FINAL
2006 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS FRITZSCHE ARMY AIRFIELD FIRE DRILL AREA FORMER FORT ORD, CALIFORNIA

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Contract No. DACA45-03-D-0029
Delivery Order CM01

Prepared by:

HydroGeoLogic, Inc.
4600 Northgate Boulevard, Suite 207
Sacramento, CA 95834

February 2007

FINAL
2006 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS FRITZSCHE ARMY AIRFIELD FIRE DRILL AREA FORMER FORT ORD, CALIFORNIA

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Prepared by

HydroGeoLogic, Inc.
4600 Northgate Boulevard, Suite 207
Sacramento, California 95834-1133

Contract No. DACA45-03-D-0029
Delivery Order CM01

Approved: /Michael J. Bombard/ for Date: 2/21/2007
Prepared by: Roy Evans, P.E.

Approved: /Dennis McCrumb/ Date: 2/21/2007
Reviewed by: Dennis McCrumb, R.G.

Approved: /Michael J. Bombard/ Date: 2/21/2007
Michael J. Bombard, P.G., C.HG., R.E.A.
Project Manager

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACL	aquifer cleanup level
BRAC	Base Realignment and Closure
CalEPA	California Environmental Protection Agency
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
COC	contaminant of concern
DD&A	Denise Duffy and Associates, Inc.
EM	environmental monitor
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
FPRI	Fixed-price Remediation with Insurance
GAC	granular activated carbon
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
HCPP	Hydraulic Control Pilot Project
HGL	HydroGeoLogic, Inc.
LTM	long-term monitoring
m^2	square meter
OU	operable unit
ROD	Record of Decision
RTE	rare, threatened, or endangered
SOC	species of concern
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
UCSC	University of California at Santa Cruz
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
VOC	volatile organic compound

FINAL
2006 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS FRITZSCHE ARMY AIRFIELD FIRE DRILL AREA FORMER FORT ORD, CALIFORNIA

1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) is executing Delivery Order CM01 entitled "Fixed-price Remediation with Insurance (FPRI) Delivery Order for Operable Unit (OU)-1, Former Fort Ord, California" for the U.S. Army Corps of Engineers (USACE)-Sacramento District. The delivery order is being executed under Contract Number DACA45-03-D-0029 (administered through the USACE-Omaha District) initiated in December 2003. The objectives of this FPRI effort are the same as those of the Record of Decision (ROD) signed in July of 1995 by the Army, U.S. Environmental Protection Agency (USEPA), and the California Environmental Protection Agency (CalEPA).

The primary remediation objectives specified in the ROD are as follows:

1. Establish hydraulic control and contain contaminated groundwater.
2. Extract and treat groundwater exceeding aquifer cleanup levels (ACLs).

Activities undertaken to achieve the OU-1 cleanup must adequately protect and maintain the critical habitat and protected species found within the Fort Ord Natural Reserve (FONR).

Figure 1.1 illustrates the location of Former Fort Ord and the OU-1 source area. Activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA) (i.e., OU-1) between 1962 and 1985 resulted in contaminants being released to soils and groundwater. Although 10 volatile organic compounds (VOCs) have been identified as contaminants of concern (COC) in groundwater underlying the FDA, trichloroethene (TCE) is the contaminant that is detected at the highest concentrations and across the greatest extent of the affected aquifer. Thus far, data show that the TCE plume "footprint" encompasses that of the other nine COCs. Figure 1.2 shows the estimated extent of the TCE plume in September 2006. The area surrounding the OU-1 contaminant plume is part of the University of California Natural Reserve System (UCNRS) designated as the FONR. The FONR is managed by staff at the University of California Santa Cruz (UCSC).

The U.S. Army consulted with the U.S. Fish and Wildlife Service (USFWS) in 1998 to assess potential impacts to the sand gilia and Monterey spineflower populations resulting from groundwater investigation and remediation activities within the FONR. The opinion was issued on the March 30, 1999. Various mitigation measures were identified in the 1998 request and these measures will be implemented before, during and after work within the FONR.

Intermittent biological surveys within the OU-1 area have been undertaken by others since 1998 (Harding Lawson Associates, 1998) and annual biological surveys were conducted by HGL, using subcontractor CH2M Hill, in 2004 and 2005 (HGL, 2004 Appendix A; CH2M, 2005). These surveys have focused on mapping the extent and population of federally protected rare, threatened, or endangered (RTE) plant species within the FONR, including the endangered sand gilia (*Gilia tenuiflora ssp. arenaria*) and the threatened Monterey spineflower (*Chorizanthe pungens var. pungens*).

This document presents the results of the 2006 rare plant survey and discusses the potential impact to date on those plants associated with the OU-1 remediation activities conducted since 2004. The 2006 rare plant survey was conducted by Denise Duffy and Associates, Inc. (DD&A) under subcontract to HGL. The following are also included in this report:

- a description of the FONR site and overview of past activities
- descriptions of the actions taken and site management protocols implemented to minimize adverse impacts to the FONR habitat
- a summary of the site activities conducted by HGL during 2006 and planned future activities
- results of the 2006 rare plant survey and interim impact assessment

These topics are addressed in the following sections.

1.1 SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to the University of California and the FONR was established in June 1996. Additional information regarding past land use at this site is presented in the Final Operable Unit 1 Project Management Plan, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California (HGL, 2004a).

The former Fort Ord is located near Monterey Bay approximately 80 miles south of San Francisco (Figure 1.1). The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary of the former Fort Ord. Toro Regional Park borders the base to the southeast and land use to the east is primarily agricultural.

OU-1 occupies approximately 590 acres of the FONR in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The dominant habitats in this area include coast live oak woodland, maritime chaparral, and annual grassland. The dominant habitats within the FONR are coast live oak woodland, coastal scrub, maritime chaparral and annual grassland. The maritime chaparral is considered a rare habitat by the California Department of Fish and Game. The former Fort Ord area contains large areas of maritime chaparral habitat.

Several federally protected RTE plant species are present within the FONR, including the endangered sand gilia and the threatened Monterey spineflower. Several plant and animal species of concern (SOC) are also present in the FONR. Other plant SOC include coast

wallflower (*Erysimum ammophilum*), Eastwood's ericameria (*Ericameria fasciculata*), Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*), Sandmat manzanita (*Arctostaphylos pumila*), and Toro manzanita (*A. montereyensis*). The California black legless lizard (*Anniella pulchra nigra*), California coast horned lizard (*Phrynosoma coronatum*), and the Monterey ornate shrew (*Sorex ornatus salarius*) are animal SOCs.

The northern boundary of OU-1 is adjacent to a large expanse of privately owned, non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing winds, which blow the seeds south and into the OU-1 area (Fusari, 2004). Non-native grasses and weedy forbs are already present throughout much of the OU-1 area. Significant expansion of the non-native grasses could result in population declines of federally listed plants.

Sand gilia appears to be less tolerant of competing plant cover than the Monterey spineflower. This hypothesis is based on the observation that numerous small Monterey spineflower populations were identified within the grassland habitat or the roadways bordering the grassland in the initial 1998 survey and in each of the rare plant surveys conducted in 2004, 2005, and 2006. Sand gilia, however, was not detected within any grassland habitat area in the 1998 or subsequent surveys.

1.2 OVERVIEW OF OPERABLE UNIT-1 REMEDIATION ACTIVITIES WITHIN THE FORT ORD NATURAL RESERVE

Numerous wells and soil borings were constructed within the FONR as part of the investigative effort to define the extent of environmental contamination or to remediate that contamination. Table 1.1 lists the wells that have been installed within the OU-1 portion of the FONR. Table 1.2 lists the abandoned well and soil borings that were drilled within OU-1 between 2004 and 2006 and then abandoned without constructing a well. Figure 1.3 illustrates the OU-1 well and soil boring locations.

1.3 SITE ACTIVITY SUMMARY

In 1987, contaminated soils (about 4,000 cubic yards) were excavated and replaced with clean fill. The OU-1 ROD (U.S. Army, 1995) indicated that remediation of the contaminated soils at the FDA was complete; the ROD also defined groundwater extraction and treatment as the selected remedial action for OU-1 groundwater. A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other related groundwater contaminants. The 1988 GWETS consists of two extraction wells located a short distance downgradient of the FDA (wells EX-OU1-17-A and EW-OU1-18-A). Extracted groundwater is transported through pipelines to a treatment unit located at the former FDA and passed through vessels containing granulated activated carbon (GAC). The treated effluent is spray-irrigated in the southern portion of the FDA.

Despite a steady overall decline in contaminant levels within the groundwater capture zone of the 1988 GWETS, COCs were subsequently detected at concentrations above ACLs in groundwater downgradient from the extraction zone. Additional wells installed between 1997 and 2001 (wells MW-OU1-21-A through MW-OU1-46-A) showed that TCE exceeded the ACL as far as 2,100 feet downgradient from the existing capture zone. Groundwater modeling showed that

contaminated groundwater north and west of extraction well EW-OU1-17A is not captured by the extraction system (AHTNA, 2003).

The HGL FPRI contract was awarded in December 2003 and a draft design for expansion of the original GWETS was presented in the Draft Remedial System Modification Plan (HGL, 2004). New wells were installed and aquifer testing began in 2004 and continued through 2006. The draft GWETS expansion design was adjusted as new data from the well installation and aquifer testing were processed and the final design was issued in the three-volume Final Engineering Design Report in 2006 (HGL, 2006, 2006a and 2006b). Figure 1.4 illustrates the layout and components of the currently planned OU-1 groundwater remediation project within the FONR. Construction of the first component of the GWETS expansion, the Hydraulic Control Pilot Project (HGL, 2006c), was initiated and completed in 2006. Additional details concerning the GWETS expansion and a summary of OU-1 site activities conducted during 2006 are provided in the following sections.

1.3.1 2006 Rare Plant and Habitat Surveys

Surveys for sand gilia and Monterey spineflower were conducted by DD&A between April 24 and May 4, 2006. The peak blooming period, late April and early May 2006, was determined through communications with UCSC staff and by observing a known occurrence of sand gilia in the vicinity of FONR. A survey was conducted along 14 existing or proposed roadway/access routes. In the absence of rare plants, the width of the survey area was approximately 10 feet beyond the edge of the roadway on either side. If a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

DD&A also conducted a habitat inventory within eight of the 14 sites roadway/access segments in areas of proposed new construction. The inventory included identifying the type and distribution of native and invasive, non-native plant species. Invasive species include any plant species that is listed as a noxious weed by the California Department of Food and Agriculture (CDFA), included on any of the invasive plant lists maintained by the California Invasive Plant Council (Cal-IPC), or considered to be a problematic species by the UCSC FONR natural resource management staff.

The areas surveyed in these efforts are shown in Figure 1.5. An overview of the biological survey results is presented in Section 2.0 of this report and a detailed description is included in DD&A's report in Appendix A.

1.3.2 2006 Site Drilling, Testing, and Sampling Activities

During 2006, drilling activity was limited to that associated with construction of the Hydraulic Control Pilot Project (HCPP) and components of the planned FONR remediation system. Table 1.1 listed the 21 new wells that were installed in 2006. Ten of these wells were installed along the northwest boundary road of the FONR and the remaining 11 wells were installed in the northern half of the FONR (Figure 1.3). DD&A staff provided environmental monitoring relative to habitat and species protection during site preparation and construction of the 11 new wells installed within the northern half of the FONR. A summary of that monitoring effort is presented in Appendix B, and key observations are discussed in Section 3.0 of this report.

Groundwater samples were collected during 2006 from most of the existing wells within the FONR as part of the OU-1 groundwater long-term monitoring program (LTM). Wells are typically sampled quarterly, semi-annually, or annually; quarterly sampling usually occurs in March, June, September, and December of each year. More frequent sampling (at six-week intervals) was conducted at selected wells along the northwest boundary road as part of the HCPP start-up performance monitoring. Table 1.3 summarizes the 2006 sampling events at each of the OU-1 wells.

1.3.3 2006 Facilities Construction Activities

In addition to the new wells shown in Table 1.1, the following remediation facilities were constructed within the FONR in 2006:

- groundwater treatment plant
- transmission pipeline from extraction wells to the treatment plant
- two infiltration trenches

These facilities were constructed within and along the FONR northwest boundary road as illustrated in Figure 1.4. Approximately 680 feet of 6-inch diameter pipeline was buried along the approximate centerline of the roadway to connect the four extraction wells to the treatment plant. The pipeline trench was approximately 3 feet wide by 4 feet deep. Extraction and monitoring wells were located along the southern edge of the roadway (Figure 1.4) as shown in Photographs 1.1 and 1.2. The treatment plant was installed and two parallel infiltration trenches were excavated in the grassland area to the east of the intersection of the northwest boundary road and the roadway that borders the eastern edge of the Coast Live Oak Woodland/Central Maritime Chaparral habitat. Photograph 1.3 shows the major portion of this area after the initial clearing.

Photograph 1.1 – New wells constructed along FONR northwest boundary road.

The treatment plant area (approximately 80 feet by 54 feet) was enclosed within a chain link fence and locked gate to inhibit unauthorized access. The treatment units, control panels, piping, and ancillary equipment were placed on a concrete pad (measuring 24 feet by 27 feet) constructed at the west end of the enclosed area. To prevent erosion from vehicle traffic, gravel was placed over the remaining portion of the enclosed area and the approach from the roadway to the gate. Photographs 1.4 and 1.5 show the treatment plant. Note that the brown shed in the background of Photograph 1.5 was a portable storage locker for equipment and tools during construction and has been removed. A portion of this shed is also visible on the right side of Photograph 1.3

The infiltration trenches consisted of two parallel lines approximately 20 feet apart. Each trench was approximately 2 feet wide and 4 feet deep. Six-inch diameter perforated pipe was laid in a gravel bed and backfilled with at least 2.5 feet of native soil. Each infiltration trench was approximately 300 feet long.

Photograph 1.2 – Typical new extraction well construction.

Photograph 1.3 – View of grassland area after clearing for infiltration trenches.

Photograph 1.4 – Construction of treatment plant facility.

Photograph 1.5 – View of treatment plant facility looking west to east (roadway in the lower left foreground is the FONR northwest boundary road).

Environmental monitoring during the construction effort was provided by CH2M Hill staff. The results of that monitoring and the construction project itself are detailed in the Draft Hydraulic Control Pilot Project Construction Report (HGL, 2006d). Monitoring results are summarized in Section 3.0 of this report.

1.3.4 Original Groundwater Extraction Treatment System Operation

Results from the ongoing groundwater quality monitoring program showed that cleanup targets within the capture zone of the existing GWETS extraction wells (Figure 1.4) were achieved during 2005. A rebound evaluation to assess if the improved groundwater quality can be sustained without additional remediation is under way and expected to be completed during the third quarter of 2007. Groundwater pumping and treatment from the existing GWETS area was suspended in February 2006 as part of the rebound evaluation. Sampling from groundwater monitoring wells in this region will continue though at a reduced frequency for some wells.

1.4 IMPACT PREVENTION AND MITIGATION MEASURES

Activities conducted within the FONR are strictly limited to those that are essential to achieving the remediation goals for the project. The remedial design and construction as well as remedial actions have been and will continue to be consistent with the various biological opinions and guidance regarding mitigation measures to reduce and avoid impacts to RTE/SOC on the project site. Guidance for the remedial design and action(s) includes the following:

- The March 30, 1999, Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R) and supporting documentation, such as Enclosure 2 to the request for consultation (Harding Lawson Associates, 1998)
- The October 22, 2002, Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey spineflower Critical Habitat, (1-8-01-F-70R) (USFWS, 2002)
- Guidance and direction from UCNRS staff
- Former Fort Ord Habitat Management Plan (US Army, 1997)

To avoid or minimize impact to the FONR during ecologically sensitive periods (i.e., the rainy season, typically ranging between November and April), construction will be scheduled at other times insofar as possible within the overall project constraints. To the extent practical, construction activities will be accelerated to be completed before the rains begin. If construction activity is not completed before the seasonal rains begin, additional efforts will be made to finish as soon as possible.

The following sections describe the additional mitigation measures that have already been taken and will continue to be followed as standard procedures during upcoming activities.

1.4.1 Pre-Construction Surveys

To minimize potential impacts from remediation activities, the locations of Monterey spineflower and Sand gilia populations were identified insofar as possible before the remedial design was finalized (HGL, 2006, 2006a, 2006b). To this end, in 2004, 2005, and 2006, HGL conducted biological surveys of those portions of the FONR that were thought most likely to be affected by the GWETS expansion. The plant populations thus surveyed were mapped and used by the design team when selecting locations for new wells, piezometers, pipeline routes, and treatment/recharge facilities.

The results of those surveys (conducted by CH2M Hill staff) were presented in Appendix A of the Draft Remedial System Modification Plan, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord (HGL, 2004) for the 2004 survey and in the 2005 Monterey spineflower and Sand Gilia Survey Results Fort Ord Operable Unit 1, Former Fort Ord, California (CH2M Hill, 2005). The 2006 survey results are summarized in Section 2.0 and detailed in Appendix A of this report. Plant populations identified in similar surveys conducted by UCNRS staff or others (intermittently since 1998) were also reviewed in preparing the final remediation design.

1.4.2 Impact Avoidance

The locations of plant populations identified in the biological surveys were considered in selecting locations for the 21 new wells and the remediation facilities installed by HGL in 2006. This information has been and will continue to be used to select well and facility locations that avoid Monterey spineflower and Sand gilia populations to the extent practical. The draft design of the GWETS expansion, for example, was able to avoid excavation in all of the Sand gilia and Monterey spineflower populations identified in that 2004 Baseline Survey (HGL, 2004a). In one

instance, a proposed well location was relocated approximately 1,000 feet distant because of potential impact to Monterey spineflower and Sand gilia populations. Fewer than 10 percent of the Sand gilia or spineflower populations in the HGL 2004 – 2006 surveys lie within 50 feet of any currently proposed construction activity or access route. A population was included in that 10 percent estimate if any part of its mapped boundary fell within the 50 foot window. For many of the populations identified as being within 50 feet, the overwhelming majority of the area lies farther away from the proposed disturbance.

In 2006, only two Monterey spineflower populations were directly affected by construction activities (Section 3.2). The approved final FONR system design and planned construction for 2007 also avoids previously mapped sand gilia populations and has minimal direct impact on mapped Monterey spineflower colonies. Direct conflicts between Monterey spineflower populations and proposed 2007 construction of project facilities are limited to the following:

- The treated water and extraction well pipelines (to be constructed within the existing roadway) will pass through eight small Monterey spineflower populations within or immediately adjacent to the northwest-southeast road that marks the edge of the grassland habitat in the eastern portion of the FONR. Four of these Monterey spineflower populations were denoted as Very Sparse density in the 2005 survey (CH2M Hill, 2005) and the rest were identified in the 1998 survey without regard to density. These populations are found in the grassland habitat and are considered of marginal value to the overall FONR population.
- The extraction well pipeline will pass through the edge of or adjacent to a Monterey spineflower population in the vicinity of EW-OU1-49-A. This population is also found at the edge of the grassland habitat and is of marginal value to the overall FONR population.
- The treated water pipeline between MW-OU1-46-AD and IW-OU1-74-A will pass through or immediately adjacent to a Monterey spineflower population identified in 1998 along much of the approximately 300-foot distance. Because of its location within the woodland habitat, this area may be of greater ecological significance. The construction methods and post-construction management and restoration measures, however, should successfully mitigate this potential impact.

In summary, the potential conflicts with rare plants in the FONR System project area are minimal, less than 300 feet out of a total pipeline distance of approximately 3,600 feet, and manageable. The footprint of the proposed FONR system will be surveyed during the 2007 plant blooming season to determine the most recent plant population boundaries and verify the accuracy of the above assessment. The survey results will be evaluated to "fine-tune" the pipeline layout and construction practices (see following section), if necessary, to minimize the potential impact to the plant populations.

1.4.3 Proactive and Reactive Construction Techniques to Minimize Impacts

The construction effort has employed a range of procedures/actions to minimize or prevent environmental damage. Where construction is required in the vicinity of known populations of protected species, for example, the sensitive areas are identified in advance by installing small

flags or temporary fencing to delineate the boundary of the area to be avoided (as illustrated in Photograph 1.6).

Photograph 1.6 – Boundary marker showing construction limit to avoid impact to rare plant populations during HCPP construction.

The following rules govern site construction activity:

- Stay in or on designated routes, locations, corridors, or work areas whenever possible.
- Drive on existing compacted roadways, whenever possible.
- Use approved access roads only. Close and lock all entrance and exit gates. The contractor supervisor will log in and out for his or her group.
- If RTE species or SOC wildlife are encountered during field activities, they will be carefully removed from harm's way and deposited on the ground surface as near to their original location as possible but outside the work area. Each encounter with a California black legless lizard or tiger salamander will be documented on a form provided by the HGL Field Supervisor and submitted to the Fort Ord Base Realignment and Closure (BRAC) Office.
- Keep out of exclusion areas marked on the ground or on aerial photos.
- Inform the on-site environmental monitor (EM) and the HGL field supervisor if an SOC is found in a designated work area. Follow the instructions of the on-site EM and the HGL field supervisor as to how to deal with this situation.
- Avoid open trenches that may trap wildlife. The general practice will be to dig, place, test connections, and cover sections of trench in the same workday. Open ends of pipes are covered to prevent wildlife entrapment (Photograph 1.7). Inspect trenches and surface well locations before work and provide escape ramps for wildlife as needed.

Photograph 1.7 – Example of covered pipe opening to prevent wildlife entrapment during 2006 HCPP construction.

- Do not litter. Remove trash from the job site on a daily basis.
- No pets or hunting are allowed.
- No fires are allowed. Report any smoke or open flame immediately to the subcontracting supervisor and to the HGL field supervisor. Keep fire fighting equipment in good operating order and readily available.
- Smoke only in approved areas or in vehicles. Do not drop butts on the ground to extinguish.
- Do not feed or disturb wildlife. Report mountain lion (or other dangerous animal) sightings immediately to the subcontracting supervisor, to the HGL field supervisor and to the on-site EM.
- Clean up and report any hazardous material spills immediately. Note that no hazardous material use is anticipated. Spills would most likely be the result of equipment malfunction, such as a ruptured hydraulic line.
- Keep fluid spill containment and cleanup materials readily available. Photograph 1.8 illustrates typical spill containment procedures during drilling.
- Do not discharge water or drill cuttings into unapproved areas. Drill cuttings will be placed in bins for transport to the off-site disposal facility.
- Keep equipment either in approved work areas or travel corridors, or in approved staging and storage areas.
- No staging, parking, or vehicle or equipment movement will occur within drip lines of oak trees, except those authorized for removal.
- No grading will occur within drip lines of oaks not slated for removal. If project activities necessitate removing standing dead trees, these will be removed to an adjacent off-site area and left in a prone position.

- Keep vehicle speeds to a minimum (less than 10 miles per hour) in the FONR.

Photograph 1.8 – Typical spill containment technique used during drilling.

1.4.4 Field Environmental Monitor

BRAC-approved biologists are assigned to act as EMs during the field activities on the FONR. The purpose of these EMs is to make sure that field personnel follow the environmental mitigation guidelines discussed below and to ensure that protected species will not be harmed by project activity. These EMs will conduct the majority of field compliance monitoring tasks under the supervision of the BRAC Biologist.

The EMs will have the authority to stop project work on the FONR in the event of non-compliance with environmental regulations or non-compliance with environmental mitigation measures. In such case, the EMs will then notify the BRAC Office and the HGL field supervisor regarding corrective actions needed to return the project to environmental compliance. The EMs will:

- Assist in identifying and clearly delineating the least-damaging access routes, turn-around locations, work zones, pipeline trench corridors, and equipment/material staging areas. The EMs will be consulted before changing designated routes, locations, corridors or areas.
- Monitor on-site work as necessary to ensure environmental mitigation measures are implemented and to resolve unanticipated environmental issues as they arise.
- Instruct the field personnel how and where to place cut vegetation that is cleared for the new drill pads, access roadways, and pipeline trenches.
- Advise construction crews on how best to avoid adverse impacts to environmental resources.

- Notify and consult with the BRAC Office and with the HGL field supervisor in the event of non-compliance with environmental regulations or mitigation efforts, and stop project work if necessary.
- Assist in supervising interim surface erosion control measures as needed.

1.4.5 Worker Training

The worker environmental awareness training program provides an overview of the following:

- the sensitive biological resources in the project area
- environmental laws and penalties
- general environmentally protective work practice
- the responsibilities of project personnel and monitors
- who to contact in case an environmentally related situation arises, or if a field worker has an environmentally related question

Each worker is given a handout that summarizes environmental issues at the site relative to the construction program and undergoes an orientation session before starting work at the site. The handout includes photographs, descriptions of each plant or animal SOC, and a contact list with phone numbers if questions arise. The handout also summarizes the work procedures to be followed to minimize impacts. Worker training was conducted with the assistance of the UCSC FONR staff during the 2006 construction efforts.

1.4.6 Recharge Method to Mitigate Impact

Three options for recharge of treated water were considered during the design of the remediation facilities:

- spray irrigation (this practice was used at the existing GWETS)
- use of injection wells
- infiltration through a seepage trench

All three are technically feasible at the OU-1 site.

Recharge through seepage trenches was selected as the preferred method for returning treated water to the A-Aquifer wherever possible. In contrast to the existing method of spray irrigation, seepage trenches will not support growth of undesirable weeds (i.e., iceplant) nor provide a water source for wildlife. Deer feeding on iceplant at the existing treatment site has helped to spread ice plant across a greater area within the FONR (Fusari, 2005). The grassland area to the northeast of the principal Monterey spineflower and Sand gilia habitat provided sufficient space to construct recharge facilities for the HCPP component of the OU-1 remediation system. This area also enabled HGL to locate the infiltration trenches (Figure 1.4) outside the most important FONR habitat.

Groundwater hydraulic and system performance factors were identified during the design of the FONR component of the groundwater remediation system. These factors led to the conclusion

that some of the treated water needed to be returned to the A-Aquifer in the north-central portion of the FONR (HGL, 2006a). However, constructing additional infiltration trenches in the area would significantly disrupt important habitat. Spray irrigation facilities would also require clearing a relatively large area of important habitat, which could promote the spread of weeds and provide a water source for wildlife. Consequently, two injection wells, IW-OU1-73-A and IW-OU1-74-A, were constructed in this region to achieve the design performance objectives with the least impact to the local habitat. Additional infiltration trenches are planned in the north-central grassland area to the east of the more important FONR habitat (Figure 1.4).

1.5 FUTURE ACTIVITIES

Currently planned and potential activities for 2007 include the following:

- Complete the existing GWETS rebound evaluation.
- Continue operating the HCPP system
- Sample groundwater quality at existing wells.
- Construct the remaining components of the GWETS expansion.
- Abandon selected wells and/or facilities.
- Monitor rare plants and habitat at selected locations.
- Control weeds and, if necessary, enact erosion control measures.

No new wells within the FONR are planned at this time. The particulars of and impacts resulting from 2007 activities will be presented in the 2007 Annual FONR Impact Report.

2.0 OVERVIEW OF 2006 RARE PLANT SURVEY RESULTS

The objectives of the 2006 rare plant survey and habitat inventory were to accomplish the following:

- Identify locations and estimate rare plant populations at each site for Monterey spineflower and sand gilia within the proposed construction areas for the remediation system.
- Map Monterey spineflower and sand gilia populations so that future activities could avoid or reduce impacts to those populations.
- Conduct a habitat assessment within each site to provide data on species composition, including the presence of non-native and invasive species.

A total of 14 potential construction sites and three previously used staging areas were surveyed for the presence of rare plants (Figure 1.5). A habitat inventory was also conducted at eight of the 14 sites. This section presents a summary of the key findings from those surveys. The complete survey report is presented in Appendix A.

Two separate surveys were conducted. Surveys for sand gilia and Monterey spineflower were conducted by a DD&A biologist and a DD&A global positioning system (GPS) technician between April 24 and May 4, 2006. The peak blooming period, late April and early May 2006, was determined through communications with UCSC FONR management staff and by observing a known occurrence of sand gilia in the vicinity of FONR. The second survey was the habitat inventory in areas of proposed new construction, which was conducted between June 8 and June 26, 2006.

Each of the rare plant surveys was conducted along existing or proposed roadways/access routes. In the absence of rare plants, the width of the survey area was approximately 10 feet beyond the edge of the roadway on either side. If a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

When surveying areas for new access routes (Sites 4 through 10 on Figure 1.5), the survey area was expanded as needed to identify alternative routes to bypass rare plant populations encountered during the survey effort. If terrain or the extent of native vegetation negated the possibility of an alternative route, the surveyed area included the route with minimal impact to the rare plant population.

A photo inventory was also taken to illustrate conditions at each site. Photos, a photo index table, and a map of photo positions are presented in Appendix A, Attachment A-1.

2.1 RARE PLANT SURVEY METHODS

Large areas of Monterey spineflower and sand gilia were mapped as polygons, using a Trimble Pathfinder ProXH GPS unit. Smaller groups and individuals were mapped as points with attributes to identify the number of individuals at each location.

Individual counts were made for all sand gilia populations whether they were mapped using points (population less than 10) or polygons (population greater than 10). However, Monterey spineflower were only counted as individuals when groups of less than five were mapped. Monterey spineflower mapped as polygons were characterized according to the percent of cover. The categories ranged from Very Sparse (corresponding to an absolute cover of less than 3 percent), Sparse (3 to 25 percent), Medium Low (26 to 50 percent), Medium (51 to 76 percent), and Medium High (76 to 97 percent) to Very High (greater than 97 to 100 percent). GPS data were exported to shapefile format for use in a Geographic Information System (ESRI ArcGIS) and mapped on high-resolution aerial photography. These maps are presented in Appendix A (Figures A3.1 through A3.4).

2.2 SAND GILIA

Sand gilia was observed and mapped in 37 locations within the 14 potential construction sites and the three staging areas surveyed for rare plants (Table A3.1 and Figures A3.1 through A3.4 in Appendix A). Population size estimates range from a single plant to approximately 375 plants, with an average of 25 plants per population. The total estimate of plants observed and mapped during the survey effort was 962 individuals. Twenty-five occurrences of sand gilia were mapped as points while 12 populations were mapped as polygons. Twelve of the 37 total populations of sand gilia (32 percent) contained 10 or more plants with eight locations exceeding the 25 plants.

Sand gilia was found in open, sandy areas and along access roads in the coast live oak woodland, coastal scrub, and maritime chaparral habitats, but was not observed in areas with dense woody vegetation. At one site, Staging Area 2, sand gilia was found within a dense area of non-native annual grasses but total plant cover associated with sand gilia observations was generally low.

2.3 MONTEREY SPINEFLOWER

A total of 56 populations (50 polygons and six points) of Monterey spineflower were mapped along the 14 rare plant survey areas and three staging areas within the FONR (Table A3.2 and Figures A3.1 through A3.4 in Appendix A). A total of nine individual plants were identified at the six mapped GIS points. Because population size estimates are not as easily quantified as the sand gilia populations, individual Monterey spineflower plants were not counted within the geographic information system (GIS) polygons. Monterey spineflower populations were categorized using visual estimation based on the percentage of the ground area that they covered. Of the 50 populations of Monterey spineflower that were mapped as polygons, one population had a Medium cover class (51 to 76 percent cover), five populations were categorized as being in the Medium Low cover class (26 to 50 percent), 34 populations were in the Sparse cover class (3 to 25 percent) and 10 populations were in the Very Sparse cover class (less than 3 percent). None of the Monterey spineflower populations observed and mapped exceeded the Medium cover class.

Plant density estimates in the polygon areas were typically Very Sparse or Sparse. Approximately 90 percent (44 of the 50 populations) fell into these two categories. Sparse populations outnumbered Very Sparse populations by nearly 3:1 (64 percent of the total versus 24 percent).

Monterey spineflower was observed in each of the classified habitat types at the site and was usually restricted to open sandy areas with sparse vegetative cover. In the live oak woodland and maritime chaparral habitats, this species was often found along access roads and other disturbed areas such as existing well locations, and in naturally occurring sandy or grassy open areas. Monterey spineflower populations were often observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover than sand gilia.

2.4 HABITAT INVENTORY METHODS

The habitat inventory was conducted within eight of the 14 sites located on FONR in areas of proposed new construction – sites 4, 6, 7, 8, 9, 11, 12 and 13 (as shown in Figure 1.5). Site 11 was later split into two sites: 11A and 11B. The inventory included identifying the type and distribution of native and invasive, non-native plant species. Invasive species include any plant species that is listed as a noxious weed by the CDFA, included on any of the invasive plant lists maintained by the Cal-IPC, or considered to be a SOC by the FONR natural resource staff.

The habitat inventory was taken by placing 100-foot consecutive transects along the centerline of the surveyed area through the entire length of each site. A 1-square meter (m^2) quadrat was placed at 10-foot intervals along each transect. The quadrat was sequentially staggered (e.g., center of site alignment, right edge of adjacent habitat, center of site alignment, and left edge of adjacent habitat) to create a more accurate representation of the entire area along each FONR site alignment. Inventory observations were compiled into two data sets: one along the "center" of the alignment and one along the "edge" of adjacent habitat.

The percentage of total ground cover by vegetation (specifying type and species, where possible), soil crust, litter, and bare ground within each 1-m^2 quadrat was visually estimated by a DD&A botanist and recorded on data sheets in the field. Descriptions of the surrounding habitat were also described and recorded by a DD&A botanist.

2.5 HABITAT AND INVASIVE SPECIES

Observed habitat types were divided into five categories:

- Coast Live Oak Woodland
- Central Maritime Chaparral
- Coastal Scrub
- Annual Grassland
- Disturbed/Developed

The latter category, Disturbed/Developed, consists of dirt roadways, staging areas, well sites, and groundwater treatment facilities. Non-native grasses including rip-gut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis ssp. rubens*), wild oat (*Avena fatua*), and rattail fescue (*Vulpia myuros*) are common and widespread in all habitats throughout OU-1. No iceplant, pampas grass, or invasive thistle species were observed within any of the sites.

Plant species identification and percent cover data were collected for 259 quadrats. Plant species were categorized as either "native," "non-native," or "non-native, invasive." "Native" refers to a plant species that normally lives and thrives in a particular ecosystem. "Non-native" refers to a plant species that has been introduced to California as a direct or indirect result of human activity. The "non-native, invasive" category refers to plant species that 1) are not native to, yet can spread into, ecosystems, 2) can displace native species, hybridize with native species, alter biological communities, or alter ecosystem processes, and 3) are included on the Cal-IPC list and identified as being of particular concern to the FONR. These species are mostly composed of annual grasses. This concern is based on the observation that non-native, invasive species generally compete for space and nutrients directly with and more effectively than native plants, including the protected Monterey spineflower and sand gilia.

Ground cover was categorized as "bare ground," "leaf litter," or as one of the three plant categories defined above. "Leaf litter" refers to an area where the ground is covered by a layer of leaves and other debris that has accumulated from the surrounding vegetation. "Bare ground" refers to an area with no vegetation present.

Overall, annual grasses (considered non-native, invasive species) comprised 30 percent of the vegetative cover within the 259 quadrats and native species comprised 41 percent. The remaining ground cover consisted of non-native species, bare ground, or leaf litter.

2.6 SPECIAL STATUS WILDLIFE SPECIES

No special status species other than a few coast horned lizards were observed during the rare plant or habitat surveys. Several woodrat nests were observed during the well construction activities in the north-central portion of the FONR and were treated one of two ways. First, woodrat nests that could be avoided, but were near any construction zones were staked and flagged by the environmental monitors. Second, woodrat nests that could not be avoided because of construction activities were dismantled by hand and documented by the environmental monitors. In all, four woodrat nests were dismantled. At one of the dismantled nests, environmental monitors observed a small mammal that could have been a woodrat vacating the woodrat nest attached to a decaying oak tree that was subsequently dismantled. The animal was able to vacate its current habitat and inhabit an adjacent structure (no more than 10 feet from the original nest) with a minimal amount of distress. The dismantled woodrat nests are documented in Appendix B.

CH2 staff provided an EM during the HCPP construction activities along the northwest boundary road and made the following observations relative to special-status wildlife:

- No special-status wildlife, including black legless lizard or California coast horned lizard were observed during the well construction activities.
- When the treatment plant and pipelines were constructed, only one biologically related issue was encountered and reported by site personnel. On May 10, 2006, the HGL site superintendent observed a California black legless lizard (*Anniella pulchra*) that was inadvertently unearthed from a spoil pile and injured by a backhoe machine during trenching operations. Personnel immediately stopped work and moved the reptile off-site

to ensure no further impact occurred. The HGL site superintendent immediately contacted the on-call EM and Mr. William Collins, BRAC Biologist to report the sighting and to request further direction. A BRAC field observation form was submitted to Mr. Collins. The reptile eventually died from its injuries.

- During the preconstruction survey for special-status wildlife, one California coast horned lizard (*Phrynosoma coronatum*) was observed adjacent to the treatment plant site. Because of pending ground disturbance, the EM hand carried the reptile away from the immediate work area to a safe location.
- All personnel and equipment stayed within approved work areas, designated access roads and staging areas.
- All open holes deeper than 1 foot were backfilled and/or covered to prevent entrapment of wildlife.
- Active or potential breeding bird activity (e.g., active nests) was noted on two occasions (bushtit, Nuttall's woodpecker) but both were more than 1,000 feet from project activities and not impacted.
- On 15 February, a California coast horned lizard was observed greater than 1,000 feet south of project activities. The reptile was not affected by project work.

The results of the environmental monitoring effort during the HCPP system construction were described in detail in the Draft HCPP Construction Report (HGL, 2006d).

3.0 IMPACT ASSESSMENT

Data collected during the 2006 rare plant survey were evaluated in conjunction with other observations to identify impacts to the FONR habitat resulting from OU-1 activities. This annual impact assessment represents current conditions only and will be considered along with future data in the overall impact assessment to be conducted upon completion of the OU-1 remedial action.

Approximately 0.6 acres of annual grassland was cleared in 2006 to construct the treatment plant and infiltration trenches. This area was grassland habitat before the new construction and part of the large expanse of grassland that comprises the eastern portion of the FONR. The grassland habitat continues to the east and north of the construction area for several thousand feet. The concrete and gravel portions of the new treatment plant site will eliminate windblown transport of non-native grasses from this area into the protected FONR habitat during the OU-1 remediation. However, the size of that modified area relative to the remaining grassland means that the impact of this benefit is too small to quantify or measure.

Thirteen of the 21 new wells constructed during 2006 were located along the edge of existing roadways (Photograph 1.1). In such cases, construction activities generally occurred within the roadway itself. Additional clearing at the edge of the roadway of approximately 100 to 200 square feet was performed at each well site to install the well itself and allow sufficient clearance to use the road safely after construction was complete. A total of approximately 0.05 acres was cleared at these 13 wells sites. These sites are adjacent to roadways regularly used to travel within the FONR and, except for wells MW-OU1-84-A and IW-OU1-74-A, adjacent to annual grassland areas on the opposite side of the road. Consequently, the impact of these actions on the FONR habitat is expected to be negligible.

Larger areas were cleared at the other eight "off-road" well sites to provide access for equipment and well construction. A work area estimated to be 25 feet by 30 feet was typically created at each location; therefore, approximately 6,000 square feet (0.15 acres) were cleared for all eight wells. New access paths were also needed to reach these eight new well locations. Pre-construction biological surveys were conducted to select access routes that reduced the habitat impact, and post-construction habitat surveys were performed to collect data for evaluating the long-term impact. These post-roadway construction surveys also included the roadway providing access to wells MW-OU1-84-A and IW-OU1-74-A cited in the previous paragraph. Approximately 1,000 feet of new access road was constructed. Each access road was approximately 15 feet wide for a total disturbance of nearly 0.35 acres of roadway.

3.1 SAND GILIA

No sand gilia populations have been found at any of the 2006 new well construction locations during previous rare plant surveys (1998 by UCSC, 2004 and 2005 by HGL through CH2M Hill, and in 2006 by HGL through DD&A).

3.2 MONTEREY SPINEFLOWER

Monterey spineflower was not found during either the 2005 or 2006 surveys conducted along the northwest boundary road. The only exception to this statement was a population (categorized as Very Sparse) within the roadway in the vicinity of wells MW-OU1-61-A. The population was identified as S215 in the 2005 rare plant survey report (CH2M, 2005). Monterey spineflower was also observed at this location in the 1998 survey and extended across a somewhat wider expanse that may also include wells EW-OU1-60-A and EW-OU1-66-A (spanning a distance of approximately 65 feet with MW-OU1-61-A located in between). All three wells appear to be at the southern edge of the population boundary and may actually be outside the limits of Monterey spineflower occurrence. Complete avoidance of this population, however, was impossible because it was necessary to construct the pipeline from the treatment plant to the four HCPP extraction wells along this roadway. The pipeline trench approximately bisects the population polygon mapped in 2005.

Table 3.1 summarizes the occurrence of Monterey spineflower relative to the 2006 new well locations. Other than the population identified in the preceding paragraph, only well MW-OU1-65-A appears to possibly be within an observed population boundary. This well is also located along the northwest boundary road and is approximately 225 feet southwest of the S215 polygon described above. The population observed at MW-OU1-65-A, however, was seen along the boundary road only in the 1998 survey and was not found during the 2005 or 2006 surveys. In the 1998 survey, this mapped Monterey spineflower polygon extended over 200 feet to the south and covered an area of approximately one-half acre. The occurrence along the boundary road marked the northernmost limit of the 1998 mapping. In 2005, the Monterey spineflower polygon mapped in that survey was virtually identical to the 1998 result except that the northern limit did not reach the boundary road (CH2M, 2005).

3.3 HABITAT AND INVASIVE SPECIES

The habitat inventory collected plant species identification and percent cover data from 259 quadrats. There were significant differences, however, in the plant population characteristics observed in the quadrats along the centerline of the roadways as opposed to those along the edge of the roadway. Figures 3.1 and 3.2 and the summary below illustrate the results of the habitat surveys for the center quadrats and the edge quadrats, respectively.

Quadrat Type	Percentage of Quadrat Area Occupied by Given Species				
	Native	Non-Native	Bare Ground	Non-Native Invasive	Leaf Litter
Center	17	11	44	28	0
Edge	64	8	12	16	0.3

The data presented above display general categories of species. UCSC staff has identified 66 specific non-native, invasive SOC to the FONR habitat (Appendix D of the 2005 Rare Plant Survey Report [CH2M Hill, 2005]). Only 10 of these 66 species were observed in any of the quadrats during the habitat inventory. A detailed presentation of the distribution of these species

is presented in Table A3.4 of Appendix A. These 10 species are listed in the table below in order of decreasing frequency.

Plant	Number of Quadrats Observed			Average Ground Cover (%)	
	Total	Center	Edge	Center	Edge
Rattail fescue	150	88	62	19	18
Soft Chess	40	30	10	20	15
Red brome	31	18	13	15	14
Rip-gut brome	31	10	21	11	17
Wild Oat	31	16	15	20	25
Cat's ears	17	13	4	9	4
Sheep sorrel	14	7	7	10	7
Rattlesnake grass	6	3	3	7	70
Poison hemlock	4	2	2	2	5
Cut-leaved plantain	4	4	0	1	0

Only Rattail fescue was present in more than 15 percent of the quadrats surveyed and was easily the most widespread non-native, invasive SOC (appearing in 58 percent of the quadrats). The data suggest that only rip-gut brome is more prevalent in the edge quadrats as opposed to the center of the roadway areas. Where present, the extent of area coverage did not vary significantly (maximum difference of 6 percent) between the center portion of the roadway and the edge of the roadway adjacent to the undisturbed habitat except for rattlesnake grass. When present in an edge quadrat, rattlesnake grass dominated the population list and covered an average of 70 percent of the quadrat area. It should be noted, however, that this characteristic may be related to special conditions in the minimal number of edge quadrats (three) where rattlesnake grass was observed.

3.4 EROSION

HGL staff conducted visual reconnaissance surveys to detect erosion resulting from construction activity along the roadways used to access the construction areas and the monitoring well network. These erosion surveys are conducted routinely during the quarterly groundwater monitoring events and on occasion during routine system maintenance. Erosion was observed in a few locations during the HCPP construction activity (HGL, 2006d) as illustrated in Photograph 3.1. Areas where erosion was observed were back-filled, re-graded and smoothed after the construction effort was complete as shown in Photograph 3.2. No other roadway erosion problems have been observed.

Photograph 3.1 – Tire ruts from construction equipment.

Photograph 3.2 – Tire rut area after re-grading.

4.0 CONCLUSIONS

Direct impacts to Monterey spineflower rare plant populations from 2006 construction activities are negligible. This conclusion is based on the limited pre-construction occurrence of Monterey spineflower within the footprint of the construction activities (two populations observed in past surveys) and the habitat in which the two populations were found. Both populations were present within or immediately adjacent to the roadway along the northwest boundary of the FONR. The habitat on the opposite side of that roadway and to the north is annual grassland. This area is, at best, marginal habitat for Monterey spineflower and subject to perpetual competition from the adjacent grassland. The Very Sparse and absent populations observed in the 2005 and 2006 pre-construction surveys support this assessment. It would be impossible to distinguish the construction impact at these sites, if any, from the impact of natural competition with the non-native, invasive species of the adjacent grassland habitat.

No Sand gilia were detected within any of the construction areas during the 1998, 2004, 2005, or 2006 rare plant surveys. Consequently, we conclude that there were no direct impacts to this species from the 2006 OU-1 new well and remediation system construction effort.

Rare plant monitoring will continue annually for up to three years after construction is complete or a well/facility has been abandoned. In the event that future data indicate that OU-1 remediation actions resulted in an unacceptable decline in either Sand gilia or Monterey spineflower populations, or a significant increase in invasive plant species, a Restoration Plan would be presented to the BRAC Office and FONR staff for review.

The 2006 habitat inventory using the quadrat method was the initial effort of this type. The methodology used in 2006 can be replicated in future years to provide a quantitative indication of indirect impact to the FONR habitat with respect to the displacement of native vegetation by non-native, invasive species. The 2006 data support the following observations:

- The center portion of the roadways is subject to continuing disturbance and plant growth of any kind is significantly restricted, as illustrated by the survey results indicating that 44 percent of those areas are classified as bare ground.
- Non-native, invasive species are the most prevalent population in the roadway center area (28 percent) but the native plant population is present in comparable magnitude (17 percent).
- The native plant population out-competes the non-native, invasive plant population along the edges of the roadways. Native vegetation dominates the edge quadrats, increasing by nearly 400 percent in comparison to the center quadrats (rising from 17 percent to 64 percent) while the area covered by non-native, invasive species population declined by more than 40 percent (from 28 percent to 16 percent).
- The dominance of the native plants within the edge quadrats suggests that inroads by non-native, invasive species further into the adjacent habitat may be limited, with one exception. Rattlesnake grass, though rarely present, dominated the mix of plant populations at those locations (accounting for 40 percent, 70 percent and 100 percent in the three edge quadrats where it was found).

- Rattail fescue was by far the most widespread non-native, invasive plant identified in either the roadway edge or center quadrats. Where present, it covered an average of approximately 19 percent of the quadrat.
- Weed control measures should emphasize control of rattlesnake grass and rattail fescue.

Conclusions based on this initial year of data are preliminary and should be re-examined as subsequent data are collected.

5.0 RECOMMENDATIONS

Direct impacts to the rare plant populations—defined as destroying the plant itself or of the habitat within a previously identified population boundary—have been avoided except in very limited areas along existing roadway. Indirect impacts may become evident over time as a result of clearing portions of the Coast Live Oak Woodland or maritime Chaparral habitats to construct wells, treatment facilities, and roadways. New growth of non-native, invasive species within cleared areas has the potential to diminish or eliminate the native population within a larger area. Vehicle traffic inhibits the natural re-vegetation of the roadway area and may contribute to the indirect impact.

HGL and UCSC FONR staff agreed to conduct weed control actions during 2007 in selected areas of new and more recent construction. HGL will provide funds for weed control efforts to be conducted by UCSC staff during 2007 in the areas shown on Figure 5.1. Weed-control activities will be conducted to achieve the following objectives:

- Eliminate invasive species of non-native forbs from specified areas disturbed by OU-1 construction activities before seeds set each year.
- Prevent or reduce the expansion of non-native grasses into areas disturbed by access and construction related to OU-1 activities.
- Prevent the occurrence of unacceptable impacts to the Monterey spineflower and sand gilia populations within that portion of the FONR affected by OU-1 remediation activities.

The weed control effort is intended to mitigate or prevent significant indirect impact to the FONR native plant population.

Specific recommendations to protect the FONR rare plants and related habitat for the coming year are as follows:

1. Continue the annual rare plant monitoring in areas of proposed 2007 OU-1 remedial system construction and where construction occurred in 2006.
2. Repeat the habitat inventory in those areas surveyed in 2006 and any new areas affected by 2007 construction. Note that the currently planned 2007 construction areas were included in the 2006 survey.
3. Assess the results of the UCSC weed control measures and determine if such actions should be continued.
4. Minimize roadway traffic during quarterly groundwater sampling activities to the extent practical.
5. Reduce the sampling frequency from the groundwater monitoring well network to minimize road traffic wherever such reductions can be made consistent with remediation and performance monitoring objectives for the OU-1 cleanup.

The results of the recommended 2007 rare plant and habitat inventory surveys will be described in the 2007 Annual FONR Impact Report.

6.0 REFERENCES

AHTNA Government Services Corporation, 2003. Draft Enhanced Reductive Dechlorination Pilot Study Report Operable Unit 1 Groundwater Remedy Former Fort Ord, Monterey County, California. Prepared for U.S. Department of the Army Sacramento District Corps of Engineers dated December 9, 2003.

CH2M Hill, 2005. 2005 Monterey spineflower and Sand Gilia Survey Results Fort Ord Operable Unit 1, Former Fort Ord, California. Prepared for HydroGeoLogic, Inc. December, 2005.

Fusari, Maggie, PhD, 2004. Director, University of California Santa Cruz Natural Reserves. Telephone conversations and email correspondence with Amy Hiss, Gary Santolo, and Roy Evans regarding the federally listed species and noxious weeds. June, 2004.

Fusari, Maggie, PhD, 2005. Director, University of California Santa Cruz Natural Reserves. Meeting discussion with Dr. Maggie Fusari and Sean McStay of University of California Santa Cruz, and Roy Evans of HydroGeoLogic. August 25, 2005.

Harding Lawson Associates. 1998. Biological information for agency consultation related to groundwater remediation activities and quarterly groundwater sampling at FONR Fort Ord Natural Reserve. Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R), Enclosure 2. Letter to Ms. Jane Holte.

HydroGeoLogic, Inc., 2004. Draft Remedial System Modification Plan, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. July 2004.

HydroGeoLogic, Inc. 2004a. Final Operable Unit 1 Project Management Plan, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. Prepared for the U.S. Army Corps of Engineers. February, 2004.

HydroGeoLogic, Inc., 2006. Final 100% Engineering Design Report, Volume 1, Geology and Conceptual Site Model, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. September 2006.

HydroGeoLogic, Inc., 2006a. Final 100% Engineering Design Report, Volume 2, Groundwater Modeling and Design Analysis, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. July 2006.

HydroGeoLogic, Inc., 2006b. Final 100% Engineering Design Report, Volume 3 of 3, Engineering Calculations, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. October, 2006.

HydroGeoLogic, Inc. 2006c. Final Work Plan Hydraulic Control Pilot Project Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. April 2006.

HydroGeoLogic, Inc. 2006d. Draft Hydraulic Control Pilot Project Construction Report Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California. September 2006.

U.S. Army, 1995. Record of Decision, Operable Unit I, Fritzsche Army Airfield Fire Drill Area. Fort Ord, California. July 25, 1995.

U.S. Army, 1997. Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California. April 1997.

U.S. Fish and Wildlife Service, 2002. Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey spineflower Critical Habitat, (1-8-01-F-70R). October 22, 2002