2020 ANNUAL RARE PLANT SURVEY
Fort Ord Natural Reserve Operable Unit 1, Operable Unit Carbon Tetrachloride Plume, Operable Unit 2, & Fort Ord Dunes State Park Sites 2/12

CONTRACT NO. W91238-14-D-0010
TASK ORDER W9123819F0015

## FORMER FORT ORD

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Woman-Owned Small Business
Environmental Services

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ACRONYMS AND ABBREVIATIONS

|	
Ahtna	Ahtna Environmental, Inc.
BRAC	Base Realignment and Closure Division
Burleson	Burleson Consulting, Inc.
CNDDB	California Natural Diversity Database
CT	Carbon tetrachloride
DD&A	Denise Duffy & Associates
EISB	Enhanced In Situ Bioremediation
FODSP	Fort Ord Dunes State Park
FONR	Fort Ord Natural Reserve
ft	foot/feet
ft^2	square feet
HGL	HydroGeoLogic, Inc.
HMP	Habitat Management Plan
in	inches
NWTS	Northwest Treatment System
OU1	Operable Unit 1
OU2	Operable Unit 2
OUCTP	Operable Unit Carbon Tetrachloride Plume
PBO	Programmatic Biological Opinion
TCE	Trichloroethene
UC	University of California
USACE	United States Army Corps of Engineers

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1. INTRODUCTION

Burleson Consulting Inc. (Burleson) was issued Task Order W9123819F0015 on Contract W91238-14-D-0010 by the United States Army Corps of Engineers (USACE) to survey rare plants in Fort Ord Natural Reserve (FONR) and Fort Ord Dunes State Park at former Fort Ord in Marina, California (see Figure 1-1). This report summarizes the 2020 rare plant survey results for Year 3 surveys in Operable Unit 1 (OU1); Year 2 surveys in Operable Unit Carbon Tetrachloride Plume (OUCTP), Operable Unit 2 (OU2), and Sites 2/12 in Fort Ord Dunes State Park (FODSP); and a reference site survey.

The Fort Ord U.S. Army Base was closed 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. Fort Ord Dunes State Park was established in 2009 when the Army transferred land to California State Parks. Groundwater in the aquifer under FONR and FODSP was contaminated with trichloroethene (TCE), carbon tetrachloride (CT), and other chemicals of concern due to activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area between 1962 and 1985. Groundwater cleanup began in 1988 with the construction of the Groundwater Extraction and Treatment System and is ongoing.

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 that rare plant surveys be conducted for three years after destruction or installation of remediation facilities to ensure that project activities protect and maintain special-status species (USACE, 1997; USFWS, 2015; USFWS, 2017). The two rare plants of concern in FONR and FODSP are sand gilia (*Gilia tenuiflora* ssp. *arenaria*) and Monterey spineflower (*Chorizanthe pungens* var. *pungens*). Yadon's piperia (*Piperia yadonii*) was not initially surveyed but was added to the survey in 2016 at the request of the agencies in accordance with the 2017 PBO.

Burleson was contracted by USACE in 2020 to conduct rare plant surveys at a reference site, OU1 (Year 3), and OUCTP, OU2, and Sites 2/12 (Year 2; see Table 1-1). The OU1 survey area consisted of 27 wells, secondary access routes, and the Northwest Treatment System (NWTS) which were decommissioned in 2017. OU1 Year 1 and 2 surveys were conducted in 2018 and 2019, respectively, by Burleson and baseline surveys (Year 0) were conducted in 2017 by Denise Duffy & Associates (DD&A) as a subcontractor to HydroGeoLogic, Inc. (HGL, 2018; Burleson, 2019). The OUCTP, OU2, and Sites 2/12 survey areas consisted of six wells and secondary access routes; three of which were installed and three of which were decommissioned in 2018. Baseline surveys (Year 0) for OUCTP, OU2, and Sites 2/12 were conducted in 2018 by DD&A as a subcontractor to Ahtna Environmental, Inc (Ahtna, 2018) and Year 1 monitoring was conducted by Burleson in 2019.

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. Additionally, surveys for HMP annuals will not be conducted in areas considered low quality habitat for these species" (USFWS, 2017). During Baseline or Year 1 surveys in the OU1 survey area, sand gilia was observed at two out of 27 wells and Monterey spineflower was observed at all 27 wells and the NWTS. The eight wells located at the northwest edge of FONR (EW-OU1-60-A, EW-OU1-62-A, EW-OU1-63-A, EW-OU1-66-A, MW-OU1-57-A, MW-OU1-58-A, MW-OU1-61-A, MW-OU1-67-A) have been surveyed for rare plants at least seven times since installation, during which sand gilia has never been found (see Appendix A Table A-1). This area is covered with nonnative annual grasses, which makes it low quality habitat for sand

gilia. These well locations and the NWTS were not surveyed for sand gilia in Year 3 surveys but all 27 OU1 well locations, secondary access routes, and the NWTS were surveyed for Monterey spineflower. See Table 1-1 for which wells were surveyed for which species.

During Baseline or Year 1 surveys in the OUCTP, OU2, and Sites 2/12 survey areas, sand gilia was observed at four out of six wells and Monterey spineflower was observed at all six wells. Two of the wells (MW-02-12-180 and MW-BW-29-180) did not have sand gilia in Baseline, nor in Year 1 follow up surveys and their locations are within low quality habitat for this species (see Appendix A Table A-2). These two well locations were not surveyed for sand gilia in Year 2 surveys. Monterey spineflower surveys were completed at all six well locations.
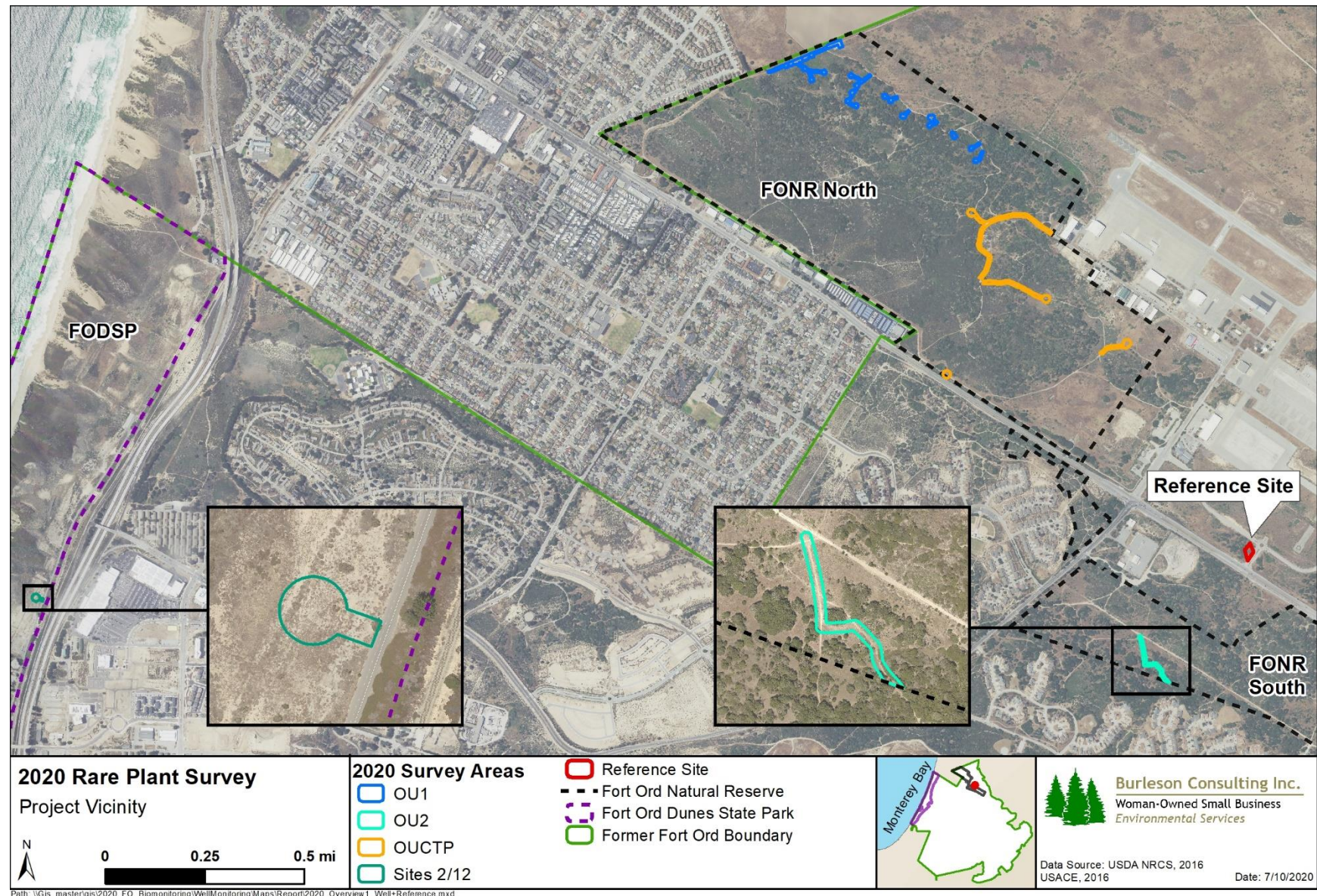
Figure 1-1. Project Vicinity

Table 1-1. Well Locations Surveyed in 2020

Year Decommissioned	Location	Unit	Well Identification	Survey Year
2017	FONR North	OU1	IW-OU1-02-A	3
2017	FONR North	OU1	PZ-OU1-02-A1	3
2017	FONR North	OU1	MW-OU1-46-A	3
2017	FONR North	OU1	MW-OU1-46-AD	3
2017	FONR North	OU1	EW-OU1-49-A	3
2017	FONR North	OU1	PZ-OU1-49-A1	3
2017	FONR North	OU1	MW-OU1-50-A	3
2017	FONR North	OU1	EW-OU1-52-A	3
2017	FONR North	OU1	EW-OU1-53-A	3
2017	FONR North	OU1	MW-OU1-57-A*	3
2017	FONR North	OU1	MW-OU1-58-A*	3
2017	FONR North	OU1	MW-OU1-59-A	3
2017	FONR North	OU1	EW-OU1-60-A*	3
2017	FONR North	OU1	MW-OU1-61-A*	3
2017	FONR North	OU1	EW-OU1-62-A*	3
2017	FONR North	OU1	EW-OU1-63-A*	3
2017	FONR North	OU1	EW-OU1-66-A*	3
2017	FONR North	OU1	MW-OU1-67-A*	3
2017	FONR North	OU1	EW-OU1-71-A	3
2017	FONR North	OU1	EW-OU1-72-A	3
2017	FONR North	OU1	IW-OU1-73-A	3
2017	FONR North	OU1	IW-OU1-74-A	3
2017	FONR North	OU1	MW-OU1-82-A	3
2017	FONR North	OU1	MW-OU1-83-A	3
2017	FONR North	OU1	MW-OU1-84-A	3
2017	FONR North	OU1	MW-OU1-85-A	3
2017	FONR North	OU1	MW-OU1-88-A	3
2017	FONR North	OU1	NWTS[†]*	3
2018 (Installation)	FONR North	OUCTP	MW-BW-93-A	2
2018 (Installation)	FONR North	OUCTP	MW-BW-94-A	2
2018 (Installation)	FONR North	OUCTP	MW-BW-95-A	2
2018	FONR North	OUCTP	MW-BW-29-180*	2
2018	FONR South	OU2	MW-OU2-59-A	2
2018	FODSP	Sites 2/12	MW-02-12-180*	2

* Wells/locations that were not surveyed for sand gilia
† Not considered a well

1.1 Site Location and Description

Fort Ord Natural Reserve is 605 acres of coast live oak woodland, coastal scrub, maritime chaparral, and annual grassland. The property is divided into two parcels: FONR North which contains the OU1 and OUCTP survey areas and FONR South which contains the OU2 survey area. Fort Ord Dunes State Park is approximately 980 acres of beach strand and sand dunes to the southeast of FONR on the coast and contains the Sites 2/12 survey area. FONR and FODSP provide 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; it was included in rare plant surveys beginning in 2016 per agencies request.

1.1.1 Reference Site

The reference site is located southeast of FONR North 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; HGL, 2011). 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 Operable Unit 1 Survey Area (Year 3)

USACE constructed a groundwater extraction and treatment system in 1988 to remediate TCE and other contaminants in OU1. In 2004, 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 aboveground components of the OU1 remediation system were removed by July 2017 (HGL, 2018). Twenty-seven wells decommissioned in 2017 and the NWTS were surveyed for Monterey spineflower in OU1 in the northwestern portion of FONR North (see Figure 1-3). Eight of these wells (MW-OU1-57-A, MW-OU1-58-A, MW-OU1-60-A, MW-OU1-61-A, MW-OU1-62-A, MW-OU1-63-A, MW-OU1-66-A, MW-OU1-67-A) as well as the NWTS, were not surveyed for sand gilia (see Table 1-1).

1.1.3 Operable Unit 2, OUCTP, and Sites 2/12 Survey Areas (Year 2)

Cleanup of groundwater in OUCTP is underway; the chemicals of concern are CT, tetrachloroethene, chloroform, 1,1-dichloroethene, total-1,2-dichloroethene, methylene chloride, vinyl chloride, and TCE. In 2016, the Enhanced In Situ Bioremediation (EISB) Deployment Area was constructed to treat groundwater in OUCTP (Ahtna, 2018). USACE contracted with Ahtna in 2014 to monitor groundwater gradients and implement additional EISB deployment areas if necessary.

Wells in the OUCTP, OU2, and Sites 2/12 survey areas were either decommissioned or installed in 2018 (see Table 1-1 and Figure 1-4). One decommissioned well and three newly installed wells were surveyed in OUCTP in the eastern half of FONR North. The one decommissioned well in OU2 was located in the western half of FONR South just outside the southern FONR property boundary (MW-OU2-59-A); only the secondary access route was surveyed. One decommissioned well was surveyed at Sites 2/12. Sand gilia was not surveyed at well MW-BW-29-180 and Sites 2/12 while Monterey spineflower was surveyed at all six wells (see Table 1-1).
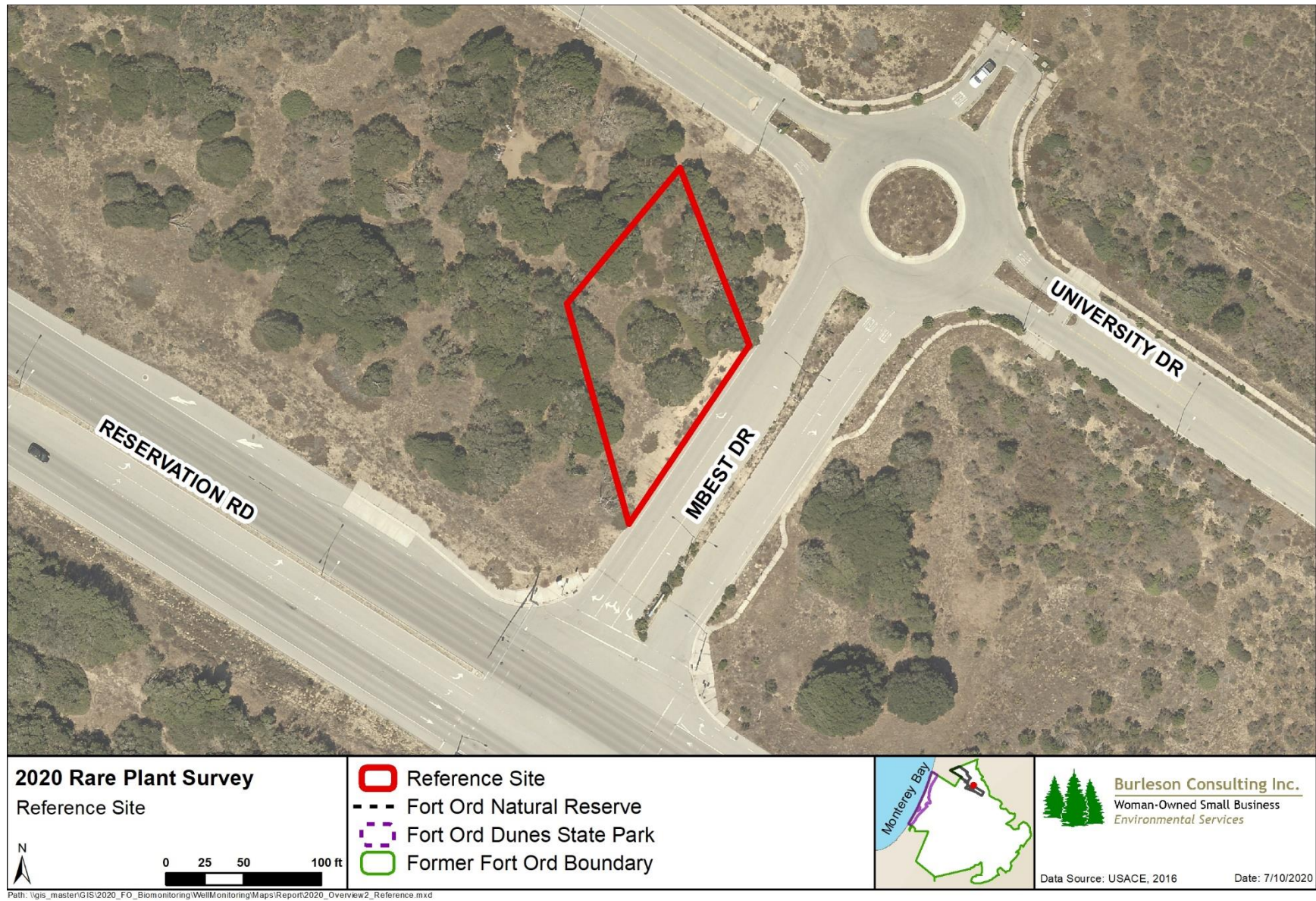
Figure 1-2. Reference Site Overview
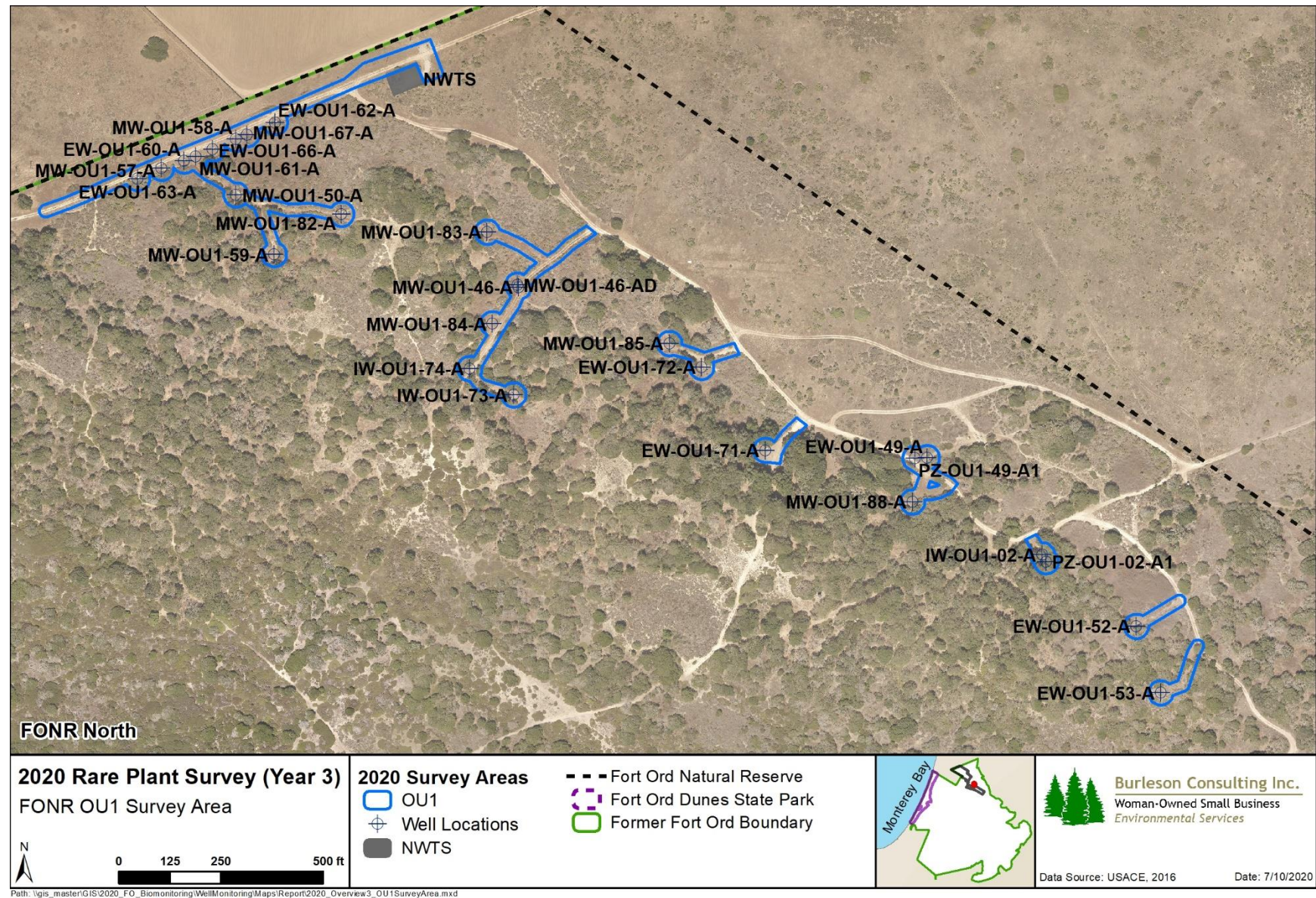
Figure 1-3. OU1 Survey Area Overview
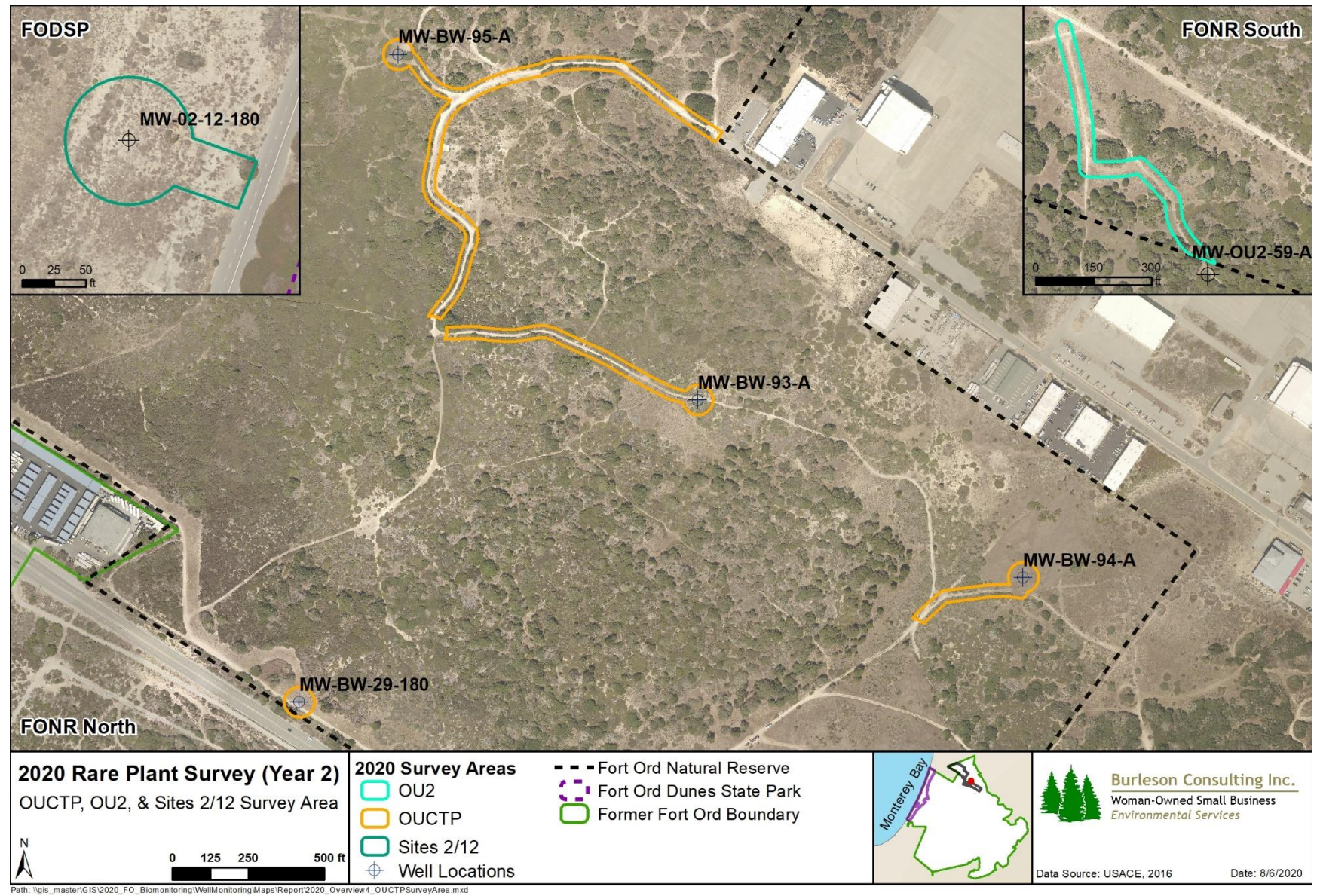
Figure 1-4. OUCTP, OU2, and Sites 2/12 Survey Area Overview

1.2   Special Status Species

1.2.1   Sand Gilia

Sand gilia is a native annual herb in the phlox family (Polemoniaceae). It is listed as state Threatened and federally Endangered (CNDDB, 2020). 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 (in) 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 (CNDDB) lists 28 occurrences in Monterey County, four of which are extirpated (CNDDB, 2020).

1.2.2   Monterey Spineflower

Monterey spineflower is a native annual herb in the buckwheat family (Polygonaceae). It is listed as federally Threatened (CNDDB, 2020). 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*) and Fort Ord spineflower (*Chorizanthe minutiflora*) except that diffuse spineflower has yellow-throated white flowers and an upright inflorescence and Fort Ord spineflower has very small greenish white flowers barely exserted from the calyx (Yeager and Mitchell, 2016) . The CNDDB lists 39 occurrences of Monterey spineflower in Monterey County, two of which are possibly extirpated, and one which is extirpated (CNDDB, 2020).

1.2.3   Yadon's Piperia

Yadon's piperia is a native perennial herb in the orchid family (Orchidaceae). It is listed as federally Endangered (CNDDB, 2020). 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 CNDDB lists 26 occurrences in Monterey County, one of which is possibly extirpated (CNDDB, 2020).

1.3   Survey Objectives

The objectives of the 2020 rare plant surveys (Year 2 and Year 3) were to:

1. Identify locations and estimate populations of select rare plants at a reference site near FONR.
2. Identify locations and estimate populations of select rare plants at twenty-seven 2017 well destruction sites, secondary access routes, and the NWTS in FONR (Year 3).
3. Identify locations and estimate populations of select rare plants at three 2018 well destruction sites, three 2018 well installation sites, and secondary access routes in FONR and FODSP (Year 2).
4. Map sand gilia, Monterey spineflower, and Yadon's piperia populations for comparison to past surveys and to inform future management activities.
5. Assess results with respect to Success Criteria specified in the 2017 PBO. Those are:
   5.1. Densities and acreage of HMP annual species are within a normal range compared with information from reference sites, and
   5.2. 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.

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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 and the Base Realignment and Closure (BRAC) biologist. 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 BRAC office so that the BRAC biologist 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. For OU1, rare plants were considered within the survey area if they were within a 30 foot (ft) radius of a well location or within 10 ft of secondary access routes and the NWTS (see Figure 1-3). For OUCTP, OU2, and Sites 2/12, rare plants were considered within the survey area if they were within a 50 ft radius of a well location or within 20 ft of secondary access routes (see Figure 1-4). 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 ft 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* and conversations with DD&A biologists, we considered populations discrete if there was a gap of greater than three feet between individuals (HGL, 2017). Populations 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 individuals were only counted 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 were exported from the GPS unit to shapefile format and were projected into NAD 1983 State Plane California IV FIPS 0404 (US Feet) using ArcGIS 10.8 software (ESRI, 2020). Polygons were manually cleaned to remove loop backs along edges and individual points were buffered to one foot.

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3. RESULTS

3.1   Sand Gilia

Sand gilia was surveyed on April 10, 14, 15, and 17, 2020. The following sections describe sand gilia populations mapped within the reference site and OU1, OUCTP, and OU2 survey areas.

3.1.1   Reference Site

Sand gilia was present at the reference site in 2020. Nineteen populations of sand gilia (10 points and nine polygons) were mapped (see Figure 3-1 and Appendix B Table B-1). The populations totaled 875 individuals and occupied 979 square feet (ft^2).

3.1.2   Operable Unit 1 (Year 3)

Sand gilia was present at one out of 19 wells surveyed within the OU1 survey area (well EW-OU1-53-A). Eight populations of sand gilia (four points and four polygons) were mapped (see Figures 3-2 and 3-7 and Appendix B Table B-2). The populations totaled 306 individuals and occupied 471 ft^2.

3.1.3   OUCTP and Operable Unit 2 (Year 2)

Sand gilia was present at two out of three wells surveyed within the OUCTP survey area and along the access route in the OU2 survey area (see Figures 3-3, 3-8 through 3-11, 3-14, and Appendix B Table B-3). Forty-four populations of sand gilia (26 points and 18 polygons) totaling 1,953 individuals and occupying 1,923 ft^2 were mapped in the OUCTP survey area. Eight populations of sand gilia (two points and six polygons) totaling 1,012 individuals and occupying 1,223 ft^2 were mapped in the OU2 survey area.

3.2   Monterey Spineflower

Monterey spineflower was surveyed at all sites on May 11-15, 18, and 19, 2020. The following sections describe Monterey spineflower populations mapped within the reference site and OU1, OUCTP, OU2, and Sites 2/12 survey areas.

3.2.1   Reference Site

Monterey spineflower was present at the reference site in 2020. Eight Monterey spineflower populations (one point and seven polygons) occupying 3,687 ft^2 were mapped (see Figure 3-1 and Appendix B Table B-4). Of the seven populations represented by polygons, two were Very Sparse (less than three percent cover), four were Sparse (3-25 percent cover), and one was Medium Low (26-50 percent cover).

3.2.2   Operable Unit 1 (Year 3)

Monterey spineflower was present at the NWTS and at 21 out of 27 wells within the OU1 survey area (see Figures 3-2, 3-4 through 3-7, and Appendix B Table B-5). Ninety-nine populations (53 points and 46 polygons) occupying 37,441 ft^2 were mapped within the OU1 survey area. Of the 46 populations represented by polygons, 18 were Very Sparse, 24 were Sparse, and four were Medium Low.

3.2.3   OUCTP, Operable Unit 2, and Sites 2/12 (Year 2)

Monterey spineflower was present at four wells in the OUCTP survey area, along the OU2 access route, and at one well surveyed at Sites 2/12 (see Figures 3-3, 3-8 through 3-15, and Appendix B Table B-6). One hundred fifty-one populations (66 points and 85 polygons) occupying 120,149 ft^2 were mapped within the OUCTP survey area. Of the 85 populations represented by polygons, 29 were Very Sparse, 49 were Sparse, and seven were Medium Low.

Fifteen populations (four points and 11 polygons) occupying 50,399 ft^2 were mapped within the OU2 survey area. Of the 11 populations represented by polygons, six were Very Sparse and five were Sparse.

Three populations (1 point and 2 polygons) occupying 326 ft^2 were mapped within the Sites 2/12 survey area. Of the two populations represented by polygons, one was Very Sparse and one was Sparse.

3.3   Yadon's Piperia

Yadon's piperia was surveyed simultaneously with sand gilia and Monterey spineflower. No individuals were observed at the reference site or within the 2020 survey areas. Yadon's piperia will not be discussed in the remainder of this report.
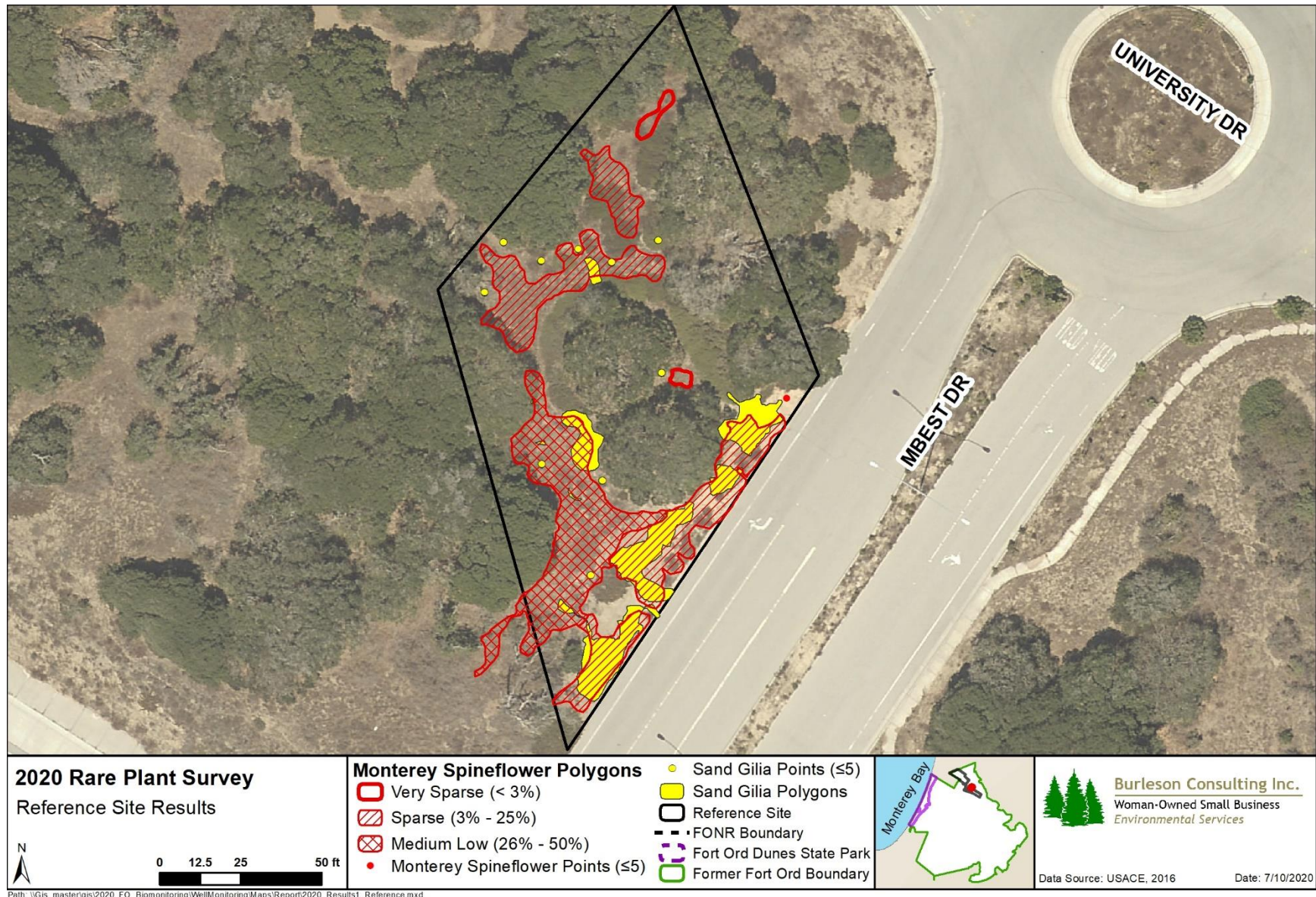
Figure 3-1. 2020 Reference Site Rare Plant Populations
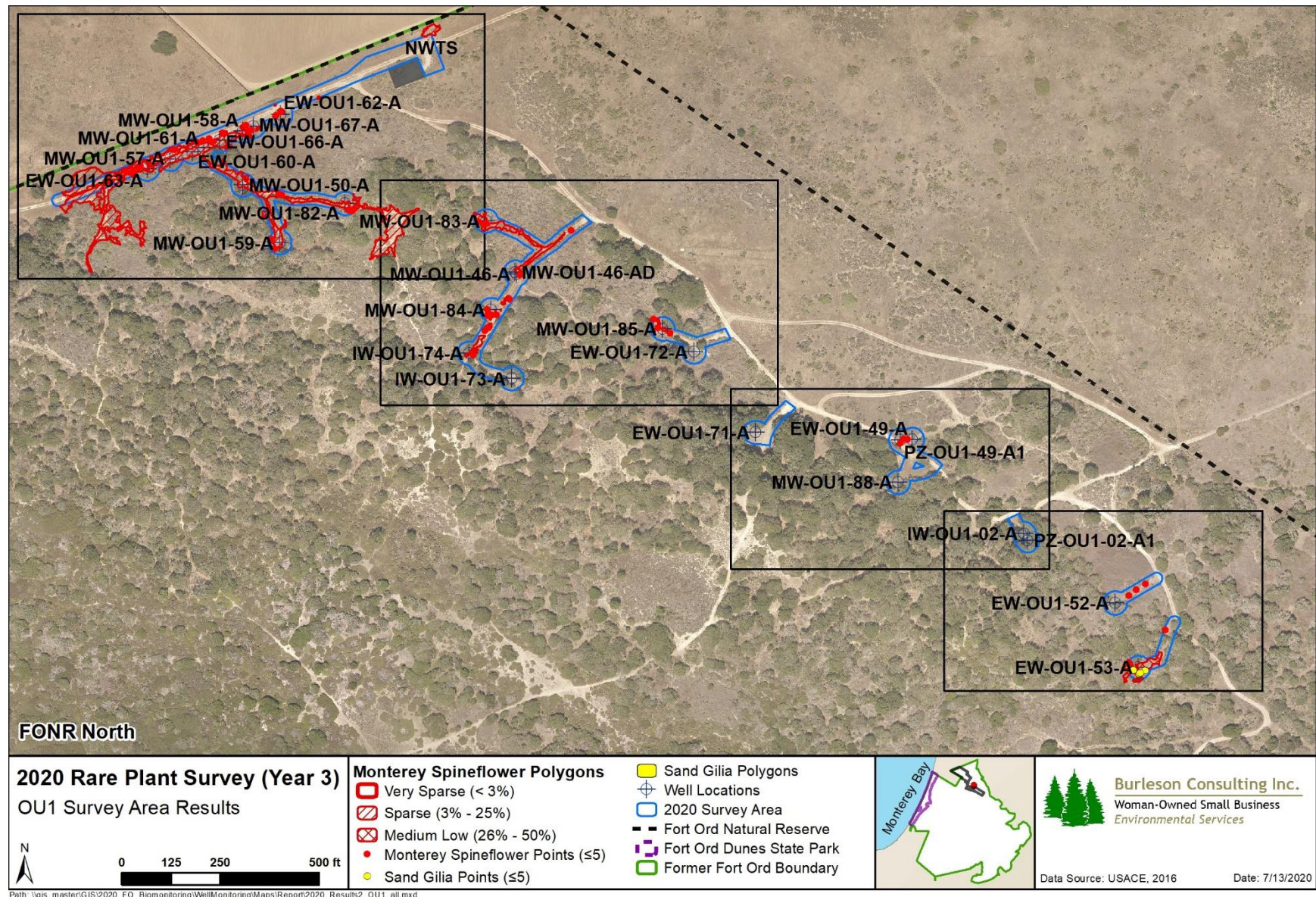
Figure 3-2. 2020 OU1 Survey Area Rare Plant Populations Overview
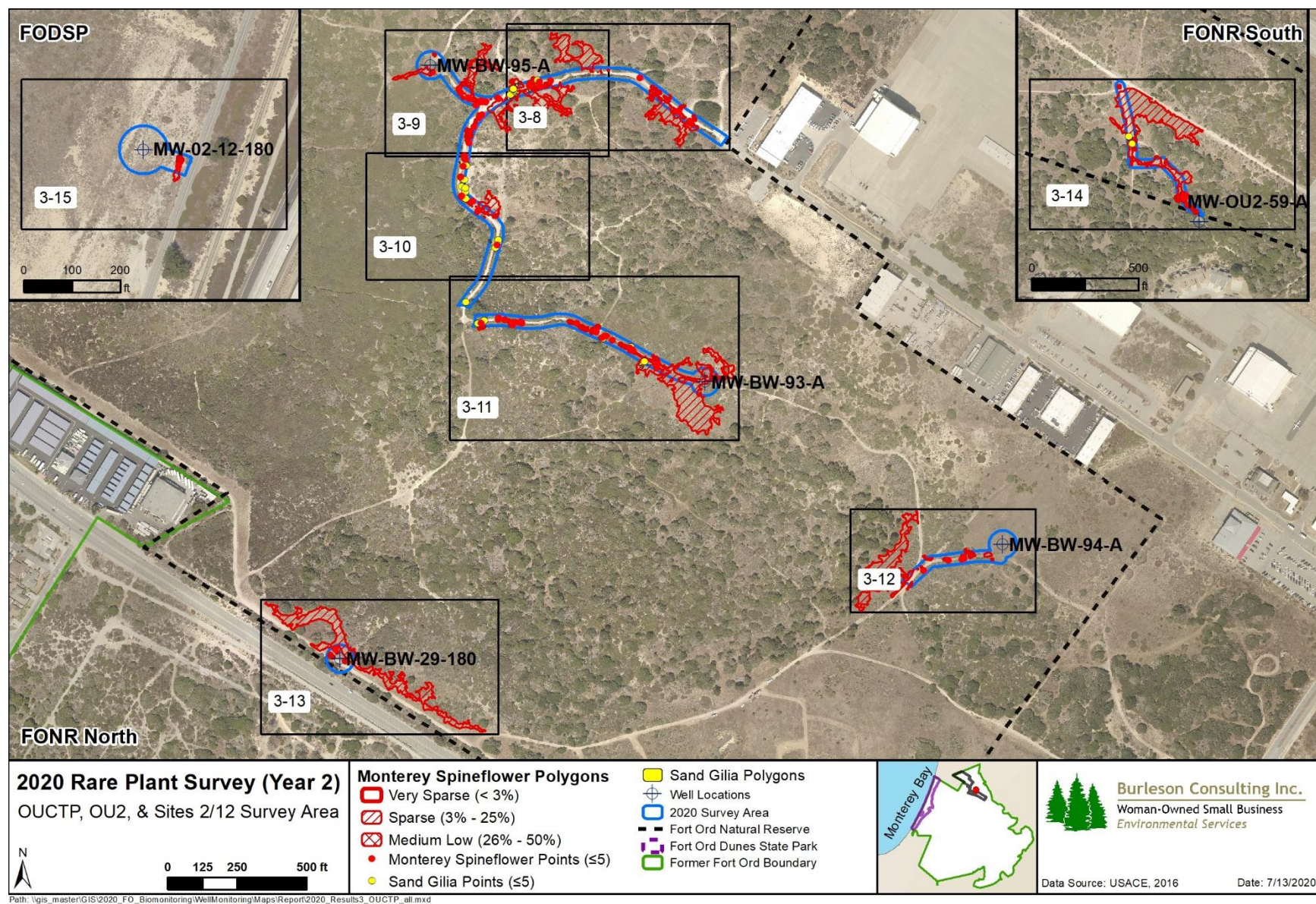
Figure 3-3. 2020 OUCTP, OU2, and Sites 2/12 Survey Area Rare Plant Populations Overview
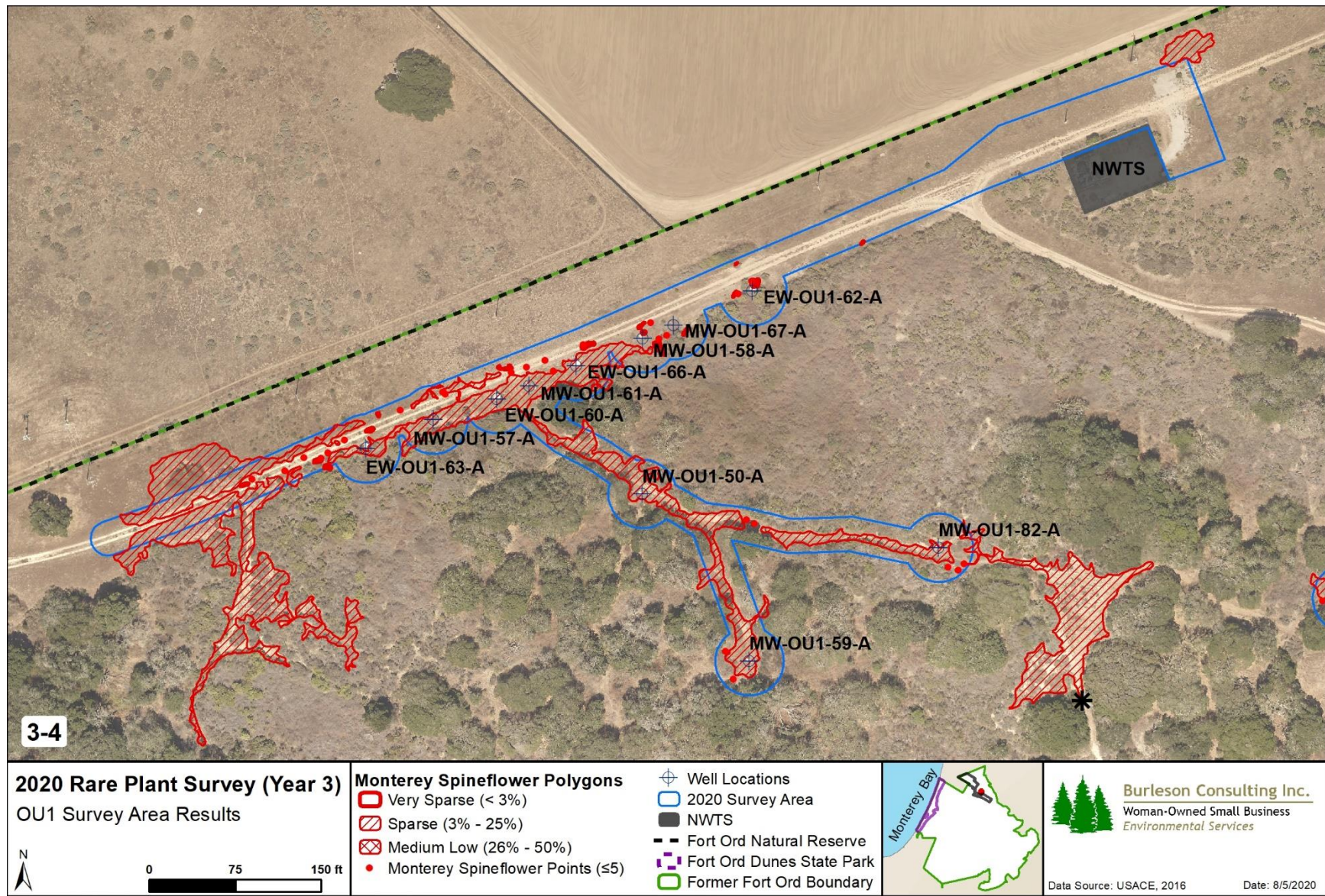
Figure 3-4. 2020 OU1 Survey Area Monterey Spineflower Populations. *The 2020 survey ended at the asterisk to match 2019 methodology
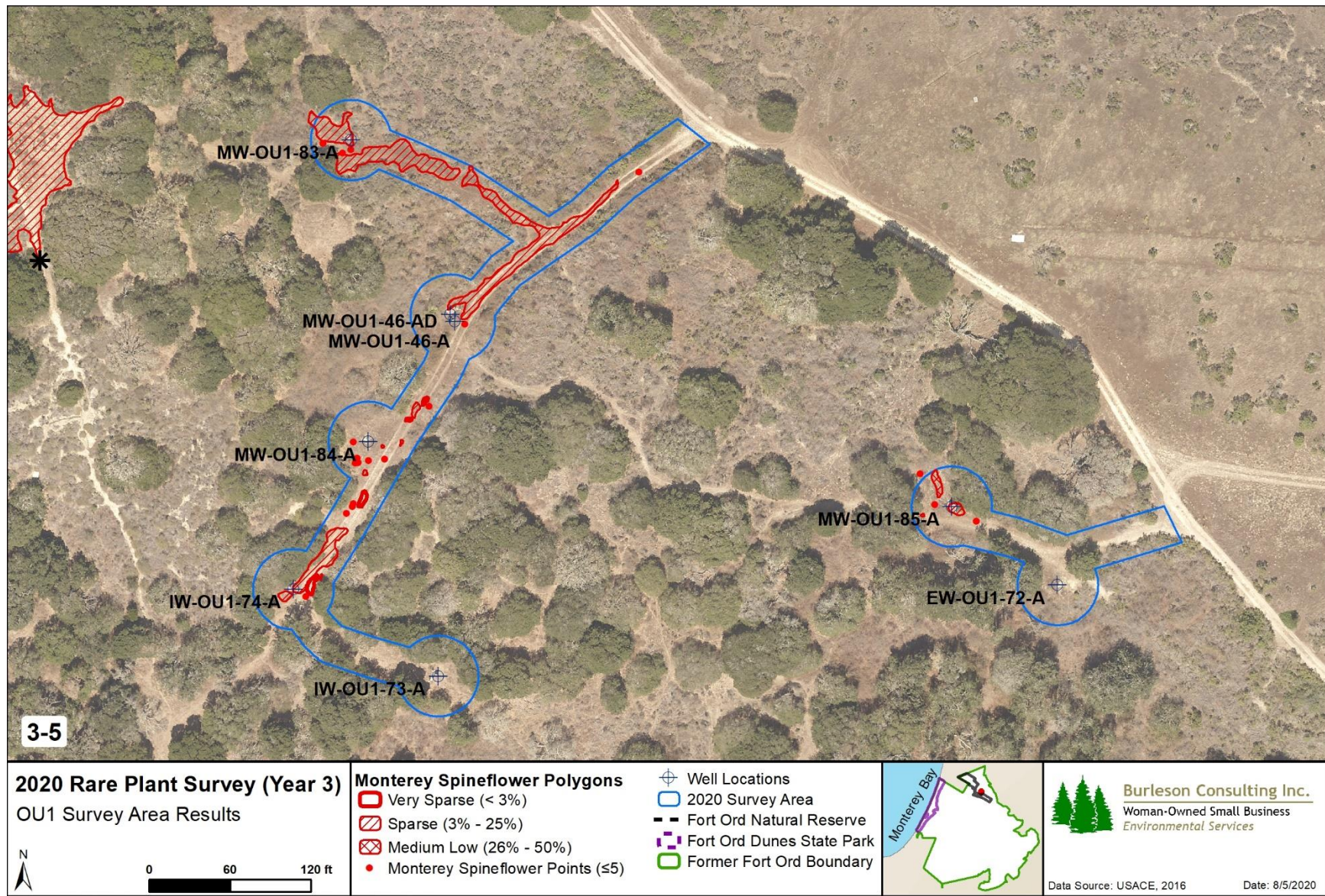
Figure 3-5. 2020 OU1 Survey Area Monterey Spineflower Populations. *The 2020 survey ended at the asterisk to match 2019 methodology

Figure 3-6. 2020 OU1 Survey Area Monterey Spineflower Populations
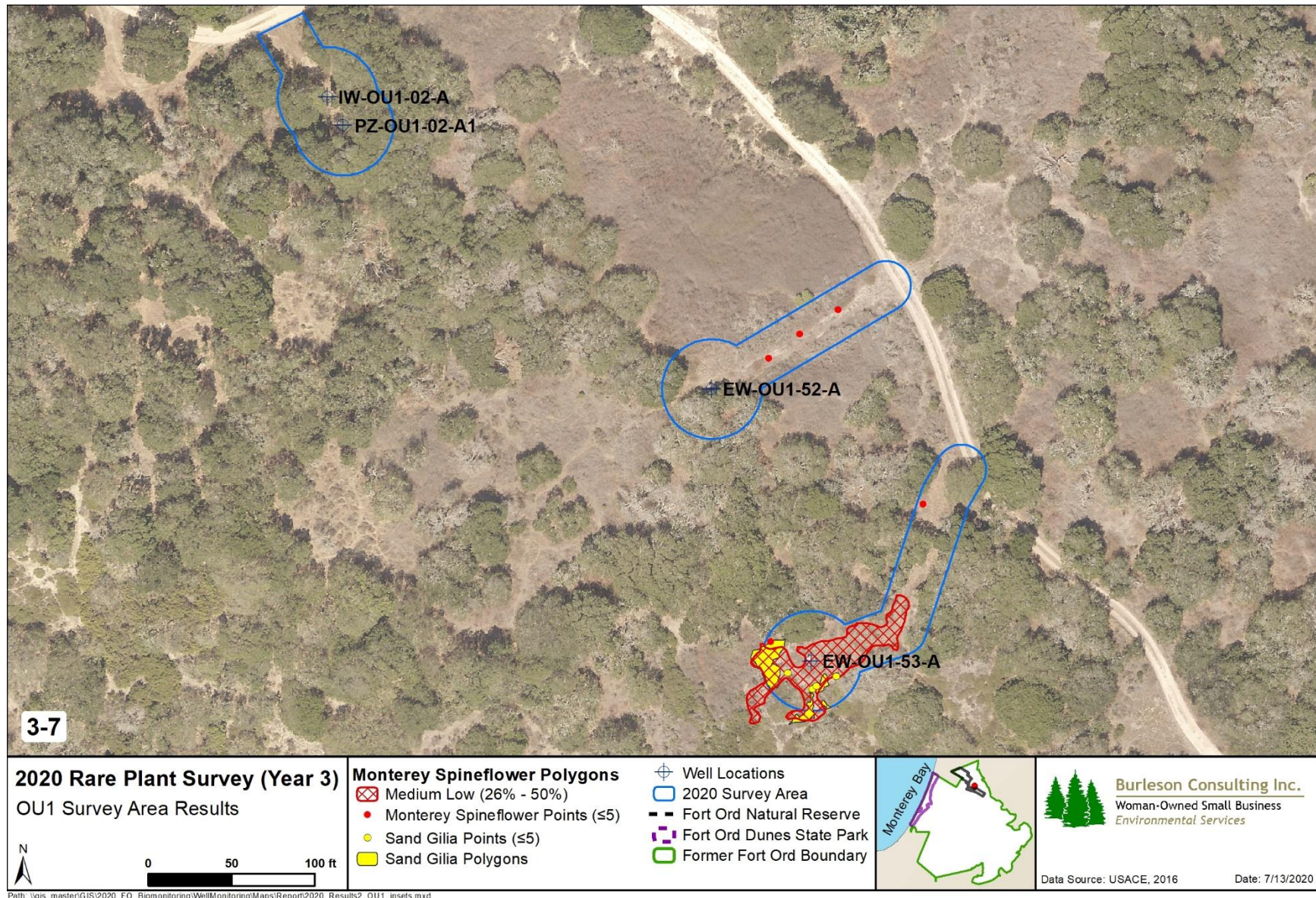
Figure 3-7. 2020 OU1 Survey Area Sand Gilia and Monterey Spineflower Populations
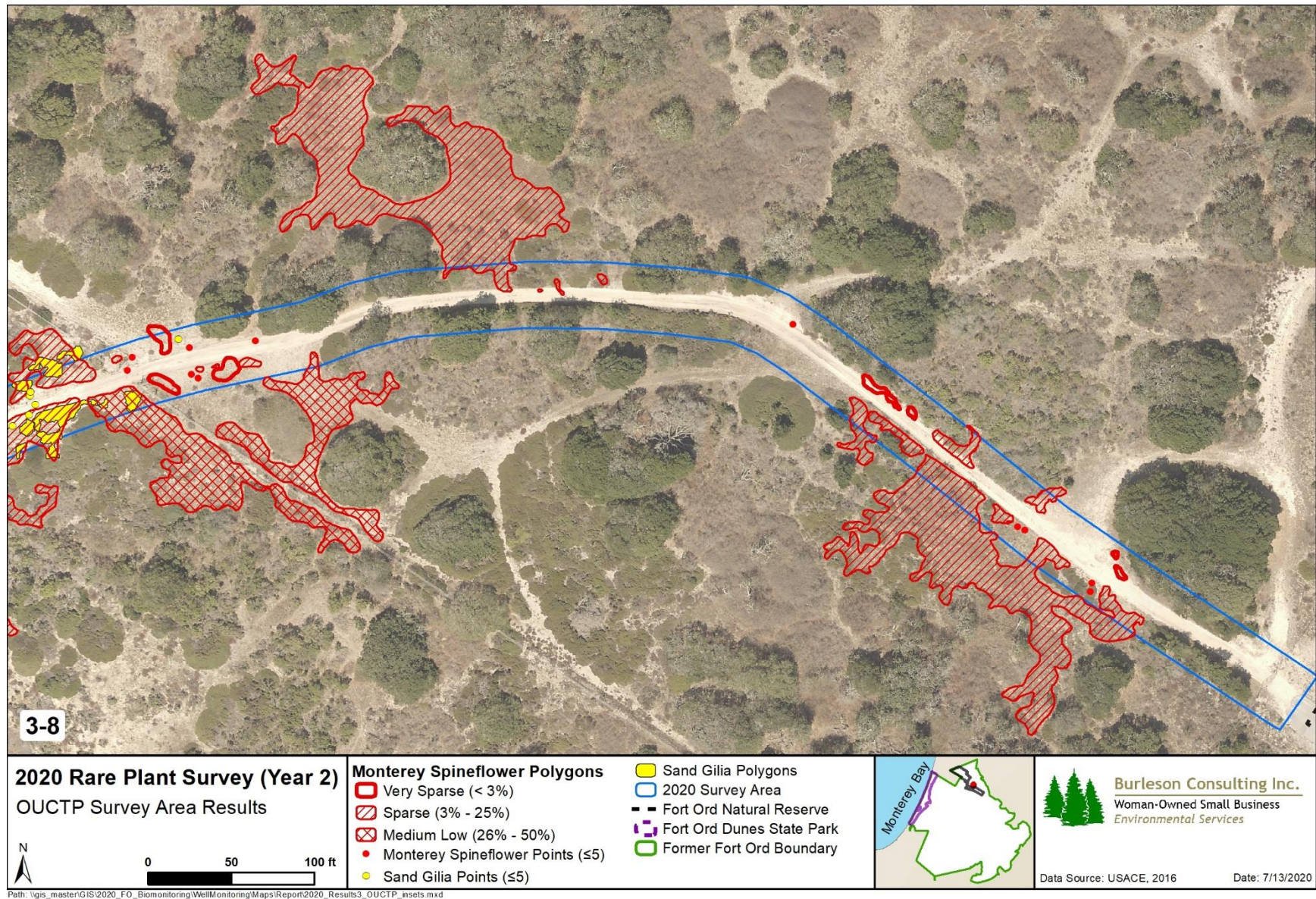
Figure 3-8. 2020 OUCTP Survey Area Sand Gilia and Monterey Spineflower Populations
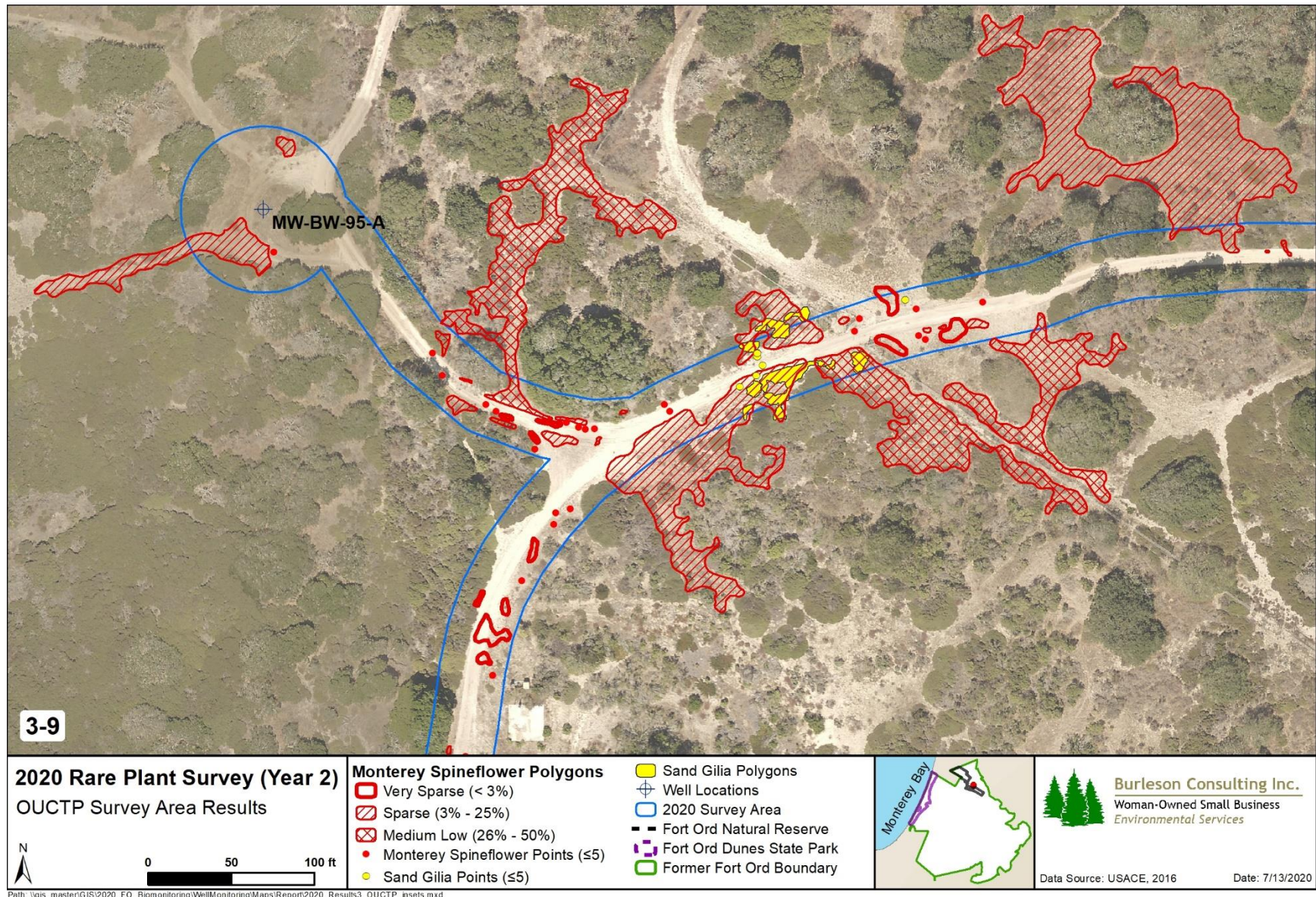
Figure 3-9. 2020 OUCTP Survey Area Sand Gilia and Monterey Spineflower Populations
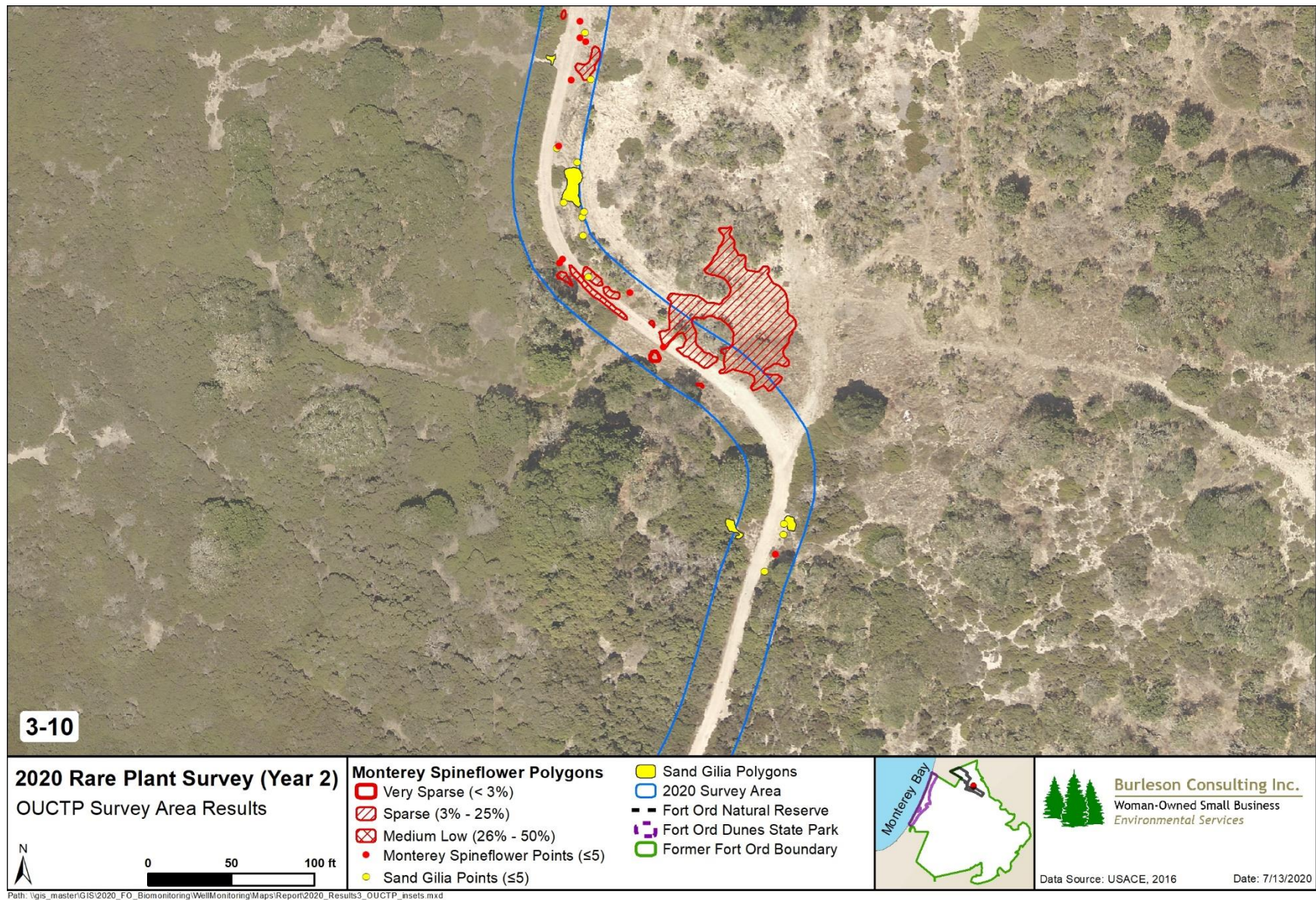
Figure 3-10. 2020 OUCTP Survey Area Sand Gilia and Monterey Spineflower Populations
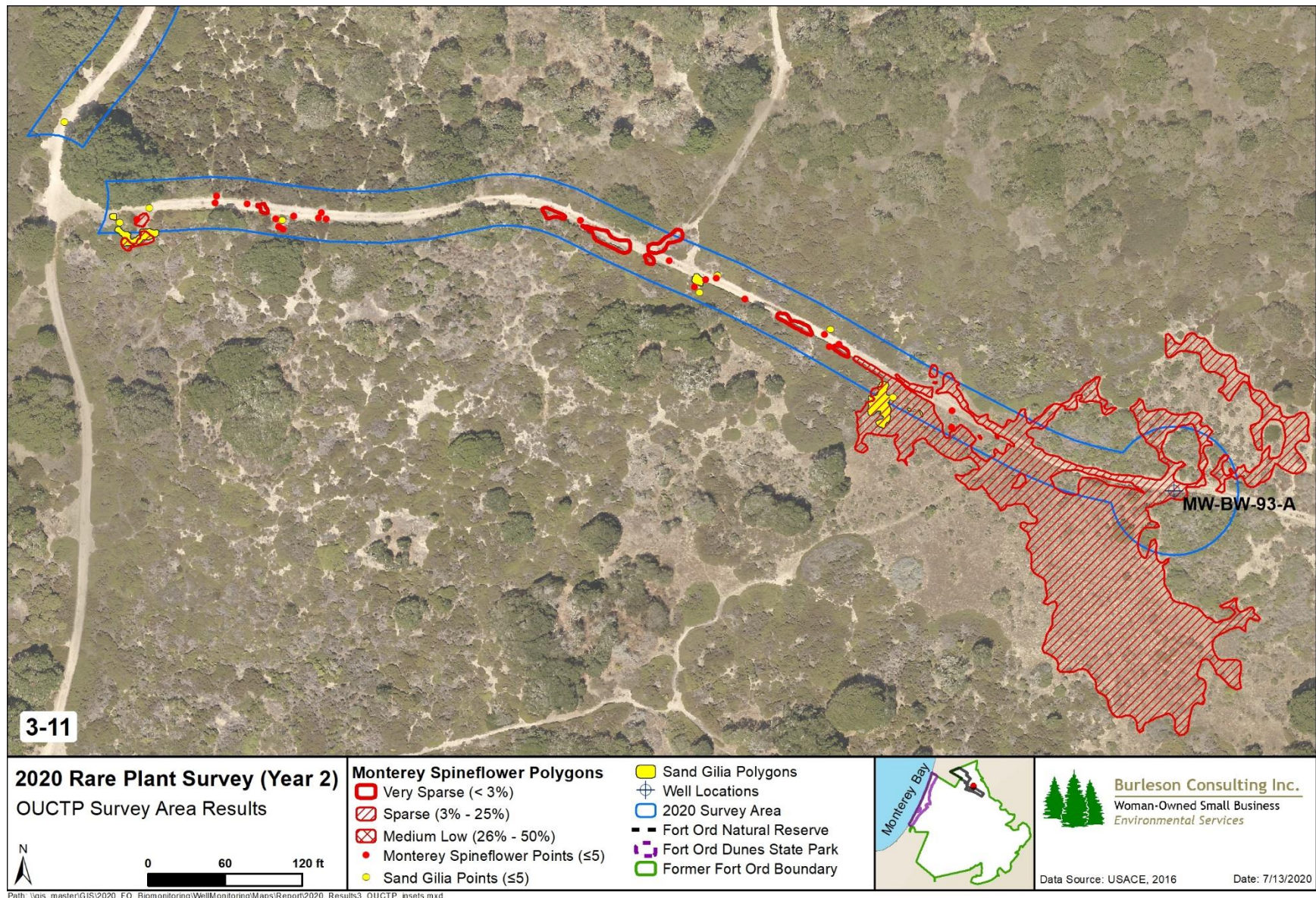
Figure 3-11. 2020 OUCTP Survey Area Sand Gilia and Monterey Spineflower Populations
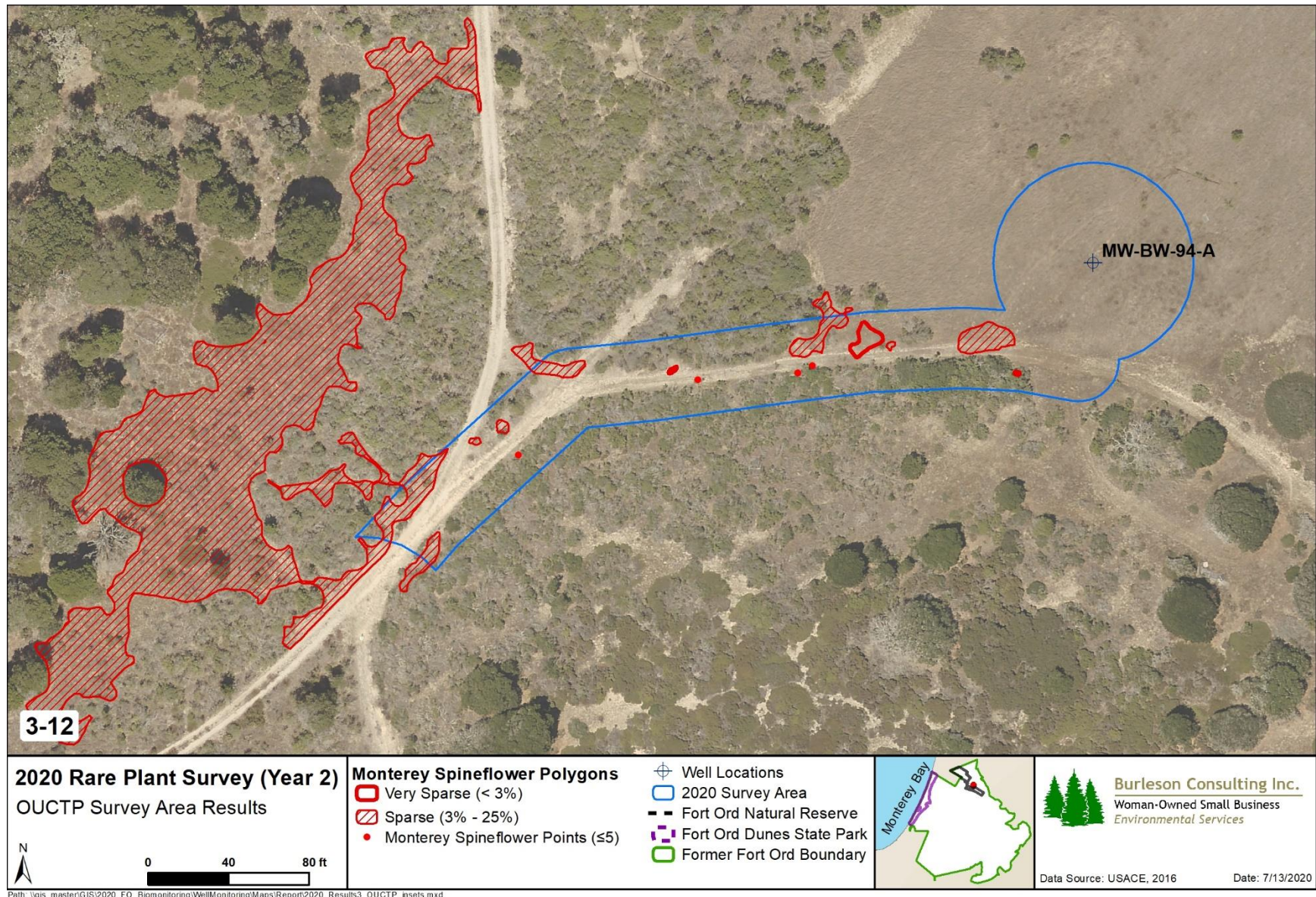
Figure 3-12. 2020 OUCTP Survey Area Sand Gilia and Monterey Spineflower Populations
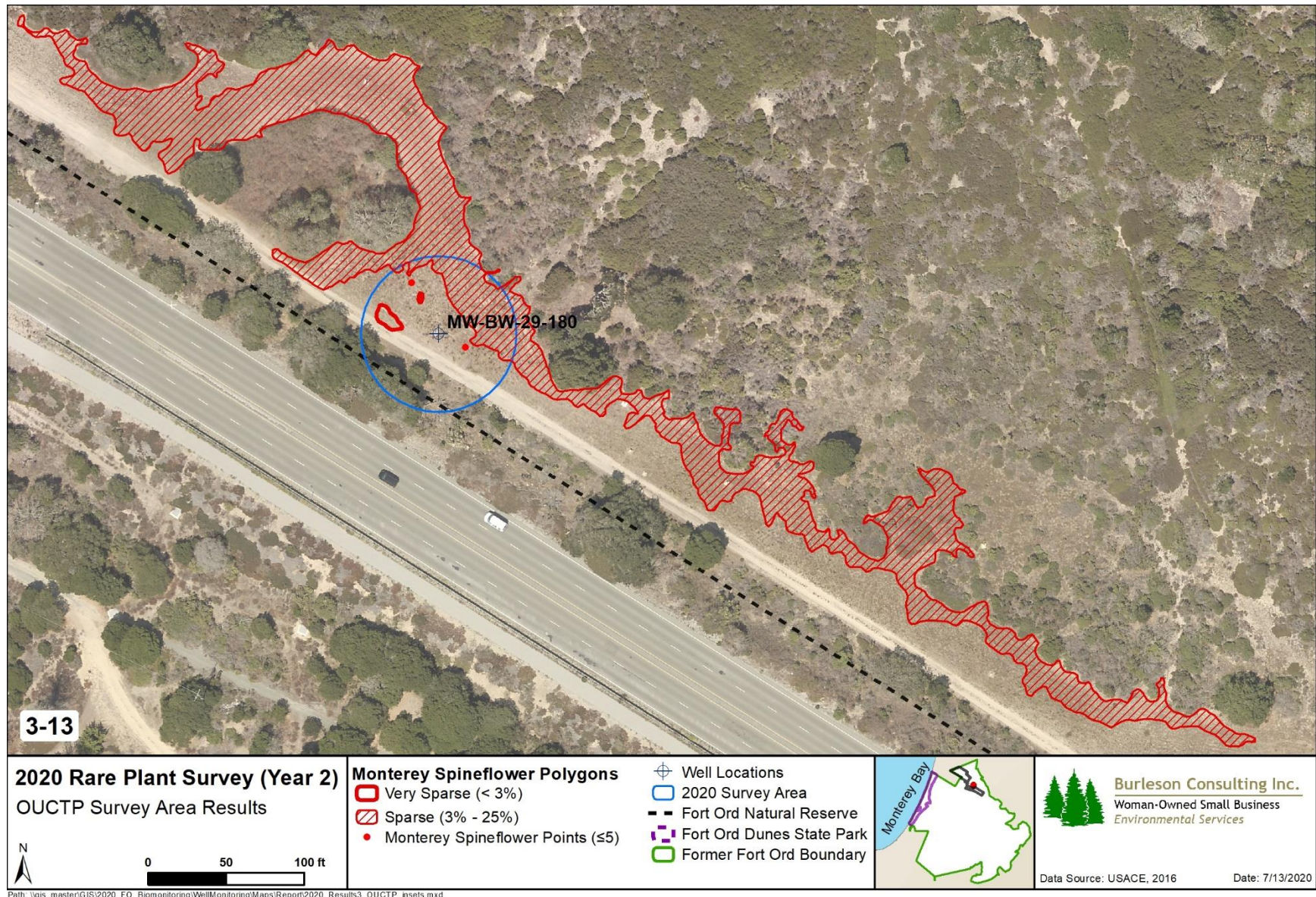
Figure 3-13. 2020 OUCTP Survey Area Monterey Spineflower Populations
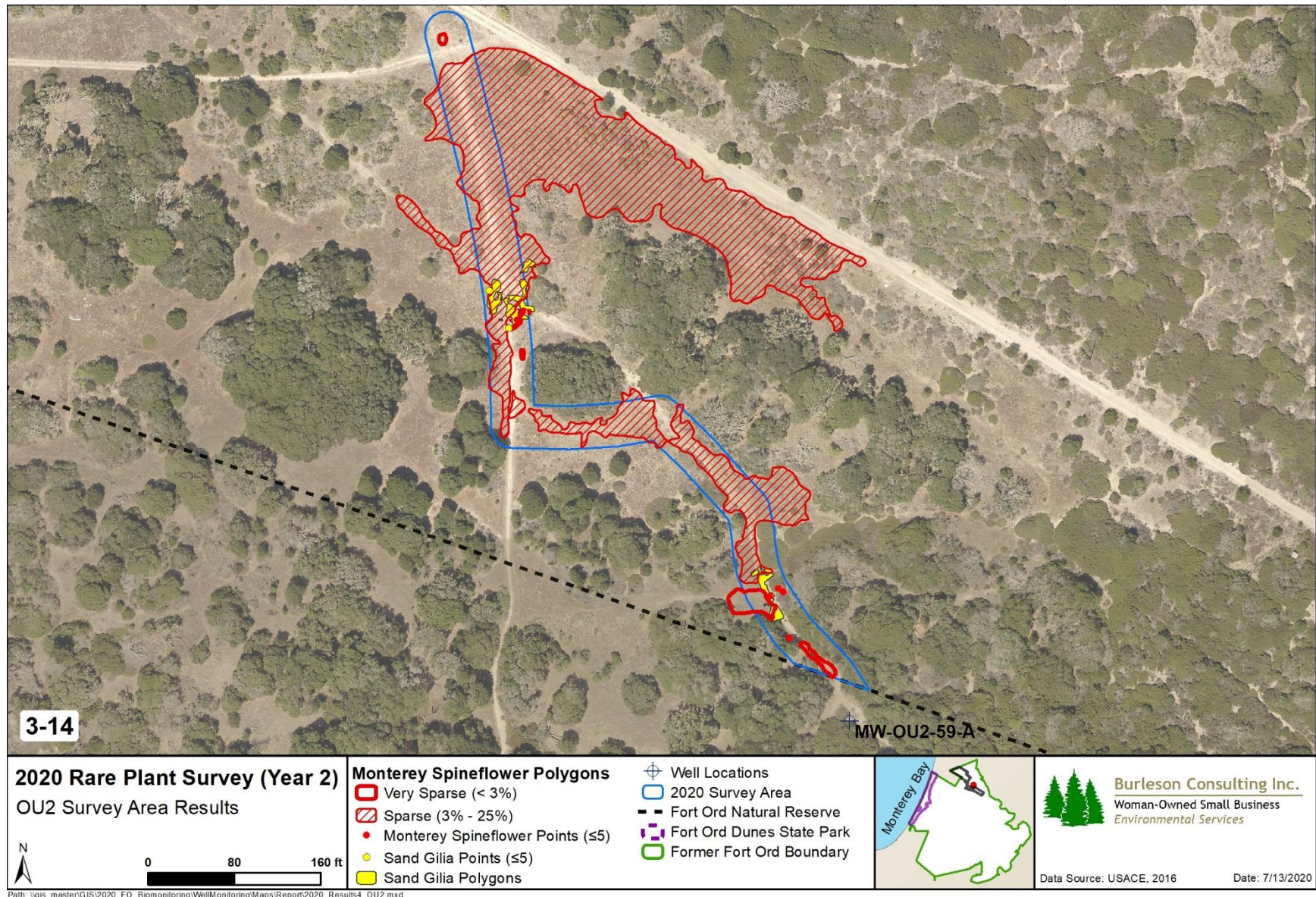
Figure 3-14. 2020 OU2 Survey Area Sand Gilia and Monterey Spineflower Populations
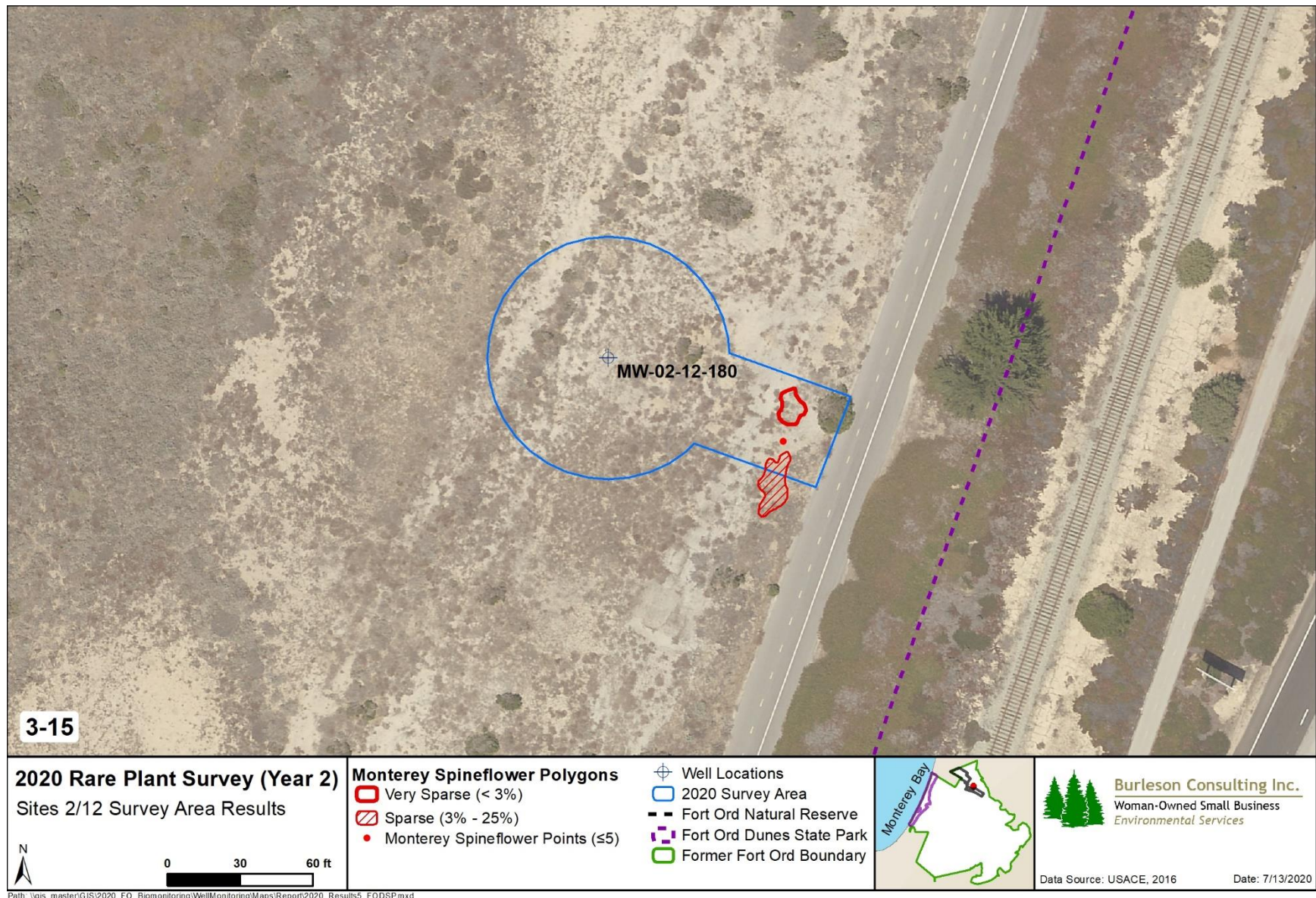
Figure 3-15. 2020 Sites 2/12 Survey Area Monterey Spineflower Populations

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4. DISCUSSION

Rare plant surveys are conducted for three years after a disturbance occurs during the remediation effort as required by the HMP and the 2017 PBO (USACE, 1997; USFWS, 2017). The 2020 surveys were Year 3 follow up surveys for wells decommissioned in 2017 and Year 2 surveys for wells decommissioned or installed in 2018 (HGL, 2018; Ahtna, 2018). For OU1, rare plants were mapped if they were within a 30 ft radius of a well location or within 10 ft of secondary access routes and the NWTS. For OUCTP, OU2, and Sites 2/12, rare plants were mapped if they were within a 50 ft radius of a well location or within 20 ft of secondary access routes.

4.1 Sand Gilia

4.1.1 Reference Site

At the reference site, sand gilia decreased by 10,594 individuals from 2019 to 2020 but the number of individuals observed in 2020 is approximately double what was observed in both 2017 and 2018 (see Table 4-1). Last year's seed set may have contributed to relatively high numbers in 2020 compared to 2017 and 2018.

Sand gilia populations naturally vary from year to year. 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). Over the last four years, reference site populations do not seem to have fluctuated consistently with the total amount of precipitation in a water year (see Figure 4-1). For example, cumulative precipitation in 2017 and 2019 was comparable (22.92 in and 21.97 in, respectively) but populations differed by 11,006 individuals. Populations also do not seem to fluctuate consistently with winter (October – January) or spring (February – May) cumulative precipitation (see Tables 4-1 and 4-2).

The lack of consistent correlations between cumulative, seasonal precipitation and sand gilia abundance suggests that month to month variations in precipitation may play a larger role in population dynamics at the reference site. The marked decrease in population from 2019 to 2020 could potentially be explained by the difference in January and February rainfall between the two years (January and February are the two months during which most plants would be starting to germinate; Dorrell-Canepa, 1994). In 2019, 3.18 in and 7.75 in of precipitation fell in January and February, respectively. In 2020, 1.18 in and zero inches fell during the same months, respectively (see Table 4-3). Perhaps the much lower amount of rainfall during January and February of 2020 hindered germination compared to 2019.

Table 4-1. Sand Gilia Populations within the Reference Site from 2017-2020

Year	Total Populations	Individual Plants	Indiv. Plants % Δ from Prev. Year	Points	Polygons	Area (ft^2)	Area % Δ from Prev. Year
2017	8	463	-	6	2	1,950	-
2018	7	321	-31%	1	6	1,102	-43%
2019	19	11,469	3,473%	8	11	2,541	131%
2020	19	875	-92%	10	9	979	-61%
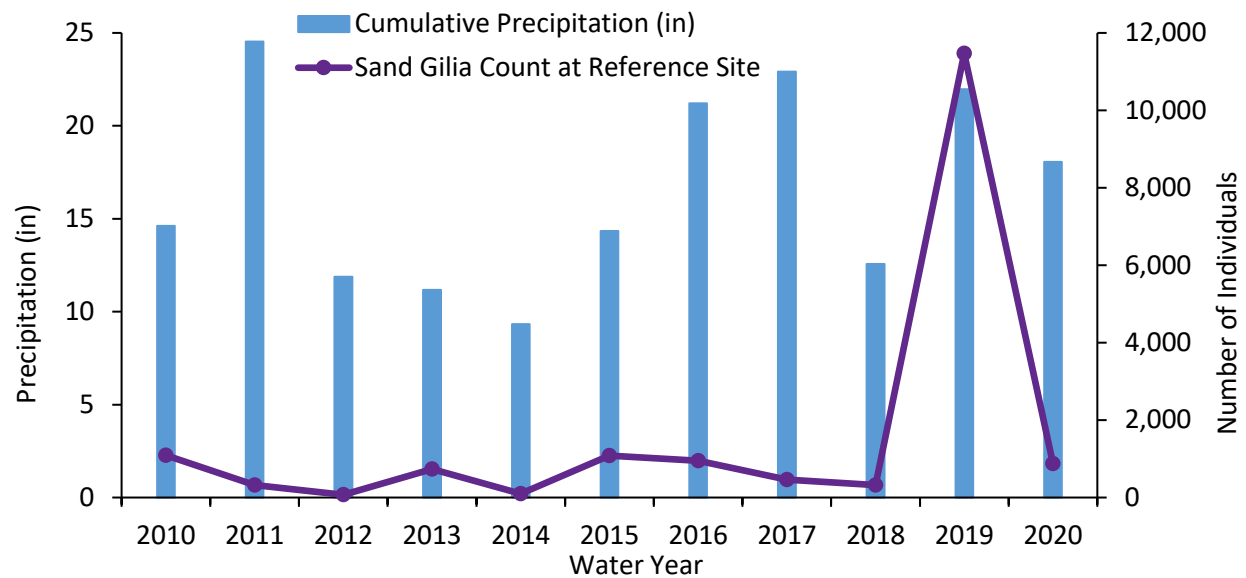
Precipitation data from NPS, 2020; 2010-2017 rare plant data from HGL, 2018.

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

Table 4-2. Precipitation for 2017-2020 and Average Precipitation from 1981-2010

Timeframe	Precipitation (in)				
	2017	2018	2019	2020	Average (1981-2010)[†]
Water Year (Cumulative)	22.92	12.57	21.97	18.08	17.84
Winter (October-January)	13.05	5.01	8.04	9.36	9.18
Spring (February-May)	9.77	7.53	13.82	8.68	8.23
Dry Season (June-September)	0.10	0.03	0.11	0.04	0.43

2017 - 2020 precipitation from NPS, 2020

† Average precipitation from NOAA, 2020

Table 4-3. Wet Season Precipitation from 2017-2020

Month	Precipitation (in)			
	2017	2018	2019	2020
October	2.73	0.14	0.20	0.02
November	1.32	1.23	2.82	1.60
December	1.51	0.20	1.84	6.56
January	7.49	3.44	3.18	1.18
February	6.17	0.35	7.75	0
March	2.33	4.74	3.25	5.99
April	1.24	2.33	0.35	2.28
May	0.03	0.11	2.47	0.41

2017 - 2020 precipitation from NPS, 2020

4.1.2   Operable Unit 1 (Year 3)

Sand gilia was observed at one well within the OU1 survey area in 2020. Sand gilia decreased by 2,856 individuals at well EW-OU1-53-A from 2019 (Year 2) to 2020 (Year 3) but was double the population observed in 2018 (Year 1; see Tables 4-4 and 4-5). No sand gilia was found in the OU1 survey area in 2017 and it was observed at only two of 33 well locations during historical 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 Table A-1.

In 2019, Sand gilia populations at the reference site and throughout FONR were markedly higher than in previous monitoring years. The substantial decrease in individual plants between 2019 and 2020 was consistent between the reference site (Table 4-1) and the OU1 survey area (Table 4-4).

Table 4-4. Sand Gilia Populations within the OU1 Survey Area from 2017-2020

Year	Total Populations	Indiv. Plants	Indiv. Plants % Δ from Prev. Year	Points	Polygons	Area (ft^2)	Area % Δ from Prev. Year
2017 (Year 0)	0	0	-	0	0	0	-
2018 (Year 1)	4	153	-	1	3	573	-
2019 (Year 2)	10	3,162	1,967%*	2	8	456	-20%
2020 (Year 3)	8	306	-90%	4	4	471	3%

*The 2019 Rare Plant Survey report listed this value at 1,960%. The correct value is 1,967%.

Table 4-5. OU1 Monterey Spineflower and Sand Gilia Populations by Well Surveyed from 2017-2020

Well Identification	Discrete Monterey Spineflower Populations (No. Individuals or Cover Class)				Discrete Sand Gilia Populations (No. Individuals)			
	2017	2018	2019	2020	2017	2018	2019	2020
IW-OU1-02-A; PZ-OU1-02-A1*	0	1	1	0	0	0	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	1, S	2, S	0	0	0	0
EW-OU1-49-A; PZ-OU1-49-A1*	0	0	1	1, 1, 1	0	0	0	0
MW-OU1-50-A	ML	ML	S	S	0	0	0	0
EW-OU1-52-A	0	2, 2	1, 3	1, 1, 4	0	0	0	0
EW-OU1-53-A	ML	2, 2, 5, S, ML	1, ML	1, 5, ML	0	1, 11, 50, 91	4, 5, 11, 14, 23, 53, 100, 195, 1077, 1680	2, 2, 2, 4, 6, 20, 110, 160
MW-OU1-57-A	ML	ML	1, 1, 2, S, S, S	1, 1, 1, 3, S, S, S, S, S	0	0	0	-
MW-OU1-58-A	S, ML	1, 2, ML	1, 1, 2, 3, S	1, 3, S, VS, VS, VS	0	0	0	-
MW-OU1-59-A	ML	ML, 1	1, 1, 2, S, S, S	1, 5, S	0	0	0	0
EW-OU1-60-A	2, 3, ML	3, 8, S, ML	1, S, VS	S, S, S, VS	0	0	0	-
MW-OU1-61-A	2, 3, S, ML	ML	1, 4, S, S, VS	1, 1, 2, S, VS	0	0	0	-
EW-OU1-62-A	0	1	1, 1, 1, 2, 2, 3, 3, 4, S	1, 3, ML, VS, VS, VS	0	0	0	-

Table 4-5. OU1 Monterey Spineflower and Sand Gilia Populations by Well Surveyed from 2017-2020

Well Identification	Discrete Monterey Spineflower Populations (No. Individuals or Cover Class)				Discrete Sand Gilia Populations (No. Individuals)			
	2017	2018	2019	2020	2017	2018	2019	2020
EW-OU1-63-A	ML	ML	1, 1, 1, 1, 1, 2, 3, 3, 4, 4, 4, 4, S, S, S, VS	1, 1, 2, 2, 5, 5, S, S, S, S, S, VS, VS, VS, VS, VS	0	0	0	-
EW-OU1-66-A	S, S, S, ML	S, ML	1, 1, 1, 1, 2, 3, 4, 4, S, S, S	1, 2, VS, S, S	0	0	0	-
MW-OU1-67-A	S	1, 1, 2	1, 1, 1, 3, VS	3, VS	0	0	0	-
MW-OU1-68-A	0	0	-	-	0	0	-	-
EW-OU1-71-A	0	0	3	0	0	0	0	0
EW-OU1-72-A	0	2, 1	1, 1	0	0	0	0	0
IW-OU1-73-A	0	1	0	0	0	0	0	0
IW-OU1-74-A	S	1, 1, 1, S	1, 1, 1, 2, 3, 4, 4, 5, S, S, S, S	3, 4, 5, 5, ML, S, S, VS, VS	0	0	0	0
MW-OU1-82-A	1, S, S, ML	1, 1, 1, 2, 2, 2, 2, 5, 5, 5, S, S, S, S	2, 2, 3, 4, S, S	1, 1, 2, 3, 3, S, S	0	0	0	0
MW-OU1-83-A	M	6, 7, S, M	1, 1, 1, 1, 3, S, VS	1, 2, 3, 3, S, S, S	0	0	0	0
MW-OU1-84-A	0	3	1, 1, 4	1, 1, 2, 2, 2, 3, 5, S, S, S, S, VS, VS	0	0	0	0
MW-OU1-85-A	1, 1	1, 2, 2, 2, 3, S	1, 3, 3, 3, S, S, S	1, 1, ML, S, S	0	0	0	0

Table 4-5. OU1 Monterey Spineflower and Sand Gilia Populations by Well Surveyed from 2017-2020

Well Identification	Discrete Monterey Spineflower Populations (No. Individuals or Cover Class)				Discrete Sand Gilia Populations (No. Individuals)			
	2017	2018	2019	2020	2017	2018	2019	2020
MW-OU1-86-A	0	0	-	-	0	0	-	-
MW-OU1-87-A	0	0	-	-	0	0	-	-
MW-OU1-88-A	2	3	0	0	0	0	0	0
NWTS	0	1	1, 2, 5, S	S	0	0	0	-

2017 data from Table 3.3 B in the *2017 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* report (HGL, 2018)

* Wells considered to be one location	M - Medium	PZ - Piezometer
- Not Surveyed	ML - Medium Low	S -Sparse
EW - Extraction Well	MW - Monitoring Well	VS - Very Sparse
IW - Injection Well	NWTS - Northwest Treatment System	

4.1.3 OUCTP, Operable Unit 2, and Sites 2/12 (Year 2)

Sand gilia decreased by 10,587 individuals from 2019 (Year 1) to 2020 (Year 2) within the OUCTP survey area (see Tables 4-6 and 4-7). Sand gilia decreased by 872 individuals along the access route within the OU2 survey area. In the 2018 Baseline survey (Year 0), sand gilia was only observed at two wells within the OUCTP survey area and along the OU2 access route (Ahtna, 2018). Sand gilia was observed at three of four OUCTP wells in 2019 and two of three wells in 2020. Historically, from 1998 to 2010, sand gilia was observed multiple times at MW-BW-93-A and MW-BW-95-A wells and secondary access routes. Sand gilia was observed along the MW-OU2-59-A access route in 1998 and 2010 and once at MW-BW-29-180 in 1998. Sand gilia was not observed in historical surveys at MW-02-12-180 at Sites 2/12 or at well MW-BW-94-A. Historical survey results are summarized in Appendix A Table A-2. Wells MW-BW-29-180 and MW-02-12-180 at Sites 2/12 were not surveyed in 2020 as no sand gilia was found during baseline or Year 1 surveys. However, if sand gilia had been observed during Monterey spineflower surveys at these locations, occurrences would have been recorded.

Table 4-6. Sand Gilia Populations within the OUCTP, OU2, & Sites 2/12 Survey Areas from 2018-2020

Location	Year	Total Populations	Individual Plants	Indiv. Plants % Δ from Prev. Year	Points	Polygons	Area (ft^2)	Area % Δ from Prev. Year
OUCTP	2018 (Year 0)	11	75	-	7	4	79	-
	2019 (Year 1)	73	12,540	16,620%	43	30	3,574	4,424%
	2020 (Year 2)	44	1,953	-84%	26	18	1,923	-46%
OU2	2018 (Year 0)	9	19	-	8	1	25	-
	2019 (Year 1)	28	1,884	9,816%	13	15	1,200	4,700%
	2020 (Year 2)	8	1,012	-46%	2	6	1,223	2%
Sites 2/12	2018 (Year 0)	0	0	-	0	0	0	-
	2019 (Year 1)	0	0	-	0	0	0	-
	2020* (Year 2)	NS	NS	-	NS	NS	-	-

*Sand gilia occurrences at Sites 2/12 would have been recorded if found during 2020 Monterey spineflower surveys
NS – Not Surveyed

Table 4-7. OU2, OUCTP, & Sites 2/12 Monterey Spineflower and Sand Gilia Populations by Well Surveyed from 2018-2020

Well Identification	Discrete Monterey Spineflower Populations (No. Individuals or Cover Class)			Discrete Sand Gilia Populations (No. Individuals)		
	2018	2019	2020	2018	2019	2020
MW-BW-93-A	1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 3, 3, 3, 3, VS, VS, S, S, S, S, S, ML	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, S, S, S, S, S, S, S, S, S, S, VS, VS	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 5, 5, 5, ML, S, S, S, S, S, S, S, S, VS, VS, VS, VS, VS, VS, VS	2, 2, 2, 11	1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 5, 6, 6, 10, 14, 18, 20, 27, 34, 69, 96, 160, 250, 1464	1, 1, 1, 3, 3, 3, 5, 6, 9, 32, 37, 66, 144, 672
MW-BW-94-A	1, 1, VS, VS, VS, VS, VS, S, S, S, ML	1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 4, S, S, S, S, S, S, S, S, S, S	1, 1, 2, 3, S, S, S, S, S, S, S, S, VS, VS, VS	0	34	0
MW-BW-95-A	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 4, 4, S, S, S, S, S, S, S, S, S, S, S, S, S, ML, ML, ML, ML	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, ML, ML, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, VS, VS, VS, VS, VS, VS, VS, VS	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, ML, ML, ML, ML, ML, ML, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, S, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS, VS	1, 1, 1, 4, 15, 15, 21	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 6, 7, 26, 26, 45, 63, 122, 145, 167, 187, 590, 591, 862, 937, 952, 5529	1, 1, 1, 1, 1, 1, 2, 2, 3, 3, 3, 3, 4, 4, 4, 5, 5, 5, 5, 9, 9, 13, 16, 20, 24, 67, 80, 80, 140, 458
MW-BW-29-180	S	1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 4, S	1, 1, S, VS, VS	0	0	-

Table 4-7. OU2, OUCTP, & Sites 2/12 Monterey Spineflower and Sand Gilia Populations by Well Surveyed from 2018-2020

Well Identification	Discrete Monterey Spineflower Populations (No. Individuals or Cover Class)			Discrete Sand Gilia Populations (No. Individuals)		
	2018	**2019**	**2020**	**2018**	**2019**	**2020**
MW-OU2-59-A	1, 1, 3, S, S, S, S, S, S, S, S, ML	1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 4, 4, 4, 5, 5, S, S, S, S, S, S, S, S, S, S, S, S, VS	1, 1, 2, 5, S, S, S, S, S, VS, VS, VS, VS, VS, VS	1, 1, 2, 2, 2, 2, 3, 5, 7	1, 1, 1, 1, 2, 2, 3, 3, 3, 3, 5, 5, 5, 6, 10, 12, 13, 20, 21, 27, 27, 36, 45, 62, 71, 222, 569, 708	1, 1, 6, 22, 61, 127, 259, 535
MW-02-12-180	S, S, S	1, 1, 3, S, VS	1, S, VS	0	0	-

2018 data from the GIS data deliverable for the *2018 Annual Rare Plant Survey for the Ahtna Monitoring Wells and Enhanced in situ Bioremediation (EISB) Deployment Area at the Operable Unit Carbon Tetrachloride Plume (OUCTP)* report (Ahnta, 2018).

- Not Surveyed	ML – Medium Low	S – Sparse
M – Medium	MW – Monitoring Well	VS – Very Sparse

4.2   Monterey Spineflower

4.2.1   Reference Site

At the reference site, Monterey spineflower populations increased by 642 ft^2 from 2019 to 2020 (see Table 4-8). The 2020 reference site populations followed approximate distributions of previous years and occupied the largest area recorded since 2017. Monterey spineflower typically germinates more readily in dry years than in wet years and survival to maturity is facilitated by spring rainfall (Fox *et al*, 2006). Both 2018 and 2020 saw larger areas of Monterey spineflower than in 2017 and 2019 at the reference site. These increases in area correlate to less cumulative precipitation for the water year in 2018 and 2020 compared to 2017 and 2019 (see Table 4-2 and Figure 4-2). Additionally, the spacing of winter and spring rain events could play a role in spineflower distribution at the reference site and at FONR. During 2018 and 2020, there was little to no precipitation recorded during the month of February, followed by more significant precipitation during the months of March and April. In 2017 and 2019, however, there was considerable precipitation during February and much less during March and April (see Table 4-3).

Table 4-8. Monterey Spineflower Populations within the Reference Site from 2017-2020

| Year | Total Populations | Points | Polygons per Density Class | | | Area (ft^2) | Area % Δ from Prev. Year |
			Very Sparse	Sparse	Medium Low		
2017	4	0	0	3	1	2,855	-
2018	4	1	2	1	0	3,556	25%
2019	18	11	0	6	1	3,045	-14%
2020	8	1	2	4	1	3,687	21%
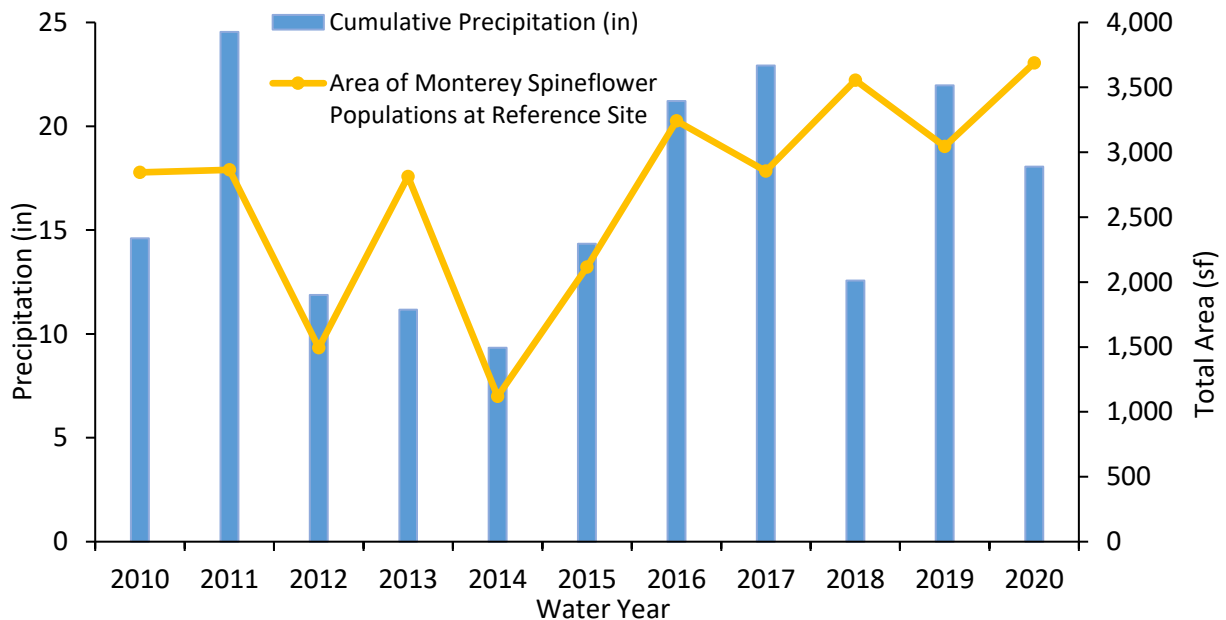
Precipitation data from NPS, 2020; 2010-2017 rare plant data from HGL, 2018.

Figure 4-2. Area of Monterey Spineflower Populations at the Reference Site versus Annual Precipitation

4.2.2   Operable Unit 1 (Year 3)

Within the OU1 survey area, Monterey spineflower populations increased by 3,486 ft^2 from 2019 (Year 2) to 2020 (Year 3). Monterey spineflower was found at 21 well locations, along secondary access routes, and outside the NWTS (see Table 4-5). The total number of discrete populations decreased from 105 to 99 from 2019 to 2020. This is interpreted to be a consequence of the merging of populations, as evidenced by the increase in total area (see Table 4-9). This trend is consistent with reference site populations. Historical Monterey spineflower survey results for the OU1 survey area are summarized in Appendix A Table A-3.

Of the 27 OU1 well locations and the NWTS surveyed in 2020:
- Monterey spineflower was not observed at two well locations at which Monterey spineflower had been observed in historical surveys (1998-2017).
- Monterey spineflower was observed at 18 well locations and the NWTS at which Monterey spineflower had been observed in historical surveys.
- Monterey spineflower was observed at three well locations at which Monterey spineflower had not been observed in any historical survey.
- Monterey spineflower was not observed at three well locations at which Monterey spineflower was only previously observed in 2018 and 2019.
- Monterey spineflower was not observed at one well location at which Monterey spineflower was only previously observed in 2018.

Table 4-9. Monterey Spineflower Populations within the OU1 Survey Area from 2017-2020

Year	Total Populations	Pts	Polygons per Density Class				Area (ft^2)	Area % Δ from Prev. Year
			Very Sparse	Sparse	Medium Low	Medium		
2017 (Year 0)	19	6	0	7	5	1	26,939	-
2018 (Year 1)	52	36	4	9	2	1	36,394	35%
2019 (Year 2)	105	80	4	20	1	-	33,955	-7%
2020 (Year 3)	99	53	18	24	4	-	37,441	10%

4.2.3   OUCTP, Operable Unit 2, and Sites 2/12 (Year 2)

Within the OUCTP survey area, Monterey spineflower populations increased by 59,917 ft^2 from 2019 (Year 1) to 2020 (Year 2) and were nearly four times the area of 2018 (Year 0) baseline surveys (see Table 4-10). Monterey spineflower was surveyed at four OUCTP wells and was found at all well locations and along secondary access routes (see Table 4-7). The total number of discrete populations decreased from 199 in 2019 to 151 in 2020. This is interpreted to be a consequence of the merging of populations, as evidenced by the increase in total area (see Table 4-10).

Within the OU2 survey area, Monterey spineflower increased by 18,753 ft^2 along the secondary access route from 2019 (Year 1) to 2020 (Year 2). The total number of populations decreased from 44 in 2019 to 15 in 2020.

Within the Sites 2/12 survey area, Monterey spineflower increased by 248 ft^2 at one well from 2019 (Year 1) to 2020 (Year 2). The total number of populations decreased from five in 2019 to three in 2020.

Historical Monterey spineflower survey results for the OUCTP, OU2, and Sites 2/12 survey areas are summarized in Appendix A Table A-4.

Of the six OUCTP, OU2, and Sites 2/12 well locations surveyed in 2020:
- Monterey spineflower was observed at five well locations at which Monterey spineflower had been observed in historical surveys (1998-2017).
- Monterey spineflower was observed at one well location at which Monterey spineflower was observed in the 2018 Baseline survey but not in any other historical survey.

Table 4-10. Monterey Spineflower Populations within the OUCTP, OU2, & Sites 2/12 Survey Areas from 2018-2020

Location	Year	Total Populations	Pts	Polygons per Density Class			Area (ft^2)	Area % Δ from Prev. Year
				Very Sparse	Sparse	Medium Low		
OUCTP	2018 (Year 0)	69	34	7	22	6	31,838	-
	2019 (Year 1)	199	129	10	58	2	60,232	89%
	2020 (Year 2)	151	66	29	49	7	120,149	99%
OU2	2018 (Year 0)	12	3	-	8	1	18,141	-
	2019 (Year 1)	44	30	1	13	-	31,646	74%
	2020 (Year 2)	15	4	6	5	-	50,399	59%
Sites 2/12	2018 (Year 0)	3	-	-	3	-	309	-
	2019 (Year 1)	5	3	1	1	-	78	-75%
	2020 (Year 2)	3	1	1	1	-	326	318%

5. IMPACT ASSESSMENT

Rare plant survey data are compared to the 2017 PBO Success Criteria in Sections 5.1 and 5.2 to assess the impact of remediation activities on rare plant populations in FONR and FODSP.

5.1   Success Criterion 1

Success Criterion 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). Survey results for sand gilia and Monterey spineflower are compared to Success Criterion 1 in the following sections.

5.1.1   Operable Unit 1 (Year 3)

5.1.1.1   Sand Gilia

The following observations were made to compare 2017 (Year 0), 2018 (Year 1), 2019 (Year 2), and 2020 (Year 3) sand gilia survey results between the reference site and OU1 survey area:

1. Sand gilia was observed at the reference site from 2017 to 2020 but was only observed within the OU1 survey area from 2018 to 2020 (see Appendix A Table A-1).
2. Total area of sand gilia populations is somewhat inconsistent between the reference site and the OU1 survey area from 2017 to 2020, but OU1 population densities are demonstrating a trend of outperforming the reference site populations (see Tables 4-1 and 4-4):
   a. From 2017 to 2018, the total area and number of individual sand gilia plants decreased at the reference site while the total area and number of individual plants increased within the OU1 survey area.
   b. From 2018 to 2019, the total area and number of individual sand gilia plants increased at the reference site while the total area decreased and the number of individual plants increased within the OU1 survey area.
   c. From 2019 to 2020, the total area and number of individual sand gilia plants decreased at the reference site while the total area increased and number of plants decreased within the OU1 survey area.
   d. From 2017 to 2020, the total area of sand gilia populations decreased and the number of individual plants increased at the reference site while the total area and number of populations increased within the OU1 survey area.

Success Criterion 1 was adequately met for sand gilia from 2017 to 2020 in Operable Unit 1. Trends in total area differed between the reference site and OU1 during monitoring years, but these differences are to be expected when looking at only one reference site. Population count metrics are more useful in determining vigor of a population and OU1 populations either followed or outperformed reference site population count trends. These findings suggest that well decommissioning activities in 2017 have not adversely impacted sand gilia abundance.

5.1.1.2   Monterey Spineflower

The following observations were made to compare 2017 (Year 0), 2018 (Year 1), 2019 (Year 2), and 2020 (Year 3) 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 from 2017 to 2020 (see Tables 4-8 and 4-9).
2. Relative abundance of Monterey spineflower appears to be consistent between the reference site and OU1 survey area:
   a. From 2017 to 2018, the total area increased and density decreased at both sites.

b. From 2018 to 2019, the total area decreased and the total number of populations increased at both sites.
c. From 2019 to 2020, the total area increased and the total number of populations decreased at both sites.
d. Overall, the total area of Monterey spineflower populations increased from 2017 to 2020, with the highest area being recorded in 2020 at both the reference site and within the OU1 survey area.

Success Criterion 1 was met for Monterey spineflower from 2017 to 2020 in Operable Unit 1. Trends in densities and acreages of Monterey spineflower populations were the same between the reference site and the OU1 survey area each year of monitoring. This suggests that well decommissioning activities in 2017 have not adversely impacted Monterey spineflower abundance.

5.1.2   OUCTP, Operable Unit 2, and Sites 2/12 (Year 2)

5.1.2.1   Sand Gilia

The following observations were made to compare 2018 (Year 0), 2019 (Year 1), and 2020 (Year 2) sand gilia survey results between the reference site and OUCTP, OU2, and Sites 2/12 survey areas:

1. Sand gilia was observed at the reference site and within the OUCTP and OU2 survey areas from 2018 to 2020.
2. Sand gilia was not observed at Sites 2/12 in 2018 or 2019. Sand gilia was not surveyed at Sites 2/12 in 2020.
3. Relative abundance of sand gilia appears to be consistent between the reference site and the OUCTP and OU2 survey areas from 2018 to 2020 (see Tables 4-1 and 4-6):
    a. From 2018 to 2019, the total area and number of individual plants increased at the reference site, OUCTP, and OU2.
    b. From 2019 to 2020, the total area and number of individual plants decreased at the reference site, OUCTP, and OU2.

Success Criterion 1 was met for sand gilia from 2018 to 2020 within the OUCTP and OU2 survey areas. In both years of monitoring, densities, and acreages of sand gilia populations were within the normal range when compared to the reference site. Sites 2/12 cannot be compared to the reference site because no sand gilia was present at Sites 2/12 in 2018 or 2019 and Sites 2/12 were not surveyed in 2020 per conditions specified in the 2017 PBO. Trends in OUCTP and OU2 densities and acreages suggest that well decommissioning and installation activities in 2018 did not adversely impact sand gilia populations. In accordance with the HMP and PBO, one additional year of monitoring will be completed. This will facilitate a more thorough evaluation of the effect of OUCTP and OU2 remediation activities on sand gilia populations.

5.1.2.2   Monterey Spineflower

The following observations were made to compare 2018 (Year 0), 2019 (Year 1), and 2020 (Year 2) Monterey spineflower survey results between the reference site and OUCTP, OU2, and Sites 2/12 survey areas:

1. Monterey spineflower populations of similar densities were observed at the reference site and OUCTP, OU2, and Sites 2/12 survey areas from 2018 to 2020 (see Tables 4-8 and 4-10).
2. Relative abundance of Monterey spineflower appears to be partially consistent between the reference site and OUCTP, OU2, and Sites 2/12 survey areas:

a. From 2018 to 2019, the total area and number of Monterey spineflower populations in the OUCTP and OU2 survey areas increased while at the reference site and at Sites 2/12 the number of populations increased and the total area decreased.

b. From 2019 to 2020, the total area of Monterey spineflower populations increased and the total number of populations decreased at all sites.

c. Overall, the total area of Monterey spineflower populations increased from 2018 to 2020, with the highest area being recorded in 2020 at both the reference site and within the OUCTP, OU2, and Sites 2/12 survey areas.

Success Criterion 1 was partially met for Monterey spineflower from 2018 to 2020 within the OUCTP and OU2 survey areas. Success Criterion 1 was fully met at Sites 2/12. Each year of monitoring within the OUCTP and OU2 survey areas, the total area of Monterey spineflower populations either mirrored trends (2020) or exhibited more positive trends than at the reference site (2019). This suggests that even though population dynamics were different at the reference site, well installation or decommissioning activities in 2018 did not adversely impact Monterey spineflower populations from 2018 to 2020. In accordance with the HMP and PBO, one additional year of monitoring will be completed. This will facilitate a more thorough evaluation of the effect of OUCTP, OU2, and Sites 2/12 remediation activities on Monterey spineflower populations.

5.2   Success Criterion 2

Success Criterion 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). Survey results for sand gilia and Monterey spineflower are compared to Success Criterion 2 in the following sections.

5.2.1   Operable Unit 1 (Year 3)

5.2.1.1   Sand Gilia

Sand gilia was detected at one out of 19 well locations in 2020, one out of 27 well locations in 2019, 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 out 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[1], PZ-OU1-02-A1[1], IW-OU1-10-A[2,5], PZ-OU1-10-A1[2,5], MW-OU1-26-A[5], MW-OU1-46-A[3], MW-OU1-46-AD[3], EW-OU1-49-A[4], PZ-OU1-49-A1[4], 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[5], 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[5], MW-OU1-87-A[5], 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

Success Criterion 2 was met for sand gilia from 2017 to 2020 in Operable Unit 1. Year 1 through Year 3 surveys indicate that the number of wells where sand gilia was detected was greater than the number of wells where it was found in Baseline surveys (1998 and 2017) within the OU1 survey area. OU1 well decommissioning did not appear to adversely impact sand gilia populations.

5.2.1.2   Monterey Spineflower

Monterey spineflower was detected at 21 out of 27 well locations in 2020, 25 out of 27 in 2019, 24 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):

1. Rare plant species not detected in any survey – 6 wells [5]
    IW-OU1-10-A[2], PZ-OU1-10-A1[2], MW-OU1-26-A, MW-OU1-68-A, MW-OU1-86-A, and MW-OU1-87-A

2. Rare plant species detected before but not after well construction – none

3. Rare plant species detected before and after well construction – 11 wells
    EW-OU1-49-A[4], PZ-OU1-49-A1[4], EW-OU1-53-A, EW-OU1-60-A, EW-OU1-66-A, MW-OU1-46-A[3], MW-OU1-46-AD[3], MW-OU1-50-A, MW-OU1-57-A, MW-OU1-61-A, and MW-OU1-84-A

4. 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[1], PZ-OU1-02-A1[1], 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

5. Well was constructed before earliest rare plant survey in 1998 – none

Monterey spineflower was also detected at the NWTS in 2020, 2019, 2018, and 1998.

Success Criterion 2 was met for Monterey spineflower from 2017 to 2020 in Operable Unit 1. Year 1 through Year 3 surveys indicate that the number of wells where Monterey spineflower was detected was greater than the number of wells where it was found in Baseline surveys (1998 and 2017) within the OU1 survey area. OU1 well decommissioning did not appear to adversely impact Monterey spineflower populations.

_____

[1, 2, 3, 4] Wells with the same notation were considered one location
[5] Wells not surveyed in 2019

5.2.2   OUCTP, Operable Unit 2, and Sites 2/12 (Year 2)

5.2.2.1   Sand Gilia

Sand gilia was detected at three out of four well locations in 2020, four out of six in 2019, three out of six in 2018, and four out of six in 1998. 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 – 1 well
   MW-02-12-180

2. Rare plant species detected before but not after well construction – 1 well
   MW-BW-29-180

3. Rare plant species detected before and after well construction – 2 wells
   MW-BW-93-A, MW-BW-95-A

4. Rare plant species detected only after well construction – 1 well
   MW-BW-94-A

5. Well was constructed before earliest rare plant survey in 1998 – 2 wells
   MW-02-12-180, MW-OU2-59-A

Success Criterion 2 was met for sand gilia from 2018 to 2020 within the OUCTP and OU2 survey areas. Year 1 and Year 2 surveys indicate that the number of wells where sand gilia was detected was the same or greater than the number of wells where it was found in Baseline surveys (1998 and 2017). Sand gilia was not surveyed at well MW-BW-29-180 or Sites 2/12 in 2020. OUCTP and OU2 well installation or decommissioning activities did not appear to adversely impact sand gilia populations. In accordance with the HMP and PBO, one additional year of monitoring will be completed. This will facilitate a more thorough evaluation of the effect of OUCTP and OU2 remediation activities on sand gilia populations.

5.2.2.2   Monterey Spineflower

Monterey spineflower was detected at all six well locations from 2018 to 2020 and at five out of six well locations in 1998. 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 – none

2. Rare plant species detected before but not after well construction – none

3. Rare plant species detected before and after well construction – 4 wells
   MW-BW-29-180, MW-BW-93-A, MW-BW-94-A, MW-BW-95-A

4. Well was constructed before earliest rare plant survey in 1998 – 2 wells
   MW-02-12-180, MW-OU2-59-A

Success Criterion 2 was met for Monterey spineflower from 2018 to 2020 within the OUCTP, OU2, and Sites 2/12 survey areas. Year 1 and Year 2 surveys indicated that the number of wells where Monterey spineflower was detected was the same or greater than the number of wells where it was found in Baseline surveys (1998 and 2018). OUCTP, OU2, and Sites 2/12 remediation activities did not appear to adversely impact Monterey spineflower populations. In accordance with the HMP and PBO, one additional year of monitoring will be completed. This will facilitate a more thorough evaluation of the effect of OUCTP, OU2, and Sites 2/12 remediation activities on Monterey spineflower populations.

5.3   Future Work

5.3.1   Operable Unit 1 Monitoring Completion

In accordance with the HMP and PBO, monitoring is complete after three years if sand gilia and Monterey spineflower populations meet both success criteria outlined in the 2017 PBO. The OU1 survey area has been monitored for sand gilia and Monterey spineflower for three consecutive years and Success Criterion 1 and Success Criterion 2 have been met for both species.

Densities and acreages of sand gilia and Monterey spineflower in the OU1 survey area have generally been within a normal range compared to the reference site. Although total areas of sand gilia populations have not consistently followed reference site trends from year to year, trends in the number of individual plants have (a stronger indication of population dynamics given the species). Additionally, there were no sand gilia plants recorded in 2017 in the OU1 survey area, but populations have been consistently observed in years 2018 to 2020, suggesting that well decommissioning activities could have encouraged sand gilia recruitment in OU1. Monterey spineflower acreages and number of individual populations have followed all reference site trends each year of monitoring. Therefore, Success Criterion 1 has been met for both HMP annual species in Operable Unit 1.

The number of wells where sand gilia and Monterey spineflower have been detected in Year 1, Year 2, and Year 3 surveys were the same or greater than the number of wells where the species were found in baseline surveys. Therefore, Success Criterion 2 has been met for both HMP annual species in Operable Unit 1.

Per the 2017 PBO (USFWS, 2017), baseline surveys and three years of follow up monitoring are required after well installation and decommissioning. As there is no indication of adverse impacts due to decommissioning, we do not recommend additional monitoring for sand gilia and Monterey spineflower within Operable Unit 1.

5.3.2   OUCTP, Operable Unit 2, and Sites 2/12 Year 3 Surveys

Year 1 (2019) follow up surveys were completed for six OUCTP, OU2, and Sites 2/12 wells that were either decommissioned or installed in 2018. During Baseline or Year 1 surveys, sand gilia was observed at four out of six wells and Monterey spineflower was observed at all six wells. Two of the wells (MW-02-12-180 and MW-BW-29-180) did not have sand gilia in Baseline nor in Year 1 follow up surveys and their locations are within low quality habitat for the species (Appendix A Table A-2). These well locations were not surveyed for sand gilia in Year 2 (2020), following the 2017 PBO guidelines on discontinuing follow up surveys based on historic occurrence and habitat quality. Year 2 (2020) Monterey spineflower OUCTP, OU2, and Sites 2/12 surveys included six well locations and secondary access routes (MW-BW-93-A, MW-BW-94-A, MW-BW-95-A, MW-BW-29-180, MW-OU2-59-A, and MW-02-12-180). Sand gilia was surveyed at all but two of these six well locations (MW-BW-29-180 and MW-02-12-180). The same wells will be surveyed for the same species in Year 3 along with the reference site.

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APPENDIX A

FONR Historical Rare Plant Survey Results

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

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.														Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Wells Installed from 1998 - 2001																								
MW-OU1-26-A	1998	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N	--	--
MW-OU1-46-A[1]	2001	N	N	N	N	N	N	N	N	N	N	N	N	N	--	--	--	--	N	N	N	N	N	N
Wells Installed in 2004 After the Rare Plant Survey																								
MW-OU1-46-AD[1]	2004	N	N	N	N	N	N	N	N	N	N	N	N	--	--	--	--	--	N	N	N	N	N	N
EW-OU1-49-A[2]	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	N
PZ-OU1-49-A1[2]	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	N
EW-OU1-52-A	2004	N	--	--	--	--	--	N	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]	SG#443[4]; SG#444[5]; SG#15[11]; SG#12[14]; SG#11[23]; SG#13[53]; SG#14[100]; SG#17[195]; SG#18[1077]; SG#16[1680]	SG#61[2]; SG#62[2]; SG#64[2]; SG#63[4]; SG#19[6]; SG#18[20]; SG#21[110]; SG#20[160]
IW-OU1-02-A[4]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N	N	N
PZ-OU1-02-A1[4]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N	N	N
IW-OU1-10-A[3]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	N	--	--	--	--	N	N	--	--
Wells Installed in 2004 in Area Not Surveyed																								
MW-OU1-50-A	2004	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N	N	N
MW-OU1-57-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
MW-OU1-58-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
MW-OU1-59-A	2004	N	--	--	--	--	--	--	N	SG#26[13]	N	--	--	--	--	--	--	--	--	--	N	N	N	N
Wells Installed in 2005 After the Rare Plant Survey																								
PZ-OU1-10-A1[3]	2005	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	--	--	--	--	N	N	--	--
HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey																								
EW-OU1-60-A	2006	N	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	N	N	N	--
EW-OU1-62-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
EW-OU1-63-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
EW-OU1-66-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
MW-OU1-61-A	2006	N	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	N	N	N	--
MW-OU1-67-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	N	N	N	--
MW-OU1-68-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	--	--	--	--	--	N	--	--
Wells Installed in 2006 After the Rare Plant Survey																								
EW-OU1-71-A	2006	N	--	--	--	--	--	N	--	N	N	N	--	--	--	--	--	--	--	--	N	N	N	N
EW-OU1-72-A	2006	N	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	--	N	N	N	N
IW-OU1-73-A	2006	N	--	--	--	--	--	--	N	N	N	N	--	--	--	--	--	--	--	--	N	N	N	N
IW-OU1-74-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N	N	N

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

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.														Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
MW-OU1-82-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	--	--	--	--	N	N	N	N
MW-OU1-83-A	2006	N	--	--	--	--	--	N	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	N	N
MW-OU1-85-A	2006	N	--	--	--	--	--	N	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	N	N
NWTS	2006	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	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 (HGL, 2018).

(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	MW - monitoring well	PZ - piezometer
EW - extraction well	N - area was surveyed; but no rare plants were detected.	SG - Sand gilia
IW - injection well	NWTS - Northwest Treatment System	SG#26[13] - population ID # [number of plants]

Table A-2. Historical Sand Gilia Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
Sites 2/12	MW-02-12-180	1996	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	N	--
OU2	MW-OU2-59-A	1997	SG	--	--	--	--	--	--	--	--	--	--	--	SG	--	SG[1]; SG[1]; SG[2]; SG[2]; SG[2]; SG[2]; SG[3]; SG[5]; SG[7]	SG#461[1]; SG#462[1]; SG#463[1]; SG#466[1]; SG#468[2]; SG#471[2]; SG#465[3]; SG#467[3]; SG#469[3]; SG#470[3]; SG#459[5]; SG#460[5]; SG#464[5]; SG#37[6]; SG#38[10]; SG#34[12]; SG#43[13]; SG#44[20]; SG#35[21]; SG#42[27]; SG#46[27]; SG#41[36]; SG#36[45]; SG#33[62]; SG#45[71]; SG#40[222]; SG#39[569]; SG#47[708]	SG#22[127]; SG#23[6]; SG#24[61]; SG#65[1]; SG#66[1]; SG#76[22]; SG#77[535]; SG#78[259]
OUCTP	MW-BW-29-180	2000	SG	--	--	--	--	--	--	--	--	--	--	N	N	--	N	N	--
OUCTP	MW-BW-93-A	2018	SG	SG	SG	SG	SG	SG	--	SG	--	--	--	--	--	--	SG[2]; SG[2]; SG[2]; SG[11]	SG#448[1]; SG#451[1]; SG#452[1]; SG#454[1]; SG#457[1]; SG#458[1]; SG#445[2]; SG#446[2]; SG#447[2]; SG#449[2]; SG#450[2]; SG#455[2]; SG#456[3]; SG#453[5]; SG#23[6]; SG#27[6]; SG#29[10]; SG#28[14]; SG#25[18]; SG#31[20]; SG#20[27]; SG#24[34]; SG#30[69]; SG#32[96]; SG#21[160]; SG#26[250]; SG#22[1464]	SG#1[9]; SG#2[672]; SG#3[6]; SG#4[37]; SG#5[32]; SG#6[144]; SG#35[1]; SG#36[3]; SG#37[1]; SG#38[1]; SG#39[3]; SG#40[3]; SG#41[5]; SG#67[66]
OUCTP	MW-BW-94-A	2018	N	--	--	--	--	--	--	N	--	--	--	--	--	--	N	SG#19[34]	N

Table A-2. Historical Sand Gilia Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
OUCTP	MW-BW-95-A	2018	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	--	--	--	--	SG#473[1]; SG#474[1]; SG#476[1]; SG#478[1]; SG#480[1]; SG#481[1]; SG#482[1]; SG#483[1]; SG#484[1]; SG#485[1]; SG#491[1]; SG#492[1]; SG#494[1]; SG#495[1]; SG#496[1]; SG#499[1]; SG#500[1]; SG#477[2]; SG#479[2]; SG#486[2]; SG#487[2]; SG#493[2]; SG#472[3]; SG#489[3]; SG#497[3]; SG#498[3]; SG#475[4]; SG#488[4]; SG#490[4]; SG#61[6]; SG#53[7]; SG#51[26]; SG#55[26]; SG#58[45]; SG#48[63]; SG#56[122]; SG#50[145]; SG#54[167]; SG#62[187]; SG#52[590]; SG#49[591]; SG#59[862]; SG#57[937]; SG#60[952]; SG#63[5529]	SG[1]; SG[1]; SG[1]; SG[4]; SG[15]; SG[15]; SG[21]	SG#7[9]; SG#8[80]; SG#9[20]; SG#10[9]; SG#11[16]; SG#12[13]; SG#13[24]; SG#14[458]; SG#15[80]; SG#16[140]; SG#17[67]; SG#42[4]; SG#43[1]; SG#44[1]; SG#45[4]; SG#46[5]; SG#47[3]; SG#48[3]; SG#49[1]; SG#50[5]; SG#51[1]; SG#52[5]; SG#53[4]; SG#54[5]; SG#55[3]; SG#56[3]; SG#57[2]; SG#58[1]; SG#59[1]; SG#60[2]

1998-2017 data from Fort Ord Data Integration System (USACE, 2019a; USACE, 2019b). 2018 data from the GIS data deliverable for the *2018 Annual Rare Plant Survey for the Ahtna Monitoring Wells and Enhanced In Situ Bioremediation (EISB) Deployment Area at the Operable Unit Carbon Tetrachloride Plume (OUCTP)* report (Ahtna, 2018).

-- Not Surveyed   N - Area surveyed; no rare plants detected
SG - Sand gilia   SG#49[VS] - population ID # [density category or number of plants]
MW - Monitoring Well

Table A-3. Historical Monterey Spineflower Survey Results Relative to OU1 Well Locations

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.										Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010-2014	2015	2016	2017	2018	2019	2020
Wells Installed from 1998 - 2001																				
MW-OU1-26-A	1998	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	N	N	--	--
MW-OU1-46-A[1]	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]	MS#161[S]; MS#354[1]	MS#193[2]; MS#347[S]
Wells Installed in 2004 After the Rare Plant Survey																				
MW-OU1-46-AD[1]	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]	MS#161[S]; MS#354[1]	MS#193[2]; MS#347[S]
EW-OU1-49-A[2]	2004	MS	--	--	--	--	--	N	N	N	N	--	--	--	--	--	N	N	MS#343[1]	MS#167[1]; MS#168[1]; MS#169[1]
PZ-OU1-49-A1[2]	2004	MS	--	--	--	--	--	N	N	N	N	--	--	--	--	--	N	N	MS#343[1]	MS#167[1]; MS#168[1]; MS#169[1]
EW-OU1-52-A	2004	N	--	--	--	--	--	N	N	N	N	--	--	--	--	--	N	MS#14[2]; MS#15[2]	MS#340[3]; MS#341[1]	MS#162[4]; MS#163[1]; MS#164[1]
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]	MS#156[ML]; MS#339[1]	MS#165[5]; MS#166[1]; MS#321[ML]
IW-OU1-02-A[4]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	N	MS#13[1]	MS#342[1][4]	N
PZ-OU1-02-A1[4]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	N	MS#13[1]	MS#342[1]	N
IW-OU1-10-A[3]	2004	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	N	N	--	--
Wells Installed in 2004 in Area Not Surveyed																				
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]	MS#176[S]	MS#298[S]
MW-OU1-57-A	2004	MS	--	--	--	--	--	--	N	N	N	--	--	--	--	--	MS#21[ML]	MS#53[ML]	MS#171[S]; MS#172[S]; MS#176[S]; MS#388[2]; MS#389[1]; MS#390[1]	MS#133[1]; MS#134[1]; MS#135[3]; MS#136[1]; MS#292[S]; MS#294[S]; MS#295[S]; MS#296[S]; MS#298[S]
MW-OU1-58-A	2004	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	MS#21[ML], MS#27[S]	MS#49[2]; MS#50[1]; MS#53[ML]	MS#176[S]; MS#372[1]; MS#373[3]; MS#398[1]; MS#399[2]	MS#125[1]; MS#126[3]; MS#288[VS]; MS#289[VS]; MS#290[VS]; MS#298[S]
MW-OU1-59-A	2004	N	--	--	--	--	--	--	MS#153[2]	N	N	--	--	--	--	--	MS#22[ML]	MS#53[ML]; MS#56[1]	MS#176[S]; MS#402[2]; MS#403[1]; MS#404[1]	MS#184[1]; MS#185[5]; MS#298[S]

Table A-3. Historical Monterey Spineflower Survey Results Relative to OU1 Well Locations

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.										Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010-2014	2015	2016	2017	2018	2019	2020
Wells Installed in 2005 After the Rare Plant Survey																				
PZ-OU1-10-A1[3]	2005	N	--	--	--	--	--	N	--	N	N	--	--	--	--	--	N	N	--	--
HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey																				
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]	MS#170[VS]; MS#176[S]; MS#391[1]	MS#292[S]; MS#293[VS]; MS#294[S]; MS#298[S]
EW-OU1-62-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	N	MS#53[ML]	MS#179[S]; MS#370[1]; MS#371[1]; MS#413[2]; MS#414[4]; MS#415[3]; MS#416[2]; MS#417[3]; MS#418[1]	MS#123[3]; MS#124[1]; MS#284[ML]; MS#285[VS]; MS#286[VS]
EW-OU1-63-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	MS#21[ML]	MS#53[ML]	MS#173[S]; MS#174[VS]; MS#175[S]; MS#176[S]; MS#378[3]; MS#379[4]; MS#380[3]; MS#381[1]; MS#382[1]; MS#383[1]; MS#384[4]; MS#385[2]; MS#386[4]; MS#387[4]; MS#400[1]; MS#401[1]	MS#186[5]; MS#187[1]; MS#199[1]; MS#200[5]; MS#201[2]; MS#202[2]; MS#297[VS]; MS#298[S]; MS#337[S]; MS#338[VS]; MS#339[S]; MS#340[VS]; MS#341[S]; MS#349[VS]; MS#350[VS]; MS#351[S]
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]	MS#168[S]; MS#169[S]; MS#176[S]; MS#374[1]; MS#375[3]; MS#376[4]; MS#377[4]; MS#394[2]; MS#395[1]; MS#396[1]; MS#397[1]	MS#128[2]; MS#130[1]; MS#291[VS]; MS#298[S]; MS#299[S]
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]	MS#169[S]; MS#170[VS]; MS#176[S]; MS#392[4]; MS#393[1]	MS#129[1]; MS#131[2]; MS#132[1]; MS#293[VS]; MS#298[S]

Table A-3. Historical Monterey Spineflower Survey Results Relative to OU1 Well Locations

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.										Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010-2014	2015	2016	2017	2018	2019	2020
MW-OU1-67-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	MS#27[S]	MS#48[1]; MS#49[2]; MS#50[1]	MS#178[VS]; MS#409[1]; MS#410[3]; MS#411[1]; MS#412[1]	MS#127[3]; MS#287[VS]
MW-OU1-68-A	2006	N	--	--	--	--	--	--	N	N	N	--	--	--	--	--	N	N	--	--
Wells Installed in 2006 After the Rare Plant Survey																				
EW-OU1-71-A	2006	N	--	--	--	--	--	N	--	N	N	MS#42[S]	N	--	--	--	N	N	MS#344[3]	N
EW-OU1-72-A	2006	N	--	--	--	--	--	N	N	N	N	N	N	--	--	--	N	MS#27[2]; MS#28[1]	MS#345[1]; MS#349[1]	N
IW-OU1-73-A	2006	N	--	--	--	--	--	--	N	N	N	N	N	--	--	--	N	MS#46[1]	N	N
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]	MS#163[S]; MS#164[S]; MS#165[S]; MS#166[S]; MS#358[2]; MS#359[1]; MS#360[4]; MS#361[1]; MS#362[1]; MS#363[4]; MS#364[3]; MS#365[5]	MS#172[5]; MS#173[3]; MS#174[5]; MS#175[4]; MS#325[S]; MS#326[S]; MS#327[ML]; MS#328[VS]; MS#329[VS]
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]	MS#177[S]; MS#180[S]; MS#405[2]; MS#406[4]; MS#407[2]; MS#408[3]	MS#194[1]; MS#195[1]; MS#196[3]; MS#197[2]; MS#198[3]; MS#336[S]; MS#348[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]	MS#160[VS]; MS#162[S]; MS#350[1]; MS#351[1]; MS#352[1]; MS#353[3]; MS#366[1]	MS#183[1]; MS#190[2]; MS#191[3]; MS#192[3]; MS#345[S]; MS#346[S]; MS#347[S]

Table A-3. Historical Monterey Spineflower Survey Results Relative to OU1 Well Locations

Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.										Burleson Consulting Inc.		
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010-2014	2015	2016	2017	2018	2019	2020
MW-OU1-84-A	2006	N	MS	N	N	N	N	--	N	N	MS#58 across the 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]	MS#355[1]; MS#356[4]; MS#357[1]	MS#176[2]; MS#177[3]; MS#178[1]; MS#179[2]; MS#180[5]; MS#181[2]; MS#182[1]; MS#330[S]; MS#331[S]; MS#332[S]; MS#333[VS]; MS#334[S]; MS#335[VS];
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]	MS#157[S]; MS#158[S]; MS#159[S]; MS#346[3]; MS#347[1]; MS#348[3]	MS#170[1]; MS#171[1]; MS#322[ML]; MS#323[S]; MS#324[S]
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]	N	N
NWTS	2006	MS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	MS#47[1]	MS#167[S]; MS#367[2]; MS#368[5]; MS#369[1]	MS#282[S]

1998-2017 data from Table 3.3 B in the *2017 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results report* (HGL, 2018).

(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	M - Medium	MS - Monterey Spineflower	N - Area surveyed; no rare plants detected	S -Sparse
EW - Extraction Well	MH - Medium High	MS#49[VS] - population ID # [density category or number of plants]	NWTS - Northwest Treatment System	VS - Very Sparse
IW - Injection Well	ML - Medium Low	MW - Monitoring Well	PZ - Piezometer	

Table A-4. Historical Monterey Spineflower Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	Burleson Consulting Inc.
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
Sites 2/12	MW-02-12-180	1996	--	--	--	--	--	--	--	--	--	--	--	--	--	--	MS[S]; MS[S]; MS[S]	MS#306[1]; MS#308[1]; MS#307[3]; MS#140[S]; MS#141[VS]	MS#122[1]; MS#280[VS]; MS#281[S]
OU2	MW-OU2-59-A	1997	MS	--	--	--	--	--	--	--	--	--	--	--	MS	--	MS[1]; MS[1]; MS[3]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[ML]	MS#309[1]; MS#319[1]; MS#322[1]; MS#323[1]; MS#325[1]; MS#327[1]; MS#334[1]; MS#337[1]; MS#338[1]; MS#310[2]; MS#311[2]; MS#312[2]; MS#313[2]; MS#314[2]; MS#317[2]; MS#318[2]; MS#324[2]; MS#326[2]; MS#328[2]; MS#329[2]; MS#331[2]; MS#332[2]; MS#335[2]; MS#316[3]; MS#333[3]; MS#321[4]; MS#330[4]; MS#336[4]; MS#315[5]; MS#320[5]; MS#151[S]; MS#142[S]; MS#144[S]; MS#145[S]; MS#146[S]; MS#147[S]; MS#148[S]; MS#149[S]; MS#150[S]; MS#152[S]; MS#153[S]; MS#154[S]; MS#155[S]; MS#143[VS]	MS#137[5]; MS#138[1]; MS#139[1]; MS#140[2]; MS#263[S]; MS#264[VS]; MS#265[S]; MS#266[VS]; MS#267[S]; MS#268[VS]; MS#269[S]; MS#270[S]; MS#300[VS]; MS#301[VS]; MS#302[VS]
OUCTP	MW-BW-29-180	2000	MS	--	--	--	--	--	--	--	--	--	--	MS	MS	--	MS[S]	MS#419[1]; MS#422[1]; MS#425[1]; MS#426[1]; MS#427[1]; MS#429[1]; MS#431[1]; MS#434[1]; MS#421[2]; MS#423[2]; MS#428[2]; MS#433[2]; MS#420[3]; MS#424[3]; MS#432[3]; MS#430[4]; MS#181[S]	MS#188[1]; MS#189[1]; MS#342[VS]; MS#343[VS]; MS#344[S]

Table A-4. Historical Monterey Spineflower Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	Burleson Consulting Inc.
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
OUCTP	MW-BW-93-A	2018	MS	N	MS	MS	MS	MS	--	--	--	--	--	--	--	--	MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[2]; MS[3]; MS[3]; MS[3]; MS[3]; MS[VS]; MS[VS]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[ML]	MS#208[1]; MS#209[1]; MS#213[1]; MS#214[1]; MS#215[1]; MS#216[1]; MS#217[1]; MS#218[1]; MS#223[1]; MS#224[1]; MS#226[1]; MS#227[1]; MS#228[1]; MS#229[1]; MS#230[1]; MS#231[1]; MS#232[1]; MS#235[1]; MS#210[2]; MS#220[2]; MS#221[2]; MS#222[2]; MS#234[2]; MS#212[3]; MS#219[3]; MS#225[3]; MS#233[3]; MS#236[3]; MS#211[4]; MS#85[S]; MS#88[S]; MS#82[S]; MS#83[S]; MS#84[S]; MS#87[S]; MS#89[S]; MS#91[S]; MS#92[S]; MS#93[S]; MS#94[S]; MS#86[VS]; MS#90[VS]	MS#141[1]; MS#142[5]; MS#143[4]; MS#144[1]; MS#145[1]; MS#146[4]; MS#147[1]; MS#148[1]; MS#149[1]; MS#150[3]; MS#151[5]; MS#152[1]; MS#153[2]; MS#154[3]; MS#155[1]; MS#156[1]; MS#157[5]; MS#158[1]; MS#159[1]; MS#160[2]; MS#161[3]; MS#303[S]; MS#304[ML]; MS#305[S]; MS#306[S]; MS#307[S]; MS#308[S]; MS#309[S]; MS#310[S]; MS#311[VS]; MS#312[VS]; MS#313[VS]; MS#314[VS]; MS#315[VS]; MS#316[VS]; MS#317[S]; MS#318[VS]; MS#354[2]
OUCTP	MW-BW-94-A	2018	MS	--	--	--	--	--	--	--	--	--	--	--	--	--	MS[1]; MS[1]; MS[VS]; MS[VS]; MS[VS]; MS[VS]; MS[VS]; MS[S]; MS[S]; MS[S]; MS[ML]	MS#194[1]; MS#199[1]; MS#200[1]; MS#201[1]; MS#205[1]; MS#193[2]; MS#195[2]; MS#197[2]; MS#202[2]; MS#204[2]; MS#206[2]; MS#196[3]; MS#198[3]; MS#207[3]; MS#203[4]; MS#71[S]; MS#72[S]; MS#73[S]; MS#74[S]; MS#75[S]; MS#76[S]; MS#77[S]; MS#78[S]; MS#79[S]; MS#80[S]; MS#81[S]	MS#118[1]; MS#119[1]; MS#120[2]; MS#121[3]; MS#271[VS]; MS#272[S]; MS#273[S]; MS#274[VS]; MS#275[S]; MS#276[VS]; MS#277[S]; MS#278[S]; MS#279[S]; MS#319[S]; MS#320[S]

Table A-4. Historical Monterey Spineflower Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	Burleson Consulting Inc.
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
OUCTP	MW-BW-95-A	2018	MS	MS	MS	MS	MS	MS	MS	MS	MS	MS	--	--	--	--	MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[1]; MS[2]; MS[2]; MS[2]; MS[2]; MS[2]; MS[3]; MS[4]; MS[4]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[S]; MS[ML]; MS[ML]; MS[ML]; MS[ML]	MS#238[1]; MS#239[1]; MS#240[1]; MS#242[1]; MS#244[1]; MS#245[1]; MS#246[1]; MS#249[1]; MS#250[1]; MS#252[1]; MS#256[1]; MS#264[1]; MS#265[1]; MS#266[1]; MS#274[1]; MS#275[1]; MS#279[1]; MS#282[1]; MS#283[1]; MS#284[1]; MS#285[1]; MS#286[1]; MS#288[1]; MS#290[1]; MS#292[1]; MS#293[1]; MS#297[1]; MS#298[1]; MS#299[1]; MS#300[1]; MS#301[1]; MS#302[1]; MS#303[1]; MS#305[1]; MS#237[2]; MS#254[2]; MS#255[2]; MS#257[2]; MS#259[2]; MS#260[2]; MS#261[2]; MS#262[2]; MS#263[2]; MS#268[2]; MS#270[2]; MS#271[2]; MS#272[2]; MS#277[2]; MS#281[2]; MS#287[2]; MS#294[2]; MS#304[2]; MS#248[3]; MS#251[3]; MS#258[3]; MS#276[3]; MS#278[3]; MS#243[4]; MS#247[4]; MS#253[4]; MS#267[4]; MS#269[4]; MS#280[4]; MS#295[4]; MS#241[5]; MS#273[5]; MS#289[5]; MS#291[5]; MS#296[5]; MS#106[ML]; MS#129[ML]; MS#98[S]; MS#124[S]; MS#122[S]; MS#96[S]; MS#95[S]; MS#97[S]; MS#99[S]; MS#100[S]; MS#101[S]; MS#103[S]; MS#104[S]; MS#105[S]; MS#107[S]; MS#108[S]; MS#109[S]; MS#110[S]; MS#112[S]; MS#113[S]; MS#115[S];	MS#80[1]; MS#81[1]; MS#82[3]; MS#83[5]; MS#84[1]; MS#85[3]; MS#86[3]; MS#87[1]; MS#88[3]; MS#89[2]; MS#90[2]; MS#91[2]; MS#92[4]; MS#93[1]; MS#94[1]; MS#95[3]; MS#96[5]; MS#97[1]; MS#98[1]; MS#99[4]; MS#100[1]; MS#101[2]; MS#102[3]; MS#103[1]; MS#104[1]; MS#105[3]; MS#106[5]; MS#107[2]; MS#108[1]; MS#109[2]; MS#110[4]; MS#111[1]; MS#112[1]; MS#113[1]; MS#114[1]; MS#115[5]; MS#116[1]; MS#117[4]; MS#208[VS]; MS#209[VS]; MS#210[S]; MS#211[S]; MS#212[S]; MS#213[VS]; MS#214[VS]; MS#215[VS]; MS#216[S]; MS#217[S]; MS#218[S]; MS#219[S]; MS#220[S]; MS#221[S]; MS#222[ML]; MS#223[S]; MS#224[S]; MS#225[VS]; MS#226[VS]; MS#227[S]; MS#228[S]; MS#229[VS]; MS#230[S]; MS#231[ML]; MS#232[S]; MS#233[S]; MS#234[VS]; MS#235[S]; MS#236[ML]; MS#237[S]; MS#238[S]; MS#239[VS]; MS#240[S]; MS#241[ML]; MS#242[S]; MS#243[S]; MS#244[S]; MS#245[S]; MS#246[S]; MS#247[VS]; MS#248[VS]; MS#249[S]; MS#250[VS]; MS#251[VS]; MS#252[VS]; MS#253[VS]; MS#254[S]; MS#255[ML]; MS#256[S]; MS#257[S]; MS#258[S]; MS#259[VS];

Table A-4. Historical Monterey Spineflower Survey Results Relative to OUCTP, OU2, & Sites 2/12 Well Locations

Location	Well Identification	Year Installed	1998	Harding Lawson Associates					HydroGeoLogic, Inc.								Ahtna Environmental, Inc.	Burleson Consulting Inc.	Burleson Consulting Inc.
				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2017	2018	2019	2020
																		MS#116[S]; MS#117[S]; MS#119[S]; MS#120[S]; MS#121[S]; MS#125[S]; MS#126[S]; MS#127[S]; MS#130[S]; MS#131[S]; MS#132[S]; MS#133[S]; MS#135[S]; MS#136[S]; MS#137[S]; MS#138[S]; MS#128[VS]; MS#102[VS]; MS#111[VS]; MS#114[VS]; MS#118[VS]; MS#123[VS]; MS#134[VS]; MS#139[VS]	MS#260[ML]; MS#261[S]; MS#262[S]

1998-2017 data from Fort Ord Data Integration System (USACE, 2019a; USACE, 2019b). 2018 data from the GIS data deliverable for the *2018 Annual Rare Plant Survey for the Ahtna Monitoring Wells and Enhanced In Situ Bioremediation (EISB) Deployment Area at the Operable Unit Carbon Tetrachloride Plume (OUCTP)* report (Ahtna, 2018).

-- Not Surveyed	ML - Medium Low	N - Area surveyed; no rare plants detected
IW - Injection Well	MS - Monterey Spineflower	S -Sparse
M - Medium	MS#49[VS] - population ID # [density category or number of plants]	VS - Very Sparse
MH - Medium High	MW - Monitoring Well	

APPENDIX B

2020 Rare Plant Survey Results

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Table B-1. Sand Gilia Populations Found in 2020 Reference Site Survey

Population Number	Well ID	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
0	Reference	6	0.61	Polygon	4/10/2020
25	Reference	4	-	Point	4/10/2020
26	Reference	5	-	Point	4/10/2020
27	Reference	2	-	Point	4/10/2020
28	Reference	4	-	Point	4/10/2020
29	Reference	1	-	Point	4/10/2020
30	Reference	3	-	Point	4/10/2020
31	Reference	5	-	Point	4/10/2020
32	Reference	4	-	Point	4/10/2020
33	Reference	1	-	Point	4/10/2020
34	Reference	1	-	Point	4/10/2020
68	Reference	9	3.37	Polygon	4/10/2020
69	Reference	226	196.55	Polygon	4/10/2020
70	Reference	79	58.25	Polygon	4/10/2020
71	Reference	160	273.20	Polygon	4/10/2020
72	Reference	321	284.59	Polygon	4/10/2020
73	Reference	8	2.36	Polygon	4/10/2020
74	Reference	25	134.48	Polygon	4/10/2020
75	Reference	11	25.70	Polygon	4/10/2020

Table B-2. Sand Gilia Populations Found in 2020 OU1 Survey

Population Number	Well ID	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
18	EW-OU1-53-A	20	47.23	Polygon	4/15/2020
19	EW-OU1-53-A	6	11.57	Polygon	4/15/2020
20	EW-OU1-53-A	160	80.31	Polygon	4/15/2020
21	EW-OU1-53-A	110	331.42	Polygon	4/15/2020
61	EW-OU1-53-A	2	-	Point	4/15/2020
62	EW-OU1-53-A	2	-	Point	4/15/2020
63	EW-OU1-53-A	4	-	Point	4/15/2020
64	EW-OU1-53-A	2	-	Point	4/15/2020

Table B-3. Sand Gilia Populations Found in 2020 OUCTP & OU2 Survey

Population Number	Region	Well ID	Individuals (#)	Area (ft^2)	GIS Feature Type	Survey Date
22	OU2	MW-OU2-59-A	127	264.05	Polygon	4/17/2020
23	OU2	MW-OU2-59-A	6	3.29	Polygon	4/17/2020
24	OU2	MW-OU2-59-A	61	29.99	Polygon	4/17/2020
65	OU2	MW-OU2-59-A	1	-	Point	4/17/2020
66	OU2	MW-OU2-59-A	1	-	Point	4/17/2020
76	OU2	MW-OU2-59-A	22	84.90	Polygon	4/17/2020
77	OU2	MW-OU2-59-A	535	465.44	Polygon	4/17/2020
78	OU2	MW-OU2-59-A	259	374.87	Polygon	4/17/2020
1	OUCTP	MW-BW-93-A	9	6.07	Polygon	4/14/2020
2	OUCTP	MW-BW-93-A	672	398.70	Polygon	4/14/2020
3	OUCTP	MW-BW-93-A	6	1.44	Polygon	4/14/2020
4	OUCTP	MW-BW-93-A	37	64.60	Polygon	4/14/2020
5	OUCTP	MW-BW-93-A	32	24.40	Polygon	4/14/2020
6	OUCTP	MW-BW-93-A	144	260.02	Polygon	4/14/2020
35	OUCTP	MW-BW-93-A	1	-	Point	4/14/2020
36	OUCTP	MW-BW-93-A	3	-	Point	4/14/2020
37	OUCTP	MW-BW-93-A	1	-	Point	4/14/2020
38	OUCTP	MW-BW-93-A	1	-	Point	4/14/2020
39	OUCTP	MW-BW-93-A	3	-	Point	4/14/2020
40	OUCTP	MW-BW-93-A	3	-	Point	4/14/2020
41	OUCTP	MW-BW-93-A	5	-	Point	4/14/2020
67	OUCTP	MW-BW-93-A	66	4.79	Polygon	4/14/2020
7	OUCTP	MW-BW-95-A	9	17.50	Polygon	4/14/2020
8	OUCTP	MW-BW-95-A	80	193.05	Polygon	4/14/2020
9	OUCTP	MW-BW-95-A	20	50.95	Polygon	4/14/2020
10	OUCTP	MW-BW-95-A	9	46.17	Polygon	4/14/2020
11	OUCTP	MW-BW-95-A	16	91.67	Polygon	4/15/2020
12	OUCTP	MW-BW-95-A	13	60.78	Polygon	4/15/2020
13	OUCTP	MW-BW-95-A	24	26.99	Polygon	4/15/2020
14	OUCTP	MW-BW-95-A	458	405.03	Polygon	4/15/2020
15	OUCTP	MW-BW-95-A	80	68.51	Polygon	4/15/2020
16	OUCTP	MW-BW-95-A	140	140.53	Polygon	4/15/2020
17	OUCTP	MW-BW-95-A	67	62.27	Polygon	4/15/2020
42	OUCTP	MW-BW-95-A	4	-	Point	4/14/2020
43	OUCTP	MW-BW-95-A	1	-	Point	4/14/2020
44	OUCTP	MW-BW-95-A	1	-	Point	4/14/2020
45	OUCTP	MW-BW-95-A	4	-	Point	4/14/2020
46	OUCTP	MW-BW-95-A	5	-	Point	4/14/2020
47	OUCTP	MW-BW-95-A	3	-	Point	4/14/2020

Table B-3. Sand Gilia Populations Found in 2020 OUCTP & OU2 Survey

Population Number	Region	Well ID	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
48	OUCTP	MW-BW-95-A	3	-	Point	4/14/2020
49	OUCTP	MW-BW-95-A	1	-	Point	4/14/2020
50	OUCTP	MW-BW-95-A	5	-	Point	4/14/2020
51	OUCTP	MW-BW-95-A	1	-	Point	4/14/2020
52	OUCTP	MW-BW-95-A	5	-	Point	4/14/2020
53	OUCTP	MW-BW-95-A	4	-	Point	4/14/2020
54	OUCTP	MW-BW-95-A	5	-	Point	4/14/2020
55	OUCTP	MW-BW-95-A	3	-	Point	4/15/2020
56	OUCTP	MW-BW-95-A	3	-	Point	4/15/2020
57	OUCTP	MW-BW-95-A	2	-	Point	4/15/2020
58	OUCTP	MW-BW-95-A	1	-	Point	4/15/2020
59	OUCTP	MW-BW-95-A	1	-	Point	4/15/2020
60	OUCTP	MW-BW-95-A	2	-	Point	4/15/2020

Table B-4. Monterey Spineflower Populations Found in 2020 Reference Site Survey

Population Number	Well ID	Individuals (#) or Percent Cover (%)	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
79	Reference	3		-	Point	5/11/2020
203	Reference	26-50%	Medium Low	1,482.79	Polygon	5/11/2020
204	Reference	<3%	Very Sparse	26.80	Polygon	5/11/2020
205	Reference	3-25%	Sparse	699.04	Polygon	5/11/2020
206	Reference	3-25%	Sparse	251.21	Polygon	5/11/2020
207	Reference	<3%	Very Sparse	52.96	Polygon	5/11/2020
352	Reference	3-25%	Sparse	859.89	Polygon	5/11/2020
353	Reference	3-25%	Sparse	314.64	Polygon	5/11/2020

Table B-5. Monterey Spineflower Populations Found in 2020 OU1 Survey

Population Number	Well ID	Individuals (#) or Percent Cover (%)	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
167	EW-OU1-49-A; PZ-OU1-49-A1	1		-	Point	5/15/2020
168	EW-OU1-49-A; PZ-OU1-49-A1	1		-	Point	5/15/2020
169	EW-OU1-49-A; PZ-OU1-49-A1	1		-	Point	5/15/2020
162	EW-OU1-52-A	4		-	Point	5/15/2020
163	EW-OU1-52-A	1		-	Point	5/15/2020
164	EW-OU1-52-A	1		-	Point	5/15/2020
165	EW-OU1-53-A	5		-	Point	5/15/2020
166	EW-OU1-53-A	1		-	Point	5/15/2020
321	EW-OU1-53-A	26-50%	Medium Low	2,266.84	Polygon	5/15/2020
292	EW-OU1-60-A; MW-OU1-57-A	3-25%	Sparse	11.65	Polygon	5/15/2020
294	EW-OU1-60-A; MW-OU1-57-A	3-25%	Sparse	221.87	Polygon	5/15/2020
123	EW-OU1-62-A	3		-	Point	5/15/2020
124	EW-OU1-62-A	1		-	Point	5/15/2020
283	EW-OU1-62-A	<3%	Very Sparse	2.05	Polygon	5/15/2020
284	EW-OU1-62-A	26-50%	Medium Low	5.58	Polygon	5/15/2020
285	EW-OU1-62-A	<3%	Very Sparse	6.50	Polygon	5/15/2020
286	EW-OU1-62-A	<3%	Very Sparse	30.73	Polygon	5/15/2020
186	EW-OU1-63-A	5		-	Point	5/18/2020
187	EW-OU1-63-A	1		-	Point	5/18/2020
199	EW-OU1-63-A	1		-	Point	5/18/2020
200	EW-OU1-63-A	5		-	Point	5/18/2020
201	EW-OU1-63-A	2		-	Point	5/18/2020
202	EW-OU1-63-A	2		-	Point	5/18/2020
297	EW-OU1-63-A	<3%	Very Sparse	4.57	Polygon	5/15/2020
337	EW-OU1-63-A	3-25%	Sparse	8,325.68	Polygon	5/18/2020
338	EW-OU1-63-A	<3%	Very Sparse	17.20	Polygon	5/18/2020
339	EW-OU1-63-A	3-25%	Sparse	11.05	Polygon	5/18/2020
340	EW-OU1-63-A	<3%	Very Sparse	11.11	Polygon	5/18/2020
341	EW-OU1-63-A	3-25%	Sparse	4,620.87	Polygon	5/18/2020
349	EW-OU1-63-A	<3%	Very Sparse	17.66	Polygon	5/18/2020
350	EW-OU1-63-A	<3%	Very Sparse	18.54	Polygon	5/18/2020
351	EW-OU1-63-A	3-25%	Sparse	120.59	Polygon	5/18/2020
128	EW-OU1-66-A	2		-	Point	5/15/2020
130	EW-OU1-66-A	1		-	Point	5/15/2020

Table B-5. Monterey Spineflower Populations Found in 2020 OU1 Survey

Population Number	Well ID	Individuals (#) or Percent Cover (%)	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
291	EW-OU1-66-A	<3%	Very Sparse	30.21	Polygon	5/15/2020
299	EW-OU1-66-A	3-25%	Sparse	22.94	Polygon	5/15/2020
172	IW-OU1-74-A	5		-	Point	5/18/2020
173	IW-OU1-74-A	3		-	Point	5/18/2020
174	IW-OU1-74-A	5		-	Point	5/18/2020
175	IW-OU1-74-A	4		-	Point	5/18/2020
325	IW-OU1-74-A	3-25%	Sparse	53.84	Polygon	5/18/2020
326	IW-OU1-74-A	3-25%	Sparse	501.92	Polygon	5/18/2020
327	IW-OU1-74-A	26-50%	Medium Low	2.55	Polygon	5/18/2020
328	IW-OU1-74-A	<3%	Very Sparse	54.29	Polygon	5/18/2020
329	IW-OU1-74-A	<3%	Very Sparse	41.17	Polygon	5/18/2020
193	MW-OU1-46-A; MW-OU1-46-AD	2		-	Point	5/18/2020
298	MW-OU1-50-A; MW-OU1-57-A; MW-OU1-58-A; MW-OU1-59-A; EW-OU1-60-A; EW-OU1-61-A; EW-OU1-63-A; EW-OU1-66-A	3-25%	Sparse	9,340.33	Polygon	5/15/2020
133	MW-OU1-57-A	1		-	Point	5/15/2020
134	MW-OU1-57-A	1		-	Point	5/15/2020
135	MW-OU1-57-A	3		-	Point	5/15/2020
136	MW-OU1-57-A	1		-	Point	5/15/2020
295	MW-OU1-57-A	3-25%	Sparse	14.74	Polygon	5/15/2020
296	MW-OU1-57-A	3-25%	Sparse	58.30	Polygon	5/15/2020
125	MW-OU1-58-A	1		-	Point	5/15/2020
126	MW-OU1-58-A	3		-	Point	5/15/2020
288	MW-OU1-58-A	<3%	Very Sparse	47.01	Polygon	5/15/2020
289	MW-OU1-58-A	<3%	Very Sparse	7.29	Polygon	5/15/2020
290	MW-OU1-58-A	<3%	Very Sparse	5.43	Polygon	5/15/2020
184	MW-OU1-59-A	1		-	Point	5/18/2020
185	MW-OU1-59-A	5		-	Point	5/18/2020
129	MW-OU1-61-A	1		-	Point	5/15/2020
131	MW-OU1-61-A	2		-	Point	5/15/2020
132	MW-OU1-61-A	1		-	Point	5/15/2020
293	MW-OU1-61-A; EW-OU1-60-A	<3%	Very Sparse	16.44	Polygon	5/15/2020

Table B-5. Monterey Spineflower Populations Found in 2020 OU1 Survey

Population Number	Well ID	Individuals (#) or Percent Cover (%)	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
127	MW-OU1-67-A	3		-	Point	5/15/2020
287	MW-OU1-67-A	<3%	Very Sparse	7.70	Polygon	5/15/2020
194	MW-OU1-82-A	1		-	Point	5/18/2020
195	MW-OU1-82-A	1		-	Point	5/18/2020
196	MW-OU1-82-A	3		-	Point	5/18/2020
197	MW-OU1-82-A	2		-	Point	5/18/2020
198	MW-OU1-82-A	3		-	Point	5/18/2020
336	MW-OU1-82-A	3-25%	Sparse	5,949.16	Polygon	5/18/2020
348	MW-OU1-82-A	3-25%	Sparse	1,396.39	Polygon	5/18/2020
183	MW-OU1-83-A	1		-	Point	5/18/2020
190	MW-OU1-83-A	2		-	Point	5/18/2020
191	MW-OU1-83-A	3		-	Point	5/18/2020
192	MW-OU1-83-A	3		-	Point	5/18/2020
345	MW-OU1-83-A	3-25%	Sparse	479.58	Polygon	5/18/2020
346	MW-OU1-83-A	3-25%	Sparse	1,130.64	Polygon	5/18/2020
347	MW-OU1-83-A; MW-OU1-46-AD; MW-OU1-46-A	3-25%	Sparse	1,516.56	Polygon	5/18/2020
176	MW-OU1-84-A	2		-	Point	5/18/2020
177	MW-OU1-84-A	3		-	Point	5/18/2020
178	MW-OU1-84-A	1		-	Point	5/18/2020
179	MW-OU1-84-A	2		-	Point	5/18/2020
180	MW-OU1-84-A	5		-	Point	5/18/2020
181	MW-OU1-84-A	2		-	Point	5/18/2020
182	MW-OU1-84-A	1		-	Point	5/18/2020
330	MW-OU1-84-A	3-25%	Sparse	10.83	Polygon	5/18/2020
331	MW-OU1-84-A	3-25%	Sparse	3.76	Polygon	5/18/2020
332	MW-OU1-84-A	3-25%	Sparse	5.88	Polygon	5/18/2020
333	MW-OU1-84-A	<3%	Very Sparse	6.80	Polygon	5/18/2020
334	MW-OU1-84-A	3-25%	Sparse	38.83	Polygon	5/18/2020
335	MW-OU1-84-A	<3%	Very Sparse	11.59	Polygon	5/18/2020
170	MW-OU1-85-A	1		-	Point	5/15/2020
171	MW-OU1-85-A	1		-	Point	5/15/2020
322	MW-OU1-85-A	26-50%	Medium Low	85.59	Polygon	5/15/2020
323	MW-OU1-85-A	3-25%	Sparse	4.15	Polygon	5/15/2020
324	MW-OU1-85-A	3-25%	Sparse	78.82	Polygon	5/15/2020
282	NWTS	3-25%	Sparse	826.11	Polygon	5/15/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
122	Sites 2/12	MW-02-12-180	1		-	Point	5/15/2020
280	Sites 2/12	MW-02-12-180	<3%	Very Sparse	110.69	Polygon	5/15/2020
281	Sites 2/12	MW-02-12-180	3-25%	Sparse	215.37	Polygon	5/15/2020
137	OU2	MW-OU2-59-A	5		-	Point	5/14/2020
138	OU2	MW-OU2-59-A	1		-	Point	5/14/2020
139	OU2	MW-OU2-59-A	1		-	Point	5/14/2020
140	OU2	MW-OU2-59-A	2		-	Point	5/14/2020
263	OU2	MW-OU2-59-A	3-25%	Sparse	191.15	Polygon	5/14/2020
264	OU2	MW-OU2-59-A	<3%	Very Sparse	20.47	Polygon	5/14/2020
265	OU2	MW-OU2-59-A	3-25%	Sparse	1.45	Polygon	5/14/2020
266	OU2	MW-OU2-59-A	<3%	Very Sparse	32.65	Polygon	5/14/2020
267	OU2	MW-OU2-59-A	3-25%	Sparse	10.45	Polygon	5/14/2020
268	OU2	MW-OU2-59-A	<3%	Very Sparse	17.28	Polygon	5/14/2020
269	OU2	MW-OU2-59-A	3-25%	Sparse	41,290.78	Polygon	5/14/2020
270	OU2	MW-OU2-59-A	3-25%	Sparse	7,782.47	Polygon	5/14/2020
300	OU2	MW-OU2-59-A	<3%	Very Sparse	53.41	Polygon	5/14/2020
301	OU2	MW-OU2-59-A	<3%	Very Sparse	223.35	Polygon	5/14/2020
302	OU2	MW-OU2-59-A	<3%	Very Sparse	775.96	Polygon	5/14/2020
188	OUCTP	MW-BW-29-180	1		-	Point	5/19/2020
189	OUCTP	MW-BW-29-180	1		-	Point	5/19/2020
342	OUCTP	MW-BW-29-180	<3%	Very Sparse	145.36	Polygon	5/19/2020
343	OUCTP	MW-BW-29-180	<3%	Very Sparse	12.29	Polygon	5/19/2020
344	OUCTP	MW-BW-29-180	3-25%	Sparse	26,571.11	Polygon	5/19/2020
141	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
142	OUCTP	MW-BW-93-A	5		-	Point	5/15/2020
143	OUCTP	MW-BW-93-A	4		-	Point	5/15/2020
144	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
145	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
146	OUCTP	MW-BW-93-A	4		-	Point	5/15/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
147	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
148	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
149	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
150	OUCTP	MW-BW-93-A	3		-	Point	5/15/2020
151	OUCTP	MW-BW-93-A	5		-	Point	5/15/2020
152	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
153	OUCTP	MW-BW-93-A	2		-	Point	5/15/2020
154	OUCTP	MW-BW-93-A	3		-	Point	5/15/2020
155	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
156	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
157	OUCTP	MW-BW-93-A	5		-	Point	5/15/2020
158	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
159	OUCTP	MW-BW-93-A	1		-	Point	5/15/2020
160	OUCTP	MW-BW-93-A	2		-	Point	5/15/2020
161	OUCTP	MW-BW-93-A	3		-	Point	5/15/2020
303	OUCTP	MW-BW-93-A	3-25%	Sparse	2,885.58	Polygon	5/14/2020
304	OUCTP	MW-BW-93-A	26-50%	Medium Low	49.42	Polygon	5/15/2020
305	OUCTP	MW-BW-93-A	3-25%	Sparse	2.17	Polygon	5/15/2020
306	OUCTP	MW-BW-93-A	3-25%	Sparse	4.67	Polygon	5/15/2020
307	OUCTP	MW-BW-93-A	3-25%	Sparse	27,854.94	Polygon	5/15/2020
308	OUCTP	MW-BW-93-A	3-25%	Sparse	3.36	Polygon	5/15/2020
309	OUCTP	MW-BW-93-A	3-25%	Sparse	74.01	Polygon	5/15/2020
310	OUCTP	MW-BW-93-A	3-25%	Sparse	164.37	Polygon	5/15/2020
311	OUCTP	MW-BW-93-A	<3%	Very Sparse	36.00	Polygon	5/15/2020
312	OUCTP	MW-BW-93-A	<3%	Very Sparse	83.53	Polygon	5/15/2020
313	OUCTP	MW-BW-93-A	<3%	Very Sparse	281.79	Polygon	5/15/2020
314	OUCTP	MW-BW-93-A	<3%	Very Sparse	38.39	Polygon	5/15/2020
315	OUCTP	MW-BW-93-A	<3%	Very Sparse	192.13	Polygon	5/15/2020
316	OUCTP	MW-BW-93-A	<3%	Very Sparse	143.63	Polygon	5/15/2020
317	OUCTP	MW-BW-93-A	3-25%	Sparse	136.10	Polygon	5/15/2020
318	OUCTP	MW-BW-93-A	<3%	Very Sparse	58.02	Polygon	5/15/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
354	OUCTP	MW-BW-93-A	2		-	Point	5/15/2020
118	OUCTP	MW-BW-94-A	1		-	Point	5/14/2020
119	OUCTP	MW-BW-94-A	1		-	Point	5/14/2020
120	OUCTP	MW-BW-94-A	2		-	Point	5/14/2020
121	OUCTP	MW-BW-94-A	3		-	Point	5/14/2020
271	OUCTP	MW-BW-94-A	<3%	Very Sparse	3.43	Polygon	5/14/2020
272	OUCTP	MW-BW-94-A	3-25%	Sparse	307.71	Polygon	5/14/2020
273	OUCTP	MW-BW-94-A	3-25%	Sparse	300.84	Polygon	5/14/2020
274	OUCTP	MW-BW-94-A	<3%	Very Sparse	140.53	Polygon	5/14/2020
275	OUCTP	MW-BW-94-A	3-25%	Sparse	11.05	Polygon	5/14/2020
276	OUCTP	MW-BW-94-A	<3%	Very Sparse	6.93	Polygon	5/14/2020
277	OUCTP	MW-BW-94-A	3-25%	Sparse	230.00	Polygon	5/14/2020
278	OUCTP	MW-BW-94-A	3-25%	Sparse	31.33	Polygon	5/14/2020
279	OUCTP	MW-BW-94-A	3-25%	Sparse	14.40	Polygon	5/14/2020
319	OUCTP	MW-BW-94-A	3-25%	Sparse	17,800.27	Polygon	5/15/2020
320	OUCTP	MW-BW-94-A	3-25%	Sparse	177.62	Polygon	5/15/2020
80	OUCTP	MW-BW-95-A	1		-	Point	5/11/2020
81	OUCTP	MW-BW-95-A	1		-	Point	5/11/2020
82	OUCTP	MW-BW-95-A	3		-	Point	5/11/2020
83	OUCTP	MW-BW-95-A	5		-	Point	5/11/2020
84	OUCTP	MW-BW-95-A	1		-	Point	5/12/2020
85	OUCTP	MW-BW-95-A	3		-	Point	5/12/2020
86	OUCTP	MW-BW-95-A	3		-	Point	5/12/2020
87	OUCTP	MW-BW-95-A	1		-	Point	5/12/2020
88	OUCTP	MW-BW-95-A	3		-	Point	5/12/2020
89	OUCTP	MW-BW-95-A	2		-	Point	5/12/2020
90	OUCTP	MW-BW-95-A	2		-	Point	5/12/2020
91	OUCTP	MW-BW-95-A	2		-	Point	5/13/2020
92	OUCTP	MW-BW-95-A	4		-	Point	5/13/2020
93	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
94	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
95	OUCTP	MW-BW-95-A	3		-	Point	5/13/2020
96	OUCTP	MW-BW-95-A	5		-	Point	5/13/2020
97	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
98	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
99	OUCTP	MW-BW-95-A	4		-	Point	5/13/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
100	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
101	OUCTP	MW-BW-95-A	2		-	Point	5/13/2020
102	OUCTP	MW-BW-95-A	3		-	Point	5/13/2020
103	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
104	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
105	OUCTP	MW-BW-95-A	3		-	Point	5/13/2020
106	OUCTP	MW-BW-95-A	5		-	Point	5/13/2020
107	OUCTP	MW-BW-95-A	2		-	Point	5/13/2020
108	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
109	OUCTP	MW-BW-95-A	2		-	Point	5/13/2020
110	OUCTP	MW-BW-95-A	4		-	Point	5/13/2020
111	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
112	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
113	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
114	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
115	OUCTP	MW-BW-95-A	5		-	Point	5/13/2020
116	OUCTP	MW-BW-95-A	1		-	Point	5/13/2020
117	OUCTP	MW-BW-95-A	4		-	Point	5/14/2020
208	OUCTP	MW-BW-95-A	<3%	Very Sparse	26.08	Polygon	5/11/2020
209	OUCTP	MW-BW-95-A	<3%	Very Sparse	9.68	Polygon	5/11/2020
210	OUCTP	MW-BW-95-A	3-25%	Sparse	159.57	Polygon	5/11/2020
211	OUCTP	MW-BW-95-A	3-25%	Sparse	89.23	Polygon	5/11/2020
212	OUCTP	MW-BW-95-A	3-25%	Sparse	258.61	Polygon	5/12/2020
213	OUCTP	MW-BW-95-A	<3%	Very Sparse	23.60	Polygon	5/12/2020
214	OUCTP	MW-BW-95-A	<3%	Very Sparse	26.75	Polygon	5/12/2020
215	OUCTP	MW-BW-95-A	<3%	Very Sparse	65.23	Polygon	5/12/2020
216	OUCTP	MW-BW-95-A	3-25%	Sparse	7,466.56	Polygon	5/12/2020
217	OUCTP	MW-BW-95-A	3-25%	Sparse	216.80	Polygon	5/12/2020
218	OUCTP	MW-BW-95-A	3-25%	Sparse	353.19	Polygon	5/12/2020
219	OUCTP	MW-BW-95-A	3-25%	Sparse	23.14	Polygon	5/12/2020
220	OUCTP	MW-BW-95-A	3-25%	Sparse	18.67	Polygon	5/12/2020
221	OUCTP	MW-BW-95-A	3-25%	Sparse	2.48	Polygon	5/12/2020
222	OUCTP	MW-BW-95-A	26-50%	Medium Low	2,543.20	Polygon	5/12/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
223	OUCTP	MW-BW-95-A	3-25%	Sparse	9,183.92	Polygon	5/12/2020
224	OUCTP	MW-BW-95-A	3-25%	Sparse	18.05	Polygon	5/12/2020
225	OUCTP	MW-BW-95-A	<3%	Very Sparse	123.36	Polygon	5/12/2020
226	OUCTP	MW-BW-95-A	<3%	Very Sparse	98.63	Polygon	5/12/2020
227	OUCTP	MW-BW-95-A	3-25%	Sparse	10.78	Polygon	5/12/2020
228	OUCTP	MW-BW-95-A	3-25%	Sparse	7.00	Polygon	5/12/2020
229	OUCTP	MW-BW-95-A	<3%	Very Sparse	132.65	Polygon	5/12/2020
230	OUCTP	MW-BW-95-A	3-25%	Sparse	54.31	Polygon	5/12/2020
231	OUCTP	MW-BW-95-A	26-50%	Medium Low	3,606.17	Polygon	5/13/2020
232	OUCTP	MW-BW-95-A	3-25%	Sparse	1,136.30	Polygon	5/13/2020
233	OUCTP	MW-BW-95-A	3-25%	Sparse	5.81	Polygon	5/13/2020
234	OUCTP	MW-BW-95-A	<3%	Very Sparse	26.63	Polygon	5/13/2020
235	OUCTP	MW-BW-95-A	3-25%	Sparse	40.19	Polygon	5/13/2020
236	OUCTP	MW-BW-95-A	26-50%	Medium Low	5,129.60	Polygon	5/13/2020
237	OUCTP	MW-BW-95-A	3-25%	Sparse	9.47	Polygon	5/13/2020
238	OUCTP	MW-BW-95-A	3-25%	Sparse	108.41	Polygon	5/13/2020
239	OUCTP	MW-BW-95-A	<3%	Very Sparse	15.10	Polygon	5/13/2020
240	OUCTP	MW-BW-95-A	3-25%	Sparse	5,291.55	Polygon	5/13/2020
241	OUCTP	MW-BW-95-A	26-50%	Medium Low	57.94	Polygon	5/13/2020
242	OUCTP	MW-BW-95-A	3-25%	Sparse	7.34	Polygon	5/13/2020
243	OUCTP	MW-BW-95-A	3-25%	Sparse	1,614.61	Polygon	5/13/2020
244	OUCTP	MW-BW-95-A	3-25%	Sparse	88.20	Polygon	5/13/2020
245	OUCTP	MW-BW-95-A	3-25%	Sparse	101.64	Polygon	5/13/2020
246	OUCTP	MW-BW-95-A	3-25%	Sparse	36.49	Polygon	5/13/2020
247	OUCTP	MW-BW-95-A	<3%	Very Sparse	16.51	Polygon	5/13/2020
248	OUCTP	MW-BW-95-A	<3%	Very Sparse	18.63	Polygon	5/13/2020
249	OUCTP	MW-BW-95-A	3-25%	Sparse	10.39	Polygon	5/13/2020
250	OUCTP	MW-BW-95-A	<3%	Very Sparse	43.75	Polygon	5/13/2020

Table B-6. Monterey Spineflower Populations Found in 2020 OUCTP, OU2, & Sites 2/12 Survey

Population Number	Region	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft^2)	GIS Feature Type	Survey Date
251	OUCTP	MW-BW-95-A	<3%	Very Sparse	32.23	Polygon	5/13/2020
252	OUCTP	MW-BW-95-A	<3%	Very Sparse	173.93	Polygon	5/13/2020
253	OUCTP	MW-BW-95-A	<3%	Very Sparse	36.15	Polygon	5/13/2020
254	OUCTP	MW-BW-95-A	3-25%	Sparse	127.44	Polygon	5/13/2020
255	OUCTP	MW-BW-95-A	26-50%	Medium Low	32.90	Polygon	5/13/2020
256	OUCTP	MW-BW-95-A	3-25%	Sparse	135.13	Polygon	5/13/2020
257	OUCTP	MW-BW-95-A	3-25%	Sparse	68.43	Polygon	5/13/2020
258	OUCTP	MW-BW-95-A	3-25%	Sparse	40.79	Polygon	5/13/2020
259	OUCTP	MW-BW-95-A	<3%	Very Sparse	25.90	Polygon	5/13/2020
260	OUCTP	MW-BW-95-A	26-50%	Medium Low	7.08	Polygon	5/13/2020
261	OUCTP	MW-BW-95-A	3-25%	Sparse	5.78	Polygon	5/13/2020
262	OUCTP	MW-BW-95-A	3-25%	Sparse	3,425.84	Polygon	5/13/2020