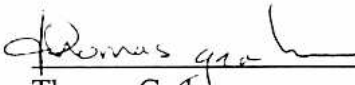


**2001 Annual Monitoring Report
Biological Baseline Studies and
Follow-up Monitoring
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Monterey, California**

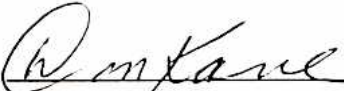
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**2001 Annual Monitoring Report
Biological Baseline Studies and Follow-up Monitoring
Former Fort Ord
Monterey, California**

Harding ESE Project No. 50271 00172

This document was prepared by Harding ESE at the direction of the U.S. Army Corps of Engineers (USACE) for the sole use of the USACE and the U.S. Department of the Army (Army), the only intended beneficiaries of this work. No other party should rely on the information contained herein without the prior written consent of Harding ESE, USACE, and the Army. This report and the interpretations, conclusions, and recommendations contained within are based in part on information presented in other documents that are cited in the text and listed in the references. Therefore, this report is subject to the limitations and qualifications presented in the referenced documents.

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DISTRIBUTION

1.0 INTRODUCTION

To maintain compliance with habitat management and monitoring requirements presented in the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (HMP; USACE, 1997a), biological resources are monitored after ordnance and explosive (OE) removal and remediation activities have been completed. The HMP identifies fauna species, flora species, and habitats of concern on the installation and specifies mitigation measures to monitor the regeneration of these species and habitat following OE removal and the completion of lead and chemical remediation projects. Requirements include conducting follow-up monitoring for a period of 5 years following lead and chemical remediation projects and OE removal to document the effects of these activities on flora and fauna.

Since the inception of the OE removal program, the Army has elected to augment the monitoring program, where feasible, to include the collection of baseline data prior to OE removal. Baseline data has been collected to provide additional information on pre-existing species composition and distribution of herbaceous annual sensitive species referred to herein as HMP annual species. Additionally, base closure and reuse activities conducted on the Former Fort Ord are required to follow specific protocols approved by the United States Fish and Wildlife Service (USFWS) as detailed in the Biological and Conference Opinion (BO) on the Closure and Reuse of Fort Ord, Monterey County, California (USFWS, 1999). Base closure and reuse activities are also identified in memoranda (Willison, 1998), requesting reinitiation of formal consultation with USFWS pursuant to section 7 of the Endangered Species Act of 1973, as amended. The BO identifies additional species and habitats of concern not addressed in an earlier BO (USFWS, 97) that could potentially be impacted during remediation, predisposal, and reuse activities. The BO also outlines mitigation measures intended to document existing conditions and monitor the regeneration of species and habitat following remediation, predisposal, and reuse activities.

This report was prepared to address the United States Department of the Army's (Army) habitat monitoring requirements as identified in the HMP and BO for OE removal and lead, chemical, and groundwater remediation. As data accumulates for these sites, the methods used to minimize adverse effects on HMP species may be refined.

1.1 Habitats and Species Considered for Habitat Monitoring

HMP sensitive habitats occurring on OE removal and lead, chemical, and groundwater remediation sites on the Former Fort Ord include central maritime chaparral and wetland habitats. These habitats include many of the special-status plants and animals identified in the HMP. Baseline and follow-up surveys are conducted on OE removal and groundwater, chemical, and lead remediation sites to characterize central maritime chaparral in terms of flora species composition, flora species dominance, HMP annual species populations, and to characterize the location and extent of special status animals. Surveys are conducted on groundwater remediation sites to characterize the location and extent of HMP annual species potentially disturbed during remedial activities. Similarly, surveys in vernal pools and ponds (waterbodies) are conducted to characterize percent vegetative cover and occurrence of special-status fauna. Environmental parameters such as surface area, water depth, pH, and turbidity are also recorded for each waterbody.

Follow-up monitoring in these habitats is required to document community regeneration in order to meet HMP success criteria. Success criteria for central maritime chaparral are defined in the HMP as "restored habitat will consist of naturally regenerating maritime chaparral that is managed using controlled burning

and other techniques that maximize habitat value for HMP species.” Success criteria for HMP annual species state that if after five years, population sizes and densities are observed to vary over time within a range similar to that estimated for these species in 1992 (the first year baseline conditions were surveyed), the regeneration would be considered successful. The success of restored or regenerated wetlands affected by OE removal will be gauged by comparing the functioning value of the habitat defined in terms of the percentage of native species and occurrence of special status species present before and after remediation.

Through an examination of aerial photographs of Former Fort Ord and field observations, three associations, or successional stages of central maritime chaparral habitat have been identified that could be separated by fire or disturbance history. These stages include mature chaparral, intermediate-age chaparral, and disturbed chaparral. Mature chaparral is composed of fully mature to senescent stands of shrubs that are of an estimated age greater than fifteen years and are generally between six and fifteen feet in height. Mature stands have very little open ground and almost no herbaceous layer. Intermediate-age stands are estimated to be five to fifteen years old and generally range from three to six feet in height. Intermediate-age stands generally exhibit more open ground and herbaceous plant cover and generally include a more diverse species composition. Disturbed chaparral habitat, as defined in this report, includes areas that were subject to regular disturbance. This habitat type is generally located in range fans with cleared rows along firing lines that are interspersed with patches of chaparral species. Disturbed stands were observed to be transitional in species composition and cover between intermediate-age chaparral and mature chaparral.

HMP species associated with terrestrial OE removal and lead, chemical and groundwater remediation sites are identified in Table 1. They include sand gilia (*Gilia tenuiflora arenaria*), Monterey spineflower (*Chorizanthe p. pungens*), Contra Costa goldfields (*Lasthenia conjugens*), coast wallflower (*Erysimum ammophilum*), seaside bird’s beak (*Cordylanthus rigidus littoralis*), Monterey manzanita (*Arctostaphylos montereyensis*), Monterey ceanothus (*Ceanothus cuneatus rigidus*), Hooker’s manzanita (*Arctostaphylos h. hookeri*), Eastwood’s goldenbush (*Ericameria fasciculata*), sandmat manzanita (*Arctostaphylos pumila*), and California black legless lizard (*Anniella pulchra nigra*).

HMP species in Table 1 associated with wetlands include California red-legged frog (*Rana aurora draytoni*), California tiger salamander (*Ambystoma californiense*), and California linderiella (*Linderiella occidentalis*). Although California linderiella currently is not state or federally listed, surveys are being continued to monitor the health of wetlands following cleanup activities. Additional species of concern were identified in the Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord (WRP) (*USACE, 1997b*) as being associated with wetland habitat and having the potential to occur at the Former Fort Ord including southwestern pond turtle (*Clemmys marmorata pallida*) and tricolored blackbird (*Agelaius tricolor*).

1.2 Previous Baseline Studies and Monitoring at OE Removal Sites 1994-2000

The locations of OE removal and lead, chemical, and groundwater remediation sites where baseline studies and monitoring have been conducted through 2000 are shown on Plate 1. All of these sites are in areas proposed to become habitat reserves and either support central maritime chaparral and/or wetland habitats known to contain, or potentially contain, HMP species. Table 2 summarizes monitoring activities conducted at OE removal and groundwater, lead, and chemical remediation sites from 1994 through 2001.

1.3 2001 Vegetation Monitoring and Surveys

Monitoring activities conducted in 2001 includes follow-up monitoring at four terrestrial OE removal sites, baseline and follow-up sampling at three wetland sites, baseline exotic species surveys at three terrestrial sites, and the characterization of HMP annual species at five terrestrial OE sites and at the University of California Natural Reserve System (UC/NRS) - Fort Ord Natural Reserve (FONR). Harding ESE and the Bureau of Land Management (BLM) conducted terrestrial follow-up monitoring and HMP annual species surveys at five OE removal sites. Harding ESE conducted baseline surveys for invasive exotic species at three terrestrial sites. Harding ESE conducted baseline wetland surveys at one waterbody and follow-up wetland monitoring at two waterbodies. At the UC/NRS – FONR, Harding ESE estimated the size and extent of HMP annual plant populations occurring along roads utilized for groundwater sampling. Surveys were not conducted at lead and chemical remediation sites in 2001.

1.3.1 Central Maritime Chaparral Monitoring

Chaparral monitoring was conducted by Harding ESE and BLM biologists. BLM conducted follow-up chaparral monitoring at OE removal sites 10A, 10B, and 19. Harding ESE conducted follow-up chaparral monitoring at OE Site 11. Flora evaluations at these sites are based upon the vegetation removal method used (burned or manually clipped) at this site.

OE Site 10A has been subject to several episodes of vegetation clearance between 1995 and 1998. Site 10A was partially burned in 1995, OE sampling and removal grids not burned were manually clipped from 1995 through 1997. Later in 1997, a majority of Site 10A was burned again, including the clipped grids. Portions of OE Site 10B were burned or manually clipped in 1997. OE Site 11 was not burned due to safety reasons, but was manually clipped of vegetation in 1997. OE Site 19 was burned in 1995.

1.3.2 HMP Annual Species

Surveys for HMP annual species were conducted in May 2001 at sites OE9, OE10, OE10A, OE11, and OE19. HMP annual species surveyed include sand gilia, Monterey spineflower, and seaside birds-beak. Populations identified during the 2001 monitoring event at OE Site 9 represent baseline data for these species presented in the Army's Annual Monitoring Report. The federal, state, and California Native Plant Society (CNSP) listing status for all three species are included in Table 1.

Visual surveys for Contra Costa goldfields populations were conducted in April 2001. To date, this species is known to occur at two populations at two OE sites on Former Fort Ord. These populations occur on OE Site 10B, one along the western edge of the vernal pool at Machine Gun Flats (MGF), the other in a "mima mound" grassland southeast of MGF. These two populations were monitored in 1998 and 1999 to collect information prior to OE removal activities at OE Site 10B.

The effect of OE removal on Contra Costa goldfields is considered in the most recent revision of the BO (*USFWS, 1999*). Contra Costa goldfields on the Former Fort Ord occur adjacent to and in vernal waterbodies in grassland habitat that generally exhibit mima mound topography (undulating terrain consisting of small mounds with hydrologically interconnected depressions). The BO identifies mitigation measures (in addition to those presented in the HMP) to be implemented during OE removal in areas where Contra Costa goldfields occur. These measures are presented in a consultation letter from the Directorate of Environmental Natural Resources (DENR) to USFWS dated November 11, 1998 (*Willison, 1998*).

1.3.3 UC/NRS FONR

Follow-up monitoring for HMP annual species were conducted at groundwater remediation sites at the UC/NRS FONR in April 2001. Surveys of HMP annual species were conducted along identified access routes and at existing groundwater monitoring well sites. Access routes were identified based on existing well locations. The wells at UC/NRS FONR are used for groundwater monitoring.

Harding ESE reviewed follow-up monitoring results of 1999, 2000, and 2001 for HMP annual species at UC/NRS-FONR to determine the success or failure of approved mitigation measures and need for further monitoring during well construction and quarterly groundwater sampling.

1.3.4 Exotic Species

Baseline surveys of exotic species were conducted at OE Site 16, Range 30A, and Ranges 43 - 48. Exotic species surveys included jubata grass (*Cortaderia jubata*), hottentot fig (*Carpobrotus edulis*), and cut-leaved fireweed (*Erechtites glomerata*). These surveys were conducted to identify the location of these three exotic species on OE Site 16, Range 30A, and Ranges 43 – 48 prior to remedial activities.

1.3.5 Wetland Monitoring

From January through June 2001, wetland monitoring was conducted at approximately one-month intervals at waterbodies 42, 53, and Machine Gun Flats (MGF).

Baseline monitoring was conducted at Waterbody 53. Follow-up monitoring was conducted at waterbodies 42 and MGF. Baseline and follow-up data collected included characterizing wetland vegetation, assessing the potential occurrence of wetland-associated special-status fauna identified in the HMP, and collecting data on the physical characteristics of each waterbody. Surveys were conducted according to protocol identified in the HMP and follow-up monitoring requirements identified in the Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord (WRP) (*USACE, 1997b*).

The results of previous follow-up monitoring were evaluated at waterbodies 1, 2, 17, Mudhen Lake East (MHLE), and Mudhen Lake West (MHLW) to examine the success of habitat regeneration after OE removal activities and determine the need for further monitoring. Baseline flora surveys were conducted at waterbodies 1, 2, 17, MHLE, and MHLW in 1994. Follow-up flora surveys for these waterbodies were conducted in 1995 and 1996 and the final follow-up survey for these waterbodies was conducted in 1999.

Baseline and follow-up survey results for waterbodies 1, 2, 17 MHLE, and MHLW are presented in the 1994 (*USACE, 1994*), 1995 (*USACE, 1995b*), 1996 (*USACE, 1996a*), and 1999 (*USACE, 1999*) Annual Monitoring Reports. A brief summary of the results of the 1999 final wetland vegetation monitoring surveys is presented below.

Waterbodies 1 and 2

Native plants accounted for approximately 84 percent of the overall coverage at waterbodies 1 and 2. Non-native exotic species accounted for approximately 16 percent of the overall coverage at waterbodies 1 and 2.

California linderiella was observed at these sites in 1994, 1995, and 1996 surveys. California linderiella displayed moderate abundance at Waterbody 1 in 1999 while California linderiella was not observed in Waterbody 2 in 1999. Fluctuations and in abundance are most likely attributable to variations of natural

conditions at the waterbodies, including precipitation timing and totals, temperature and pH. The reasons why linderiella were not observed at Waterbody 1 during the 1999 surveys are unknown but are most likely attributable to variations of natural conditions at the Waterbody, including precipitation timing and totals, temperature and pH. Fairy shrimp eggs hatch only when the required environmental cues in their aquatic habitat are established (USACE, 1996b). Changes in abundance or the absence of linderiella is not likely attributable to OE removal activities because OE removal activities did not occur close enough to affect these waterbodies. California tiger salamander was not observed at these sites in 1999. The 1992 Baseline Flora and Fauna Study of Fort Ord, California (USACE, 1992) reported that California tiger salamander had been observed at Waterbody 1. Although no tiger salamander were observed during follow-up monitoring at Waterbody 1, suitable habitat exists. OE activities at were not conducted in or adjacent to Waterbody 1 and did not affect the natural conditions of this waterbody.

Waterbody 17

Native flora accounted for approximately 91 percent of the overall coverage at Waterbody 17. Non-native species accounted for approximately 9 percent of the cover at this waterbody.

The presence of California linderiella has not been observed at this site during baseline and follow-up surveys. There was significant sedimentation was observed at Waterbody 17 in 1999. The sedimentation in Waterbody 17 is most likely the result of construction of Turn 11 at Laguna Seca Raceway that may also have modified the waterbody boundaries. The estimated wetland conditions may not be comparative to conditions identified during baseline sampling in 1994. California tiger salamander was not observed at this site in baseline or follow-up surveys at this site.

MHLE

Native flora accounted for approximately 90 percent of the overall coverage at MHLE. Non-native species accounted for approximately 10 percent of the cover at this waterbody.

The presence of California linderiella was not observed at this site during baseline and follow-up surveys. California tiger salamander was not observed at this site in baseline or follow-up surveys at this site.

MHLW

Native flora accounted for approximately 83 percent of the overall coverage at MHLW. Non-native species accounted for approximately 17 percent of the cover at this waterbody.

The presence of California linderiella has not been observed at this site during baseline and follow-up surveys. Significant sedimentation was also observed at MHLW in 1999. Sedimentation at MHLW was most likely the result from erosion off ridges to the north from a wildfire in 1997 and heavy rainfall in 1998. This sedimentation apparently modified the wetland boundary of MHLW. The estimated wetland conditions may not be comparable to conditions identified during baseline sampling in 1994. California tiger salamander was not observed at this site in baseline or follow-up surveys at this site.

A review of the results of follow-up studies at Waterbodies 1, 2, 17, MHLE, and MHLW reveal that future monitoring surveys are not required at these sites. The overall cover provided by flora species and the absence/presence of fauna species habitat at these waterbodies are consistent with the baseline conditions at these waterbodies. Thus, recovery at these sites has been successful and success criteria has been met. Sedimentation and boundary changes at Waterbody 17 and MHLW are not attributed to OE activities. The changes of physical parameters at Waterbody 17 are attributed to construction activities at the Laguna Seca racetrack. Changes to the physical waterbody characteristics at MHLW are attributed to natural incidents (a wildfire in 1997 and heavy rainfall in 1998).

1.4 Future Activities on Habitat Reserve Lands

Baseline surveys were conducted in 1999 for Site 39 Lead Remediation activities at Range 18. Baseline surveys activities were also conducted in 2000 for Site 39 Lead Remediation activities at Ranges 21, 24, 25, and 26. Baseline surveys were conducted in areas supporting maritime chaparral and HMP annual species. Surveys characterize habitat and establish baseline conditions in areas that will be disturbed during lead removal activities. Remediation has not been initiated at these ranges and therefore, no additional monitoring or evaluation has been conducted.

2.0 METHODS

Methods used to collect data on HMP species and habitat in the 2001 monitoring year are described in Protocol for Conducting Vegetation Sampling at Fort Ord in Compliance with the Installation-Wide Multispecies Habitat Management Plan (*HMP Sampling Protocol*) (USACE, 1995a). Reports from previous monitoring years (USACE, 1994, 1995b, 1996a, 1996b, 1997b, 1998, 1999, 2000) and the WRP (USACE, 1997a) were reviewed and the survey methods described were implemented to maintain consistency in sampling. Methods for terrestrial monitoring include line-intercept sampling along permanent transects to characterize chaparral shrub cover, quadrat sampling in areas with a high percentage of herbaceous vegetation (areas visually estimated at greater than 20 percent cover), and focused surveys in suitable habitat to map the distribution of HMP annual species. Monitoring activities at wetland sites included wetland vegetation sampling (vegetative cover by species), special status wildlife surveys, and the collection of physical and hydrological data. Chaparral and wetland sites monitored in 2001 are shown on Plate 2. All biological monitoring conducted in the Multiple Range Area (MRA) was accomplished with an escort by an OE specialist.

2.1 Central Maritime Chaparral

Harding ESE and BLM conducted follow-up central maritime chaparral monitoring at four OE removal sites. BLM conducted follow-up monitoring at OE sites 10A, 10B, and 19 between April and June 2001. Harding ESE conducted follow-up monitoring at OE Site 11 in August 2001. Plates 3 through 6 display line-intercept sampling transect locations at chaparral monitoring sites. Methods specific to each site are presented below.

2.1.1 Line-Intercept Sampling

Line-intercept sampling is conducted to determine flora species composition and cover in central maritime chaparral habitat. Shrub composition, cover, and abundance were sampled along the length of a measuring tape that was extended above, below, or through the woody canopy. Intercept distance for each species was recorded separately to include foliar overlap. Additional species observed within 10 meters of the transect were also recorded. Intercept distances of each species were combined and this total was divided by the length of the transect and multiplied by 100 to obtain individual species percent cover. Cumulative intercept distances for all cover types (i.e., shrubs, bare ground, and vegetated ground) were combined and divided by the total length of transects sampled and multiplied by 100 to provide a numerical estimate of cover by species or cover type for each OE site or successional stage.

Sample size for each variation of chaparral habitat type (or seral stage, i.e. disturbed, intermediate-age, or mature) was determined by calculating the cumulative total cover for the dominant and/or HMP species if present. The total was graphed versus a running total of the combined transect length. An adequate sample size was considered reached when, after including additional transect data with the combined data, there was a change of less than 10 percent in total cover.

Transect locations, for baseline and follow-up sampling were located using Global Positioning System (GPS) equipment and are indicated on Plates 3 through 6. Four- or five-foot, lightweight t-posts were installed at transect endpoints and photographs were taken to record location and condition of the sampling transect. Transect numbers were marked on aluminum tags that were attached to both endpoints. Most transects were 50 meters (approximately 164 feet) in length. In some cases, transect length was limited by tall, impenetrable brush or OE concerns. In most cases at follow-up monitoring

sites, pre-established transect endpoints had been removed during OE sampling. At these locations, new transect endpoints were installed.

2.1.2 Quadrat Sampling

Quadrat sampling was used to characterize the herbaceous component of central maritime chaparral habitat. Quadrat sampling was conducted along transects with greater than 20 percent (visually estimated) cover contributed by herbaceous plant species. Quadrat sampling was conducted along the line intercept tape at 10-meter intervals. Sampling was conducted along the transects by placing a 0.25-meter square quadrat at the starting point and at 10-meter intervals alternating from the right to left side of the transect. Plant species present within the quadrat were identified, percent cover was estimated for each species, and data were recorded. Quadrat sampling was performed at OE sites 10A, 10B, 11, and 9. Quadrat sampling was not performed at OE site 19.

2.1.3 Line-Intercept and Quadrat Sampling Site Locations

OE Site 10A: BLM conducted line-intercept sampling at sixteen transects (Transects 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18 and 19) located at this site. Supplemental quadrat sampling for common herbaceous species was conducted along three transects where the overall cover by herbaceous species exceeded 20 percent. Data collected from Transects 4, 14, and 15 were not used in this evaluation. Previous reports (*USACE, 1998*) identified these transects as occurring in “transitional grids” and considered them as more accurately representing a transitional area between coast live oak woodland and central maritime chaparral. Transect locations are identified in Plate 3.

OE Site 10B: BLM conducted line-intercept sampling at twelve transects located at this site. Ten transects (Transects 1, 6, 7, 8, 9, 10-2, 11, 13, 14, and 15) are located in burned areas. Supplemental quadrat sampling for common herbaceous species was conducted along two transects, Transects 7 and 15, where the overall cover by herbaceous species exceeded 20 percent. Two transects (Transects 2 and 12) are located in clipped areas. Supplemental quadrat sampling for common herbaceous species was not conducted along transects located in clipped grids. Herbaceous vegetation did not exceed 20 percent at these transects. Data collected from Transects 3, 4, and 5 was not used in this evaluation as these transects are located in undisturbed areas. Transect locations are identified in Plate 4.

OE Site 11: Harding ESE conducted line-intercept sampling at five transects (Transects 1, 2, 3, 5, and 8) located at this site. Supplemental quadrat sampling for common herbaceous species was conducted along one transect at OE Site 11 where the overall cover by herbaceous vegetation exceeded 20 percent. Sampling was not conducted along Transects 4, 6, and 7. Transects 4 and 7 are located in undisturbed areas and Transect 6 is located outside the boundary of OE Site 11. Transect locations are identified in Plate 5.

OE Site 19: BLM conducted line intercept sampling was conducted at eight transects (Transects 1, 2, 3, 4, 5, 6, 7, and 8) located at this site. Supplemental quadrat sampling for common herbaceous species was not conducted at OE Site 19. The overall cover provided by herbaceous vegetation in transects at OE Site 19 did not exceed 20 percent. Transect locations are identified in Plate 6.

2.2 HMP Annual Species Surveys

Surveys were conducted at monitoring sites either to verify the continued presence of previously recorded populations or to identify new populations. Prior to conducting surveys for HMP annual species, aerial photographs or maps showing previously recorded populations were reviewed to identify suitable or potential habitat. Surveys were conducted by inspecting areas of known or potential habitat by walking species-specific habitats at approximately 25-foot intervals. The location of observed populations was recorded using GPS. The sites where HMP annual species surveys were conducted are indicated on Plates 3 through 8.

A baseline survey for HMP annual species was conducted by Harding ESE at OE Site 9. Harding ESE also conducted visual identification surveys of Contra Costa goldfields populations at OE Site 10B.

2.2.1 OE Removal Site Methods and Sampling Locations

Population totals for sand gilia and seaside bird's-beak were estimated by direct counts. For Monterey spineflower, density estimates were identified based upon spot sampling. Density estimates for Monterey spineflower were assigned density levels as follows:

- Low-density populations are estimated to contain between 1 – 500 individuals per acre.
- Medium-density populations are estimated to contain between 501 – 5000 individuals per acre.
- High-density populations are estimated to contain more than 5000 individuals

In April 2001, Harding ESE conducted baseline surveys for HMP annual species at OE site 9. In May 2001, Harding ESE conducted follow up surveys HMP annual species OE site 11. BLM conducted follow-up surveys in 2001 for HMP annual species at OE sites 10A, 10B, and 19. Population sizes for all three species were estimated and the boundaries mapped using GPS.

2.2.2 Contra Costa Goldfields Methods and Sampling Locations

Sampling methods for Contra Costa goldfields involves conducting visual surveys by systematically walking over grassland habitats where this species might occur. Particular attention is given to topographically low areas that contained species associated with areas supporting Contra Costa goldfields.

Visual surveys were conducted in May, 2001 in the two areas containing Contra Costa goldfields populations located on OE Site 10B: one at MGF and the other at the mima mound area.

2.2.3 UC/NRS FONR Methods and Sampling Locations

Harding ESE conducted follow-up surveys in April 2001 for Monterey spineflower and sand gilia at the UC/NRS FONR in accordance with the BO (*USFWS, 1999*) regarding activities included in the on-going remedial investigations at UC/NRS FONR, which is located adjacent to the former Fritzsche Airfield. Harding ESE implemented mitigation measures to address potential impacts to HMP annual species associated with quarterly groundwater monitoring, well development, and other activities related to groundwater remediation at UC/NRS FONR. Activities conducted within UC/NRS FONR property are required to follow specific protocols that were approved by the USFWS as detailed in the BO (*USFWS, 1999*) and memoranda (Wilson, 1998).

Following is a list of activities conducted to fulfill the intent of the BO regarding sand gilia and Monterey spineflower:

- A route along existing roads within the UC/NRS property was identified to allow Harding ESE staff access to existing wells and potential areas of future well development. These roads are currently in use by Harding ESE to conduct quarterly groundwater monitoring and other associated groundwater remediation activities. These roads are also currently in use by other organizations such as the Marina Water District and University of California Santa Cruz (UCSC).
- Surveys were conducted at existing well sites and along the approved access route. Areas supporting sand gilia and Monterey spineflower were identified and flagged. Population totals were estimated within each identified area by direct counts.
- Populations were located using landmarks on aerial photographs and hand mapped. Populations were later delineated using GPS.

2.3 Exotic Species Methods and Sampling Locations

A review of historical chaparral monitoring data and aerial photographs to identify previous populations was conducted. Identified areas were surveyed and GPS'ed for jubata grass, hottentot fig, and cut leaved fireweed. The presence of either sparse individuals or dense populations was identified. Jubata grass individuals were classified into age classes to estimate the establishment of a population. Jubata grass age classes were identified as juvenile (not fertile), intermediate (fertile though not exhibiting reproductive structures), and adult (exhibiting reproductive structures). The density of exotic species were estimated and classified.

Harding ESE conducted baseline surveys on Ranges 43 - 48, OE Site 16, and Range 30A to identify the locations of the non-native plant species jubata grass, hottentot fig, and cut-leaved fireweed. The California Exotic Pest Plant Council (CalEPPC) considers these species extremely invasive. Jubata grass and hottentot fig were placed on CalPECC's List A-1. List A-1 is defined as Most Invasive Wildland Plants. Both species are colonizers of bare and disturbed ground and compete with native vegetation. Cut-leaved fireweed was on CalPECC's List A-2. List A-2 is defined as: Wildland pest plant of lesser invasiveness. Cut-leaved fireweed propagates quickly after a fire disturbance. The results of surveys for jubata grass, hottentot fig, and cut-leaved fireweed are presented on Plates 9 through 11.

2.4 Wetland Monitoring

A baseline wetland survey was conducted at Waterbody 53. Follow-up monitoring was conducted at two waterbodies: 42 and MGF. The baseline monitoring was conducted to collect baseline data on wetland associated special status fauna identified in the HMP and wetland vegetation. Follow-up monitoring was conducted to evaluate whether OE removal activities affected baseline conditions previously observed at these waterbodies. The WRP (*USACE, 1997b*) identifies the level of effort for monitoring depending on the degree of disturbance that occurred during OE removal. The physical characteristics of waterbodies were recorded during fauna surveys to identify factors that could potentially affect the continuing presence or absence of special status fauna, specifically California linderiella, other fairy shrimp species, California tiger salamander, and California red-legged frog.

Special status fauna surveys were conducted at waterbodies 42, 53, and MGF during four monitoring events between January and June. Vegetation surveys at these waterbodies were conducted in June. Methods used to collect baseline and follow-up data on special status fauna, physical characteristics and

wetland vegetation were developed in accordance with guidelines specified in the HMP and WRP and are described briefly in the sections below.

2.4.1 Wetland Vegetation Sampling

Wetland vegetation sampling was conducted at waterbodies 42, 53, and MGF during the June monitoring event. Wetland vegetation sampling focused on characterizing emergent and transitional herbaceous species.

Sampling was conducted using a modification of the quadrant method used for HMP annual species (USACE, 1995a). The primary modification of the sampling protocol presented in the above referenced document involved the interval between quadrats. The original protocols were developed for vegetation sampling in chaparral habitat. Quadrats for wetland habitats monitored in 2001 were placed every ten feet to capture abrupt vegetation changes, including intermittent patches of bare ground and open water.

One to nine survey transects were established at waterbodies 42, 53, and MGF based on size and variability of habitat. Transect length ranged from 50 to 241 feet. The number, location, and length of transects were selected to provide data representative of the transitional and emergent habitats at each waterbody. Five-foot lightweight t-posts were installed at the start and endpoints of each sampled transect. For identification the top of the each t-post was spray painted orange and labeled with an aluminum tag. Photographs were taken to record the location and condition of the sampling transect, and transect start and endpoint locations were mapped using GPS. Sampling was conducted along each transect by placing a 0.25-meter square quadrat at the starting point and at 10-foot intervals alternating from the right to left side of the transect. Plant species present within the quadrat were identified, percent cover was estimated for each species, and data were recorded.

The WRP states that the monitoring period of wetlands is based upon the assumption that performance functions of a wetland will be successfully achieved within 5 years of disturbance activities. The WRP also states that at least three monitoring events are required within the five-year period after OE disturbance activities have been completed. The requirement for additional follow-up monitoring is based on the results of monitoring surveys.

2.4.2 Fauna

Wildlife monitoring was conducted at all three waterbodies, and included surveys for wildlife species identified in the HMP and other potentially occurring special status species identified in the WRP. Vertebrate species observed during fauna surveys were recorded in field logs. Wildlife surveys were specifically conducted to determine the presence/absence of California linderiella, California tiger salamander, California red-legged frog, tricolored blackbird, and southwestern turtle.

Fairy shrimp

Surveys for California linderiella and other fairy shrimp were conducted during monthly site visits at Waterbody 42 from January through April, Waterbody 53 February through April, and MGF from February through May. No surveys were conducted at MGF in June, or at waterbodies 42 and 53 in May and June due to the absence of water at these sites.

To assess the presence/absence of California linderiella and other fairy shrimp, representative portions of each waterbody were sampled using a dipnet and samples were examined for fairy shrimp species. Fairy shrimp were examined with a field-magnifying lens to identify genus. Samples were collected systematically from each waterbody until habitat was adequately represented. When fairy shrimp were

observed, their relative abundance was estimated by collecting between 10 and 20 samples from throughout each waterbody (depending on the size and complexity of each waterbody). The number of linderiella in all 10 to 20 samples was totaled and the relative abundance was defined as follows:

- Low abundance: 1 to 10 linderiella
- Moderate abundance: 11 to 100 linderiella
- High abundance: 101 to 300 linderiella
- Very high abundance: more than 300 linderiella.

California tiger salamander

To assess the presence/absence of California tiger salamander, representative portions of each waterbody were sampled using a dipnet, and samples were examined for the presence of California tiger salamander larvae. Samples were collected systematically from each waterbody until habitat was adequately represented. In addition to the dipnet surveys for larvae, upland habitat was surveyed for the presence of adult California tiger salamander. Upland surveys consisted of walking transects from the edge of the waterbody into upland habitat and looking underneath downed tree branches and rocks, in burrow entrances, and soil fissures under tree canopies where there were suitable upland refugia.

California red-legged frog

To assess the presence/absence of California red-legged frog, representative portions of each waterbody were sampled using a dipnet, and samples were examined for presence of California red-legged frog tadpoles. Samples were collected systematically from each waterbody until the habitat was adequately represented. In addition to the dipnet surveys for tadpoles the presence/absence of adult California red-legged frog were conducted on the perimeter of each waterbody. Habitat features such as duration of ponding, presence of submergent and emergent vegetation, and adequate upland estivation habitat were noted.

Tricolored blackbird and southwestern pond turtle

Visual surveys to determine the presence/absence of tricolored blackbird and southwestern pond turtle were conducted during all visits (January through May) at waterbodies 42, 53, and MGF searching for nesting or physical evidence of either species. In addition, observations of other vertebrate species at each waterbody were recorded.

2.4.3 Physical Characteristics

Physical data were collected at all three waterbodies, even though the degree of disturbance was not significant enough to require the collection of physical data at the follow-up waterbodies as identified in Table 3 of the WRP. Table 3 indicates that only those waterbodies in which OE removal activities have resulted in excavations greater than four feet or have been identified as having soil conditions other than a thick deep clay horizon are required to have hydrological monitoring. Although not specifically required in the WRP, physical data was collected at waterbodies 42, 52, and MGF. Physical data collected at waterbodies 42, 53, and MGF included pH measurements, maximum water depth, duration of ponding, and the surface area of each waterbody. Disturbance to the wetland habitat during data collection was minimized by restricting the amount of wading in each waterbody to only what was necessary for dipnet sampling and measurements of physical characteristics. Physical data was recorded at MGF and Waterbody 53 during each visit from February through May and at Waterbody 42 during visits February

through April. This data was not measured at MGF in June due to the limited size of the waterbody. This data was not measured waterbodies 42 and 53 in May and June due to the absence of water.

Measurements of pH were collected during each monitoring event at all three waterbodies. A portable pH field meter was calibrated prior to each field monitoring visit, pH measurements were collected prior to other survey activities that could affect data accuracy (e.g., gathering depth measurements, vegetation sampling, and/or dipnetting). Measurements were taken no sooner than 24 hours after a storm event, as required by protocol indicated in the WRP.

Maximum water depth was measured during each monitoring event by wading toward the center of the waterbody until the apparent maximum depth was located. The distance between the water surface and the bottom of the waterbody was measured by placing a staff gauge into the deepest portion of each monitored waterbody and recorded on field forms.

The area of ponding of all three waterbodies was determined by measuring the perimeter of the area of ponding using a GPS unit. Waterbodies 53 and MGF were measured during three of the four monitoring events. Waterbody 42 was not measured in April due to the unavailability of GPS coordinates at this waterbody. The perimeters of waterbodies 42 and 53 were not measured in May due to the absence of water.

The duration of ponding was not recorded at Waterbody MGF during the 2001 follow-up monitoring surveys as ponding occurred after the final survey date. However, ponding observed during monitoring events was recorded and is presented in the Results section of this report.

Survey results were reviewed for several waterbodies to identify the success criteria and determine the need for additional monitoring in 2001. Baseline fauna surveys were conducted at waterbodies 1, 2, 17, MHLE, and MHLW in 1994. Follow-up fauna surveys for these waterbodies were conducted in 1995 and 1996 and the final follow-up fauna survey for these waterbodies was conducted in 1999.

3.0 RESULTS

This section presents survey data collected during monitoring in 2001. The results are presented according to the three types of monitoring conducted: central maritime chaparral, HMP annual species, and waterbodies.

3.1 Central Chaparral Habitat Monitoring

The results of the line-intercept and quadrat sampling of central maritime chaparral habitat are summarized below. Results of chaparral vegetation sampling are presented in terms of dominant and/or HMP species. Tables 3 through 10 provide the percent cover by transect for line intercept and quadrat sampling for each species observed at the OE sites monitored in 2001. Figure 1 is a representative example of central maritime chaparral habitat sampled during 2001 monitoring surveys. Figures 2 through 9 provide the percent cover by species for line-intercept sampling and average coverage by species for quadrat sampling for each of the OE sites monitored in 2001.

3.1.1 OE Sites

OE Site 10A: Results of the line-intercept sampling for OE Site 10A are presented in Table 3 and Figure 2. OE Site 10A has been subject to several episodes of vegetation clearance between 1995 and 1998. Site 10A was partially burned in 1995. OE sampling and removal grids not burned were manually clipped from 1995 through 1997. In 1997, a majority of Site 10A was burned again, including areas previously identified as clipped grids.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in burned areas include: chamise (*Adenostoma fasciculatum*) at 5.43 percent, shaggy-barked manzanita (*Arctostaphylos t. tomentosa*) at 9.61 percent, dwarf ceanothus (*Ceanothus dentatus*) at 5.54 percent, and rush rose (*Helianthemum scoparium*) at 16.01 percent. Bare ground was estimated at 15.14 percent. HMP shrub species encountered at OE Site 10A and their respective cover are as follows: Toro manzanita (3.16 percent), Hooker's manzanita (2.89 percent), and Monterey ceanothus (1.82 percent). Exotic species encountered at OE Site 10A and their estimated covers are as follows: hottentot fig (1.8 percent), pampas grass (0.08 percent), and cut-leaved fireweed (0.06 percent). Of the 25 shrub and perennial species encountered, 22 are native.

Results of quadrat sampling for OE Site 10A are presented in Table 4 and Figure 3. Cover contributed by herbaceous vegetation at OE Site 10A was estimated using line-intercept sampling to be approximately 31.68 percent. Dominant the herbaceous species (individually contributing greater than 2 percent cover) observed during sampling include cut-leaved fireweed at 10.2 percent, smooth cat's-ear (*Hypochaeris glabra*) at 5.93 percent, pitcher sage (*Lepechinia calyci*) at 4.4 percent, six-week fescue (*Vulpia bromides*) at 3.67 percent, narrow-leaved filago (*Filago gallica*), and rat-tail fescue (*Vulpia myuros*) at 2.73 percent. An unidentified moss species provided an estimated 12.53 percent of the overall cover in quadrat squares at this site. Shrub and perennial species provided an estimated 31.6 percent of the overall cover in quadrat squares at this site. Of the 21 herbaceous species encountered during quadrat sampling, 13 are native.

A discussion of the 2001 central maritime chaparral monitoring results as compared to the 1994 baseline data for OE Site 10A is provided in Section 4 of this report. Data analysis for this site is based upon the burn clearance method used in 1997.

OE Site 10B: Results of line-intercept sampling for burned areas at OE Site 10B are presented in Table 5 and Figure 4. Portions of OE Site 10B were burned or manually clipped in 1997.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in burned areas include: rush rose (33.87 percent), dwarf ceanothus (21.12 percent), shaggy-barked manzanita (12.30 percent), Monterey ceanothus (6.82 percent), deerweed (*Lotus scoparius*) at 6.13 percent, chamise (4.88 percent), and Toro manzanita (4.14 percent). HMP shrub species encountered at OE Site 10B and their respective cover in burned areas are as follows: Monterey ceanothus (6.82 percent), Toro manzanita (4.14 percent), and Eastwood's goldenbush (0.08 percent). Bare ground was estimated at 8.81 percent cover. Cover contributed by herbaceous vegetation was estimated to be 19.55 percent. Exotic shrub or perennial species were not encountered at burned areas in OE Site 10B.

The percent cover of herbaceous species as indicated by quadrat sampling is presented in Table 6. The average cover of herbaceous species as indicated by quadrat sampling is presented in Figure 5. Dominant herbaceous species (individually contributing greater than 2 percent cover) include smooth car's-ear (6.83 percent), rat-tailed fescue (6.17 percent), soft chess (*Bromus hordeaceus*) at 5.00 percent, scarlet pimpernel (*Anagallis arvensis*) at 3.67 percent, pygmy-weed (*Crassula connata*) at 3.00 percent, an unidentifiable Gnapallium species (2.50 percent), Hemizonia (2.50 percent), and thyme-leaf pogogyne (*Pogogyne serpylloides*) at 2.25 percent. It should be noted that an unidentified moss species provided approximately 16.92 percent of the vegetative cover in quadrats at this site. Of the 36 herbaceous species encountered, 24 are native.

Results of line-intercept sampling for clipped areas at OE Site 10B are presented in Table 7 and Figure 6. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in clipped areas include Toro manzanita (53.60 percent), shaggy-barked manzanita (33.01 percent), and California coffeeberry (*Rhamnus c. californica*) at 5.13 percent. HMP shrub species encountered at OE Site 10B and their respective cover in clipped areas are as follows: Toro manzanita (53.60 percent), Monterey ceanothus (0.51 percent) and Eastwood's goldenbush (0.15 percent). Bare ground was estimated to be 23.46 percent cover. Cover contributed by herbaceous vegetation was estimated at 0.66 percent. Exotic shrub and perennial species were not encountered at burned areas in OE Site 10B.

A discussions of the 2001 central maritime chaparral monitoring results as compared to the 1996 baseline data for OE Site 10B is provided in Section 4 of this report. Data analysis for this site is divided into burned areas and clipped areas based upon the vegetation clearance method used.

OE Site 11: Results of line-intercept sampling for OE Site 11 are presented in Table 8 and Figure 7. OE Site 11 was manually clipped of vegetation in 1997. Cleared vegetation was piled in parallel rows approximately 3 to 5 feet high and 6 to 10 feet wide at the site. No burning has been conducted on OE Site 11.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include chamise (20.62 percent), sticky monkey flower (12.20 percent), shaggy-barked manzanita (9.88 percent), and Toro manzanita (6.34 percent). Bare ground was estimated at 22.01 percent. HMP shrub species sampled at OE Site 11 and their respective cover are as follows: Toro manzanita (6.34 percent) and Monterey ceanothus (1.39 percent).

Cover contributed by herbaceous vegetation was estimated at 12.98 percent. Exotic species encountered at OE Site 11 and their estimated covers are as follows: cut-leaved fireweed (1.88 percent). Of the 17 shrub and perennial species encountered, 16 are native.

Results of quadrat sampling for OE Site 11 are presented in Table 9 and Figure 8. Cover contributed by herbaceous vegetation at OE Site 11 was estimated using line-intercept sampling at approximately 12.98.

Dominant herbaceous species (individually contributing greater than 2 percent cover) observed during sampling include silvery hair-grass (*Aira caryophylla*) at 16.0 percent, climbing bedstraw (*Galium porrigens*) at 3.6 percent, Gnaphalium (2.6 percent), and wedge-leafed horkelia (*Horkelia c. cuneata*) at 2.0 percent. However, unidentified annual grasses provided an estimated 6.00 percent of the cover and dead vegetation provided an estimated 20.00 percent of the cover at this site. These figures may not accurately represent species composition and cover as sampling at this site was performed in late fall after the growing and flowering season for herbaceous species had ended. Of the 9 herbaceous species encountered during quadrat sampling, 8 are native.

A discussion of the 2001 central maritime chaparral monitoring results as compared to the 1996 baseline data for OE Site 11 is provided in Section 4 of this report. Data analysis for this site is based upon the clipped clearance method used in 1997.

OE Site 19: Results of line-intercept sampling for OE Site 19 are presented in Table 10 and in Figure 9. OE Site 19 was burned in 1995.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include shaggy-barked manzanita (46.21percent), rush rose (9.17), chamise (11.84 percent), Monterey ceanothus (7.97 percent), and dwarf ceanothus (6.61 percent). HMP shrub species encountered at OE Site 19 and their respective cover in burned areas are as follows: Toro manzanita (0.49 percent), and Monterey ceanothus (7.97 percent). Coast live oak (*Quercus a. agrifolia*) was estimated at 7.54 percent and bare ground was estimated at 7.28 percent. Cover contributed by herbaceous vegetation was estimated at 12.87 percent. Exotic species encountered at OE Site 19 and their estimated covers are as follows: hottentot fig (0.39 percent). Of the 20 shrub and perennial species encountered, 19 were native.

A discussion of the 2001 central maritime chaparral monitoring results compared to the 994 baseline data for OE Site 19 is provided in Section 4 of this report. Data analysis for this site is based upon the burn clearance method used in 1995.

3.2 HMP Annual Species Monitoring

Harding ESE conducted focused surveys for HMP annual species at OE sites 9 and 11, and at the UC/NRS-FONR. Harding ESE also conducted visual surveys for Contra Costa goldfields populations at OE Site 10B. Focused surveys for HMP annual species were conducted by the BLM at OE sites 10A, 10B, and 19. The following sections summarize results of HMP annual species monitoring at the above described locations

3.2.1 OE Sites

OE Site 9: Plate 7 illustrates the spatial extent of baseline surveys conducted for HMP annual species at this site. No HMP annual species were observed at this site in 2001.

OE Site 10A: Plate 4 illustrates the location and size of HMP annual species populations for sand gilia and Monterey spineflower at this site. Two large populations (population size between 501 – 5,000 individuals), one medium population (population size between 101 – 500 individuals), and eight small populations (population size less than 100 individuals) of Monterey spineflower were observed in the southern and central portions of this site. One large population, one medium population, and five small populations of sand gilia were also observed on OE Site 10A. Seaside bird's-beak was not observed at this site.

A discussion of the 2001 HMP annual species monitoring results as compared to the 1994 baseline data for OE Site 10A is provided in Section 4 of this report.

OE Site 10B: Plate 5 illustrates the location and size of HMP annual species populations for seaside bird's-beak, sand gilia, and Monterey spineflower at this site. Three large populations, one medium population, and four small populations of sand gilia were observed in the southern portion of OE Site 10B. One very large population (population size greater than 50,000 individuals), one large population, and two small populations of Monterey spineflower were observed on the southern portion of this site. One medium population and five small populations of seaside bird's-beak were also observed on OE Site 10B.

Discussions of the 2001 HMP annual species monitoring results as compared to the 1994 baseline data for OE Site 10B is provided in Section 4 of this report.

OE Site 11: Plate 6 illustrates the extent of follow-up monitoring surveys conducted for HMP annual species at this site. No HMP annual species were observed at this site in 2001.

OE Site 19: Plate 7 displays the extent of follow-up conducted for HMP annual species at this site. No HMP annual species were observed at this site in 2001.

3.2.2 Contra Costa Goldfields

Several small populations (estimated population size between 1-500) of Contra Coast goldfields were observed at MGF and at the adjacent mima mounds on OE Site 10B. Plants were observed to be generally associated with topographically low-lying habitat, transitional between areas that were dominated by obligate wetland species and areas dominated by upland species. Both sites exhibited an uneven mounded topography with intervening low areas that impound water for varying lengths of time. Populations of Contra Costa goldfields at the mima mound area appeared to have a much more pronounced elevation difference between saturated and upland areas than at MGF.

3.2.3 UN/NRS

Plate 8 illustrates the location and spatial extent of sand gilia and Monterey spineflower populations present along access routes at the UC/NRS-FONR. Surveys were conducted at all groundwater monitoring well sites and along approximately 5.7 miles of identified access routes. Coverage by sand gilia populations is approximately 3,038 linear feet with an estimated population total of 4,643 individuals. There was an increase in the sand gilia population located at the UC/NRS gate located near the OU1 groundwater filtration station. Sand gilia population at this location substantially increased from approximately 480 in 2000 to approximately 1,421 in 2001. Coverage by Monterey spineflower populations is approximately 3,968 linear feet with an estimated population total of 15,451 individuals. The largest population (over 5,000 individuals) of Monterey spineflower is located at a newly constructed groundwater monitoring well and its access road in the southern portion of the reserve.

3.3 Exotic Species

OE Site 16: A review of historical monitoring data revealed no observations of the three species were made in the baseline survey for OE Site 16. A review of historical aerial photographs revealed no identifiable populations. Plate 9 illustrates the location and spatial extent of hotentot fig and jubata grass on OE Site 16. One large, high-density population of jubata grass was observed within an erosion area on the eastern side of the site. Approximately 63 juvenile individuals, 61 intermediate individuals, and 72 mature individuals of jubata grass were observed at OE Site 16. One large, high-density population of

hottentot fig was also observed in the erosion area previously identified. Cut-leaved fireweed was not observed at this site.

Range 30A: Jubata grass, hottentot fig, and cut-leaved fireweed was not recorded in Range 30A during previous surveys. Plate 10 illustrates the location and spatial extent of hottentot fig and jubata grass on OE 30A. Several dense jubata grass and hottentot fig populations were observed running parallel to Evolution, Darwin, and Orion access roads. Approximately 560 juvenile individuals, 650 intermediate individuals, and 331 mature individuals of jubata grass were observed at this site. Cut-leaved fireweed was not observed at this site.

Ranges 43 - 48: Historical data revealed hottentot fig, with a total coverage of .012 percent, was found on Transects 20-1 (3.8 percent) and BC-5 (0.2 percent) within the Ranges 43 - 48 baseline monitoring. No observations of Australian cutleaf fireweed or jubata grass were previously made for within the 2000 Burn Area baseline monitoring.

Plate 11 illustrates the location and spatial extent of hottentot fig and jubata grass on Ranges 43 - 48. Several jubata grass populations were observed in Ranges 43 - 48. The largest and densest population of jubata grass is located between Ranges 46 and 47. Approximately 131 juvenile individuals, 183 intermediate individuals, and 193 mature individuals of jubata grass were observed outside of Ranges 46 and 47. Hottentot fig populations were primarily located adjacent to Eucalyptus Road. The dense populations of hottentot fig were observed along the northern border Range 45. Cut-leaved fireweed was not observed at this site.

3.4 Wetland Monitoring

A summary of wetland survey dates and the type of survey conducted at waterbodies 42, 53, and MGF is presented in Table 11. Results of the wetland monitoring are discussed below.

3.4.1 Wetland Vegetation Sampling

Wetland vegetation sampling was conducted on 14 transects located at three wetland monitoring sites, water bodies 42, 53, and MGF in 2001. Transect ranged from 50- to 241-feet in length. Transect lengths, number of quadrats and total area sampled on each transect are summarized in Table 12. The relative percent cover by species for each waterbody is summarized in Tables 13 through 15. Plates 12 through 14 indicate the transect and photo point locations and the maximum measured boundary of each waterbody. Figures 10 through 12 provide the percent cover by species for waterbodies 42, 53, and MGF, which were surveyed in 2001. Figures 13 through 15 provide a representative example of each of the waterbodies surveyed in 2001. Plant species observed during 2001 wetland monitoring are listed in Table 16.

Waterbody 42

Species composition and estimated percent cover at Waterbody 42 are presented in Table 13 and Figure 10. Plate 12 illustrates the transect locations surveyed at Waterbody 42 in 2001. Twenty-eight plant species were recorded at Waterbody 42. Dominant plant species, present at greater than 10 percent of the combined average cover, include California oatgrass (*Danthonia californica*), needle spike-rush (*Eleocharis a. acicularis*), and coast eryngo (*Eryngium armatum*). Silvery hair-grass (*Aira caryophyllea*), lady's mantle (*Aphanes occidentalis*), coast tarweed (*Hemizonia corymbosa* ssp. *Corymbosa*), smooth cats' ear (*Hypochaeris glabra*), cut-leaved plantain (*Plantago coronopus*), and blue-eyed grass (*Sisyrinchium bellum*) were present between 2.1 and 7.3 percent of the combined average cover. Most other plant species were present at 1 percent or less of the combined average percent cover. Of the 28 species observed during sampling, 16 are native.

Waterbody 53

Species composition and estimated percent cover at Waterbody 53 are presented in Table 14 and in Figure 11. Plate 13 illustrates the transect locations surveyed at this Waterbody 53 in 2001. Thirty-one plant species were recorded at Waterbody 53. Dominant plant species, present at greater than 10 percent of the combined average cover, include Dombey's spike rush (*Eleocharis montividentis*) and rabbit foot grass (*Polypogon monspeliensis*). Common brass buttons (*Cotula coronopifolia*), meadow barley (*Hordeum b. brachyantherum*), spreading rush (*Juncus confertus patens*), Hickman's popcorn flower (*Plagiobothrys chorisianus hickmanii*), and bugle-hedge nettle (*Stachys a. ajugoides*) were present between 2.2 and 6.6 percent of the combined average cover. Most other plant species were present at 1 percent or less of the combined average cover. Of the 31 species observed during sampling, 15 are native.

Machine Gun Flats

Species composition and estimated percent cover at MGF are presented in Table 15 and Figure 12. Plate 14 displays transect locations associated with this waterbody. Forty-six plant species were recorded at MGF. The dominant plant species, present at greater than 10 percent of the combined average cover, is pale spike-rush (*Eleocharis macrostachya*). Saltgrass needle (*Distichlis spicata*), spike-rush (*Eleocharis a. acicularis*), coast eryngo (*Eryngium armatum*), salt rush (*Juncus lesueurii*), brown-headed rush (*Juncus phaeocephalus*), beardless ryegrass (*Leymus triticoides*), and rabbit foot grass (*Polypogon monspeliensis*) were present between 3.5 and 6.3 percent of the combined average cover. Most of the other plant species were present at 1 percent or less of the combined average cover. Of the 46 species observed during sampling, 22 are native.

3.4.2 Fauna

California linderiella were observed during follow-up monitoring at waterbodies 42 and MGF, and baseline surveys at Waterbody 53. No fairy shrimp species listed as threatened or endangered were observed at any monitored sites during 2001 surveys. Table 18 presents the list of special status species observed at wetland monitoring sites.

Fairy Shrimp

California linderiella were observed in Waterbody 42 in January in very low numbers: only 2 individuals were observed in more than 20 dipnet samples. No fairy shrimp were observed in Waterbody 42 during subsequent sampling. California linderiella were present in moderate numbers in Waterbody 53 in February (100 individuals) and March (12 individuals). Recorded abundance in MGF was very high (approximately 740 individuals) during the February monitoring, and low (3 individuals) in March. Table 17 presents a summary of California linderiella data collected in 2001 for each waterbody and month.

California tiger salamander/California red-legged frogs

California tiger salamander and California red-legged frog were not observed during baseline surveys at Waterbody 53. California tiger salamander and California red-legged frog were not observed during follow-up monitoring at waterbodies 42 and MGF in 2001. Pacific treefrog (*Hyla regilla*) adults and larvae were observed in all three waterbodies. Adult bullfrogs were observed in abundance in MGF. Table 18 presents the list of special status species observed at wetland monitoring sites in 2001.

Southwestern pond turtle/tricolored blackbird

Southwestern pond turtle and tricolored blackbird were not observed at any of the waterbodies during 2001 monitoring. Other vertebrate fauna observed during the surveys is listed in Table 19.

3.4.3 Physical Characteristics

The physical parameters measured in waterbodies during the 2001 wetland monitoring activities include water depth, area of ponding, and pH and the results are summarized in Table 20. The maximum water depth and area of ponding at all three waterbodies was observed in March. Measurements for pH ranged from 6.3 at waterbodies 42 and 53 in March to 7.5 at MGF in May. The maximum water depth and area of ponding was observed in January at Waterbody 42. The maximum water depth was observed in March at Waterbody 53 and MGF. The maximum area of ponding was observed in February at Waterbody 53 and March at MGF.

Waterbodies 53, and MGF ponded water from the time of the first survey in February through the May site visit. During the April and May visits, ponding at Waterbody 42 was limited to the area located under the oak canopies. Waterbody 53 ponded water from the first site visit in January through the last visit in May. Ponding at Waterbody 53 typically occurs in two physically isolated ponds. Henneken Ranch Road is located between the two areas of ponding and physically separates the eastern and western ponding areas. Heavy precipitation in 1999 linked these pools and closed Henneken Ranch Road. The eastern waterbody gradually separates into a series of small waterbodies as water levels receded. Waterbodies 42 and 53 dried out between the fourth wetland survey activity in May and baseline vegetation surveys in June. MGF was still inundated in May, but was significantly reduced in June. Ponding was limited to a deep pool located on the western edge of MGF.

4.0 DISCUSSION

4.1 Central Maritime Chaparral Habitat Monitoring

4.1.1 OE Sites

OE Site 10A: The data collected in 2001 by BLM represents the fifth year of follow-up monitoring at this site. Baseline surveys were conducted for this site in 1994. OE Site 10A has been subject to several episodes of vegetation clearance between 1995 and 1998. Site 10A was partially burned in 1995, OE sampling and removal grids not burned, were manually clipped beginning in 1995 and through 1997. The majority of Site 10A was burned again in 1997, including clipped areas. Therefore, all transect areas have been subject to burning and follow-up monitoring transect data collected in clipped areas after 1997 will be analyzed with transects in burned areas. The data collected in 2001 represents the first year all of OE Site 10A was analysed as a burn area. Figure 16 presents the overall coverage provided by chaparral species observed during line-intercept sampling in 1999, 2000, and 2001. Figure 17 presents the overall coverage provided by HMP species observed during line-intercept sampling in 1999, 2000, and 2001

Overall coverage provided by flora species observed during line-intercept sampling for OE Site 10A are presented in Table 3 and Figure 2. Cover provided by shrub and perennial species comprised approximately 66 percent of the overall cover at this site in 2001. Shrub and perennial species provided approximately 70 percent of the overall cover in 2000. The 1994 baseline survey shows that shrub and perennial species provided approximately 21 percent of the overall cover in seral chaparral and approximately 89 percent of the overall cover in mature chaparral. HMP seed reproducer such as Toro manzanita, Hooker's manzanita, and Monterey ceanothus provided approximately 8 percent of the overall cover at this site compared to approximately 13 percent in burned areas and 7 percent in clipped areas in 2000. The 1994 baseline survey shows that HMP seed producers accounted for approximately 33 percent of the overall cover in mature chaparral. Toro and Hooker's manzanita were not recorded in seral chaparral in the 1994 baseline survey of this site. Monterey chaparral accounted for less than 1 percent of the overall cover in seral chaparral.

There was a notable change in species composition at Transect 6 in 2001. The overall coverage provided by Monterey ceanothus in Transect 6 at this site dropped from approximately 53 percent in 2000 to less than 4 percent in 2001 while the overall cover provided by dwarf ceanothus increased from approximately 8 percent in 2000 to approximately 51 percent in 2001. There is no plausible reason for the large change in the overall cover provided by these two species at this transect. The high cover provided by rush rose in 2000 (approximately 28 percent) dropped to about 16 percent in 2001. Bare ground was 15 percent at this site compared to approximately 22 percent in the 1994 baseline survey. The overall cover provided by exotic species such as hottentot fig, pampus grass, and cut-leaved fireweed dropped from 5 percent in 2000 to less than 2 percent in 2001. Exotic species were not recorded during the 1994 baseline survey.

Flora species recorded during quadrat sampling at this site are presented in Table 4 and Figure 3. The most obvious feature is that shrub and perennial species account for 38 percent of the overall species cover recorded during quadrat sampling.

His site appears to be regenerating to baseline conditions based upon the continued increase in the proportion of cover provided by chaparral shrub species and the percent cover provided of shrub species identified in baseline surveys. The cover provided by herbaceous species remains high at this site.

Herbaceous species provided 32 percent of the overall cover at this site in 2000 and 2001. In the 1994 baseline survey, herbaceous species provided 46 percent of the cover in seral chaparral at this site. Herbaceous was not recorded to occur in mature chaparral at this site in the 1994 baseline survey. Further monitoring events will continue to identify the overall species cover provided by herbaceous and chaparral shrub species. While 2001 represents the fifth year of follow-up monitoring at OE Site 10A as required by the HMP. It is only the fourth year of follow-up monitoring that has occurred since the 1997 burn at this site. At least one more year of follow-up monitoring is required at this site to meet HMP requirements.

OE Site 10B: Data collected in 2001 represents the fourth year of follow-up monitoring on OE site 10B. Baseline surveys for this site were conducted in 1996. Portions of OE Site 10B were burned or manually clipped in 1997. Figure 18 presents the overall coverage provided by chaparral species observed during line-intercept sampling of burned areas of OE Site 10B in 1999, 2000, and 2001. Figure 19 presents the overall coverage provided by HMP species observed during line-intercept sampling of burned areas in 1999, 2000, and 2001. Figure 21 presents the overall coverage provided by HMP species observed during line-intercept sampling for clipped areas in 1999, 2000, and 2001. Figure 22 compares the coverage provided by chaparral shrub species recorded during line-intercept sampling for burned and clipped areas of OE Site 10B. This site is the only OE site where the comparison of clipped and burned vegetation is available.

Overall cover provided by flora species recorded during line-intercept sampling in burned areas at this site is presented in Table 5 and Figure 4. In 2001, cover by chaparral shrub and perennial species rose to approximately 105 percent in burned grids as compared to 94 percent in 2000. Chaparral shrub and perennial species accounted for approximately 103 percent of the overall cover during the 1996 baseline survey at this site. Chaparral shrub species most prevalent in burned areas were shaggy-barked manzanita and dwarf ceanothus. These two species provide approximately 33 percent of the overall species cover in burned areas in 2001 at OE Site 10B. The overall coverage by Toro manzanita remains low at this site but has increased from less than 1 percent in 2000 to approximately 4 percent in 2001. An analysis of transects considered to occur in burned areas show that Toro manzanita accounted for approximately 25 percent of the overall during the 1996 baseline survey at this site. Most notable is the disappearance in 2001 of Toro manzanita in Transects 7, 8, 9, 10-2, 13, and 15. The decrease in Toro manzanita is most likely a result of the substantial cover provided by rush rose (approximately 34 percent) at this site. Rush rose was not observed during the 1996 baseline survey. The seed source for rush rose at this site remains unknown at this time. Exotic species were not observed during follow-up surveys in burned areas at this site.

Flora species recorded during quadrat sampling in burned areas are presented in Table 6 and Figure 5. In 2001, the cover provided by herbaceous species was 20 percent, virtually unchanged from the 2000 survey (approximately 19 percent). Chaparral and scrub species comprised approximately 43 percent of the cover noted during quadrat sampling at this site in 2001 compared to 29 percent in 1998. Quadrat sampling was not performed at this site in 1999 and 2000.

With two notable exceptions, Toro manzanita and rush rose cover, species composition and cover in burned areas appears consistent with baseline conditions recorded at this site. The low overall cover provided by Toro manzanita (approximately 4 percent) is possibly caused by the high overall cover provided by rush rose (approximately 34 percent) at this site. Finally, the increase in cover provided by chaparral shrub (from 94 percent in 2000 to 105 percent in 2001) and high species diversity (11 species in clipped grids compared to 21 species in burned areas) is consistent with chaparral recovering to baseline conditions at this site. Future surveys will continue to monitor the regeneration of these two species at this site.

Results of line-intercept sampling for clipped areas at OE Site 10B are presented in Table 7 and Figure 6. Figure 20 presents the overall percent cover provided by chaparral species observed during line-intercept sampling for clipped areas of OE Site 10B in 1999, 2000, and 2001. Analysis of clipped grids is limited due to the small number of transects (2) sampled in 2001. The cover provided by chaparral and perennial species rose to approximately 99 percent in clipped grids as compared to 94 percent in 2000. Chaparral shrub and perennial species accounted for approximately 103 percent of the overall cover during the 1996 baseline survey at this site. Overall species cover in clipped grids is dominated by two taller shrubs, shaggy-barked manzanita and Toro manzanita, which account for approximately 87 percent of the overall cover at transects located in clipped areas. Shaggy-barked manzanita and Toro manzanita are tall and would have most likely been left standing after manual vegetation clearing. Species diversity was much lower in clipped areas than in burned areas of this site. Eleven species provided the overall cover in clipped transects compared to 21 species in burned transects. Herbaceous species account for approximately 1 percent of the overall cover at this site.

The species composition in clipped areas at OE Site 10B is not consistent with baseline conditions for central maritime chaparral habitat. Cover is dominated by two tall shrub species, Toro and shaggy-barked manzanita, which was left standing after limited manual vegetation clearing was performed. In addition, species diversity is 48 percent lower in clipped areas (11 species) as compared to burned areas (21 species). The low diversity of species in clipped areas is consistent with expectations as allelopathic chemicals in the soil and the physical and shade barrier presented by duff and chipped material could prevent germination of some seed species.

OE Site 11: This is the fourth year of follow-up monitoring conducted at this site. Baseline data for this site was collected in 1996. In 1997, OE Site 11 was manually clipped of vegetation in preparation for OE removal. Cleared vegetation was piled in parallel rows approximately 3 to 5 feet high and 6 to 10 feet wide. Figure 23 presents the overall percent cover provided by chaparral species observed during line-intercept sampling for OE Site 11 in 1999, 2000, and 2001. Figure 24 presents the overall percent cover provided by HMP species observed during line-intercept sampling for this site in 1999, 2000, and 2001.

Overall cover provided by flora species noted during line-intercept sampling at this site are presented in Table 8 and Figure 7. Cover by chaparral shrub and perennial species dropped from approximately 67 percent in 2000 to approximately 60 percent in 2001. The decrease in cover by sticky monkey flower (*Mimulus aurantiacus*) from approximately 18.6 percent in 2000 to 11.2 percent in 2001 is responsible for the drop in cover provided by chaparral and perennial species at this site. The 1996 baseline survey shows that shrub and perennial species provided approximately 117 percent of the overall cover at this site. Cover by the HMP seed species, Toro manzanita, showed little variation from previous sampling data. Toro manzanita provided approximately 6 percent of the overall cover from 1998 through 2001. Toro manzanita accounted for approximately 26 percent of the cover in the 1996 baseline survey. The physical and shade barrier presented by piles of cleared vegetation maybe inhibiting the recovery of Toro manzanita at this site. Cover provided by brush piles has shown little variation (11 percent in 1999 and 16 percent in 2001) in sampling data at this site. Bare ground remains high at this site and was approximately 22 percent in 2001 compared to 11 percent in the 1996 baseline survey.

Flora species recorded during quadrat sampling at OE Site 11 are presented in Table 9 and Figure 8. Most notable was an increase in the density of the non-native species silvery hair-grass (*Aira caryophyllea*) and the decrease in the cover provided by shrub and perennial species. Silvery hair-grass rose from approximately 3 percent cover in 2000 to 16 percent in 2001. Shrub and perennial species decreased from approximately 42 percent in 2000 to 31 percent in 2001.

The overall percent cover at OE Site 11 is not consistent with baseline conditions for central maritime chaparral habitat. The overall cover provided by chaparral and perennial species at this site remains low

at this site. Chaparral shrub and perennial species accounted for 60 percent of the overall cover at this site compared to 116 percent in the 1996 baseline survey. The cover provided by Toro manzanita (6 percent) remains low at this site. The physical and shade barriers presented by brush piles maybe inhibiting the recovery of germinating seed species at this site. In addition, piled brush occupies approximately 16 percent of cover at this site. Future follow-up monitoring will continue to identify the regeneration of species and species diversity at this site.

OE Site 19: Data collected in 2001 represents the fourth year of follow-up data collected for OE Site 19. Baseline data was collected for this site in 1994. OE Site 19 was burned in 1995 and sampled for OE between 1995 and 1998. Limited vegetation clearance was performed on stump-sprouting species at this site. Unburned branches and large stems of species such as chamise and shaggy-barked manzanita were manually clipped. Figure 25 presents the overall coverage provided by chaparral species observed during line-intercept sampling for OE Site 19 in 1999, 2000, and 2001. Figure 26 presents the overall cover provided by HMP species observed during line-intercept sampling for OE Site 19 in 1999, 2000, and 2001.

Overall coverage provided by shrub and perennial species recorded during line-intercept sampling at this site are presented in Table 10 and Figure 9. There was a substantial reduction in the overall coverage provided by shrub and perennial species in 2001 as compared to 2000. The overall cover by shrub and perennial species decreased from approximately 137 percent in 2000 to approximately 107 percent in 2001. A significant decrease in cover provided by the two species rush rose and deerweed is responsible for the decrease in cover provided by chaparral and perennial species at this site. The cover provided by rush rose and deerweed decreased from 45 percent in 2000 to approximately 12 percent in 2001. In the 1994 baseline survey, chaparral shrub and perennial species accounted for 96 percent of the cover at this site. There was a substantial change in covers provided by shaggy-barked manzanita and Toro manzanita. The overall cover of shaggy-barked manzanita rose from 28 percent in 2000 to approximately 46 percent in 2001. The cover provided by Toro manzanita decreased from approximately 14 percent in 2000 to less than 1 percent in 2001. In the 1994 baseline survey, Toro manzanita provided approximately 13 percent of the cover and shaggy-barked manzanita provided approximately 33 percent of the cover. There is no plausible reason for the large change in the overall cover provided by these two species at this site.

With the exception of the large decrease in the cover provided by Toro manzanita, regeneration of this site appears to be approaching baseline conditions. The cover provided by chaparral and perennial species remains high at this site. Chaparral shrub and perennial species provided 106 of the cover at this site compared to 96 percent in the 1994 baseline survey. The high species diversity at this site is consistent with recovering chaparral habitat. Twenty species provided cover at this site compared to 11 species in clipped transects in OE Site 10B. Bare ground and coverage by herbaceous species remains consistent with baseline conditions at this site. Future monitoring events will continue to record the regeneration of central maritime chaparral species at this site.

4.2 HMP Annual Species Surveys

4.2.1 OE Sites

OE Site 9: Surveys in 2001 represent the baseline survey for HMP annual species at this site. No HMP annual species were observed at this site.

OE Site 10A: Surveys in 2001 represent the fourth year of follow-up monitoring for HMP annual species at this site. The HMP annual species baseline survey for this site was conducted in 1997. The density and location of HMP annual species populations observed in 2001 is illustrated on Plate 3.

The 2001 survey shows that the population densities of Monterey spineflower and sand gilia are higher when compared to 2000. There were two large populations (501 – 5000 individuals) of Monterey spineflower in 2001 compared to one large population in 2000. Two additional populations (1-500 individuals) of sand gilia were observed in the 2001 survey. Population differences in the 2000 and 2001 surveys may be attributable to normal annual population fluctuations or to differences in rainfall totals. The 1997 baseline survey indicated that the population density of sand gilia was less than 250. Follow-up surveys in 2001 identified several scattered populations of sand gilia at OE Site 10A. The 1998 annual survey revealed that the Monterey spineflower was isolated to a sandy road in the central portion of this site. Based upon the 2000 and 2001 monitoring surveys, Monterey spineflower appears to be concentrated in the southwestern portion of this site. Further monitoring is required and changes in population totals will be compared with reported HMP annual species population fluctuations at OE sites for the same years.

HMP annual species appear to be recovering at OE Site 10A. The population densities of Monterey spineflower and sand gilia are larger and more scattered than those observed in the 1998 baseline survey for this site. In the 1998, the sand gilia population occurred in a small, single population while Monterey spineflower was only observed along one road. In 2000 and 2001, several scattered populations of Monterey spineflower and sand gilia were observed throughout the southwestern portion of this site.

OE Site 10B: Surveys in 2001 represent the fourth year of follow-up monitoring for HMP annual species at this site. The HMP annual baseline survey for this site was conducted in 1996. The density and location of HMP annual populations observed in 2001 is illustrated on Plate 4.

Follow-up surveys at OE Site 10B identified a very large population (estimated to contain over 50,000 individuals) of Monterey spineflower in the southern portion of this site. Several small populations of Monterey spineflower were also scattered throughout the southern portion of this site. The 1996 baseline data indicates that Monterey spineflower occurred at a low density throughout this site. The 2001 HMP annual survey identified two large populations (501 – 5,000 individuals) and several small populations (1 – 100 individuals) of sand gilia at this site. Sand gilia was isolated to a solitary small population of 37 individuals in the 1997 baseline survey. Several small populations (1 - 100 individuals) of seaside bird's-beak were also identified at this site. Large populations (501 - 5,000 individuals) of seaside bird's-beak and sand gilia are located within the boundary of the previously identified very large (excess of 50,000) Monterey spineflower population. Densities in the 2001 survey indicated that the overall population density of Monterey spineflower and sand gilia are higher as compared to population density in 2000. However, the population density of seaside birds-beak was substantially lower in 2001 as compared to 2000. One very large population (5,000 – 50,000 individuals) of seaside bird's-beak observed in 2000 was not observed in 2001. Population differences in the 2000 and 2001 surveys may be attributable to normal annual population fluctuations or to differences in rainfall totals. Further monitoring is required and changes in population totals will be recorded and compared with reported HMP annual species population fluctuations at OE sites for the same years.

HMP annual species appear to be recovering at OE Site 10B. The population densities of Monterey spineflower (greater than 50,000 individuals) and sand gilia (excess of 5,000 individuals) are greater than those observed in the 1996 baseline survey for this site. In the 1996, the sand gilia population occurred in a small, single (37 individuals) population. Monterey spineflower occurred in low density throughout the site. In 2000 and 2001, several larger, scattered populations of Monterey spineflower and sand gilia were observed throughout the southwestern portion of this site. The population density of seaside-bird's beak is lower in 2001 (population density estimated to be less than 1,000) and compared to 2000 (population density estimated to be greater than 50,000). As stated earlier, population differences in the seaside bird's-beak population may be attributed to normal population fluctuations. No estimated were given for

seaside bird's-beak in the 1996 baseline survey. Populations of seaside bird's-beak were observed in the southwestern portion of the site.

OE Site 11: Surveys in 2001 represent the third year of follow-up monitoring for HMP annual species at this site. No HMP annual species were observed at this site in 2001. The HMP annual baseline survey for this site was conducted in 1996. One individual of seaside bird's-beak was observed at this site during the 1996 baseline survey. No sand gilia or Monterey spineflower were observed. Further monitoring is required at this site to document the lack of HMP annual species at this site.

OE Site 19: The 2001 data represents the fourth year of follow-up monitoring for HMP annual species at this site. The HMP annual baseline survey for this site was conducted in 1994. No HMP annual species were located at this site this year or in the 1994 baseline survey. The small population (less than 100) located just outside of the site's northwestern boundary in 2000 was not identified in 2001. Further monitoring of HMP annual species is recommended to determine if the adjacent population of Monterey spineflower identified in 2000 is able to colonize at this site.

4.2.2 Contra Costa Goldfields

Populations of Contra Costa goldfields observed at OE Site 10B were restricted to low-lying areas at MFG and the mima mound area. Plant density is greater at MFG than at the mima mound site. This difference in populations may be attributed to the duration of water ponding at the two sites. Changes in population in the year-to-year totals for HMP annual species will be recorded and compared with reported basewide fluctuations for those same years.

4.2.3 UC/NRS FONR

Surveys conducted at the US/NRS FONR in 2001 for sand gilia and Monterey spineflower comprise the second year of monitoring activities. HMP annual baseline surveys for this site was conducted in 1998. The density and location of HMP annual populations is illustrated on Plate 8.

Two large populations of sand gilia were documented in 2001. The first large population (over 1,000 individuals) is located along the access road used for a newly constructed groundwater monitoring well located on the southern portion of UC/NRS. The second large sand gilia population (1,600 individuals) occurs adjacent to the entrance gate to the UC/NRS adjacent to the OU1 well treatment system. Harding ESE placed exclusion fencing around a known population at the entrance gate to the OU1 treatment system to prevent vehicular access at this site. The significant increase in this sand gilia population at this site could be a direct result of the exclusion fencing placed in this area to prevent vehicular access.

Populations of Monterey spineflower and sand gilia are located along access roads and in the vicinity of groundwater monitoring wells. Population differences in 2000 and 2001 may be attributable to normal annual population fluctuations or to differences in rainfall totals. The Army implemented a series of mitigation measures to reduce the impacts of groundwater well drilling activities to adjacent habitat. These mitigation measures included: limiting groundwater well construction activities to the dry season to avoid impacts to HMP annual species during growth and flowering periods and to avoid potential erosion; the use of a DENR approved biologist to identify the least damaging access routes, work zones, equipment and material stockpile; the placement of flagging/fencing around potential spineflower/sand gilia habitat with instructions to well drillers to avoid flagged/fenced off areas; and windrowing of the top 4 inches of soil around the well site if impacts to potential Monterey spineflower and sand gilia habitat were unavoidable.

HMP annual species are doing well at this site. The population fluctuations for these species at this site are consistent with population fluctuations observed at other OE sites, specifically OE Sites 10A and 10B. Populations of Monterey spineflower and sand gilia are located in along roads observed in 2000 and in the baseline survey conducted in 1999. Surveys were initiated along these roads to evaluate the potential impacts of groundwater well installation and monitoring activities to Monterey spineflower and sand gilia populations at this site. The precautions implemented during groundwater monitoring well installation and the mitigation measures implemented during groundwater monitoring well activities do not appear to have affected seed germination of these species at this site. Further annual monitoring for HMP annual species is required to monitor the recovery of HMP annual species at this site.

4.3 Exotic Species

Several jubata grass and hottentot fig populations were located at OE Site 16, Range 30A, and the Ranges 43 - 48. With the exception of the large jubata grass population located at Ranges 46 and 47, both species are primarily located adjacent to Eucalyptus Road and access roads. Both species have been previously located along access roads and disturbed areas at Ranges 25 and 26. Cut-leaved fireweed was not observed within the sites surveyed.

These areas represent a potential seed source for these species and allow for potential colonization of disturbed habitat by these species following OE removal, lead, and chemical remediation, or natural disturbances. In addition, wildlife species spread non-native, exotic species through their use of these species as a food source or on their bodies as the transit through areas containing exotic species. Non native species should be cleared prior to scheduled disturbances to reduce the potential for regeneration of these species after OE clearance and other remedial activities have been completed.

4.4 Wetland Monitoring

The findings presented here represent the first year of wetland monitoring at Waterbody 53. Data collected at waterbodies 42 and MGF represents the second year of follow-up monitoring for these waterbodies.

Fairy shrimp

California linderiella were observed during follow-up monitoring conducted at waterbodies 42 and MGF and during the 2001 baseline surveys conducted at Waterbody 53. Linderiella in Waterbody 53 represent baseline conditions that may be used for future comparison if OE removal activities warrant follow-up monitoring.

The relative abundance of fairy shrimp at Waterbody 42 during the 1998 baseline monitoring survey ranged from moderate abundance (11 to 100 individuals) in January to a low abundance (1 to 10 individuals) in February. During the 2001 monitoring events relative abundance of fairy shrimp at Waterbody 42 was low, with only 3 individuals observed in January. The low abundance of fairy shrimp observed at this site during the 2001 monitoring surveys may be the result of the insufficient ponding. Waterbody depth was less than 0.2 inches in March and no ponding was observed beginning in April. Habitat suitable for the presence of fairy shrimp is present at Waterbody 42. Fluctuations in the abundance and presence of fairy shrimp are attributed to variations of natural conditions at the waterbody, including precipitation timing and totals, temperature, and pH.

Linderiella were previously observed in MGF during the 1998 baseline monitoring event. The relative abundance during the 1998 baseline survey ranged from high abundance (101 to 300 individuals) in January to a moderate abundance (11 to 100 individuals) in February. Relative abundance of fairy shrimp

at MFG was lower in 2001 compared to monitoring surveys in 2000 (greater than 1,400 individuals) but remains substantially higher than baseline surveys (greater than 300 individuals) conducted in 1998. Relative abundance again reached very high levels at MFG in February with 740 individuals to a low of 3 individuals in March. The substantial decrease in abundance are attributed to variations of natural conditions at the waterbody, including precipitation timing and totals, temperature, and pH. OE removal activities at OE Site 10B did not appear to have affected abundance of linderiella at MFG. The high abundance of fairy shrimp has been observed at waterbodies once OE removal activities have been completed.

Baseline monitoring in 2001 at Waterbody 53 resulted in observations of California linderiella in moderate levels of relative abundance in February (100 individuals) and March (12 individuals). Waterbody conditions and species abundance will be used for future comparison if OE removal activities warrant follow-up monitoring.

California tiger salamander

No California tiger salamander were observed during 2001 baseline surveys at Waterbody 53, or during follow-up monitoring at Waterbody 42 and MFG. California tiger salamanders, adults and juveniles were observed at Waterbody 42 in 2000, the year following OE removal activities.

The absence of California tiger salamander in MFG is most likely attributable to the presence of a large number of bullfrogs in the waterbody. Adult bullfrogs are opportunistic feeders whose prey items include fish, salamanders, and other frogs. An area in the western portion of MFG, measuring approximately 500 square feet, is significantly deeper than the rest of the waterbody. The depth has been measured at greater than 5 feet when the waterbody is fully inundated. This area has also been observed to retain water throughout a majority of the year (7 to 8 months), which is beneficial to the continued existence of bullfrog in this waterbody.

Although no tiger salamanders were observed during baseline surveys at Waterbody 53, suitable habitat exists for this species. OE removal activities have not occurred in or adjacent to this waterbody, which could have affected habitat suitability. Migrations to and from breeding ponds may occasionally exceed 1000 meters (*California Department of Fish and Game, 1988*).

Red-legged frog

Many of the waterbodies occurring at Former Fort Ord provide suitable habitat for California red-legged frog, and it is possible that red-legged frogs may be present. However, they were not observed during previous baseline surveys, follow-up monitoring events or at any of the waterbodies surveyed in 2001. The absence of California red-legged frogs in MGF is most likely attributable to the presence of a large number of bullfrogs in the waterbody. Adult bullfrogs are opportunistic feeders whose prey items include fish, salamanders, and other frogs. An area in the western portion of MGF, measuring approximately 500 square feet, is substantially deeper than the rest of the waterbody. The depth has been measured at greater than 5 feet when the waterbody is fully inundated. This area has also been observed to retain water throughout a majority of the year (7 to 8 months), beneficial to the continued existence of bullfrog in this waterbody.

4.5 Anticipated Future Monitoring

Habitat monitoring activities recommended to be performed and included in the 2002 annual monitoring report include:

- Follow-up chaparral monitoring at OE Site 11, OE Site 10A, OE Site 10B, and OE site 19.
- If OE removal occurs, follow-up chaparral monitoring at OE Site 9, OE site 16, MRA North and West, and Ranges 43 - 48.
- Annual HMP annual species surveys at UC/NRS sites OE 10A, OE 10B, OE 11, and OE19.
- If OE removal activities occur, annual HMP annual species surveys at OE Site 9, MRA North, MRA West, and Ranges 43 - 48
- Follow-up monitoring of Contra Costa Goldfields populations at OE 10B.
- Final wetland monitoring at waterbodies 42 and MGF.
- Follow-up wetland monitoring at waterbodies 43, 44, and 53 if OE removal occurs and 52 if remediation is complete.

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