*Burleson, 2006, 2007*) for (1) HMP annual plants, and (2) HMP shrubs, and (3) wetland species. Results of monitoring would be documented in annual reports submitted to the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG).

4.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section presents the Long Term Management Measures that will be implemented at the Impact Area MRA; the development of remedial alternatives for the Impact Area MRA based on the response actions identified in Section 3.0 as shown on Figure 1; and a discussion of potentially applicable ARARs associated with implementation of the remedial alternatives.

4.1 Long Term Management Measures Specific to the Impact Area MRA

This section describes the Long Term Management Measures that are specific to the Impact Area MRA. These measures will be applied to implement and manage the remedial alternatives selected for the Impact Area MRA, and as such, are not risk management measures or response actions and are not screened or evaluated for reuse area-specific applicability. These measures would be described in further detail in the LUCI RD/RAWP.

Property Transfer Documentation

The Army will specify MEC-related land use controls in the property transfer document that (1) informs future property owners MEC was found and removed at the area; (2) specifies requirements that must be met prior to performing certain activities at the area; and (3) outlines appropriate procedures to be followed in the event that MEC is encountered during reuse. Specific types of restrictions would vary depending on the conditions, potential MEC risks, and anticipated future land use. The Army will follow appropriate federal property management regulations. The property transfer document would identify who would be responsible for implementation, monitoring, reporting, and enforcement. The restrictions identified in the ROD would be described in further detail in the LUCI RD/RAWP.

Property transfer document restrictions regarding potential MEC risks at the Impact Area MRA would establish the appropriate restriction that indicates:

- Specified reuses evaluated in the RA that were designated and approved at the time the Army transfers the property must be maintained by all property owners. Unrestricted land use, typically represented by a residential exposure scenario by the regulatory agencies, would be prohibited.

- Potential MEC risks may significantly increase if changes in the designated and approved reuse are implemented.

- Any modifications to these restrictions must be approved by the project team (the Army, EPA, and DTSC; a part of Cal/EPA) prior to implementation.

At the time of the five-year review, the Army or Army's representatives, in consultation with the property users and regulatory agencies, would assess whether the restrictions continue to be protective or require modifications.

Annual Monitoring and Five-Year Review Reporting

The Army will monitor the Impact Area MRA on an annual basis, and collect and report any MEC-related data that may be discovered after transfer of the property. The Army will report results of the annual

monitoring on a yearly basis. If MEC is encountered at the area during reuse (1) MEC incident reporting will be performed; (2) the project team (the Army, EPA, and DTSC; a part of Cal/EPA) will be notified; and (3) the need for re-evaluation of the protectiveness of the area under the current remedy would be assessed by the project team.

A review of the remedies selected for the Impact Area MRA will be conducted within 5 years after implementation. The purpose of the five-year review is to determine whether the remedy at a reuse area continues to be protective of human health and the environment (1) after a period of 5 years from the time the remedy was implemented, or (2) from the time of a previous five-year review. The results of annual monitoring and the methods, findings, and conclusions of the five-year review will be documented in a five-year review report, which will identify any recommendations to address them as appropriate.

At the time of each five-year review, the Army or Army's representatives would assess the status of the annual monitoring program based on the established reuse for each area, and document any recommendations or modifications to the program as described in the LUCI RD/RAWP.

4.2 Identification of Response Actions

Three different response actions are considered in this FS in the development of remedial alternatives for the Impact Area MRA as shown on Figure 1:

- **No Further Action**—Provided as a baseline for comparison to the other remedial alternatives as required under CERCLA and the NCP and described in Section 3.1.

- **Land Use Controls**—As described in Section 3.2, includes a range of potential components, including: prohibitions on unrestricted reuse in property transfer documentation; MEC recognition and safety training; construction monitoring by UXO-Qualified Personnel, and support during reuse activities; access management measures that could include maintaining a perimeter fence and signs; law enforcement security patrols; and onsite helicopters for fire suppression during select future HMP/HCP prescribed burns.

- **MEC Remediation**—As described in Section 3.3, vegetation clearance via prescribed burning would be implemented using a phased approach of conducting prescribed burning and MEC removals. Each contiguous prescribed burned area would not exceed 400 acres as specified under the HMP, unless specifically coordinated with USFWS; under the HMP, no more than 800 acres of the 6,560-acre Impact Area MRA would be allowed to be prescribed burned in any given year. The remedial action could include technology-aided surface removal and/or subsurface MEC removal, and would be completed over a period of approximately 10 to 22 years. All detected MEC would be removed and destroyed by detonation using an appropriate DDESB-approved method.

4.3 Development of Remedial Alternatives

The potentially applicable alternatives that would provide mitigation of potential After Action MEC risks for those receptors identified in the RA (Section 4.0; Volume I) at the Impact Area MRA were developed based on the applicable components of the response actions described above in Section 3.0.

As described in Section 2.2.1, the risk assessment for the Impact Area MRA assumed two different MEC removal actions could be implemented to address potential MEC risks: (1) technology-aided surface MEC removal (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible), and (2) subsurface MEC removal. Based

on the risk assessment, it is anticipated that unrestricted use that would allow unrestricted intrusive activities will be unacceptable after conducting either surface or subsurface MEC removals. Note that a potential residential receptor that could be expected to have intrusive activities as deep as 4 to 5 feet would have similar risk scores as a construction worker (potential After Action MEC Risk is E). Therefore, an unrestricted land use, typically represented by a residential exposure scenario by the regulatory agencies, would be prohibited. Appropriate land use controls would be necessary for proper management of any potential residual MEC risks. As described in Section 2.2, the objective of the remedial alternatives evaluation presented in this FS is to support the reuse of the Impact Area MRA as a habitat reserve. The HMP and additional requirements designate the entirety of the Impact Area MRA as a Natural Resource Management Area, and the Fort Ord Reuse Plan (as updated) designates the entirety of the Impact Area MRA as a Habitat Reserve.

Although surface and subsurface MEC removals would result in eliminating many MEC items from the site and reducing the possibility of future exposures, it would not be possible to verify all MEC items were removed to all depths. Therefore, a possibility would remain that an intruding receptor could encounter a MEC item. The results of the risk assessment indicate that potential After Action MEC Risk scores would remain in the high range for those receptors conducting intrusive activities. Therefore, Land Use Controls described in Section 3.2 will be evaluated as part of remedial alternatives to support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management). These land use controls will allow for proper management of the habitat reserve as described in the HMP and additional requirements.

4.4 Description of Remedial Alternatives

Four potential remedial alternatives were developed for the Impact Area MRA as described in the following sections, based on the applicable components of the response actions described above in Section 3.0, to provide a range of remedial approaches to (1) address potential After Action MEC risks for those receptors identified in the RA (Section 4.0; Volume I), and (2) allow for proper management of the Impact Area MRA as a habitat reserve.

The detailed analysis of the remedial alternatives presented in Section 5.0 provides further discussion of the assumptions used in estimating costs associated with implementing each of the components of the alternatives.

4.4.1 Alternative 1—No Further Action

This alternative assumes no further action would be taken to address potential After Action MEC risks for those receptors identified in the RA (Section 4.0; Volume I). This alternative is provided as a baseline for comparison to the other remedial alternatives as required under CERCLA and the National Contingency Plan (NCP) as described in Section 3.1.

4.4.2 Alternative 2—Technology-Aided Surface MEC Remediation and Land Use Controls

This alternative assumes Technology-Aided Surface MEC Remediation would be conducted throughout the entire Impact Area MRA. MEC detection instruments would be available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible. The prescribed burning and MEC removal actions would be conducted in stages, and a site-specific work plan would be developed for each phase of work. The work plan would describe the anticipated distribution of MEC, the vegetation

clearance plan, and the method for completion of the removal. It is assumed prescribed burning (followed by MEC remedial action) would be conducted in stages and consist of several small burns (approximately 100-acre units as described in Section 3.3.1.1) rather than one large burn. During each mobilization, a contiguous area of up to 400 acres would be burned (unless specifically coordinated with USFWS). Planned prescribed burns would not exceed 800 acres per year as allowed by the HMP for Habitat Reserve areas at the former Fort Ord. Therefore, for the purpose of this FS, MEC remedial actions would be conducted on up to 800 acres of the Impact Area MRA each year for approximately 8 years.

The Technology-Aided Surface MEC Remediation and Land Use Controls Alternative would include the following components:

- Prescribed burning to clear vegetation and provide access for MEC removals;

- Technology-aided surface MEC removal throughout the entire Impact Area MRA, and detonation with engineering controls of any MEC identified. MEC detection instruments would be available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible;

- Digital mapping to provide a record of remaining anomalies and to assist future property users in identifying areas with specific MEC safety support requirements for surface or subsurface activities; and

- Implementation of Land Use Controls (MEC recognition and safety training; construction monitoring for intrusive activities; UXO-qualified personnel support; access management measures, including regular security patrols of the Impact Area MRA perimeter and maintaining a perimeter fence and signs; fire suppression helicopters for select future HCP prescribed burn support; and property transfer documentation outlining the prohibition of unrestricted land use and any other reuse restrictions or conditions).

It should be noted that digital mapping would require manual and/or mechanical cutting of the burned vegetation in order to provide access to the digital geophysical equipment. Manual and mechanical cutting of maritime chaparral immediately following a prescribed burn is protective of the seedbank and is consistent with the HMP and Biological Opinions. Post-remediation habitat monitoring would be required. Digital mapping in some areas may not be implementable based on site conditions such as difficult terrain that prevent equipment access or operation; these areas would be documented in the After-Action report and digital mapping records.

Under this alternative, reusers conducting surface-only activities such as habitat monitoring and prescribed burning would be provided MEC recognition and safety training. Public access would be managed or restricted (e.g., accompanied by person(s) who have received MEC recognition and safety training). In addition, regular security patrols would be conducted along the perimeter of the Impact Area MRA to enforce access restrictions, and a perimeter fence and signs would be maintained. Intrusive activities such as erosion control, some invasive weed control, and facility development (construction) activities would be conducted with construction monitoring by UXO-Qualified Personnel, and MEC recognition and safety training would also be provided for workers conducting intrusive activities. A team of two full-time onsite UXO-qualified personnel would be available to provide long-term support during reuse of the property.

To address potential changes in site conditions due to erosion, the site would be assessed within 1 year of MEC removal to identify areas where MEC may be present at the surface due to erosion. Annual surface

reconnaissance/monitoring would be conducted following the surface removal by the Army until vegetation regrowth is sufficient to stabilize the site. Any areas where erosion and/or MEC were identified would then be placed in a monitoring program and additional surface removal would be conducted as appropriate. In addition, after the property is transferred, UXO-qualified personnel would be available for long-term support of reuse activities. After property transfer, the UXO-qualified personnel could perform additional surface reconnaissance if/as needed following prescribed burns that may be conducted by the future landowner.

Future 100-acre HMP/HCP prescribed burns would be conducted after property transfer for fire and habitat management purposes by the future landowner. The possible presence of subsurface MEC could make the use of hand crews and heavy equipment unsafe in some areas to address spot fires that may occur. The use of alternative methods to address spot fires could involve requirements for additional resources in those instances; therefore, an onsite fire suppression helicopter would be provided on an as needed basis for the duration of prescribed burning activities.

4.4.3 Alternative 3—Subsurface MEC Remediation and Land Use Controls

This alternative assumes Subsurface MEC Remediation would be conducted throughout the entire Impact Area MRA. The prescribed burning and MEC removal actions would be conducted in stages, and a site-specific work plan would be developed for each phase of work. The work plan would describe the anticipated distribution of MEC, the vegetation clearance plan, and the method for completion of the removal. It is assumed prescribed burning (followed by MEC remedial action) would be implemented using a phased approach and consist of several small burns (approximately 100-acre units as described in Section 3.3.1.1) rather than one large burn. During each mobilization, a contiguous area of up to 300 acres would be burned. Based on the implementation of interim action at Ranges 43 through 48, it is assumed that approximately 300 acres per year of subsurface MEC removals is implementable before the vegetation grows back. Therefore, for the purpose of this FS, Subsurface MEC Remediation would be conducted on 300 acres of the Impact Area MRA each year for approximately 22 years.

The Subsurface MEC Remediation and Land Use Controls Alternative would include the following components:

- Prescribed burning to clear vegetation and provide access to conduct MEC removals;
- MEC removal on the surface and in the subsurface throughout the entire Impact Area MRA (intrusive investigation of all anomalies), and detonation with engineering controls of any UXO identified;
- Digital mapping to provide a digital record, and investigation of remaining anomalies;
- Implementation of Land Use Controls (MEC recognition and safety training; construction monitoring for intrusive activities; UXO-qualified personnel support; access management measures, including regular security patrols of the Impact Area MRA perimeter and maintaining a perimeter fence and signs; and property transfer documentation outlining the prohibition of unrestricted land use and any other reuse restrictions or conditions); and
- Post-remediation habitat monitoring (collecting data on HMP species and habitats, and perform mapping, data management and evaluation, and reporting).

Based on a review of currently available MEC-related data, a total of approximately 320 acres of the Impact Area MRA could contain significant amounts of MEC and/or metallic debris and may require large-scale excavations to remove the subsurface MEC (Plate 5, RI; Volume I). For the purpose of this FS, this effort is assumed to include sifting the top 2-foot layer of soil. Post-remediation habitat restoration and monitoring would be required. It should be noted that the size of area that would require excavation and sifting is approximate; it could only be confirmed during MEC remediation. Based on the approximate size of these large-scale excavations, it will likely be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act.

It should be noted that subsurface removal and digital mapping would require manual and/or mechanical cutting of the burned vegetation. Manual and mechanical cutting of maritime chaparral immediately following a prescribed burn is protective of the seedbank and is consistent with the HMP and Biological Opinions. Post-remediation habitat monitoring would be required. Digital mapping in some areas may not be implementable based on site conditions such as difficult terrain that prevent equipment access or operation; these areas would be documented in the After-Action report and digital mapping records.

Under this alternative, workers conducting surface-only activities such as habitat monitoring and prescribed burning would be provided MEC recognition and safety training. In addition, regular security patrols would be conducted along the perimeter of the Impact Area MRA to enforce access restrictions, and a perimeter fence and signs would be maintained. Public access would be managed or restricted (e.g., restricted to designated roads and trails). Intrusive activities such as erosion control, some invasive weed control, and facility development (construction) activities would be conducted with construction monitoring by UXO-Qualified Personnel, and MEC recognition and safety training would be provided for workers conducting intrusive activities. A team of two full-time onsite UXO-qualified personnel would be available to provide long-term support during reuse of the property. Existing access roads would continue to be available for vehicle access.

4.4.4 Alternative 4—Technology-Aided Surface MEC Remediation, With Subsurface MEC Remediation in Selected Areas, and Land Use Controls

This alternative assumes Technology-Aided Surface MEC Remediation would be conducted throughout the entire Impact Area MRA, and Subsurface MEC Remediation would be conducted in selected areas as described below.

The components of this alternative would be as described for these alternatives above. As under the Technology-Aided Surface MEC Remediation and Land Use Controls Alternative (Alternative 2), the prescribed burning and MEC removal actions would be conducted in stages, and a site-specific work plan would be developed for each phase of work. The work plan would describe the anticipated distribution of MEC, the vegetation clearance plan, and the method for completion of the removal. It is assumed prescribed burning (followed by MEC remedial action) would be conducted in stages and consist of several small burns (approximately 100-acre units as described in Section 3.3.1.1) rather than one large burn. During each mobilization, a contiguous area of up to 400 acres would be burned (unless specifically coordinated with USFWS). Planned prescribed burns would not exceed 800 acres per year as allowed by the HMP for Habitat Reserve areas at the former Fort Ord. Therefore, for the purpose of this FS, MEC remedial actions would be conducted on 800 acres of the Impact Area MRA each year for approximately 8 years.

The Technology-Aided Surface MEC Remediation, With Subsurface MEC Remediation in Selected Areas, and Land Use Controls Alternative would include the following components:

- Prescribed burning to clear vegetation and provide access to conduct MEC removals.

- Technology-aided surface MEC removal throughout the entire Impact Area MRA, and detonation with engineering controls of any UXO identified. MEC detection instruments would be available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible.

- Subsurface MEC removals (intrusive investigation of all anomalies) in selected areas such as on fuel breaks and roads essential to habitat management activities, and for other limited areas that may require subsurface MEC removal for specific purposes to support the reuse as described below (for the purposes of this FS, assumed to be approximately 10 percent [656 acres] of the 6,560 acre Impact Area MRA).

- Digital mapping to provide a record of remaining anomalies and to assist future property users in identifying areas with specific MEC safety support requirements for surface or subsurface activities. Anomalies within the areas identified for subsurface MEC removals would be investigated or resolved. The digital map could be used by the future landowner to assist in land management decision making. The digital mapping would require manual and/or mechanical cutting of the burned vegetation in order to provide access to the digital geophysical equipment.

- Anomalies within the areas identified for subsurface MEC removals will be investigated or resolved.

- Implementation of Land Use Controls (MEC recognition and safety training; construction monitoring for intrusive activities; UXO-qualified personnel support; access management measures, including regular security patrols of the Impact Area MRA perimeter and maintaining a perimeter fence and signs; fire suppression helicopters for select future HCP prescribed burn support; and property transfer documentation outlining the prohibition of unrestricted land use and any other reuse restrictions or conditions).

- Post-remediation habitat monitoring within the areas of subsurface MEC removals (collecting data on HMP species and habitats, and perform mapping, data management and evaluation, and reporting).

Portions of Impact Area MRA Where Subsurface MEC Removal Would be Implemented in Selected Areas

Subsurface MEC removal in selected areas would be conducted in portions of the Impact Area MRA to address specific reuse concerns and needs. For the purposes of this FS, the total area of subsurface MEC removals is assumed to be approximately 10 percent (656 acres) of the 6,560 acre Impact Area MRA. The following portions of the Impact Area MRA are anticipated to be selected for implementation of subsurface MEC removals:

- Regularly maintained fuel breaks and access roads identified by the Army and future landowner for habitat management;

- A minimum 100-foot buffer area along the habitat-development border of the Impact Area MRA on the habitat side of the border that is adjacent to developed areas, and would act as an additional safety zone to provide firefighters with the ability to fight wildfires that might occur within the Impact Area

from the border buffer area. The firefighters would be able to temporarily widen fuel breaks under such circumstances, to protect life and property on the development side of the border. Per the HMP, fuel breaks are to be maintained on the development side of the border. The width of the buffer could be widened based on area-specific conditions that will be specified in the site-specific work plans for each phase of work. Vegetation would be allowed to regrow in the 100-foot buffer following Subsurface MEC Removal.

- Other areas to address specific risk and/or reuse needs, such as proposed, future habitat restoration sites, and areas of high density anomalies that are associated with sensitive-type munitions (assumed to be approximately 85 acres of the Impact Area MRA) that would be candidates for subsurface MEC removals via excavation and sifting as further described below.

Based on a review of currently available MEC-related data, a total of approximately 85 acres of the Impact Area MRA could contain significant amounts of MEC and/or metallic debris involving sensitively fuzed munitions types (Plate 5, RI; Volume I). These areas are candidates for additional actions (subsurface removal) in order to make it safe for future reusers. For the purpose of this FS, this effort is assumed to include sifting the top 2-foot layer of soil. Post-remediation habitat restoration and monitoring would be required. It should be noted that the size of area that would require excavation and sifting is approximate; it could only be confirmed during MEC remediation. Depending on the actual size of these large-scale excavations, it may also be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act.

After technology-aided surface MEC removals are completed for each phase of work described in the site-specific work plans, digital geophysical mapping will be conducted. Following the geophysical mapping the Army will review the data and prepare a Technical Memorandum to EPA and DTSC that will present an evaluation of the work completed to date and if necessary, describe additional subsurface removals recommended based on the results of the initial work. Factors that would be considered when determining whether additional actions are necessary include, but are not limited to: (1) type of MEC encountered and danger associated with MEC; (2) proximity to potential receptors; (3) density of items; and (4) consistency with ARARs. If no additional work is required this would also be documented in the Technical Memorandum along with the rationale for no further removal actions.

Each Technical Memorandum would be an addendum to the site-specific work plan, and therefore, would be associated with a primary document and be disputable. To avoid impacts to the rare, threatened and endangered species, completion and agency approval of the Technical Memorandum will be expedited to allow any additional actions to be executed before the next growing season. Each Technical Memorandum and associated correspondence would be made available to the public in the Administrative Record.

Under this alternative, workers conducting surface-only activities such as habitat monitoring and prescribed burning would be provided MEC recognition and safety training. In addition, regular security patrols would be conducted along the perimeter of the Impact Area MRA to enforce access restrictions, and a perimeter fence and signs would be maintained. Public access would be managed or restricted (e.g., accompanied by person(s) who have received MEC recognition and safety training). Intrusive activities such as erosion control, some invasive weed control, and facility development (construction) activities would be conducted with construction monitoring by UXO-Qualified Personnel, and MEC recognition and safety training would be provided for workers conducting intrusive activities. A team of two full-time onsite UXO-qualified personnel would be available to provide long-term support during reuse of the property. Existing access roads would continue to be available for vehicle access.

To address potential changes in site conditions due to erosion, the surface removal areas would be assessed within 1 year of MEC removal to identify areas where MEC may be present at the surface due to erosion. Annual surface reconnaissance/monitoring would be conducted following the surface removal until vegetation regrowth is sufficient to stabilize the site. Any areas where erosion and/or MEC were identified would then be placed in a monitoring program and additional surface removal would be conducted as appropriate. In addition, after the property is transferred, UXO-qualified personnel would be available for long-term support of reuse activities. After property transfer, the UXO-qualified personnel could perform additional surface reconnaissance if/as needed following prescribed burns that may be conducted by the future landowner.

Post-remediation digital mapping would require manual and/or mechanical cutting of the burned vegetation in order to provide access to the digital geophysical equipment. Manual and mechanical cutting of maritime chaparral immediately following a prescribed burn is protective of the seed bank and is consistent with the HMP and Biological Opinions. Post-remediation habitat monitoring would be required. Digital mapping in some areas may not be implementable based on site conditions such as difficult terrain that prevent equipment access or operation; these areas would be documented in the After-Action report and digital mapping records.

Future 100-acre HCP prescribed burns will be conducted for fire and habitat management purposes by the future landowner. The possible presence of subsurface MEC could make the use of hand crews and heavy equipment unsafe in some areas to address spot fires that may occur. The use of alternative methods to address spot fires could involve requirements for additional resources in those instances; therefore, an onsite fire suppression helicopter would be provided on an as needed basis for the duration of prescribed burning activities.

5.0 EVALUATION AND COMPARISON OF REMEDIAL ALTERNATIVES

This section presents the evaluation and comparison of the four remedial alternatives identified in Section 4.3 that would provide mitigation of potential MEC risks for receptors assumed to reuse the Impact Area MRA based on the nine CERCLA evaluation criteria specified in the EPA's RI/FS Guidance (*EPA, 1989*).

The four remedial alternatives developed for the Impact Area MRA that are evaluated and compared below include:

- Alternative 1: No Further Action
- Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls
- Alternative 3: Subsurface MEC Remediation and Land Use Controls
- Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls.

Table 2 summarizes the evaluation and comparison of potentially applicable remedial alternatives based on the following nine evaluation criteria specified in the EPA's RI/FS Guidance (*EPA, 1989*).

Threshold Criteria *(Remedial Action Objectives; See Section 2.2)*

(1) Overall Protection of Human Health and the Environment – An alternative must eliminate, reduce, or control potential threats to public health and the environment through treatment or institutional controls.

(2) Compliance with Applicable, Relevant and Appropriate Requirements (ARARs) – The alternative must meet Federal and State environmental statutes, regulations, and other requirements that pertain to the site or area unless a waiver is justified.

Balancing Criteria

(3) Long-Term Effectiveness and Permanence – Considers the ability of an alternative to maintain protection of human health and the environment over time.

(4) Reduction of Toxicity, Mobility, or Volume Through Treatment – Evaluates the alternative's use of treatment (for which there is a statutory preference) to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

(5) Short-Term Effectiveness – Considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

(6) Implementability – Considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services. Technical feasibility considerations include the availability of services, necessary equipment, and skilled workers to implement a particular alternative. Administrative feasibility includes obtaining necessary permits and regulatory approvals for implementation of the alternative.

(7) Cost – Capital and long-term management (LTM) costs are estimated for each alternative based on quotes for labor, materials, and equipment necessary to implement the alternative. For annual LTM costs, the net present value (NPV) is calculated over the expected period of years it will take to implement the alternative based on real discount rates (similar to interest rates) that vary according to the period of performance for federal projects. For those alternatives whose life-cycle is indeterminate or exceeds 30 years, for the purposes of evaluating and comparing alternatives as specified in EPA's RI/FS Guidance (*EPA, 1989*), a period of 30 years is used for estimating long term LTM costs. USACE/EPA provide guidelines for estimating remedial alternative costs in Office of Soil Waste and Emergency Response (OSWER) Directive 9355.0-75 (January 2007; updated yearly), Office of Management and Budget (OMB), Executive Office of the President, Appendix C. The guidelines for federal projects are applied to cost estimates provided by Army/USACE contractors for the alternatives. These cost estimates are intended to have an accuracy of +50 percent/-30 percent.

Modifying Criteria

(8) State Acceptance – Evaluates technical and administrative issues and concerns that the state may have regarding each alternative. State Acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received (*EPA, 1989*).

(9) Community Acceptance – Evaluates issues and concerns that the public may have regarding each alternative. Community Acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the report and Proposed Plan have been received (*EPA, 1989*).

5.1 Evaluation of Remedial Alternatives

This section presents the evaluation of the four remedial alternatives developed for the Impact Area MRA based on each of the nine CERCLA evaluation criteria described above.

5.1.1 Overall Protection of Human Health and the Environment

5.1.1.1 Overall Protection of Human Health

Alternative 1: No Further Action

The baseline MEC Risks since no MEC removal would be conducted would be the highest risk (E) for all receptors. This alternative would not be protective of human health in the long term for the receptors assumed in the Risk Assessment (RA) to reuse the Impact Area MRA during habitat management and monitoring activities under the HMP and other requirements (such as vegetation management via prescribed burning, monitoring, and maintenance of fuel breaks and roads essential for fire fighting activities). MEC is known to be present on the surface and likely in the subsurface and would pose MEC risks during reuse of the area.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls

The hypothetical After Action MEC Risks associated with a technology-aided surface removal (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible) are highest risk (E) for all intruding receptors and a medium risk (C) for surface only receptors. Technology-aided surface MEC removal would provide protection of human health by removing all detected MEC on the surface; however, MEC would not be removed from

the subsurface, and MEC could potentially be exposed over time in erosion-prone areas; periodic monitoring would detect and address such areas.

Land Use Controls would be protective of human health, including: (1) prohibitions on unrestricted reuse; (2) MEC recognition and safety training; (3) construction monitoring during any intrusive activities; (4) the availability of full-time onsite UXO-Qualified Personnel to provide safety education and UXO support as needed; (5) access management measures, including maintaining a perimeter fence and signs, and law enforcement support to prevent unauthorized access into the Impact Area MRA; and (6) helicopter support during select future HMP/HCP prescribed burns conducted by the future land owner. The Army recognizes that due to the presence of subsurface MEC these measures are necessary to provide protection of human health for reusers. The combination of technology-aided surface MEC remediation and Land Use Controls would support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements. In addition, prohibition of unrestricted land use would provide additional protection of human health.

Because subsurface MEC removal would not be conducted under this alternative, the possibility of MEC remaining below the surface along the boundary of the Impact Area MRA would need to be considered during development of adjacent property, and is expected to be addressed in a manner that is protective of human health and the environment. After remedial actions to remove surface MEC have been conducted, residual After Action MEC risks may be re-evaluated using site-specific MEC removal data, which, in addition to the digital geophysical mapping information, would be considered in verifying the appropriateness of remedial Land Use Control components.

Alternative 3: Subsurface MEC Remediation and Land Use Controls

The hypothetical After Action MEC Risks associated with a subsurface MEC removal for all receptors intruding below 1 foot remain highest risk (E). For shallow intruding receptors (those intruding less than one foot) and for surface only receptors the risk is lowest (A). Subsurface MEC removal would provide protection of human health by removing all detected MEC on the surface and in the subsurface; however, the potential for MEC to be present on the subsurface would remain.

Land Use Controls would be protective of human health, including: (1) prohibitions on unrestricted reuse; (2) MEC recognition and safety training; (3) construction monitoring during any intrusive activities; (4) the availability of full-time onsite UXO-Qualified Personnel to provide safety education and UXO support as needed; (5) access management measures, including maintaining a perimeter fence and signs, and law enforcement support to prevent unauthorized access into the Impact Area MRA. The combination of subsurface MEC remediation and Land Use Controls would support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements. In addition, prohibition of unrestricted land use would provide additional protection of human health.

Although subsurface MEC removal would be conducted under this alternative, the possibility of MEC remaining in the subsurface along the boundary of the Impact Area would need to be considered during development of adjacent property, and is expected to be addressed in a manner that is protective of human health. After remedial actions to remove all detected surface and subsurface MEC, residual After Action MEC risks may be re-evaluated using site-specific MEC removal data, which, in addition to the digital geophysical mapping information, would be considered in verifying the appropriateness of the remedial Land Use Control components.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls

The hypothetical After Action MEC Risks associated with the two different MEC remediation alternatives are described above under Alternatives 2 and 3. Alternative 4 offers a combination of the two approaches. This alternative includes a technology-aided surface MEC removal throughout the Impact Area MRA, and subsurface MEC removal in selected areas including: (1) fuel breaks and access roads; (2) a safety buffer area along the habitat-side of the development border of the Impact Area MRA, that would act as an additional safety zone and provide firefighters with the ability to fight wildfires that might occur within the Impact Area from the border; and (3) other areas to address specific risk and/or reuse needs. The proposed safety buffer would reduce the potential for casual MEC encounters by trespassers in areas that are potentially more susceptible to trespassing due to proximity to development areas.

Technology-aided surface MEC removal would provide protection of human health by removing all detectable MEC on the surface and in approximately 10 percent of the subsurface in selected areas where greater risk reduction would further facilitate reuse of the area as a habitat reserve, as described above. For the purposes of this FS, subsurface MEC removal is assumed to be implemented in approximately 10 percent of the Impact Area MRA. However, MEC would not be removed from approximately 90 percent of the subsurface, and MEC could potentially be exposed over time in erosion-prone areas; periodic monitoring would detect and address such areas. Land Use Controls would be protective of human health, including: (1) prohibitions on unrestricted reuse; (2) MEC recognition and safety training; (3) construction monitoring during any intrusive activities; (4) the availability of full-time onsite UXO-Qualified Personnel to provide safety education and UXO support as needed; (5) access management measures, including maintaining a perimeter fence and signs, and law enforcement support to prevent unauthorized access into the Impact Area MRA; and (6) helicopter support during select future HMP/HCP prescribed burns conducted by the future land owner. The Army recognizes that due to the presence of subsurface MEC these measures are necessary to provide protection of human health for reusers. The combination of technology-aided surface MEC remediation, subsurface MEC remediation in selected areas, and Land Use Controls would support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements. In addition, prohibition of unrestricted land use would provide additional protection of human health.

Although subsurface MEC would be removed from a safety buffer along the habitat-development border under this alternative, the possibility of MEC remaining in the subsurface along the boundary of the Impact Area would need to be considered during development of adjacent property, and is expected to be addressed in a manner that is protective of human health. After remedial actions to remove all detected surface and subsurface MEC, residual After Action MEC risks may be re-evaluated using site-specific MEC removal data, which, in addition to the digital geophysical mapping information, would be considered in verifying the appropriateness of the remedial Land Use Control components.

5.1.1.2 Overall Protection of the Environment

Natural Resources Background

Plate 5 shows the Fort Ord plant communities that are present within the Track 3 Impact Area MRA. The dominant community is the central maritime chaparral that covers about 6,066 acres of the Impact Area MRA. Other communities include the inland coast woodland community that comprises about 199 acres of the site, the grassland community (about 256 acres), and the wetland community that comprises about 24 acres of the site. A small portion of the site has been developed. Listed species present in the Impact

Area MRA include the California tiger salamander (*Ambystoma californiense*), sand gilia (*Gilia tenuiflora* ssp. *arenaria*), California goldfields (*Lasthenia conjugens*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), and Seaside bird's beak (*Cordylanthus rigidus* var. *litteralis*) including critical habitat designated for Monterey spineflower.

The Impact Area MRA is also home for the federally threatened California tiger salamander, which uses approximately 31 acres of vernal pools for reproduction and the remaining 1,444 acres of adjacent habitat for upland refuge. In addition to the listed species, the Impact Area MRA is also home to many other rare species including state endangered seaside bird's beak, Monterey manzanita (*Arctostaphylos montereyensis*), sandmat manzanita (*Arctostaphylos pumila*), Hooker's manzanita (*Arctostaphylos hookeri*), Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*), Coast wallflower (*Erysimum ammophilum*), California black legless lizard (*Anniella pulchra nigra*), and California linderiella (*Linderiella occidentalis*).

Alternative 1: No Further Action

Natural Resources Impacts

The habitat would not be able to be managed with prescribed burn and other measures as required by the HMP and Biological Opinions. This would result in a change to the age structure of the CMC habitat, which would no longer have a mosaic of many different age classes but rather an older senescent stand of CMC that would not support the diversity of plants and animals currently inhabiting the Impact Area MRA. In addition, the CMC would continue to grow to a point that would pose a significant fuel load that would increase the threat of a wildfire.

Overall Protection of the Environment

This alternative would not be protective of the environment in the long term because all HMP and other requirements for management of the habitat such as prescribed burning could not be implemented due to the explosive safety threat posed by MEC remaining on the surface. Therefore, this alternative would not comply with special requirements as described in the HMP and additional requirements.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls

Natural Resources Impacts

This alternative would include vegetation clearance using prescribed fire with a limited amount of manual and mechanical vegetation cutting to provide the required temporary fuel breaks to keep the fire within the containment lines. The remaining burned vegetation would be cut to the ground following the prescribed burn to allow the safe and effective use of the digital mapping equipment. The habitat would be monitored as required by the HMP and biological opinions to ensure the habitat recovers consistent with the success criteria.

Overall Protection of the Environment

This alternative would provide protection of the environment at the Impact Area MRA because prescribed burning and surface MEC removal (including preparation of temporary fuel breaks) would be performed using methods that would comply with the HMP and additional requirements. Since no excavations for MEC are proposed under this alternative, impacts to listed species are expected to be minimal. Reasonable and prudent measures would be to be taken during these activities to mitigate possible impacts to listed species or critical habitat for species such as the California tiger salamander, California

goldfields, Monterey spineflower, sand gilia, and seaside bird's beak. In addition, post-remediation habitat monitoring would continue to be conducted in accordance with the Vegetation Monitoring Plan and Wetland Monitoring and Restoration Plan for (1) HMP annual plants, (2) HMP shrubs, and (3) wetland species (*Burleson, 2006, 2007*). Results of monitoring would be documented in annual reports submitted to the USFWS and California Department of Fish and Game (CDFG).

Alternative 3: Subsurface MEC Remediation and Land Use Controls

Natural Resources Impacts

This alternative involves conducting a prescribed burn and preparing temporary fuel breaks to facilitate a safe and efficient burn to clear vegetation from the site. The remaining burned vegetation would be cut to the ground following the prescribed burn and initial surface sweep of MEC to allow the safe and effective use of the digital mapping equipment and to conduct subsurface MEC removal. The entire site would then be searched for subsurface MEC where subsurface anomalies would be intrusively investigated and sources of the anomalies are removed to the depths identified. In addition, approximately 320 acres (estimated) identified as high-density anomaly areas would be excavated and sifted to remove subsurface metallic clutter and possibly MEC. This would result in significant impacts to the natural resources and it would likely take decades to recover. The areas that would be sifted would likely require active restoration (planting) and all portions of the site would be monitored as required by the HMP and biological opinions to ensure the habitat recovers consistent with the success criteria.

Overall Protection of the Environment

Prescribed burning (including preparation of temporary fuel breaks) and subsurface MEC removal (detection and investigation of individual anomalies) would be performed using methods that would comply with the HMP and additional requirements. Reasonable and prudent measures would be taken during these activities to mitigate impacts to listed species or critical habitat for species such as the California tiger salamander, California goldfields, and Monterey spineflower, sand gilia, and seaside bird's beak. Prescribed burning and subsurface MEC removal have been conducted in other areas at the former Fort Ord in accordance with these requirements without significant adverse impacts to biological resources based on habitat monitoring results. In addition, post-remediation habitat monitoring would continue to be conducted in accordance with the Vegetation Monitoring Plan and Wetland Monitoring and Restoration Plan for (1) HMP annual plants, and (2) HMP shrubs, and (3) wetland species (*Burleson, 2007; Burleson, 2006*). Results of monitoring would be documented in annual reports submitted to the USFWS and CDFG.

However, based on a review of currently available MEC-related data, an estimated total of approximately 320 acres of the Impact Area MRA could contain significant amounts of MEC and/or metallic debris that are anticipated to require large-scale excavations to remove the MEC in the subsurface, including sifting the top 2-foot layer of soil. For this portion of the Impact Area MRA, this alternative would not be protective of the environment due to the scale of the habitat impacts. Excavation and sifting of high anomaly density areas would cause significant impacts and loss of listed species, seedbank, or critical habitat for species such as the California tiger salamander, California goldfields, and Monterey spineflower, sand gilia, and seaside bird's beak. The HMP and additional requirements currently limit the amount of temporary habitat destruction to 75 acres. Therefore, for the 320 acres anticipated to require excavation and sifting for which temporary habitat destruction would exceed this limit; it would be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act. In addition, the Army is required to ensure that habitat and species within any large-scale excavations recover. It would also be necessary to conduct active habitat restoration as a

corrective action in order to meet the HMP and additional requirements. Successful restoration of CMC habitat has not been attempted in such a large scale, and the success of the restoration effort is uncertain. The impacted areas must be monitored in accordance with the HMP and additional requirements to determine if the HMP success criteria have been achieved.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls

Natural Resources Impacts

This alternative substantially reduces the explosive risks, but would also result in manageable impacts to the significant natural resources found on the site. This alternative results in the use of prescribed fire to clear the rare CMC habitat as required by the HMP and biological opinions. It also results in a technology aided surface removal following the manual/mechanical clearance of the remaining burned vegetation following a burn to allow the safe and effective use of the digital mapping equipment. The subsurface MEC removal areas (assumed to be approximately 10 percent of the site for the purpose of the FS) would include a safety buffer along the habitat–side of the development interface, permanent fuel breaks and access roads, and other areas as required by the future land owner to support their reuse (e.g. habitat restoration areas, etc.). Following the completion of MEC remediation, the land would be able to be managed as identified by the HMP, biological opinions, HCP, and other supporting documents. In addition, approximately 85 acres (estimated) identified as high-density anomaly areas that are associated with sensitively fuzed munitions types would be excavated and sifted to remove subsurface metallic clutter and possibly MEC. This would result in significant impacts to the natural resources. The areas that would be sifted would likely require active restoration (planting) and all portions of the site would be monitored as required by the HMP and biological opinions to ensure the habitat recovers consistent with the success criteria.

Overall Protection of the Environment

Prescribed burning (including preparation of temporary fuel breaks), surface MEC removals, and subsurface MEC removals (detection and investigation of individual anomalies) would be performed in a manner that is protective of the environment as described above under Alternatives 2 and 3.

Based on a review of currently available MEC-related data, an estimated total of approximately 85 acres could contain significant amounts of MEC and/or metallic debris involving sensitively fuzed munitions types. These areas are candidates for subsurface removal under this alternative and are anticipated to require large-scale excavations to remove the MEC in the subsurface, including sifting the top 2-foot layer of soil. For this portion of the Impact Area MRA, as described above under Alternative 3, excavation and sifting would cause significant temporary impacts and loss of listed species, seedbank, or critical habitat for species such as the California tiger salamander, California goldfields, and Monterey spineflower, sand gilia, and seaside bird's beak. The HMP and additional requirements currently limit the amount of temporary habitat destruction to 75 acres. It should be noted that the acreages attributed for sifting are estimates; the actual number of acres of habitat that would be temporarily disturbed by excavation and sifting could be more or less depending on site conditions. The estimated 85 acres of sifting under this alternative would be conducted in several small areas over the entire period of the cleanup so that temporary habitat disturbance can be managed within the HMP allowance at any given time. Depending on the actual size of these large-scale excavations, the need for re-initiating formal consultation with the USFWS in accordance with the requirements of the ESA would be assessed and implemented as necessary.

5.1.2 Compliance with ARARs

Alternative 1: No Further Action—This alternative could not be implemented in compliance with all ARARs listed in Table 1. If MEC were not removed from the Impact Area MRA, management of habitat reserve under the HMP and additional requirements listed in Table 1 could not be fully implemented.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative would be implemented in compliance with the ARARs listed in Table 1.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative could not be implemented in compliance with all ARARs listed in Table 1. Subsurface MEC removals in the portion of the Impact Area MRA where high anomaly density areas are present (estimated to be approximately 320 acres) could not be implemented in a manner that complies with the ARARs listed in Table 1 under the HMP and additional requirements; it would be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act. Subsurface MEC removals in the remainder of the Impact Area MRA would be implemented in compliance with the ARARs listed in Table 1.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls —This alternative would be implemented in compliance with the ARARs listed in Table 1 for technology-aided surface MEC removal and subsurface MEC removal. As described above, excavation and sifting of high-density anomaly areas is anticipated in approximately 85 acres. The estimated 85 acres of sifting would be conducted in several small areas over the entire period of the cleanup so that temporary habitat disturbance can be managed within the HMP allowance of 75 acres at any given time. Depending on the actual size of these large-scale excavations, it may be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act.

5.1.3 Short-Term Effectiveness

Alternative 1: No Further Action—This alternative would be effective in the short term related to MEC because no further action would be taken to mitigate MEC risks, so there would be no immediate impacts to workers or the adjacent community. Existing property management would not be continued (e.g., maintain perimeter fence, conduct minimum habitat management requirements such as invasive weed and erosion control). This alternative would not be effective in the short term related to the environment, because it would not allow for timely implementation of the full scope of habitat management to be implemented under the HMP and additional requirements due to the presence of MEC remaining onsite.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative would be effective in the short term for surface MEC removal in each 800-acre per year phased implementation that would allow for timely implementation of MEC removals and the full scope of habitat management to be implemented under the HMP and additional requirements. Prescribed burns may cause some smoke impacts to the community, which are expected to be temporary. Community notification and smoke management would minimize potential impacts from smoke. Workers, the adjacent community, and the environment would be protected during implementation of prescribed burning, MEC removal, habitat management, and land use controls.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative would be effective in the short term for subsurface MEC removals in each 300-acre per year phased implementation that would allow for timely implementation of MEC removals and the full scope of habitat management

to be implemented under the HMP and additional requirements. Prescribed burns may cause some smoke impacts to the community, which are expected to be temporary. Community notification and smoke management would minimize potential impacts from smoke. Workers, the adjacent community, and the environment would be protected during implementation of prescribed burning, MEC removal, habitat management, and land use controls. However, in portions of the Impact Area MRA where high density anomalies are present and require excavation and sifting, there would be significant short-term impacts to the environment due to habitat destruction in order to address MEC risks. Depending on the extent of implementation in these areas during each phase of implementation and over the long term, short term impacts would need to be assessed, and would require restoration, corrective actions, and re-initiating formal consultation with the USFWS.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative would be effective in the short term for each 800-acre per year phased implementation as described above under Alternatives 2 and 3. Prescribed burns may cause some smoke impacts to the community, which are expected to be temporary. Community notification and smoke management would minimize potential impacts from smoke. Workers, the adjacent community, and the environment would be protected during implementation of prescribed burning, MEC removal, and land use controls. However, in portions of the Impact Area MRA where high density anomalies are present and require excavation and sifting, there would be significant short-term impacts to the environment in order to address MEC risks. Depending on the extent of implementation in these areas during each phase of implementation and over the long term, short term impacts would need to be assessed, and may require restoration, corrective actions, and re-initiating formal consultation with the USFWS.

5.1.4 Long-Term Effectiveness and Permanence

Alternative 1: No Further Action—This alternative would not provide long-term effectiveness or permanence regarding mitigation of potential MEC risks, because no further action would be taken to mitigate potential MEC risks to receptors assumed in the RA to reuse the area. In addition, this alternative is not anticipated to have long-term effectiveness and permanence in regards to the environment, because it would not allow for implementation of the full scope of habitat management and monitoring under the HMP and additional requirements.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative would provide long-term effectiveness and permanence regarding mitigation of potential MEC risks on the surface, because all MEC detected on the surface of the Impact Area MRA would be removed, a digital map of remaining anomalies would be available to the future land owner to assist in making land management decisions, and Land Use Controls would be implemented to mitigate risks from potentially remaining MEC to receptors assumed in the RA to reuse the area. However, because subsurface MEC would not be removed, potential exists for MEC items to be exposed to the surface over the long-term, which would be addressed via the remedial Land Use Controls.

Land Use Controls would be required to support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements. After remedial actions to address potential MEC risks at the Impact Area MRA have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, which, along with the digital geophysical mapping information, would be considered in verifying the appropriateness of remedial Land Use Control components. In addition, this alternative is anticipated to have long-term effectiveness and permanence regarding the environment because it would allow for implementation of the full scope of

habitat management and monitoring under the HMP and additional requirements. Post-remediation habitat monitoring would be conducted in accordance with HMP requirements to monitor the recovery of the habitat.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative would provide long-term effectiveness and permanence regarding mitigation of potential MEC risks, because all MEC detected on the surface and in the subsurface of the Impact Area MRA would be removed using the best appropriate technology, a digital map of remaining anomalies would be available to the future land owner to assist in making land management decisions, and Land Use Controls would be implemented to mitigate potentially remaining MEC risks to receptors assumed in the RA to reuse the area. However, because MEC may potentially remain onsite, long term Land Use Controls would be required to support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements. After remedial actions to address potential MEC risks at the Impact Area MRA have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, which, along with the digital geophysical mapping information, would be considered in verifying the appropriateness of remedial Land Use Control selected for implementation components. In addition, this alternative is anticipated to have long-term effectiveness and permanence regarding the environment for the majority of the Impact Area MRA because it would allow for implementation of the full scope of habitat management and monitoring under the HMP and additional requirements. Post-remediation habitat monitoring would be conducted in accordance with HMP requirements to monitor the recovery of the habitat. However, in the approximate 320-acre portion of the Impact Area MRA where high density anomalies are estimated to be present and require excavation and sifting, there could be significant long term impacts to the environment. Depending on the extent of implementation and recovery in each area during each phase of implementation, long-term impacts would need to be assessed, and would require restoration, corrective actions, and re-initiating formal consultation with the USFWS.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation, and Land Use Controls—This alternative would provide long-term effectiveness and permanence regarding mitigation of potential MEC risks on the surface and limited areas of the subsurface, because all MEC detected on the surface of the Impact Area MRA would be removed, and subsurface MEC would be removed from selected areas where greater risk reduction would further support the reuse, including fuel breaks and roads, a buffer along the habitat-side of the development border, and other limited areas. The potential for MEC to be exposed on the surface over the long-term due to changes in site conditions (e.g., erosion) would be addressed by follow up site monitoring. Land Use Controls would be required to support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management) and allow for proper management of the habitat reserve as described in the HMP and additional requirements.

The Land Use Controls include UXO-Qualified personnel support, access management support and helicopter support in some cases, to further support safe reuse activities by the future land owner. After remedial actions to address potential MEC risks at the Impact Area MRA have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, which, along with the digital geophysical mapping information, would be considered in verifying the appropriateness of Land Use Controls selected for implementation. In addition, this alternative is anticipated to have long-term effectiveness and permanence regarding the environment for the majority of the Impact Area MRA because it would allow for implementation of the full scope of habitat management and monitoring under the HMP and additional requirements. A digital map of remaining anomalies would be provided to the future landowner at the conclusion of the cleanup to assist the future landowner in their land management decisions. Post-remediation habitat monitoring would be conducted in accordance with HMP

requirements to monitor the recovery of the habitat. In the approximate 85-acre portion of the Impact Area MRA where high density anomalies are present and could require excavation and sifting, there could be significant long-term impacts to the environment. However, the acreages attributed for sifting are estimates; the actual number of acres of habitat that would be temporarily disturbed by excavation and sifting could be more or less depending on site conditions. In addition, temporary habitat impacts would be managed to be within the HMP allowance at any given time, and habitat restoration and monitoring would promote habitat recovery. Depending on the extent of implementation and recovery in each area during each phase of implementation, long term impacts would need to be assessed, and may require restoration, corrective actions, and re-initiating formal consultation with the USFWS.

5.1.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

This RI/FS addresses only the physical hazards to humans from MEC. The chemical hazards are being addressed under the Basewide Range Assessment (BRA) program (*Shaw/MACTEC, 2006*) and Site 39 Ranges Feasibility Study (*MACTEC, 2007*).

Alternative 1: No Further Action—This alternative would not provide reduction of these parameters through treatment because no further action would be taken to reduce the amount of MEC in the Impact Area MRA.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative would provide significant reduction of these parameters through treatment because all MEC detected on the surface of the Impact Area MRA would be removed.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative would provide the greatest reduction of these parameters through treatment because all MEC detected on the surface and in the subsurface of the Impact Area MRA would be removed.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative would provide significant reduction of these parameters through treatment because all MEC detected on the surface of the Impact Area MRA would be removed, and MEC detected in the subsurface would be removed in selected areas of the Impact Area MRA where greater risk reduction would further support the reuse.

5.1.6 Implementability

Alternative 1: No Further Action—This alternative would not be administratively feasible to implement because the necessary approvals to take no further action to mitigate potential MEC risks to reusers assumed in the RA are not expected. This alternative would be technically easy to implement (since taking no further action), however it would not comply with ARARs.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative would be administratively feasible to implement, because the necessary approvals to implement surface MEC removals to reduce potential MEC risks for planned reuses could be obtained. The necessary services, equipment, and skilled workers to implement this alternative are readily available. This alternative would require a high level of effort to implement from a technical perspective, because (1) it would require vegetation clearance via prescribed burning prior to implementation of MEC removal, and (2) involves UXO-Qualified Personnel teams conducting MEC removals, and managing and reporting MEC-related data. Prescribed burning of up to 800 acres per year would require significant coordination and level of effort, and would be moderately difficult to implement due to the many

components involved in conducting a prescribed burn as follows: (1) Preparation of a burn prescription/burn plan outlining the objectives of the burn, the burn area, and the range of environmental conditions (temperature, humidity, wind speed/direction, fuel load, and fuel moisture) under which the burn will be conducted; (2) site preparation, including establishment and maintenance of containment lines, staging areas, and escape routes in accordance with the burn plan; (3) identifying the optimum weather conditions in order to conduct the burns within the window of environmental conditions established in the burn prescription; and (4) conducting follow-up operations to ensure that the fire is fully contained and does not escape the perimeter of the burn area. A site-specific work plan will be prepared prior to each phase of work, and would include a burn plan and community notification program. In addition, after MEC remediation is completed, Land Use Controls are expected to be easy to implement during reuse to protect human health.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative would be administratively feasible to implement, because the necessary approvals to implement surface and subsurface MEC removals to reduce potential MEC risks for planned reuses could be obtained. The necessary services, equipment, and skilled workers to implement this alternative are readily available. This alternative would require an extremely high level of effort to implement from a technical perspective, because it (1) would require vegetation clearance via prescribed burning prior to implementation of MEC removal; (2) involves UXO-Qualified Personnel teams conducting subsurface MEC removals via intrusive investigation of anomalies, and managing and reporting MEC-related data. Subsurface MEC removals require a much higher level of effort than surface MEC removals to investigate and resolve each anomaly detected below the surface. Prescribed burning of up to 300 acres per year would require significant coordination and level of effort as described under Alternative 2; however, it would be conducted on fewer acres per year, so is anticipated to be somewhat easier to implement from this perspective than described under Alternative 2 in terms of level of effort. In addition, after MEC remediation is completed, Land Use Controls are expected to be easy to implement during reuse to protect human health. From an administrative perspective, this alternative would be difficult to implement in the approximate 320-acre portion of the Impact Area MRA where high density anomalies are assumed to be present and require excavation and sifting. There would be significant long-term impacts to the environment in this area that would need to be assessed, and consulted on with the USFWS. The impacts would require long-term habitat restoration, monitoring, and reporting to ensure corrective actions were successful.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative would be administratively feasible to implement, because the necessary approvals to implement technology-aided surface and subsurface MEC removals in selected areas (e.g., fuel breaks, roads) could be obtained. The necessary services, equipment, and skilled workers to implement this alternative are readily available. This alternative would require an extremely high level of effort to implement from a technical perspective, because (1) it would require vegetation clearance via prescribed burning prior to implementation of MEC removal, and (2) involves UXO-Qualified Personnel teams conducting MEC removals on the surface and in the subsurface via intrusive investigation of anomalies, and managing and reporting MEC-related data. Prescribed burning of up to 800 acres per year would require significant coordination and level of effort as described above under Alternative 2. In addition, after MEC remediation is completed, Land Use Controls are expected to be easy to implement during reuse to protect human health. From an administrative perspective, this alternative would be moderately difficult to implement in the approximate 85-acre portion of the Impact Area MRA where high density anomalies are assumed to be present and require excavation and sifting. There could be significant impacts to the environment. It should be noted the acreages attributed for sifting are estimates; the actual number of acres of habitat that would be temporarily disturbed by excavation and sifting could be more or less depending on site conditions.

Depending on the extent of implementation and recovery in each area during each phase of implementation, long term impacts would need to be assessed, in consultation with the USFWS. The impacts would require long-term habitat restoration, monitoring, and reporting to ensure corrective actions were successful.

5.1.7 Cost

Capital and LTM costs are estimated for each alternative based on quotes for labor, materials, and equipment necessary to implement the alternative. For LTM costs, the NPV is calculated over the expected period of years it will take to implement the alternative based on real discount rates (similar to interest rates) that vary according to the period of performance for federal projects. USACE/EPA provide guidelines for estimating remedial alternative costs in OSWER Directive 9355.0-75 (January 2007; updated yearly), OMB, Executive Office of the President, Appendix C. The guidelines for federal projects are applied to cost estimates provided by Army/USACE contractors for the alternatives. These cost estimates are intended to have an accuracy of +50 percent/-30 percent. For those alternatives whose life-cycle is indeterminate or exceeds 30 years, for the purposes of evaluating and comparing alternatives as specified in EPA's RI/FS Guidance (*EPA, 1989*), a period of 30 years is used for estimating LTM costs.

Cost estimating assumptions, unit costs, and real discount rates (that vary according to the period of performance) that are associated with implementation of the remedial alternatives are provided in Appendix A. Estimated costs for each of the alternatives evaluated are summarized in Table 3.

Long Term Management Measures (property transfer restrictions, annual monitoring, five-year review reporting) will be implemented at the Impact Area MRA as implementation and management aspects of the selected remedy. The costs associated with implementing these measures for the entire Impact Area MRA over a period of 30 years are estimated at approximately $453,000 ($22,000 in Capital Costs and $431,000 in annual costs). Cost estimates for these measures and assumptions are provided in Appendix A, Table A-2.

Cost estimates associated with implementation of the remedial alternatives are presented in Appendix A, Tables A-3 through A-5, and are summarized as follows.

Alternative 1: No Further Action—There are no costs associated with implementation of this alternative.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—Cost estimates and assumptions for this alternative are provided in Appendix A, Table A-3, and are estimated as follows:

- Total Cost: $88.90 million over a period of 30 years assumed for costing purposes.
- Capital Cost (Year 1): $8.88 million associated with the phased implementation of 800 acres per year prescribed burning, MEC removal, and reporting.
- Annual Costs (Years 1 to 30): $80.02 million associated with the phased implementation of 800 acres per year prescribed burning, MEC removal, habitat management, reporting, and Land Use Controls.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—Cost estimates and assumptions for this alternative are provided in Appendix A, Table A-4, and are estimated as follows:

- Total Cost: $423.17 million over a period of 30 years assumed for costing purposes.
- Capital Cost (Year 1): $23.41 million associated with the phased implementation of 300 acres per year prescribed burning, MEC removal, and reporting.
- Annual Costs (Years 1 to 30): $399.76 million associated with the phased implementation of 300 acres per year prescribed burning, MEC removal, sifting and restoration of approximately 320 acres of high-density anomaly areas, habitat management, reporting, and Land Use Controls.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—Cost estimates and assumptions for this alternative are provided in Appendix A, Table A-5, and are estimated as follows:

- Total Cost: $138.41 million over a period of 30 years assumed for costing purposes.
- Capital Cost (Year 1): $15.38 million associated with the phased implementation of 800 acres per year prescribed burning, MEC removal, and reporting.
- Annual Costs (Years 1 to 30): $123.03 million associated with the phased implementation of 800 acres per year prescribed burning, MEC removal, sifting and restoration of approximately 85 acres of high-density anomaly areas that are associated with sensitively fuzed munitions types, habitat management, reporting, and Land Use Controls.

5.1.8 State Acceptance

State acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received. Anticipated acceptability of the remedial alternatives are described as follows:

Alternative 1: No Further Action—This alternative is not likely to be acceptable to the regulatory agencies because it would not be protective if human health, as it does not take action to mitigate potential MEC risks to workers assumed in the RA to reuse the Impact Area MRA during habitat management activities under the HMP and additional requirements. In addition, it would not be protective of the environment or comply with ARARs.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative is not anticipated to be acceptable to the regulatory agencies because, although it takes action both in the short and long term to mitigate MEC risks, and also implements Land Use Controls to protect receptors that may conduct intrusive activities during planned reuses, thereby providing protection of human health, MEC present in the subsurface would not be removed under this alternative. It also would be protective of the environment because it would allow for habitat management activities required under the HMP and additional requirements. It is anticipated that regulatory agencies concerned with protection of human health would be supportive of removing all MEC in the subsurface as well to reduce potential MEC risks in the long term; however, Land Use Controls that provide additional protection for future users due to the presence of subsurface MEC would be implemented. It is anticipated that regulatory agencies concerned with protection of the environment would be supportive of this alternative, because it

would not involve excavation of MEC during subsurface removals that could have significant impacts on biological resources protected under the ESA, HMP and other requirements.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative is likely to be acceptable to the regulatory agencies because it takes action both in the short and long term to mitigate MEC risks, and also implements Land Use Controls to protect receptors that may conduct intrusive activities during planned reuses, thereby providing protection of human health. It also would be protective of the environment for the majority of the Impact Area MRA because it would allow for habitat management activities required under the HMP and additional requirements. However, for the approximate 320-acre portion of the Impact Area MRA where high density anomalies are present that would require excavation and sifting with significant habitat destruction, it would not be protective of the environment or comply with ARARs. It is anticipated that regulatory agencies concerned with protection of human health would be supportive of removing all MEC in the subsurface to reduce potential MEC risks in the long term. It is anticipated that regulatory agencies concerned with protection of the environment would not be supportive of this alternative, because it would have significant impacts on biological resources protected under the ESA, HMP and other requirements.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative is likely to be acceptable to the regulatory agencies because it takes action both in the short and long term to mitigate MEC risks, as well as Land Use Controls to protect receptors during planned reuses, thereby providing protection of human health. It also would be protective of the environment because it would allow for habitat management activities required under the HMP and additional requirements. It is anticipated that regulatory agencies concerned with protection of human health would be supportive of this alternative because it removes all MEC from the surface, and in specific areas from the subsurface to reduce MEC risks in the long term. It is anticipated that regulatory agencies concerned with protection of the environment would be supportive of this alternative, because it minimizes the disturbance due to subsurface MEC removals, including large scale excavations, on biological resources protected under the ESA, HMP and other requirements.

5.1.9 Community Acceptance

Community acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received. Anticipated acceptability of the remedial alternatives are described as follows:

Alternative 1: No Further Action—This alternative is not likely to be acceptable to the public and other stakeholders because it does not take action to mitigate MEC risks onsite, nor to mitigate risks to workers assumed in the RA to reuse the Impact Area MRA during habitat management activities required under the HMP and additional requirements.

Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls—This alternative may be acceptable to the public and other stakeholders because it takes action both in the short and long term to mitigate MEC risks by removing MEC, and also implementing Land Use Controls to protect receptors during planned reuses, thereby providing protection of human health. It also would be protective of the environment because it would allow for habitat management activities required under the HMP and additional requirements. It is anticipated that some community members would have concerns regarding potential impacts to the public associated with prescribed burning, and the presence of MEC in the subsurface that would not be removed under this alternative. However, it is anticipated that other community members would be supportive of this alternative because it removes all MEC from the surface and allows for reuse as habitat reserve.

Alternative 3: Subsurface MEC Remediation and Land Use Controls—This alternative may be acceptable to the public and other stakeholders because it takes action both in the short and long term to mitigate MEC risks by removing MEC, and also implementing Land Use Controls to protect receptors during planned reuses, thereby providing protection of human health. It also would be protective of the environment in the long term, because it would allow for habitat management activities required under the HMP and additional requirements. It is anticipated that some community members would have concerns regarding potential impacts to the public associated with prescribed burning under this alternative. However, it is anticipated that other community members would be supportive of this alternative because it removes all MEC from the surface and subsurface and allows for reuse as habitat reserve.

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative may be acceptable to the public and other stakeholders because it takes action both in the short and long term to mitigate MEC risks by removing MEC, as well as implementing Land Use Controls to protect receptors during planned reuses, thereby providing protection of human health. It also would be protective of the environment because it would allow for habitat management activities required under the HMP and additional requirements. It is anticipated that some community members would have concerns regarding potential impacts to the public associated with prescribed burning, and the presence of MEC in the subsurface that would not be removed under this alternative except in limited areas. However, it is anticipated that other community members would be supportive of this alternative because it removes all MEC from the surface and portions of the subsurface and allows for reuse as habitat reserve.

5.2 Comparison of Remedial Alternatives

The four remedial alternatives evaluated above for the Impact Area MRA are compared below based on their ability to achieve the nine evaluation criteria specified in the EPA's RI/FS Guidance (*EPA, 1989*).

5.2.1 Overall Protection of Human Health and the Environment

5.2.1.1 Overall Protection of Human Health

Alternative 1 would not be protective of human health because it takes no action to address the known presence of MEC or potential MEC risks posed to the receptors assumed in the RA to reuse the Impact Area MRA, and would not allow for safe access to perform required habitat management procedures protective of the environment. Alternatives 2, 3, and 4 would all be protective of human health for the receptors assumed in the RA to reuse the Impact Area MRA in combination with Land Use Controls. Alternative 3 would provide the greatest level of protection for human health because it would remove all MEC on the surface and subsurface, thereby mitigating potential MEC risks to reusers to the greatest degree. However, because there is a potential for MEC to remain onsite regardless of the level of removal, Land Use Controls would be included with all three alternatives to provide an equivalent level of protection for each alternative to (1) support safe reuse activities (e.g., habitat monitoring, invasive weed control, prescribed burning, and associated fire management); and (2) allow for proper management of the habitat reserve as described in the HMP and additional requirements.

5.2.1.2 Overall Protection of the Environment

Natural Resources Impacts

Alternative 1 would not allow for the habitat to be managed as required by the HMP and Biological Opinions. This would result in a change to the age structure of the CMC habitat, which would no longer

have a mosaic of many different age classes but rather an older senescent stand of CMC which would not support the diversity of plants and animals currently inhabiting the Impact Area MRA. In addition, the CMC would continue to grow to a point that would pose a significant fuel load that would increase the threat of a wildfire.

Alternative 2 would have the least impact on the significant natural resources found on the site. The habitat would be monitored as required by the HMP and biological opinions to ensure the habitat recovers consistent with the success criteria identified. There are fewer impacts to natural resources expected under this alternative since no excavations would occur.

Alternative 3 would result in significant impacts to the natural resources and would likely take decades to recover. The areas that would be sifted would likely require active restoration (planting) and all portions of the site would be monitored as required by the HMP and biological opinions to ensure the habitat recovers consistent with the success criteria identified. This alternative would result in the most significant impacts to natural resources compared to the other alternatives.

Alternative 4 would also result in minimal impacts to the significant natural resources found on the site. Subsurface MEC removal would be implemented in selected areas of the Impact Area MRA where greater risk reduction would further facilitate reuse of the area as a habitat reserve. The subsurface MEC removal areas would include a 100-foot buffer along the habitat side of the development interface, permanent fuel breaks and access roads, and other areas as required by the future landowner to support their reuse (e.g., habitat restoration, additional fuel breaks, etc.). Following completion of this alternative the land would be able to be managed as identified by the HMP, biological opinions, HCP, and other supporting documents.

Overall Protection of the Environment

Alternative 1 would not be protective of the environment in the long term because all HMP and other requirements for management of the habitat such as prescribed burning and monitoring could not be implemented under this alternative. Therefore, this alternative would not comply with special requirements as described in the HMP and additional requirements.

Alternatives 2, 3, and 4 would all be protective of the environment for the majority of the Impact Area MRA where high anomaly density areas are not present. Prescribed burning, surface MEC removals, and subsurface MEC removals would be performed using methods that would comply with HMP and additional requirements incorporating reasonable and prudent measures to avoid or mitigate impacts to listed species or critical habitat for species such as the California tiger salamander, California goldfields, and Monterey spineflower, sand gilia and seaside bird's beak. Prescribed burning, surface MEC removals, and subsurface MEC removals have been conducted in other areas at the former Fort Ord in accordance with these requirements without significant adverse impacts to biological resources based on habitat monitoring results. In addition, post-remediation habitat monitoring would continue to be conducted in accordance with the Vegetation Monitoring Plan and Wetland Monitoring and Restoration Plan for (1) HMP annual plants, (2) HMP shrubs, and (3) wetland species (*Burleson, 2006, 2007*). Results of monitoring would be documented in annual reports submitted to the USFWS and CDFG.

Alternative 3 is anticipated to have the most significant impacts to the environment due to the approximately 320 acres containing high-density anomalies that are anticipated to require large-scale excavations to remove the MEC in the subsurface, including sifting the top 2-foot layer of soil. For this portion of the Impact Area MRA, excavation and sifting of high anomaly density areas would cause significant impacts that exceed the current 75-acre limit in the HMP. Alternative 4 is also anticipated to

include subsurface MEC removal on up to 85 acres anticipated to require excavation and sifting, in areas where high density anomaly is present and are associated with sensitive munitions types. However, for this alternative the 85 acres is close to the 75–acre limit and: (1) is an estimate that would be confirmed during implementation when access to these areas is available after prescribed burning is conducted to clear vegetation; (2) does not significantly exceed the 75 acre limit; and (3) subsurface MEC removals in the 85 acres would not be conducted all at once, but would be implemented in different areas in phases of smaller acreages, allowing for management and monitoring of the need for potential restoration measures, corrective actions, and re-initiating formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act to be assessed and implemented as necessary.

5.2.2 Compliance with ARARs

Alternative 1 could not be implemented in compliance with all ARARs listed in Table 1. If MEC were not removed from the Impact Area MRA, management of habitat reserve under the HMP and additional requirements listed in Table 1 could not be implemented. Alternative 2 would be implemented in compliance with ARARs. Alternative 3 could not be implemented in compliance with all ARARs listed in Table 1. Subsurface MEC removals in the portion of the Impact Area MRA where high anomaly density areas are present (320 acres) could not be implemented in a manner that complies with the HMP and additional requirements. It would be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the Endangered Species Act. Subsurface MEC removals in the remainder of the Impact Area MRA would be implemented in compliance with the ARARs listed in Table 1. Alternative 4 would be implemented in compliance with ARARs. However, as described above, depending on the actual extent of excavation and sifting of the high-density anomaly areas associated with sensitive type munitions (estimated to be approximately 85 acres), it may be necessary to re-initiate formal consultation with the USFWS in accordance with the requirements of the ESA.

5.2.3 Short-Term Effectiveness

Alternative 1 would be effective in the short term regarding workers and the community because no further action would be taken to mitigate MEC risks, so there would be no potential immediate impacts regarding MEC. Alternatives 2, 3, and 4 would all be effective in the short term regarding mitigation of MEC risks for each 300- or 800-acre per year phased implementation. Prescribed burns may cause some smoke impacts to the community, which are expected to be temporary. Community notification and smoke management would minimize potential impacts from smoke. Workers and the community would be protected during implementation of prescribed burning, MEC removal, and land use controls via safety protocols that will be described in the implementation work plan. Regarding the environment, Alternatives 3 and 4 would have significant impacts on the environment for the portions of the Impact Area MRA where high density anomalies would require excavation and sifting that would require mitigation.

5.2.4 Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness or permanence because no further action would be taken. Alternatives 2, 3, and 4 would all provide long-term effectiveness and permanence during reuse because all MEC detected on the surface and portions or all of the subsurface MEC in the Impact Area MRA would be removed using the best appropriate technology, and land use controls would be implemented to mitigate remaining MEC risks during reuse. Although the risk assessment did not show a significant difference in overall risk reduction between these alternatives, Alternative 3 would provide a greater degree of long-term effectiveness and permanence because it is assumed to remove all MEC

detected on the surface and in the subsurface. Alternative 4 would provide for subsurface MEC removal in selected areas where greater risk reduction would further facilitate reuse of the area as a habitat reserve. After remedial actions to address potential MEC risks at the Impact Area MRA have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, which, along with the digital geophysical mapping information, would be considered in verifying the appropriateness of the remedial Land Use Control components. Regarding the environment, Alternative 3 would have the most significant long-term impacts, and Alternative 4 may have significant long-term impacts on the environment for the portions of the Impact Area MRA where high density anomalies would require excavation and sifting that would require mitigation.

5.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 would not provide reduction of these parameters through treatment because no further action would be taken to remove MEC within the Impact Area MRA. Alternatives 2, 3, and 4 would all provide varying degrees of reduction of these parameters through treatment. Under Alternatives 2 and 4, all MEC detected on the surface would be removed. Under Alternative 4, subsurface MEC would be removed from within selected areas (approximately 10 percent) of the Impact Area MRA. Alternative 3 would provide the greatest reduction of these parameters through treatment because it would remove all MEC detected on the surface and in the subsurface.

5.2.6 Implementability

Alternative 1 would be not be administratively feasible to implement because the necessary approvals to (1) take no further action to mitigate the MEC risks, and (2) allow for management of habitat reserve under the HMP and additional requirements, are not expected. Alternatives 2, 3, and 4 would all be implementable from a technical perspective, because the necessary approvals to (1) implement MEC removals to reduce potential MEC risks for planned reuses; and (2) allow for management of habitat reserve under the HMP and additional requirements, could be obtained. The necessary services, equipment, and skilled workers to implement these alternatives are also readily available. However, Alternative 3 would require the highest level of effort to implement from a technical perspective, because it involves subsurface investigation of all anomalies throughout the Impact Area MRA. Alternatives 2, 3, and 4 would all require significant coordination and level of effort to implement prescribed burning prior to MEC removals as follows: (1) Preparation of a burn prescription/burn plan outlining the objectives of the burn, the burn area, and the range of environmental conditions (temperature, humidity, wind speed/direction, fuel load, and fuel moisture) under which the burn will be conducted; (2) site preparation, including establishment and maintenance of containment lines, staging areas, and escape routes in accordance with the burn plan; (3) identifying the optimum weather conditions for conducting the burn within the window of environmental conditions established in the burn prescription; and (4) conducting follow-up operations to ensure that the fire is fully contained and does not escape the perimeter of the burn area.

In addition, after MEC remediation is completed under Alternatives 2, 3, and 4, After Action MEC risks may be re-evaluated using site-specific MEC removal data, which, in addition to the digital geophysical mapping information, would be considered in verifying the appropriateness of the remedial Land Use Control components. Determining and implementing appropriate Land Use Controls and habitat monitoring are expected to be easy to implement to protect human health during reuse.

5.2.7 Cost

Table 3 and Appendix A, Table A-1 summarize the estimated costs associated with implementation of the four remedial alternatives. The No Further Action Alternative has no costs associated with its implementation, but it takes no long-term action to mitigate the MEC risks, and would not allow for management of habitat reserve under the HMP and additional requirements. Of the three MEC remediation alternatives, Alternative 2 has the lowest total estimated cost associated with its implementation, of $88.90 million. Alternative 3 has the highest total estimated cost associated with its implementation, of approximately $423.17 million. Alternative 4 has a total estimated cost associated with implementation of approximately $138.41 million, which is in between the total estimated costs for implementation of Alternatives 2 and 3. Cost estimates for these alternatives, and Long Term Management Measure costs of $453,000 for the entire Impact Area MRA are provided in Appendix A, and are summarized on Table A-1; with costs for Long Term Management Measures and Alternatives 2 through 4 presented in Tables A-2 through A-5, respectively.

5.2.8 State Acceptance

State acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received. It is anticipated Alternative 1 would not be acceptable to the regulatory agencies because it takes no MEC remedial action to address MEC risks, and would not allow for habitat management under the HMP and other requirements. It is anticipated the regulatory agencies may not be supportive of Alternative 2 because it does not address the presence of MEC in the subsurface; however, they are anticipated to be supportive of Alternatives 3 and 4 depending on their concerns regarding varying components of each alternative in terms of its protectiveness of human health and/or the environment.

5.2.9 Community Acceptance

Community acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received. It is anticipated Alternative 1 would not be acceptable to the community because it takes no MEC remedial action to address MEC risks, and would not allow for habitat management under the HMP and other requirements. It is anticipated the community may be supportive of Alternatives 2, 3, and 4 depending on their concerns regarding varying components of each alternative in terms of its protectiveness of human health and/or the environment.

6.0 IDENTIFICATION OF THE PREFERRED REMEDIAL ALTERNATIVE

This section identifies the preferred remedial alternative that best meets the evaluation criteria for MEC remediation at the Impact Area MRA. Long Term Management Measures (i.e., property transfer documentation, annual monitoring, and five-year review reporting) associated with the implementation and management of the selected remedy for the Impact Area MRA are estimated to have a total cost over a period of 30 years of approximately $453,000. Cost estimates for these measures are provided in Appendix A, Table A-2.

The four remedial alternatives evaluated and compared in Section 5.0 based on the nine CERCLA evaluation criteria specified in the EPA's RI/FS Guidance (*EPA, 1989*) for the Impact Area MRA include:

- Alternative 1: No Further Action
- Alternative 2: Technology-Aided Surface MEC Remediation and Land Use Controls
- Alternative 3: Subsurface MEC Remediation and Land Use Controls
- Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls.

Based on the evaluation and comparison of the four potential remedial alternatives, Alternative 4 is identified as the preferred remedial alternative for implementation at the Impact Area MRA. The main components of this alternative are summarized as follows:

Alternative 4: Technology-Aided Surface MEC Remediation, Subsurface MEC Remediation in Selected Areas, and Land Use Controls—This alternative includes Technology-Aided Surface MEC Remediation throughout the entire Impact Area MRA (with MEC detection instruments available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible), and Subsurface MEC Remediation in selected areas where greater risk reduction would further facilitate reuse of the area as a habitat reserve. Subsurface MEC remediation would be conducted in selected areas including (1) regularly maintained fuel breaks and access roads; (2) a buffer area along the habitat-side of the development border of the Impact Area MRA that would act as an additional safety zone and provide firefighters with the ability to fight wildfires from the border (minimum 100-ft width, may be expanded if site conditions warrant); and (3) other areas to address specific risk and/or reuse needs such as proposed, future land owner habitat restoration areas. For the purposes of this FS, subsurface MEC removals are assumed to be conducted in approximately 10 percent of the Impact Area MRA.

It is assumed prescribed burning (followed by MEC remedial action) would be implemented using a phased approach. Prescribed burns would be conducted in stages and consist of several smaller burns, approximately 100 acres in size (actual size could be more or less than 100 acres depending site-specific considerations), over several days, rather than one large burn. Prescribed burning and MEC remedial actions would be conducted in up to 800 acres of the 6,560-acre Impact Area MRA per year, for 8 years. In compliance with the HMP, no more than 800 acres would be prescribed burned in any given year.

The Technology-Aided Surface MEC Remediation and Subsurface MEC Remediation in Selected Areas Alternative would include the following components:

- Prescribed burning to clear vegetation and provide access to conduct MEC removals.

- Technology-Aided surface MEC removal throughout the entire Impact Area MRA, and detonation with engineering controls of any UXO identified; MEC detection instruments would be available onsite for investigation and removal of any MEC present in areas where the ground surface is not visible; surface reconnaissance would be conducted annually following surface MEC remediation to identify and address erosion-prone areas, until re-growth of vegetation stabilizes the area.

- Subsurface MEC removal (intrusive investigation of all anomalies) on fuel breaks and roads essential to safe habitat management activities, a safety buffer along the habitat-side of the development boundary, and other selected areas where greater risk reduction would further support the reuse (such as proposed future land owner habitat restoration areas). For the purposes of this FS, subsurface MEC removal is assumed to be conducted in approximately 10 percent of the Impact Area MRA. Additional subsurface MEC removal areas would be identified in coordination with the agencies and the future land owner based on factors such as the feasibility of implementation, cost, and habitat management requirements. Based on a review of currently available MEC-related data, a total of approximately 85 acres of the Impact Area MRA could contain significant amounts of MEC and/or metallic debris involving sensitively fuzed munitions types. These areas are candidates for subsurface MEC removals, and the effort is assumed for the purpose of this FS to include excavation and sifting the top 2-foot layer of soil in order to make it safe for future reusers. Post-remediation habitat restoration and monitoring would be required in these areas.

- Digital mapping to provide a record of remaining anomalies and to assist future property users in identifying areas with specific MEC safety support requirements. Anomalies within the areas identified for subsurface MEC removal will be investigated or resolved; the digital map can be used by the future land owner to assist in land management decision making.

- Implementation of Land Use Controls including: MEC recognition and safety training, construction monitoring for intrusive activities, helicopter support for select HMP/HCP future land owner prescribed burns if warranted, access management measures including maintaining a perimeter fence and law enforcement support to prevent unauthorized access, and land transfer documentation outlining the prohibition of unrestricted land use and any other reuse restrictions or conditions; In addition to providing MEC recognition training and construction monitoring, the full-time onsite UXO-Qualified Personnel would be available to provide other UXO-Qualified Personnel support as needed to support reuse activities based on area-specific conditions and activities, such as surface reconnaissance of future prescribed-burned areas and activity planning.

- Post-remediation habitat monitoring within the areas of subsurface MEC removal or other disturbances such as mechanical clearance of vegetation (collecting data on HMP species and habitats, and perform mapping, data management and evaluation, and reporting), and habitat restoration in sifting areas.

After technology-aided surface MEC removals are completed for each phase of work described in the site-specific work plans, digital geophysical mapping would be conducted. Following the geophysical mapping the Army would review the data and prepare a Technical Memorandum to EPA and DTSC that would present an evaluation of the work completed to date and if necessary, describe additional subsurface removals recommended based on the results of the initial work. Factors that would be considered when determining whether additional actions are necessary include, but are not limited to: (1) type of MEC encountered and danger associated with MEC; (2) proximity to potential receptors; (3) density of items; and (4) consistency with ARARs such as the HMP and Biological Opinions. If no additional work is required this would also be documented in the Technical Memorandum along with the rationale for no further removal actions. Each Technical Memorandum would be an addendum to the

site-specific work plan, and therefore, would be associated with a primary document and be disputable. To avoid impacts to the rare, threatened and endangered species, completion and agency approval of the Technical Memorandum will be expedited to allow any additional actions to be executed before the next growing season. Each Technical Memorandum and associated correspondence would be made available to the public in the Administrative Record.

Additional information about Alternative 4 is provided in Section 4.4.4 of the FS. Alternative 4 is identified as the preferred remedial alternative because it best balances the reduction of MEC risks to human health and the resulting impacts to the significant natural resources, and meets the nine evaluation criteria specified in the EPA's RI/FS Guidance (*EPA, 1989*) as follows:

Threshold Criteria

(1) Overall Protection of Human Health and the Environment – Alternative 4 eliminates, reduces, and controls potential threats to public health through treatment (MEC removal) and institutional controls (Land Use Controls), offering the benefits of a complete surface MEC removal throughout the Impact Area MRA, as well as subsurface MEC removal in selected areas to support habitat management activities over the long term. This alternative would be protective of human health and the environment in conjunction with Land Use Controls. After remedial actions to address potential MEC risks at the Impact Area MRA have been conducted, residual After Action MEC Risks may be re-evaluated using site-specific MEC removal data, which, in addition to the digital geophysical mapping information, would be considered in verifying the appropriateness of remedial Land Use Controls selected for implementation. Impacts to the significant natural resources found on the site would be minimized during the implementation of this alternative. Subsurface MEC removal would be implemented in selected areas (approximately 10 percent) of the Impact Area MRA where greater risk reduction would further facilitate reuse of the area as a habitat reserve. The subsurface MEC removal areas would include a safety buffer on the habitat side of the development interface, permanent fuel breaks and access roads, and other areas as required by the future land owner to support their reuse (e.g. habitat restoration areas, etc.). Following completion of this alternative, in combination with remedial land use controls that include UXO-Qualified Personnel support, access management support and helicopter support in some cases, the land would be able to be managed as identified by the HMP, biological opinions, HCP, and other supporting documents. This alternative would provide protection of the environment at the Impact Area MRA because prescribed burning and MEC removal would be performed using methods that would comply with ARARs and special HMP requirements that apply to habitat reserve at the former Fort Ord. In addition, post-remediation habitat monitoring would be conducted in accordance with HMP requirements to monitor the recovery of the habitat after MEC remedial actions are implemented. Approximately 85 acres of high anomaly density associated with sensitive munitions types, anticipated for subsurface MEC removals via excavation and sifting, would have significant impacts on the habitat in these areas that would need to be mitigated in consultation with USFWS.

(2) Compliance with Applicable, Relevant and Appropriate Requirements (ARARs) – Alternative 4 would be conducted using methods that would comply with Federal and State environmental statutes, regulations, and other requirements that pertain to the remedial actions and site-specific conditions within the Impact Area MRA. However, approximately 85 acres of high anomaly density associated with sensitive munitions types, anticipated to require subsurface MEC removals via excavation and sifting would have significant impacts on the habitat in these areas that would need to be mitigated in consultation with USFWS.

Balancing Criteria

(3) Long-Term Effectiveness and Permanence – Although none of the alternatives would allow for unrestricted reuses, Alternative 4 would provide long-term effectiveness and permanence for planned reuses of the site and maintain protection of human health and the environment over time.

(4) Reduction of Toxicity, Mobility, or Volume Through Treatment – Alternative 4 would provide significant reduction of the toxicity, mobility, and volume of MEC through treatment (for which there is a statutory preference) to reduce the harmful effects of principal contaminants (MEC) on the surface of the Impact MRA and in selected areas in the subsurface as well that support safe reuse.

(5) Short-Term Effectiveness – Alternative 4 would require a moderate length of time and level of effort to implement (approximately 800 acres per year for a period of 8 years), and could be conducted while mitigating potential risks posed to workers, residents, and the environment during implementation. Prescribed burns may cause some smoke impacts to the community, which are expected to be temporary. Community notification and smoke management would minimize potential impacts from smoke.

(6) Implementability – Alternative 4 would be administratively feasible to implement, and the necessary approvals for its implementation are assumed to be easy to obtain. This alternative would also be technically feasible to implement as the services, necessary equipment, and skilled workers to implement this alternative are readily available. However, as with Alternatives 2 and 3, prescribed burning of up to 800 acres per year would require significant coordination and level of effort including suitable weather conditions.

(7) Cost – Total costs estimated for implementation of Alternative 4 are approximately $138.4 million assuming a phased approach of conducting prescribed burning and MEC removals on a total of approximately 800 acres per year over an assumed period of 8 years for costing purposes (with an additional 5 years of habitat management, and 30 years of Land Use Controls), which is in between the total cost for Alternative 2 of $88.9 million, and $423.2 million for Alternative 3.

Modifying Criteria

(8) State Acceptance – State Acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the RI/FS report and Proposed Plan have been received (*EPA, 1989*). It is anticipated the regulatory agencies would be supportive of Alternative 4 because it would address MEC risks and be protective, and best meet the evaluation criteria described above.

(9) Community Acceptance – Community Acceptance will be addressed in the Impact Area MRA RI/FS ROD once comments on the report and Proposed Plan have been received (*EPA, 1989*). It is anticipated the community would be supportive of Alternative 4 because it would best meet the evaluation criteria described above. However, some members of the community would have concerns regarding implementation of the prescribed burning component of this alternative.

7.0 APPROVAL PROCESS

The approval process for the Impact Area MRA RI/FS includes the following components:

- Prepare the RI/FS report with regulatory agency and public review of the Draft and Draft Final reports.
- Prepare a Proposed Plan that presents the Army's preferred alternative for the Impact Area MRA and summarizes the results of the RI, RA, and FS.
- Solicit public comments on the Proposed Plan during a 30-day public comment period.
- Provide an opportunity for a public meeting on the Proposed Plan where written and verbal comments can be submitted.
- Prepare the Record of Decision (ROD) that (1) summarizes the results of the RI, RA, and FS, (2) includes a Responsiveness Summary that summarizes any public comments received on the Proposed Plan, and Army responses to comments, and (3) specifies the details of the selected remedy(s), including plans for development and submittal of a Remedial Design/Remedial Action Work Plan (RD/RAWP). Under the FFA between the Army, EPA, and DTSC, a schedule for preparation of the RD/RAWP for the Impact Area MRA will be submitted within 21 days of signature of the ROD.
- Receive EPA approval of the ROD, and review by DTSC.
- Announce the decision regarding the remedy selection in a local major newspaper and place copies of the RI/FS, Proposed Plan, and ROD in the Administrative Record and local information repositories.

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TABLES