

**2018 ANNUAL REPORT**  
**Fort Ord Natural Reserve Rare Plant Survey**  
Operable Unit 1  
CONTRACT NO. W91238-14-D-0010-F0060

**FORMER FORT ORD**



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**Burleson Consulting Inc.**

Woman-Owned Small Business  
*Environmental Services*

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## APPENDICES

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Appendix A - FONR Historical Rare Plant Survey Results

## ACRONYMS AND ABBREVIATIONS

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BRAC	Base Realignment and Closure Division
Burleson	Burleson Consulting Inc.
CNDDB	California Natural Diversity Database
DD&A	Denise Duffy & Associates
FONR	Fort Ord Natural Reserve
HGL	HydroGeoLogic, Inc.
HMP	Habitat Management Plan
NWTS	Northwest Treatment System
OU1	Operable Unit 1
PBO	Programmatic Biological Opinion
sf	Square feet
TCE	Trichloroethene
UC	University of California
USACE	US Army Corps of Engineers

## 1. INTRODUCTION

Burleson Consulting Inc. (Burleson) was issued Task Order W91238-14-D-0010-F0060 by the US Army Corps of Engineers (USACE) to survey rare plants in Fort Ord Natural Reserve (FONR) at former Fort Ord, Monterey, California (see Figure 1-1). This report summarizes the 2018 rare plant survey results for 33 wells, secondary access routes, and the Northwest Treatment System (NWTS) in FONR Operable Unit 1 (OU1) and a reference site.

The Fort Ord U.S. Army Base was closed down in 1994 and a portion of former Fort Ord was transferred to the University of California (UC). Fort Ord Natural Reserve was established in 1996 as part of the UC Natural Reserve system. Groundwater under FONR OU1 was contaminated with trichloroethene (TCE) and other chemicals of concern due to activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area between 1962 and 1985. USACE constructed a groundwater extraction and treatment system in 1988 to remediate TCE and other contaminants. In 2004, HydroGeoLogic, Inc. (HGL) took over remediation efforts and constructed the NWTS. Groundwater sampling in 2014 indicated that concentrations of chemicals of concern were below cleanup targets; OU1 officially met cleanup criteria and was approved by the agencies in 2016 (HGL, 2015; HGL, 2016a; HGL, 2016b). OU1 remediation facilities were decommissioned and destroyed in a phased approach in 2011, 2014, and 2017; all above ground components of the OU1 remediation system were removed by July 2017 (HGL, 2018).

The area of FONR potentially impacted by the decommissioning and destruction of OU1 remediation facilities is approximately 130 acres; this includes a 30-foot radius from well locations, a 10-foot buffer along associated secondary access routes, and the NWTS. The *Installation-Wide Multispecies Habitat Management Plan* (HMP) and the reinitiated *Programmatic Biological Opinion (PBO) for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord* require rare plant surveys be conducted for three years after destruction of remediation facilities to ensure that project activities protect and maintain special-status species found in FONR (USACE, 1997; USFWS, 2015; USFWS, 2017). The two rare plants of concern in FONR are sand gilia (*Gilia tenuiflora* ssp. *arenaria*) and Monterey spineflower (*Chorizanthe pungens* var. *pungens*). Yadon's piperia (*Piperia yadonii*) was not initially surveyed at OU1 but was added to the survey in 2016 at the request of the agencies in accordance with the 2017 PBO. No occurrences of Yadon's piperia have been observed on FONR to date.



Figure 1-1. Project Vicinity Map

Burleson was contracted by USACE to conduct Year 1 rare plant surveys for the area encompassing 33 OU1 wells that were destroyed in 2017, associated secondary access routes, and the NWTs (see Table 1-1 and Figure 1-3). Thirty-five wells were destroyed in 2017; however, two wells were not surveyed because they were located in grassland habitat near the FONR boundary that was deemed low quality habitat for the special-status species of concern (MW-B-02-A and MW-OU1-27-A; HGL, 2018). Baseline surveys (Year 0) were conducted in 2017 by Denise Duffy & Associates (DD&A) as a subcontractor to HGL (HGL, 2018).

**Table 1-1. OU1 Wells Destroyed in 2017**

Well Identification		
MW-B-02-A*	EW-OU1-52-A	EW-OU1-71-A
IW-OU1-02-A	EW-OU1-53-A	EW-OU1-72-A
PZ-OU1-02-A1	MW-OU1-57-A	IW-OU1-73-A
IW-OU1-10-A	MW-OU1-58-A	IW-OU1-74-A
PZ-OU1-10-A1	MW-OU1-59-A	MW-OU1-82-A
MW-OU1-26-A	EW-OU1-60-A	MW-OU1-83-A
MW-OU1-27-A*	MW-OU1-61-A	MW-OU1-84-A
MW-OU1-46-A	EW-OU1-62-A	MW-OU1-85-A
MW-OU1-46-AD	EW-OU1-63-A	MW-OU1-86-A
EW-OU1-49-A	EW-OU1-66-A	MW-OU1-87-A
PZ-OU1-49-A1	MW-OU1-67-A	MW-OU1-88-A
MW-OU1-50-A	MW-OU1-68-A	

\* Wells destroyed in 2017 that were not surveyed for rare plants

## 1.1 Site Location and Description

### 1.1.1 Reference Site

The reference site is located southeast of FONR and was established by DD&A in 2010 due to its known populations of sand gilia and Monterey spineflower and easy accessibility (see Figure 1-2). The dominant habitat type of the reference site is coast live oak woodland with patches of annual grasslands that support populations of Monterey spineflower and sand gilia. It is bounded on three sides by paved roads (Reservation Road, MBEST Drive, and University Drive).

### 1.1.2 FONR OU1 Survey Area

FONR is 590 acres of coast live oak woodland, coastal scrub, maritime chaparral, and annual grassland. FONR provides suitable habitat for several rare plant species including sand gilia and Monterey spineflower. Yadon's piperia prefers maritime chaparral, Monterey pine forest, and Monterey cypress forest and has never been detected on FONR property to date but was included in rare plant surveys beginning in 2016 per agencies request. Rare plants were considered within the FONR OU1 remediation impact area and the 2018 OU1 survey area if they were within a 30-foot radius of a well location or within 10 feet of secondary access routes and the NWTs (see Figure 1-3).



Figure 1-2. Reference Site Overview Map



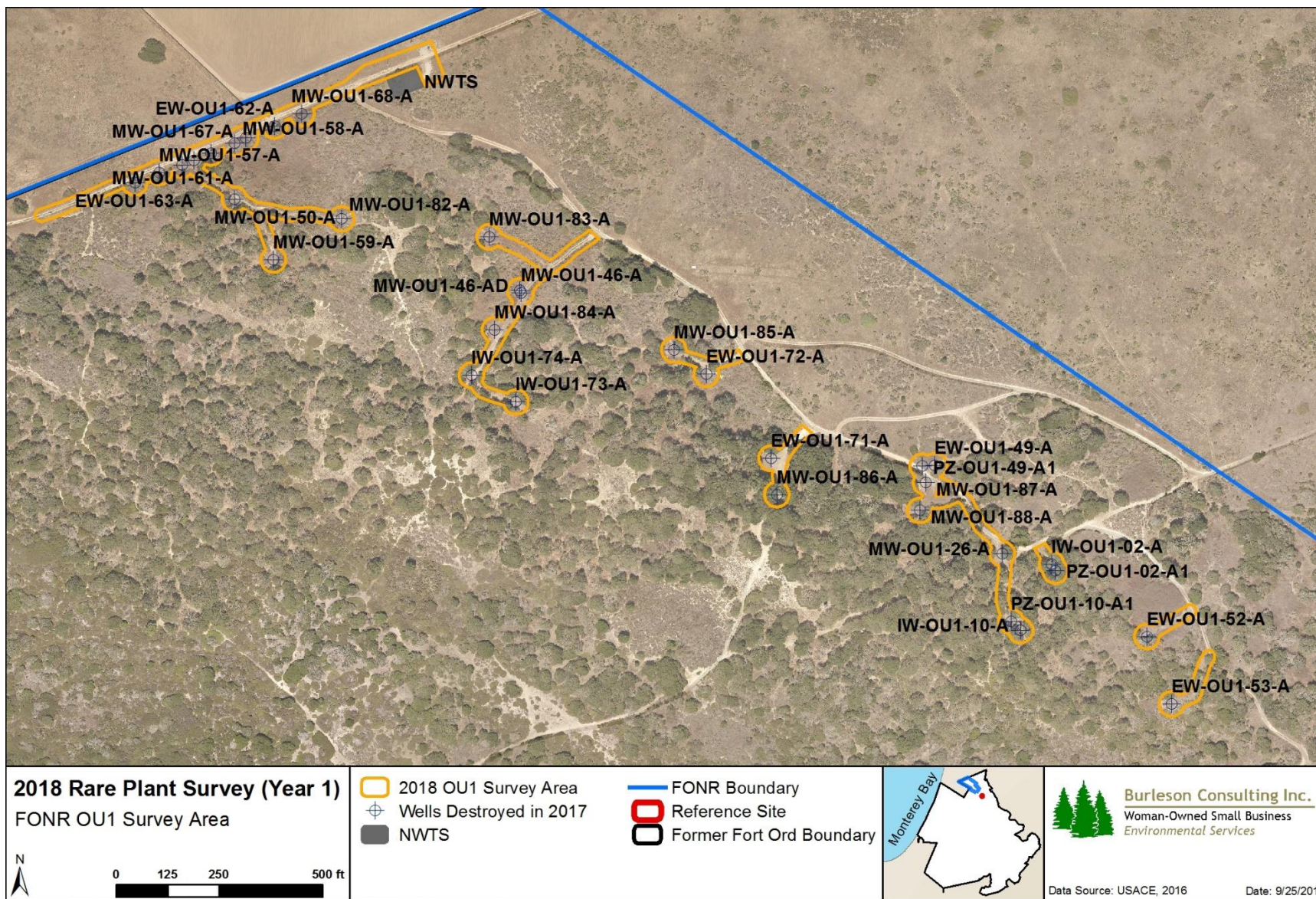


Figure 1-3. OU1 Survey Area Overview Map

### 1.1.3 Sand Gilia

Sand gilia is a native annual herb in the phlox family (*Polemoniaceae*). It is listed as Threatened by the State of California and Endangered by the Federal Government (CNDDDB, 2018). Sand gilia occurs in open sandy soil in maritime chaparral, dune scrub, coastal scrub, and disturbed areas. The plant forms a prostrate, basal rosette with serrate or once pinnate leaves (Porter, 2018). The branching flowering stalks range from two to six inches tall and are densely glandular. The plant blooms from April through June and the flower consists of a narrow tube with a purple throat and pink to purple lobes. Sand gilia is endemic to Monterey Bay. The California Natural Diversity Database (CNDDDB) lists 31 occurrences in Monterey County, four of which are extirpated (CNDDDB, 2018).

### 1.1.4 Monterey Spineflower

Monterey spineflower is a native annual herb in the buckwheat family (*Polygonaceae*). It is listed as Threatened by the Federal Government (CNDDDB, 2018). Monterey spineflower occurs in open sandy soil in maritime chaparral, dune scrub, coastal scrub, and disturbed areas. The plant is prostrate with dense inflorescences and a white to pink corolla; it blooms from April to June (Reveal and Rosatti, 2014). Monterey spineflower may be confused with diffuse spineflower (*Chorizanthe diffusa*) except that diffuse spineflower has a lemon-yellow floral tube and a more upright inflorescence. The CNDDDB lists 51 occurrences in Monterey County, three of which are possibly extirpated (CNDDDB, 2018).

### 1.1.5 Yadon's Piperia

Yadon's piperia is a native perennial herb in the orchid family (*Orchidaceae*). It is listed as Endangered by the Federal Government (CNDDDB, 2018). Yadon's piperia occurs in maritime chaparral, Monterey pine forest, and Monterey cypress forest. The plant has two to three basal leaves and a single erect flowering stalk (Ackerman and Lauri 2013). The white flowers are distinguished from other piperia species by the short, downward facing spur. Yadon's piperia blooms from May to August. The CNDDDB lists 23 occurrences in Monterey County, one of which is possibly extirpated (CNDDDB, 2018).

## 1.2 Survey Objectives

The objectives of the 2018 rare plant surveys (Year 1) were to:

1. Identify locations and estimate populations of selected rare plants at a reference site near FONR.
2. Identify locations and estimate populations of selected rare plants at thirty-three 2017 well destruction sites, secondary access routes, and the NWTS in FONR (Year 1).
3. Map sand gilia, Monterey spineflower, and Yadon's piperia populations for comparison to past surveys and to inform future activities.
4. Assess results with respect to Success Criteria specified in the 2017 PBO. Those are:
  - 4.1. Densities and acreage of HMP annual species are within a normal range compared with information from reference sites, and;
  - 4.2. The number of wells where HMP annual species are detected in follow up surveys will be the same or greater than the number of wells where these species were found in baseline surveys.

## 2. METHODS

Sand gilia and Monterey spineflower were surveyed during peak bloom to map population size and abundance. Peak bloom was determined by visiting the reference site and communicating with FONR staff. *Piperia* was surveyed for the presence of vegetative structures at the same times as sand gilia and Monterey spineflower. If *piperia* plants were observed, locations were reported to the Base Realignment and Closure (BRAC) office so that BRAC biologists could return during the appropriate bloom period to identify the species.

Burleson biologists mapped rare plants using a Trimble® Juno® T41/5B Series GPS unit with an external Trimble® R1 GNSS receiver. Rare plants were considered within the survey area for OU1 remediation activities if they were within a 30-foot radius of a well location or within 10 feet of secondary access routes and NWTs (see Figure 1-3). When sand gilia, Monterey spineflower, or Yadon's *piperia* were encountered, the survey was extended beyond the survey area to the boundary of the population encountered. If the population extended more than 500 feet beyond the survey area, then the polygon was cut off at the survey area boundary.

Following protocol from the *2016 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results, Operable Unit 1* (HGL) and conversations with DD&A biologists, we considered populations discrete if there was a gap of greater than three feet between individuals. Populations comprised of five or fewer individuals were mapped as points and the number of individual plants for each point was recorded. Populations with more than five individuals were mapped using polygons. Individual plants were counted for all sand gilia and Yadon's *piperia* populations (points and polygons), whereas Monterey spineflower were only counted as individuals for points. Monterey spineflower populations mapped as polygons were instead characterized by the average absolute percent cover within the polygon. Percent cover was decided by visually assessing the entire polygon and determining which cover class best fit the polygon on average.

The cover classes used were:

- 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 75 percent)
- Medium High (76 to 97 percent)
- Very High (greater than 97 percent)

Data defining rare plant populations was exported from the GPS unit to shapefile format. Shapefiles were mapped using ArcGIS 10.6.1 (ESRI, 2018).

### 3. RESULTS

#### 3.1 Sand Gilia

Sand gilia was surveyed on April 17, 18, and 19, 2018. Sand gilia was present at the reference site and one OU1 well (see Table 3-1 and Figures 3-1, 3-5, and 3-6). Seven populations (one point and six polygons) totaling 321 individuals and occupying 1,102 square feet (sf) were mapped at the reference site. Four populations (one point and three polygons) totaling 153 individuals and occupying 573 sf were mapped within the OU1 survey area.

**Table 3-1. Sand Gilia Populations found in 2018 Survey**

Population Number	Individuals (#)	GIS Feature Type	Survey Date	Reference or Well ID
1	5	Point	4/17/2018	Reference
2	8	Polygon	4/17/2018	Reference
3	131	Polygon	4/17/2018	Reference
4	70	Polygon	4/17/2018	Reference
5	23	Polygon	4/17/2018	Reference
6	9	Polygon	4/17/2018	Reference
7	75	Polygon	4/17/2018	Reference
8	11	Polygon	4/17/2018	EW-OU1-53-A
9	91	Polygon	4/17/2018	EW-OU1-53-A
10	1	Point	4/17/2018	EW-OU1-53-A
11	50	Polygon	4/17/2018	EW-OU1-53-A

#### 3.2 Monterey Spineflower

Monterey spineflower was surveyed on May 14, 15, and 16, 2018. Four Monterey spineflower populations (one point and three polygons) occupying 3,556 sf were mapped at the reference site (see Table 3-2 and Figure 3-6). Of the three populations represented by polygons, two were Very Sparse (less than 3 percent cover) and one was Sparse (3-25 percent cover).

Monterey spineflower was present at 24 out of 33 wells and the NWTs within the OU1 survey area (see Table 3-2 and Figures 3-1 through 3-5). Fifty-two populations (36 points and 16 polygons) occupying 36,394 sf were mapped within the OU1 survey area. Of the 16 populations represented by polygons, four were Very Sparse, nine were Sparse, two were Medium Low (26-50 percent cover), and one was Medium (51-75 percent cover).

**Table 3-2. Monterey Spineflower Populations found in 2018 Survey**

Population Number	Individuals (#) or Percent Cover	Cover Class	GIS Feature Type	Survey Date	Reference or Well ID
13	1		Point	5/14/2018	IW-OU1-02-A; PZ-OU1-02-A1
14	2		Point	5/14/2018	EW-OU1-52-A
15	2		Point	5/14/2018	EW-OU1-52-A
16	3		Point	5/14/2018	MW-OU1-88-A
17	3-25%	Sparse	Polygon	5/14/2018	Reference
18	2		Point	5/14/2018	Reference
19	<3%	Very sparse	Polygon	5/14/2018	Reference
20	<3%	Very sparse	Polygon	5/14/2018	Reference
21	1		Point	5/15/2018	EW-OU1-62-A
22	2		Point	5/15/2018	EW-OU1-53-A
23	5		Point	5/15/2018	EW-OU1-53-A
24	3-25%	Sparse	Polygon	5/15/2018	EW-OU1-53-A
25	2		Point	5/15/2018	EW-OU1-53-A
26	26-50%	Medium low	Polygon	5/15/2018	EW-OU1-53-A
27	2		Point	5/15/2018	EW-OU1-72-A
28	1		Point	5/15/2018	EW-OU1-72-A
29	2		Point	5/15/2018	MW-OU1-85-A
30	1		Point	5/15/2018	MW-OU1-85-A
31	2		Point	5/15/2018	MW-OU1-85-A
32	2		Point	5/15/2018	MW-OU1-85-A
33	3-25%	Sparse	Polygon	5/15/2018	MW-OU1-85-A
34	3		Point	5/15/2018	MW-OU1-85-A
35	<3%	Very sparse	Polygon	5/15/2018	MW-OU1-83-A
36	<3%	Very sparse	Polygon	5/15/2018	MW-OU1-83-A
37	3-25%	Sparse	Polygon	5/15/2018	MW-OU1-83-A
38	51-75%	Medium	Polygon	5/15/2018	MW-OU1-83-A
39	<3%	Very sparse	Polygon	5/15/2018	MW-OU1-46-A; MW-OU1-46-AD
40	2		Point	5/15/2018	MW-OU1-46-A; MW-OU1-46-AD
41	3		Point	5/15/2018	MW-OU1-84-A
42	1		Point	5/15/2018	IW-OU1-74-A
43	3-25%	Sparse	Polygon	5/15/2018	IW-OU1-74-A
44	1		Point	5/15/2018	IW-OU1-74-A
45	1		Point	5/15/2018	IW-OU1-74-A
46	1		Point	5/15/2018	IW-OU1-73-A
47	1		Point	5/15/2018	NWTS
48	1	-	Point	5/16/2018	MW-OU1-67-A

**Table 3-2. Monterey Spineflower Populations found in 2018 Survey**

Population Number	Individuals (#) or Percent Cover	Cover Class	GIS Feature Type	Survey Date	Reference or Well ID
49	2	-	Point	5/16/2018	MW-OU1-67-A; MW-OU1-58-A
50	1	-	Point	5/16/2018	MW-OU1-67-A; MW-OU1-58-A
51	3-25%	Sparse	Polygon	5/16/2018	EW-OU1-66-A; EW-OU1-60-A
52	<3%	Very sparse	Polygon	5/16/2018	EW-OU1-60-A
53	26-50%	Medium low	Polygon	5/16/2018	MW-OU1-50-A; MW-OU1-57-A; MW-OU1-58-A; MW-OU1-59-A; EW-OU1-60-A; EW-OU1-63-A; EW-OU1-66-A
54	1	-	Point	5/16/2018	Outside OU1 survey area near EW-OU1-63-A
55	2	-	Point	5/16/2018	Outside OU1 survey area near EW-OU1-63-A
56	1	-	Point	5/16/2018	MW-OU1-59-A
57	5	-	Point	5/16/2018	MW-OU1-82-A
58	5	-	Point	5/16/2018	MW-OU1-82-A
59	2	-	Point	5/16/2018	MW-OU1-82-A
60	1	-	Point	5/16/2018	MW-OU1-82-A
61	3-25%	Sparse	Polygon	5/16/2018	MW-OU1-82-A
62	2	-	Point	5/16/2018	MW-OU1-82-A
63	2	-	Point	5/16/2018	MW-OU1-82-A
64	3-25%	Sparse	Polygon	5/16/2018	MW-OU1-82-A
65	5	-	Point	5/16/2018	MW-OU1-82-A
66	3-25%	Sparse	Polygon	5/16/2018	MW-OU1-82-A
67	1	-	Point	5/16/2018	MW-OU1-82-A
68	1	-	Point	5/16/2018	MW-OU1-82-A
69	2	-	Point	5/16/2018	MW-OU1-82-A
70	3-25%	Sparse	Polygon	5/16/2018	MW-OU1-82-A

### 3.3 Yadon's Piperia

Yadon's piperia was surveyed simultaneously with sand gilia and Monterey spineflower (April 17, 18, and 19 and May 14, 15, and 16, 2018). No individuals were observed at the reference site or within the 2018 OU1 survey area. Yadon's piperia will not be discussed in the remainder of this report.

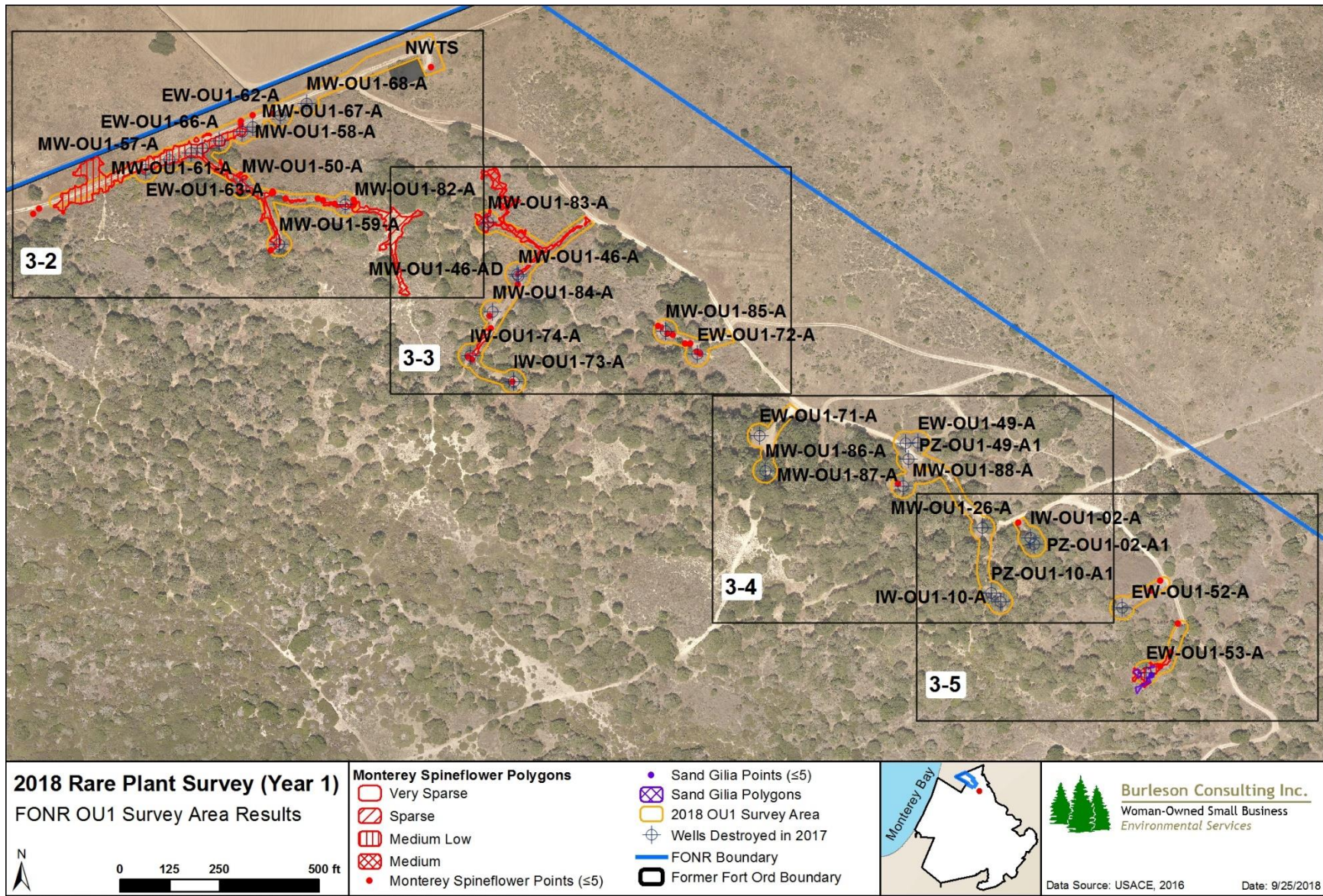


Figure 3-1. 2018 OU1 Survey Area Rare Plant Populations Overview

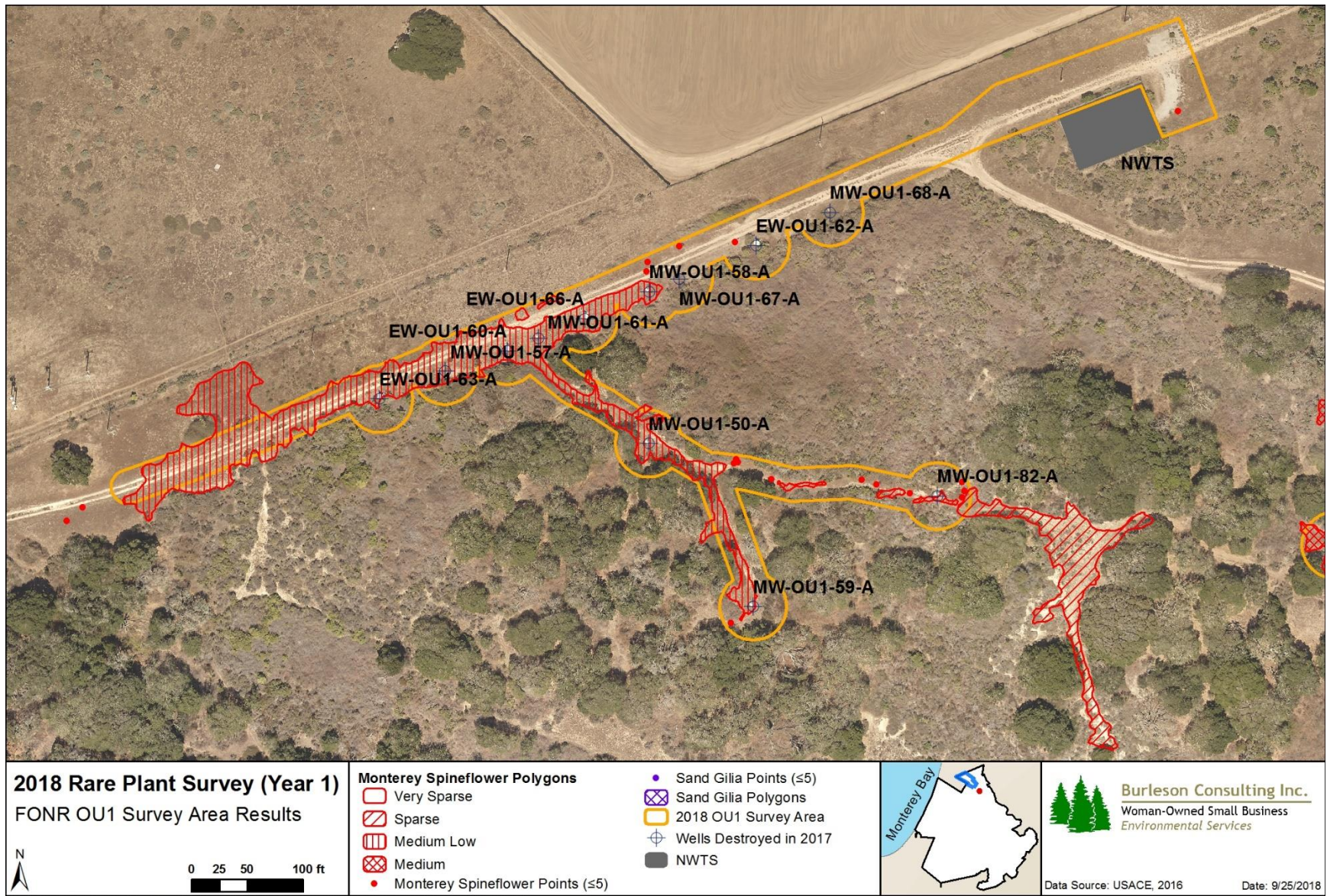


Figure 3-2. 2018 OU1 Survey Area Monterey Spineflower Populations



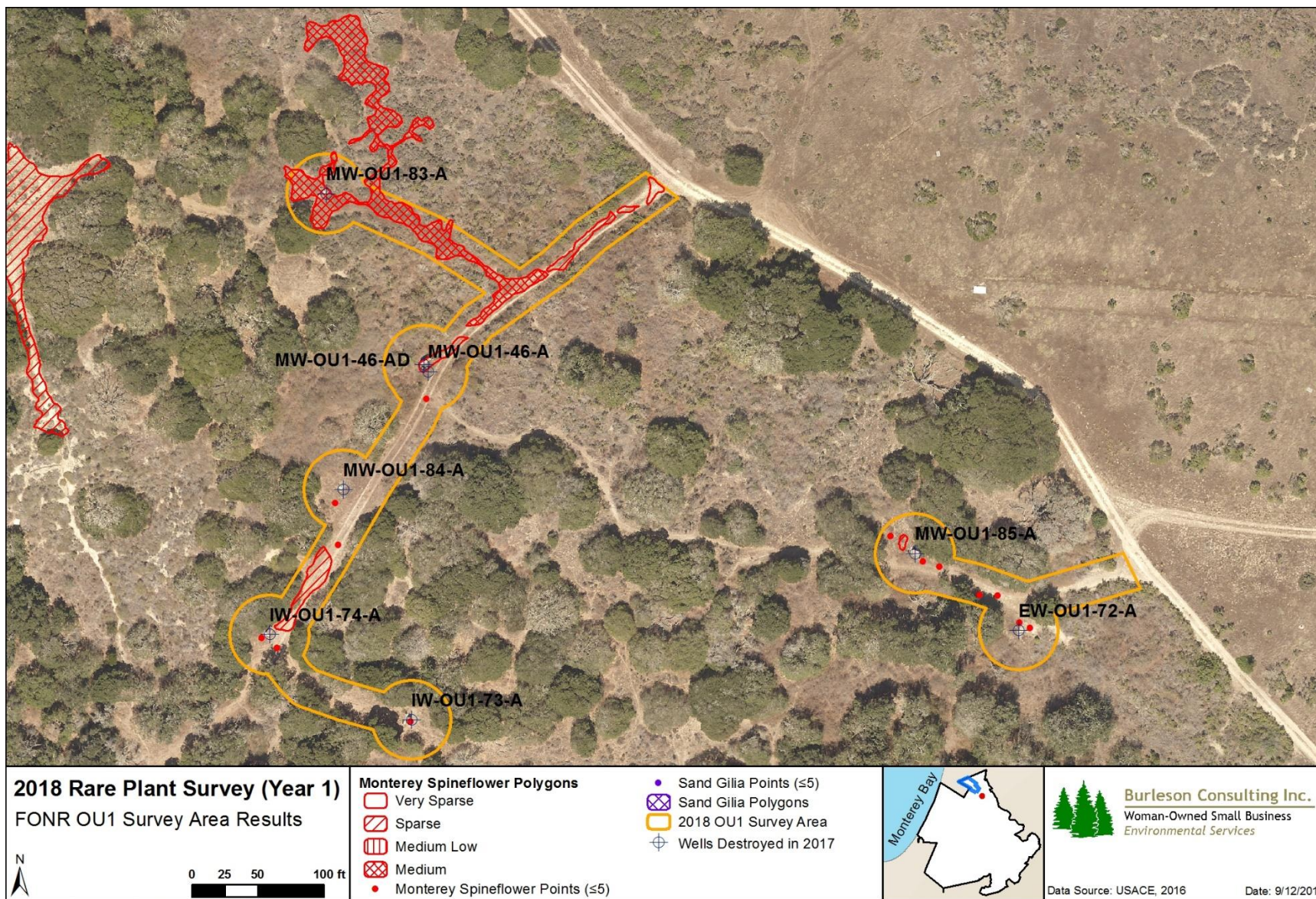


Figure 3-3. 2018 OU1 Survey Area Monterey Spineflower Populations



Figure 3-4. 2018 OU1 Survey Area Monterey Spineflower Populations

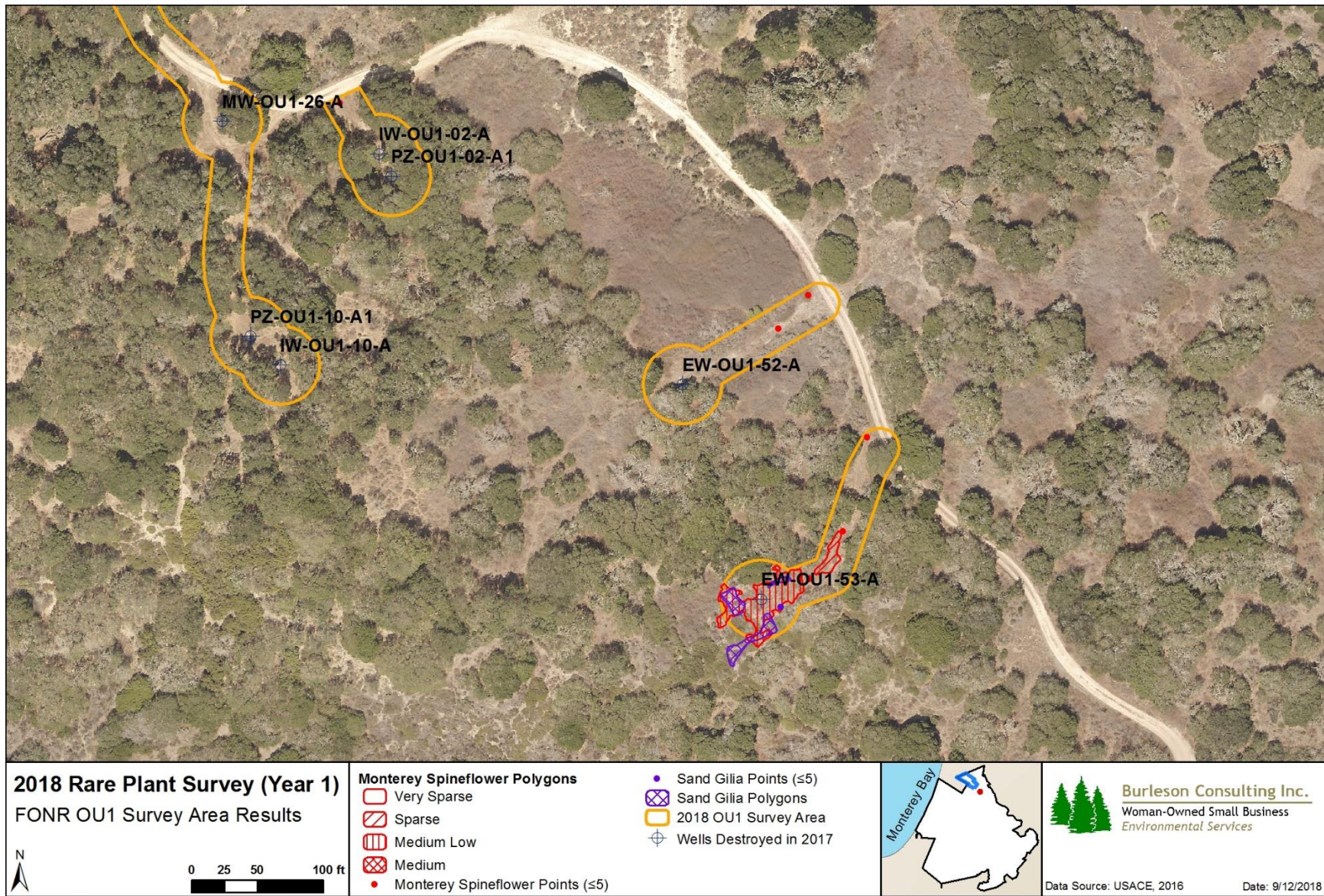


Figure 3-5. 2018 OU1 Survey Area Sand Gilia and Monterey Spineflower Populations

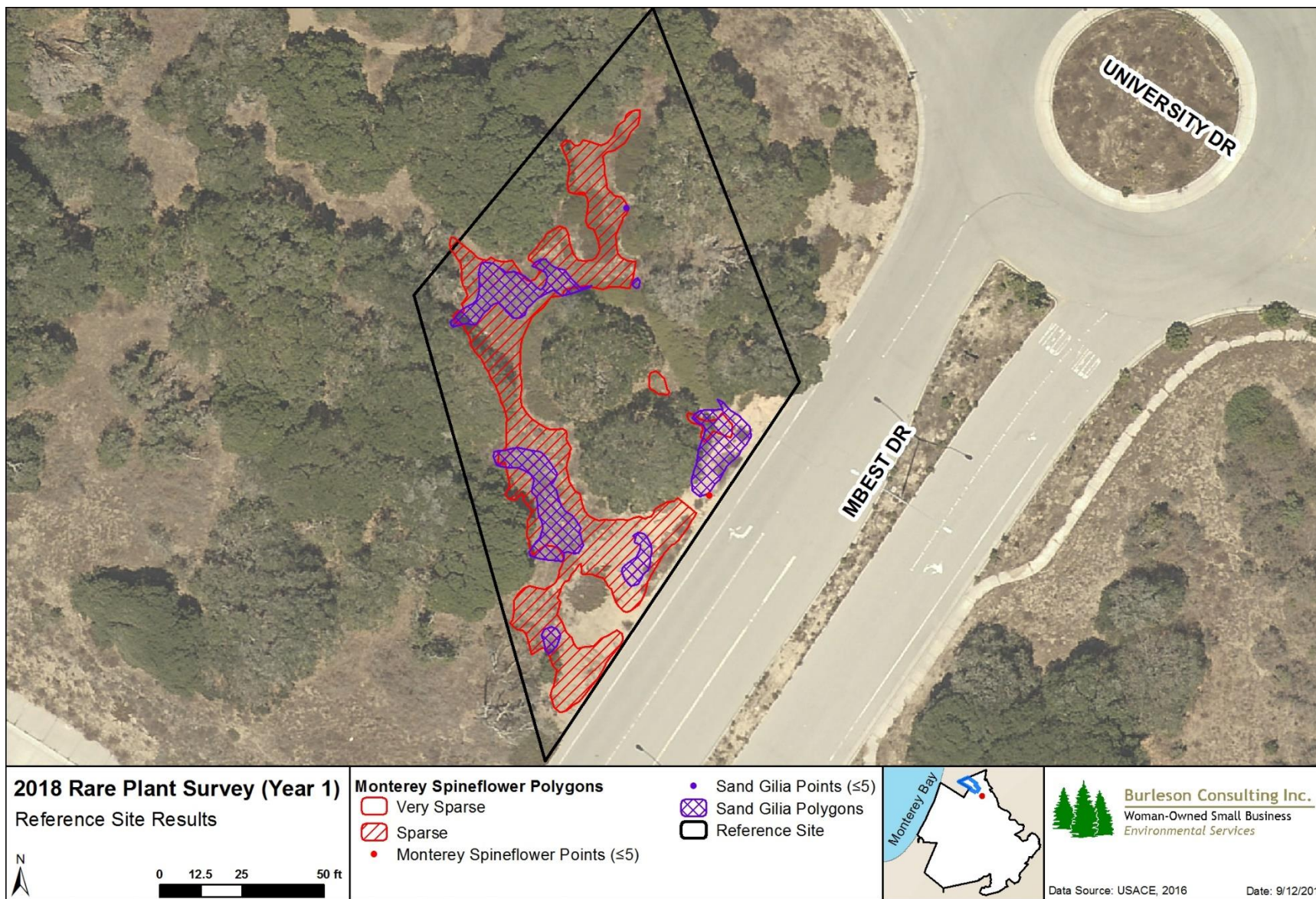


Figure 3-6. 2018 Reference Site Rare Plant Populations

## 4. DISCUSSION

Rare plant surveys are conducted for three years after a disturbance occurs during the OU1 remediation effort as required by the HMP and the 2017 Programmatic Biological Opinion (USACE, 1997; USFWS, 2017). The 2018 surveys were Year 1 follow up surveys after 33 wells were decommissioned and destroyed in 2017 (HGL, 2018). Rare plants were mapped within 30 feet of wells and within 10 feet of secondary access routes and the NWTs.

### 4.1 Sand Gilia

#### 4.1.1 Reference Site

At the reference site, sand gilia decreased by 142 individuals from 2017 (Year 0) to 2018 (Year 1; see Table 4-1). Sand gilia populations vary from year to year and their abundance may depend on the timing and amount of precipitation and the level of herbivory (Dorrell-Canepa, 1994; Fox *et al*, 2006; Fox, 2007). The decrease in sand gilia at the reference site from 2017 to 2018 could be due to receiving half the precipitation in 2018 versus 2017 (12.56 inches and 22.92 inches, respectively) and approximately half as much winter rain from November through January (4.87 inches in 2018 and 10.32 inches in 2017; see Table 4-2 and Figure 4-1).

**Table 4-1. Sand Gilia Population within the Reference Site in 2017 and 2018**

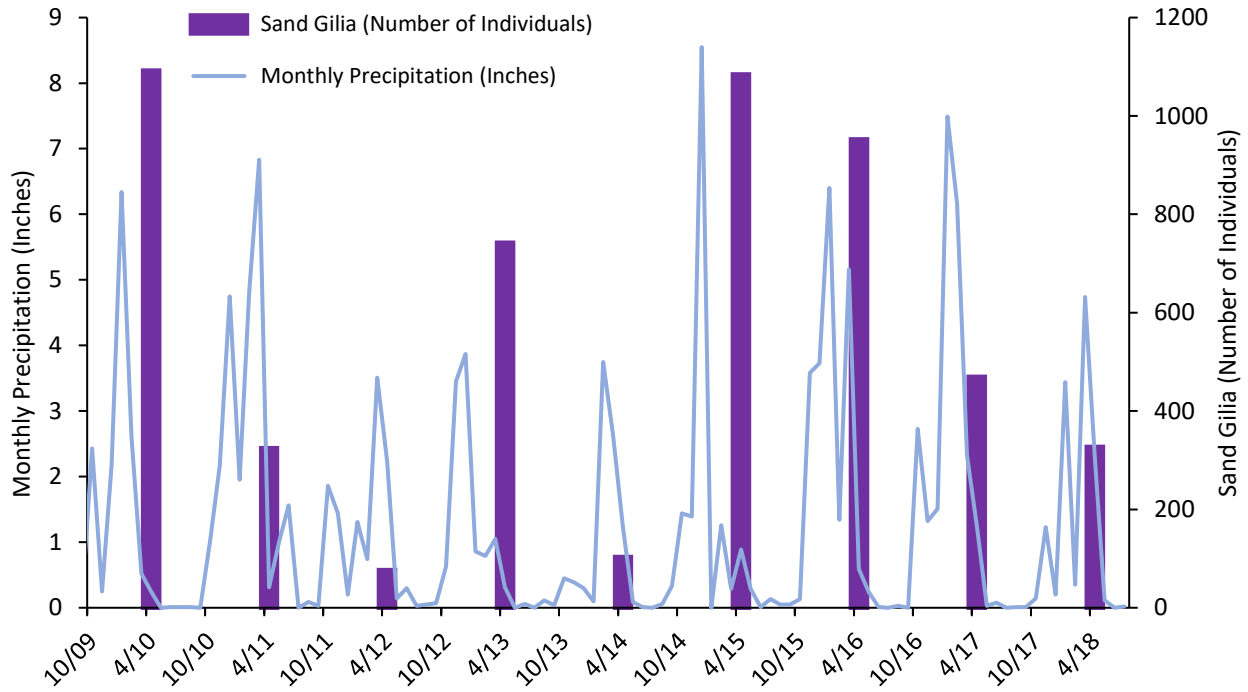
Year	Total Populations	Individual Plants	Indiv. Plants Percent Change from Previous Year	Points	Polygons	Area of Polygons (sf)	Area Percent Change from Previous Year
2017	8	463	NA	6	2	1,950	NA
2018	7	321	-30.7%	1	6	1,102	-43.5%

**Table 4-2. Precipitation for 2017 and 2018 and Average Precipitation from 1981-2010**

	Precipitation (inches)		
	2017*	2018*	Average (1981-2010) <sup>†</sup>
Water Year	22.92	12.56	17.84
Winter (November-January)	10.32	4.87	8.28
Spring (February-April)	9.74	7.42	7.74

\* 2017 and 2018 precipitation from NPS, 2018

† Average precipitation from NOAA, 2018



Precipitation data from NPS, 2018; 2010-2017 rare plant data from HGL, 2018.

**Figure 4-1.** Sand Gilia Populations at the Reference Site versus Monthly Precipitation

**4.1.2 FONR OU1 Survey Area**

Sand gilia increased by 153 individuals at one well location (EW-OU1-53-A) within the OU1 survey area from 2017 (Year 0) to 2018 (Year 1; see Table 4-3 and 4-6). No sand gilia was found in the OU1 survey area in 2017 and sand gilia was observed at only two of 33 well locations during past surveys (EW-OU1-53-A in 2006/2007 and MW-OU1-59-A in 2006; HGL, 2018). Historical survey results are summarized in Appendix A (see Table A-1). OU1 remediation activities disturbed the well sites in 2017 (HGL, 2018). Despite the lower water year, disturbance may be a contributing factor in the expansion of the sand gilia population in 2018 within the OU1 survey area.

**Table 4-3. Sand Gilia Population within the FONR OU1 Survey Area in 2017 and 2018**

Year	Total Populations	Individual Plants	Points	Polygons	Area of Polygons (sf)
2017	0	0	0	0	0
2018	4	153	1	3	573

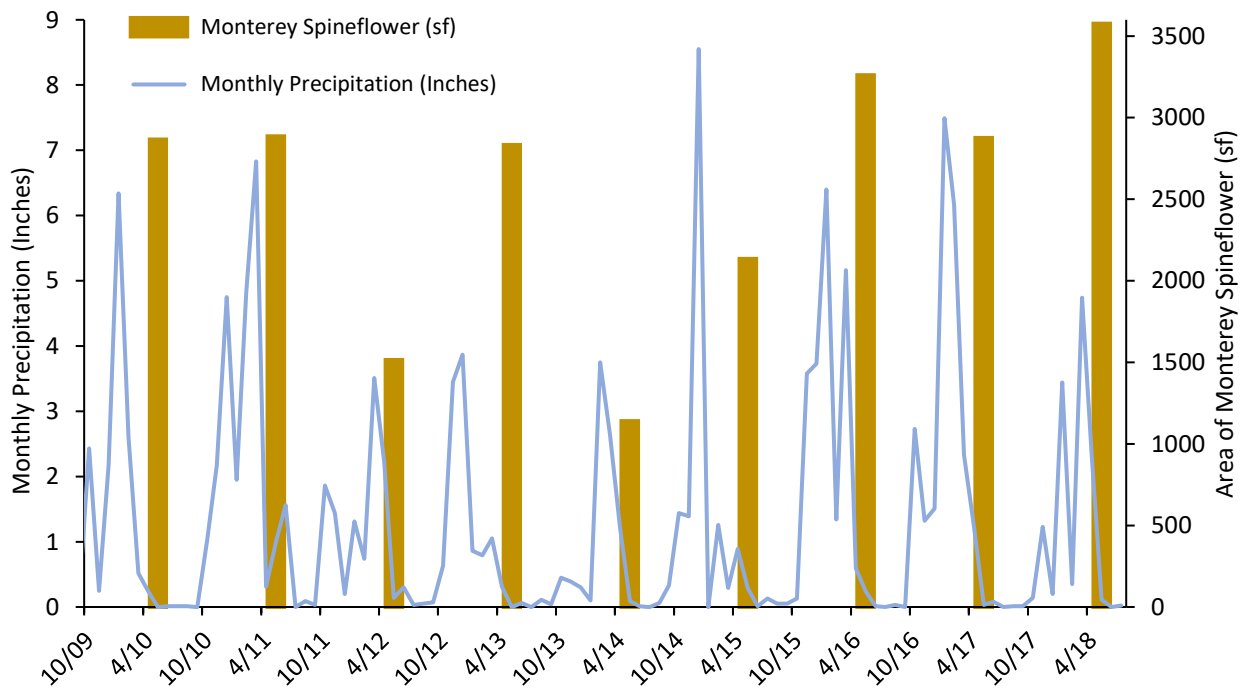
## 4.2 Monterey Spineflower

### 4.2.1 Reference Site

At the reference site, Monterey spineflower increased by 701 sf from 2017 to 2018 (see Table 4-4). Monterey spineflower germinates more readily in dry years than wet years and survival to maturity is facilitated by spring rainfall (Fox *et al*, 2006). The 2018 water year had less than average precipitation and the majority of rain occurred in the spring; this may explain the increase in total area of Monterey spineflower from 2017 to 2018 (see Table 4-2 and Figure 4-2).

**Table 4-4. Monterey Spineflower Population within the Reference Site in 2017 and 2018**

Year	Total Populations	Points	Polygons per Density Class			Area of Polygons (sf)	Area Percent Change from Previous Year
			Very Sparse	Sparse	Medium Low		
2017	4	0	0	3	1	2,855	NA
2018	4	1	2	1	0	3,556	24.5%



Precipitation data from NPS, 2018; 2010-2017 rare plant data from HGL, 2018.

**Figure 4-2. Monterey Spineflower Populations at the Reference Site with Monthly Precipitation**

### 4.2.2 FONR OU1 Survey Area

Within the OU1 survey area, Monterey spineflower increased by 9,455 sf from 2017 to 2018 and was found at 22 well locations, along secondary access routes, and outside the NWTs (see Table 4-5 and 4-6). Thirty-six points (populations less than or equal to five individuals) were mapped in 2018 while only six points were mapped in 2017. Monterey spineflower population area expanded but density

decreased from 2017 to 2018. This trend is consistent with reference site populations. Historical survey results are summarized in Appendix A (see Table A-2).

Of the 33 well locations surveyed in 2018:

- Monterey spineflower was not observed at 6 well locations at which Monterey spineflower has never been observed in historical surveys (1998-2017).
- Monterey spineflower was not observed at 3 well locations at which Monterey spineflower has been observed in historical surveys.
- Monterey spineflower was observed at 18 well locations at which Monterey spineflower has been observed in historical surveys.
- Monterey spineflower was observed at 6 well locations at which Monterey spineflower has not been observed in any historical OU-1 survey.

**Table 4-5. Monterey Spineflower Population within the FONR OU1 Survey Area in 2017 and 2018**

Year	Total Populations	Points	Polygons per Density Class				Area of Polygons (sf)	Area Percent Change from Previous Year
			Very Sparse	Sparse	Medium Low	Medium		
2017	19	6	0	7	5	1	26,939	NA
2018	52	36	4	9	2	1	36,394	35.1%



**Table 4-6. Monterey Spineflower and Sand Gilia Populations Surveyed in 2017 and 2018**

Well Identification	Monterey Spineflower Populations (No. Individuals or Cover Class)		Sand Gilia Populations (No. Individuals)	
	2017	2018	2017	2018
IW-OU1-02-A; PZ-OU1-02-A1*	0	1	0	0
IW-OU1-10-A; PZ-OU1-10-A1*	0	0	0	0
MW-OU1-26-A	0	0	0	0
MW-OU1-46-A; MW-OU1-46-AD*	S	2, VS	0	0
EW-OU1-49-A; PZ-OU1-49-A1*	0	0	0	0
MW-OU1-50-A	ML	ML	0	0
EW-OU1-52-A	0	2, 2	0	0
EW-OU1-53-A	ML	2, 2, 5, S, ML	0	1, 11, 50, 91
MW-OU1-57-A	ML	ML	0	0
MW-OU1-58-A	S, ML	1, 2, ML	0	0
MW-OU1-59-A	ML	ML, 1	0	0
EW-OU1-60-A	2, 3, ML	3, 8, S, ML	0	0
MW-OU1-61-A	2, 3, S, ML	ML	0	0
EW-OU1-62-A	0	1	0	0
EW-OU1-63-A	ML	ML	0	0
EW-OU1-66-A	S, S, S, ML	S, ML	0	0
MW-OU1-67-A	S	1, 1, 2	0	0
MW-OU1-68-A	0	0	0	0
EW-OU1-71-A	0	0	0	0
EW-OU1-72-A	0	2, 1	0	0
IW-OU1-73-A	0	1	0	0
IW-OU1-74-A	S	1, 1, 1, S	0	0
MW-OU1-82-A	1, S, S, ML	1, 1, 1, 2, 2, 2, 2, 5, 5, 5, S, S, S, S	0	0
MW-OU1-83-A	M	6, 7, S, M	0	0
MW-OU1-84-A	0	3	0	0
MW-OU1-85-A	1, 1	1, 2, 2, 2, 3, S	0	0
MW-OU1-86-A	0	0	0	0
MW-OU1-87-A	0	0	0	0
MW-OU1-88-A	2	3	0	0
NWTS	0	1	0	0

2017 data from Table 3.3B in 2017 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results Report (HGL)

\* Considered one location

EW - Extraction Well

IW - Injection Well

M - Medium

ML - Medium Low

MW - Monitoring Well

NWTS - Northwest Treatment Center

PZ - Piezometer

S - Sparse

VS - Very Sparse

## 5. IMPACT ASSESSMENT

2018 (Year 1) rare plant survey data for wells destroyed in 2017 were compared to the 2017 PBO Success Criteria in Sections 5.1 and 5.2 to assess the impact of OU1 remediation activities on rare plant populations in FONR.

### 5.1 Success Criteria 1

Success Criteria 1 in the 2017 PBO states, “densities and acreage of HMP annual species are within a normal range compared with information from reference sites” (USFWS, 2017). Year 1 survey results for sand gilia and Monterey spineflower are compared to Success Criteria 1 in the following sections.

#### 5.1.1 Sand Gilia

The following observations were made to compare 2017 (Year 0) and 2018 (Year 1) sand gilia survey results between the reference site and OU1 survey area:

1. Sand gilia was observed at the reference site in 2017 and 2018 but was only observed within the OU1 survey area in 2018.
2. Relative abundance of sand gilia was not consistent between the reference site and the OU1 survey area. Total area and the number of individual plants decreased at the reference site from 2017 to 2018 but increased within the OU1 survey area (no sand gilia was observed within the OU1 survey area in 2017).

The densities and acreage of sand gilia populations observed in 2018 (Year 1) within the OU1 survey area do not correspond with population trends exhibited at the reference site. However, the total area and number of individuals in sand gilia populations within the OU1 survey area increased from 2017 to 2018, suggesting that well destruction activities in 2017 did not adversely impact sand gilia populations. Two additional years of monitoring will be completed to more thoroughly evaluate the effect of OU1 remediation activities on sand gilia populations.

#### 5.1.2 Monterey Spineflower

The following observations were made to compare 2017 (Year 0) and 2018 (Year 1) Monterey spineflower survey results between the reference site and OU1 survey area:

1. Monterey spineflower populations of similar densities were observed at the reference site and OU1 survey area in 2017 and 2018.
2. Relative abundance of Monterey spineflower appears to be consistent between the reference site and OU1 survey area as total area increased and density decreased at both sites from 2017 to 2018.

The densities and acreage of Monterey spineflower populations observed in 2018 (Year 1) within the OU1 survey area appear to be within the normal range when compared to the reference site. This suggests that well destruction activities in 2017 did not adversely impact Monterey spineflower populations. Two additional years of monitoring will be completed to more thoroughly evaluate the effect of OU1 remediation activities on Monterey spineflower populations.

### 5.2 Success Criteria 2

Success Criteria 2 in the 2017 PBO states that “the number of wells where HMP annual species are detected in follow up surveys will be the same or greater than the number of wells where these species

were found in baseline surveys” (USFWS, 2017). Year 1 survey results for sand gilia and Monterey spineflower are compared to Success Criteria 2 in the following sections.

### 5.2.1 Sand Gilia

Sand gilia was detected at one out of 33 well locations in 2018 and zero out of 33 well locations in 2017 and 1998. Sand gilia was observed at only two of 33 well locations during past surveys (EW-OU1-53-A in 2006/2007 and MW-OU1-59-A in 2006). Five impact categories were defined in previous FONR rare plant survey reports as follows (HGL, 2018):

1. Rare plant species not detected in any survey – 31 wells  
IW-OU1-02-A<sup>1</sup>, PZ-OU1-02-A1<sup>1</sup>, IW-OU1-10-A<sup>2</sup>, PZ-OU1-10-A1<sup>2</sup>, MW-OU1-26-A,  
MW-OU1-46-A<sup>3</sup>, MW-OU1-46-AD<sup>3</sup>, EW-OU1-49-A<sup>4</sup>, PZ-OU1-49-A1<sup>4</sup>, MW-OU1-50-A,  
EW-OU1-52-A, MW-OU1-57-A, MW-OU1-58-A, EW-OU1-60-A, MW-OU1-61-A, EW-OU1-62-A,  
EW-OU1-63-A, EW-OU1-66-A, MW-OU1-67-A, MW-OU1-68-A, EW-OU1-71-A, EW-OU1-72-A,  
IW-OU1-73-A, IW-OU1-74-A, MW-OU1-82-A, MW-OU1-83-A, MW-OU1-84-A, MW-OU1-85-A,  
MW-OU1-86-A, MW-OU1-87-A, and MW-OU1-88-A
2. Rare plant species detected before but not after well construction – none
3. Rare plant species detected before and after well construction – none
4. Rare plant species detected only after well construction – 2 wells  
EW-OU1-53-A and MW-OU1-59-A
5. Well was constructed before earliest rare plant survey in 1998 – none

Year 1 surveys indicated that the number of wells where sand gilia was detected in 2018 was greater than the number of wells where it was found in baseline surveys (1998 and 2017). OU1 remediation activities did not appear to adversely impact sand gilia populations. Two additional years of monitoring will be completed to more thoroughly evaluate the effect of OU1 remediation activities on sand gilia populations.

### 5.2.2 Monterey Spineflower

Monterey spineflower was detected at 22 out of 33 well locations in 2018, 17 out of 33 well locations in 2017, and 10 out of 33 well locations in 1998. Five impact categories were defined in previous FONR rare plant survey reports as follows (HGL, 2018):

6. Rare plant species not detected in any survey – 6 wells  
IW-OU1-10-A<sup>2</sup>, PZ-OU1-10-A1<sup>2</sup>, MW-OU1-26-A, MW-OU1-68-A, MW-OU1-86-A, and  
MW-OU1-87-A
7. Rare plant species detected before but not after well construction – 2 wells  
EW-OU1-49-A<sup>4</sup> and PZ-OU1-49-A1<sup>4</sup>
8. Rare plant species detected before and after well construction – 9 wells  
EW-OU1-53-A, EW-OU1-60-A, EW-OU1-66-A, MW-OU1-46-A<sup>3</sup>, MW-OU1-46-AD<sup>3</sup>,  
MW-OU1-50-A, MW-OU1-57-A, MW-OU1-61-A, and MW-OU1-84-A

<sup>1, 2, 3, 4</sup> Wells with the same notation were considered one location

9. Rare plant species detected only after well construction – 16 wells  
EW-OU1-52-A, EW-OU1-62-A, EW-OU1-63-A, EW-OU1-71-A, EW-OU1-72-A, IW-OU1-02-A<sup>1</sup>,  
PZ-OU1-02-A1<sup>1</sup>, IW-OU1-73-A, IW-OU1-74-A, MW-OU1-58-A, MW-OU1-59-A, MW-OU1-67-A,  
MW-OU1-82-A, MW-OU1-83-A, MW-OU1-85-A, and MW-OU1-88-A
10. Well was constructed before earliest rare plant survey in 1998 – none

Monterey spineflower was also detected at the NWTS in 2018 and 1998.

Year 1 surveys indicated that the number of wells where Monterey spineflower was detected in 2018 was greater than the number of wells where it was found in baseline surveys (1998 and 2017) despite the lack of Monterey spineflower at two wells where the species was previously recorded. OU1 remediation activities did not appear to adversely impact Monterey spineflower populations overall. Two additional years of monitoring will be completed to more thoroughly evaluate the effect of OU1 remediation activities on Monterey spineflower populations.

### 5.3 Future Work

The 2017 PBO states that, in FONR, “monitoring will be suspended at sites where HMP annuals have not been documented during baseline surveys nor in the first year of follow up surveys” (USFWS, 2017). Year 1 follow up surveys were completed for 33 wells destroyed in 2017. Sand gilia and Monterey spineflower were not observed during baseline or Year 1 surveys at six well locations: IW-OU1-10-A, PZ-OU1-10-A1, MW-OU1-26-A, MW-OU1-68-A, MW-OU1-86-A, and MW-OU1-87-A. These well locations will not be included in Year 2 or Year 3 surveys. Year 2 and Year 3 surveys will include 27 well locations, secondary access routes, and the NWTS.

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<sup>1</sup> Considered one location

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**APPENDIX A**

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**FONR Historical Rare Plant Survey Results**

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Table A-1. Historical Sand Gilia Survey Results Relative to OU1 Well Locations

Well Identification	Year Installed	1998	Harding Lawson Associates Surveys					HydroGeoLogic, Inc. Surveys													Burleson Consulting Inc. Surveys	
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Wells Installed from 1998 - 2001</b>																						
MW-OU1-26-A	1998	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	N	N	
MW-OU1-46-A <sup>(1)</sup>	2001	N	N	N	N	N	N	N	N	N	N	N	N	N	--	--	--	--	N	N	N	N
<b>Wells Installed in 2004 After the Rare Plant Survey</b>																						
MW-OU1-46-AD <sup>(1)</sup>	2004	N	N	N	N	N	N	N	N	N	N	N	N	--	--	--	--	--	N	N	N	N
EW-OU1-49-A <sup>(2)</sup>	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N
PZ-OU1-49-A1 <sup>(2)</sup>	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N
EW-OU1-52-A	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N
EW-OU1-53-A	2004	N	--	--	--	--	--	N	N	SG#21-25; #30	SG#24[16]	--	--	--	--	--	--	--	--	--	N	SG#8[11]; SG#9[91]; SG#10[1]; SG#11[50]
IW-OU1-02-A <sup>(4)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
PZ-OU1-02-A1 <sup>(4)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
IW-OU1-10-A <sup>(3)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	N	--	--	--	--	N	N
<b>Wells Installed in 2004 in Area Not Surveyed</b>																						
MW-OU1-50-A	2004	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-57-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
MW-OU1-58-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
MW-OU1-59-A	2004	N	--	--	--	--	--	--	N	SG#26[13]	N	--	--	--	--	--	--	--	--	--	N	N
<b>Wells Installed in 2005 After the Rare Plant Survey</b>																						
PZ-OU1-10-A1 <sup>(3)</sup>	2005	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
<b>HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey</b>																						
EW-OU1-60-A	2006	N	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	N	N
EW-OU1-62-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
EW-OU1-63-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
EW-OU1-66-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
MW-OU1-61-A	2006	N	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	N	N
MW-OU1-67-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
MW-OU1-68-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	--	N

**Table A-1. Historical Sand Gilia Survey Results Relative to OU1 Well Locations**

Well Identification	Year Installed	1998	Harding Lawson Associates Surveys					HydroGeoLogic, Inc. Surveys													Burleson Consulting Inc. Surveys	
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Wells Installed in 2006 After the Rare Plant Survey</b>																						
EW-OU1-71-A	2006	N	--	--	--	--	--	N	--	N	N	N	N	--	--	--	--	--	--	--	N	N
EW-OU1-72-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	N
IW-OU1-73-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N
IW-OU1-74-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-82-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-83-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-84-A	2006	N	N	N	N	N	N	--	N	N	N	N	N	--	--	--	--	--	--	N	N	N
MW-OU1-85-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-86-A	2006	N	--	--	--	--	--	N	--	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-87-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-88-A	2006	N	--	--	--	--	--	N	--	N	N	N	N	--	--	--	--	--	--	--	N	N
NWTS	2006	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	N

1998-2017 data from Table 3.3 B in the 2017 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results Report by HGL

(1) MW-OU1-46-A, MW-OU1-46-AD, and PZ-OU1-46-AD2 considered to be one location

(2) EW-OU1-49-A and PZ-OU1-49-A1 considered to be one location

(3) IW-OU1-10-A and PZ-OU1-10-A1 considered to be one location

(4) IW-OU1-02-A and PZ-OU1-02-A1 considered to be one location

-- Not Surveyed

IW - Injection Well

PZ - Piezometer

EW - Extraction Well

MW - Monitoring Well

SG - Sand Gilia

HCCP - Hydraulic Control Pilot Project

N - Area surveyed; no rare plants detected

SG#26[13] - Population ID # [number of plants]

**Table A-2. Historical Monterey Spineflower Survey Results Relative to OU-1 Well Locations**

Well Identification	Year Installed	1998	Harding Lawson Associates Surveys					HydroGeologic, Inc. Surveys														Burleson Consulting Inc. Surveys
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Wells Installed from 1998 - 2001</b>																						
MW-OU1-26-A	1998	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
MW-OU1-46-A <sup>(1)</sup>	2001	MS	MS	N	N	MS	MS	N	N	N	N	MS#34[VS]	MS#27[M]	--	--	--	--	--	MS#36[S]	MS#32[ML]	MS#30[S]	MS#39[VS]; MS#40[2]
<b>Wells Installed in 2004 After the Rare Plant Survey</b>																						
MW-OU1-46-AD <sup>(1)</sup>	2004	MS	MS	N	N	MS	MS	N	N	N	N	MS#34[VS]	MS#27[M]	--	--	--	--	--	MS#36[S]	MS#32[ML]	MS#30[S]	MS#39[VS]; MS#40[2]
EW-OU1-49-A <sup>(2)</sup>	2004	MS	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N
PZ-OU1-49-A1 <sup>(2)</sup>	2004	MS	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N
EW-OU1-52-A	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	MS#14[2]; MS#15[2]
EW-OU1-53-A	2004	MS	--	--	--	--	--	N	N	MS#92[S]	MS#52[VS]; MS#53[VS]	--	--	--	--	--	--	--	--	MS#20[ML]	MS#22[2]; MS#23[5]; MS#24[S]; MS#25[2]; MS#26[ML]	
IW-OU1-02-A <sup>(4)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	MS#13[1]
PZ-OU1-02-A1 <sup>(4)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	MS#13[1]
IW-OU1-10-A <sup>(3)</sup>	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
<b>Wells Installed in 2004 in Area Not Surveyed</b>																						
MW-OU1-50-A	2004	MS	--	--	--	--	--	--	MS#21[MH]	N	MS#61[ML]	MS#49[ML]; MS#50[S]	MS#36[S]; MS#4[2]; MS#5[2]	--	--	--	--	--	--	--	MS#21[ML]	MS#53[ML]
MW-OU1-57-A	2004	MS	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	MS#21[ML]	MS#53[ML]
MW-OU1-58-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	MS#21[ML], MS#27[S]	MS#49[2]; MS#50[1]; MS#53[ML]
MW-OU1-59-A	2004	N	--	--	--	--	--	--	MS#153[2]	N	N	--	--	--	--	--	--	--	--	--	MS#22[ML]	MS#53[ML]; MS#56[1]
<b>Wells Installed in 2005 After the Rare Plant Survey</b>																						
PZ-OU1-10-A1 <sup>(3)</sup>	2005	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N
<b>HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey</b>																						
EW-OU1-60-A	2006	MS	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	MS#10[2], MS#11[3], MS#21[ML]	MS#51[S]; MS#52[8]; MS#53[ML]
EW-OU1-62-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	MS#53[ML]
EW-OU1-63-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	MS#21[ML]	MS#53[ML]
EW-OU1-66-A	2006	MS	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	MS#21[ML], MS#27[S], MS#28[S], MS#29[S]	MS#51[S]; MS#53[ML]
MW-OU1-61-A	2006	MS	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	MS#10[2], MS#11[3], MS#21[ML], MS#29[S]	MS#53[ML]

**Table A-2. Historical Monterey Spineflower Survey Results Relative to OU-1 Well Locations**

Well Identification	Year Installed	1998	Harding Lawson Associates Surveys					HydroGeoLogic, Inc. Surveys														Burleson Consulting Inc. Surveys
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
MW-OU1-67-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	MS#27[S]	MS#48[1]; MS#49[2]; MS#50[1]
MW-OU1-68-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N
<b>Wells Installed in 2006 After the Rare Plant Survey</b>																						
EW-OU1-71-A	2006	N	--	--	--	--	--	N	--	N	N	MS#42[S]	N	--	--	--	--	--	--	--	N	N
EW-OU1-72-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	MS#27[2]; MS#28[1]
IW-OU1-73-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	MS#46[1]
IW-OU1-74-A	2006	N	--	--	--	--	--	--	N	N	MS#60[VS]	MS#39[S]	MS#41[S]; MS#33[ML]	--	--	--	--	--	--	--	MS#19[S]	MS#42[1]; MS#43[S]; MS#44[1]; MS#45[1]
MW-OU1-82-A	2006	N	--	--	--	--	--	--	N	N	N	MS#51[ML]	MS#10[2]	--	--	--	--	--	--	--	MS#12[1], MS#24[S], MS#25[S], MS#26[ML]	MS#57[5]; MS#58[5]; MS#59[2]; MS#60[1]; MS#61[S]; MS#62[2]; MS#63[2]; MS#64[S]; MS#65[5]; MS#66[S]; MS#67[1]; MS#68[1]; MS#69[2]; MS#70[S]
MW-OU1-83-A	2006	N	--	--	--	--	--	N	N	N	N	MS#26[1]; MS#46[S] adjacent	MS#23[2]; MS#24[2]; MS#25[1]	--	--	--	--	--	--	--	MS#31[M]	MS#35[6]; MS#36[7]; MS#37[S]; MS#38[M]
MW-OU1-84-A	2006	N	MS	N	N	N	N	--	N	N	MS#58 across road	MS#37[ML]; MS#36[ML] across road	MS#28[M]; MS#15[3]	--	--	--	--	--	--	MS#37[ML]; MS#38[S]	N	MS#41[3]
MW-OU1-85-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	MS#7[1], MS#8[1]	MS#29[2]; MS#30[1]; MS#31[2]; MS#32[2]; MS#33[S]; MS#34[3]
MW-OU1-86-A	2006	N	--	--	--	--	--	N	--	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-87-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	--	--	--	--	N	N
MW-OU1-88-A	2006	N	--	--	--	--	--	N	--	N	N	N	N	--	--	--	--	--	--	--	MS#9[2]	MS#16[3]
NWTS	2006	MS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	MS#47[1]

1998-2017 data from Table 3.3 B in the 2017 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results Report by HGL

- (1) MW-OU1-46-A, MW-OU1-46-AD, and PZ-OU1-46-AD2 considered to be one location
- (2) EW-OU1-49-A and PZ-OU1-49-A1 considered to be one location
- (3) IW-OU1-10-A and PZ-OU1-10-A1 considered to be one location
- (4) IW-OU1-02-A and PZ-OU1-02-A1 considered to be one location

-- Not Surveyed  
 EW - Extraction Well  
 HCCP - Hydraulic Control Pilot Project  
 IW - Injection Well  
 M - Medium  
 MH - Medium High  
 ML - Medium Low  
 MS - Monterey Spineflower  
 MS#49[VS] - Population ID # [density category or number of plants]  
 MW - Monitoring Well  
 N - Area surveyed; no rare plants detected  
 NWTS - Northwest Treatment Center  
 PZ - Piezometer  
 S - Sparse  
 VS - Very Sparse