

APPENDIX A

2008 RARE PLANT AND HABITAT SURVEY RESULTS

Results of 2008 Monterey Spineflower and Sand Gilia Surveys

OU-1, Fort Ord Natural Reserve, California

Prepared for HydroGeoLogic Inc.



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Acronym List

CDFG	California Department of Fish and Game
CNDDDB	California Natural Diversity Database
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
GIS	Geographic Information System
GPS	Global Positioning System
GWETS	Groundwater Extraction and Treatment System
HGL	HydroGeoLogic, Inc.
OU	Operable Unit
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
VOC	volatile organic compound

A1.0 Introduction

HydroGeoLogic, Inc. (HGL) is executing a groundwater remediation project at Operable Unit (OU)-1 at the former Fort Ord U.S. Army Base located in Monterey County, California. This work was awarded in December 2003 by the U.S. Army Corps of Engineers (USACE)-Sacramento District under Contract Number DACA45-03-D-0029; it is being administered by the USACE-Sacramento District.

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. The former Fort Ord is located near Monterey Bay approximately 80 miles south of San Francisco (Figure A1.1). 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, Toro Regional Park borders the base to the southeast and land use east is primarily agricultural.

Activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA) (i.e., OU-1) between 1962 and 1985 resulted in the release of contaminants to soils and groundwater. Although 10 separate volatile organic compounds (VOCs) were identified as contaminants of concern in groundwater underlying OU-1, trichloroethene (TCE) is the contaminant that was detected at the highest concentrations and across the greatest extent of the affected aquifer. A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other groundwater contaminants.

The components of the remediation project include wells, pipelines, infiltration trenches, and treatment facilities (Figure A1.2). A key factor affecting the design and implementation of the groundwater cleanup is the fact the groundwater plume lies beneath a part of the University of California Natural Reserve System (UCNRS) designated as the Fort Ord Natural Reserve (FONR). The FONR area potentially impacted by the construction of OU-1 remediation facilities is approximately 130 acres. Therefore, the project has the additional constraint that activities undertaken to achieve the OU-1 cleanup adequately protect and maintain the special-status species found within the FONR, specifically two federally listed plant species, Monterey spineflower (*Chorizanthe pungens* var. *pungens*) and sand gilia (*Gilia tenuiflora* ssp. *arenaria*).

OU-1 occupies a portion of the FONR in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The remediation project illustrated in Figure A1.2 is designed to avoid, mitigate, or minimize environmental impacts in the OU-1 area. To that end, the locations, extent, and populations of sand gilia and Monterey spineflower that are present in the footprint of proposed construction activities were identified through a rare plant survey conducted at specified sites.

A1.1 Survey Objectives

The objectives of the 2008 rare plant survey were to: 1) identify locations and estimate rare plant populations at each designated site for Monterey spineflower and sand gilia; and 2) to map Monterey spineflower and sand gilia populations so that future activities could avoid or reduce impacts to those populations. A total of 5 sites, including 15 well locations were surveyed for the presence of rare plants (Figure A1.3).

A1.2 Site Location and Description

The dominant habitats in this area include coast live oak woodland, maritime chaparral, coastal scrub, and annual grassland. Several special-status plant and wildlife species occur within the FONR, including sand gilia and Monterey spineflower. The northern and eastern boundary of OU-1 is adjacent to a large expanse of non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing winds, which blow 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. The spread of non-native, invasive species into newly disturbed areas might result in population declines of Monterey spineflower and, especially, sand gilia, which is less tolerant of plant cover than Monterey spineflower.

A1.1.1 Sand Gilia

Sand gilia is a small annual in the phlox family (Polemonaceae). Plants range in height from two to six inches with a small, basal rosette of leaves. The lower branches of the stem are generally densely glandular. Plants typically bloom from April through June and have funnel-shaped flowers with narrow, purple to pinkish petal lobes and a purple throat. This species occurs in open sandy soils in dune scrub, coastal sage scrub, and maritime chaparral habitats. Sand gilia is endemic to Monterey Bay and the peninsular dune complexes. A search of the California Natural Diversity Database (CNDDDB) revealed that there are 28 occurrences within Monterey County, including the occurrences at Fort Ord (CDFG 2008). It is likely that some of these occurrences are no longer present and the exact number of extant (still in existence) occurrences are unknown.

A1.1.2 Monterey Spineflower

Monterey spineflower is a small, prostrate annual in the buckwheat family (Polygonaceae) that blooms from April to June. The white to rose floral tube of Monterey spineflower distinguishes it from the more common, but closely related diffuse spineflower (*Chorizanthe diffusa*), which has a lemon-yellow floral tube. This species typically occurs on open sandy or gravelly soils in coastal dune, coastal scrub, and maritime chaparral habitats. There are 24 records of Monterey spineflower within Monterey County in the CNDDDB (CDFG 2008); however, it is not known how many of these are extant.

A2.0 Methods

The survey area consisted of selected well sites and discrete segments of the existing roads within OU-1. The well sites surveyed are located either adjacent to the roadway or at the terminus of access paths constructed to reach the well site. A total of 5 sites and 15 wells were identified for surveys. Figure A1.3 shows the survey sites. The areas were surveyed for rare plants Monterey spineflower and sand gilia completely on one survey effort conducted on May 5, 2008.

A2.1 Rare Plant Surveys

The survey for sand gilia and Monterey spineflower was conducted by a DD&A biologist and a DD&A GPS technician on May 5, 2008. The peak blooming period, late April - early May 2008, was determined by observing a known occurrence of sand gilia in the vicinity of FONR. The rare plant survey area included the sites and staging areas shown in Figure A1.3.

The survey was conducted along existing 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.

Mapping of rare plant species was done using a Trimble Pathfinder ProXH GPS unit with an additional Zephyr antenna system to boost reliability and accuracy of GPS data collection. Large areas of Monterey spineflower and sand gilia were mapped as polygons; 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 < 10) or polygons (population \geq 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 (3-25 percent), Medium Low (26-50 percent), Medium (51-76 percent), and Medium High (76-97 percent) to Very High (>97-100 percent). GPS data was exported to shapefile format for use in a Geographic Information System (ESRI ArcGIS) and mapped on high resolution aerial photography. These maps are represented in Figures A3.1 and A3.2.

A3.0 Results and Discussion

A3.1 Rare Plant Survey Results

A3.1.1 Sand Gilia

Sand gilia was not observed or mapped in any of the locations within the 5 survey areas and 15 well sites surveyed for rare plants.

A3.1.2 Monterey Spineflower

A total of 52 populations (19 polygons and 33 points) of Monterey spineflower were mapped along the 5 rare plant survey areas, and 15 well sites within FONR (Table A3.1 and Figures A3.1 and A3.2). A total of 56 individual plants were identified at the 33 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 GIS polygons. As mentioned in the methods section of this document, populations of Monterey spineflower were given a percentage of cover using visual estimation. Of the 19 populations of Monterey spineflower that were mapped as polygons, two populations had a Medium cover class (51-76 percent cover), five populations had a Medium Low cover class (26-50 percent), 11 populations had a Sparse cover class (3-25 percent), and one population had a Very Sparse cover class (<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 63% (12 of the 19 populations) fell into these two categories. Sparse populations out-numbered Very Sparse populations by 11:1 (58% of the total versus 5%).

Monterey spineflower was observed in all habitat types 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. In the annual grassland habitat, Monterey spineflower was most often restricted to relatively open areas around the perimeter of shrubs, small areas of disturbance, and along existing access roads. Common associated species include stork's bill geranium (*Erodium botrys*), sand mat (*Cardionema ramosissimum*), fescue (*Vulpia* sp.), rip-gut brome, and catchfly (*Silene gallica*). Populations of Monterey spineflower 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.

A3.2.1 Habitat Descriptions

Habitat types that were observed in each of the surveyed sites are summarized in Table A3.2 and discussed below.

Coast Live Oak Woodland

Coast live oak woodland within the FONR is characterized by a mosaic of coast live oak trees (*Quercus agrifolia*), intermixed with chaparral, grassy and sandy openings. The oak woodland within the FONR ranges from high canopy cover to low canopy cover. The areas with high canopy cover generally do not permit the existence of shrubs in the understory, and, therefore, the understory is limited to poison oak and the common annual grasses, such as rip-gut brome, wild oat, and annual fescue. In areas with a low to moderate canopy cover, the oak woodland is intermixed with chaparral shrub species such as California sagebrush (*Artemisia californica*), coyote brush (*Baccharis pilularis*), shaggy bark manzanita (*Arctostaphylos tomentosa ssp. tomentosa*), and sandmat manzanita. Common herbaceous species in these areas include native species such as miner's lettuce (*Claytonia perfoliata*), and non-native species such as rip-gut brome, and rattail fescue.

Grassy openings in the woodland habitat contain scattered coast live oak trees and shrubs with dense growth of annual grasses such as rip-gut brome, annual fescue, red brome, and wild oat. Open, sandy areas within coast live oak woodland can support special-status species such as Monterey spineflower and sand gilia. Coast live oak woodland is widespread throughout the FONR property, and was observed at or surrounding all sites surveyed.

Central Maritime Chaparral

Central maritime chaparral habitat within the FONR is dominated by hard-leaved shrubs such as shaggy bark manzanita, sandmat manzanita, and Monterey manzanita. Other shrubs that are common throughout this habitat types include coyote brush and California sagebrush. In areas where soils maintain a higher moisture content, poison oak can also be a dominant species in the maritime chaparral. The central maritime chaparral on FONR is often mixed with coast live oak trees and several annual grass species including rip-gut brome, red brome, and rattail fescue.

Coastal Scrub

Coastal scrub occurs near the coast on sandy soils and on inland hills with shallow top soils. Within the FONR, this habitat type is characterized by sparse to dense cover of soft-leaved, low stature shrubs about three to seven feet in height, such as coyote brush, California sagebrush, sticky monkey flower (*Mimulus aurantiacus*), poison oak, mock heather (*Ericameria ericoides*), and black sage (*Salvia mellifera*). The herbaceous layer in the coastal scrub is sparse where shrub cover is dense but is more developed in areas where there is less shrub cover. Species typically occurring in this layer include Monterey spineflower, sand mat, and everlasting (*Gnaphalium sp.*).

Annual Grasslands

The annual grassland habitat is characterized by a dense cover of rip-gut brome with other non-native annual grasses such as wild oat, soft chess, Italian ryegrass (*Lolium multiflorum*), and rattail fescue. Other species that are common in the annual grassland habitat include sky lupine (*Lupinus nanus*), a native species, and weedy forbs (non-native plants that are not woody and are not grasses), such as filaree (*Erodium sp.*) and cat's ears

(*Hypochaeris* sp.). Cat's ears is a non-native, invasive species of particular concern to the UC staff managing the FONR. Shrubs species, such as coyote brush, California sagebrush, and coffee berry (*Rhamnus californica*), occur scattered throughout the annual grassland.

Disturbed/Developed

The disturbed habitat is characterized by the roadways and staging areas currently and historically in use on the FONR property. Most disturbed areas are dominated by bare ground and non-native grasses, such as wild oat, rip-gut brome, and red brome. All of the sites surveyed contained disturbed/developed habitat in the forms of trails and/or roads.

A4.0 Conclusions

Monterey spineflower populations were observed in more locations than sand gilia populations (52 locations versus zero locations of sand gilia). DD&A conducted rare plant surveys from 2006-2008 within the FONR OU-1 property, and the 2008 rare plant survey was the first year sand gilia was not observed within any of the areas surveyed. There are several possible reasons for the apparent decline in sand gilia populations. Sand gilia had previously been observed in only two of these surveys areas in the previous two years. Also sand gilia populations at DD&A reference sites were relatively low indicating that the conditions during sand gilia growing season were not optimal. Relatively abundant Monterey spineflower populations do not seem as equally affected by the same constraints as sand gilia. Previous rare plant surveys conducted by DD&A also indicate that populations of Monterey spineflower 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.

A5.0 Comparisons 2007-2008

Sand gilia populations decreased significantly from last year (12 locations in 2007 compared to zero locations in 2008); however, the amount of surveyed locations also decreased from the rare plant survey last year (15 sites in 2007 compared to 5 sites in 2008). Of the five sites that were surveyed during the 2008 rare plant survey, sand gilia previously had been observed at Sites 6 and 9 during the 2006 survey.

Monterey spineflower populations have increased compared to the 2007 rare plant survey. Both years generally had the same number of populations (54 populations in 2007 and 52 in 2008) and densities (the majority of the populations ranged from sparse to very sparse densities in 2007 and 2008). However, the survey area was greatly diminished from 2007 to 2008. In 2008, Monterey spineflower polygons were observed increasing in size. Sites 4, 6, 11, and 8 have all increased in area from 2007 to 2008. In Site 9, the only site that did not show an increase in area, the polygons observed increased in density (one Medium-Low polygon in 2007 compared to one Sparse, two Medium, and three Medium-Low polygons in 2008).

A6.0 References

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

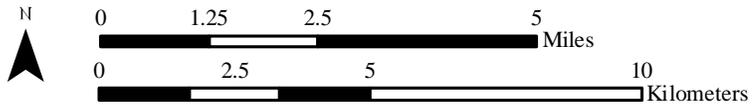
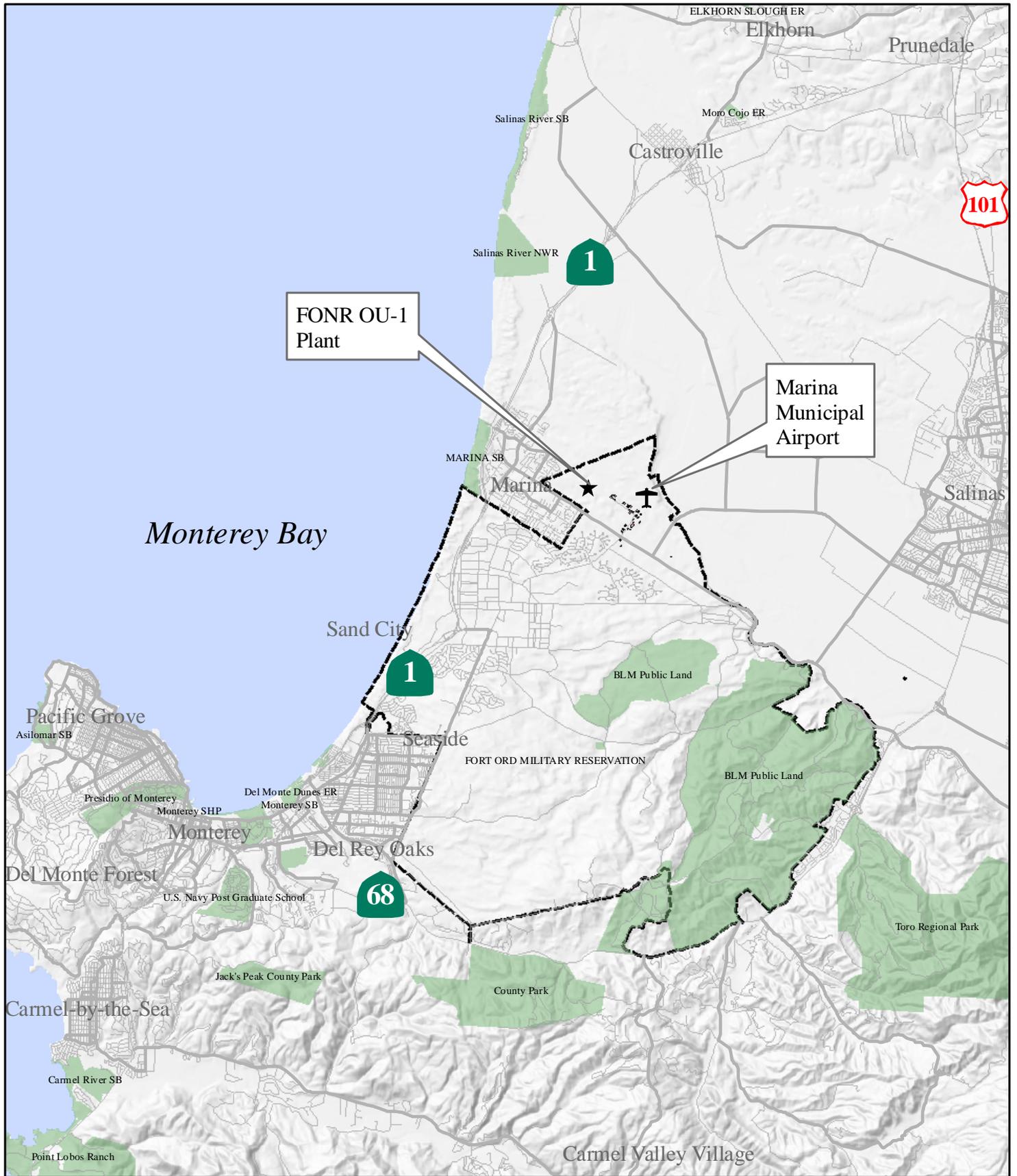
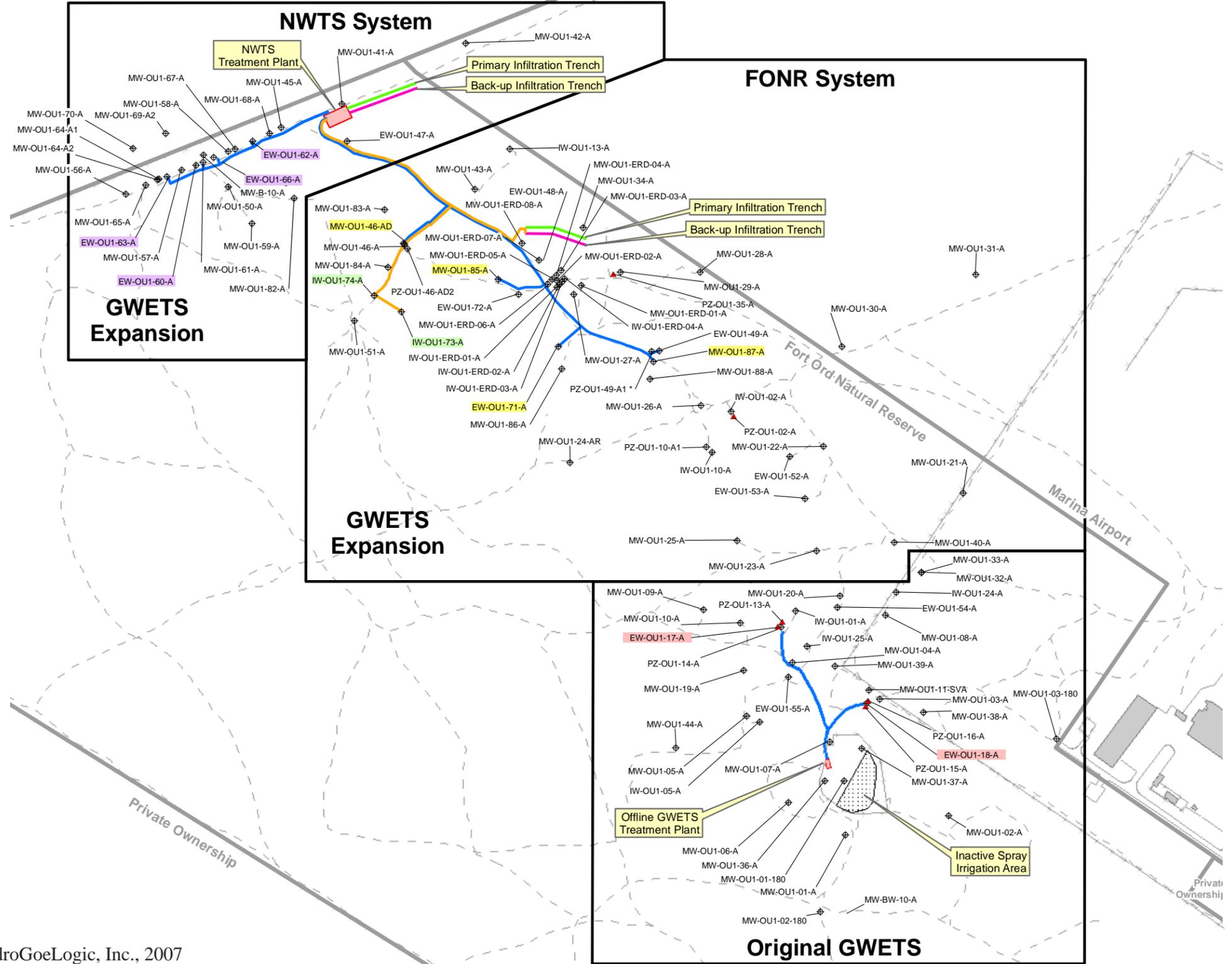


Figure A1.1

Project Vicinity Map

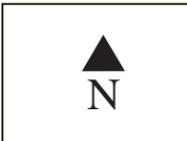


- Legend**
- ⊕ Monitoring Well
 - EW-OU1-18-A Original GWETS Extraction Well
 - SIW 36061 FONR Injection Well
 - MW-OU1-46-AD FONR Extraction Well
 - EW-OU1-63-A NWTS Extraction Well
 - ▲ Piezometer
 - - - Trail/Unimproved Road
 - ××× Fence
 - Extraction Pipeline
 - Infiltration Trench
 - Treated Water Pipeline
 - Treatment Plant

Notes:
 NWTS = Northwest Treatment System
 FONR = Fort Ord Natural Reserve
 GWETS = Groundwater Extraction and Treatment System
 The treated water and extraction water pipelines are located in separate trenches within or near the existing roadway. The separation shown in this figure is exaggerated for clarity.

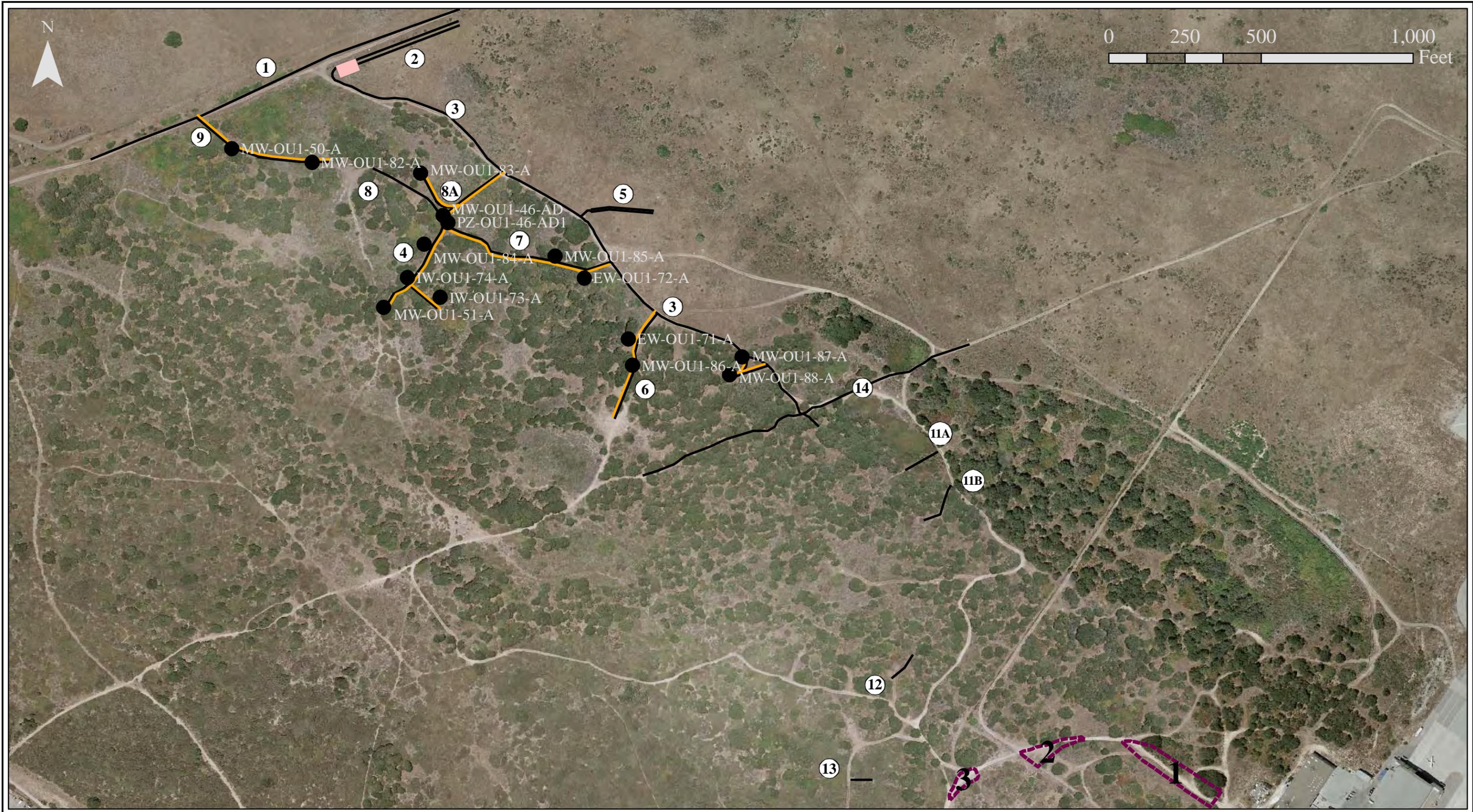


Source: HydroGoeLogic, Inc., 2007



Project Facilities

Figure A1.2



 FONR OU-1 Sites

 FONR OU-1 Sites Surveyed During 2008

 Well Locations Surveyed

 FONR Staging Areas

 **Figure A1.3**

FONR OU-1 Sites Surveyed for 2008 Rare Plant Surveys



White labels correspond with special-status plant population ID's from Tables A3.1

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> Monterey Spineflower Polygons Very Sparse Sparse Medium-Low Medium | <ul style="list-style-type: none"> Monterey Well or Piezometer Abandoned Boring or Well Well Installed After Completion of Rare Plant Survey Events | <ul style="list-style-type: none"> Treatment Plant Infiltration Trench Treated Water Pipeline Route Previously Surveyed Potential Access Routes |
|--|---|---|



Figure A3.1

Access Routes With 2008 Rare Plant Survey Results - Northern OU1 FONR Area

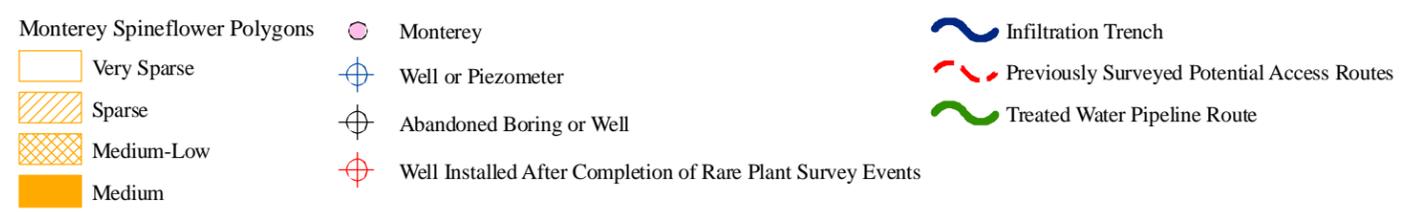


Figure A3.2

Access Routes With 2008 Rare Plant Survey Results - Northeastern OU1 FONR Area

Table A3.1 Monterey Spineflower Populations Identified During 2008 Survey

FONR Location	Population #	Number of Individuals or Percent Cover	Cover Class	Survey Date	Figure Number
SITE 4	1	1	N/A	5/5/2008	A3.1
SITE 4	2	1	N/A	5/5/2008	A3.1
SITE 4	3	2	N/A	5/5/2008	A3.1
SITE 4	4	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	5	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	6	3	N/A	5/5/2008	A3.1, A3.2
SITE 4	7	2	N/A	5/5/2008	A3.1, A3.2
SITE 4	8	2	N/A	5/5/2008	A3.1, A3.2
SITE 4	9	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	10	3	N/A	5/5/2008	A3.1, A3.2
SITE 4	11	2	N/A	5/5/2008	A3.1, A3.2
SITE 4	12	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	13	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	14	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	15	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	16	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	17	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	18	2	N/A	5/5/2008	A3.1, A3.2
SITE 4	19	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	20	1	N/A	5/5/2008	A3.1, A3.2
SITE 4	21	1	N/A	5/5/2008	A3.2
SITE 4	22	1	N/A	5/5/2008	A3.2
SITE 7	23	1	N/A	5/5/2008	A3.1, A3.2
SITE 7	24	1	N/A	5/5/2008	A3.1, A3.2
SITE 8	25	2	N/A	5/5/2008	A3.1
SITE 8	26	1	N/A	5/5/2008	A3.1
SITE 9	27	4	N/A	5/5/2008	A3.1
SITE 9	28	3	N/A	5/5/2008	A3.1
SITE 9	29	3	N/A	5/5/2008	A3.1
SITE 9	30	2	N/A	5/5/2008	A3.1
SITE 9	31	1	N/A	5/5/2008	A3.1
SITE 9	32	4	N/A	5/5/2008	A3.1
SITE 9	33	3	N/A	5/5/2008	A3.1
SITE 4	34	5.00	Sparse	5/5/2008	A3.1, A3.2
SITE 4	35	10.00	Sparse	5/5/2008	A3.1, A3.2
SITE 4	36	40.00	Medium-Low	5/5/2008	A3.1, A3.2
SITE 4	37	40.00	Medium-Low	5/5/2008	A3.1, A3.2
SITE 4	38	15.00	Sparse	5/5/2008	A3.1, A3.2
SITE 4	39	5.00	Sparse	5/5/2008	A3.1, A3.2
SITE 4	40	5.00	Sparse	5/5/2008	A3.2
SITE 4	41	10.00	Sparse	5/5/2008	A3.2

FONR Location	Population #	Number of Individuals or Percent Cover	Cover Class	Survey Date	Figure Number
SITE 6	42	25.00	Sparse	5/5/2008	A3.2
SITE 7	43	1.00	Very Sparse	5/5/2008	A3.1, A3.2
SITE 7	44	5.00	Sparse	5/5/2008	A3.1, A3.2
SITE 8	45	25.00	Sparse	5/5/2008	A3.1
SITE 8	46	5.00	Sparse	5/5/2008	A3.1
SITE 9	47	75.00	Medium	5/5/2008	A3.1
SITE 9	48	75.00	Medium	5/5/2008	A3.1
SITE 9	49	40.00	Medium-Low	5/5/2008	A3.1
SITE 9	50	5.00	Sparse	5/5/2008	A3.1
SITE 9	51	50.00	Medium-Low	5/5/2008	A3.1
SITE 9	52	40.00	Medium-Low	5/5/2008	A3.1

Table A3.2 Habitat Types Observed in Survey Areas

Survey Area	Coast Live Oak Woodland	Central Maritime Chaparral	Coastal Scrub	Annual Grassland	Disturbed / Developed
4	X	X	X	X	X
6	X		X	X	X
7	X		X		X
8A	X		X		X
8	X		X		X
9	X		X		X