2024 BIOLOGICAL MONITORING COMPLETION REPORT

for Operable Unit Carbon Tetrachloride Plume (OUCTP) & Per- and Polyfluoroalkyl Substances (PFAS) Site Inspection, at the Fort Ord Natural Reserve (FONR)

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SUBMITTED TO:

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ACRONYMS AND ABBREVIATIONS

Ahtna Environmental, Inc.
Base Realignment and Closure
Chenega Reliable Services, LLC
California Natural Diversity Database
Denise Duffy & Associates
Fort Ord Natural Reserve
foot/feet
square feet
Harris Environmental Group Inc.
Harris Environmental Group Inc. and Terracon Consultants Inc. Team
Habitat Management Plan
Operable Unit Carbon Tetrachloride Plume
Programmatic Biological Opinion
Per- and Polyfluoroalkyl Substances
real-time kinematic
Terracon Consultants Inc. (formerly Burleson Consulting Inc.)
University of California
United States Army Corps of Engineers

1. INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted Harris Environmental Group, Inc. (Harris) and Terracon Consultants Inc. (Terracon) to conduct rare plant surveys in Fort Ord Natural Reserve (FONR) in Marina, California (Figure 1-1). This report summarizes the 2024 rare plant survey results associated with the Operable Unit Carbon Tetrachloride Plume (OUCTP) and Per- and Polyfluoroalkyl Substances (PFAS) Site Inspection.

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. Groundwater in the aquifer under FONR was contaminated by several chemicals of concern due to activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area between 1962 and 1985. OUCTP chemicals of concern include trichloroethene, carbon tetrachloride, tetrachloroethene, chloroform, 1,1-dichloroethene, total-1,2-dichloroethene, methylene chloride, and vinyl chloride. Per- and polyfluoroalkyl substances were potentially introduced to the FONR groundwater after 1972 when the Army began using PFAS-containing aqueous film-forming foams to extinguish fuel-based fires (USACE, 2024). Groundwater cleanup began in 1988 with the construction of the Groundwater Extraction and Treatment System and is ongoing. As part of the OUCTP clean-up efforts and PFAS Site Inspection analysis, soil boring locations and monitoring wells have been installed to test contamination of groundwater (Ahtna, 2023).

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). Rare plants of concern with suitable habitat in FONR include Monterey gilia (*Gilia tenuiflora* ssp. *arenaria*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Seaside bird's beak (*Cordylanthus rigidus ssp. littoralis*), and Yadon's piperia (*Piperia yadonii*). Surveys for Yadon's piperia were included in 2016 at the request of the agencies.



Figure 1-1. Overview of project site at Fort Ord Natural Reserve (FONR).

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 PFAS survey areas and FONR South which contains the OUCTP survey areas. FONR provides suitable habitat for several rare plant species including Monterey gilia, Monterey spineflower, Seaside bird's beak, and Yadon's piperia. However, Yadon's piperia prefers maritime chaparral as well as Monterey pine forest and Monterey cypress forest, and there are no confirmed Yadon's piperia individuals in FONR.

1.1.1 Reference Sites

Reference Site 1 is the reference site used for biological monitoring of HMP annuals in FONR; it is located southeast of FONR North and was established by DD&A in 2010 due to its known populations of Monterey gilia and Monterey spineflower and easy accessibility (Figure 1-2; HGL, 2011). It is bounded on three sides by paved roads (Reservation Road, MBEST Drive, and University Drive). Following several annual meeting discussions, it was determined that Reference Site 1 was not fully representative of the well locations, and thus additional reference sites were selected (Table 1-1). F3 Plots 1, 2, and 3 were added to provide additional context to the FONR North survey areas; and V1 Plots 1, 2, and 3 were added to provide additional context to the FONR South survey areas (Figure 1-2 and Figure 1-3). The dominant habitat type of the reference sites is coast live oak woodland with patches of annual grasslands that support populations of Monterey spineflower and Monterey gilia. F3 and V1 have been established by FONR staff in the past for long term monitoring of Monterey spineflower and Monterey gilia.

1.1.2 Survey Areas

The PFAS survey areas included the access route to the monitoring well MW-BW-95-A and soil boring location SB-FDA-01, including the 50-ft buffer surrounding the soil boring location (Figure 1-3). Baseline surveys (Year 0) for the PFAS site were conducted in 2022 by Denise Duffy & Associates (DD&A) as a subcontractor to Ahtna Environmental, Inc. (Ahtna) and Year 1 monitoring was conducted by USACE and Chenega Reliable Services, LLC (Chenega) in 2023 (DD&A, 2023; USACE, 2024).

The OUCTP survey areas included the access route to the decommissioned well MW-OU2-86-180 and the access route to and the 10-inch decommissioned steel conductor pipe in FONR South (Figure 1-2; Table 1-1). Baseline surveys (Year 0) for OUCTP sites were conducted in 2023 by DD&A as a subcontractor to Ahtna (DD&A, 2024).

Location	Survey	Wall Identification	Survey	Reference Sites			
Location	Area Weil Identification		Year	Ref Site 1	V1 Plots	F3 Plots	
FONR North	ΡΕΔς	PEAS Access Route to MW-BW-95-A and				_ /	
ronnorth	117.5	Soil Boring SB-FDA-01	Soil Boring SB-FDA-01			\sim	
FOND South	OUCTP	MW-OU2-68-180	1	. /	. /		
FOINK SOULI		(Access Route Only)	T	\sim	\checkmark		
FOND South	ОПСТВ	Steel Conductor Pipe	1	. /	. /		
FUNK SOULI	UUCIP	(including Access Route)	L		\sim		

Table 1-1. Locations Surveyed in 2024 and their Respective Reference Sites.



Figure 1-2. FONR South and Reference Site 1 overview.

*Reference Site 1 used as a reference for FONR South and FONR North survey areas



Figure 1-3. FONR North overview.

1.2 Special Status Species

1.2.1 Monterey gilia

Monterey gilia is a native annual herb in the phlox family (Polemoniaceae) and is listed as state Threatened and federally Endangered. It occurs in open sandy soil in maritime chaparral, dune scrub, coastal scrub, and disturbed areas (Calflora, 2024). The plant forms a prostrate, basal rosette with serrate or once pinnate leaves. The branching flowering stalks range from two to six inches tall and are densely glandular (Porter, 2018). The plant blooms from April through June and the flower consists of a narrow tube with a purple throat and pink to purple lobes. Monterey gilia is endemic to Monterey Bay.

1.2.2 Monterey Spineflower

Monterey spineflower is a native annual herb in the buckwheat family (Polygonaceae) and is listed as federally Threatened. It occurs in open sandy soil in maritime chaparral, dune scrub, coastal scrub, and disturbed areas (Calflora, 2024). 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*); 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).

1.2.3 Seaside Bird's Beak

Seaside bird's beak is a native annual herb in the broomrape family (Orobanchaceae) and is listed as state Endangered. It occurs in coastal strand, northern coastal scrub, coastal sage scrub, closed-cone pine forest, southern oak woodland, foothill woodland, and chaparral habitats (Calflora, 2024). The plant is erect with compact, head-like clusters of yellowish flowers marked with maroon on the lower side; it blooms from June to August and can be identified into October (Wetherwax and Tank, 2013).

1.2.4 Yadon's Piperia

Yadon's piperia is a native perennial herb in the orchid family (Orchidaceae) and is listed as federally Endangered. Yadon's piperia occurs in maritime chaparral, Monterey pine forest, and Monterey cypress forest (Calflora, 2024). 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.

1.3 Survey Objectives

The objectives of the 2024 rare plant surveys were to:

- 1. Identify locations and estimate populations of Monterey gilia, Monterey spineflower, Seaside bird's beak, and Yadon's piperia at reference sites.
- Identify locations and estimate populations of Monterey gilia, Monterey spineflower, Seaside bird's beak, and Yadon's piperia along the access route to well location MW-BW-95-A and soil boring location SB-FDA-01 (Year 2) in FONR North (PFAS survey area); and along the access route to well location MW-OU2-68-180 (Year 1) and the steel conductor pipe and access route (Year 1) in FONR South (OUCTP survey areas).
- 3. Map Monterey gilia, Monterey spineflower, Seaside bird's beak, and Yadon's piperia populations for comparison to past surveys and to inform future management activities.
- 4. Assess results with respect to Success Criteria specified in the 2017 PBO.

2. METHODS

Monterey gilia, Monterey spineflower, and Seaside bird's beak were surveyed during peak bloom to map population size and abundance. Peak bloom was determined by visiting the reference sites and communicating with FONR staff and the Base Realignment and Closure (BRAC) biologist. Because Yadon's piperia must be identified by its inflorescence, and the blooming period for the species occurs later in the summer, locations of any piperia plants are recorded and reported for future species identification.

The Harris-Terracon team mapped rare plants using ArcGIS Field Maps with a Juniper Systems Geode GNS3S Receiver with sub-meter accuracy and RTK (real-time kinematic) corrections. Where applicable, rare plants were considered within the survey area if they were within a 50-foot (ft) radius of a well or soil boring location or within 20 ft of secondary access routes. When Monterey gilia, Monterey spineflower, Seaside bird's beak, or piperia species were encountered, the survey was extended beyond the survey area to the boundary of the population encountered.

Rare plant survey methods were based on the 2022 Biological Monitoring Completion Report and past vegetation surveys at FONR (DD&A, 2023). 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 as polygons. Generally, populations were considered discrete if there was a gap of greater than three feet between individuals, however this was left to the discretion of the field biologist to delineate logical population boundaries. Individual plants were counted for all Monterey gilia, Seaside bird's beak, and piperia species 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 categorizing it by cover class.

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 to shapefiles and projected into NAD 1983 State Plane California IV FIPS 0404 (US Feet) using ArcGIS Pro (ESRI, 2024).

The 2024 data were compared to the 2023 data to evaluate percent change of individual plants and percent change in area of polygons from year to year. If the 2024 survey area boundaries were different from past years, the past years' data were clipped to this year's extent, to ensure an accurate comparison of data from year to year. For example, in 2023, the MW-OU2-68-180 survey area included the access route and 50 ft well buffer, whereas in 2024, it only included the access route (because no ground disturbing activity occurred within the 50ft well buffer); therefore, the point and polygon data within the well buffer was excluded from the 2023 data for comparison.

3. **RESULTS and DISCUSSION**

3.1 Monterey Gilia

Monterey gilia was surveyed on April 29 and 30; and May 1 and 3, 2024. The following sections describe Monterey gilia populations mapped within the reference sites, OUCTP, and PFAS survey areas. See Appendix A for complete survey results.

3.1.1 Reference Sites

Monterey gilia was present at all reference sites in 2024 (highlighted in yellow in Table 3-1). Fortyfour populations of Monterey gilia (29 points and 15 polygons) totaling 2,017 individuals and occupying 1,322 square feet (ft²) were mapped at Reference Site 1 (Table 3-1; Figure 3-3). Seventy-four populations of Monterey gilia (55 points and 19 polygons) were mapped at the F3 Plots, which include Plots 1, 2, and 3 (Table 3-1; Figure 3-4). The populations included 513 individuals and occupied 313 ft². Thirty-one populations of Monterey gilia (19 points and 12 polygons) were mapped at the V1 Plots, which include Plots 1, 2, and 3 (Table 3-1; Figure 3-5). The populations included 263 individuals and occupied 125 ft².

Location	Year	Total Populations	Individual Plants	Indiv. Plants % Change from Prev. Year	Points	Polygons	Population Area (ft ²)*	Area % Change from Prev. Year
	2010 ²	14	1,086	N/A	7	7	1,715	N/A
	2011 ²	16	318	-71%	4	12	1,410	-18%
	2012 ²	16	70	-78%	12	4	210	-85%
	2013 ²	20	736	951%	7	13	1,281	510%
	2014 ²	4	97	-87%	2	2	370	-71%
	2015 ²	11	1,078	1,011%	4	7	1,512	309%
Deferre	2016 ²	12	1,090	1%	6	3	1,964	30%
Reference	2017	8	463	-58%	6	2	1,950	-1%
SILE I	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%
	2021	23	926	6%	10	13	1,062	8%
	2022 ¹	4	40	-96%	0	4	60	-94%
	2023 ²	22	1,985	4,863%	11	11	1,243	1,972%
	2024	44	2,017	2%	29	15	1,322	6%
V1 Plot 1		3	272	N/A	1	2	272	N/A
V1 Plot 2	2023 ³	2**	19**	N/A	1**	1	31	N/A
V1 Plot 3		3	92	N/A	0	3	239	N/A
V1 Plot 1		12	168	-38%	7	5	77	-72%
V1 Plot 2	2024	6	9	-53%	6	0	0	-100%
V1 Plot 3		13	86	-7%	6	7	48	-80%
F3 Plot 1		N/A	58	N/A	N/A	N/A	N/A	N/A
F3 Plot 2	2023 ²	N/A	197	N/A	N/A	N/A	N/A	N/A
F3 Plot 3		N/A	284	N/A	N/A	N/A	N/A	N/A

Table 3-1. Monterey Gilia Populations within Reference Aites across Years.

F3 Plot 1		32	112	93%	29	3	22	N/A
F3 Plot 2	2024	25	303	54%	13	12	211	N/A
F3 Plot 3		17	98	-65%	13	4	80	N/A

*Population area does not include point data

**Data different from past reports due to updated survey area boundaries in 2024 Terracon, 2021; ¹DD&A, 2023; ²USACE, 2024; ³DD&A, 2024

In 2024, the Monterey gilia population size at Reference Site 1 remained consistent with 2023, with a slight increase of 32 individuals and population area increase of 6%. This population is up from only 40 individuals and 60 ft² in 2022 (Table 3-1). All reference V1 Plots decreased in both Monterey gilia individuals and area of polygons between 2023 and 2024. The reference F3 Plots had varying shifts in individual plant count, with Plots 1 and 2 increasing by 93% and 54%, respectively, and Plot 3 decreasing by 65% since 2023 (Table 3-1). However, there was no point or polygon data collected for the F3 Plots in 2023, thus we can only compare the individual plant counts.

Monterey 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). Although the number of individuals did increase between 2022 and 2023 after above normal rainfall in 2023, Monterey gilia populations did not seem to fluctuate consistently with the total amount of precipitation in a water year (Figure 3-1). The population size at Reference Site 1, the V1 Plots, and the F3 Plots remained approximately the same between 2023 and 2024, despite the decrease in precipitation from above normal to normal. This could be attributed to the above normal water year we saw in 2023 creating favorable conditions to maintain the seed bank into 2024.



Figure 3-1. Monterey gilia populations at reference sites versus annual precipitation. (NPS, 2024; NOAA, 2024; HGL, 2018; Burleson, 2021; USACE, 2024; DD&A 2024)

3.1.2 PFAS Survey Area

Monterey gilia was present along the access route to well MW-BW-95-A and soil boring location SB-FDA-01 (highlighted in yellow in Table 3-2). Eleven populations of Monterey gilia (eight points and three polygons) totaling 101 individuals and occupying 111 ft² were mapped along the access route to MW-BW-95-A and SB-FDA-01; all individuals in this area were found within the access route and buffer (Figure 3-6 and Figure 3-7).

In 2024, the Monterey gilia population size within the access route to MW-BW-95-A and SB-FDA-01 remained relatively consistent with 2023, with the same number of populations and a slight increase of 17 individuals. This population is up from only 20 individuals in Baseline (2022), a 405% increase from 2022 to 2024 (Table 3-2).

3.1.3 OUCTP Survey Areas

Monterey gilia was also present in FONR South along the access route to MW-OU2-68-180 (Table 3-2). Three populations of Monterey gilia (two points and one polygon) totaling 44 individuals and occupying 54 ft² were mapped within the access route to MW-OU2-68-180 (Figure 3-8). There were no Monterey gilia individuals found within the steel conductor pipe survey area.

The access route to well MW-OU2-68-180 increased from zero Monterey gilia individuals in Baseline to 44 individuals in 2024 (Year 1) (Table 3-2). There were, however, two populations (42 individuals) that were mapped within the buffer of well MW-OU2-68-180 in 2023, but these were outside the survey area boundary in 2024 so were not used for comparison here. Due to proximity and slight overlap in the 2023 and 2024 populations, it is plausible that the 2023 population contributed to the seedbank for the populations within the access route this year. Lastly, there were no individuals recorded within the access route to the steel conductor pipe in FONR South in Baseline (2023) or Year 1 (2024) (Table 3-2).

Location	Year	Total Populations	Indiv. Plants	Indiv. Plants % Change from Prev. Year	Points	Polygons	Population Area (ft²)*	Area % Change from Prev. Year
Access Route	2022 (Year 0) ¹	3**	20**	N/A	2**	1	65	N/A
to MW-BW- 95-A and Soil Boring SB- FDA-01	2023 (Year 1) ²	11	84	320%	8	3	50	-23%
	2024 (Year 2)	11	101	20%	8	3	111	121%
MW-OU2-68-	2023 (Year 0) ³	0**	0**	N/A	0	0**	0**	N/A
Route)	2024 (Year 1)	3	44	N/A	2	1	54	N/A
Steel Conductor	2023 (Year 0) ³	0	0	N/A	0	0	0	N/A
Pipe (and Access Route)	2024 (Year 1)	0	0	N/A	0	0	0	N/A

Table 3-2. Monterey Gilia Populations within the OUCTP and PFAS Survey Areas from 2022-2024.

*Population area does not include point data

**Data different from past reports due to updated survey area boundaries in 2024

¹ DD&A, 2023; ² USACE, 2024; ³ DD&A 2024

3.2 Monterey Spineflower

Monterey spineflower was surveyed on May 20, 21, 30, and 31, 2024. The following sections describe Monterey spineflower populations mapped within the reference sites, OUCTP, and PFAS survey areas. See Appendix A for complete survey results.

3.2.1 Reference Sites

Monterey spineflower was present at all reference sites in 2024 (highlighted in yellow in Table 3-3). Twenty-nine Monterey spineflower populations (15 points and 14 polygons) occupying 4,468 ft² were mapped at Reference Site 1; the cover classes of the polygons ranged from *very sparse* (<3% cover) to *medium high* (76-97% cover), with the majority of the polygons falling within the *very sparse* and *sparse* cover classes (Table 3-3; Figure 3-3). Twenty-seven Monterey spineflower populations (15 points and 12 polygons) occupying 898 ft² were mapped at the F3 Plots; the cover classes of the polygons ranged from *very sparse* to *medium low* (26-50% cover) (Table 3-3; Figure 3-4). Seven Monterey spineflower populations (four points and four polygons) occupying 1,067 ft² were mapped at the V1 Plots; the cover classes of the polygons ranged from *sparse* (3-25% cover) to *medium high* (Table 3-3; Figure 3-5).

Location	Year	Total Populations	Indiv. Plants	Indiv. Plants % Change from Prev. Year	Points	Polygons (varying density classes)	Population Area (ft ²)*	Area % Change from Prev. Year
	2010 ²	2	N/A	N/A	0	2	2,846	N/A
	2011 ²	1	N/A	N/A	0	1	2,865	1%
	2012 ²	3	N/A	N/A	1	2	1,494	-48%
	2013 ²	7	N/A	N/A	0	7	2,813	88%
	2014 ²	7	N/A	N/A	1	6	1,119	-60%
	2015 ²	4	N/A	N/A	1	3	2,114	89%
Reference	2016 ²	2	N/A	N/A	0	2	3,241	53%
Site 1	2017	4	N/A	N/A	0	4	2,855	-12%
Site 1	2018	4	N/A	N/A	1	3	3,556	25%
	2019	18	N/A	N/A	11	7	3,045	-14%
	2020	8	N/A	N/A	1	7	3,687	21%
	2021	30	N/A	N/A	15	15	1,890	-49%
	2022 ¹	10	N/A	N/A	7	3	117	-94%
	2023 ²	34	N/A	N/A	21	13	1,464	1151%
	2024	29	N/A	N/A	15	14	4,468	205%
V1 Plot 1		1	N/A	N/A	0	1	541	N/A
V1 Plot 2	2023 ³	6**	N/A	N/A	3**	3**	143**	N/A
V1 Plot 3		1	N/A	N/A	0	1	1,211	N/A
V1 Plot 1		1	N/A	N/A	0	1	503	-7%
V1 Plot 2	2024	1	N/A	N/A	1	0	0	-100%
V1 Plot 3		6	N/A	N/A	3	3	564	-53%
F3 Plot 1		N/A	289	N/A	N/A	N/A	N/A	N/A
F3 Plot 2	2023***	N/A	239	N/A	N/A	N/A	N/A	N/A
F3 Plot 3		N/A	23	N/A	N/A	N/A	N/A	N/A
F3 Plot 1	2024	8	345	19%	1	7	363	N/A

Table 3-3. Monterey Spineflower Populations within Reference Sites across Yea	Irs
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F3 Plot 2	8	316	32%	3	5	535	N/A
F3 Plot 3	11	25	9%	11	0	0	N/A

*Population area does not include point data

**Data different from past reports due to updated survey area boundaries in 2024

***2023 F3 Plot data only included individual plant counts

Terracon, 2021; ¹DD&A, 2023; ²USACE, 2024; ³DD&A, 2024

At Reference Site 1, Monterey spineflower populations increased by 3,004 ft² from 2023 to 2024 to 4,468 ft². This population occupied the highest area recorded since 2017 and is up from only 117 ft² of Monterey spineflower in 2022 (Table 3-3). However, the total number of discrete populations was less than that of 2023; and there were three polygons in the *medium* and *medium high* cover classes in 2024 compared to zero in 2023; indicating that the 2024 populations have increased in area and density, rather than dispersed. However, it should be noted that due to the methodology used, the overall area of Monterey spineflower can vary dramatically depending on encroachment of the surrounding populations. In 2024, one polygon in the southern corner of Reference Site 1 accounted for roughly 2,500 ft², an area that was not included last year because it had not yet encroached within the survey area boundary (Figure 3-3).

The V1 Plots were comparable year to year, with eight populations of Monterey spineflower in both 2023 (Baseline) and 2024 (Year 1). The three plots collectively saw a decrease of 828 ft² in area occupied by spineflower in 2024, however they occupied a higher cover class on average; three polygons fell within the *medium low* to *medium high* cover classes in 2024, compared to zero in these cover classes in 2023 (Table 3-3). The individual Monterey spineflower plants increased across all F3 Plots at a similar rate (9-32%) between 2023 and 2024. There was no point or polygon data collected for the F3 Plots in 2023, therefore this 2024 data is not comparable across years.

Monterey spineflower typically germinates more readily in dry years than in wet years but adult survival and seed set increases with wetter, warmer weather in spring. Additionally, seedling abundance often reflects recent additions to and depletions of the seed bank rather than prevailing weather (Fox *et al*, 2006). The Monterey spineflower population area increased dramatically at Reference Site 1 from 2023 to 2024 (Figure 3-2). The wet springs in both years likely played an important role in this population spike. However, as mentioned above, due to the survey methodology, there was a large population (~2,500 ft²) included in the 2024 area that was not included in past years, which could explain the unexpected increase in population area with a decrease in precipitation. The Monterey spineflower population area in the V1 Plots saw an appropriate reduction, given the reduction in precipitation, though the overall cover classes increased in density.



Figure 3-2. Area of Monterey spineflower populations at the reference sites versus annual precipitation.

(NPS, 2024; NOAA, 2024; HGL, 2018; Terracon, 2021; USACE, 2024; DD&A 2024)

3.2.2 PFAS Survey Areas

Monterey spineflower was present along the access route to well MW-BW-95A and soil boring location SB-FDA-01, as well as the 50-ft buffer surrounding the soil boring location (highlighted in yellow in Table 3-4). One hundred and six populations (70 points and 36 polygons) occupying 4,362 ft² were mapped within the access route to MW-BW-95-A and SB-FDA-01; the populations represented by polygons ranged from *very sparse* (<3% cover) to *very high* (>97% cover) density, with the majority of the polygons falling within the *very sparse* density class (Table 3-4; Figure 3-6 and Figure 3-7).

The Monterey spineflower population size within the access route to MW-BW-95-A and SB-FDA-01 decreased by 94% from Baseline (2022) to Year 1 (2023) but increased substantially in Year 2 (2024) to 106 discrete populations occupying 4,362 ft² (Table 3-4). PFAS survey areas had a greater number of polygons in the *medium low* to *very high* cover classes in 2024, as the 2023 polygons were only *very sparse* to *sparse* cover; overall, populations are increasing in density.

3.2.3 OUCTP Survey Areas

Monterey spineflower was present in both OUCTP survey areas in 2024 (highlighted in yellow in Table 3-4). Thirteen populations (seven points and six polygons) occupying 1,537 ft² were mapped within the access route to MW-OU2-68-180, ranging from *very sparse* to *medium high* (76-97% cover) density populations (Figure 3-8). Within the steel conductor pipe survey area, 38 populations (19 points and 19 polygons) were mapped in 2024, ranging from *very sparse* to *medium high* density populations (Table 3-4; Figure 3-9).

The access route to well MW-OU2-68-180 remained consistent from 2023 to 2024, increasing from 10 to 13 discrete populations and decreasing in spineflower occupied area by 5% (Table 3-4). The access route to the steel conductor pipe saw a large increase in number of populations (from 7 to 38) between Baseline (2023) and Year 1 (2024), but a substantial decrease (63%) in area occupied by Monterey spineflower. This is interpreted to be a consequence of populations becoming more isolated rather than continuous. OUCTP survey areas had a greater number of polygons in the *medium low* to *medium high* cover classes in 2024, as the 2023 polygons were only *very sparse* to *sparse* cover; overall, populations are increasing in density.

Table 3-4. Monterey Spineflower Populations within the OUCTP and PFAS Survey Areas from 2022
2024.

Location	Year	Total Populations	Points	Polygons (varying density classes)	Population Area (ft ²)*	Area % Change from Prev Year
Access Route to	2022 (Year 0) ¹	19**	6**	13**	2,403**	N/A
MW-BW-95-A and Soil Boring SB-FDA-01	2023 (Year 1) ²	18	12	6	134	-94%
	2024 (Year 2)	106	70	36	4,362	3,155%
MW-OU2-68-	2023 (Year 0) ³	10**	4**	6**	1,620**	N/A
180 (Access Route)	2024 (Year 1)	13	7	6	1,537	-5%
Steel Conductor Pipe (and Access Route)	2023 (Year 0) ³	7	1	6	2,400	N/A
	2024 (Year 1)	38	19	19	876	-63%

*Population area does not include point data

**Data different from past reports due to updated survey area boundaries in 2024 ¹DD&A, 2023; ²USACE, 2024; ³DD&A 2024

3.3 Seaside bird's beak

Seaside bird's beak was surveyed concurrently with Monterey gilia and Monterey spineflower. No Seaside bird's beak individuals were observed in 2024 survey areas, and it will not be discussed further in this report.

3.4 Yadon's Piperia

Yadon's piperia was surveyed concurrently with Monterey gilia and Monterey spineflower. One piperia rosette was identified within the reference site F3 Plot 3 on May 3, 2024, but the plant was not identifiable to species. No piperia were found within the remaining 2024 survey areas. Yadon's piperia will not be discussed further in this report.



Figure 3-3. 2024 Monterey gilia and Monterey spineflower populations at Reference Site 1.



Figure 3-4. 2024 Monterey gilia and Monterey spineflower populations at reference F3 Plots.



Figure 3-5. 2024 Monterey gilia and Monterey spineflower populations at reference V1 Plots.



Figure 3-6. 2024 Monterey gilia and Monterey spineflower populations within the access route to MW-BW-95-A and SB-FDA-01 (west portion of survey area).



Figure 3-7. 2024 Monterey gilia and Monterey spineflower populations within the access route to MW-BW-95-A and SB-FDA-01 (east portion of survey area).



Figure 3-8. 2024 Monterey gilia and Monterey spineflower populations within the access route to MW-OU2-68-180.



Figure 3-9. 2024 Monterey gilia and Monterey spineflower populations within the access route to the steel conductor pipe.

4. SUCCESS CRITERIA

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 2024 surveys were Year 1 and Year 2 follow up surveys for OUCTP and PFAS survey areas, respectively. The following sections compare survey area population changes across years. Rare plant survey data are also compared to the 2017 PBO Success Criteria in the following sections to assess the impact of remediation activities on rare plant populations within the OUCTP and PFAS survey areas. The 2017 PBO identifies the Success Criteria as follows:

- 1) "Densities and acreage of HMP annual species are within a normal range compared with information from reference sites" (USFWS, 2017).
- "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).

4.1 Monterey Gilia

Within the access route to MW-BW-95-A and soil boring location SB-FDA-01 (PFAS survey area), year-toyear Monterey gilia densities and area were within a normal range when compared to those at Reference Site 1 from 2022 (Baseline) to 2024 (Year 2) and the F3 plots from 2023 (Year 1) to 2024 (Year 2) (Table 3-1 and Table 3-2). Although the extent of the Monterey gilia population in the access route to MW-BW-95-A contracted in 2023, both the access route and Reference Site 1 saw a substantial increase in the number of individual plants in 2023 and another moderate increase in 2024. In the F3 Plots, Monterey gilia individuals increased an average of 27% from 2023 to 2024, a similar increase to that of the MW-BW-95-A access route (Table 3-1 and Table 3-2).

Within the access route to MW-OU2-68-180 (OUCTP survey area), year-to-year Monterey gilia densities and area substantially increased from Baseline to Year 1, as there were zero plants found in the survey area in 2023 compared to 44 individuals (54 ft²) in 2024 (Table 3-1 and Table 3-2). This is in opposition to the FONR South reference V1 Plots, where the number of individual plants and population area decreased across all three plots. However, the considerable increase in number of individuals and populations area within the MW-OU2-68-180 access route is consistent with that of Reference Site 1, where there was a steady increase in number of individuals and population area from 2023 (Year 1) to 2024 (Year 2) (Table 3-1 and Table 3-2). Within the steel conductor pipe survey area, there was no Monterey gilia observed in 2023 or 2024. See Table 4-1 and Table 4-2 for year-to-year Monterey gilia population trends across survey sites, based on number of individuals and population area (area of polygons).

 Table 4-1. Year-to-Year Monterey Gilia Population Trends across PFAS Survey Areas and Associated

 Reference Sites.

Region	MBEST Drive		FONR North			
Site	Reference Site 1		Reference F3 Plots		Access route to MW-BW- 95-A and SB-FDA-01	
Metric	Number of Individuals	Population Area	Number of Individuals	Population Area	Number of Individuals	Population Area
2022 -> 2023			N/A ¹	N/A ¹	1	+
2023 -> 2024				N/A ²		

¹Not surveyed in 2022

²No polygon data collected in previous year

 Table 4-2. Year-to-Year Monterey Gilia Population Trends across OUCTP Survey Areas and Associated

 Reference Sites.

Region	MBES	T Drive			FONR South					
Site	Referen	ice Site 1	Reference V1 Plots		ReferenceMW-OU2V1 Plots(Access Ro		MW-OU2-68-180 (Access Route only)		Steel Conductor Pipe (and Access Route)	
Metric	Number of Indiv.	Population Area	Number of Indiv.	Population Area	Number of Indiv.	Population Area	Number of Indiv.	Population Area		
2022 -> 2023			N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹		
2023 -> 2024			➡	➡			N/A ²	N/A ²		

¹Not surveyed in 2022

²No populations found in either survey year

Success Criterion 1 was met for Monterey gilia for all survey areas in 2024, as the density and population areas were within a normal range for the species, as evidenced by the increase in the number of individuals at the MW-OU2-68-180 and MW-BW-95A access routes. These results differed however from the results at the V1 Plots, where the Monterey gilia population decreased. It should be noted there is a wide range of variables that could be contributing to the gilia population dynamics in the V1 Plots, including competition from other plants, differences in soil moisture retention, or sunlight availability. Nevertheless, the increase in population size at all monitored survey areas is a positive trend over the last two survey years. These findings overall suggest that Monterey gilia abundance has not been adversely impacted in the OUCTP or PFAS survey areas in 2024.

Success Criterion 2 was met for Monterey gilia in 2024, as all survey areas where Monterey gilia was detected in Baseline, still contained the species in 2024.

4.2 Monterey Spineflower

Within the access route to MW-BW-95-A and soil boring location SB-FDA-01 (PFAS survey area), year-toyear Monterey spineflower densities and area were within a normal range when compared to those at Reference Site 1 from 2022 (Baseline) to 2024 (Year 2) and the F3 Plots from 2023 (Year 1) to 2024 (Year 2) (Table 3-3 and Table 3-4). While Reference Site 1 increased each year from 2022 to 2024 (1,151% and 205%, respectively), the MW-BW-95-A access route decreased from Baseline but considerably increased in Year 2 (-94% to 3,155%, respectively). Monterey spineflower individuals saw a steady increase of 26% on average across all F3 Plots from 2023 to 2024, a shift similar to that at the access route to MW-BW-95-A, but at a far lower rate of population growth (Table 3-3 and Table 3-4).

Within the OUCTP survey areas, year-to-year Monterey spineflower densities and area were similar to those at the FONR South reference V1 Plots but were notably different than those at Reference Site 1. The Monterey spineflower populations within the access route to MW-OU2-68-180 were relatively stable from Baseline (2023) to Year 1 (2024), with a 5% decrease in population area and an increase of three additional populations (Table 3-3 and Table 3-4). The V1 Plots decreased by 53% on average across all three plots, a more negative shift than that of MW-OU2-68-180. The steel conductor pipe survey area saw a similar decline, with a decrease of 63% in area occupied by Monterey spineflower from Baseline (2023) to Year 1 (2024) (Table 3-4). However, Reference Site 1 significantly differed from both the access route to MW-OU2-68-180 and the steel conductor pipe survey area, with a 205% increase in area occupied by Monterey spineflower from 2023 (Year 1) to 2024 (Year 2) (Table 3-1 and Table 3-2). See Table 4-3 for year-to-year Monterey spineflower population trends across survey sites, based on population area (area of polygons).

Table 4-3. Year-to-Year Monterey Spineflower Population Trends across Reference and Survey Areas
and Associated Reference Sites (based on population area).

Region	MBEST Drive	FOI	NR North		FONR South		
Site	Reference Site 1	Reference F3 Plots*	Access route to MW-BW-95-A and SB-FDA-01	Reference V1 Plots	MW-OU2-68- 180 (Access Route)	Steel Conductor Pipe (and Access Route)	
2022 -> 2023	1	N/A ¹	+	N/A ¹	N/A ¹	N/A ¹	
2023 -> 2024	1	1	+	➡	➡	₽	

*F3 Plot trend based on number of individuals ¹Not surveyed in 2022

Success Criterion 1 was met for Monterey spineflower for all survey areas in 2024, as the density and population areas were within a normal range for the species, as evidenced by the Monterey spineflower populations at the respective reference sites. Although the year-to-year population trends within the OUCTP survey areas were not consistent with those in Reference Site 1, they were consistent with the V1 Plots. It should be noted there is a wide range of variables that could be contributing to the opposing results in Reference Site 1 and the OUCTP survey areas, both in survey methodology and population dynamics. As mentioned above, the population area of Monterey spineflower this year was significantly skewed as a result of the southern population in Reference Site 1 encroaching into the survey area boundary. Additionally, environmental factors such as precipitation patterns, environmental disturbance, and competition could be affecting the population growth at these sites, resulting in

dynamic trends across years. This is why we conduct surveys at multiple reference sites, as the variability in environmental conditions can make one reference site more suitable for comparison in certain years than others. These findings overall suggest that Monterey spineflower abundance has not been adversely impacted in the OUCTP or PFAS survey areas in 2024.

Success Criterion 2 was met for Monterey spineflower in 2024, as all survey areas where Monterey spineflower was detected in Baseline, still contained the species in 2024.

5. CONCLUSIONS

In accordance with the HMP and PBO, monitoring is complete after three years if Monterey gilia and Monterey spineflower populations meet both success criteria outlined in the 2017 PBO. The OUCTP survey areas have been monitored for Monterey gilia and Monterey spineflower for one year and the PFAS survey area has been monitored for two years. Success Criterion 1 and 2 have both been adequately met for Monterey gilia and Monterey spineflower across all sites. Although Monterey spineflower saw a decline in population size in the OUCTP FONR South sites, these year-to-year population trends were generally consistent with the FONR South reference sites. In 2025, Year 2 surveys will be conducted for the steel conductor pipe and MW-OU2-68-180 survey areas and Year 3 surveys will be conducted for the access route to MW-BW-95-A and SB-FDA-01.

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APPENDIX A

2024 Rare Plant Survey Results

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Population Number	Location	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
245	Reference Site 1	119	98.38	Polygon	4/29/2024
246	Reference Site 1	201	123.65	Polygon	4/29/2024
247	Reference Site 1	165	70.29	Polygon	4/29/2024
248	Reference Site 1	37	30.73	Polygon	4/29/2024
249	Reference Site 1	8	4.50	Polygon	4/29/2024
250	Reference Site 1	179	145.52	Polygon	4/29/2024
251	Reference Site 1	6	2.13	Polygon	4/29/2024
252	Reference Site 1	61	34.82	Polygon	4/29/2024
253	Reference Site 1	182	89.37	Polygon	4/29/2024
254	Reference Site 1	51	30.53	Polygon	4/29/2024
255	Reference Site 1	63	28.64	Polygon	4/29/2024
256	Reference Site 1	7	12.46	Polygon	4/29/2024
257	Reference Site 1	225	222.91	Polygon	4/29/2024
258	Reference Site 1	305	139.74	Polygon	4/30/2024
259	Reference Site 1	345	288.80	Polygon	4/30/2024
1	Reference Site 1	2	-	Point	4/29/2024
2	Reference Site 1	1	-	Point	4/29/2024
3	Reference Site 1	2	-	Point	4/29/2024
4	Reference Site 1	5	-	Point	4/29/2024
5	Reference Site 1	5	-	Point	4/29/2024
6	Reference Site 1	5	-	Point	4/29/2024
7	Reference Site 1	1	-	Point	4/29/2024
8	Reference Site 1	1	-	Point	4/29/2024
9	Reference Site 1	1	-	Point	4/29/2024
10	Reference Site 1	5	-	Point	4/29/2024
11	Reference Site 1	1	-	Point	4/29/2024
12	Reference Site 1	5	-	Point	4/29/2024
13	Reference Site 1	1	-	Point	4/29/2024
14	Reference Site 1	1	-	Point	4/29/2024
15	Reference Site 1	2	-	Point	4/29/2024
16	Reference Site 1	5	-	Point	4/29/2024
17	Reference Site 1	2	-	Point	4/29/2024
18	Reference Site 1	1	-	Point	4/29/2024
19	Reference Site 1	1	-	Point	4/29/2024
20	Reference Site 1	1	-	Point	4/29/2024
21	Reference Site 1	5	-	Point	4/29/2024
22	Reference Site 1	1	-	Point	4/30/2024
23	Reference Site 1	1	-	Point	4/30/2024

Table A-1. 2024 Montere	y gilia populations	recorded within Ref	erence Site 1.
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24	Reference Site 1	1	-	Point	4/30/2024
25	Reference Site 1	1	-	Point	4/30/2024
26	Reference Site 1	1	-	Point	4/30/2024
27	Reference Site 1	1	-	Point	4/30/2024
28	Reference Site 1	2	-	Point	4/30/2024
29	Reference Site 1	2	-	Point	4/30/2024

Table A-2. 2024 Monterey gilia populations recorded within the reference V1 Plots.

Population Number	Location	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
267	V1 Plot 1	81	25.63	Polygon	4/30/2024
268	V1 Plot 1	7	2.43	Polygon	4/30/2024
269	V1 Plot 1	15	15.40	Polygon	4/30/2024
270	V1 Plot 1	12	3.51	Polygon	4/30/2024
271	V1 Plot 1	39	29.90	Polygon	4/30/2024
36	V1 Plot 1	2	-	Point	4/30/2024
37	V1 Plot 1	3	-	Point	4/30/2024
38	V1 Plot 1	1	-	Point	4/30/2024
39	V1 Plot 1	5	-	Point	4/30/2024
40	V1 Plot 1	1	-	Point	4/30/2024
41	V1 Plot 1	1	-	Point	4/30/2024
42	V1 Plot 1	1	-	Point	4/30/2024
43	V1 Plot 2	4	-	Point	5/21/2024
44	V1 Plot 2	1	-	Point	5/21/2024
45	V1 Plot 2	1	-	Point	4/30/2024
46	V1 Plot 2	1	-	Point	4/30/2024
142	V1 Plot 2	1	-	Point	4/30/2024
143	V1 Plot 2	1	-	Point	4/30/2024
260	V1 Plot 3	8	3.31	Polygon	4/30/2024
261	V1 Plot 3	10	5.45	Polygon	4/30/2024
262	V1 Plot 3	7	1.65	Polygon	4/30/2024
263	V1 Plot 3	11	8.74	Polygon	4/30/2024
264	V1 Plot 3	24	11.79	Polygon	4/30/2024
265	V1 Plot 3	10	11.04	Polygon	4/30/2024
266	V1 Plot 3	7	6.01	Polygon	4/30/2024
30	V1 Plot 3	1	-	Point	4/30/2024
31	V1 Plot 3	1	-	Point	4/30/2024
32	V1 Plot 3	3	-	Point	4/30/2024
33	V1 Plot 3	1	-	Point	4/30/2024
34	V1 Plot 3	1	-	Point	4/30/2024
35	V1 Plot 3	2	-	Point	4/30/2024

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Population Number	Location	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
273	F3 Plot 1	8	2.14	Polygon	5/1/2024
274	F3 Plot 1	17	17.51	Polygon	5/1/2024
275	F3 Plot 1	14	2.47	Polygon	5/1/2024
49	F3 Plot 1	1	-	Point	5/1/2024
50	F3 Plot 1	1	-	Point	5/1/2024
51	F3 Plot 1	2	-	Point	5/1/2024
52	F3 Plot 1	2	-	Point	5/1/2024
53	F3 Plot 1	2	-	Point	5/1/2024
54	F3 Plot 1	3	-	Point	5/1/2024
55	F3 Plot 1	4	-	Point	5/1/2024
56	F3 Plot 1	1	-	Point	5/1/2024
57	F3 Plot 1	5	-	Point	5/1/2024
58	F3 Plot 1	2	-	Point	5/1/2024
59	F3 Plot 1	4	-	Point	5/1/2024
60	F3 Plot 1	1	-	Point	5/1/2024
61	F3 Plot 1	4	-	Point	5/1/2024
62	F3 Plot 1	5	-	Point	5/1/2024
63	F3 Plot 1	2	-	Point	5/1/2024
64	F3 Plot 1	5	-	Point	5/1/2024
65	F3 Plot 1	2	-	Point	5/1/2024
66	F3 Plot 1	5	-	Point	5/1/2024
67	F3 Plot 1	2	-	Point	5/1/2024
68	F3 Plot 1	2	-	Point	5/1/2024
69	F3 Plot 1	1	-	Point	5/1/2024
70	F3 Plot 1	2	-	Point	5/1/2024
71	F3 Plot 1	3	-	Point	5/1/2024
72	F3 Plot 1	1	-	Point	5/1/2024
73	F3 Plot 1	2	-	Point	5/1/2024
74	F3 Plot 1	3	-	Point	5/1/2024
75	F3 Plot 1	2	-	Point	5/1/2024
76	F3 Plot 1	3	-	Point	5/1/2024
80	F3 Plot 1	1	-	Point	5/1/2024
276	F3 Plot 2	8	2.20	Polygon	5/1/2024
277	F3 Plot 2	44	33.29	Polygon	5/1/2024
278	F3 Plot 2	10	3.90	Polygon	5/1/2024
279	F3 Plot 2	66	48.39	Polygon	5/1/2024
280	F3 Plot 2	7	5.56	Polygon	5/1/2024
281	F3 Plot 2	19	18.57	Polygon	5/1/2024

282	F3 Plot 2	7	6.94	Polygon	5/1/2024
283	F3 Plot 2	21	17.34	Polygon	5/1/2024
284	F3 Plot 2	27	23.53	Polygon	5/1/2024
285	F3 Plot 2	23	19.56	Polygon	5/1/2024
286	F3 Plot 2	17	12.80	Polygon	5/1/2024
287	F3 Plot 2	23	19.38	Polygon	5/1/2024
77	F3 Plot 2	1	-	Point	5/1/2024
78	F3 Plot 2	5	-	Point	5/1/2024
79	F3 Plot 2	1	-	Point	5/1/2024
81	F3 Plot 2	1	-	Point	5/1/2024
82	F3 Plot 2	3	-	Point	5/1/2024
83	F3 Plot 2	2	-	Point	5/1/2024
84	F3 Plot 2	1	-	Point	5/1/2024
85	F3 Plot 2	5	-	Point	5/1/2024
86	F3 Plot 2	4	-	Point	5/1/2024
87	F3 Plot 2	2	-	Point	5/1/2024
88	F3 Plot 2	3	-	Point	5/1/2024
89	F3 Plot 2	2	-	Point	5/1/2024
90	F3 Plot 2	1	-	Point	5/1/2024
288	F3 Plot 3	34	45.98	Polygon	5/3/2024
289	F3 Plot 3	14	14.91	Polygon	5/3/2024
290	F3 Plot 3	11	10.58	Polygon	5/3/2024
291	F3 Plot 3	12	8.93	Polygon	5/3/2024
91	F3 Plot 3	1	-	Point	5/3/2024
92	F3 Plot 3	1	-	Point	5/3/2024
93	F3 Plot 3	1	-	Point	5/3/2024
94	F3 Plot 3	1	-	Point	5/3/2024
95	F3 Plot 3	1	-	Point	5/3/2024
96	F3 Plot 3	1	-	Point	5/3/2024
97	F3 Plot 3	1	-	Point	5/3/2024
98	F3 Plot 3	1	-	Point	5/3/2024
99	F3 Plot 3	4	-	Point	5/3/2024
100	F3 Plot 3	4	-	Point	5/3/2024
101	F3 Plot 3	3	-	Point	5/3/2024
102	F3 Plot 3	4	_	Point	5/3/2024
103	F3 Plot 3	4	-	Point	5/3/2024

Population Number	Location	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
272	MW-OU2-68-180	39	54.36	Polygon	5/1/2024
47	MW-OU2-68-180	4	-	Point	5/1/2024
48	MW-OU2-68-180	1	-	Point	5/1/2024

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Table A-5. 2024 Monterey gilia populations recorded within the access route to MW-BW-95-A and soil boring location SB-FDA-01.

Population Number	Location	Individuals (#)	Area (ft²)	GIS Feature Type	Survey Date
292	MW-BW-95-A & SB-FDA-01	6	7.10	Polygon	5/3/2024
293	MW-BW-95-A & SB-FDA-01	7	5.99	Polygon	5/3/2024
294	MW-BW-95-A & SB-FDA-01	73	97.48	Polygon	5/3/2024
104	MW-BW-95-A & SB-FDA-01	1	-	Point	5/3/2024
105	MW-BW-95-A & SB-FDA-01	1	-	Point	5/3/2024
106	MW-BW-95-A & SB-FDA-01	1	-	Point	5/3/2024
107	MW-BW-95-A & SB-FDA-01	3	-	Point	5/3/2024
108	MW-BW-95-A & SB-FDA-01	3	-	Point	5/3/2024
109	MW-BW-95-A & SB-FDA-01	3	-	Point	5/3/2024
110	MW-BW-95-A & SB-FDA-01	1	-	Point	5/3/2024
111	MW-BW-95-A & SB-FDA-01	2	-	Point	5/3/2024

Table A-6. 2024 Monterey spineflowe	r populations recorded	within Reference Site 1.
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Population Number	Location	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
360	Reference Site 1	26-50%	Medium-low	378.18	Polygon	5/30/2024
361	Reference Site 1	<3%	Very Sparse	4.01	Polygon	5/30/2024
362	Reference Site 1	<3%	Very Sparse	10.03	Polygon	5/30/2024
363	Reference Site 1	<3%	Very Sparse	5.54	Polygon	5/30/2024
364	Reference Site 1	<3%	Very Sparse	12.22	Polygon	5/30/2024
365	Reference Site 1	3-25%	Sparse	73.39	Polygon	5/30/2024
366	Reference Site 1	<3%	Very Sparse	1.77	Polygon	5/30/2024
367	Reference Site 1	3-25%	Sparse	77.12	Polygon	5/30/2024
368	Reference Site 1	76-97%	Medium-high	2,552.86	Polygon	5/31/2024
369	Reference Site 1	51-75%	Medium	484.48	Polygon	5/31/2024
370	Reference Site 1	3-25%	Sparse	214.30	Polygon	5/31/2024
371	Reference Site 1	51-75%	Medium	496.27	Polygon	5/31/2024
372	Reference Site 1	3-25%	Sparse	38.29	Polygon	5/31/2024

373	Reference Site 1	26-50%	Medium-low	119.89	Polygon	5/31/2024
214	Reference Site 1	2	-	-	Point	5/30/2024
215	Reference Site 1	1	-	-	Point	5/30/2024
216	Reference Site 1	1	-	-	Point	5/30/2024
217	Reference Site 1	3	-	-	Point	5/30/2024
218	Reference Site 1	2	-	-	Point	5/30/2024
219	Reference Site 1	3	-	-	Point	5/30/2024
220	Reference Site 1	2	-	-	Point	5/30/2024
221	Reference Site 1	1	-	-	Point	5/30/2024
222	Reference Site 1	2	-	-	Point	5/30/2024
223	Reference Site 1	2	-	-	Point	5/30/2024
224	Reference Site 1	3	-	-	Point	5/30/2024
225	Reference Site 1	3	-	-	Point	5/30/2024
226	Reference Site 1	1	-	-	Point	5/31/2024
227	Reference Site 1	2	-	-	Point	5/31/2024
228	Reference Site 1	2	-	-	Point	5/31/2024

Table A-7. 2024 Monterey spineflower populations recorded within reference V1 Plots.

Population Number	Location	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
323	V1 Plot 1	3-25%	Sparse	502.62	Polygon	5/21/2024
141	V1 Plot 2	1	-	-	Point	5/21/2024
320	V1 Plot 3	76-97%	Medium-high	38.13	Polygon	5/21/2024
321	V1 Plot 3	26-50%	Medium-low	86.37	Polygon	5/21/2024
322	V1 Plot 3	51-75%	Medium	439.54	Polygon	5/21/2024
138	V1 Plot 3	2			Point	5/21/2024
139	V1 Plot 3	2			Point	5/21/2024
140	V1 Plot 3	1			Point	5/21/2024

Table A-8. 2024 Monterey spineflower populations recorded within reference F3 Plots.

Population Number	Location	Individuals (#) or % Cover	Cover Class Area (ft ²)		GIS Feature Type	Survey Date
374	F3 Plot 1	26-50%	Medium-low	272.42	Polygon	5/31/2024
375	F3 Plot 1	<3%	Very Sparse	6.99	Polygon	5/31/2024
376	F3 Plot 1	3-25%	Sparse	58.68	Polygon	5/31/2024
377	F3 Plot 1	3-25%	Sparse	8.04	Polygon	5/31/2024
378	F3 Plot 1	<3%	Very Sparse	5.80 Polygor		5/31/2024
379	F3 Plot 1	26-50%	Medium-low	low 2.27 Polygon		5/31/2024
380	F3 Plot 1	3-25%	Sparse	8.33	Polygon	5/31/2024

229	F3 Plot 1	4	-	-	Point	5/31/2024
381	F3 Plot 2	<3%	Very Sparse	12.36	Polygon	5/31/2024
382	F3 Plot 2	3-25%	Sparse	164.55	Polygon	5/31/2024
383	F3 Plot 2	3-25%	Sparse	60.68	Polygon	5/31/2024
384	F3 Plot 2	<3%	Very Sparse	197.51	Polygon	5/31/2024
385	F3 Plot 2	3-25%	Sparse	99.52	Polygon	5/31/2024
230	F3 Plot 2	2	-	-	Point	5/31/2024
231	F3 Plot 2	2	-	-	Point	5/31/2024
232	F3 Plot 2	2	-	-	Point	5/31/2024
233	F3 Plot 3	1	-	-	Point	5/31/2024
234	F3 Plot 3	3	-	-	Point	5/31/2024
235	F3 Plot 3	1	-	-	Point	5/31/2024
236	F3 Plot 3	1	-	-	Point	5/31/2024
237	F3 Plot 3	5	-	-	Point	5/31/2024
238	F3 Plot 3	4	-	-	Point	5/31/2024
239	F3 Plot 3	3	-	-	Point	5/31/2024
240	F3 Plot 3	1	-	-	Point	5/31/2024
241	F3 Plot 3	1	-	-	Point	5/31/2024
242	F3 Plot 3	2	-	-	Point	5/31/2024
243	F3 Plot 3	3	-	-	Point	5/31/2024

Table A-9. 2024 Monterey spineflower populations recorded within the access route to MW-OU2-6	58-
180.	

Population Number	Location	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
295	MW-OU2-68-180	3-25%	Sparse	125.28	Polygon	5/20/2024
296	MW-OU2-68-180	3-25%	Sparse	102.60	Polygon	5/20/2024
297	MW-OU2-68-180	76-97%	Medium-high	35.21	Polygon	5/20/2024
298	MW-OU2-68-180	<3%	Very Sparse	4.95	Polygon	5/20/2024
299	MW-OU2-68-180	3-25%	Sparse	55.48	Polygon	5/20/2024
300	MW-OU2-68-180	51-75%	Medium	1,213.71	Polygon	5/20/2024
112	MW-OU2-68-180	4	-	-	Point	5/20/2024
113	MW-OU2-68-180	1	-	-	Point	5/20/2024
114	MW-OU2-68-180	1	-	-	Point	5/20/2024
115	MW-OU2-68-180	1	-	-	Point	5/20/2024
116	MW-OU2-68-180	1	-	-	Point	5/20/2024
117	MW-OU2-68-180	4	-	-	Point	5/20/2024
118	MW-OU2-68-180	1	-	-	Point	5/20/2024

Table A-10. 2024 Monterey spineflower populations recorded within the access route to MW-BW-95-A and soil boring location SB-FDA-01.

Population Number	Location	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
324	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	29.93	Polygon	5/21/2024
325	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	19.32	Polygon	5/21/2024
326	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	3.35	Polygon	5/21/2024
327	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	14.07	Polygon	5/21/2024
328	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	9.11	Polygon	5/21/2024
329	MW-BW-95-A & SB-FDA-01	26-50%	Medium-low	3.95	Polygon	5/21/2024
330	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	2.23	Polygon	5/21/2024
331	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	22.02	Polygon	5/21/2024
332	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	88.89	Polygon	5/21/2024
333	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	22.94	Polygon	5/21/2024
334	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	35.60	Polygon	5/21/2024
335	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	171.79	Polygon	5/30/2024
336	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	7.98	Polygon	5/30/2024
337	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	5.58	Polygon	5/30/2024
338	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	6.39	Polygon	5/30/2024
339	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	838.04	Polygon	5/30/2024
340	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	26.65	Polygon	5/30/2024
341	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	57.54	Polygon	5/30/2024
342	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	28.53	Polygon	5/30/2024
343	MW-BW-95-A & SB-FDA-01	51-75%	Medium	707.75	Polygon	5/30/2024
344	MW-BW-95-A & SB-FDA-01	51-75%	Medium	254.05	Polygon	5/30/2024
345	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	5.57	Polygon	5/30/2024
346	MW-BW-95-A & SB-FDA-01	>97%	High	16.35	Polygon	5/30/2024
347	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	27.53	Polygon	5/30/2024
348	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	11.72	Polygon	5/30/2024
349	MW-BW-95-A & SB-FDA-01	26-50%	Medium-low	1,367.00	Polygon	5/30/2024
350	MW-BW-95-A & SB-FDA-01	26-50%	Medium-low	38.98	Polygon	5/30/2024
351	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	382.88	Polygon	5/30/2024
352	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	26.33	Polygon	5/30/2024
353	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	4.86	Polygon	5/30/2024
354	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	15.05	Polygon	5/30/2024
355	MW-BW-95-A & SB-FDA-01	3-25%	Sparse	7.77	Polygon	5/30/2024
356	MW-BW-95-A & SB-FDA-01	26-50%	Medium-low	36.17	Polygon	5/30/2024
357	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	16.50	Polygon	5/30/2024
358	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	11.11	Polygon	5/30/2024
359	MW-BW-95-A & SB-FDA-01	<3%	Very Sparse	38.40	Polygon	5/30/2024

144	MW-BW-95-A & SB-FDA-01	5	-		Point	5/21/2024
145	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
146	MW-BW-95-A & SB-FDA-01	5	-	-	Point	5/21/2024
147	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/21/2024
148	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/21/2024
149	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
150	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/21/2024
151	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
152	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
153	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
154	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/21/2024
155	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/21/2024
156	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/21/2024
157	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
158	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
159	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/21/2024
160	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
161	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
162	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/21/2024
163	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
164	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/21/2024
165	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
166	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
167	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
168	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
169	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
170	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
171	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
172	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
173	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
174	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
175	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
176	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
177	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
178	MW-BW-95-A & SB-FDA-01	5	-	-	Point	5/30/2024
179	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
180	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
181	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
182	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
183	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
184	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024

185	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
186	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
187	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
188	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
189	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
190	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
191	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
192	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
193	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
194	MW-BW-95-A & SB-FDA-01	5	-	-	Point	5/30/2024
195	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
196	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
197	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
198	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
199	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
200	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
201	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
202	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
203	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
204	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
205	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
206	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
207	MW-BW-95-A & SB-FDA-01	2	-	-	Point	5/30/2024
208	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024
209	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
210	MW-BW-95-A & SB-FDA-01	4	-	-	Point	5/30/2024
211	MW-BW-95-A & SB-FDA-01	3	-	-	Point	5/30/2024
212	MW-BW-95-A & SB-FDA-01	5	-	-	Point	5/30/2024
213	MW-BW-95-A & SB-FDA-01	1	-	-	Point	5/30/2024

Table A-11. 2024 Monterey spineflower populations recorded within the steel conductor pipe survey area and access route.

Population Number	Well ID	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
301	Steel Conductor Pipe	<3%	Very Sparse	4.17	Polygon	5/20/2024
302	Steel Conductor Pipe	<3%	Very Sparse	18.25	Polygon	5/20/2024
303	Steel Conductor Pipe	3-25%	Sparse	140.00	Polygon	5/20/2024
304	Steel Conductor Pipe	3-25%	Sparse	137.61	Polygon	5/20/2024
305	Steel Conductor Pipe	3-25%	Sparse	8.26	Polygon	5/20/2024
306	Steel Conductor Pipe	<3%	Very Sparse	45.03	Polygon	5/20/2024

307	Steel Conductor Pipe	26-50%	Medium-low	19.67	Polygon	5/20/2024
308	Steel Conductor Pipe	3-25%	Sparse	8.62	Polygon	5/20/2024
309	Steel Conductor Pipe	51-75%	Medium	4.10	Polygon	5/20/2024
310	Steel Conductor Pipe	76-97%	Medium-high	50.70	Polygon	5/20/2024
311	Steel Conductor Pipe	3-25%	Sparse	20.64	Polygon	5/20/2024
312	Steel Conductor Pipe	76-97%	Medium-high	2.49	Polygon	5/20/2024
313	Steel Conductor Pipe	26-50%	Medium-low	362.56	Polygon	5/20/2024
314	Steel Conductor Pipe	3-25%	Sparse	4.35	Polygon	5/20/2024
315	Steel Conductor Pipe	<3%	Very Sparse	11.16	Polygon	5/21/2024
316	Steel Conductor Pipe	3-25%	Sparse	20.14	Polygon	5/21/2024
317	Steel Conductor Pipe	26-50%	Medium-low	9.73	Polygon	5/21/2024
318	Steel Conductor Pipe	3-25%	Sparse	1.51	Polygon	5/21/2024
319	Steel Conductor Pipe	<3%	Very Sparse	7.02	Polygon	5/21/2024
119	Steel Conductor Pipe	2	-	-	Point	5/20/2024
120	Steel Conductor Pipe	1	-	-	Point	5/20/2024
121	Steel Conductor Pipe	2	-	-	Point	5/20/2024
122	Steel Conductor Pipe	1	-	-	Point	5/20/2024
123	Steel Conductor Pipe	5	-	-	Point	5/20/2024
124	Steel Conductor Pipe	1	-	-	Point	5/20/2024
125	Steel Conductor Pipe	1	-	-	Point	5/20/2024
126	Steel Conductor Pipe	2	-	-	Point	5/20/2024
127	Steel Conductor Pipe	3	-	-	Point	5/20/2024
128	Steel Conductor Pipe	1	-	-	Point	5/20/2024
129	Steel Conductor Pipe	1	-	-	Point	5/20/2024
130	Steel Conductor Pipe	3	-	-	Point	5/20/2024
131	Steel Conductor Pipe	1	-	-	Point	5/20/2024
132	Steel Conductor Pipe	1	-	-	Point	5/20/2024
133	Steel Conductor Pipe	2	-	-	Point	5/20/2024
134	Steel Conductor Pipe	1	-	-	Point	5/20/2024
135	Steel Conductor Pipe	1	_	-	Point	5/21/2024
136	Steel Conductor Pipe	1	-	-	Point	5/21/2024
137	Steel Conductor Pipe	3	-	-	Point	5/21/2024

Table A-12. 2024 piperia populations recorded within reference F3 Plots (not identifiable to species).

Population Number	Location	Individuals (#) or % Cover	Cover Class	Area (ft²)	GIS Feature Type	Survey Date
244	F3 Plot 3	1	-	-	Point	5/31/2024