2014 Annual Natural Resource Monitoring, Mitigation, and Management Report

Covering Activities Conducted from 1 January 2014 through 31 December 2014

Environmental Services Cooperative Agreement Remediation Program Munitions Response Areas

Former Fort Ord
Monterey County, California

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order of Consent
ARCADIS	ARCADIS U.S., Inc.
Army	United States Department of the Army
BMP	Best Management Practices
BO	Biological Opinion
BRAC	Base Realignment and Closure
CDFW	California Department of Fish and Wildlife
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter(s)
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CSUMB	California State University Monterey Bay
CTS	California tiger salamander
dbh	diameter at breast height
DGM	digital geophysical mapping
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESCA	Environmental Services Cooperative Agreement
ESCA RP	Environmental Services Cooperative Agreement Remediation Program
FFA	Federal Facility Agreement
FORA	Fort Ord Reuse Authority
FEG	Future East Garrison
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare(s)
HMP	Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California
HRP	Habitat Restoration Plan
IAR	Interim Action Ranges
km	kilometer(s)
m	meter(s)
MD	munitions debris
MEC	munitions and explosives of concern
MOUT	Military Operations in Urban Terrain

MRA	Munitions Response Area(s)
MRS	Munitions Response Site
msl	mean sea level
NCA	Non-Completed Area
NRCS	Natural Resources Conservation Service
NRIM	Natural Resource Impact Mitigation
NRMA	Natural Resources Management Area
QB	Qualified Biologist
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SCA	Special Case Area
SOP	Standard Operating Procedure
SQB	Senior Qualified Biologist
SUXOS	Senior Unexploded Ordnance Supervisor
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance

1.0 INTRODUCTION

1.1 Purpose and Scope

This Annual Natural Resource Monitoring, Mitigation, and Management Report summarizes natural resource-related activities performed by the Fort Ord Reuse Authority (FORA) Environmental Services Cooperative Agreement (ESCA) Remediation Program (RP) Team during the period from 1 January 2014 through 31 December 2014. This report includes data and associated information that meet requirements outlined in the Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California (HMP; USACE 1997) and in Biological Opinions (BOs; USFWS 1999, 2002, 2005 and 2007) issued to the United States Department of the Army (Army) by the United States Fish and Wildlife (USFWS). The HMP and BOs identify mitigation measures to avoid and minimize impacts to rare, threatened, and endangered species and their habitats during pre-disposal activities such as munitions investigation activities. Implementation of the requirements by the ESCA RP Team is conducted in coordination with the Army.

ARCADIS U.S., Inc. (ARCADIS) has prepared this document on behalf of FORA (the Recipient) in accordance with industry standards and consistent with the requirements of the Remediation Services Agreement dated 31 March 2007 by and between ARCADIS and the Recipient, including any applicable governing documents and applicable laws and regulations.

This report is the seventh in a series of Annual Natural Resource Monitoring, Mitigation, and Management Reports produced for the ESCA RP. The six previous reports covered the 2008, 2009, 2010, 2011, 2012, and 2013 reporting periods (ESCA RP Team 2009, 2010a, 2011a, 2012a, 2013b, and 2014).

1.2 Environmental Services Cooperative Agreement

The former Fort Ord (Figure 1) was placed on the National Priorities List in 1990, primarily because of chemical contamination in soil and groundwater that resulted from past Army operations. To oversee the cleanup of the base, the Army, the Department of Toxic Substances Control (DTSC), the Central Coast Regional Water Quality Control Board (RWQCB), and the United States Environmental Protection Agency (EPA) entered into a Federal Facility Agreement (FFA). One of the purposes of the FFA was to ensure that the environmental impacts associated with past and present activities at the former Fort Ord were thoroughly investigated and appropriate remedial action taken as necessary to protect public health and the environment.

In accordance with the FFA, the Army is designated as the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for conducting environmental investigations, making cleanup decisions, and taking cleanup actions at the former Fort Ord. The EPA is designated as the lead regulatory agency for the cleanup, while the DTSC and RWQCB are supporting agencies.

On March 31, 2007, the Army and FORA entered into an ESCA to provide funding for munitions and explosives of concern (MEC) remediation services. In accordance with the ESCA and an Administrative Order on Consent (AOC), FORA is responsible for completion of CERCLA response actions, except for those responsibilities retained by the Army, on approximately 3,300 acres (1351.6 ha) of the former Fort Ord with funding provided by the Army. The AOC was entered into voluntarily by FORA, the EPA Region 9, the DTSC, and the United States Department of Justice Environment and Natural Resources Division on December 20, 2006 (EPA Region 9 Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA Docket No. R9-2007-03]). The underlying property was transferred to FORA in May 2009. The AOC was issued under the authority vested in the President of the United States by Sections 104, 106, and 122 of CERCLA, as amended, 42 United States Code §§ 9604, 9606, and 9622.

FORA, through the ESCA RP Team, is in the process of completing the Army's MEC response actions in a program hereinafter identified as the ESCA RP. Proposed future land use designations for the ESCA Munitions Response Areas (MRAs) include: habitat reserve, habitat corridor, development (residential and non-residential), and borderland development areas along Natural Resources Management Area (NRMA) interface (Figure 2). As described in the 1997 HMP, these categories are defined as:

Habitat Reserve – management goal is conservation and enhancement of threatened and endangered species

Habitat Corridor – lands between major reserve areas; to be managed to promote connections between conservation areas

Development – no management restrictions; some plans for salvage of biological resources from these lands may be specified

Borderland Development Areas along NRMA Interface (also called Borderland Boundary or Borderland Interface) – areas abutting the NRMA that are slated for development; management of these lands includes no restrictions except along the development/reserve interface

Future Road Conditions – lands within habitat reserve set aside for future road development; to be managed as habitat reserve until road development occurs

The nine ESCA MRAs are made up of entire or partial parcels as defined by the HMP, and thus have multiple intended uses. These MRAs include: California State University at Monterey Bay (CSUMB) Off-Campus MRA, County North MRA, Del Rey Oaks/Monterey MRA, Future East Garrison (FEG) MRA, Interim Action Ranges (IAR) MRA, Laguna Seca Parking MRA, Military Operations in Urban Terrain (MOUT) Site MRA, Parker Flats MRA, and Seaside MRA (Figure 1 and 2). Of these nine ESCA MRAs, five include habitat reserve or habitat corridor parcels: County North, Del Rey Oaks/Monterey, FEG, IAR, and Parker Flats (ESCA RP Team 2009, 2010a, 2011a; Figure 2). These five MRAs that contain habitat reserves or corridors have been subject to natural resource monitoring, mitigation, and management activities since the inception of the ESCA, such as erosion control, target weed

management, and active and passive restoration activities. Borderland boundary areas are also subject to erosion control and weed management efforts, as needed. The borderland boundary is shown on Figure 2.

The majority of the ESCA RP Team munitions investigation activities were completed in all MRAs by the end of 2013; future work may be required to address any concerns raised during the quality control process. Associated biological field activities continue to be performed in three MRAs that contain habitat reserve or habitat corridor parcels: FEG, Parker Flats, and IAR (Table 1-1, Figures 3a, 3b, and 3c). As detailed in Appendix A, habitat restoration activities were conducted in the IAR MRA Range 47 restoration area during this period.

Erosion control, weed monitoring, and environmental awareness training were conducted in development parcels in the Seaside MRA as well as along the adjacent borderland boundary.

2.0 NATURAL RESOURCE MONITORING AND MITIGATION REQUIREMENTS

Primary requirements for natural resource monitoring and mitigation are described in the HMP (USACE 1997) and the BOs (USFWS 1999, 2002, 2005, and 2007) issued to Army to enable compliance with the Federal Endangered Species Act (ESA) and to avoid or minimize, to the extent feasible, the take of listed species as well as protecting other native species of concern.

2.1 Habitat Management Plan

The HMP (USACE 1997) and modifications to the HMP provided in the "Assessment, East Garrison—Parker Flats Land Use Modifications, Fort Ord, California" (Zander 2002) present the boundaries of habitat reserve and development areas and describe land use, conservation, management, and habitat monitoring requirements for target species within the former Fort Ord.

The HMP and BOs establish guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival (USACE 1992, 1997). Threatened and endangered plant and animal species as well as designated critical habitat for some species occur at the former Fort Ord. Each reuse area has been screened for potential impacts or disturbances to threatened and endangered species identified in the HMP (USACE 1997). Implementation of the provisions of the HMP and referenced additional measures satisfy the requirements of the ESA.

Pertinent goals of the HMP include:

- Preserve, protect, and enhance populations and habitats of federally listed threatened and endangered wildlife and plant species;

- Avoid reducing populations or habitat of federal proposed and candidate wildlife and plant species to levels that may result in one or more of these species becoming listed as threatened or endangered;
- Preserve and protect populations and habitat of state-listed threatened and endangered wildlife and plant species;
- Avoid reducing populations or habitat of species listed as rare, threatened, and endangered by the California Native Plant Society, or with large portions of their range at former Fort Ord, to levels that may result in one or more of these species becoming listed as threatened or endangered.

Natural resource monitoring and mitigation requirements associated with munitions investigation activities addressed in the HMP have several primary objectives: minimize disturbance associated with munitions investigation activities; avoid or minimize impacts to known sensitive HMP species, where feasible; conduct passive and/or active habitat restoration, where required; and conduct employee environmental awareness training.

A total of 18 species are addressed in the HMP and are referred to in this report as HMP species (Table 2-1); these species are described in further detail in Section 4. HMP species are defined as those species that had the following status at the time of HMP preparation (USACE 1997):

- Federally proposed and listed threatened and endangered species;
- Species that are candidates for federal listing as threatened or endangered;
- State-listed threatened and endangered species;
- Species that fell under one of the previous categories during preparation of the 1994 HMP but that no longer have any legal status under the federal or state ESA; and
- CNPS List 1B species with extensive portions (greater than 10 %) of their known ranges at former Fort Ord: (Hooker's manzanita [*Arctostaphylos hookeri* subsp. *hookeri*], Toro manzanita [*Arctostaphylos montereyensis*], sandmat manzanita [*Arctostaphylos pumila*], Eastwood's ericameria [*Ericameria fasciculata*], and coast wallflower [*Erysimum ammophilum*]).

The types of effects that munitions investigation activities have on sensitive habitats and HMP species were anticipated in the HMP; these include vegetation burning and cutting, whole plant excavation, crushing or trampling from movement of excavation equipment and removal team foot traffic, and on-site MEC detonation. The anticipated habitat acreage and number of plants of HMP species affected by munitions investigation activities were not quantified in the HMP because the range and quantity of MEC targets had not been determined and investigations are ongoing.

The HMP addresses potential effects of MEC investigation and remedial activities at the former Fort Ord to sensitive HMP wildlife species, including California black legless lizard (*Anniella pulchra nigra*), California red-legged frog (*Rana draytonii*), California tiger salamander (CTS; *Ambystoma californiense*), California linderiella (*Linderiella occidentalis*), Smith's blue butterfly (*Euphilotes enoptes smithi*), Monterey ornate shrew (*Sorex ornatus salarius*), and western snowy plover (*Charadrius nivosus nivosus*). HMP plant species include Monterey spineflower (*Chorizanthe pungens* var. *pungens*), robust spineflower

(*Chorizanthe robusta* var. *robusta*), sand (Monterey) gilia (*Gilia tenuiflora* subsp. *arenaria*), seaside bird's-beak (*Cordylanthus rigidus* subsp. *littoralis*), coast wallflower, Yadon's piperia (*Piperia yadoni*), Eastwood's ericameria, Hooker's manzanita, Toro manzanita, sandmat manzanita, and Monterey ceanothus (*Ceanothus rigidus*). Several HMP species have estimated ranges that include more than 50% of their population at the former Fort Ord; these include: sand (Monterey) gilia, Monterey spineflower, Eastwood's ericameria, Monterey ceanothus, sandmat manzanita, and Toro manzanita (USACE 1997). The HMP considers two federally-listed HMP annual species with populations concentrated at the former Fort Ord as particularly vulnerable to the potential effects of MEC investigation and remedial activities at the former Fort Ord: Monterey spineflower and sand (Monterey) gilia.

Monitoring requirements at munitions investigation sites include baseline surveys prior to munitions investigation activities as well as follow-up monitoring after munitions investigation activities are complete. Follow-up surveys for shrubs and subshrubs are conducted in years 3, 5, 8, and 13 after munitions investigation activities, and follow-up surveys for HMP annuals are conducted in years 1, 3, 5, and 8 after munitions investigation activities (Burleson 2009). Data to be gathered during maritime chaparral baseline and follow-up monitoring include site size, methods used for vegetation clearing, extent of soil disturbance, percent cover by different shrub species, percent cover by non-native species, HMP annual species density, field notes and photographic documentation.

Habitat restoration activities in central maritime chaparral vegetation affected by munitions inspection activities focus on restoring naturally regenerating vegetation that exhibits characteristics such as high species diversity, a mosaic of seral stages and age classes, and suitable habitat to support HMP species such as sand (Monterey) gilia, Monterey spineflower, seaside bird's-beak, and California black legless lizard. Recovery of native vegetation after munitions investigation activities on the former Fort Ord has historically proceeded naturally within a several-year timeframe in areas that are subjected to controlled burning and vegetation cutting (TetraTech 2012).

Post-disturbance restoration focusing on HMP annual species - sand (Monterey) gilia, Monterey spineflower, and seaside bird's-beak - is considered successful if three criteria are met five years after disturbance: self-sustaining populations of these HMP annual species are observed in a mosaic of various stand ages of maritime chaparral, the amount of habitat supporting these species is comparable to 1992 levels, and population sizes are comparable to 1992 levels (USACE 1997). After each year's monitoring, the resulting data are then utilized for adaptive management of restoration activities to reflect changing conditions and continued progression toward success criteria, including supplemental weeding, planting, or seeding.

Wetlands used by CTS, if disturbed, are also required to be restored (USFWS 2005). Corrective measures for vernal pool and pond (referred to as "aquatic features" by the ESCA RP Team) restoration include minimizing excavation area and depth, topsoil salvaging and replacement, and restoring affected wetlands so that they are of the same acreage and provide the same functions as before MEC clearance. Aquatic feature effects are evaluated on a case-by-case basis.

Follow-up monitoring of restored aquatic features occurs during each rainy season for five years after restoration. Data to be gathered during monitoring of restored aquatic features include dates when the aquatic features begin to fill, when they dry out, water conditions, percent cover by different wetland vegetation types, and occurrence and relative abundance of California linderiella, CTS, and California red-legged frog.

Monitoring methods are detailed in Sections 5.

2.2 Biological Opinions

U.S. Fish and Wildlife Service (USFWS) has issued BOs to the Army, of which four are applicable to the ESCA (USFWS 1999, 2002, 2005, and 2007). The ESCA RP Team acts as the Army's agent to implement relevant requirements of the BOs while conducting fieldwork within ESCA MRAs. In this role, the ESCA RP Team members are in frequent communication with Mr. William Collins, Base Realignment and Closure (BRAC) Office Environmental Coordinator and Mr. Bart Kowalski, Chenega Support Services Wildlife Biologist supporting BRAC, to address natural resource compliance requirements and progress.

Of the three applicable BOs, the 30 March 1999 "Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R)" addresses the impacts that the closure and reuse of Fort Ord may have on nine sensitive species, which were at the time federally listed or proposed to be listed (USFWS 1999).

The 22 October 2002 "Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California as it affects Monterey Spineflower Critical Habitat (1-8-01-F-70R)" addresses the impacts that the closure and reuse of Fort Ord may have on the Monterey spineflower and its critical habitat (USFWS 2002). Monterey spineflower critical habitat exists in County North, IAR, Laguna Seca Parking, and FEG MRAs (USACE 1992).

The 30 March 2005 BO titled "Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields ([*Lasthenia conjugens*] 1-8-04-F-25R)" addresses the impacts that the closure and reuse of Fort Ord may have on CTS and critical habitat for Contra Costa goldfields (USFWS 2005). CTS occur within areas adjacent to County North, IAR, FEG, Laguna Seca Parking, MOUT Site, Parker Flats, and Seaside MRAs (USACE 1992). It should be noted that no critical habitat for Contra Costa goldfields occurs on former Fort Ord.

3.0 SITE DESCRIPTION

Former Fort Ord is located about 8 miles (13 kilometers [km]) north of the city of Monterey, California and occupies approximately 28,000 acres (11,331 ha) adjacent to Monterey Bay and the cities of Marina, Seaside, Sand City, Del Rey Oaks, and Monterey. State Highway 1 crosses the western portion of the former Fort Ord, separating the beachfront from most of the former Fort Ord site (Figure 1). The former Fort Ord lies just to the south of the Salinas

River delta in a broad low area between the Santa Lucia Mountains to the south and the Santa Cruz Mountains to the north.

The site is dominated by Pleistocene-age Aeolian sand dunes and other geologically younger sediments (Aromas sand and sandstone, Baywood sand, Oceano sand, Paso Robles formation, gravels, sands, silts, and clays), which cover older consolidated rocks, including Mesozoic granite and metamorphic rocks, Miocene sedimentary rocks of the Monterey shale formation, and upper Miocene to lower Pliocene marine sandstones. The sand sheet in the Salinas Basin is the northernmost of six distinctive sand sheets that occur in geologically subsiding basins at the mouths of rivers along the coast of southern California and northern Baja California (Hunt 1993).

The local weather pattern of mild, wet winters and warmer, dry summers is characteristic of Mediterranean-climate regions, with most precipitation concentrated between October and April. In the Monterey area, local climate is influenced by summer fog and predominant cool northwest winds. There is a sharp gradient in climate from the coast to inland areas, where summer temperatures may be much higher, especially during calm periods and/or in areas sheltered from the prevailing winds.

3.1 Vegetation Types in MRAs

The four most frequently encountered vegetation types in MRA habitat parcels are central maritime chaparral, coast live oak woodland, grassland, and aquatic features. Other vegetation types, such as central coastal scrub, cover smaller areas; a brief description of coastal scrub is incorporated into the vegetation description for maritime chaparral that follows. Observed plant and wildlife species are documented in each of the monitoring areas in the ESCA MRAs, especially those with habitat parcels where the ESCA RP biologists most frequently work (Tables 3-1 and 3-2). These lists do not represent a comprehensive inventory of all species expected in the MRAs, but only those that have been observed to date.

3.1.1 Central Maritime Chaparral

The predominant vegetation at the former Fort Ord is central maritime chaparral, which is comprised of evergreen shrubs and occasional multi-trunked coast live oaks that grow together at varying densities from open stands to almost impenetrable thickets in coastal areas of the Central Coast underlain with sand or sandstone-derived soils. This woody chaparral shrub vegetation ranges from 4 to 15 or more feet (1 to 5 meters [m]) in height, although low-growing annuals and herbaceous perennials are scattered in exposed openings. Species composition varies with microhabitat characteristics and stand age since the last disturbance.

In general, maritime chaparral is an unusual vegetation type found primarily on sandy substrates in a few coastal locations in Santa Barbara, San Luis Obispo, Monterey, and Santa Cruz Counties. Often these maritime chaparral associations are dominated by local endemic species of ceanothus (*Ceanothus*) and manzanita (*Arctostaphylos*) mixed with other widespread and endemic species (Holland 1986; Holland and Keil 1995). Maritime chaparral

is a vegetation type of particular concern in the HMP because it supports a number of rare, threatened, and endangered species populations; see Section 4 below.

Central maritime chaparral is the dominant vegetation type in the ESCA RP MRAs in which 2014 vegetation transect monitoring was conducted. Mature chaparral vegetation structure consists of a relatively simple canopy layer with a diversity of annual and short-lived herbaceous species occurring in sunny openings between shrubs, including a number of local endemic taxa.

The sandy substrate typical of maritime chaparral habitats tends to be low in organic matter and nutrients, particularly nitrogen and phosphorus (Smith et. al 2002). As a result, microflora and microfauna play a particularly important role in nutrient cycling, and cryptogamic soil crusts are observed in most undisturbed chaparral vegetation. Two generalized subtypes of maritime chaparral have been characterized at the former Fort Ord: sandhill maritime chaparral and inland maritime chaparral (USACE 1992). Sandhill maritime chaparral occurs in the rolling sand hills of coastal areas on loose Aeolian sand (Smith et al. 2002). The deep sandy soils allow deep root penetration and retained moisture below the dry surface layers in summer. Sandhill maritime chaparral is typically dominated by stump-sprouting shrubs such as shaggy-barked manzanita (*Arctostaphylos tomentosa* subsp. *tomentosa*) and chamise (*Adenostoma fasciculatum*), along with a mixture of obligate-seeding regional endemics such as sandmat manzanita, Monterey ceanothus, and dwarf ceanothus (*Ceanothus dentatus*); these obligate-seeding shrubs are often codominant with the stump-sprouting shrubs, and chamise rarely contributes the greatest cover of any shrub species to the canopy. Sandhill chaparral occurs in the Seaside, Parker Flats, and IAR MRAs, as well as elsewhere on the western half of the former Fort Ord.

Further inland the elevation increases as sandstone outcroppings appear. The relatively thin veneer of sand, derived from sand deposits and weathering, forms a layer over the top of the sandstone outcroppings. Soil texture and permeability have a direct impact on root penetration and plant species distribution. Like sandhill chaparral, the inland maritime chaparral vegetation is also dominated by stump-sprouting shrubs such as chamise, which has relatively higher cover on sandstone compared with sand. Shaggy-barked manzanita is replaced by another stump-sprouting shrub, brittleleaf manzanita (*Arctostaphylos crustacea* subsp. *crustacea*), in inland areas, and a stump-sprouting ceanothus species, blue-blossom (*Ceanothus thyrsiflorus*), forms large colonies in the chaparral vegetation. Obligate-seeding shrub dominants include Toro manzanita, Hooker's manzanita, dwarf ceanothus, Monterey ceanothus, and others. Inland chaparral is widespread in the FEG MRA.

Fire plays a major role in chaparral ecosystems, typically occurring every few decades, returning nutrients to the soil that are tied up in dead wood and leaf litter as well as creating openings with ample sunlight and space for seed germination and seedling establishment. A number of chaparral shrubs, such as shaggy-barked manzanita, brittleleaf manzanita, and chamise have underground or surface stems (burls) that resprout after fire. Other shrubs, such as dwarf ceanothus, Monterey ceanothus, sandmat manzanita, Hooker's manzanita, and Toro manzanita, are obligate seeders that can only recolonize a burned site from seed after fire; often the seed requires fire-induced cues in order to germinate. Post-fire sites are often carpeted with a mixture of obligate-seeding shrubs and herbaceous species the spring after a

wildfire. As shrubs become re-established after fire, herbaceous and smaller species tend to be excluded by expanding canopies of the dominant shrubs; however, even in mature stands of central maritime chaparral, open areas may occur between shrubs that support herbaceous species.

The primary vegetation alliance for this vegetation type is the Shaggy-Barked or Brittleleaf Manzanita Shrubland Alliance, as characterized by CNPS and California Department of Fish and Wildlife (CDFW; Sawyer et. al 2009). Shaggy-barked or brittleleaf manzanita chaparral has a G2/S2 rating (6-20 viable occurrences and/or 2,000-10,000 acres [518-2590 ha] worldwide and statewide), as listed in the CDFW Natural Communities Hierarchy (CDFW 2010) and in CNDDB (CDFW 2014); G2/S2 ratings indicate an alliance that is threatened throughout its range.

Central coastal scrub shares many shrub species with maritime chaparral vegetation, although dominant species differ. Overall stature of mature chaparral vegetation is generally taller than that of coastal scrub vegetation and mature chaparral dominants tend to produce waxy sclerophyllous leaves that contrast with the softer, pubescent or smaller leaves of many coastal scrub dominants such as black sage. In addition, the wood of chaparral shrubs tends to be harder and the burls larger and more resistant to surface disturbance than the stems and burls of shrubs that predominate in coastal scrub vegetation. Coastal scrub vegetation generally occurs in drier sites than chaparral, often on south-facing exposures at slightly lower elevations. Coastal scrub dominants frequently appear in chaparral vegetation immediately after disturbances such as burns or vegetation cutting but gradually get overtopped by the larger chaparral dominant shrubs. Central coastal scrub occurs in a small portion in eastern Parker Flats MRA.

This vegetation type would be classified as the Black Sage Shrubland Alliance by CNPS and CDFW (Sawyer et. al 2009); the Black Sage Shrubland Alliance has global and state ranks of G5/S5 (no threats known), as listed in the CDFW Natural Communities Hierarchy (CDFW 2010) and in CNDDB (CDFW 2014).

3.1.2 Coast Live Oak Woodland

Coast live oak woodland is dominated by mixed-aged stands of coast live oak (*Quercus agrifolia*) that vary in density from concentrated bands of oaks along drainage bottoms to scattered trees on nearby slopes. Coast live oak is an evergreen tree ranging from 20 to 75 feet (6 to 25 m) in height, with a spreading crown, many massive branches, and a dense canopy of thick waxy leaves. Trees can live for 100 years or more. Although common in the hills surrounding Monterey, coast live oaks are restricted to a 50-mile (8-km) wide swath along the coast from Mendocino County south to northern Baja California. They are completely absent in the Sierra Nevada and other interior ranges; rather, they tend to occur in the maritime belt that receives fog during the summer months.

Most healthy stands of coast live oak woodland contain mixed age classes of oak trees, saplings, and seedlings that can vary widely in overall appearance, depending on moisture availability. Associated species such as toyon (*Heteromeles arbutifolia*), poison-oak

(*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), coastal wood fern (*Dryopteris arguta*), bracken fern (*Pteridium aquilinum*), yerba buena (*Satureja douglasii*), wood mint (*Stachys bullata*), and others also form a dense understory in undisturbed oak woodland.

Coast live oak woodland is found in the FEG MRA in drainage bottoms as well as in the Parker Flats and County North MRAs. Like chaparral vegetation, oak woodland and annual grassland may integrate in areas with extensive habitat disturbance.

Coast live oak woodland is characterized as the Coast Live Oak Woodland Community in the CNDDB legacy community classification system (Holland 1986), and as the *Quercus agrifolia* Woodland Alliance in the CNPS Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009). *Quercus agrifolia* Woodland Alliance has a G5 global rarity ranking (demonstrably secure because of its worldwide occurrence) and an S4 state rarity ranking (greater than 100 viable occurrences statewide, and/or more than 31,110 acres [12,950 hectares]); some associations within the *Quercus agrifolia* Woodland Alliance have G3 and S3 rankings (21-100 viable occurrences worldwide/statewide, and/or more 6,400-31,110 acres [2,590-12,950 hectares]), according to the CDFW (2010 and 2014).

3.1.3 Grassland

Annual grassland vegetation is located in disturbed areas where there has been prior soil disturbance, as well as along roadways, access routes, and fuel breaks; annual grasslands tend to be dominated by non-native annual grasses and other native and weedy herbaceous species. Among the non-native grasses observed are invasive annual Mediterranean grasses such as slender wild oats (*Avena barbata*), rip-gut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis* subsp. *rubens*), foxtail barley (*Hordeum murinum*), and annual fescues (*Festuca* species) and forbs such as filaree (*Erodium cicutarium, E. botrys*), iceplant (*Carpobrotu*s spp., especially *C. edulis*), and others. Degraded central maritime chaparral subjected to habitat disturbances often supports a mosaic of shrubs and weedy non-native grasses.

Limited annual grassland vegetation occurs in disturbed areas in all three MRAs containing habitat parcels where work was conducted during 2014.

In general, the annual grassland areas would be classified as Non-Native Grasslands in the CNDDB legacy community classification system (Holland 1986) and as California Annual Grassland Series within the CNPS Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009). Non-native Grassland has a global rank of G4 (apparently secure, but factors exist to cause some concern; i.e. there is some threat or somewhat narrow habitat) and a state rank of S4 (apparently secure, but factors exist to cause some concern; i.e. there is some threat or somewhat narrow habitat), as listed in the CNDDB (2014).

Perennial grassland vegetation at the former Fort Ord is more common adjacent to broad drainages and swales, where spreading grasses such as alkali rye (*Elymus triticoides*) form large colonies. Perennial grasslands occur near some aquatic features in the northeast corner

of the FEG MRA. Small stands of native perennial bunchgrass species such as purple needlegrass (*Stipa pulchra*) also are observed within central maritime chaparral in all MRAs. In all cases, perennial grassland colonies within MRAs are too small (< 0.2 acres) to be classified separately as perennial grassland.

3.1.4 Aquatic Features

Aquatic features are dominated by native herbaceous annual and perennial plants that are typical of seasonal wetlands in coastal California (Table 3-3). Species tend to occur in zones depending on the depth of the depression, from submergent aquatic species to emergent species and then surrounding upland vegetation such as coast live oak woodland, central maritime chaparral, and grassland. Arroyo willow (*Salix lasiolepis*) occurs adjacent to some of the aquatic features in the northeast corner of the FEG MRA as well. A total of 12 aquatic features are found only in the FEG MRA in two main clusters, one in the northeastern corner and the other in the southern portion of the MRA in a former grenade range (Section 3.2.1). These aquatic features were described in detail in Appendix C of the 2011 Annual Resource Monitoring Report (ESCA RP Team 2012a).The grenade range aquatic features are surrounded by mostly bare sandstone due to apparent historical disturbance.

3.2 Environmental Characteristics of MRAs with Habitat Parcels

A summary of environmental characteristics and existing vegetation for each of the MRAs containing habitat parcels where natural resource monitoring was conducted during 2014 is provided in the following sections. These MRAs are shown in Figures 3a, 3b, and 3c.

3.2.1 Future East Garrison MRA Site Description

The FEG MRA (formerly known as the East Garrison MRA) is located in the northeastern portion of the former Fort Ord (Figures 2 and 3a), and is wholly contained within the jurisdictional boundaries of Monterey County. This MRA encompasses approximately 251.5 acres (102 ha) and contains the following four United States Army Corps of Engineers (USACE) parcels: E11b.6.1, E11b.7.1.1, E11b.8 (includes 100-foot [30-m] borderland interface buffer), and L20.19 1.1. Of the 251.5 acres (102 ha) within this MRA, 177.5 acres (71.8 ha) are designated as habitat reserve.

The topography of the FEG MRA is variable, with gentle ridges and steeper canyon walls. Overall, slopes descend from south to north, with higher ridges in the south over 450 feet (137 m) above mean sea level (msl) and lower slopes to the north at 170 feet (52 m) above msl. The southern portion of the FEG MRA is bisected by a small drainage that descends gradually from west to east before joining an unnamed tributary to the Salinas River. Sandstone Ridge borders this drainage to the south, reaching over 400 feet (122 m) above msl; upper slopes of this drainage exceed 500 feet (152 m) elevation to the immediate west of the FEG MRA. Another small forked drainage is located in the northern portion of the FEG MRA and descends directly to the Salinas River floodplain to the north.

The slope of the terrain in the FEG MRA ranges from relatively flat (3 to 5 percent) within an area formerly used as an Ammunition Supply Point, to steep (up to 50 percent) along the drainages. The FEG MRA is underlain by several hundred feet of Aeolian deposits (Aromas formation) consisting mostly of weathered dune sand (NRCS 2013). Surface soil conditions in the FEG MRA are predominantly weathered dune sand and/or sandstone.

Vegetation on the ridges of the FEG MRA primarily consists of central maritime chaparral, with coast live oak woodland predominating in drainages. A limited amount of grassland vegetation is present as well. The western portion of the MRA is designated as critical habitat for Monterey spineflower (Figure 4).

There are twelve aquatic features concentrated in two main areas within the FEG MRA (Figure 3a). Three aquatic features are located in the eastern portion of the former grenade range. The grenade range has been repeatedly scraped; as a result, much of the terrain surrounding the aquatic features in the grenade range is un-vegetated sandstone. The remaining aquatic features occur in the northeast corner of the FEG MRA and are surrounded by coast live oak woodland, arroyo willow clusters, and grassland vegetation.

Aquatic larval surveys were completed in the FEG MRA during the 2009-2010 and 2010-2011 rainy seasons to determine whether CTS were present in advance of munitions investigations remediation activities, consistent with the HMP, 2005 BO, Wetland Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at the Former Fort Ord (Burleson 2006) and the Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander (CDFG 2003); two CTS larvae were observed in 2011 by the ESCA RP Team in aquatic features located in northeast FEG MRA in the habitat parcel (ESCA RP Team 2011a and 2012a).

3.2.2 Parker Flats MRA Site Description

The Parker Flats MRA is located in the central portion of the former Fort Ord, bordered by the CSUMB Off-Campus MRA and the County North MRA to the north, the IAR MRA to the south, CSUMB campus property to the west, and additional former Fort Ord property to the east and southeast (Figures 2 and 3b). The Parker Flats MRA is contained within the jurisdictional boundaries of the City of Seaside and Monterey County.

The Parker Flats parcel was targeted for development prior to the closure of Fort Ord in 1994, and in 1999 all vegetation was mowed as a part of munitions investigations activities. A subsequent land exchange resulted in this parcel being rezoned as habitat preserve (Zander 2002). In 2005, FORA, under the supervision of the Army, performed a prescribed burn on 147 acres (59.5 ha) in the Parker Flats MRA.

The Parker Flats MRA has been divided into two phases of work, identified as Parker Flats MRA Phase I and Parker Flats MRA Phase II. The Army completed a Track 2 Munitions Response Remedial Investigation/Feasibility study and the signed Track 2 Munitions Response Site Record of Decision (MACTEC 2006 and Army 2008, respectively) for the

Parker Flats MRA Phase II area. The remediation plan documented in the Army ROD for the Phase I area is implemented in this area by the ESCA RP Team. The Parker Flats MRA (Phase I and Phase II areas) encompasses approximately 1,180 acres (477.5 ha) and fully contains USACE parcels E18.1.1, E18.1.2, E18.1.3, E18.4, E19a.1, E19a.2, E19a.5, E20c.2, E21b.3, L20.18, L23.2, and L32.1, and portions of USACE parcels E19a.3 and E19a.4. The remaining portions of USACE parcels E19a.3 and E19a.4 are contained in the County North MRA. Of the 1,180 acres (477.5 ha) identified as the Parker Flats MRA, approximately 211 acres (85.36 ha) are designated as habitat reserve. The borderland interface in this MRA where the development parcel abuts the NRMA is in the middle of the Parker Flats MRA (Figures 2 and 3b).

The terrain of the Parker Flats MRA consists primarily of rolling sandy hills. The elevation ranges from approximately 280 to approximately 490 feet (85 to 149 m) msl, with 2 to 15 percent slopes. The surface soils are characterized as Aeolian (sand dune) and terrace (river deposits), formed from unconsolidated materials of the Aromas and Old Dune Sand formations. The primary soil type present in the Parker Flats MRA is Oceano Loamy Sand with smaller areas of Arnold-Santa Ynez complex and Baywood Sand, which are all weathered dune sands (NRCS 2013).

Vegetation in the Parker Flats MRA consists primarily of coast live oak woodland, maritime chaparral (and associated central coastal scrub vegetation), and grassland. Vegetation varies from sparsely vegetated areas to heavy brush.

3.2.3 Interim Action Ranges MRA Site Description

The IAR MRA is located in the north-central portion of the former Fort Ord, within the boundary of the historical impact area. The IAR MRA is bordered by the Parker Flats MRA to the north, the Seaside MRA to the east, and the historical impact area to the southeast, south, and southwest (Figures 2 and 3c). The IAR MRA is contained within the jurisdictional boundaries of Monterey County and a small portion of the City of Seaside.

The IAR MRA encompasses approximately 227 acres (92 ha) and is located in the area designated by the Army as Munitions Response Site (MRS) Ranges 43-48. An Interim Action Record of Decision (ROD) was produced by the Army in August 2002 for Interim Action Sites at the former Fort Ord (Army 2002). The Interim Action Sites include MRS Ranges 43-48. The ROD summarizes the Final Interim Action Ordnance and Explosives Remedial Investigation/Feasibility Study for Ranges 43-48, Range 30A, Site OE-16, Former Fort Ord, which summarizes the previous field activities conducted at the Interim Action Sites and examines and selects a preferred interim remedial action for the Interim Action Sites.

Previous interim remedial actions conducted by the Army resulted in areas, totaling approximately 235 acres (95 ha), within MRS Ranges 43-48 where the interim remedial action was not completed as Special Case Areas (SCAs) or Non-completed Areas (NCAs). Approximately 35 acres (14 ha) of the SCAs and approximately 9 acres (4 ha) of NCAs within MRS Ranges 43-48 are located within the boundaries of the IAR MRA. Range 44 SCA, Range 47 SCA, and Central Area NCAs are the focus of the ESCA RP Team's efforts. .

Two additional SCAs (Range 45 Trench SCA and a small portion of the Fenceline SCA) are also located within the IAR MRA; however, the ESCA RP Team did not perform remedial actions in these areas. The IAR MRA fully contains the following five USACE Parcels: E38, E39, E40, E41, and E42. Of the 227 acres (92 ha) within this MRA, 206 acres (83 ha) are designated as habitat reserve, and the northern boundary comprises part of the borderland interface (Figure 3c).

The terrain of the IAR MRA consists of gently undulating slopes ranging from 370 to approximately 530 feet (161.5 m) above msl, generally with 2 to 15 percent slopes. No ravines pass through the IAR MRA, although a few low areas support grassland and scattered shrubs and/or trees. In the Range 47 SCA, prior military earthwork has modified the original topography, resulting in an artificial escarpment located in the southwest portion of this area.

The primary soil type present in the IAR MRA is Arnold-Santa Ynez Complex, with Baywood Sand in the northwestern portion of the MRA. Soil conditions at the MRA consist predominantly of weathered Aeolian dune sand and are described as unconsolidated materials of the Aromas and Old Dune Sand formations (NRCS 2013).

Vegetation in the IAR MRA consists primarily of central maritime chaparral, with a small patch of grassland vegetation in the southern portion of the MRA. Prior to 2003, much of the IAR MRA was inhabited by mixed-aged stands of dense maritime chaparral. The MRA was subjected to a prescribed burn in 2003. Except for a small parcel on the northern edge of the area, most of the MRA is designated as critical habitat for Monterey spineflower (Figure 4).

The areas within the IAR MRA that are the focus of monitoring efforts have been given the following names for the purposes of this report (Figure 3c):

- North Range 44: North Range 44 SCA;
- South Range 44: South Range 44 SCAs/Central Area NCAs;
- Range 47 Subarea A: Includes a portion of Range 47 subject to large-scale excavation in which the vegetative cover has historically been low, 10% or less (ESCA RP Team 2012a). Non-native pampas grass *(Cortaderia jubata, C. selloana)* was abundant in places. Historical aerial imagery indicates that the vegetation of the area has changed little since the 1970s, despite an apparent lack of recent disturbance, except for fire that has affected the whole range;
- Range 47 Subarea B: Includes the majority of Range 47, which was subject to large-scale excavation prior to restoration activities;
- Range 47 Subarea C: Includes a small portion of Range 47 surrounding the large-scale excavation area in which vegetation cutting took place in 2012.

4.0 HMP SPECIES

The requirements outlined in the HMP (USACE 1997) and in BOs (USFWS 1999, 2002, 2005) are described in more detail in Section 2 and focus on compliance with the federal ESA and avoidance or minimization, to the extent feasible, of take of listed species, as well as protection of other species of concern. A total of 18 species were addressed in the HMP (Table 2-1, see Section 2). Of these, 11 are plant species and 7 are wildlife species. Five species are restricted to the Monterey Bay region: the Monterey ornate shrew, Toro manzanita, sandmat manzanita, Eastwood's ericameria, and Yadon's piperia. An additional eight species are endemic to the Central Coast of California between the Bay area and Santa Barbara County, including the California black legless lizard, Smith's blue butterfly, Hooker's manzanita, Monterey ceanothus, Monterey spineflower, robust spineflower, sand (Monterey) gilia, and seaside bird's-beak. Most of these species have 10 or more percent of their populations concentrated at the former Fort Ord. Two HMP plants (robust spineflower and Yadon's piperia) and three HMP wildlife species (California red-legged frog, CTS, and California linderiella) have 99% of their range outside the Fort Ord region.

Those HMP species that occur in vegetation types that are widespread at the former Fort Ord, such as central maritime chaparral, tend to be much more common in the MRAs addressed in this report than species confined to specific habitats such as aquatic features and shoreline areas. A summary of each HMP species is provided below, along with brief comments on occurrence in the MRAs.

4.1 HMP Amphibians

There are two amphibian species that are designated as HMP species (USACE 1997).

California tiger salamander (*Ambystoma californiense*) – Federally Endangered and California Threatened. Adults are 7 to 8 inches (18 to 20 centimeters [cm]) long, black with yellow to cream-colored spots, larvae are greenish-gray in color. CTS occur in open woodlands and grasslands, ponds, and vernal pools from Sonoma to Santa Barbara Counties, inland to portions of the Sierra Nevada. Surveys were conducted for CTS larvae in 2010 and 2011 in aquatic features in the FEG MRA in advance of munitions investigations remediation activities. Two CTS larvae were observed by the ESCA RP Team in the FEG MRA during the 2011 aquatic surveys (ESCA RP 2012a; Appendix C). Both aquatic features are located in northeast FEG MRA in the habitat parcel. USFWS designated habitat zones for CTS on site are shown on Figure 5. ESCA RP biologists did not observe CTS in ESCA MRAs during 2014.

California red-legged frog (*Rana draytonii*) – Federally Threatened and California Species of Concern. Adults are 2 to 5 inches (5 to 13 cm) long, reddish-brown, olive, or green with black flecks; hind legs can be red underneath. California red-legged frogs require cold water ponds or slow moving river pools with emergent and submergent vegetation and riparian vegetation at the edges. California red-legged frogs range from Humboldt to San Diego Counties and in portions of the Sierra Nevada. Larvae of California red-legged frogs have been reported in BLM's portion of the Fort Ord National Monument adjacent to Toro Park

(William Collins, personal communication) and suitable habitat is present in parcels outside of ESCA MRAs (USACE 1997). No red-legged frogs have been reported from vernal pools during Army monitoring since 1994. ESCA RP biologist did not observe California red-legged frogs in ESCA MRAs during 2014.

4.2 HMP Reptiles

There is one reptile species that is designated as an HMP species (USACE 1997).

California black legless lizard (*Anniella pulchra nigra*) – California Species of Concern. The limbless adults reach 7 inches (18 cm) in length and are dark on the upper surface and yellow below. Black legless lizards occur in various coastal plant communities where loose sandy soil and abundant invertebrate populations are available. Presently they are found in Monterey County and possibly extirpated from Santa Cruz and San Luis Obispo Counties.

California black legless lizards have been observed by the ESCA RP Team in Parker Flats MRA and IAR MRA. In 2009, a California black legless lizard was observed in an area of oak woodland habitat at the interface with maritime chaparral habitat in sandy soil in the habitat parcel in the Parker Flats MRA. In 2010, a California black legless lizard was observed in maritime chaparral habitat in a development parcel of Parker Flats MRA. In 2012, a California black legless lizard was observed in maritime chaparral with sandy soil in a habitat reserve parcel in IAR MRA. ESCA RP biologists did not observe black legless lizards in ESCA MRAs during 2014.

4.3 HMP Birds

There is one bird species that is designated as an HMP species (USACE 1997) and it occurs outside of the ESCA MRAs, found in the Beach Ranges.

Western snowy plover (*Charadrius nivosus nivosus*) – Federally Threatened and California Species of Concern. The western snowy plover is a small shore bird about 6 to 7 inches (18 cm) in length with pale grayish brown upper body and white underbody bearing a dark breast band, and black legs and bill. Western snowy plovers occur on flat sandy beaches above the high tide level from Washington to Baja California. Western snowy plovers have not been observed by ESCA RP biologists in any of the MRAs on site, and no MRA includes shoreline habitat.

4.4 HMP Mammals

There is one mammal species that is designated as an HMP species (USACE 1997).

Monterey ornate shrew (*Sorex ornatus salaries*) - California Species of Concern. The Monterey ornate shrew is a small mammal approximately 3.5 to 4.25 inches (10 cm) long with grayish brown black fur. It occurs in riparian, woodland, and upland communities where there is thick duff or downed logs. It is endemic to Monterey region. Potential habitat exists for the Monterey ornate shrew in County North, CSUMB, FEG, IAR, MOUT Site, and Parker

Flats MRAs. No Monterey ornate shrews have been observed during ESCA RP biological surveys.

4.5 HMP Invertebrates

There are two invertebrate species that are designated as HMP species (USACE 1997).

California linderiella (*Linderiella occidentalis*) – No California or federal listing. California linderiella is a small (<0.5 inch, or 1.2 cm) aquatic fairy shrimp found in seasonal ponds. California linderiella have been observed by ESCA RP biologists in two aquatic features in habitat parcels in the FEG MRA during the 2010 aquatic surveys (ESCA RP 2011a).

Smith's blue butterfly (*Euphilotes enoptes smithi*) – Federally Endangered. Adults with a wingspan of 1 inch (2.5 cm); males with bright blue upper (dorsal) wing surfaces and females with brown upper wing surfaces; both with orange spotted band on hind upper wing surface edge and whitish gray underwings with dark speckling. It occurs in coastal sand dunes and ravines associated with coast and seacliff buckwheats in Monterey, Santa Cruz, and San Mateo Counties. The Smith's blue butterfly has not been observed by ESCA RP biologists in the ESCA MRAs; it occurs outside of the ESCA parcels in the Beach Ranges.

4.6 HMP Shrubs

There are five shrub species that are designated as HMP species (USACE 1997).

Hooker's manzanita (*Arctostaphylos hookeri subsp. hookeri*) – CNPS 1B.2. Hooker's manzanita is a low-growing to medium-sized shrub in the heather family that rarely reaches 5 feet (1.5 m) in height, and is usually much shorter in stature; it lacks a basal burl and therefore does not resprout after fire or vegetation cutting. Hooker's manzanita is endemic to the general Monterey Bay region, where it occurs in central maritime chaparral vegetation, especially in sandy soils (Baywood sands) or on ancient marine terraces of the Aromas sandstone formation. Hooker's manzanita is a smaller manzanita than the two widespread stump-sprouting manzanitas in the MRAs: shaggy-bark manzanita, which predominates in lowland ocean-facing central maritime chaparral, and brittleleaf manzanita, which occurs further inland. Hooker's manzanita has been previously mapped as relatively common in portions of the Parker Flats, FEG, and the MOUT Site MRAs, with smaller numbers in the Laguna Seca Parking MRA (USACE 1992). Mapping work completed in 2012 by ESCA RP biologists suggests that densities of Hooker's manzanita have been over-estimated due to previous plant misidentification. Hooker's manzanita is found in the FEG, Parker Flats, and the MOUT Site MRAs.

Toro manzanita (*Arctostaphylos montereyensis*) – CNPS 1B.2. Toro manzanita is a large single-trunked shrub to 12 feet (3.6 m) in height in the heather family; it lacks a basal burl and therefore does not resprout after fire or vegetation cutting. Toro manzanita is endemic to the Monterey region, where it occurs in central maritime chaparral vegetation, especially in sandy soils (Arnold sands) overtopping leached Aromas sandstone bedrock. Toro manzanita is scattered to dominant in maritime chaparral in portions of the Parker Flats, FEG, and

MOUT Site MRAs; it occurs in lower densities in the Seaside and Laguna Seca Parking MRAs.

Sandmat manzanita (*Arctostaphylos pumila*) – CNPS 1B.2. Sandmat manzanita is a low mound-forming shrub in the heather family that can reach up to 3 feet (1 m) in height, with broad spreading branches bearing bicolored dull green to grayish leaves. Like Toro manzanita, sandmat manzanita lacks a basal burl and does not resprout after a fire or vegetation cutting. Sandmat manzanita is endemic to Monterey County, and tends to be found in central maritime chaparral and at the margins of oak woodland and Monterey pine forest in Baywood sands and on marine terraces of the Aromas and Paso Robles formations and sandstones allied to Monterey shale. Sandmat manzanita occurs commonly in maritime chaparral in the Seaside, IAR, Parker Flats, and Del Rey Oaks/Monterey MRAs, and in lower densities in the County North and Laguna Seca Parking MRAs.

Monterey ceanothus (*Ceanothus rigidus*) – CNPS 4.2. Monterey ceanothus is a densely-branching shrub in the buckthorn family that reaches approximately 4.5 feet (1.4 m) in height and rarely exceeds 6 feet (2 m). It lacks a basal burl and does not resprout after a fire or vegetation cutting. Monterey ceanothus is endemic to maritime chaparral, central coastal scrub, and Monterey pine forest habitats from southern Santa Cruz to San Luis Obispo County, with its center of distribution in Monterey County. Monterey ceanothus occurs commonly in maritime chaparral in the Seaside, IAR, Parker Flats, FEG, Laguna Seca Parking, MOUT Site, and Del Rey Oaks/Monterey MRAs.

Eastwood's ericameria (*Ericameria fasciculata*) – CNPS 1B.1. Eastwood's ericameria is a multi-stemmed, rounded subshrub to small shrub in the sunflower family that rarely reaches 5 feet (1.5 m) in height. It is able to resprout after fire or vegetation cutting. Eastwood's ericameria is endemic to Monterey County and is found primarily in central coastal scrub and central maritime chaparral in sandy inland soils (Arnold sands overtopping Aromas sandstone). Eastwood's ericameria occurs in maritime chaparral in the Seaside, IAR, Parker Flats, FEG, MOUT Site, and Del Rey Oaks/Monterey MRAs.

4.7 HMP Herbaceous Perennials

There are two herbaceous perennial species that are designated as HMP species (USACE 1997).

Coast wallflower, sand-loving wallflower (*Erysimum ammophilum*) – CNPS 1B.2. Coast wallflower is a biennial to short-lived perennial in the mustard family that reaches from several inches to 1 to 2 feet (0.3 to 0.6 m) in height when flowering. It is endemic to coastal dunes flanking the Monterey Bay region and is also found on Santa Rosa Island in Santa Barbara County. It is found at Marina Dunes State Beach and has been observed east of the City of Marina. During 2013 and 2014, coast wallflower was observed by ESCA RP biologists in both the Seaside MRA and in the IAR MRA North Range 44.

Yadon's piperia (*Piperia yadoni*) – Federally Endangered, CNPS 1B.2. Yadon's piperia is a perennial herb in the orchid family with basal leaves and an elongate flowering spike when it

blooms in late spring and summer. A 1992 survey located a population of Yadon's piperia in northwestern former Fort Ord, just to the east of Highway 1 and the Del Monte Boulevard exit (USACE 1997). Yadon's piperia also exists in several locations to the east and south of the IAR MRA (David Styer, personal communication). Yadon's piperia has not been observed by ESCA RP biologists in any of the MRAs on site.

4.8 HMP Annuals

There are four annual species that are designated as HMP species (USACE 1997); these annual HMP species have sometimes been referred to as HMP focus species.

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) – Federally Threatened, CNPS 1B.2. Monterey spineflower is a low spreading annual in the buckwheat family that is covered with gray hairs and blooms in late spring and early summer. It occurs in sandy soils in coastal strand, coastal scrub, maritime chaparral, margins of oak woodland and riparian habitats, and disturbed sites in grassland below 450 m elevation. It is endemic to northern Monterey and southern Santa Cruz Counties. Monterey spineflower occurs commonly in maritime chaparral in the County North, CSUMB, Del Rey Oaks/Monterey, FEG, IAR, MOUT Site, Parker Flats, and Seaside MRAs; USFWS-designated critical habitat for Monterey spineflower on site is shown on Figure 4. During 2014, Monterey spineflower was observed and mapped by ESCA RP biologists in FEG, IAR, and Parker Flats MRAs.

Robust spineflower (*Chorizanthe robusta* var. *robusta*) – Federally Endangered, CNPS 1B.1. Robust spineflower is low spreading to erect annual in the buckwheat family. It occurs in sandy soils in coastal dune and coastal scrub habitats. Robust spineflower ranges from Santa Cruz County to northern Monterey County. Historically one population was found on former Fort Ord west of Highway 1 to the north of the Lightfighter Road exit. According to the HMP, former Fort Ord does not provide important habitat for this species (USACE1997). Robust spineflower has not been observed by ESCA RP biologists in any of the MRAs on site.

Seaside bird's-beak (*Cordylanthus rigidus* subsp. *littoralis*) – California Endangered, CNPS 1B.1. Seaside bird's-beak is a multi-stemmed annual root parasite that reaches 1 to 2 feet (0.3 to 0.6 m) in height at maturity. Seaside bird's-beak generally occurs in openings in coastal dune scrub, central coastal scrub, and maritime chaparral and is restricted to the ancient sand sheets of Santa Barbara and Monterey Counties. Seaside bird's-beak has been observed by ESCA RP biologists in maritime chaparral in IAR, Seaside, and FEG MRAs. According to the HMP, seaside bird's-beak has the potential to occur in Del Rey Oaks/Monterey and Parker Flats MRAs. During 2014, seaside bird's-beak was observed and mapped by ESCA RP biologists in the FEG and IAR MRAs.

Sand (Monterey) gilia, sand gilia (*Gilia tenuiflora* var. *arenaria*) – Federally Endangered, California Threatened, CNPS 1B.2. Sand (Monterey) gilia is a small annual in the phlox family that produces a basal rosette of leaves and lavender flowers that emerge from a short branching inflorescence that reaches about 6.5 inches (16.5 cm) in height in late spring. It occurs in open loose sandy soils with low silt content in coastal dune scrub and maritime

chaparral habitats in limited locations near Monterey Bay and the adjacent coastal plain of the Salinas Valley. Sand (Monterey) gilia generally occurs in maritime chaparral and has been observed in IAR, FEG, Parker Flats, and Seaside MRAs. During 2014, sand (Monterey) gilia was observed and mapped by ESCA RP biologists in the Future East Garrison, Parker Flats, and IAR MRAs.

5.0 METHODS FOR MUNITIONS INVESTIGATION ACTIVITIES AND HABITAT MONITORING

Methods used for ESCA RP munitions investigation activities and associated biological monitoring activities are summarized in this section. The ESCA RP munitions investigation activities addressed here are those that have resulted in disturbance to native vegetation in habitat parcels in the FEG, Parker Flats, and IAR MRAs.

Munitions investigation activities include analog or geomagnetic investigation, vegetation cutting, small or large scale soil disturbance, and other minor activities. These are defined more specifically in Section 5.1. A grid system developed by the Army is used to document all activities; each grid is assigned a unique number and covers 100 feet by 100 feet (30.5 m x 30.5 m).

By the end of 2013, the majority of the munitions investigation activities were completed in all ESCA MRAs. Associated biological monitoring involves using established or modified protocols to document baseline conditions prior to munitions investigation activities as well as documenting post-activity vegetation recovery. Minimization and avoidance measures are also implemented to avoid or reduce impacts to sensitive biological resources.

5.1 Methods for Munitions Investigation Activities

Munitions investigation activities often require removal of vegetation in order to facilitate target investigation using visual and electromagnetic means. When surface targets are identified, they are generally removed by hand or with the use of handheld tools. When subsurface targets are identified, they are investigated individually or in larger contiguous areas (soil excavation and sifting). Subsurface investigation areas range in size from a single cubic foot to several cubic feet, depending on the type, location, and position of the target. A shovel or other hand tool is typically used, although a backhoe may be used for deeper targets. If MEC is identified but is unsafe to move, in situ detonation may be conducted. Soil replacement follows the same sequence in reverse, with replacement of subsoil and then topsoil replacement after munitions investigation activities are complete.

This method facilitates vegetation regeneration by retaining the seed bank, nutrients, and beneficial organisms on the surface. Other minor activities in support of munitions investigation activities include installation of signage, trash and debris removal, erosion control monitoring and installation of erosion prevention materials.

A brief summary of general methods for munitions investigation activities is provided below.

5.1.1 Tools and Techniques in Munitions Investigations - Digital Geophysical Mapping and Analog Investigations

Digital Geophysical Mapping (DGM) munitions investigation was conducted in areas subject to vegetation cutting (see Section 5.1.2) with either an EM61-MK2 towed array platform ("the FORA ESCA Sled") or manually towed single-array EM61-MK2 combined with a navigation system. Personnel guided the sled along parallel transects through the work area. Data were evaluated and target anomalies were selected for further investigation. Unexploded ordnance (UXO) technicians reacquired target anomalies based on Global Positioning System (GPS) coordinates and intrusively investigated targets to depth.

Analog remedial investigations were generally conducted on foot by technicians to locate and remove surface or subsurface MEC or munitions debris (MD). Technicians generally walked 3-foot (1-m)-wide search lanes through grid cells (grids) with a handheld magnetometer, which recorded the presence of ferrous metal targets. If potential MEC was detected in an investigation area, subsurface investigation (excavation) was sometimes required.

5.1.2 Methods for Vegetation Cutting

Vegetation cutting in this report generally refers to removal of most vegetation to ground level by manual and/or mechanical means, leaving the root mass, soil seedbank, and associated microorganisms and nutrients intact. Prior to initiation of munitions investigation activities, manual and mechanical vegetation cutting was conducted under the direction of the Senior Unexploded Ordnance Supervisor (SUXOS) in coordination with an ESCA RP biologist. Manual vegetation cutting entailed the use of power chippers, powered weed cutters, DR™ trimmers, chainsaws, and a variety of similar hand tools and equipment. Vegetation-cutting support equipment included skip loaders, self-loading log trucks, and/or excavators with grappling arms, which were used to haul out salvageable timber or remove cut brush from the work area for chipping. If consolidated chipping operations were conducted, excavators or loaders were used to feed the chipping or grinding equipment and spread or load chips (masticated plant material).

Vegetation cutting and associated target-specific investigations (see Section 5.1.3) were conducted in the FEG, Parker Flats MRAs, and IAR MRAs.

Where feasible, mature coast live oak trees and shrubs such as HMP manzanitas with a diameter at breast height (dbh) equal or greater than 6 inches (15 cm) were left in place (retained) and limbed up to a height that allowed human access below the tree canopies. Manzanita retention was conducted in the FEG MRA, as described further in Section 5.2.5. Oak tree retention in the Parker Flats MRA is summarized in Section 8.1.

5.1.3 Types of Excavations

In general, subsurface investigation areas (excavations) range in size from a single cubic foot to several cubic feet, depending on the type, location, and position of the target. Excavation

work can involve removal of root mass of individual native plant species and displacement of soil seedbank.

A '**target-specific investigation**' is a subsurface investigation that is smaller than 100 square feet [9.3 m^2]. A shovel or other hand tool was typically used to dig for a target, however a backhoe was sometimes required for deeper targets. Target-specific investigations were conducted in portions of the FEG, Parker Flats, and IAR MRAs on an as-needed basis after vegetation cutting activity.

A '**small-scale excavation'** is a subsurface investigation that affected an area between 100 square feet and 1 acre [9.3 m^2], or alternatively, an area that was greater than 100 square feet but less than 100 feet (30.5 m) wide. Small-scale excavations were conducted in portions of of the IAR MRA and was also required in a portion of the former grenade range in the FEG MRA.

A **'large-scale excavation'** is a subsurface investigation that disturbed an area over 1 acre (0.4 ha) in size. For the habitat parcels, one large-scale excavation was conducted in the IAR MRA in Range 47.

5.1.4 Methods for Target Specific Investigation

Target specific investigation was used on the majority of the ESCA RP habitat parcels. This investigation method focuses soil disturbance to individual targets thereby minimizing impacts to the natural resources.

Additionally a "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

5.1.5 Methods for Small Scale Excavation

Small scale excavations were used in areas where target specific investigation was not viable due to analogy density, depth and expanse of investigation area. An investigative approach was developed and implemented by the ESCA RP team in 2011 to minimize impacts to intact central maritime chaparral vegetation and relatively high densities of associated HMP herbaceous species in the IAR MRA. This approach was implemented under a Design Studyand addressed locations where the Army had not previously conducted subsurface investigations, called Non-completed Areas [NCAs] and Special Case Areas [SCAs]. The IAR MRA Design Study confined vegetation cutting and subsurface investigations to10-foot-wide (3-m-wide) linear transects placed in the NCAs and SCAs in the IAR MRA; usually two parallel investigation transects traversed a single grid but often extended in a north-south linear alignment of contiguous grids in the study areas (see Appendix A). The Design Study approach greatly reduced disturbance to native habitat while gathering critical information about the location, type, and level of munitions investigation activities needed to support the

Army's interim ROD; this process is described in the Phase II Interim Action Work Plan (ESCA RP Team 2011b).

5.1.6 Methods for Interim Action Ranges MRA Design Study

An investigative approach (called the Design Study) was developed by the ESCA RP team in 2011 to minimize impacts to intact central maritime chaparral vegetation and relatively high densities of associated HMP herbaceous species in the IAR MRA. The Design Study addressed locations where the Army had not previously conducted subsurface investigations - NCAs and SCAs. The Design Study confined vegetation cutting and subsurface investigations to10-foot-wide (3-m-wide) linear transects placed in the NCAs and SCAs in the IAR MRA; as described in Section 5.1.5.

5.1.7 Methods for FEG MRA Step-outs

A "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

5.1.8 Methods for Large-Scale Soil Excavation

In the Range 47 SCA, large-scale excavation was required due to the high density of sensitively-fuzed munitions, small metallic debris, and ammunition links discovered within the soil in 2011 in an area encompassing 13.4 acres (5.4 ha). Prior to soil excavation, the above- and below-ground vegetation was removed by "root raking;" during root raking, a bulldozer equipped with heavy tines pushed the tines through the soil, pulling out entire plants, including roots and burls, while retaining most of the soil. The plant material was stockpiled, masticated into wood chips, and inspected by a UXO technician to determine that the material was free from potential MEC or MD.

Excavated soils were removed with bulldozers or excavators, transported by dump trucks to an onsite mechanical sift plant, where potential MEC was removed from the soil by UXO teams.

The excavation process consisted of a sequence of topsoil removal (top 6 to 12 inches [15 to 30 cm]), followed by removal of subsoil. Each soil layer was sifted and stockpiled separately. Soil replacement followed the same sequence in reverse, with replacement of subsoil and then of topsoil. This process encourages regeneration of native species through replacement of seed bank, soil nutrients, and beneficial soil organisms.

The habitat restoration requirements in the large-scale excavation area in Range 47 are detailed in the Phase II Interim Action Work Plan Addendum Habitat Restoration Plan (HRP) for the IAR MRA and associated Field Variance Forms, as identified in the Installation Wide Habitat Management Plan (ESCA RP Team 2012b and 2013a; USACE 1997). See Section

7.0 and Appendix A for details on restoration planning, implementation, and monitoring in the IAR MRA.

5.1.9 Methods for Other Activities in Support of Munitions Investigation Activities

Other minor activities in support of munitions investigation activities have included installation of signage, trash and debris removal, weed and erosion control monitoring, and installation of erosion control materials reflecting current best management practices (BMPs). Most of these activities have been conducted on an as-needed basis except for erosion and weed monitoring. Methods for weed monitoring and management are described in more detail in Section 5.2.8 and methods for erosion monitoring and control are described in Section 5.2.9.

Field activities are conducted in accordance with the HMP, BOs, and the appropriate ESCA work plan. All project personnel and subcontractors working in ESCA parcels receive environmental awareness training provided by ESCA RP Qualified Biologists.

5.2 Biological Monitoring Methods

Biological monitoring in 2014 was conducted in habitat parcels in which vegetation was disturbed as a result of ESCA RP munitions investigation activities to meet the requirements of the 1997 HMP and BOs; biological monitoring methodology adhered to the *U.S. Army Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at the former Fort Ord* (Burleson 2009).

Pre-disturbance (i.e., "baseline") vegetation surveys were conducted to document species dominance and cover in shrub- and tree-dominated central maritime chaparral. In addition, baseline data are gathered on HMP herbaceous species distribution and density prior to investigation activities. Post-remediation surveys are conducted in native shrub-and tree-dominated vegetation types in Years 3, 5, 8, and 13. Post-remediation surveys for HMP annuals and herbaceous perennial species are completed in Years 1, 3, 5, and 8.

Methods are also detailed below for monitoring Toro manzanita retention during vegetation cutting, post-rainfall CTS monitoring, monitoring of aquatic features, weed monitoring, and erosion monitoring. Monitoring related to restoration activities in the IAR MRA is described in Appendix A.

Plant nomenclature follows the *Jepson Manual: Vascular Plants of California,* Second Edition (Baldwin et al. 2012). In addition, pertinent volumes of the *Flora of North America* (Flora of North America Editorial Committee, eds. 1993+) are also utilized for plant identification. Plant community classifications and sensitive species information follow Holland (1986), Sawyer, Keeler-Wolfe, and Evens (2009), and the California Natural Diversity Database (CNDDB; CDFW 2014).

5.2.1 Methods for Vegetation Monitoring

Line-intercept vegetation transects are used to measure shrub and herbaceous vegetation cover in areas subject to munitions investigation activities in project work areas. Both baseline and post-activity transects are monitored in central maritime chaparral vegetation, along with a limited number of transects in central coastal scrub and oak woodland vegetation that consistently support central maritime chaparral species as well. Differences in stand age, species diversity, or other characteristics are documented in order to stratify transect placement into areas that are likely to have distinct species composition and distribution.

Vegetation transects are placed randomly on an MRA-by-MRA basis. A random number generator is used to A) select a grid (total number of grids in strata), B) select the quadrant of the grid for transect starting point (1-4), and C) select which compass direction in which to align the transect from the starting point (0-360 degrees). If a transect location is randomly selected and overlaps another transect, it is discarded and a new transect location is chosen. Transects are generally measured by using a 164-foot-long (50-m-long) tape, although a shorter transect length may be used if it is placed in a single isolated grid; diagonal placement in a grid enables monitoring of a transect that is 141 feet (43 m) long, as in the FEG MRA. Some shorter transects have also been placed in small-scale excavation areas in Range 44 in the IAR. GPS waypoints and the transect survey direction (e.g., north to south) are recorded so that the same transect can be revisited in subsequent years. Additionally, each year a photograph is taken from one end of each transect. Locations of transects are shown on Figure 6a, 6b, and 6c.

Aerial cover by shrub and tree species is recorded on data sheets for all plants that intercept the monitoring tape; all layers of shrub and tree species cover are recorded, so there may be two or more species recorded in the same location. Cover by herbaceous species in the absence of shrub or tree overstory is only recorded as a combined “herbaceous cover” category, per the 2009 protocol (Burleson 2009).

Frequency data are represented here as the percentage of total transects containing at least one rooted individual of a given species.

Bare ground and/or thick layers of masticated vegetation are recorded in transect segments devoid of vegetation; prior to 2014, the “bare ground” category often included both bare ground and loose masticated vegetative material.

Primary access to munitions investigation areas in the FEG and Parker Flats MRAs has been on existing roads or fuel breaks. Because all of the habitat parcels were work areas, ingress/egress routes are not treated as a separate activity site for the FEG and Parker Flats MRAs. In the IAR MRA, a concerted effort was made to confine access to investigation areas by using existing roads, where possible, thereby reducing the need to creating new ingress/egress routes through intact vegetation areas not subject to investigation. A special category was created during the development of the HRP for the IAR MRA to monitor the effect of ingress/egress routes on biological resources (see Appendix A). A summary of vegetation transect installation dates and monitoring is provided below.

A summary of vegetation transect installation dates and monitoring is provided below. Table 1-1 presents all monitoring effort to date.

5.2.1.1 Future East Garrison MRA Vegetation Transect Monitoring

As previously described, a "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

Baseline Transects:

A total of 43 baseline transects were established by the Army in the FEG MRA prior to ESCA RP munitions investigation activities which are described below (HLA 1996, 1998).

2010-2011 - Thirty-nine baseline transects were installed in central maritime chaparral.

2012 - Two baseline transects were installed in oak woodland at the edge of the former grenade range; this oak woodland vegetation supported many dominants of central maritime chaparral in the understory and likely represented a seral stage in mature chaparral development.

Baseline data from these 41 transects were gathered during the year of installation, and post-activity data were collected from transects, per the 2009 protocol schedule (Burleson 2009). If there were no previously established transects in an area in which monitoring was required, new transects were established. In 2013, there were no baseline transects in grids subject to activities in 2010, and 6 new transects were installed in these grids. These data were then compared to the 39 original baseline transects.

Munitions Activities Dates:

2010

- West habitat parcel in the FEG MRA: vegetation cutting took place in four isolated grids and along the single roadway/maintained fuel break.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in 23 scattered grids, along the single roadway/maintained fuel break, and along narrow strips scattered throughout the parcel.

2011

- West habitat parcel in the FEG MRA: vegetation cutting was confined to narrow strips scattered throughout the parcel.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in most grids that had not been previously cut, except for the grenade range/MRS-11, as well as a few grid clusters around the perimeter of the parcel.

2012

- West habitat parcel in the FEG MRA: vegetation cutting occurred in all remaining uncut area.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in the grenade range/MRA-11 and in clusters of grids around the perimeter of the parcel.

2013

- West habitat parcel in the FEG MRA: no vegetation cutting occurred.
- East habitat parcel in the FEG MRA: less than an acre of vegetation cutting occurred in portions of four grids along the southeast side of the Ammunition Supply Point or Explosive Storage Location, which is located in the middle of the MRA.

Post-activity Transects (Shown in Figure 6a):

2013 - Six Year 3 post-activity transects were established in order to monitor vegetation establishment in areas subject to vegetation cutting in 2010; three transects were placed in the west habitat parcel and three in the east habitat parcel.

2014 - Seventeen Year 3 post-activity vegetation transects in central maritime chaparral were monitored in areas that had been subject to munitions investigation activities, including vegetation cutting, in 2011; all of these transects were located in the east habitat parcel. Monitoring events were conducted on 28-30 April and 5-6 May 2014.

All ESCA RP vegetation monitoring transects in the FEG MRA are shown in Figure 6a.

5.2.1.2 Parker Flats MRA Vegetation Transect Monitoring

Baseline Transects:

Prior to 2008, the Army conducted all biological monitoring (Jones & Stokes 1995b, c; CH2MHill 2005).

2008 - Eleven baseline vegetation transects were established by the ESCA RP Team in the Parker Flats MRA Phase II habitat parcels prior to vegetation cutting in 2009. One isolated transect was established in a small patch of central maritime chaparral surrounded by oak woodland habitat in the middle of the Phase II area. The remaining 10 transects were clustered in the larger contiguous patch of central maritime chaparral on the east end of the habitat reserve; the eastern three transects are dominated by shrubs typical of central coastal scrub (ESCA RP Team 2009).

No vegetation monitoring transects were monitored in the Phase I habitat reserve.

Munitions Activities Dates:

1998 - Phase I: vegetation cutting took place in the MRS-37, MRS-54, and MRS 55 portions of the PF MRA Phase I habitat reserve completed by the Army.

1999 - Phase I: vegetation cutting took place in the MRS-03 portion of the PF MRA Phase I habitat reserve completed by the Army.

2000 - Phase I: vegetation cutting was completed in the MRS-52 and MRS-53 portions of the PF MRA Phase I habitat reserve completed by the Army.

2009 - Phase II: vegetation cutting was completed in the PF MRA Phase II habitat reserve by the ESCA RP Team. It commenced in the end of 2008 at the east end of the reserve and continued until March 2009 at the west end.

Post-activity Transects (Shown in Figure 6b):

2012 - Eleven Year 3 post-activity vegetation transects were monitored in the same location as baseline transects.

2014 - Eleven Year 5 post-activity vegetation transects were monitored in the same location as baseline transects.

Vegetation monitoring was conducted on the following dates in the Phase II habitat parcels on 1 and 6-7 May 2014.

Locations of all ESCA RP transects in the Parker Flats MRA are shown in Figure 6b.

5.2.1.3 Interim Action Ranges MRA Vegetation Transect Monitoring

Baseline Transects:

1999-2000 – Baseline transects established by the Army in the Range 44, Range 45, and Range 47 in 2000, prior to the 2003 prescribed burn (HLA 2001, Parsons 2005).

2008 – Thirty transects established by the Army were monitored by the ESCA RP team (ESCA RP Team 2009).

2010-2011 – Twenty-three baseline transects were designated by the Army in central maritime chaparral and selected as "proxy" baseline transects for upcoming munitions activities, excluding the Range 47 SCA large-scale excavation area. An additional nine new "proxy" baseline transects were designated by the ESCA RP Team near the proposed ESCA RP munitions investigation areas; three of these transects were located immediately west of Range 47 SCA to serve as proxy baseline transects for the large-scale excavation.

As of 2011, no further monitoring of Army transects outside of the IAR MRA NCAs and SCAs was indicated due to vegetation recovery reflecting an appropriate and sustainable trajectory associated with high quality habitat (ESCA RP 2012).

Munitions Activities Dates:

2011 - Vegetation cutting and small-scale excavations were completed in linear scrapes in South Range 44. Limited ingress-egress routes were cut for access to work areas.

2011-2012 - Large-scale excavation was conducted in 14.4 acres (5.8 ha) in Range 47 and completed in December 2012. A small amount of vegetation cutting was conducted around the edges of Range 47 in 2012. Limited ingress-egress routes were cut for access to work areas.

2012-2013 - Vegetation cutting in North Range 44 was conducted in 2012 and completed in early 2013; in addition, small-scale excavations in targeted areas and along scrapes were also conducted in 2012 and completed in early 2013.

Post-activity Transects (Shown in Figure 6c):

2012 - Sixteen Year 1 post-activity transects were established in the South Range 44 SCAs/NCAs, a small portion of North Range 44, and areas outside the large-scale excavation in Range 47 SCA.

2013 - Thirteen Year 1 post-activity transects were established in North Range 44 SCA. Ten new transects were established in the Range 47 large scale excavation. One of these 10 grids was placed in Subarea A, one was placed in the deer exclusion control area (deer present), and one was placed in the irrigation control area. The remaining seven were in Subarea B.

All 29 transects were monitored in 2013 (Years 1 and 2).

2014 - All 29 transects were monitored on 8 and 13-14 May, 26 and 30 June, and 1-3 and 14-15 July 2014.

Locations of all ESCA RP transects in the IAR MRA are shown in Figure 6c.

5.2.2 Methods for Supplemental Herbaceous Vegetation Monitoring

Herbaceous quadrat monitoring is conducted as a component of the vegetation transect monitoring effort when shrub cover is relatively low and herbaceous species cover is proportionately high; methods follow the Army's 2009 sampling protocol (Burleson 2009). These supplementary 2.7 square-foot (0.25 m^2) herbaceous quadrats are placed every 32.8 feet (10 m) on alternating sides of each transect, for a total of six per transect. Percent aerial cover for each plant species in the plot is recorded. If any HMP annuals occur within the quadrat, number of plants are counted and recorded. Comparative baseline data may not be available for quadrats.

Monitoring events for supplemental herbaceous vegetation occurs on the same dates and in the same transect locations, when sampled, as vegetation monitoring described in the prior section.

Supplementary herbaceous quadrats are also sampled in grassland vegetation in the IAR MRA. Three grassland "proxy" baseline quadrats were sampled in the IAR MRA grassland on 29 September 2011; these were placed near to proposed munitions investigation activity areas prior to work.

2012 - Six new herbaceous quadrats were monitored in the IAR MRA grassland area on 25 June 2012: three in areas subject to vegetation cutting and three in areas subject to small-scale excavation. These quadrats were not along a transect, but randomly placed within the activity areas, and returned to annually for monitoring.

2013 – The six grassland herbaceous quadrats were monitored on 22 May 2013.

2014 – The six grassland herbaceous quadrats were monitored on 30 June and 1 July 2014.

5.2.3 Methods for HMP Herbaceous Species Monitoring

HMP herbaceous species are sensitive annual or herbaceous perennial species that are generally restricted to the Fort Ord region and are vulnerable to habitat degradation. HMP monitoring surveys document baseline and post-remediation locations and densities during the peak flowering period for each species. A minimum of twenty percent or thirty-eight (which ever number is larger) 100-ft x 100-ft grids per munitions investigation activity type are surveyed for all HMP herbaceous species during the peak flowering period (April through July, depending on the species). Colonies of HMP herbaceous species found within each grid are mapped with a hand-held GPS unit (Trimble GeoHX) to record their general distribution and range in the work area (Figures 6a, 6b, 6c, 7a, 7b, 7c, 7d, 8a, 8b, 8c, 9, 10a, 10b, 10c, and 10d).

Numbers of HMP herbaceous species are either censused, or, in areas with high densities, sampled within circular plots (8.2 feet, or 2.5 meter (m) radius), following Burleson (2009). Often an HMP species may be concentrated in only a portion of a grid; these individuals or colonies are mapped with a hand-held GPS unit; those polygons are shown on Figures 8a, 8b, 8c, 9, 10a, 10b, 10c, and 10d . On occasion, the plot shape is adjusted to fit the shape of the disturbance area so that the sampled area fits within the grid, the habitat type, the activity type, and the activity year; this was done in portions of Range 44 and along ingress/egress corridors.

In the FEG and Parker Flats MRAs, HMP herbaceous species are sampled in Years 1, 3, 5, 7, and 10 after munitions investigation activities. In accordance with the HRP for the IAR MRA, HMP herbaceous species in the IAR MRA are counted in each monitoring plot every year for seven years after habitat disturbance.

Reference colonies of each HMP herbaceous species were mapped and sampled if a given HMP herbaceous species was observed in undisturbed vegetation in or around each MRA during a given year; in many cases a reference location could not be found. Identified reference colonies are re-mapped and re-sampled each year, if present, according to the standard protocol described above.

Locations of all grids monitored for HMP annuals in 2014 in the FEG, Parker Flats, and IAR MRAs are shown in Figures 6a, 6b, and 6c, respectively.

Grids that support existing colonies of HMP herbaceous species in MRAs 2014 are shown in Figures 8a, 8b, and 8c for the FEG, Figure 9 for Parker Flats, and Figures 10a, 10b, 10c, and 10d for IAR. Table 1-1 presents all monitoring effort to date.

5.2.3.1 Future East Garrison MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring:

2010 - Baseline monitoring was conducted in 2010 for all HMP herbaceous species in the FEG MRA. Three baseline sand (Monterey) gilia plots were sampled in the north and south ends of the east habitat parcel and two baseline Monterey spineflower plots were sampled in the middle of the east habitat parcel. Due to the dense vegetation at the time, the baseline surveys were limited to accessible areas (ESCA RP Team 2011a).

Munitions Activities Dates: see Section 5.2.1.1.

Post-activity HMP Herbaceous Species Monitoring (Shown in Figure 6a):

2012 HMP Herbaceous Species Monitoring – Year 1 surveys for all HMP herbaceous species in the east habitat parcel; Monterey spineflower and sand (Monterey) gilia sampling (ESCA RP Team 2013b).

2013 HMP Herbaceous Species Monitoring – Year 1 and 3 monitoring for all HMP herbaceous species in portions of the east and west habitat parcels, including Monterey spineflower, sand (Monterey) gilia, and seaside bird's beak sampling (ESCA RP Team 2014).

2014 Reference Plots – One seaside bird's-beak reference colony, containing three new reference plots, was surveyed immediately to the southeast of the FEG MRA on 24 June 2014. No Monterey spineflower or sand (Monterey) gilia colonies were observed in 2014 (Figure 8a).

2014 HMP Herbaceous Species Monitoring – Year 1 and 3 monitoring was conducted on 21-25 and 29 April, 12 and 14 May, and 24 June 2014. Three plots were sampled for Monterey spineflower in the middle of the east habitat parcel. One plot was sampled for sand (Monterey) gilia in the north end of the east habitat parcel. Eight plots were sampled for seaside bird's-beak just southeast of the FEG MRA. All areas surveyed in 2014 for HMP herbaceous species in the FEG MRA are shown in Figure 6a.

5.2.3.2 Parker Flats MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring:

2008 - Phase II – Baseline surveys were conducted in the Parker Flats MRA Phase II habitat reserve on 15-23 May 2008 and 8 August 2008. One Monterey spineflower colony,

containing three new baseline plots, was surveyed in the middle of the Phase II habitat reserve. An additional seven new baseline plots were sampled in Monterey spineflower colonies that were clustered in several locations in the east end of the habitat reserve close to Watkins Gate Road (ESCA RP Team 2009).

Baseline surveys were not conducted by the ESCA RP team for herbaceous species in the Phase I habitat reserve, because no munitions investigation activities were conducted in these areas.

Munitions Activities Dates: see Section 5.2.1.2.

Post-activity HMP Herbaceous Species Monitoring:

2011 Phase II HMP Herbaceous Species Monitoring – Ten Monterey spineflower Year 2 post-activity plots were sampled in the same location as baseline plots.

2012 Phase II HMP Herbaceous Species Monitoring – Ten Monterey spineflower Year 3 post-activity plots were sampled in the same location as baseline plots.

2013 Phase II HMP Herbaceous Species Monitoring – Six Monterey spineflower Year 4 plots were sampled in the east end of the habitat parcel.

2014 - Phase I Reference Plots – One Monterey spineflower reference colony, containing three new reference plots, was surveyed just west of the Phase I habitat reserve on 3 July 2014.

2014 - Phase I HMP Herbaceous Species Monitoring – Surveys were conducted for all HMP herbaceous species in suitable habitat on 22 April, 13 May, and 4 and 10-12 June 2014; these areas were subject to activities conducted by the Army between 1998 - 2000. Seventy-one Monterey spineflower plots were sampled.

2014 - Phase II HMP Herbaceous Species Monitoring – Year 5 surveys were conducted for all HMP herbaceous species in suitable habitat on 13 May and 4 and 10-12 June 2014. Five Monterey spineflower plots were sampled.

Survey areas for HMP herbaceous species in the Parker Flats MRA are shown in Figure 6b.

5.2.3.3 Interim Action Ranges MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring :

2010-2011 - Safety issues in the IAR MRA from 2010 until 2012 necessitated modifications to the 2009 HMP herbaceous species monitoring protocol. Sampling was conducted in nearby areas cleared by UXO support personnel outside of the SCAs and NCAs.

Baseline surveys were conducted for all HMP herbaceous species in the IAR MRA in the following locations, with the number of sampled grids (100-ft x 100-ft) reflecting presence of HMP herbaceous species:

- North Range 44 SCA, South Range 44 SCA/Central Area NCA central maritime chaparral – Forty-one grids sampled for Monterey spineflower, 30 for sand (Monterey) gilia, and 24 for seaside bird's-beak.
- South Range 44 SCA/Central Area NCA grassland - One grid sampled for Monterey spineflower and one for sand (Monterey) gilia.
- Range 47 SCA Subarea A maritime chaparral – One grid sampled for Monterey spineflower, one for sand (Monterey) gilia, and one for seaside bird's-beak.
- Range 47 SCA Subarea B maritime chaparral – Twenty-four grids sampled for Monterey spineflower, 24 for sand (Monterey) gilia, and five for seaside bird's-beak.
- Range 47 SCA Subarea C maritime chaparral – Three grids sampled for Monterey spineflower, three for sand (Monterey) gilia, and 30 for seaside bird's-beak.
- Ingress/Egress corridors maritime chaparral – All existing ingress and egress corridors sampled for Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak.

2012 - Modified baseline HMP species 25 m^2 plots were sampled in 59 grids for Monterey spineflower, 20 grids for sand (Monterey) gilia, and four grids for seaside-bird's-beak around the perimeter of the SCAs/NCAs in habitat with similar vegetation structure and diversity to that of off-limit areas. In addition to monitoring plots, HMP herbaceous species were counted within entire grids when feasible. Baseline data from plots were extrapolated to entire grids for comparison purposes. The HRP (ESCA RP Team 2013a) describes these baseline locations in more detail; the 2012 data are the reference set for required performance standards related to HMP herbaceous species in the HRP.

Munitions Activities Dates: see Section 5.2.1.3.

Post-activity HMP Herbaceous Species Monitoring (Shown in Figure 6c):

2012 Central Maritime Chaparral Reference Monitoring – Seven Monterey spineflower reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered around the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

Five sand (Monterey) gilia reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered around the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

Five seaside bird's-beak reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered on the eastern half of the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

2012 HMP Herbaceous Species Monitoring – Year 1 monitoring of all HMP herbaceous species in South Range 44 and Range 47 Subarea C.

2013 Central Maritime Chaparral Reference Plots – One sand (Monterey) gilia reference location was sampled in northwest IAR MRA habitat reserve on 6 May 2013.

One Monterey spineflower reference location was sampled just east of North Range 44 on 11 June 2013.

One seaside bird's-beak reference plot was sampled just east of South Range 44 on 16 May 2013.

Two coast wallflower reference plots were sampled just outside the North Range 44 SCA.

2013 HMP Herbaceous Species Monitoring – Year 1 monitoring for all HMP herbaceous species was conducted in North Range 44 and Range 47 Subareas A and B.

2013 HMP Herbaceous Species Monitoring – Year 2 monitoring for all HMP herbaceous species was conducted in South Range 44 and Range 47 Subarea C.

2014 Central Maritime Chaparral Reference Plots - Two new sand (Monterey) gilia reference colonies were surveyed in northwest IAR MRA on 23 May 2014. One new sand (Monterey) gilia reference colony was surveyed just southeast and outside the IAR MRA on 23 May 2014.

Two Monterey spineflower reference colonies, containing with five new reference plots, were sampled just east of North Range 44 SCA on 26 June and 3 July 2014.

One seaside bird's-beak reference colony, containing two new reference plots, was surveyed along Tanker Road on the east side of the IAR MRA on 24 June 2014.

2014 Grassland Reference Plots - Three Monterey spineflower reference plots were sampled in an undisturbed part of the IAR MRA grassland on 31 July 2014.

2014 HMP Herbaceous Species Monitoring – Year 2 monitoring for all HMP herbaceous species was conducted in North Range 44 and Range 47 Subareas A and B on the following dates: 5, 9, 23, 25-26 June 2014. In the Range 47 restoration area, 51 plots were sampled for Monterey spineflower, 13 for sand (Monterey) gilia, 22 for seaside bird's-beak, and four for coast wallflower. HMP herbaceous species were monitored in seeded and planted HMP plots, as well as in all grids per the 2009 protocol (Burleson 2009).

2014 HMP Herbaceous Species Monitoring - Year 3 monitoring was conducted for all HMP herbaceous species in South Range 44 and Range 47 Subarea C on the following dates: 13 and 29-30 May, 2-5, 9-12, and 25-26 June, and 3 July 2014. Fifty-one plots were sampled for Monterey spineflower, 13 for sand (Monterey) gilia, and three for seaside bird's-beak.

2014 HMP Herbaceous Species Monitoring - HMP herbaceous species monitoring was conducted on the following dates in the IAR MRA: 13 and 29-30 May, 2-5, 9-12, 23, and 25-26 June, and 3 July 2014.

Inside the Range 47 restoration area, HMP herbaceous species were monitored in seeded and planted HMP plots, as well as in all grids per the 2009 protocol (Burleson 2009).

5.2.4 Methods for Documenting Species Diversity

Documentation of native species presence in each MRA provides an overview of existing species richness and the suite of species that recolonize work areas over time, along with the relative abundance of HMP species in the site as a whole. A comprehensive list of species for each MRA is compiled and updated each year (Tables 3-1, 3-2, and 3-3). In 2014, all native plant species occurring along a transect or within a quadrat were recorded to provide total species richness per sample; in addition, all native plant species within one meter of a transect tape were also recorded in order to capture a more comprehensive summary of native species in munitions investigation areas.

Mean species richness per transect or quadrat is calculated for each year and each activity type.

Diversity was determined using the Shannon-Wiener Index (H'), which is a function of the relative abundances of the species present, depending on both the number of species and their evenness (Pielou 1974). The following equation was used to calculate H'.

$$H' = -\sum p_i \ln p_i$$

Where:

H' = Shannon-Wiener Index

p_i = proportion of community that belongs to the *i*th species

Evenness (J') was calculated as the ratio of the observed H' to the maximum possible H' for a community with the same number of species (H'_{max}) (Pielou 1974). The maximum possible value for evenness (i.e., 1) is achieved when H' = H'_{max}, which occurs when all species are present in equal abundance. The following equation was used to calculate J'.

$$J' = \frac{H'}{H'_{max}} = \frac{H'}{\log s}$$

Where:

J' = evenness

H' = Shannon-Wiener Index

H'max = maximum possible H' for a community with s species

s = total number of species present

Discussion of species diversity is incorporated into vegetation monitoring summaries for each MRA (Section 6.1).

5.2.5 Methods for HMP Manzanita Retention Monitoring

Unlike stump-sprouting shrubs such as shaggy-barked manzanita, brittleleaf manzanita, and chamise, non-stump sprouting shrub species such as Toro manzanita and Hooker's manzanita do not readily recolonize sites subject to vegetation cutting in the absence of fire, as documented by the ESCA RP Team between 2008 and 2013. To mitigate for possible reduction in the abundance of these obligate-seeding species and to ensure the presence of seed-producing mature HMP shrubs, as many Hooker's and Toro manzanitas were retained as feasible by the ESCA RP team in areas subject to vegetation cutting in the FEG MRA, where Toro manzanitas are common and Hooker's manzanitas are rare.

To measure the effectiveness of the HMP manzanita retention approach after munitions investigation activities, 116 grids were selected in 2012 for annual sampling of manzanita survival using a random number table; stratification of grids was used for selection of sampling locations based on geographic area (east and west habitat parcels), shrub dominance types, and level of disturbance. Once a grid was chosen for sampling, three to five adjacent cells were also sampled. Within each surveyed grid, a census of all shrub and tree species left standing after vegetation cutting was recorded in 2012, as well as in 2013 and 2014. This sampling approach is consistent with the goals of the HMP to avoid and preserve HMP species to the maximum extent possible and to monitor associated efforts.

Manzanita retention monitoring was conducted on the following dates in the FEG MRA: 29-30 July 2014.

5.2.6 Methods for Post-Rainfall CTS Monitoring

CTS tend to emerge from burrows after large rain events. Inspections for CTS are conducted by biologists and field crews after one-half inch (1.2 cm) or more of rain is recorded on site within the previous 24-hour period. Inspections are focused within two kilometers of known, current, or historical CTS breeding pond (Figure 5). All CTS inspectors have received MRA-specific environmental awareness training.

Inspections take place prior to fieldwork commencement and involve careful examination surrounding and under materials, equipment, and vehicles that could be used during the post-rainfall day, often using a high-powered flashlight. If a CTS is observed by a crew member, the ESCA RP Senior Qualified Biologist (SQB) is consulted for approval prior to CTS relocation to a safe place by a USFWS-approved Qualified Biologist (QB), if necessary. A crew member stays with the animal until it is outside of the work area so that it is not injured or killed by a vehicle, predator, or other means.

5.2.7 Methods for Aquatic Feature Monitoring

During 2014, the three aquatic features in the FEG grenade range were monitored on a routine basis during the rainy season, include AF09-1A, which was subject to sifting during remediation activities that took place between October 2012 and January 2013. Water depth, turbidity, pH, presence of submergent and/or emergent vegetation, and presence of aquatic invertebrates and any sensitive species were documented, along with total rainfall for the period and season. Aquatic feature monitoring events are summarized in Appendix C. Appendix C also includes aquatic feature monitoring reports from 2014.

5.2.8 Methods for Weed Monitoring and Management

During 2014, weed monitoring was conducted throughout the year using visual surveys, with focused attention on pampas and/or jubata grass (*Cortaderia selloana, C. jubata*), French broom (*Genista monspessulana*), and iceplant pursuant to the HMP (USACE 1997).

Weed abatement is conducted where necessary, including in ESCA development parcels, to reduce the spread of these target weed species into habitat areas. In addition, any weedy species that are listed by the California Invasive Plant Council as highly invasive weeds are also monitored if present in sufficient numbers to threaten sensitive species or habitats (California Invasive Plant Council 2006). Weed monitoring and abatement events are summarized in Appendix D. Appendix D also includes weed monitoring reports from 2014.

5.2.9 Methods for Erosion Monitoring and BMPs

During 2014, erosion monitoring was conducted in MRAs before and after rain events of 0.5 to 1 inch (1 to 2.5 cm) or more within 24 hours, depending on the intensity of rainfall. When necessary, the ESCA RP Team installed erosion control best management practices measures (BMPs), such as burlap sand bags, silt fencing, biodegradable weed-free straw wattles, biodegradable coconut fiber erosion control blankets, and water bars. Hydroseeding with local native species was conducted in the grenade range in the FEG MRA and on the escarpment in Range 47 in the IAR MRA, and hydromulching was conducted in the development parcel in the IAR MRA on November 11 and 12, 2014 to reduce erosion and enhance plant establishment in these areas (Figures 11a and 11 b). Erosion monitoring events are summarized in Appendix E. Appendix E also includes erosion monitoring reports and photo documentation from 2014.

6.0 BIOLOGICAL MONITORING RESULTS

Baseline biological monitoring data have been gathered in habitat parcels subject to munitions investigation activities in the FEG, Parker Flats, and IAR MRAs in order to meet the requirements of the 1997 HMP and BOs; biological monitoring methodology adhered to the *U.S. Army Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at the former Fort Ord* (Burleson

2009); methods and general locations of munitions investigation types are summarized in Section 5.1.

A summary of habitat monitoring activities completed by the ESCA RP Team during 2014 is shown in Table 1-1 and includes vegetation transects and associated herbaceous quadrats in shrub-dominated vegetation types, herbaceous quadrats in grassland vegetation, HMP herbaceous species monitoring, and aquatic feature monitoring. Species richness data are also collected and reported.

Tables 6-1 through 6-50 present the results from biological monitoring activities in habitat parcels in the FEG, Parker Flats, and IAR MRAs.

6.1 Vegetation Monitoring in MRAs

Vegetation monitoring of habitat parcels performed during 2014 in habitat parcels subject to vegetation cutting during munitions investigation activities is summarized by MRA in this section: FEG MRA, Parker Flats MRA, and IAR MRA (Table 1-1). Munitions investigation activities in the IAR MRA also included small-scale excavation, large-scale excavation, and creation of new ingress-egress routes; vegetation monitoring of areas subject to these activities are reported in Appendix A.

6.1.1 Vegetation Monitoring in Future East Garrison MRA

During 2014, a total of 17 transects were monitored in those areas subject to munitions investigation activities that ended in 2011 (Figure 6a). Data from these Year 3 transects are compared with data obtained from 39 baseline transects in Table 6-1; data from six Year 3 transects sampled in 2013 are included in Table 6-1 as well. Section 5.2.1 summarizes transect monitoring methods.

Mean baseline total shrub and subshrub cover in central maritime chaparral in the FEG MRA surpassed 100% in 2010 and, three years after vegetation cutting, exceeded 50% cover. Mean shrub cover for Year 3 transects ranged between 54.4% and 58.1%, with cover by herbaceous species averaging between 8% and 16.8%.

In all transects, the stump-sprouting shrubs brittleleaf manzanita and chamise maintained dominance both before and after vegetation cutting. Distribution and abundance of associated shrub species in the FEG MRA vary based on environmental characteristics and site history; the most common associated shrubs prior to vegetation cutting were Toro manzanita and black sage, and an additional 18 shrub species were found in low numbers in one or more baseline transects (Tables 6-1, 6-2, and 6-3).

Three years after vegetation cutting, mean cover by obligate-seeding shrubs such as Toro manzanita declined in the three years after vegetation cutting, from 14.4% cover in baseline transects to 1.6% in Year 3 transects (Figure 12G). A few plants, especially rapidly colonizing native subshrubs such as rush-rose (*Crocanthemum scoparium*), bush monkeyflower (*Mimulus aurantiacus*), and deerweed (*Acmispon glaber*) exhibited greater

cover after vegetation cutting than in the dense chaparral cover observed in baseline transects. Other shrub species were found at similar low numbers in both baseline and Year 3 transects, such as coyote bush (*Baccharis pilularis* subsp. *consanguinea*) and California coffeeberry (*Frangula californica*). As in baseline transects, a total of 22 shrub species were documented in all Year 3 transects, often in low numbers. Some species present in baseline conditions have not yet appeared in transect locations, such as blue blossom ceanothus (*Ceanothus thyrsiflorus*) and California sagebrush (*Artemisia californica*); both had less than 1% mean cover in baseline transects. Shrubs such as creeping snowberry (*Symphoricarpos mollis*) and California blackberry (*Rubus ursinus*) were absent in baseline transects but present in Year 3 transects.

Frequency data facilitate comparisons of species distributions in a given area, even for species with low cover. The two dominant stump-sprouting shrubs, brittleleaf manzanita and chamise, are widespread, exhibiting frequencies greater than 80% before and after vegetation cutting (Figure 13G). Although the cover of two HMP shrubs, Toro manzanita and Monterey ceanothus, declined after vegetation cutting, frequency data indicate reestablishment of germinating HMP shrub seedlings in at least half of the transects in which they were originally present. Toro manzanita was present in 64.1% of baseline transects and in 33.3% to 35.3% of Year 3 transects; hence, seedlings are currently found in more than half of transects in which Toro manzanita was originally present and ongoing recruitment is likely. Monterey ceanothus was present in 48.7% of baseline transects and 35.3% to 66.7% of Year 3 transects. Native subshrubs that rapidly colonize sites after burns and other disturbances exhibited higher frequencies in Year 3 transects compared with baseline transects.

Openings between shrubs support a range of native herbaceous species, including round-fruited sedge (*Carex globosa*), California bedstraw (*Galium californicum* subsp. *californicum*), purple cudweed (*Gamochaeta ustulata*), needle-leaved navarrettia (*Navarretia intertexta*), California milkwort (*Polygala californica*), and others. Mean herbaceous cover in herbaceous quadrats ranged between 0% in baseline transects and 6.0% in Year 3 quadrats. The most common native species in herbaceous quadrats was California aster (*Corethrogyne filaginifolia*). Native species comprised 6.2% mean cover in quadrat sampling; native shrubs averaged 4.5% cover and herbaceous species 1.7% cover. Non-native species produced a mean total of 4.4% cover, with non-native grasses averaging 4.1% cover.

Non-native target weed cover by iceplant was less than 1% in Year 3 transects in chaparral vegetation.

Approximately 7% of baseline mean cover was categorized as “bare ground.” After vegetation cutting, approximately 35% of mean cover encompassed bare ground, including a sizeable portion of masticated vegetation. Bare ground is expected to decline as mature vegetation increases.

Plant species richness increased after vegetation cutting in the FEG MRA (Table 6-3). A total of 25 native plant species was recorded in 39 baseline transects in dense chaparral vegetation in 2010-2011, 22 of which were shrub species, with an average of 5.7 native shrub species per transect. Three years after vegetation cutting, when more light and open area was available for plant colonization, a total of 28 species were recorded in transects, with a mean

of 8.4 native shrub species per transect and 91 native species within one meter of all Year 3 transects combined. The same number of shrub species were recorded along both baseline and Year 3 transects, with five more species within one meter. The number of herbaceous species increased from two to five between baseline and Year 3 measurements, but was boosted to 64 herbaceous species, along with two fern species, after vegetation cutting within one meter of transects.

6.1.2 Vegetation Monitoring in Parker Flats MRA

During 2014, a total of 11 transects were monitored in the Parker Flats MRA ESCA RP Phase II munitions response areas (Figure 6b). Baseline, Year 3, and Year 5 post-activity data are summarized Tables 6-4, 6-5, 6-6, and 6-7; see Section 5.2.1 for details on monitoring methods. Eight transects are located in shrub-dominated habitats supporting species typical of central maritime chaparral vegetation and three transects are located in shrub-dominated habitats supporting species typical of central coastal scrub vegetation.

Central maritime chaparral: Mean total native cover in central maritime chaparral in the Parker Flats MRA exceeded 100% in 2008 in baseline transects and increased to 90.6% just three years after vegetation cutting in 2012, with a slight drop to 82.7% in Year 5 following two years of drought. Mean native herbaceous species cover in these transects is consistently low, ranging from 2.5% in baseline transects to 2.2% in Year 5 data.

As in other MRAs, chamise and a species of stump-sprouting manzanita (primarily shaggy-barked manzanita in Parker Flats MRA) predominate both before and after vegetation cutting, with combined mean cover of these two species alone equaling almost 75% in Years 3 and 5 post-activity transects (Figure 14G). Chamise reached pre-disturbance cover levels after just three years.

All other associated shrub species exhibited less than 7% cover values in both baseline and post-remediation data, often less than 1.2%. Cover for black sage declined by half or more from the baseline of 6.2% mean cover. Coyote bush and poison-oak had similar low cover values both before and after vegetation cutting. Toro manzanita exhibited low mean cover (3.5%) in baseline transects and was absent after vegetation cutting. The colonizing subshrub deerweed was absent in baseline and Year 5 transects but was found in 75% of transects with a mean cover of 2.7% in Year 3 (Figure 15G).

A total of 8 shrub species were documented in all baseline transects; shrub species increased to 14 in Year 3 transects and was 11 in Year 5. Cover by non-dominant associated native shrubs was often very low. Some species present in baseline conditions were not present in Year 3 or Year 5 transect locations, such as blue blossom ceanothus (*Ceanothus thyrsiflorus*) and California sagebrush (*Artemisia californica*); both had less than 1% mean cover in baseline transects. Shrubs such as creeping snowberry (*Symphoricarpos mollis*) and California blackberry (*Rubus ursinus*) were absent in baseline transects but present in Year 3 transects.

There was insufficient herbaceous cover for quadrat sampling in central maritime chaparral in the Parker Flats MRA transects in 2014. Non-native target weed cover by iceplant and non-native grass species was less than 1% in mature chaparral vegetation.

Approximately 22.5% of mean bare ground was documented in 2014, with 15.5% of that consisting of masticated vegetation. There was insufficient herbaceous cover for quadrat sampling in 2014. Non-native target weed cover by iceplant was less than 1% in mature chaparral vegetation.

Species richness increased immediately after vegetation cutting in central maritime chaparral vegetation in the Parker Flats MRA, with the mean number of species per transect rising from 11 in baseline transects to 15 in Year 3 transects and dropping to 12 in Year 5 transects (Table 6-7). Shrub species increased from 8 in baseline transects to 14 in Year 3, dropping to 11 in Year 5. Herbaceous species richness was low in baseline transects and zero in post-activity transects in central maritime chaparral, but increased to 48 herbaceous species within one meter of Year 5 transects.

Central coastal scrub: Total mean cover in central coastal scrub baseline transects in 2008 was 78.3%, comprised almost entirely of shrubs and subshrubs, with herbaceous cover less than 1% between shrubs. Total mean cover rose to 87.8% in Year 3 transects, dropping to 66.7% in Year 5 transects after two years of drought (Table 6-7, Figure 16G). Herbaceous cover is an important component of post-remediation native cover, comprising 31% of all native cover in Year 3 and 44% in Year 5.

Cover by the most dominant shrub in central coastal scrub transects, black sage, decreased from a baseline mean cover of 33% to 3.4% in Year 3 and 4.3% in Year 5 after vegetation cutting. In contrast, the subshrub bush monkeyflower almost doubled between baseline measurements (7.5%) and Year 3 transect data (14.4%). Coyote bush showed little change between baseline and post-remediation cover values. Deerweed is absent in baseline and Year 5 transects but has a mean cover of 13.5% in Year 3 transects. Dominant species in central coastal scrub vegetation exhibit similar frequencies both before and after vegetation cutting (Figure 17G).

Openings between shrubs support a range of native herbaceous species, including purple needlegrass (*Stipa pulchra*), Coast Range melic (*Melica imperfecta*), California everlasting (*Pseudognaphalium californicum*), and fairy mist (*Pterostegia drymarioides*). Mean herbaceous cover in herbaceous quadrats ranged between 3.9% in Year 3 quadrats and 10.0% in Year 5 quadrats, the majority of which was non-native species such as smooth cat's ears (*Hypochaeris glabra*, 3.7% mean cover), several non-native annual grasses (3.2% combined mean cover), and others. Although non-native cover was proportionately high, native species comprised approximately half of total vegetation cover in herbaceous quadrats, with species such as coast live oak and poison-oak increasing in cover as well.

Native plant species richness increased in central coastal scrub vegetation in the Parker Flats MRA after vegetation cutting. A total of 11 native plant species was recorded in 3 baseline transects and six herbaceous quadrats in central coastal scrub vegetation in 2008, eight of which were shrub species (Table 6-7). Three years after vegetation cutting, a total of 14

native species were recorded in all Year 3 transects combined, including 10 shrub species, one tree species, and three herbaceous species. Five years after vegetation cutting, 21 native species were documented along transects and in quadrats, with an additional 33 native species within one meter of the transect line.

6.1.3 Vegetation Monitoring in Interim Action Ranges MRA

During 2014, a total of 38 transects were monitored in the IAR MRA (Figure 6c). Native vegetation in the IAR MRA is comprised primarily of central maritime chaparral, with a small grassland area located in South Range 44 SCA. Unlike munitions investigation activities in the FEG and Parker Flats MRAs, which consisted primarily of vegetation cutting in central maritime chaparral, a total of four activity types are being monitored in the IAR MRA for long-term effects on biological resources in accordance with the HRP; these include vegetation cutting and associated target-specific investigations, small-scale excavations, large-scale excavation, and ingress/egress routes; see Section 5.1. Only monitoring results from areas subject to vegetation cutting in the IAR MRA are provided below (Tables 6-8 to 6-12); results from monitoring in areas subject to all four activity types in the IAR MRA are reported in Appendix A.

Four dominant shrubs formed the majority of shrub cover in 2010-2011 baseline transects in the entire IAR MRA: shaggy-barked manzanita (29.3% average cover), dwarf ceanothus (20.2% cover), Monterey ceanothus (13.5% cover), and chamise (9.0 % average cover), all of which had frequencies of 90% or greater (Table 6-8 to 6-12); mean total shrub and subshrub cover was 94.5%. When baseline transect data are segregated by site, different localized patterns emerge. South Range 44 has the lowest combined mean baseline cover of shaggy-barked manzanita and chamise (25.8%), compared with North Range 44 (37.8%) and Range 47 Subarea C (44.8%). Dwarf ceanothus is an important associated species in all three areas: South Range 44 (30.4%), North Range 44 (23.4%), and Range 47 Subarea C (13.7%). Monterey ceanothus has similar cover (16%) in South Range 44 and Range 47 Subarea C, but lower cover in North Range 44 (9.4%).

All post-activity vegetation monitoring transects showed a decline in native shrub cover immediately after vegetation cutting, with a fairly rapid rise in cover two to three years after munitions investigation activities were complete. Mean native shrub cover was 28.4% in Year 3 transects in South Range 44, 38.4% in Year 2 transects in North Range 44, and 62.7% in Year 3 transects in Range 47 Subarea C (Figures 18G, 20G, and 22G).

Since the greatest initial cover in post-activity transects is initially provided by stump-sprouting dominants such as shaggy-barked manzanita and chamise, a comparison of baseline and post-activity data for those two species by site points to a pattern of strong vegetation recovery, with combined Year 3 cover of these two species equaling 65% of baseline cover in South Range 44 and exceeding 100% of baseline cover in Range 47 Subarea C and Year 2 cover in North Range 44 equaling 57% of baseline cover.

Obligate seeding species also exhibit high frequencies in post-activity data (Figures 19G, 21G, and 23G). In both South Range 44 and North Range 44, sandmat manzanita and

Monterey ceanothus both are documented in at least 80% of all transects. In Range 47 Subarea C, where dwarf ceanothus was an important baseline associate, it is found in 67% of transects, and Monterey ceanothus is found in 100% of transects.

Resprouting by burl-forming shrubs, combined with establishment of obligate-seeding species and pioneering subshrubs such as deerweed and rush-rose, suggests that all sites are on a recovery trajectory that will mirror the species composition and diversity present under pre-activity conditions.

Native plant species richness increased after vegetation cutting in the IAR MRA (Tables 6-11 and 6-12). Nineteen native plant species were recorded in baseline transects in dense chaparral vegetation in 2010-2011, 17 of which were shrub species, and one which was an herbaceous species. The total number of native species along transects was highest in Year 1 after vegetation cutting, with 24 native species in North Range 44, 17 in South Range 44, and 7 in Range 47 Subarea C. Mean number of shrub species per transect decreased after vegetation cutting in South Range 44 and Range 47 Subarea C but was similar to baseline data in North Range 44. Herbaceous species richness increased in all areas when data were included within one meter of the transect tape in 2014.

Herbaceous cover was 12.7% in Year 2 transects in North Range 44, but only 1% in Year 3 transects in Range 47 Subarea C (excluding iceplant) and 2.2% in Year 3 transects in South Range 44.

6.2 Vegetation Monitoring Summary

Similar vegetation recovery patterns occur in central maritime chaparral in all MRAs that were monitored in 2014, although details vary.

Vegetation Cover and Frequency: Combined mean baseline cover of a species of stump-sprouting manzanita and chamise equaled approximately 73% in the FEG MRA, 94% in the Parker Flats MRA, and 38% in the IAR MRA. In the Parker Flats MRA, no obligate-seeding shrub species had mean cover values that exceeded 10% in baseline transects, in contrast to the FEG MRA, where Toro manzanita was a frequent associate (14.4%) and to the IAR MRA, where Monterey ceanothus (13.5%) and dwarf ceanothus (20.2%) were co-dominant with chamise and shaggy-barked manzanita.

Vegetation cutting leaves the root systems of many stump-sprouting shrubs intact, and dormant shoots emerge quickly after being cut. By Year 5, shaggy-barked manzanita and chamise reached 75% mean cover in post-activity transects in the Parker Flats MRA, equaling 97% of combined baseline cover for these two species. In Year 3 transects in the FEG MRA, combined mean cover of brittle-leaf manzanita and chamise was 32%, or 43% of combined baseline cover. In the IAR MRA, combined mean cover of shaggy-barked manzanita and chamise in Year 3 transects in Range 47 Subarea C reached 49% mean cover, or 109% of baseline cover, with much lower values in Range 44 (17% in South Range 44 and 22% in North Range 44), where baseline cover was lower for these species as well.

Regardless of location, stump-sprouting shrubs show a trajectory of steady increase over time after the initial drop due to vegetation cutting.

Obligate-seeding shrubs like Toro manzanita, Monterey ceanothus, dwarf ceanothus, and sandmat manzanita recolonize sites subject to vegetation cutting from seed, so post-activity cover by these shrubs is initially extremely low and gradually increases over time, especially with adequate rainfall. Frequency data represent a snapshot of shrub seedling recruitment. The HMP shrub Toro manzanita occurred in 35% of Year 3 transects in the FEG MRA (55% of the baseline frequency), indicating widespread reestablishment within just three years. In the Parker Flats MRA, black sage was the most common associated shrub species in baseline transects (6.2% mean cover); it had become established in 62.5% of Year 3 transects and then declined to 37.5% of Year 5 transects, during a three-year period of subnormal rainfall. In the IAR MRA, establishment by the HMP shrub Monterey ceanothus occurred in 80% to 100% of post-activity transects by Years 2 or 3, with the HMP shrub sandmat manzanita present in at least 80% of all transects in South Range 44 and North Range 44 and 67% of transects in Range 47 Subarea C.

Species Richness and Diversity: The mean number of shrubs and herbaceous species per transect generally tends to increase during the first three years after vegetation cutting in all sites; generally by Year 3, the mean number of shrubs per transect equals or exceeds the baseline.

HMP species, all of which require seed germination in activity areas in order to recolonize a site, were present in similar to greater numbers in post-activity transects in the FEG and IAR MRAs as in baseline transects. Only in the Parker Flats MRA, where Toro manzanita was the only HMP species recorded in baseline transects, were no HMP species recorded post-activity. Lessons learned from poor recruitment of Toro manzanita in the Parker Flats MRA led to the ESCA RP initiating an HMP manzanita retention practice in the FEG MRA (see Section 6.2.1).

Species richness, based on comparisons of baseline and post-activity transect species composition data, increased in the FEG, Parker Flats, and IAR MRAs (except for Range 47 Subarea C) after vegetation cutting, an expected result due to increased light and space available for seedling recruitment after removal of the dense chaparral canopy.

In 2014, species richness documentation also encompassed all species within one meter of the transect tape as a separate metric. In the FEG MRA, a total of 94 native species were observed in the one-meter perimeter area surrounding the tape, including five additional shrub species not found on the transect line, as well as 59 additional native herbaceous species and two ferns (Table 6-3).

In the Parker Flats MRA in central maritime chaparral, a total of 65 native species were observed in the one-meter perimeter area surrounding the tape, including five additional shrub species not found on the transect line, as well as 48 additional native herbaceous species (Table 6-7). However, baseline shrub richness was lower in the Parker Flats MRA than in the FEG MRA, eight species rather than 22, respectively.

Required annual monitoring in the IAR MRA provides an opportunity to compare year by year variability in species richness data. In Range 44, species richness increased the first year after vegetation cutting and was higher in 2014 than 2013, despite the prolonged drought. In Range 47 Subarea C, species richness declined in Years 1 and 2 but increased in Year 3; two additional shrub species were present in Year 3 transects that were absent in previous years. A total of 41 species were recorded in the expanded one-meter transect perimeter in 2014 in South Range 44, 50 species in North Range 44, and 33 species in Range 47 Subarea C (Tables 6-11 and 6-12).

The Shannon index reflects species composition and relative abundance of each species based on transect cover values in central maritime chaparral; a higher Shannon index value reflects not just species diversity but the proportion that each species contributes to the entire sample. In the 2014 sampling effort, the Shannon index values do not incorporate the diversity of species observed within one meter of transects (since cover values were not recorded for species off the immediate transect line).

In the FEG MRA, the Shannon index was higher in Year 3 transects (1.5) than baseline values (1.1); the FEG MRA also has the highest species richness of any of the sites. The Shannon index was lower in the Parker Flats MRA than in the FEG MRA and remained fairly static: 0.9 in baseline transects, 0.9 in Year 3, and 0.8 in Year 5.

In the IAR MRA, the Shannon index was somewhat lower after vegetation cutting in all locations, and the post-activity vegetation cover differed from other sites due to relatively lower baseline cover of stump-sprouting shrubs, which resulted in lower cover by these shrubs post-activity as well. Because most other species recolonize activity sites from seed and have low proportionate cover initially, the Shannon index is expected to dip after vegetation cutting. In South Range 44, the baseline Shannon index value was 1.8, and it fell to 1.4 in Year 1, and then climbed to 1.5 in Year 2, returning to 1.4 in Year 3. In North Range 44, the Shannon index was 1.8 in baseline transects and 1.7 in Years 1 and 2. In Range 47 Subarea C, the baseline Shannon index was 1.6, and it declined to 1.0 in Year 1 and was 1.3 in Year 2 and 1.1 in Year 3; these lower values may reflect the predominance of stump-sprouting shrubs, the prolonged drought, and slow recovery of native shrubs and herbaceous species, especially in the presence of iceplant, which covered 8.6 % of the Range 47 Subarea C site (iceplant removal in this area will be addressed in early 2015 as part of ongoing BMPs).

All sites had relatively low evenness values around 0.2; a value of 1 represents complete evenness, or codominance by all species.

6.3 HMP Species Monitoring in MRAs

HMP species monitoring focuses primarily on herbaceous species, including three annuals -- Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak – and one herbaceous perennial, coast wallflower (Figures 7a, 7b, 7c, and 7d). In addition, routine monitoring has been conducted for the HMP manzanitas that are part of the manzanita retention effort in the FEG MRA (see Section 5.2.5).

In the FEG and Parker Flats MRAs, vegetation cutting was the only munitions investigation activity previously conducted in areas requiring surveys for HMP herbaceous species in 2014.

In the IAR MRA, four munitions investigation activity types were conducted in areas requiring surveys for HMP herbaceous species in 2014:

Activity A – Ingress/egress pathways and roads

Activity B – Above-ground vegetation cutting only, prior to target-specific excavation

Activity C – Small-scale soil excavation

Activity D – Large-scale soil excavation

These activity types are described in more detail in Appendix A. HMP herbaceous species data for Activities A, B, and C are discussed below, however, in order to provide comparisons between MRAs.

Figures 8 to 10 present HMP species density data by MRA. Tables 6-13 to 6-18 and 6-20 to 6-50 present HMP herbaceous species monitoring data, providing both detailed densities, estimates, and associated statistics, as well as HMP herbaceous species monitoring data organized by density class.

6.3.1 HMP Species Monitoring in Future East Garrison MRA

Three HMP annual species were monitored by ESCA RP biologists in the FEG MRA in 2014 in post-activity areas: Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak (Figures 8a, 8b, and 8c); a total of 372 grids located east of Barloy Canyon Road were surveyed in areas subject to vegetation cutting between 2010 and 2013 (see Section 5.2.3.1). One new seaside bird's-beak reference plot was also sampled.

A census of Toro manzanitas retained during vegetation cutting was also conducted.

Monterey spineflower: In general, Monterey spineflower is found in lower densities in the sandstone-derived substrate in the FEG MRA compared with the relatively high densities of Monterey spineflower that occupy Aeolian sandy substrates at lower elevations to the west and southwest, such as in the IAR and Parker Flats MRAs. Monterey spineflower was not found in the FEG MRA in the flora and fauna base-wide 1992 surveys (USACE 1992; Figure 7a).

In 2010, only two grids supported Monterey spineflower, one with 12 plants and one with 224 plants; these grids became the baseline site. The estimated average number of Monterey spineflower in baseline grids was 118. This area was subject to vegetation cutting in 2011.

Monterey spineflower persisted in the same location, with 110 plants in 2012 (Year 1 post-activity), 138 in 2013 (Year 2), and 377 in 2014 (Year 3).

In 2014, 377 Monterey spineflower individuals were spread through three grids, with 2 individuals in one grid, 75 in another, and 300 in the third, with an estimated mean of 126 individuals/grid in 2014 (Tables 6-13 and 6-14; Figure 8a). Mean Monterey spineflower density per grid is similar to the baseline, and total 2014 numbers were higher than any previous year.

It is difficult to correlate Monterey spineflower density solely with activity year, since Monterey spineflower is currently confined to one location in the FEG MRA, with fluctuating numbers that could also reflect variable rainfall patterns. However, Year 3 sampling in 2014 indicate robust recovery of Monterey spineflower in the one known location, despite a three-year drought (Figure 24G).

No other Monterey spineflower colonies have been observed in the FEG MRA, despite extensive searches each year, including a survey of 371 grids in 2014 for potential sightings. No undisturbed Monterey spineflower reference plots were available for comparison.

Sand (Monterey) gilia: Sand (Monterey) gilia occurs in low densities in loose sandy soils with low silt content in several locations at the former Fort Ord. It was mapped in 1992 in low densities in a central swath across the former military base, with higher densities in the northwest (Figure 7b, USACE 1992). A small area was mapped near the northeastern perimeter of the FEG MRA, and it is in this general area that low numbers of sand (Monterey) gilia continue to be observed.

In 2010, three grids supported 330 sand (Monterey) gilia in two locations. One of these locations encompassed two grids and included 329 sand (Monterey) gilia; this location became the baseline site. The other location was in the center of the southern perimeter of the eastern habitat parcel, where only one sand (Monterey) gilia was observed and not found again in subsequent years. This entire area was subject to vegetation cutting in 2011.

The number of sand (Monterey) gilia individuals was 0 plants in two grids in 2012 (Year 1), 16 plants in 2013 in three grids, and 30 individuals in one grid in 2014 (Year 3; Tables 6-15 and 6-16 and Figure 8b).

As with Monterey spineflower, sand (Monterey) gilia colonies often recur each year in the same location, with fluctuating numbers that could reflect variable rainfall patterns as well as response to activity type. Total sand (Monterey) gilia densities dropped from 15 individuals in two grids during 2012 baseline sampling, to a low of 0 in 2012, before rebounding to 30 in one occupied grid in 2014 (Figure 25G).

No undisturbed sand (Monterey) gilia reference plots were available for comparison.

Seaside bird's-beak: In 1992, base-wide mapping indicates low density of seaside bird's-beak in a central swath through mostly the northern half of the former Fort Ord, with a small area of low-density bird's-beak in the eastern FEG MRA (Figure 7c, USACE 1992).

Prior to 2013, seaside bird's beak had not been recorded inside the FEG MRA by ESCA RP biologists, although it had been previously mapped to the south in 1992 (Figures 7c and 8c).

In 2014, 375 seaside bird's-beak individuals were located in six grids located in the same general location as the seaside bird's-beak colony that was first recorded in 2013, double the 2013 number of 187 (Tables 6-17 and 6-18, Figure 26G). In 2014, a total of 132 seaside bird's beak individuals were counted in Year 2 grids and 243 in Year 3 grids, with mean densities of 19 individuals/plot for Year 2 and 11.5 plants/plot for Year 3, suggesting an increase over time subsequent to vegetation cutting.

Two reference plots were placed nearby in undisturbed habitat and supported a total of 9 seaside bird's beak individuals, with a mean density of 4.5 individuals per plot and an estimated 55 individuals per grid in suitable habitat.

Toro manzanita and Hooker's manzanita: To mitigate for possible reduction in the abundance of obligate-seeding HMP manzanita shrubs in vegetation-cut areas in the FEG MRA, the ESCA RP Team developed methods for retaining between five and 50 Toro manzanitas per acre and any observed Hooker's manzanitas in areas subject to vegetation cutting in the FEG MRA (Section 5.2.5).

An average of 20.9 Toro manzanitas per acre (0.4 ha) survived in 2012 after vegetation cutting using the modified shrub retention method (Table 6-19). This number held steady at 20.7 surviving Toro manzanitas per acre (0.4 ha) in 2014. Only five Toro manzanitas have died subsequent to vegetation cutting activities, mostly from toppling; three died in 2013 and two died in 2014. Hooker's manzanitas also occur in the manzanita retention area in very low densities, and these plants continue to survive.

6.3.2 HMP Herbaceous Species Monitoring in Parker Flats MRA

One HMP annual species, Monterey spineflower, has been observed in the Parker Flats MRA Phase II area subject to munitions investigation activities by the ESCA RP Team between 2008 and 2014. After a 2005 prescribed burn in the Phase I area, both sand (Monterey) gilia and coast wallflower were observed in the south end of the Phase I area by biologists from California State University and the Bureau of Land Management (Pierce et al. 2010).

Surveys for all HMP herbaceous species were conducted in both Phase I and Phase II areas in 2014; a total of 327 grids located in the Phase I area and 321 grids in the Phase II area (Figure 9). Only Monterey spineflower was observed in Phase I and Phase II areas in 2014.

Monterey spineflower: Monterey spineflower has a wide distribution at the former Fort Ord, and was mapped in 1992 as having low to medium densities over large portions of the Parker Flats MRA (Figure 7a).

During 2008 baseline surveys for Monterey spineflower in the Phase II portion of the Parker Flats MRA, an estimated total of 1,369 plants were counted in eight grids, at a mean density of 111.3 plants per plot. This area was subject to vegetation cutting in 2009.

In 2014, an estimated total of 4,562 Monterey spineflower individuals were found in five grids in Phase II areas after vegetation cutting (Tables 6-20 and 6-21; Figure 9); 571

Monterey spineflower individuals were reported in 2012 (Year 3 post-activity) and 383 in 2013 (Year 4). The mean density of Monterey spineflower in plots was 40.7 in 2012 (Year 3), 35.7 in 2013 (Year 4), and 54.2 in Year 5 (2014).

2014 surveys for Monterey spineflower colonies were also conducted in the Phase I portion of the Parker Flats MRA, which had been subject to vegetation cutting by the Army between 1998 and 2000, as well as a burn in 2005. Monterey spineflower individuals were widespread, occurring in 65 grids, with mean densities ranging from 115.7 individuals/plot in Year 14 (2000), 172.9 individuals/plot in Year 15 (1999), and 130.0 individuals/plot in Year 16 (1998), respectively, for an estimated combined total of over 208,500 Monterey spineflower individuals (Figure 27G).

Three reference plots installed in 2014 in undisturbed vegetation supported a total 3,314 Monterey spineflower individuals, with a mean density of 1,104.7 individuals/plot. Recently cut vegetation support stable colonies of Monterey spineflower, and associated data from colonies in vegetation that has remained uncut for more than ten years indicate steady population increases through time.

A total of 331 grids were surveyed for HMP species in the Phase I portion of the Parker Flats MRA in 2014, and 327 grids in Phase II.

6.3.3 HMP Herbaceous Species Monitoring in IAR MRA

Four HMP herbaceous species were monitored in the IAR MRA in 2014 in post-activity areas: Monterey spineflower, sand (Monterey) gilia, seaside bird's-beak, and coast wallflower (Figures 10a, 10b, 10c, and 10d). A total of 127 grids were surveyed in South Range 44, 60 grids in North Range 44, 22 grids in Range 47 Subarea C, and 66 grids in Range 47 Subareas A and B.

Data are presented in Tables 6-22 to 6-50 and include density values expressed as the number of plants per plot in order to facilitate comparisons with other 25 m^2 plot data from previous years. Data are reported separately for North Range 44, South Range 44, Range 47 Subareas A and B, and Range 47 Subarea C based on activity types: ingress/egress routes; vegetation cutting and target-specific excavation; and small-scale excavation. Results of HMP annual establishment in the Range 47 large-scale excavation area are provided in Appendix A, along with details on seeding and planting efforts.

6.3.3.1 Ingress/Egress Routes in IAR MRA

Ingress/egress routes consist of limited access corridors created outside of a grid targeted for munitions investigation activities, primarily in South Range 44.

In the 2013 Annual Natural Resource Report, HMP herbaceous species data were reported from some ingress/egress routes in North Range 44 and elsewhere that are no longer placed in this category. During 2014, ingress/egress routes were more narrowly defined to only

encompass access corridors newly created for munitions investigations activities, since no anticipated road widening was necessary on existing corridors.

In 2014, the mean density/plot of Monterey spineflower in the ingress/egress corridors in South Range 44 was 1,100 individuals; the total Monterey spineflower plants per grid was estimated at 10,618 and the estimated total plants in two grids was 21,235. The 2014 results are much higher than the total 3,349 estimated individuals reported in ingress/egress corridors in 2013 (Tables 6-23 and 6-31). No sand (Monterey) gilia or seaside bird's beak were found along ingress/egress routes in 2014.

6.3.3.2 Vegetation-Cut Areas in Range 44 and Range 47 Subarea C

Monterey spineflower: An estimated 31.9 Monterey spineflower individuals/plot were documented in the 2012 baseline sampling in North Range 44 prior to disturbance (Table 6-22 to 6-24). 2012 baseline Monterey spineflower densities were 40.5 individuals/plot in South Range 44 and 6 individuals/plot in Range 47 Subarea C.

North Range 44: In 2014, Monterey spineflower occurred in 35 grids, with a mean density of 35.0 plants/plot in areas subject to vegetation cutting in 2012 (Table 6-22). An estimated total of 35,492 Monterey spineflower individuals were present in post-activity Year 2 areas in 2014, with a mean of 1,014 individuals/grid. Year 2 (2014) Monterey spineflower density was slightly higher than the 2012 baseline density for North Range 44.

Two nearby reference plots supported a mean density of 60 Monterey spineflower individuals/plot.

South Range 44: In 2014, Monterey spineflower was located in 24 grids with a mean density of 1,548.1 plants/plot (Table 6-23) and 2,049 individuals per grid in Year 3 post-activity vegetation-cut areas in South Range 44, which exceeds the 2012 baseline. A total of 49,168 Monterey spineflower individuals were estimated to occur in South Range 44 in vegetation-cut areas, which unlike North Range 44, includes grassland vegetation (these data are discussed further in Appendix A). Fewer Monterey spineflower individuals were observed in the previous year, 3,601 individuals in 3 grids, with a density of 158.6 plants per plot.

Three nearby reference plots supported a total of 870 Monterey spineflower individuals with a mean density of 290 individuals/plot in 2014.

Range 47 Subarea C: In 2014, average Monterey spineflower density was 122.9 individuals/plot and an estimated 1,484 individuals/grid in Year 3 post-activity vegetation cut areas, encompassing 9 grids for a total estimated 13,353 individuals (Table 6-24). Mean Monterey spineflower density/plot was higher in Year 2 than Year 1 data from the same location, as well as higher than the baseline or nearby North Range 44 reference plots.

Monterey Spineflower Summary for Vegetation-cut Areas in the IAR MRA: In summary, Monterey spineflower was found in 66 grids in vegetation-cut areas in the IAR MRA in 2014 (excluding Range 47 Subareas A and B), with mean densities that ranged from 35 to 1,548 plants /plot. 2014 Monterey spineflower density values are higher than their respective 2012

baseline values and both South Range 44 and Range 47 Subarea C supported more Monterey spineflower at higher densities in Year 3 (2014) than in Year 2 (2013). The total number of Monterey spineflower in areas subject to vegetation cutting in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 28G. Although density and total estimated numbers of Monterey spineflower individuals were lower in North Range 44 in Year 2 (2014) compared with Year 1 (2013), vigorous stump-sprouting and recruitment of native shrubs in that area may have affected Monterey spineflower density, coupled with three years of subnormal rainfall.

Sand (Monterey) gilia: No sand (Monterey) gilia were found in North Range 44 or Range 47 Subarea C in 2012 baseline sampling; an average 2.7 sand (Monterey) gilia/plot were documented in South Range 44.

North Range 44: In 2014, sand (Monterey) gilia was observed in 17 grids in Year 2 post-activity vegetation-cut areas, with a mean density of 4.5 individuals/plot and an estimated 9 individuals/grid and 147 total individuals (Table 6-25). Although Year 2 average sand (Monterey) gilia density values are higher than the 2012 baseline value and nearby reference plot density values, sand (Monterey) gilia plants were extremely diminutive and found in relatively low densities in 2014 compared with previous years. In 2013, an estimated 2,329 sand (Monterey) gilia plants were observed in 29 grids in areas subject to vegetation cutting in 2012, compared with 147 plants in 17 grids in 2014.

An additional 48 sand (Monterey) gilia plants were counted in the Army lead remediation area immediately adjacent to ESCA RP vegetation–cut areas in 2014; it is presumed that seeds and seedbank from sand (Monterey) gilia in North Range 44 have dispersed into adjacent areas.

Three nearby reference plots supported an average of 1.3 sand (Monterey) gilia/plot, 4 individuals/grid, and 12 total individuals.

South Range 44: In 2014, sand (Monterey) gilia was observed in three grids in Year 3 post-activity vegetation-cut areas, with a mean density of 2.0 individuals/plot and a total of 6 individuals (Table 6-26). As in North Range 44, sand (Monterey) gilia plants were tiny and sparsely distributed in 2014. The mean Year 3 density was slightly higher than the nearby reference plots and slightly lower than the 2012 baseline of 2.7 individuals/plot, although the differences are not statistically significant.

Year 3 data are lower than Year 2 results, in which an average density of 3.1 plants were present per plot, with sand (Monterey) gilia present in eight grids, for a total of 33 plants in 2013.

Three nearby reference plots supported a total of 12 sand (Monterey) gilia individuals in 2014, with a mean density of 1.3 individuals/plot.

Range 47 Subarea C: No sand (Monterey) gilias were observed in Range 47 Subarea C in areas subject to vegetation cutting in 2011 (Table 6-27). A total of 66 plants were counted in these same grids in 2013 Year 1 post-activity sampling, at a mean density of 6.6 plants/plot.

Sand Gilia Summary for Vegetation-cut Areas in the IAR MRA: The total number of sand (Monterey) gilia in areas subject to vegetation cutting in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 29G. The number and stature of sand (Monterey) gilia were much smaller in 2014 compared with 2013; 2014 was the third year in a row of subnormal rainfall, which seemed to effect sand (Monterey) gilia site-wide in areas subject to vegetation cutting, where competition from other sprouting and recruiting species may have impacted sand (Monterey) gilia germination and establishment. Sand (Monterey) gilia was found in 20 grids in 2014 compared with 37 in 2013 in areas subject to vegetation cutting.

Seaside bird's-beak: 2012 baseline data for seaside bird's-beak indicate an average of 3.3 to 9.3 plants per plot prior to disturbance, depending on the location. In 2013, one reference grid was sampled, and there were 108 seaside bird's-beak plants in this grid, or 8.5 plants per plot.

North Range 44: In 2014, seaside bird's-beak exhibited a mean density of 11.2 plants per plot in Year 2 sampling (Table 6-28) in 2013. An estimated total of 751 seaside bird's-beak plants were found in 11 grids in North Range 44 in vegetation-cut areas, with an average of 68 seaside bird's beak plants/grid. Seaside bird's-beak density and total distribution represented by grid count was higher in Year 2 (2014) results than in the 2012 baseline and also higher than the nearby reference plot, but average seaside bird's beak density was lower in Year 2 than in Year 1 (2013).

Nearby reference plots supported a total of 31 seaside bird's-beak individuals in 2014, with a mean density of 3.0 individuals/plot.

South Range 44: In 2014 in South Range 44 in areas subject to vegetation cutting in 2011, seaside bird's-beak had an estimated average density of 6.3 plants per plot (Table 6-29). Seaside bird's-beak was located in 3 grids in Year 2 post-activity vegetation-cut areas in South Range 44 in 2014, compared with 14 grids in the 2012 baseline and 8 grids in 2013. A total of 19 seaside bird's-beak individuals were counted in South Range 44 in all in vegetation-cut areas. Seaside bird's beak density in 2014 (Year 2) was higher than the 2014 reference plot, but lower than the 2012 baseline and Year 1 density.

Nearby reference plots supported a total of 31 seaside bird's-beak individuals in 2014, with a mean density of 3.0 individuals/plot.

Range 47 Subarea C: No seaside bird's-beak plants were observed in Range 47 Subarea C.

Seaside Bird's-beak Summary for Vegetation-cut Areas in the IAR MRA: A total of 770 seaside bird's beak individuals were observed in areas subject to vegetation cutting in the IAR MRA in 2014 sampling. Total individuals and density were higher than the nearby 2014 reference plots but lower than 2013 data. Seaside bird's-beak densities were higher than the 2012 baseline in North Range 44 but lower in South Range 44. The total number of seaside bird's beak in areas subject to vegetation cutting in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 30G. As with sand (Monterey) gilia, the prolonged

drought coupled with competition from other sprouting and recruiting species may have impacted seaside bird's beak germination and establishment.

Coast wallflower: Prior to 2013, coast wallflower had not been observed in the IAR MRA by ESCA RP biologists, so no reference data from previous years exist. Two 2013 reference grids were established for coast wallflower in North Range 44, the only location in the IAR MRA where this HMP herbaceous perennial has been observed. A total of 11 plants were counted in the two grids, providing an average density of 0.1 plants per plot (Table 6-30).

In 2014, coast wallflower was observed in three grids, with an estimated average density of 5.0 individuals/ plot, compared with average density of 4.5 individuals/plot in 2013. A total of 33 plants were counted in North Range 44 in Year 2 vegetation-cut areas in 2014. An additional 133 coast wallflower individuals were observed in the Army lead remediation area immediately adjacent to ESCA RP vegetation–cut areas; it is presumed that seeds and seedbank from coast wallflower in North Range 44 have dispersed into adjacent areas, boosting the overall population of this sensitive HMP herbaceous perennial. The total number of coast wallflower observed in the entire area in 2014 was 166, compared with 66 in 2013.

6.3.3.3 Small-scale Excavation Areas in Range 44 and Range 47 Subarea C

Monterey spineflower: An estimated 31.9 Monterey spineflower individuals/plot were documented in the 2012 baseline sampling in North Range 44 prior to disturbance (Table 6-22 to 6-24). Baseline Monterey spineflower densities were 40.5 individuals/plot in South Range 44 and 6 individuals/plot in Range 47 Subarea C.

North Range 44: In 2014, Monterey spineflower occurred in 13 grids, with a mean density of 18.4 plants/plot in areas subject to small-scale excavation in 2012 (Table 6-22). An estimated total of 1,528 Monterey spineflower individuals were present in post-activity Year 2 areas, with an estimated mean of 239 individuals/grid. Year 2 Monterey spineflower density was slightly below Year 1 density of 23.2 plants/plot, and total Monterey spineflower numbers were higher in 2014 than in 2013, when there were an estimated 1,294 Monterey spineflower plants in 11 grids.

South Range 44: In 2014, Monterey spineflower was observed in 10 grids in South Range 44 in areas subject to small-scale excavations in 2011, with an average estimated density of 154.8 plants/plot in Year 3 and 1548 plants/grid (Table 6-23). Approximately 8,422 Monterey spineflower individuals occurred in Year 3 post-activity small-scale excavation areas in 2014, slightly higher than the 7,763Monterey spineflower plants reported in 2013.

Range 47 Subarea C: In Range 47 Subarea C in areas subject to small-scale excavations in 2011, none of the 3 grids sampled (0%) in 2013 supported Monterey spineflower, but one individual was observed in 2014 (Year 2, Table 6-24).

Monterey Spineflower Summary for Small-scale Excavation Areas in the IAR MRA: In summary, Monterey spineflower was found in 24 grids in small-scale excavation areas in the IAR MRA in 2014 (excluding Range 47 Subareas A and B), expanding from 15 grids in 2013. The mean density of Monterey spineflower individuals/plot varied from 18.4

individuals/plot in North Range 44 in Year 2 (2014) sampling to 154.8 individuals/plot in South Range 44 in Year 3 (2014) sampling; 2014 density values in South Range 44 are higher than the 2012 baseline values three years after small-scale excavation activities, but 2014 mean density values in North Range 44 are lower than the 2012 baseline values two years after small-scale excavation activities. The total number of Monterey spineflower in areas subject to small-scale excavation in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 31G, indicating an overall increase site-wide.

Sand (Monterey) gilia: No sand (Monterey) gilia were found in North Range 44 or Range 47 Subarea C in 2012 baseline sampling; an average of 2.7 sand (Monterey) gilia/plot were documented in South Range 44 in the 2012 baseline.

North Range 44: In 2014, sand (Monterey) gilia was observed in 11 grids in Year 2 post-activity small-scale excavation areas, with a mean density of 11.5 individuals/plot, 28 individuals/grid, and an estimated total of 331 individuals (Table 6-25).

Year 2 (2014) mean sand (Monterey) gilia density values in small-scale excavation areas are higher than the reference plots, the 2012 baseline data, and the Year 1 (2013) mean estimated density of 4.4 plants/plot, as are total estimated numbers of sand (Monterey) gilia, 224 in Year 2 (2014) and 108 individuals in Year 1 (2013).

South Range 44: In 2014, sand (Monterey) gilia was observed in 10 grids in Year 3 post-activity small-scale excavation areas, with a mean density of 7.6 individuals/plot, 76 individuals/grid, and an estimated total of 237 sand (Monterey) gilia individuals (Table 6-26). These Year 3 (2014) data show higher mean sand (Monterey) gilia densities than the mean density in Year 2 (2013) of 3.7 plants/plot. Sand (Monterey) gilia was located in 3 grids in small-scale excavation areas in South Range 44 in 2013 and expanded to 10 grids in 2014.

Range 47 Subarea C: In Range 47 Subarea C in areas subject to small-scale excavations in 2011, one sand (Monterey) gilia individual was located in Range 47 Subarea C in small-scale excavation areas in 2013 but no individuals were observed in 2014 (Table 6-27).

Sand (Monterey) Gilia Summary for Small-scale Excavation Areas in the IAR MRA: In summary, sand (Monterey) gilia density was higher in 2014 in both North and South Range 44 than in the 2012 baseline and was also higher in 2014 than in 2013. Sand (Monterey) gilia was found in 21 grids, up from 14 grids in 2013 in areas subject to small-scale excavation the IAR MRA. The total number of sand (Monterey) gilia in areas subject to small-scale excavation in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 32G, indicating an overall increase site-wide.

Seaside bird's-beak: 2012 baseline data for seaside bird's-beak indicate an average of 3.3 plants/plot in North Range 44 prior to disturbance and 9.3 individuals/plot in South Range 44.

In 2014, seaside bird's beak was observed in 15 grids in Year 2 post-activity small-scale excavation areas, with a mean density of 3.4 individuals/plot, 51 individuals/grid, and an estimated total of 203 sand (Monterey) gilia individuals (Table 6-29). Seaside bird's beak was only observed in two grids in 2013, with one individual each. Year 2 seaside bird's beak

density equals the 2012 baseline and surpasses the Year 1 (2013) density and totals. The total number of seaside bird's beak in areas subject to small-scale excavation in the IAR MRA are shown for the 2012 baseline and Years 1, 2, and 3 in Figure 33G, indicating an overall increase site-wide. No seaside bird's beak plants were located in South Range 44 or in Range 47 Subarea C in small-scale excavation areas in 2014.

Coast wallflower: In 2014, coast wallflower appeared in Year 2 small-scale excavation areas for the first time, with an estimated average density of 5.0 individuals/ plot and 10 plants per grid (Table 6-30).

6.4 HMP Herbaceous Species Monitoring Summary

The mean annual rainfall in the project region is 13.2 inches (33.5 cm); in 2010, when baseline surveys were conducted, 22.2 inches (56.3 cm) of precipitation was recorded, significantly above the norm (weatherunderground.com). Precipitation between 2012 and 2014 was subnormal, 11.4 inches (29 cm) in 2012, 11.3 inches (28.6 cm) in 2013, and 8.5 inches (21.5 cm) in 2014. Due to three consecutive years of drought, suppressed densities and total numbers of HMP herbaceous species was expected from 2014 HMP herbaceous monitoring data. Certainly observed individuals of HMP herbaceous species were often smaller and less robust than in previous seasons. Nonetheless, HMP herbaceous species presence in all MRAs was encouraging, and in many cases, density and total numbers increased in 2014.

In the FEG MRA, HMP herbaceous species are currently confined to limited areas, where they often persist year after year. These small colonies have exhibited resilience after vegetation cutting, and densities and total numbers of Monterey spineflower, sand (Monterey) gilia, and seaside bird's beak all increased in 2014, regardless of the drought or of the year since munitions investigation activities.

In the Parker Flats MRA Phase II area, Monterey spineflower has exhibited an increase in both density and total numbers of individuals between Year 3 and Year 5. Phase I areas, which had been subject to vegetation cutting by the Army between 1998 and 2000, as well as a burn in 2005, showed the most dramatic recovery of any area, with over 208,000 Monterey spineflower individuals scattered across 81 grids, despite the three-year drought.

The IAR MRA has been subject to munitions investigation activities the most recently of any of the three MRAs that were surveyed in 2014, and different patterns of HMP herbaceous species density and numbers are apparent there. The IAR MRA currently supports four HMP herbaceous species, the most of any MRA. Furthermore, the IAR supports the highest numbers of sand (Monterey) gilia, seaside bird's beak, and coast wallflower HMP individuals of any MRA. In 2014, more than 136,000 Monterey spineflower, 1,620 sand (Monterey) gilia, 1,000 seaside bird's-beak, and 43 coast wallflower individuals were found in all activity types in the IAR MRA.

HMP herbaceous species monitoring results for the IAR MRA includes four activity types, unlike the FEG and Parker Flats MRAs, where the main munitions investigation activity type

in woody vegetation has been vegetation cutting and associated target-specific investigations. This narrative only addresses monitoring results for three of the four activity types in the IAR MRA; results from monitoring in the large-scale excavation (restoration) area in Range 47 are reported in Appendix A.

In 2014, there is a striking distinction between HMP herbaceous species densities and colony numbers between areas that were subject to vegetation cutting and small-scale excavations and those that were subject to small-scale excavations. In 2014, there were higher densities and numbers of all species after small-scale excavations compared with areas subject to vegetation cutting (except for Range 47 Subarea C sand [Monterey] gilia); see Figures 28G – 33G. In areas subject to vegetation cutting, stump-sprouting shrubs and numerous recruits of trees, shrubs, and herbaceous species have colonized the open areas in the last two (North Range 44, Range 47 Subarea C) to three years (South Range 44); in contrast, Years 2 and 3 small-scale excavation areas in the IAR MRA support relatively low vegetation cover and low shrub densities. The year 2014 is the driest year of a three-year drought, and competition for space, water, and nutrients may be exerting stronger pressures in vegetation-cut areas than in small-scale excavation areas. In addition, persistent chipped mulch from native shrubs in areas subject to vegetation cutting may retard seedling establishment, especially of small-seeded annuals.

6.5 Aquatic Feature Monitoring in the Future East Garrison MRA

During 2014, aquatic feature monitoring was conducted in the grenade range aquatic features and encompassed the following: general site reconnaissance, botanical surveys, photo documentation, geological investigations, munitions investigation activities work monitoring, and restoration.

All three of the aquatic features in the grenade range were dry in early 2014, and began to form pools for the first time in February after sufficient seasonal rains. Ponded water peaked (in aerial coverage) on 3 March 2014, with both submergent and emergent vegetation noted in AF09-1A and AF09-2. No California linderiella were observed in 2014, although other aquatic invertebrates were noted in the two larger pools, including the restored pool, AF09-1A. A small colony of hooded ladies tresses orchids (*Spiranthes romanzoffiana*) appeared for the first time by AF09-2. Details of observed aquatic plants, and monitoring summaries are provided in Appendix C.

7.0 HABITAT RESTORATION IMPLEMENTATION AND MONITORING IN THE INTERIM ACTION RANGES MRA

Habitat restoration implementation and monitoring activities for 2014 are summarized in Appendix A and are based on an HRP prepared by the ESCA RP Team in 2012 as an addendum to the Phase II Interim Action Work Plan for the IAR MRA (ESCA RP Team 2013a). The HRP details the methods for restoration implementation, maintenance, and monitoring of central maritime chaparral and associated plant populations in habitat parcels that were affected by munitions investigation activities in the IAR MRA. Four main activity

types were associated with vegetation disturbance in these areas, each with associated remediation, monitoring, and restoration requirements: ingress/egress corridors, vegetation cutting, small-scale excavation, and large-scale excavation. These activity types are associated with the following restoration strategies: monitoring only, passive restoration, and passive and active restoration.

After soil replacement in Range 47 in December 2012, site preparation activities commenced, including installation of erosion control BMPs, animal deterrent fencing around the perimeter of the site, and an irrigation system and associated infrastructure. Over 30,000 container plants representing 16 species were planted in January and early February 2013. In addition, seeding of targeted areas in the IAR MRA was also conducted to boost native species cover and re-establish HMP herbaceous species in suitable locations.

Quantitative success criteria for plant survival, species richness, and percentage cover targeted for the first seven years following site restoration are included in the HRP and results of monitoring for these criteria for Year 2 are reported in Appendix A. As part of implementation of the HRP, a comprehensive adaptive management plan has been implemented that focuses on managing the active restoration sites. The adaptive management plan utilizes a wide range of qualitative and quantitative monitoring data to evaluate site conditions and determine the need for additional actions. Restoration monitoring and adaptive management will continue in 2015 in North Range 44, South Range 44, and Range 47.

8.0 MANAGMENT AND MITIGATION ACTIVITIES SUMMARY

This section summarizes the habitat management and mitigation activities required by the HMP and BOs and performed by the ESCA RP Team through 2014.

8.1 Vegetation and HMP Species Protection Measures

The ESCA RP biologists worked closely with munitions investigation teams to successfully design the following species-specific and MRA-specific measures to reduce impacts to native vegetation and HMP species during field activities. A brief summary of these efforts over the past two years is provided below.

Future East Garrison MRA: In order to preserve mature seed-producing individuals of HMP manzanitas in the FEG MRA, Toro manzanita were preserved and limbed up and all Hooker's manzanita were preserved during vegetation cutting and associated target-specific investigations, where possible, between 2008 and 2013. High survival of over 500 retained Toro and Hooker's manzanitas has been documented during the past three years; see Sections 5.2.5 and 6.2.1.

In addition, a "step-out" approach was employed in the FEG MRA to reduce vegetation cutting to only that required for munitions investigation activities.

Parker Flats MRA: In order to preserve almost all coast live oak trees in the Parker Flats MRA Level 2 Residential Quality Assurance areas, oak tree retention was coordinated by the ESCA RP arborist and field biologists in approximately 10.3 acres (4.2 ha) of coast live oak woodland. Special measures were taken to preserve coast live oak trees greater than six inches (15.2 cm) diameter at breast height (dbh). Prior to munitions investigation activities, the ESCA RP arborist and field biology team measured the dbh, number of trunks per tree, and tree health of all trees in the work area. Approximately 885 coast live oak trees were evaluated; most oak trees were in good health and approximately ten trees were dead, diseased, or seriously damaged (bark removed and cambium damaged. Healthy trees greater than six inches dbh (15.2 cm) were left standing. Low-hanging limbs that presented a safety hazard for the munitions investigation team were removed if there was no overall threat to tree health.

Coast live oak trees were qualitatively monitored in 2014, and oak tree health is excellent overall. Native understory has also regrown vigorously in this area.

IAR MRA: Munitions investigation activities in intact central maritime chaparral vegetation were minimized to the maximum extent feasible. Ingress/egress corridors were restricted to existing road and every effort was made to minimize any additional widening or creation of new access routes. As a result, actual investigation activities affected only 0.4 acres (0.2 ha) instead of the anticipated 5.5 acres (2.0 ha).

With the information gained from initial Design Study investigations, vegetation cutting and subsurface investigations in NCAs and SCAs in South Range 44 were confined primarily to10-foot-wide (3-m-wide) linear transects that traversed grids in a north-south linear alignment in the study areas; see Section 5.1.4. As a result, out of 17.7 acres (7.2 ha) of intact central maritime chaparral, only 4.5 acres (1.8 ha) of native vegetation were disturbed during this effort and 13.2 acres (5.3 ha) of central maritime vegetation (75 %) was left intact, preserving central maritime chaparral in an area that supports numerous HMP species.

8.2 Wildlife Relocation

ESCA RP Team members perform animal rescue and/or relocation as needed to avoid or reduce impacts of the fieldwork on wildlife. A 14-inch (35.6 cm) long western rattlesnake was observed in the work are in IAR MRA Range 47 on 21 July 2014. A biologist transported the snake to suitable habitat in dense chaparral vegetation in the IAR MRA development parcel approximately 500 feet (152 m) away from Range 47, where it would not be a safety hazard to the field crew.

8.3 Environmental Awareness Training

Environmental awareness trainings are conducted by a QB for field personnel prior to initiation of fieldwork in all MRAs, placing special emphasis on CTS awareness, requirements, and mitigation measures. During the training personnel are advised of the locations of ponds, vernal pools, and aquatic features within 2 km (1.24 miles) that may be potential breeding habitats for CTS, including aquatic features in and near the FEG, Parker

Flats, and IAR MRAs (Figure 5). Trainings also introduce work crews to the HMP, the relevant habitats in the MRAs, measures to comply with the federal ESA, protection of HMP species and their habitats, and minimization of environmental impacts during MEC work. Site requirements are reviewed, including restricting site access to established roads and paths whenever possible and limiting vegetation cutting and soil disturbance to the minimum feasible area required to conduct the field task. Where appropriate, the ESCA RP biologists communicate and/or mark out locations of HMP plant species and/or their habitats to assist avoidance by field crews.

Environmental awareness training was provided for the IAR MRA on 4 March and 11 November 2014 and for the SEA MRA on 11 September 2014.

8.4 Weed Management Activities

Monitoring and management activities for target weeds are routinely conducted in ESCA RP parcels, consistent with the requirements of the HMP (USACE 1997) and BOs (USFWS 1999, 2002 and 2005); the 2005 BO (USFWS 2005, pp. 14-15) outlines weed control measures in detail. The goal of weed management is to avoid degradation of ecological communities and especially sensitive species populations as a result of weed invasion in parcels not designated for development.

During 2014, weed monitoring occurred on a regular basis, particularly in areas where weeds could easy spread from a development parcel to a habitat parcel. Most weed abatement was done in the IAR MRA Range 47. All pampas grass seedlings were removed as soon as they were observed. Ice plant seedlings were removed on an ongoing basis in Range 47 but periodically all ice plant seedlings were removed in a single concentrated effort.

All weed monitoring and removal activities are summarized in Appendix D.

8.5 Erosion Control Monitoring and Mitigation

Ongoing erosion control monitoring and installation of erosion control BMPs are implemented as needed in ESCA RP parcels, consistent with the requirements of the HMP (USACE 1997) and BOs relevant to ESCA RP activities (USFWS 1999, 2002, and 2005); the 2005 BO (USFWS 2005, pp. 14-15) and the ESCA RP Soil Management Field Implementation Plans for each MRA (ESCA RP Team 2011, 2012a) describe erosion control measures in detail.

FEG MRA - There were no major erosion issues in FEG during 2014. Ongoing erosion control BMP maintenance was needed where rilling or small gully formation was observed in the former grenade range. In preparation for the 2014/2015 rainy season, additional erosion control measures were implemented, including repairs and improvements to water bars, installation of sandbags in target locations, and hydroseeding two acres of the grenade range with local seeds (Figure 11a).

IAR MRA - There were no major erosion issues in the IAR during 2014. Ongoing erosion control BMP maintenance was needed where rilling or small gully formation was observed, such as in some locations in the IAR MRA development parcel. In preparation for the 2014/2015 rainy season additional erosion control measures were implemented, including new silt fencing and hydroseeding the 0.5 acre (0.2 ha) escarpment using a native seed mix comprised of locally collected seeds (Figure 11b).

ESCA RP erosion monitoring activities are summarized in Appendix E.

9.0 CONCLUSION

No munitions investigation and response activities were conducted in any MRAs during 2014. Biological monitoring in 2014 included completion of 56 vegetation transects, 117 herbaceous species quadrats, and 213 HMP herbaceous species plots, along with surveys on 30.8 acres for HMP herbaceous species; these monitoring events and associated data provide the ESCA RP Team with valuable information to guide in ongoing site management.

Baseline vegetation and herbaceous transects were installed by the ESCA RP Team in the FEG, Parker Flats, and IAR MRAs between 2008 and 2012 in order to document native shrub cover prior to munitions investigation activities. Recovery of native vegetation cover after vegetation cutting has been rapid in central maritime chaparral, exceeding 50% in Year 3 transects in the FEG MRA and 83% in Year 5 transects in the Parker Flats MRA. In the IAR MRA, mean vegetation cover in Year 2 and 3 transects in North Range 44 and Range 47 Subarea C also exceeds 50%. Only in South Range 44 is recovery slower, at 25% in Year 3 transects. However, only 25 % of central maritime chaparral in South Range 44 was cut or otherwise disturbed during munitions response activities, so overall native chaparral shrub cover per grid surpasses 80% or more. A range of seedlings of obligate-seeding shrubs in these vegetation-cut areas contribute to shrub diversity in chaparral stands in all areas, as evidenced by frequency and diversity data, including HMP shrubs.

HMP herbaceous species also show increased numbers in 2014 monitoring in the FEG and Parker Flats MRAs. A total of 377 Monterey spineflower, 30 sand (Monterey) gilia, and 375 seaside bird's beak were recorded in the FEG MRA in 2014. In the Parker Flats MRA, an estimated 213,063 Monterey spineflower were included in sampling, and many more observed nearby. The IAR MRA currently supports four HMP herbaceous species, the most of any MRA. Furthermore, the IAR supports the highest numbers of sand (Monterey) gilia, seaside bird's beak, and coast wallflower HMP individuals of any MRA. In 2014, more than 136,000 Monterey spineflower, 1,620 sand (Monterey) gilia, 1,000 seaside bird's-beak, and 43 coast wallflower individuals were found in all activity types in the IAR MRA.

Vegetation cover and species diversity data indicate recovery of all sensitive vegetation types subject to munitions response actions in ESCA RP MRAs. A combination of committed stewardship, including reductions in acreages potentially subject to vegetation cutting in South Range 44 (saving 13.2 acres [5.4 ha], or 75% of intact central maritime chaparral, along with a diversity of native and HMP species); retention of over 500 Toro manzanitas in the FEG MRA; retention of over 880 coast live oak trees in the Parker Flats MRA

development parcel; habitat restoration (see Appendix A); steady post-activity increases in vegetation cover, species diversity, and number of individual HMP herbaceous species; and ongoing weed and erosion control management activities all combine to promote habitat recovery after munitions investigation activities. The enhanced native species diversity and cover observed at all sites, along with wildlife usage and other indications of elevated ecological functionality, suggest all areas are on trajectories toward self-sustaining native plant communities equitable with the species richness and relative cover of species that were present on the site prior to the FORA ESCA RP Team investigation and remedial efforts.

Appendix A provides details on the restoration monitoring activities in the IAR MRA in 2014.

Planned activities in FEG, IAR, Parker Flats and Seaside MRAs in 2015 include weed and erosion control monitoring and abatement. Habitat monitoring activities expected in 2015 for each MRA are listed below.

FEG MRA:

- Vegetation Transects
- Herbaceous Quadrats
- HMP Annual Surveys
- Toro Manzanita Surveys
- Species Diversity Documentation

IAR MRA (SCAs and NCAs):

- Vegetation Transects
- Herbaceous Quadrats
- HMP Annual Surveys
- Species Diversity Documentation
- Survival Censuses and Related Data in Range 47

No Year 6 biological monitoring is planned in the Parker Flats MRA in 2015.

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