San Diego Association of Governments
Otay Ranch Preserve Enhancement Project
County of San Diego Department of Parks and Recreation
Final Report
Project Period: July 1, 2023 – August 13, 2024
Submission Date: September 23, 2024
SANDAG Contract Number: S1125469

Executive Summary

The primary goal of the Otay Ranch Preserve Enhancement Project (project) was to restore and increase the quality of habitat for Quino checkerspot butterfly (*Euphydryas editha quino*) near the Minnewawa Truck Trail through seasonal road closure when Quino checkerspot butterfly larvae and adults are active, as well as seeding and planting host and nectar plant species within suitable Quino checkerspot butterfly habitat. Quino checkerspot butterfly is included in the San Diego Management and Monitoring Program (SDMMP) Management Strategic Plan (MSP) as a Category SL (species at risk of loss from the MSP Area). This project addressed the immediate needs of Quino checkerspot butterfly within the Otay Ranch Preserve Dulzura Parcels, where loss and degradation of existing Quino checkerspot butterfly habitat occurred due to vehicles, an increase of invasive plants, and drought. The objectives to reach these goals included 1) container plant installation, 2) seeding, 3) watering, 4) erosion control, 5) removable bollard and sign installation, and 6) photo monitoring.

This project is consistent with the management and monitoring approach prescribed in the SDMMP's Management and Monitoring Strategic Plan (SDMMP and The Nature Conservancy [TNC] 2017: MSP Vol. 2D, page V2D.2-6): "The overarching goal for Quino checkerspot is to protect, enhance, and restore occupied habitat and historically occupied habitat and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years)." This project is also consistent with the management objectives and actions prescribed in the Otay Ranch Resource Management Plan.

Final project results showed an increase in native plant cover, including Quino checkerspot butterfly host and nectar plants, and a decrease in invasive non-native plant cover compared to the baseline conditions. The project successfully increased the quality of habitat for Quino checkerspot butterfly in the project site through seasonal road closure, seeding, and planting.

During the post-grant period, the project site will be managed by the Otay Ranch Preserve Owner/Manager (City of Chula Vista and County of San Diego) for an additional four years. During the additional four-year maintenance and monitoring period the Otay Ranch Preserve fiscal year annual work plans will include invasive non-native plant

treatment with herbicide and/or removal by hand, quantitative vegetation monitoring using the rapid assessment method, and repeat photographs. After the four-year maintenance and monitoring period, the project site will be assessed annually to determine when additional invasive non-native plant treatment is needed. Focused surveys for Quino checkerspot butterfly, as described in the Otay Ranch Preserve RMP Phase 2 Update and repeat photo monitoring will be conducted concurrently every five years. Installation and removal of bollards will occur annually during and after seasonal closure for Quino checkerspot butterfly. Fence, sign, and bollards will be repaired, as needed. All maintenance and monitoring will be reported in the Otay Ranch Preserve annual reports.

Table of Contents

Project Background

Project Setting

- Project Site Size: 0.69-acre
- Preserve Name: Otay Ranch Preserve
- Preserve Location: The Otay Ranch Preserve is in southwestern San Diego County.

The need and how the project pertains to the goals and objectives specified in the San Diego Management and Monitoring Program (SDMMP) Management Strategic Plan (MSP) Roadmap. The SDMMP Management and Monitoring Strategic Plan (MSP) states, "Quino checkerspot faces a number of threats to persistence including urbanization leading to habitat loss and fragmentation, invasive nonnative plants, altered fire regimes, and overgrazing (Mattoni et al. 1997; Longcore et al. 2003; USFWS [U.S. Fish and Wildlife Service] 2003, 2009). Invasive plant species reduce bare ground important for larval insolation and reduce native species, resulting in a loss of host and nectaring plants. Other threats include direct mortality from roads and human use of preserves that cause trampling of larvae and host plants and compaction of soils." Habitat loss due to vehicles and invasive non-native plants have been identified by the Otay Ranch Preserve Steward/Biologist (RECON Environmental, Inc. [RECON]) as a major threat to Quino checkerspot butterfly at the project site. This habitat restoration project meets the immediate need to repair degraded habitat that is causing a decline in Quino checkerspot butterfly at the Otay Ranch Preserve Dulzura Parcels. Seeding host and nectar plants provides higher quality habitat for Quino checkerspot butterfly to reproduce. Seasonal road closures will protect Quino checkerspot butterfly from being impacted by vehicles. These activities directly eliminate and manage identified threats to Quino checkerspot butterfly by restoring and enhancing Quino checkerspot butterfly habitat.

The project implements specific SDMMP MSP Management Unit 3 goals and objectives for Quino checkerspot butterfly populations (SDMMP and TNC 2017: MSP Vol. 2D, page V2D.2-6): "The overarching goal for Quino checkerspot is to protect, enhance, and restore occupied habitat and historically occupied habitat and the landscape connections between them to create resilient, self-sustaining populations that provide for persistence over the long term (>100 years)."

Project location and site description. Otay Ranch Preserve – Dulzura Parcels are located within Assessor Parcel Numbers 598-160-17 and 598-170-18. Located east of Lower Otay Reservoir and approximately 0.3 mile southwest of 14615 Otay Lakes Road, Jamul, CA 91935 (Figures 1 and 2). The project site consists of open coastal sage

scrub, chamise chaparral, and non-native grassland habitat with a dirt road that leads to a hilltop (Appendix A, Photographs 1 and 2).

The methodologies used for this project are like those used to successfully restore 6 acres of Quino checkerspot butterfly habitat in the Otay Ranch Preserve San Ysidro Parcels (California Department of Fish and Wildlife Local Assistance Grant), 14.28 acres located in the Otay Ranch Preserve Salt Creek Parcels for the City of Chula Vista Quino Checkerspot Recovery Program, and 5 acres on USFWS Refuge property for the Quino Checkerspot Augmentation Project. These methodologies included seasonal road closure, fence and sign installation, invasive non-native plant treatment, and enhancing the habitat with Quino checkerspot butterfly host and nectar plants.

Project Goals

The goal of the project was to restore and increase the quality of habitat for Quino checkerspot butterfly (MSP Category SL [Species at risk of loss from the Management Strategic Plan Area]) near Minnewawa Truck Trail through seasonal road closure, seeding, and planting within suitable Quino checkerspot butterfly habitat.

This project addressed the immediate needs of Quino checkerspot butterfly within the Otay Ranch Preserve Dulzura Parcels where loss and degradation of existing Quino checkerspot butterfly habitat has occurred due to vehicles, an increase of invasive non-native plants, and drought. The objectives to reach the project goal included the following:

1) container plant installation,
2) seeding,
3) watering,
4) erosion control, and
5) removable bollard and sign installation,
6) photo monitoring,
7) submittal of quarterly reports, and
8) submittal of a final report.

The project goals were achieved.

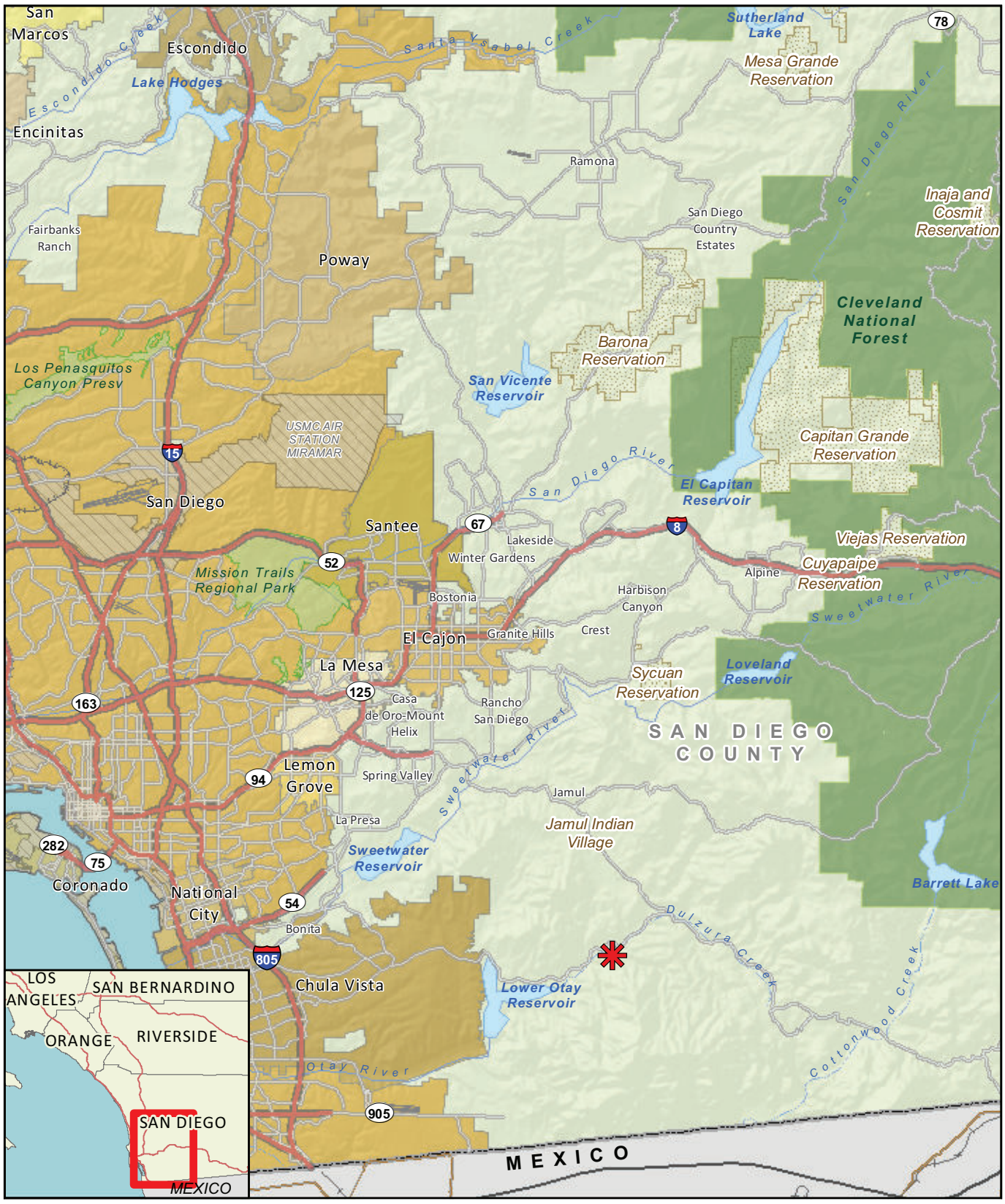

FIGURE 1
Regional Location

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Image Source: NearMap (flown January 2023)

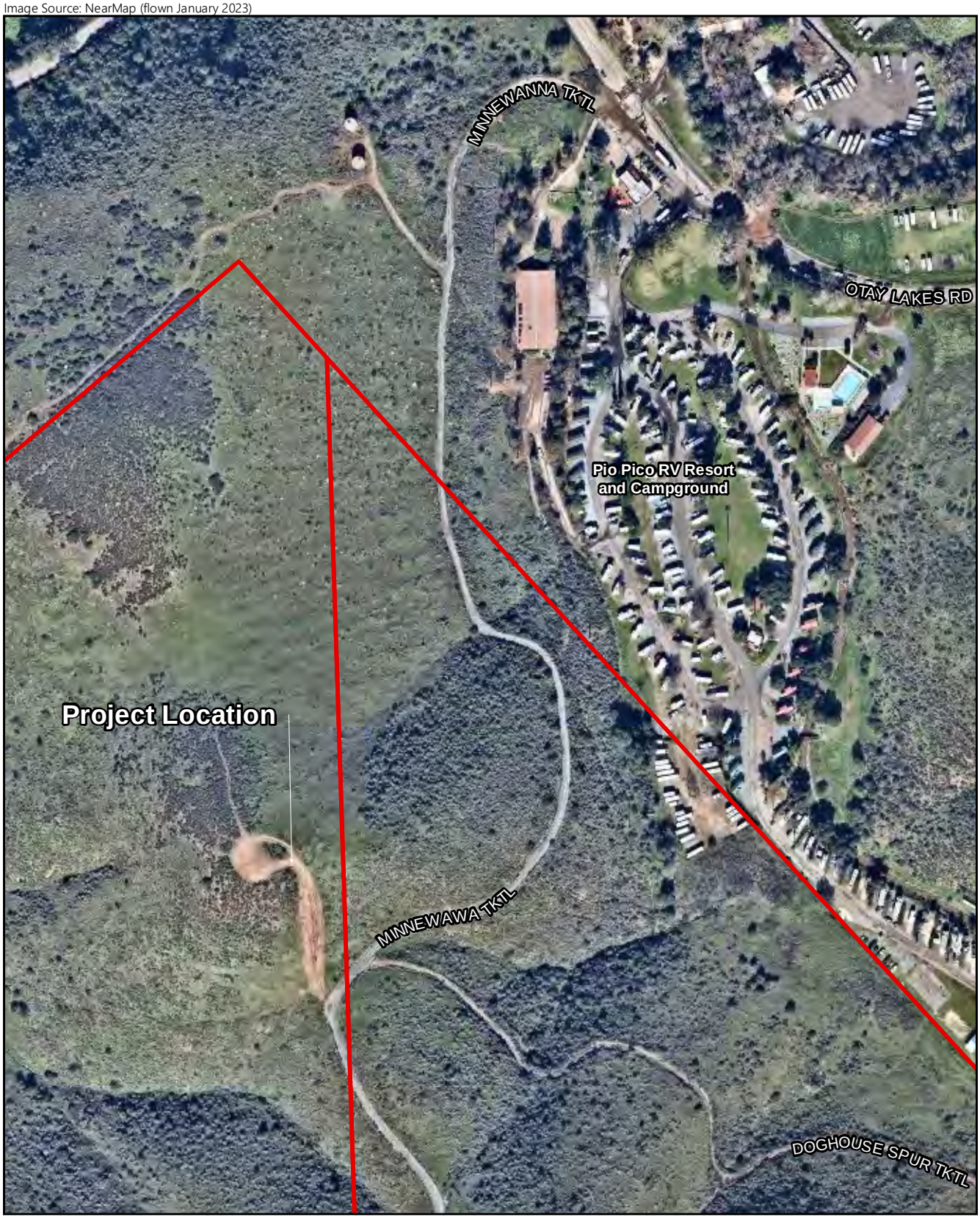

FIGURE 2
Project Location on Aerial Photo

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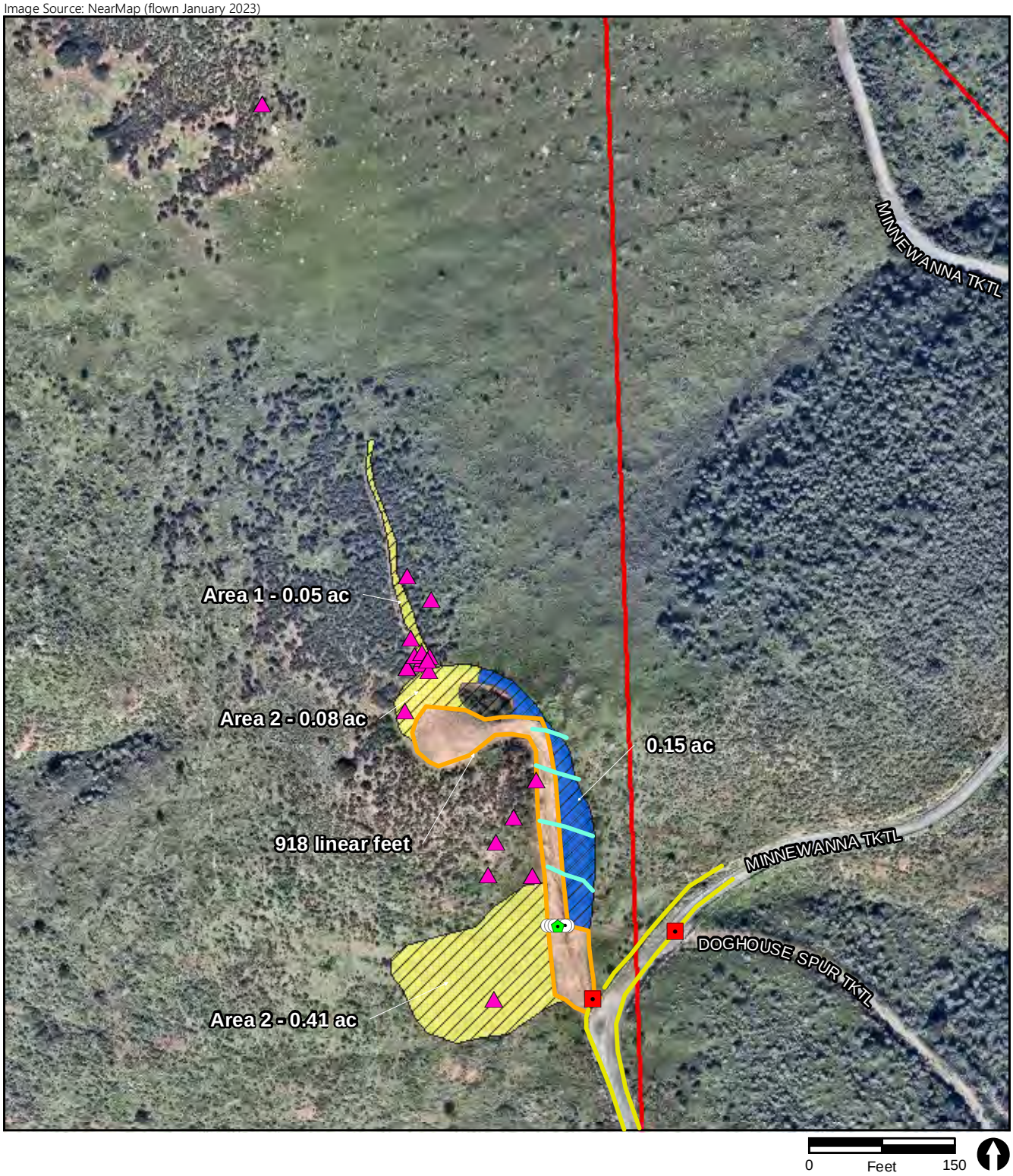
The expected results of the project included the following:

- Decreasing sensitive habitat degradation from vehicle access and use through installation of access control measures, including fencing, bollards, and signage.
- Increasing possibility that Quino checkerspot butterfly habitat will recover from its current degraded condition on a historically important site; thus, fostering Quino checkerspot butterfly larval resilience and survival.
- Installing seven removable bollards and one removable seasonal closure sign. The bollards and sign will be installed and locked to close the road to vehicles when Quino checkerspot butterfly larvae and adults are active. The road is located behind a robust tubular steel locked gate and a tubular steel barrier that runs parallel to Minnewawa Truck Trail (Figure 3). The road is exclusively used by U.S. Customs and Border Protection (USCBP), with the hilltop being an observation area and the base of the road used to occasionally stage equipment when repairing Minnewawa Truck Trail. The road will remain open to USCBP when Quino checkerspot butterfly are in diapause. The project has been designed to cooperate with the USCBP mission by allowing off-season vehicle access to the hilltop while protecting and restoring Quino checkerspot butterfly habitat.
- Hand-seeding 0.69 acre with Quino checkerspot butterfly nectar plant seeds to enhance Quino checkerspot butterfly habitat where vehicles have damaged vegetation (Figure 3).
- Reducing erosion within 0.15 acre by using a skid steer to fill in rills and installing biodegradable wattles to slow the flow of water (Figure 3).
- Installing 400 one-gallon container plants within 0.15 acre to reduce erosion and provide additional nectar sources for Quino checkerspot butterfly (Figure 3).
- A biologist possessing a current USFWS Quino checkerspot butterfly permit and at least five years of experience with Quino checkerspot butterfly habitat restoration present for all installation activities.
- Establishing a minimum of five photo monitoring locations.
- Preparing four quarterly reports.
- Preparing one final report.

Image Source: NearMap (flown January 2023)



- Otay Ranch Preserve: Dulzura Parcels
- Matching: Barbless Wire T-post Fence
- Tubular Steel Barrier
- Sign: Seasonal Closure
- Bollards: Removable
- Locked Gate
- QCB Observed in 2011, 2012, 2017, and 2022
- Water Bar
- Container Plants
- Seeded by Hand
- Matching: Weeding Treatment

FIGURE 3

QCB Short-term Threat Reduction Project Location

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Work Performed by Task

Task 1-Planting

Budget: $20,801.59 (approved reallocation), $13,601.59 (from grant agreement)
Spent: $20,795.94
Match for Task: $0.00

Starting on September 6, 2023, the project biologist began coordinating the purchase of plants and seed from Native West Nursery, project materials, and RECON restoration crew (field crew) scheduling. From November 6 through 9, 2023, the field crew dug 400 holes using a mini excavator to prepare for the installation of 1-gallon plants (Appendix A, Photograph 3).

On December 4 and 6, 2023, the plant holes were watered in preparation for planting. On December 6 and 7, 2023, the field crew installed 100 San Diego County viguiera (*Bahiopsis laciniata*), 180 California buckwheat (*Eriogonum fasciculatum*), 45 Munz's sage (*Salvia munzii*), 20 scrub oak (*Quercus berberidifolia*), and 55 chamise (*Adenostoma fasciculatum*) 1-gallon container plants (Appendix A, Photographs 4 through 6). The top of the slope was planted primarily with chamise and scrub oak, and the bottom of the slope was planted primarily with San Diego viguiera, California buckwheat, and Munz's sage. This matches the existing natural vegetation on-site. All plants were watered after they were installed.

The project biologist conducted a site visit on December 29, 2023, to qualitatively monitor the health of the plants. Minor signs of herbivory were observed on some of the container plants, particularly the San Diego County viguiera. Most of the plants that showed signs of herbivory were recovering with new leaves forming. Approximately 85 percent of the plants appeared to be in good health.

On February 13 and 21, 2024, a RECON biologist conducted site assessments to qualitatively monitor the container plants. It was noted that 60 or more container plants had poor vigor and had died. The surviving plants looked healthy. The most vigorous species were chamise, scrub oak, and San Diego County viguiera.

On May 7, 2024, the San Diego Association of Governments (SANDAG) approved the request to reallocate budget to allow for additional container plants to be installed. On May 29, 2024, a RECON biologist conducted a site assessment to qualitatively monitor the container plants. On May 30, 2024, the field crew removed soil from previously dug holes in preparation for installing additional plants (Appendix A, Photograph 7). On June 5, the field crew planted an additional 200 chamise and 200 scrub oak to supplement previously installed container plants that had died earlier in the year (Appendix A, Photograph 8). Chamise and scrub oak were selected because these species had the best survivorship from the previous plantings. Cages were

installed around the plants to deter herbivory. Appendix A, Photograph 9, shows a section of the slope with healthy plants that were installed previously in early December. On June 28, 2024, a RECON biologist conducted a site assessment to qualitatively assess the health of the installed plants.

During the additional four-year post-grant period, the container plants will continue to be watered, as needed. Container plant watering will be included as a task in the Otay Ranch Preserve fiscal year annual work plan.

Task 2-Seeding

Budget: $5,075.00 (approved reallocation), $4,775.00 (from grant agreement)
Spent: $5,054.85
Match for Task: $0.00

On November 6 through 9, 2023, the field crew used a mini excavator to decompact the soil surface of the hilltop to prepare for seeding. The mini excavator was used to scratch the first few inches of the compacted hilltop (Appendix A, Photograph 10).

On December 7, 2023, the field crew applied 4.5 pounds of host and nectar plant seed to the site consisting of 1.0 pound of cryptantha (*Cryptantha* spp.) seed, 1.0 pound of common goldfields (*Lasthenia gracilis*) seed, 0.5 pound of tidy-tips (*Layia platyglossa*) seed, and 2.0 pounds of dot-seed plantain (*Plantago erecta*) seed (Appendix A, Photographs 11 and 12). The seed was raked into the soil and sprayed with water to help keep it in place (Appendix A, Photograph 13). A significant rain event (greater or equal to 0.5 inch of rain) occurred from December 21 through 23, 2023. The project biologist conducted a site visit on December 29 to qualitatively monitor the seed. It was noted that more rain was needed to germinate the seed that was applied to the site. A significant rain event totaling 2.71 inches occurred from January 20 through 23, 2024. This was a germinating rain event; however, germination was poor within the hilltop. Host and nectar plants that germinated from the dispersed seed along the lower slope did well and are shown in Appendix A, Photographs 14 through 18.

On May 7, 2024, SANDAG approved the request to reallocate budget to allow for additional seed to be purchased and dispersed. Additional native seed was purchased consisting of 0.5 pound of common goldfields, 0.5 pound of tidy-tips, 0.5 pound of nievitas cryptantha (*Cryptantha intermedia*), and 0.5 pound of dot-seed plantain. On June 5, 2024, seed was placed on-site to create greater cover of host and nectar plants for Quino checkerspot butterfly. Exposure to summer heat can break seed dormancy mechanisms, increasing the number of seeds which will germinate in the rainy season. Broadcasting the seed in the summer can increase the fall germination rates by allowing the seeds to stratify in natural conditions. Delaying the broadcasting until summer can also reduce some seed predation

pressure compared to broadcasting in spring. During the additional four-year post-grant period, the seeded area will continue to be qualitatively monitored during bi-weekly site visits and quantitatively monitored one time annually each spring. Monitoring will be included as a task in the Otay Ranch Preserve fiscal year annual work plan.

Task 3-Watering

Budget: $26,496.20 (approved reallocation), $31,931.20 (from grant agreement)
Spent: $26,496.00
Match for Task: $0.00

On December 4, 2023, the field crew watered the previously dug holes to prepare for the installation of the container plants. On December 6 and 7, 2023, the field crew watered the plant holes and the recently installed plants. On December 8, 2023, the field crew watered the plants again after installation and lightly watered the seeded areas to encourage seed adherence to the soil (Appendix A, Photograph 19). On December 19, 2023, the field crew watered the container plants to encourage plant establishment. Consistent rainfall in winter and spring 2024 eliminated the need for supplemental watering at that time.

On March 14, 2024, a RECON biologist conducted a site assessment to determine if supplemental watering was needed. It was determined that supplemental watering was not needed at that time. On May 7, 2024, SANDAG approved the request to reallocate budget from this task to other tasks, since this task was projected to be completed under budget due to supplemental watering not being needed during the winter 2023 and spring 2024 rainy season. On May 24 and June 21, 2024, a RECON biologist conducted a site assessment to determine if the timing of supplemental watering needed to be adjusted. On May 30, June 5, 6, 7, 10, and 25, and July 2, 11, 18, and 29, 2024, the field crew watered the newly installed and previously installed container plants. Appendix A, Photograph 20, shows plant health on June 21, 2024. During the additional four-year post-grant period, the container plants will continue to be watered, as needed. Qualitative monitoring will occur during bi-weekly site visits and quantitatively monitored one time annually each spring. Container plant watering will be included as a task in the Otay Ranch Preserve fiscal year annual work plan.

Task 4-Erosion Control

Budget: $5,822.99 (approved reallocation), $5,322.99 (from grant agreement)
Spent: $5,819.20
Match for Task: $0.00

From November 6 through 9, 2023, the field crew recontoured the access road and filled in rills. A mini excavator was used to remove rocks and loosen the soil to prepare the site for grading with the skid steer (Appendix A, Photographs 21 through 23). The work area was wetted with a portable water tank to minimize dust and to prepare the site for compaction with the skid steer (Appendix A, Photograph 24). Water bars were created to direct the flow of water (Appendix A, Photograph 25). Appendix A, Photograph 26, shows the water bars and road after grading. The water bars located outside the road were lined with rocks to help direct and slow the flow of water, thereby reducing the potential for erosion (Appendix A, Photograph 27). Biodegradable wattles were installed to also direct the flow of water in areas outside of the road (Appendix A, Photographs 28 and 29).

A RECON biologist conducted a site visit on December 29, 2023, to qualitatively monitor erosion. During the site visit, no obvious erosion issues were observed, and the erosion control measures appeared to be functioning. Minor erosion was later documented after significant rain events that occurred in January 2024. On May 7, 2024, SANDAG approved the request to reallocate budget to allow for additional minor erosion repairs. On May 31, 2024, the field crew repaired areas with minor erosion where water had undercut the wattles (Appendix A, Photograph 30). During the additional four-year post-grant period, erosion issues will continue to be repaired, as needed. Qualitative monitoring will occur during bi-weekly site visits. Erosion control will be included as a task in the Otay Ranch Preserve fiscal year annual work plan.

Task 5-Bollards and Sign

Budget: $12,189.54 (approved reallocation), $14,754.54 (from grant agreement)
Spent: $12,161.76
Match for Task: $0.00

From November 6 through 9, 2023, the field crew dug holes using a skid-steer-mounted auger, poured concrete, and set the bases for seven bollards (Appendix A, Photograph 31). On January 12, 2024, the field crew installed the removable bollards in their bases and locked the bollards to the bases, closing the road for Quino checkerspot butterfly season (Appendix A, Photograph 32). One 24-inch by 36-inch aluminum sign stating “Road Closed” was installed on-site on February 21, 2024 (Appendix A, Photograph 33).

On May 7, 2024, SANDAG approved the request to reallocate budget from this task to other tasks, since this task was projected to be completed under budget. On May 30, 2024, the bollards and "Road Closed" sign were removed, opening the road for USCBP to use outside of Quino checkerspot butterfly season. Caps were placed over the bollard sleeves and locked, so dirt and rocks would not accumulate. . The bollards and sign are stored at the RECON yard. During the post-grant period, installation and removal of bollards will occur annually during and after the seasonal closure for Quino checkerspot butterfly. The sign and bollards will be repaired, as needed, as part of the Otay Ranch Preserve fiscal year annual work plan.

Task 6-Photo Monitoring

Budget: $593.84 (from grant agreement)
Spent: $574.74
Match for Task: $0.00

On October 6, 2023, eight photo monitoring locations were established (Figure 4). On January 25, March 21, and June 28, 2024, a RECON biologist conducted repeat photo monitoring at previously established photo monitoring locations. The results of the photo monitoring are used to visually compare site conditions prior to implementation, during implementation, and at the end of the project (Appendix B, Photographs 1 through 43).

For an additional four years during the post-grant period, the Otay Ranch Preserve fiscal year annual work plans will include repeat photos. After the additional 4-year maintenance and monitoring period, repeat photo monitoring will be conducted concurrently with focused surveys for Quino checkerspot butterfly every five years.

Task 7-Reporting

Budget: $9,020.84 (from grant agreement)
Spent: $7,235.63
Match for Task: $0.00

Quarterly reports were prepared and submitted to SANDAG on the dates shown in Table 1.

Table 1
Quarterly Report Submittal Dates

Quarterly Report Period	Date Submitted to SANDAG
July 1 to September 30, 2023	10/23/2023
October 1 to December 31, 2023	3/28/2024
January 1 to March 31, 2024	5/24/2024
April 1 to June 30, 2024	9/19/2024

Image Source: NearMap (flown January 2023)

FIGURE 4
Photo Monitoring Locations

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Matching/Complementary Work

Budget: $0.00 (from grant agreement)
Spent: $0.00
Match for Task: $17,065.00

Quantitative Monitoring

Quantitative monitoring was conducted to compare changes in plant diversity as well as cover estimates for bare ground, host, nectar, native, and invasive non-native plants. A rapid assessment survey was conducted prior to implementation on September 12, 2023, and on June 28, 2024, as part of the Otay Ranch Preserve fiscal year 2023-2024 annual work plan.

A total of 16 native and 14 invasive non-native plant species were recorded in the project site in September 2023. A total of 20 native and 12 invasive non-native plant species were recorded in the project site in June 2024. Although only nine months passed between monitoring events, increasing populations of native species are being observed at the project site due to seeding and plant installation. Appendix C lists the species observed within the project site.

The 0.15-acre Container Plants Area consists of an unauthorized road that was actively used prior to project implementation (see Appendix B, Photographs 32 through 35; see Figure 3). The area had limited vegetation due to vehicle use. Within the Container Plants Area, absolute total cover of shrub and herbaceous plants (a combination of native and invasive non-native plants) remained approximately the same between September 2023 (prior to implementation) and June 2024. The relative cover shows a substantial increase in native plants and decrease in invasive non-native plants from September 2023 to June 2024. The limited change in absolute total cover and substantial change in relative native and non-native plant cover are due to invasive non-native plant species being removed from the project site and native plants being added. Results are shown in Table 2.

Table 2
Container Plants Area Rapid Assessment Results

Vegetation Type	September 12, 2023 Absolute	June 28, 2024 Absolute	September 12, 2023 Relative (vegetation only)	June 28, 2024 Relative (vegetation only)
Average Total Cover (Shrub & Herbaceous)	2.56%	2.28%	100%	100%
Average Native Plant Cover	0.08%	2.18%	3.1%	95.6%
Average Invasive Non-native Plant Cover	2.48%	0.10%	96.9%	4.4%
Average Bare Ground	97.44%	97.72%	Not Applicable	Not Applicable

The 0.05-acre Seeded by Hand – Area 1 consists of an unauthorized road that was decommissioned at least five years prior to project implementation (see Appendix B, Photographs 4 through 7; see Figure 3). Within the Seeded by Hand – Area 1, absolute total cover increased between September 2023 (prior to implementation) and June 2024. The relative cover shows an increase in native plants and decrease in invasive non-native plants from September 2023 to June 2024. The increase in absolute total and relative plant native cover and the decrease in relative invasive non-native plant cover are due to invasive non-native plant species being removed from the project site and native plants seed being added. The results are shown in Table 3.

Table 3
Seeded by Hand – Area 1
Rapid Assessment Results

Vegetation Type	September 12, 2023 Absolute	June 28, 2024 Absolute	September 12, 2023 Relative (vegetation only)	June 28, 2024 Relative (vegetation only)
Average Total Cover (Shrub & Herbaceous)	8.34%	10.54%	100%	100%
Average Native Plant Cover	5.70%	7.88%	68.3%	74.8%
Average Invasive Non-native Plant Cover	2.64%	2.66%	31.7%	25.2%
Average Bare Ground	91.69%	89.46%	Not Applicable	Not Applicable

The 0.49-acre Seeded by Hand – Area 2 consists of a hilltop with an unauthorized road that was actively used prior to project implementation and a slope where vehicles had damaged vegetation (see Appendix B, Photographs 1 through 3 and 24 through 27; see Figure 3). The hilltop was nearly devoid of vegetation and the soil was severely compacted. Within the Seeded by Hand – Area 2, absolute total cover decreased between September 2023 (prior to implementation) and June 2024. The relative cover shows an increase in native plants and decrease in invasive non-native plants from September 2023 to June 2024. The decrease in absolute total cover is due to invasive non-native plants being removed from the project site. An increase in relative native cover is due to native plant seed being added to the site. The results are shown in Table 4.

Table 4 Seeded by Hand – Area 2 Rapid Assessment Results				
Vegetation Type	September 12, 2023 Absolute	June 28, 2024 Absolute	September 12, 2023 Relative (vegetation only)	June 28, 2024 Relative (vegetation only)
Average Total Cover (Shrub & Herbaceous)	13.84%	9.14%	100%	100%
Average Native Plant Cover	2.72%	4.88%	19.7%	53.4%
Average Invasive Non-native Plant Cover	11.12%	4.26%	80.3%	46.6%
Average Bare Ground	86.16%	90.86%	N/A	N/A

Fence Installation

Nine hundred eighteen linear feet of barbless wire T-post fence was installed to protect Quino checkerspot butterfly and its habitat from vehicle damage as part of the Otay Ranch Preserve fiscal year 2023-2024 annual work plan. The fencing was installed starting November 6 through 9, 2023 (Appendix A, Photographs 34 through 36). A RECON biologist flagged the fence perimeter to guide the field crew on where to install the T-posts. The soil was compacted from vehicle use and rocky. These conditions made it challenging to install holes by hand. A jackhammer on the skid steer was used to pre-drill the holes for some of the T-posts (Appendix A, Photograph 37). For an additional four years during the post-grant period, the fence will be repaired, as needed.

Invasive Non-native Plant Treatment

Invasive non-native plants were treated with line trimmers and herbicide three times within the 0.69-acre area of the project site as part of the Otay Ranch Preserve fiscal year 2023-2024 annual work plan. Treatment occurred on October 4 and 5, 2023, April 24, 2024, and May 30 and 31, 2024. The primary invasive non-native plants treated were short-pod mustard (*Hirschfeldia incana*), brome (*Bromus* spp.), tocalote (*Centaurea melitensis*), thistle (*Salsola* sp.), filaree (*Erodium* sp.), rattail fescue (*Festuca myuros*.), golden-top (*Lamarckia aurea*), and oats (*Avena* sp.). Appendix A, Photographs 38 through 41, show site conditions prior to implementing invasive non-native plant treatment. Appendix A, Photographs 42 through 44, show site conditions after the initial invasive non-native plant treatment on October 6, 2023. The field crew is shown treating invasive non-native plants in Appendix A, Photographs 45 through 47. Care was taken to avoid native plants during invasive non-native plant treatment (Appendix A, Photograph 48).

For an additional four years during the post-grant period, the Otay Ranch Preserve fiscal year annual work plans will include invasive non-native plant treatment with

herbicide and/or removal by hand and quantitative vegetation monitoring using the rapid assessment method. After the additional four-year maintenance and monitoring period, the project site will be assessed annually to determine when additional invasive non-native plant treatment is needed. All maintenance and monitoring will be reported in the Otay Ranch Preserve annual reports.

Conclusions

The project was successful in restoring and increasing the quality of habitat for Quino checkerspot butterfly through seasonal road closure, seeding, and planting within suitable Quino checkerspot butterfly habitat. The project has contributed to the conservation of Quino checkerspot butterfly by protecting a known population from habitat loss due to vehicle use as well as enhancing habitat through host and nectar plant seeding and planting.

Post-grant, the project site will continue to be monitored and maintained by the Preserve Owner/Manager. Future work will consist of focused surveys for Quino checkerspot butterfly; invasive non-native plant treatment; supplemental watering, fence, sign, and bollard repair; quantitative monitoring of plant cover and diversity; and repeat photo monitoring.

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2003 Recovery Plan for the Quino Checkerspot Butterfly (*Euphydryas Editha Quino*). Portland, OR.

2009 Quino Checkerspot Butterfly (*Euphydryas Editha Quino*) 5-Year Review Summary and Evaluation. Carlsbad, California.

Appendices

Appendix A: General Photographs 1 through 48

Appendix B: Photo Monitoring Photographs 1 through 43

Appendix C: Plant Species Observed

Environmental Mitigation Program

Land Management Grant Program: Performance Measures

[Contract #S1125469,County of San Diego, Otay Ranch Preserve Enhancement Project]																														
Habitat Type & Size		Habitat Restoration			Sensitive Animal Species Management				Sensitive Plant Species Enhanced/Restored (E/R)				Invasive Plant Treatment/Removal (T/R)				Invasive Animal Species Removal				Fence Repair/Installation (R/I) & Signage Repair/Installation (R/I)						Outreach Events & Volunteer Hours					
Habitat Type	Acres Managed	Proposed Total Habitat Restoration (ac)	Total Habitat Restored (ac)	Total Habitat Restored %	MSP Animal Species by Habitat Type	Proposed Acres Managed for MSP Animal Species	Total Acres Managed for Sensitive Animal Species	Percent of Proposed Acres Managed for Sensitive Animal Species	MSP Plant Species by Habitat Type	Proposed Total MSP Sensitive Plant Species Occurrences E/R by Species	Total Sensitive Plant Species Occurrences E/R by Species	Percenct of Proposed Sensitive Plant Species Occurrence E/R	Type of Invasive Plant Species by Habitat Type	Proposed Acres Managed of Invasive Plant Species T/R	Total Acres Managed for Invasive Plant Species	Percent Proposed Acres Invasive Plant Species T/R	Type of Invasive Animal Species	Total Invasive Animal Species Observed	Total Invasive Animal Species Removed	Percent Observed Invasive Animal Species Removed	Proposed Total Fencing R/I (ft)	Total Fencing R/I (ft)	Percent of Proposed Total Fencing R/I	Proposed Total Signage R/I	Total Signage R/I	Percent Proposed Total Signage R/I	Proposed Total Outreach Events	Total Outreach Events	Percent Proposed Total Outreach Events	Proposed Total Volunteer Hours	Total Volunteer Hours	Percent of Proposed Total Volunteer Hours
				0%	Quino checkerspot butterfly	0.69	0.69	100%				0%				0%				0%	7.00	7.00	100%	1.0	1.0	100%			0%			0%
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Please Read 'How to Input Data Instructions' & 'Acroynm Definitions' Before Inputting your Data

APPENDIX A

General Photographs 1 through 48

PHOTOGRAPH 1
Overview of the Project Site Prior to Implementation, October 4, 2023

PHOTOGRAPH 2
Overview of the Project Site After Implementation, June 21, 2024

PHOTOGRAPH 3
Holes Were Dug Prior to Planting, November 9, 2023

PHOTOGRAPH 4
1-Gallon Plants Were Placed Near Holes Prior to Installation,
December 6, 2023

PHOTOGRAPH 5
Crew Removed Dirt from Previously Dug Holes and Installed 1-Gallon Plants,
December 6, 2023

PHOTOGRAPH 6
View of the Slope After Planting, December 6, 2023

PHOTOGRAPH 7
The Crew Removed Soil from Previously Dug Holes and Removed Non-native Plants by Hand, May 30, 2024

PHOTOGRAPH 8
The Crew Installed Additional Plants, June 5, 2024

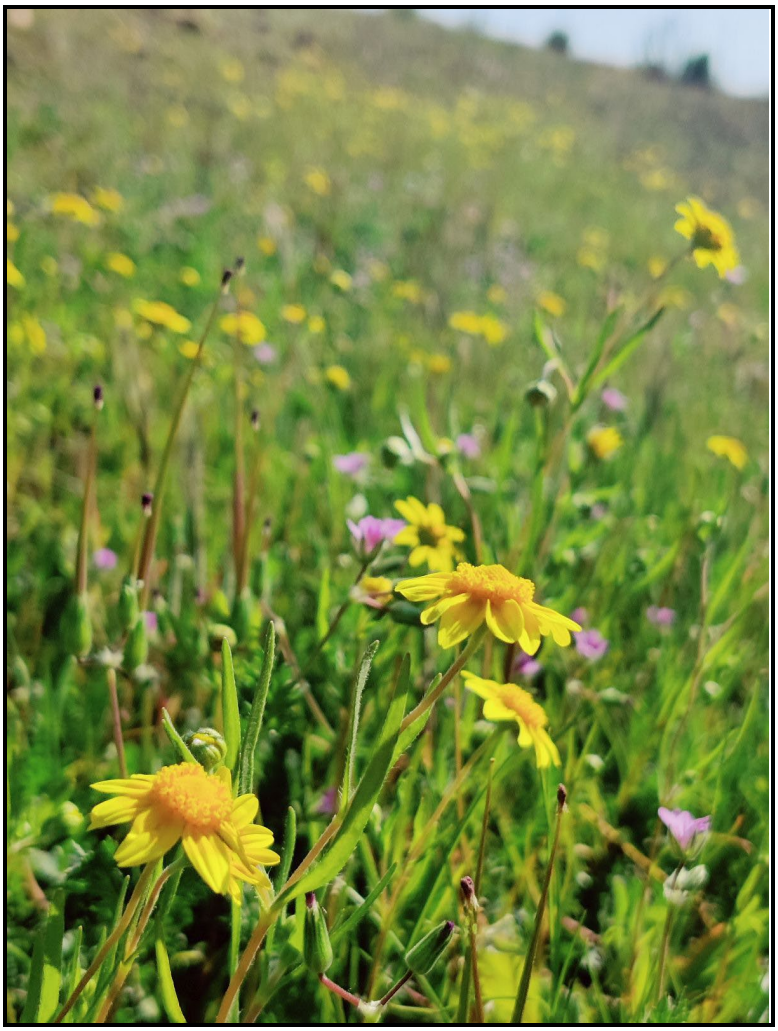
PHOTOGRAPH 9
A Section of the Slope with Healthy Plants That Were Installed Previously in Early December 2023.
Photo Taken June 5, 2024

PHOTOGRAPH 10
The Mini-Excavator was Used to Scratch the First Few Inches of the Compacted Hilltop in Preparation of Seeding, November 7, 2023

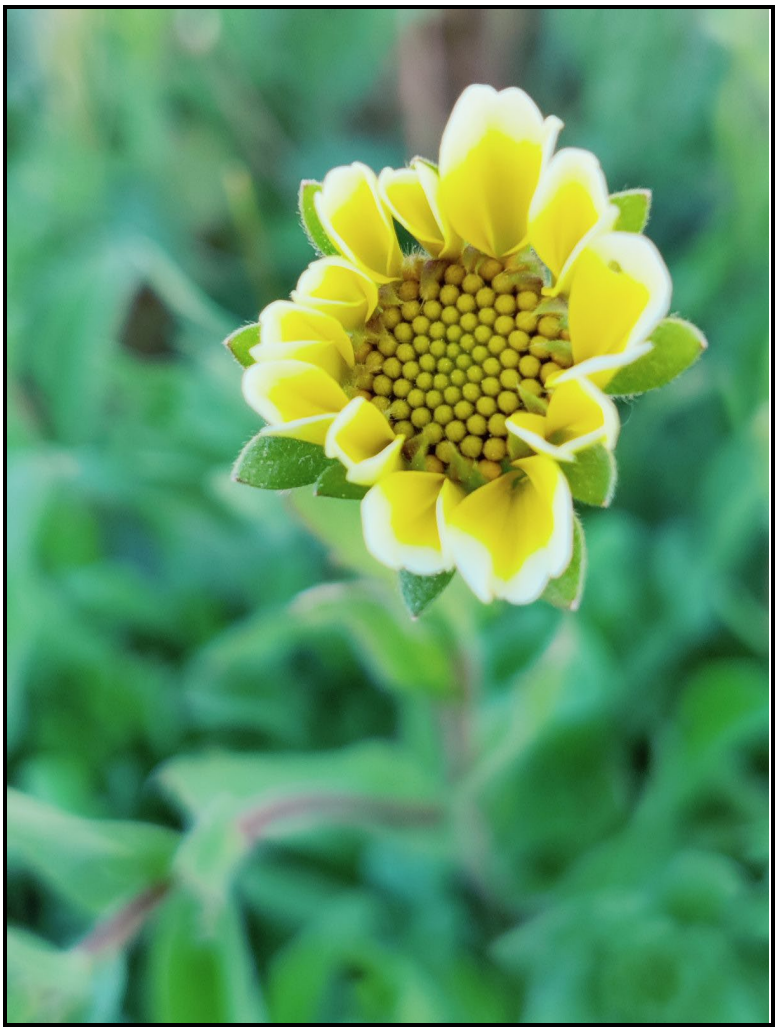
PHOTOGRAPH 11
The Seed Was Mixed for Dispersal by Hand,
December 7, 2023

PHOTOGRAPH 12
The Crew Broadcast Seed by Hand, December 7, 2023

PHOTOGRAPH 13
Seed was Raked into the Soil and Watered to Help the Seed Stick to the Soil, December 7, 2023



PHOTOGRAPH 14
Seeded Common Goldfields, March 21, 2024



PHOTOGRAPH 15
Seeded Tidy-tips, March 21, 2024

PHOTOGRAPH 16
Seeded Dot-seed Plantain, March 21, 2024

PHOTOGRAPH 17
Seeded Tidy-tips, April 24, 2024

PHOTOGRAPH 18
Dot-seed Plantain and Tidy-tips within the Hilltop, June 5, 2024

PHOTOGRAPH 19
The Crew Watered the Plants After Installation and Adjusted the Basins, December 8, 2023

PHOTOGRAPH 20
The Previously Installed Plants Appeared Healthy, June 21, 2024

PHOTOGRAPH 21
The Crew Filled Ruts in Preparation for Grading with the Skid Steer, November 6, 2023

PHOTOGRAPH 22
The Crew Roughened the Road and Installed Fencing, November 6, 2023

PHOTOGRAPH 23
The Crew Smoothed the Road with the Skid Steer, November 6, 2023

PHOTOGRAPH 24
The Crew Watered the Road to Reduce Dust, November 9, 2023

PHOTOGRAPH 25
Water Bars Were Created to Direct the Flow of Water, November 7, 2023

PHOTOGRAPH 26
The Road and the Water Bars After Grading, November 8, 2023

PHOTOGRAPH 27
The Water Bars Were Lined with Rocks to Help Direct and Slow the Flow of Water, November 8, 2023

PHOTOGRAPH 28
The Crew Laid Out and Installed Biodegradable Wattles, November 9, 2023

PHOTOGRAPH 29
View of the Wattles from the Bottom of the Hill, November 9, 2023

PHOTOGRAPH 30
On May 31, Minor Erosion Repairs Were Made Including Replacing a Wattle, June 5, 2024

PHOTOGRAPH 31
Digging Holes for the Bollards Using the Skid Steer Mounted Auger, November 9, 2023

PHOTOGRAPH 32
The Removable Bollards Were Installed in Their Bases and Locked, January 12, 2024

PHOTOGRAPH 33
A "Road Closed" Sign Was Installed, February 21, 2024

PHOTOGRAPH 34
The Crew Securing Angled Braces Before Stringing Wire Fencing,
November 7, 2023

PHOTOGRAPH 35
The Crew Securing the Fence Wire with a Tie,
November 7, 2023

PHOTOGRAPH 36
The Crew Pulling the Fence Wire Tight, November 9, 2023

PHOTOGRAPH 37
A Jackhammer Attachment on the Skid Steer Was Used to Drill Holes for the T-posts, November 6, 2023

PHOTOGRAPH 38
Standing Dead Non-native Plants to Be Hand Pulled to Reduce Spreading Seed, October 4, 2023

PHOTOGRAPH 39
Tumbleweed (*Salsola* sp.) Along the Future Road Will Be Sprayed with Herbicide, October 4, 2023

PHOTOGRAPH 40
Tocalote (*Centaurea melitensis*) to Be Hand Pulled to Reduce Spreading Seed, October 4, 2023

PHOTOGRAPH 41
Hilltop Non-native Plants Were Limited to the Edges of Shrubs, October 4, 2023

PHOTOGRAPH 42
The Future Road After Non-native Plant Treatment, October 6, 2023

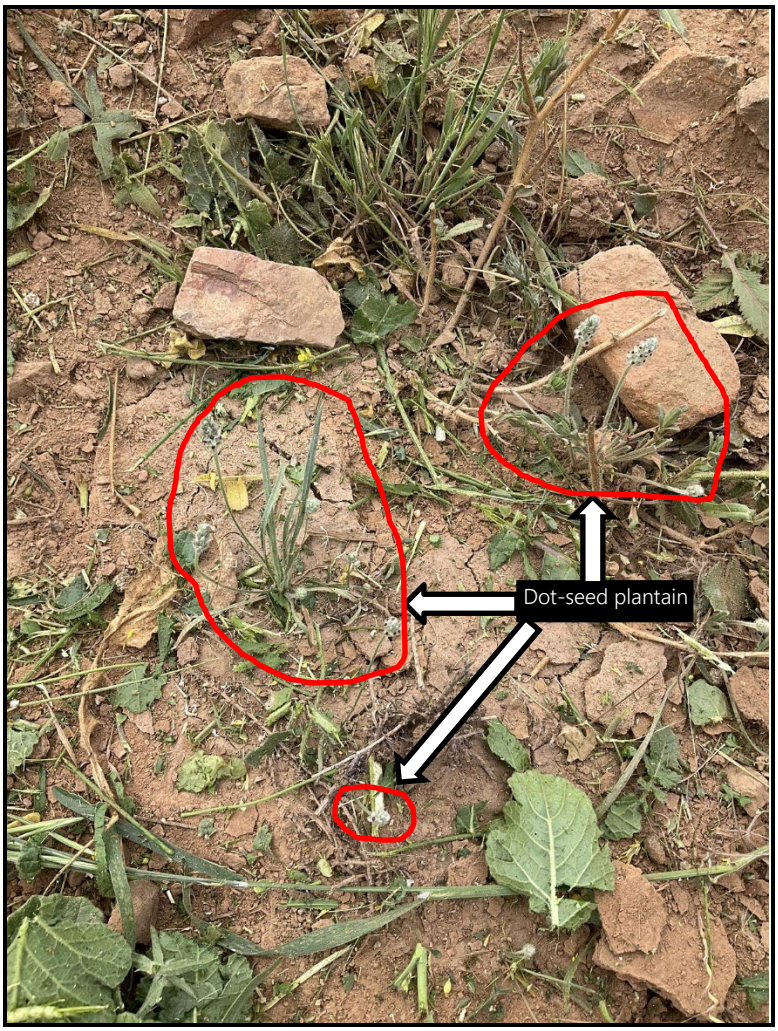
PHOTOGRAPH 43
The Future Seeding Area After Non-native Plant Treatment, October 6, 2023

PHOTOGRAPH 44
Hilltop After Non-native Plant Treatment, October 6, 2023

PHOTOGRAPH 45
The Crew Removed Non-native Plants and Removed the Material from the Site in Tarps, October 4, 2023

PHOTOGRAPH 46
The Crew Line-trimmed Short-pod Mustard (*Hirschfeldia incana*) and Filaree (*Erodium* sp.) before Spraying with Herbicide, April 24, 2024

PHOTOGRAPH 47
Flowering Short-pod Mustard (*Hirschfeldia incana*) Was Removed by Hand and Bagged, May 30, 2024



PHOTOGRAPH 48
Dot-seed Plantain Was Carefully Avoided During
Non-native Plant Treatment, April 24, 2024

APPENDIX B

Photo Monitoring
Photographs 1 through 43

PHOTOGRAPH 1
Photo Point 1
Facing South,
October 6, 2023

PHOTOGRAPH 2
Photo Point 1
Facing South,
January 25, 2024

PHOTOGRAPH 3
Photo Point 1
Facing South,
June 28, 2024

PHOTOGRAPH 4
Photo Point 1 Facing North,
October 6, 2023

PHOTOGRAPH 5
Photo Point 1 Facing North,
January 25, 2024

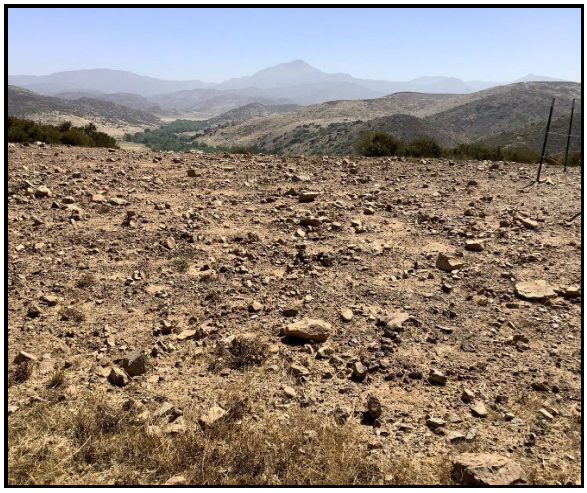
PHOTOGRAPH 6
Photo Point 1 Facing North,
March 21, 2024

PHOTOGRAPH 7
Photo Point 1 Facing North,
June 28, 2024

PHOTOGRAPH 8
Photo Point 2 Facing Northeast,
October 6, 2023

PHOTOGRAPH 9
Photo Point 2 Facing Northeast,
January 25, 2024

PHOTOGRAPH 10
Photo Point 2 Facing Northeast,
March 21, 2024

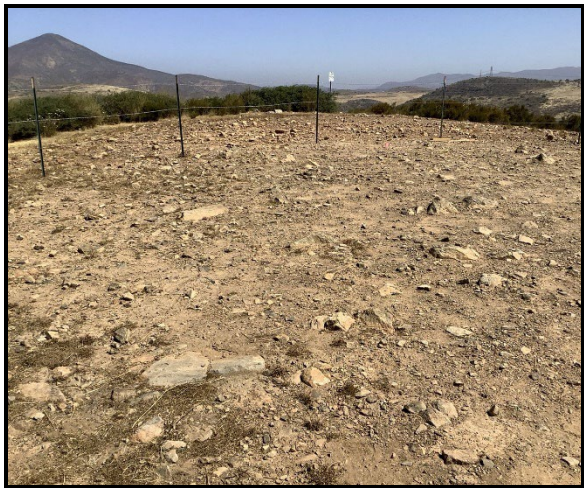


PHOTOGRAPH 11
Photo Point 2 Facing Northeast,
June 28, 2024

PHOTOGRAPH 12
Photo Point 3 Facing North,
October 6, 2023

PHOTOGRAPH 13
Photo Point 3 Facing North,
January 25, 2024

PHOTOGRAPH 14
Photo Point 3 Facing North,
March 21, 2024



PHOTOGRAPH 15
Photo Point 3 Facing North,
June 28, 2024

PHOTOGRAPH 16
Photo Point 4 Facing South,
October 6, 2023

PHOTOGRAPH 17
Photo Point 4 Facing South,
January 25, 2024

PHOTOGRAPH 18
Photo Point 4 Facing South,
March 21, 2024

PHOTOGRAPH 19
Photo Point 4 Facing South,
June 28, 2024

PHOTOGRAPH 20
Photo Point 5 Facing South,
October 6, 2023

PHOTOGRAPH 21
Photo Point 5 Facing South,
January 25, 2024

PHOTOGRAPH 22
Photo Point 5 Facing South,
March 21, 2024

PHOTOGRAPH 23
Photo Point 5 Facing South,
June 28, 2024

PHOTOGRAPH 24
Photo Point 6 Facing Southeast,
October 6, 2023

PHOTOGRAPH 25
Photo Point 6 Facing Southeast,
January 25, 2024

PHOTOGRAPH 26
Photo Point 6 Facing Southeast,
March 21, 2024

PHOTOGRAPH 27
Photo Point 6 Facing Southeast,
June 28, 2024

PHOTOGRAPH 28
Photo Point 7 Facing Northwest,
October 6, 2023

PHOTOGRAPH 29
Photo Point 7 Facing Northwest,
January 25, 2024

PHOTOGRAPH 30
Photo Point 7 Facing Northwest,
March 21, 2024

PHOTOGRAPH 31
Photo Point 7 Facing Northwest,
June 28, 2024

PHOTOGRAPH 32
Photo Point 7 Facing North,
October 6, 2023

PHOTOGRAPH 33
Photo Point 7 Facing North,
January 25, 2024

PHOTOGRAPH 34
Photo Point 7 Facing North,
March 21, 2024

PHOTOGRAPH 35
Photo Point 7 Facing North,
June 28, 2024

PHOTOGRAPH 36
Photo Point 8 Facing North,
October 6, 2023

PHOTOGRAPH 37
Photo Point 8 Facing North,
January 25, 2024

PHOTOGRAPH 38
Photo Point 8 Facing North,
March 21, 2024

PHOTOGRAPH 39
Photo Point 8 Facing North,
June 28, 2024

PHOTOGRAPH 40
Photo Point 8 Facing Northwest,
October 6, 2023

PHOTOGRAPH 41
Photo Point 8 Facing Northwest,
January 25, 2024

PHOTOGRAPH 42
Photo Point 8 Facing Northwest,
March 21, 2024

PHOTOGRAPH 43
Photo Point 8 Facing Northwest,
June 28, 2024

APPENDIX C

Plant Species Observed

Table 1
Plants Observed and Percent Cover – Container Plant Area

Major Plant Group	Family	Scientific Name / Common Name	Origin	Percent Cover Sept. 12, 2023	Percent Cover June 28, 2024
Angiosperms: Monocots	Poaceae (Gramineae) / Grass Family	*Bromus rubens* [=*Bromus madritensis* ssp. *rubens*] / red brome	I	0.02	0.02
		Schismus barbatus / Mediterranean schismus	I	0.02	0
Angiosperms: Eudicots	Asteraceae / Sunflower Family	*Artemisia californica* / California sagebrush	N	0.02	0.02
		Bahiopsis laciniata [=*Viguiera laciniata*] / San Diego viguiera, San Diego County viguiera	N	0	0.02
		Centaurea melitensis / tocalote, Maltese star-thistle	I	0.20	0.02
		Corethrogyne filaginifolia var. *filaginifolia* / California sand-aster	N	0	0.02
		Lasthenia gracilis [*L. californica* Lindley, misapplied in San Diego County] / common goldfields	N	0	0.02
	Brassicaceae (Cruciferae) / Mustard Family	*Hirschfeldia incana* / short-pod mustard	I	0.02	0.02
		Lepidium sp. / peppergrass	N	0.02	0.02
		Sisymbrium sp. / hedge mustard	I	0.02	0.02
	Chenopodiaceae / Goosefoot Family	*Salsola* sp. / tumbleweed	I	2	0
	Fabaceae (Leguminosae) / Legume Family	*Acmispon glaber* [=*Lotus scoparius*] / deerweed, California broom	N	0.02	0.02
	Fagaceae / Oak Family	*Quercus berberidifolia* / scrub oak	N	0	0.02
	Geraniaceae / Geranium Family	*Erodium* sp. / filaree, storksbill	I	0.20	0.02
	Lamiaceae / Mint Family	*Salvia munzii* / Munz's sage	N	0	0.02
	Plantaginaceae / Plantain Family	*Plantago erecta* / dot-seed plantain	N	0	0.02
	Polygonaceae / Buckwheat Family	*Eriogonum fasciculatum* / California buckwheat	N	0.02	1
	Rosaceae / Rose Family	*Adenostoma fasciculatum* / chamise, greasewood	N	0	1

NOTE: Scientific and common names were primarily derived from Jepson eFlora (Jepson Flora Project 2020). In instances where common names were not provided in this resource, common names were obtained from Rebman and Simpson (2014).

ORIGIN
N =Native to locality; I = Introduced species from outside locality

Table 2
Plants Observed and Percent Cover –Area 1

Major Plant Group	Family	Scientific Name / Common Name	Origin	Percent Cover Sept. 12, 2023	Percent Cover June 28, 2024
Angiosperms: Monocots	Agavaceae / Agave Family	*Hooveria parviflora* [=*Chlorogalum parviflorum*] / small-flower soap-plant, amole	N	0.02	0.02
	Poaceae (Gramineae) / Grass Family	*Bromus rubens* [=*Bromus madritensis* ssp. *rubens*] / red brome	I	1	1
		Festuca myuros [=*Vulpia myuros*] / rattail sixweeks grass	I	1	1
		Gastridium phleoides [=*Gastridium ventricosum*] / nit grass	I	0.02	0.02
		Lamarckia aurea / golden-top	I	0.0	0.02
		Stipa sp. [=*Nassella* sp.] / needle grass	N	0.02	0.02
Angiosperms: Eudicots	Asteraceae / Sunflower Family	*Artemisia californica* / California sagebrush	N	0.2	0.2
		Centaurea melitensis / tocalote, Maltese starthistle	I	0.2	0.2
		Lasthenia gracilis [*L. californica* Lindley, misapplied in San Diego County] / common goldfields	N	0	0.02
		Logfia gallica [=*Filago gallica*] / daggerleaf cottonrose	I	0.2	0.2
	Boraginaceae / Borage Family	*Cryptantha* sp. / cryptantha	N	0.02	0.02
	Caryophyllaceae / Pink Family	*Silene gallica* / small-flower catchfly, windmill pink	I	0.02	0.02
	Cistaceae / Rock-Rose Family	*Crocanthemum scoparium* [=*Helianthemum scoparium*] / peak rush-rose	N	0.02	0.2
	Ericaceae / Heath Family	*Xylococcus bicolor* / mission manzanita	N	0.2	0.2
	Fabaceae (Leguminosae) / Legume Family	*Acmispon glaber* [=*Lotus scoparius*] / deerweed, California broom	N	0.2	0.2
	Geraniaceae / Geranium Family	*Erodium* sp. / filaree, storksbill	I	0.2	0.2
	Plantaginaceae / Plantain Family	*Plantago erecta* / dot-seed plantain	N	0.02	1
	Rosaceae / Rose Family	*Adenostoma fasciculatum* / chamise, greasewood	N	5	6

NOTE: Scientific and common names were primarily derived from Jepson eFlora (Jepson Flora Project 2020). In instances where common names were not provided in this resource, common names were obtained from Rebman and Simpson (2014).

ORIGIN
N =Native to locality; I = Introduced species from outside locality

Table 3
Plants Observed and Percent Cover – Area 2

Major Plant Group	Family	Scientific Name / Common Name	Origin	Percent Cover Sept. 12, 2023	Percent Cover June 28, 2024
Angiosperms: Monocots	Poaceae (Gramineae) / Grass Family	*Avena* sp. / oats	I	0.02	0.02
		Bromus hordeaceus / soft chess	I	0.02	0.02
		Bromus rubens [=*Bromus madritensis* ssp. *rubens*] / red brome	I	1	1
		Festuca myuros [=*Vulpia myuros*] / rattail sixweeks grass	I	1	1
		Lamarckia aurea / golden-top	I	0.02	0
		Stipa sp. [=*Nassella* sp.] / needle grass	N	0.02	0.2
Angiosperms: Eudicots	Asteraceae / Sunflower Family	*Artemisia californica* / California sagebrush	N	0.20	1
		Baccharis sarothroides / broom baccharis	N	0.02	0.02
		Centaurea melitensis / tocalote, Maltese star-thistle	I	4	1
		Deinandra fasciculata [=*Hemizonia fasciculata*] / fascicled tarweed	N	2	2
		Gutierrezia sp. / matchweed	N	0.20	0.20
		Lasthenia gracilis [*L. californica* Lindley, misapplied in San Diego County] / common goldfields	N	0.02	0.02
	Brassicaceae (Cruciferae) / Mustard Family	*Hirschfeldia incana* / short-pod mustard	I	2	0.20
		Sisymbrium sp. / hedge mustard	I	0.02	0.02
	Caryophyllaceae / Pink Family	*Silene gallica* / small-flower catchfly, windmill pink	I	0.02	0
	Chenopodiaceae / Goosefoot Family	*Salsola* sp. / tumbleweed	I	0.02	0
	Euphorbiaceae / Spurge Family	*Croton setiger* [=*Eremocarpus setiger*] / turkey-mullein, dove weed	N	0.02	0.20
	Fabaceae (Leguminosae) / Legume Family	*Acmispon glaber* [=*Lotus scoparius*] / deerweed, California broom	N	0.02	0.02
	Geraniaceae / Geranium Family	*Erodium* sp. / filaree, storksbill	I	3	1
	Plantaginaceae / Plantain Family	*Plantago erecta* / dot-seed plantain	N	0.02	0.20
	Polygonaceae / Buckwheat Family	*Eriogonum fasciculatum* / California buckwheat	N	0.20	1
	Rosaceae / Rose Family	*Adenostoma fasciculatum* / chamise, greasewood	N	0	0.02

NOTE: Scientific and common names were primarily derived from Jepson eFlora (Jepson Flora Project 2020). In instances where common names were not provided in this resource, common names were obtained from Rebman and Simpson (2014).

ORIGIN
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EMP Land Management Grants

Final Report

Otay Ranch Preserve Enhancement Project (SANDAG Contract Number S1125469)

State of Preserve Monitoring

Habitat Type	Habitat Enhancement through Invasive Species Control	Habitat Created/Restored	Acres Requiring Management	Acres Requrining Monitoring
Coastal Sage Scrub		0.69	0.69	0.69