Topock Project Executive Abstract

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Pacific Gas and Electric Company
Topock Revegetation Year 1 Mitigation Monitoring Report

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☐ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment)
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☐ Corrective Measures Implementation (CMI)/Remedial Action
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☒ Other / Explain: Annual Revegetation Mitigation Monitoring Report

Is this a Regulatory Requirement?
☒ Yes
☐ No
If no, why is the document needed?

What is the consequence of NOT doing this item? What is the consequence of DOING this item?

The revegetation and report is required by the approved 2018 Final Subsequent Environmental Impact Report (SEIR).
Not preparing this report constitutes non-compliance with the SEIR.

Other Justification/s:
☐ Permit ☐ Other / Explain:

Brief Summary of attached document:

The 2023 Topock Revegetation Year 1 Mitigation Monitoring Report summarizes project restoration plan requirements, provides the information on the number and species of sensitive trees and shrubs that were removed due to unavoidable construction impacts, as well as the number, species and locations of mitigation plantings, summarizes revegetation implementation activities, and provides the current status of the revegetation project during the first-year monitoring period. The report addresses revegetation maintenance and monitoring activities during Year 1, presents the results of annual quantitative monitoring of mitigation plantings and transplants, in addition to discussing adaptive management monitoring. The report also includes Pre-Planting and Year-1 photos from the photomonitoring.

Written by: PG&E

Recommendations:

This report is for information only.

How is this information related to the Final Remedy or Regulatory Requirements:

The survey and this report fulfill the requirement of Mitigation Measures AES-1, BIO-1a, and Cul-1a-5 of the 2018 SEIR.

Other requirements of this information?
None.

Version 10

Pacific Gas and Electric Company

Topock Revegetation Year 1 Mitigation Monitoring Report

January 2024

Topock Revegetation Year 1 Mitigation Monitoring Report

December 2023

Prepared By:
Arcadis U.S., Inc.
101 Creekside Ridge Court, Suite 200
Roseville
California 95678
Phone: 916 786 0320
Fax: 916 786 0366

Prepared For:
Pacific Gas and Electric Company

Our Ref:
30197232

Mary Carroll
Senior Ecologist

Dan Bush
Program Manager

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Acronyms and Abbreviations

Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CH2M Hill	CH2M Hill, Inc.
C/RAWP	Construction/Remedial Action Work Plan
dS/m	deciSiemens per meter
DOI	United States Department of Interior
DTSC	California Department of Toxic Substances Control
FEIR	Final Environmental Impact Report
FGL	Fruit Growers Laboratory
GIS	geographic information system
gph	gallon per hour
HRF	historical floodplain revegetation
HNWR	Havasu National Wildlife Refuge
MDLT	Mojave Desert Land Trust
MMPR	Mitigation Monitoring and Reporting Program
O&M	operation and maintenance
PG&E	Pacific Gas and Electric Company
Project	Final Groundwater Remedy
PVC	polyvinyl chloride
Revegetation Project	Groundwater Remediation Revegetation Project
RHR	riparian habitat revegetation
SEIR	Final Subsequent Environmental Impact Report
Site	designated revegetation areas
Tribes	Colorado River Indian Tribes, Chemehuevi Indian Tribe, Fort Mojave Indian Tribes, Hualapai Indian Tribe, and Cocopah Indian Tribe
TCS	Topock Compressor Station
UCCE	University of California Cooperative Extension
UHR	Upland Habitat Revegetation

USFWS	United States Fish and Wildlife Service

1 Introduction

Pacific Gas and Electric Company (PG&E) is implementing the final groundwater remedy (the Project) to address chromium in groundwater near the PG&E Topock Compressor Station (TCS) located in eastern San Bernardino County, 15 miles southeast of the City of Needles, California (Figure 1).

Construction of the Project began in October 2018 following the plans and procedures within the Construction/ Remedial Action Work Plan (C/RAWP; CH2M Hill, Inc. [CH2M Hill] 2015). In accordance with the C/RAWP, construction includes the installation of remedial wells and monitoring wells. The remedial action involves monitoring select wells to provide additional hydraulic data to update the conceptual site model, groundwater model, and design (C/RAWP Section 3.2.1.5).

The California Department of Toxic Substances Control (DTSC) is the state lead agency overseeing corrective actions at the TCS. Pursuant to the California Environmental Quality Act (CEQA), DTSC had prepared and certified a final environmental impact report (2011 Groundwater FEIR; DTSC 2011) that evaluated and prescribed mitigation measures to lessen the potential unavoidable environmental impacts associated with the final groundwater remedy.

DTSC also prepared and certified an addendum to the 2011 Groundwater FEIR (DTSC 2013) that evaluated the potential environmental impacts associated with implementation of the alternative freshwater source evaluation in the TCS Project area. In addition, DTSC prepared and certified a Final Subsequent EIR (SEIR; DTSC, 2018) that focuses primarily on modifications to the groundwater remedy since the 2011 Groundwater FEIR and the 2013 addendum to the FEIR. Included in the certified SEIR is the Groundwater Mitigation Monitoring and Reporting Program (Groundwater MMRP; DTSC 2018), which outlines the requirements for the mitigation for unavoidable direct impacts to plants associated with aesthetics and visual quality to key viewpoints, non-disturbed jurisdictional ephemeral waters and plants of traditional cultural significance. Mitigation measures are detailed in the Groundwater MMRP Mitigation Measures AES-1 part (f), BIO-1a parts (a) and (b), and CUL-1a-5 (DTSC 2018). The full text of the Mitigation Measures is provided in Appendix A.

As a requirement of the three mitigation measures mentioned above, PG&E prepared the following three plans; Topock Compressor Station Groundwater Remediation Project Aesthetics and Visual Resources Revegetation Plan (CH2M Hill and E2 Consulting Engineers 2014), Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2014b]) and Topock Groundwater Remediation Project Mitigation and Monitoring Plan for Culturally Significant Plants (CH2M HILL, 2014).

The restoration and revegetation of the Project Area shall be guided by and occur in accordance with the previously approved revegetation plans. These revegetation plans are addressed briefly in Section 1.2.1.

In addition, PG&E prepared the Havasu National Wildlife Refuge (HNWR) Habitat Restoration Plan (Appendix G to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2015]) to comply with Paragraph 13(b) of the Consent Decree, that the Construction/Remedial Action Work Plan (C/RAWP) which required a Habitat Restoration Plan for unavoidable impacts to sensitive habitats under the jurisdiction of the United States Fish and Wildlife Service, United Staes Army Corps of Engineers or the California Department of Fish and Game [now Department of Fish and Wildlife].

As stated in BIO-1a (b), “Implementation of these plans will be informed by the technical memorandum, A*ssessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts*, included as Appendix V to the C/RAWP (CH2M Hill 2015b), which provides preliminary information on the condition within fourteen proposed mitigation planting areas.”

The revegetation plans specify revegetation success criteria; monitoring and reporting requirements; and adaptive management guidelines for salvage and replanting of trees, shrubs, and perennial species. In accordance with the habitat revegetation plans, removal of mature trees in key viewpoints, riparian trees or culturally significant plants (e.g., blue palo verde trees *[Parkinsonia florida*]) were replaced at a 3:1 ratio (i.e., planting three trees in revegetation areas for each tree removed during construction). The success criterion for mitigation plantings is a final minimum plant replacement ratio of 2.25:1 (75 percent overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

The Groundwater Remediation Revegetation Project (the Revegetation Project) encompasses revegetation implementation and ongoing maintenance, monitoring, and reporting in designated revegetation areas (the Site, Figures 1 and 2). Restoration was implemented on October 8, 2022, and the post-revegetation implementation monitoring period began on October 9, 2022. This Year 1 Topock Revegetation Mitigation Monitoring Annual Report summarizes the current status of the Revegetation Project during the first-year monitoring period, revegetation maintenance and monitoring, and results of annual quantitative monitoring of mitigation plantings and revegetation areas and provides a review of current mitigation revegetation requirements.

1.1 Revegetation Year 1 Mitigation Monitoring Report Organization

This Topock Revegetation Year 1 Mitigation Monitoring Report is organized as follows:

- Section 1 provides an overview of approved revegetation plans, project impacts and required mitigation, previously salvaged and transplanted plants, and revegetation goals.
- Section 2 presents a summary of revegetation implementation activities conducted since 2015, including details on selection of the mitigation planting areas and site preparation.
- Section 3 summarizes the methods implemented for routine monthly revegetation assessments, annual quantitative monitoring, adaptive management monitoring, and reference sites assessments prior to planting and during Year 1.
- Section 4 summarizes the methods implemented for routine maintenance during Year 1.
- Section 5 summarizes the results of annual quantitative monitoring for mitigation plants in Year 1, including implementation of adaptive management strategies, a review of performance standards, and salvaged beavertail cactus survival.
- Section 6 provides a summary of maintenance carried out during Year 1, including details on repairs to revegetation infrastructure and results of continued invasive plant species abatement.
- Section 7 summarizes monitoring results and offers recommendations on subsequent revegetation activities for revegetation monitoring and maintenance.
- Section 8 provides a list of references cited throughout this report.

1.2 Background

This section summarizes the previously approved revegetation plans, project impacts and required mitigation, salvaged and transplanted beavertail cactus, and revegetation goals.

1.2.1 Approved Revegetation Plans

As part of the final design submittal for the Project, revegetation plans were submitted to address impacts to plants that would occur during construction. Each of these plans describes the specific mitigation measure or regulatory requirement driving the revegetation needs as well as the general approaches that would be implemented.

These plans specifically addressed plant impacts on HNWR lands (Appendix G to the C/RAWP, CH2M Hill and E2 Consulting Engineers 2015); within jurisdictional areas associated with waters of the U.S. and the State of California (Appendix O to the C/RAWP, CH2M Hill and E2 Consulting Engineers 2014b); for mature plants (Appendix N to the C/RAWP, CH2M Hill and E2 Consulting Engineers 2014a); and for ethnobotanically significant plants (Appendix H to the C/RAWP, CH2M Hill and GANDA 2014), which was submitted in compliance with the Cultural and Historic Properties Management Plan (U.S. Bureau of Land Management 2012).

The plans also specify on-site revegetation success criteria; monitoring and reporting requirements; and adaptive management guidelines for salvage and replanting of trees, shrubs, and perennial species.

In accordance with the habitat revegetation plans, removal of mature trees in key viewpoints, riparian trees or culturally significant plants (e.g., blue palo verde trees) must be replaced at a 3:1 ratio (i.e., planting three trees in revegetation areas for each tree removed during construction). The success criterion for mitigation plantings is a final minimum plant replacement ratio of 2.25:1 (75 percent overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period. Adaptive management guidelines outline modifications to revegetation approaches, as appropriate, to provide for successful establishment of native vegetation and desired density of cover of plants. As required by the plans, the following adaptive management actions will be implemented if success criteria are not being met: weed control, irrigation modification, herbivory protection, and additional plantings. Annual mitigation monitoring reports will be submitted to DTSC, California Department of Fish and Wildlife (CDFW), and United States Fish and Wildlife Service (USFWS) in January each year through 2027 for the duration of the required revegetation monitoring period or until performance targets are met.

1.2.2 Project Impacts and Required Mitigation

During site remediation construction between 2018 and 2022, a total of 220 native plants were removed including cacti, shrubs, and riparian trees (Table 1-1). PG&E avoided impacting sensitive plants or only minimally trimmed plants where possible. Sensitive plants were removed if avoidance was not possible.

1.2.2.1 Transplantation Effort in 2018

Just prior to initiating the remedy construction activities in 2018, PG&E attempted to salvage and transplant plants within the anticipated construction footprint to a single, upland habitat transplant location. Salvage and transplantation of sensitive plants occurred primarily over two separate events in 2018: November 27-28 and December 19. A total of 174 plants were salvaged and transplanted that included 146 blue palo verde, five desert smoke tree (*Psorothamnus spinosus*), 16 western honey mesquite (*Prosopis glandulosa* var. *torreyana*), and

seven beavertail cacti (*Opuntia basilaris* var. *basilaris*). Salvage and transplanting efforts followed protocols described in the revegetation plans. All the transplants were placed within the approximately 1.3-acre Upland Revegetation Area (UHR-1) located on the west side of National Trails Highway (Figure 2).

As of March 2021, none of the transplanted plants in the UHR-1 revegetation area were alive except for the seven beavertail cacti. Although PG&E followed the transplanting protocol, the transplantation methods were not successful. Transplant failure was due to a number of factors including (Strohl, 2020);

- High transplant mortality may have been because many unsuitable (i.e., poor health status) plants were transplanted. PG&E decided to transplant individuals with poor health in case they could potentially survive and if the transplant required little effort.
- Although revegetation plans recommended transplanting of individuals up to 6 feet tall, later research identified that plants under 12 inches tall have better transplant success. Most individuals transplanted were over 12 inches tall.
- The prescribed irrigation routine in the revegetation plans was probably not adequate for transplanted individuals.

Due to the high level of mortality seen from the initial efforts for direct transplants, PG&E decided that the remaining remedy construction mitigation for additional plant removals would be addressed through replacement only using container plants. PG&E committed to replacing failed transplants with container plants as well. Table 1-1 includes the failed transplanted individuals and sensitive plants that were not transplanted due to size limitations. It also includes any plants that were removed after it was decided to no longer attempt transplantations.

To mitigate for impacts to native cacti, shrubs, and riparian species, container plantings were propagated for outplanting in proposed revegetation areas at a 3:1 ratio (three mitigation plantings for each plant individual impacted) as shown in Table 1-2, plus 10 percent more container plantings of each species to allow for mortality and/or additional impacts, which is shown in Table 2-4. Container planting implementation is described in Section 2.2.4.

Table 1-1 Native Plants Impacted During Remediation

Scientific Name	Common Name	Total Plants Impacted
Riparian and Wash Species		
Parkinsonia florida	blue palo verde	163
Prosopis glandulosa	honey mesquite	22
Prosopis pubescens	screwbean mesquite	5
Psorothamnus spinosus	desert smoke tree	8
Senegalia greggii	catclaw acacia	1
Upland Species		
Atriplex polycarpa	cattle saltbush, allscale	4
Cylindropuntia acanthocarpa	buckhorn cholla	2
Cylindropuntia echinocarpa	silver cholla	6
Lycium andersonii	Anderson's desert thorn	1
Opuntia basilaris var. *basilaris*	beavertail cactus	3
	Total Plants Impacted	**215**

Table 1-2 Required Native Mitigation Plantings

Scientific Name	Common Name	Total Plants Impacted	Total Plantings at 3:1 Mitigation Ratio
Riparian and Wash Species			
Parkinsonia florida	blue palo verde	163	489
Prosopis glandulosa	honey mesquite	22	66
Prosopis pubescens	screwbean mesquite	5	15
Psorothamnus spinosus	desert smoke tree	8	24
Senegalia greggii	catclaw acacia	1	3
Upland Species			
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	4	12
Cylindropuntia acanthocarpa	buckhorn cholla	2	6
Cylindropuntia echinocarpa	silver cholla	6	18
Lycium andersonii	Anderson's desert thorn	1	3
Opuntia basilaris var. *basilaris*	beavertail cactus	3	9
	Total Plants	**215**	**645**

1.2.3 Revegetation Goals and Year 1 Monitoring Requirements

This section summarizes the goals for the Revegetation Project and the Year 1 monitoring requirements.

1.2.3.1 Revegetation Goals

The primary goals for establishing sustainable mitigation plantings of upland and riparian species at the Site include:

- Minimize disturbance to existing native vegetation on site.
- Restore and/or enhance healthy, self-sustaining upland vegetation and riparian and wash vegetation in suitable revegetation sites with the physical and biological characteristics of adjoining undisturbed colonies, allowing for biotic flows and exchange.

To achieve these goals, the procedures described in this Year 1 Mitigation Monitoring Report have been designed to conserve soil and reduce erosion, protect existing wildlife and native plants at the Site, and re-establish native species in areas that are self-sustainable and that reflect the characteristics of adjacent native vegetation. Specific techniques to meet these goals, as well as performance criteria, monitoring requirements, and contingency plans, are provided in the sections below.

1.2.3.2 Year 1 Monitoring Requirements

The Year 1 monitoring program focused on monthly assessments of native plantings in mitigation planting areas and tracking progress in meeting the performance targets. A detailed monitoring dataset is maintained for each visit that includes the specific task, date, monitoring details, and general conditions and observations, as described in more detail in Section 3.1.

Annual quantitative sampling focuses on a detailed assessment of the survival and health of each mitigation plant and also includes documentation of species richness, photomonitoring, and variables that might affect successful completion of the Revegetation Project. These methods are detailed in Section 3.2.

The performance criterion for mitigation plants is: Mitigation plantings will exhibit 75 percent survival of required plantings by species. Survival of any mitigation planting species that drops to less than a 2.25:1 mitigation ratio (number planted: number impacted, or 75 percent survival of mitigation plantings) will require remedial planting. If remedial planting is required, remedial plantings will be monitored for 5 years from the time of their initial planting.

The required mitigation plant numbers are presented in Table 1-2.

2 Revegetation Implementation Summary

Final selection of six mitigation planting areas is described in detail in Section 2.1, followed by a discussion of site preparation and associated revegetation implementation methods.

2.1 Revegetation Areas

PG&E prepared a Technical Memorandum titled “Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts (Appendix O to the C/RAWP [CH2M 2015]) in 2015. The goal of the memo was to identify suitable planting areas for the revegetation plantings within the project area. Fourteen proposed mitigation planting areas were selected for the revegetation plantings (Figure 3). These revegetation sites were assessed for revegetation planting suitability along with additional potential planting sites in 2021.

2.1.1 Proposed Planting Areas 2015

The fourteen mitigation planting areas were grouped into two upland habitat revegetation (UHR) units, six riparian habitat revegetation (RHR) units, and six historical floodplain revegetation (HFR) units. The historical floodplain term refers to the areas between the National Trails Highway and the ordinary high-water mark of the Colorado River where dredged sands were historically deposited. The historical floodplain no longer functions as a riparian habitat with hydrologic connectivity to the river.

The proposed mitigation planting areas were selected along existing or proposed access routes to facilitate future planting, monitoring, and maintenance. They were also located outside of the groundwater remedy construction footprint and away from existing/planned infrastructure to avoid future impacts during decommissioning and removal of the remedy infrastructure. A number of factors were considered during selection of the planting areas such as, mitigation planting area size, habitat type (upland or riparian), existing plants, and cultural issues.

The mitigation planting areas proposed in 2015 included:

- Two previously disturbed upland habitat proposed planting areas (UHR-1 and UHR-2) - located along the National Trails Highway
- Six riparian habitat proposed planting areas (RHR units - five of which are located in the western drainage (RHR-1 through RHR-5), and one recently burned location (RHR-6) on the 100-year floodplain of the Colorado River
- Six historical floodplain proposed planting areas (HFR-1 through HFR-6) – also located on the historical floodplain.

2.1.2 Additional Proposed Planting Areas - 2021

PG&E decided to re-access the 14 previously approved sites and explore new opportunities for more suitable mitigation planting areas in hindsight of the failed transplant effort. While PG&E was identifying possible new planting areas, HNWR identified a need to remove tamarisk in the floodplain to improve the riparian habitat for protected wildlife species, which would open further areas for PG&E to plant within the floodplain. PG&E decided to investigate new areas within the floodplain in California as suitable candidates for mitigation plantings. In September 2021, PG&E conducted soil sampling and soil moisture studies in the existing and newly identified

mitigation planting areas to complete an in-depth investigation of all the areas to determine which would be most suitable for the mitigation plantings. This resulted in new areas being proposed for assessment as potential mitigation planting areas in 2021 which included the following:

- Area A, an unvegetated area east of National Trails Highway and in the historic floodplain;
- Area B, an unvegetated linear feature that parallels patches of existing blue palo verde and honey mesquite located at the base of the eastern slope below National Trails Highway;
- Area C, which supported large stands of saltcedar and arrowweed (*Pluchea sericea*) in 2021 and overlaps most of RHR-6-1; and
- Area D, an unvegetated area surrounding remediation infrastructure.

The following sections summarize the 2021 assessment of the proposed planting areas.

2.1.3 Planting Area Assessments

In 2021, the 2015 and 2021 proposed planting areas were assessed for revegetation planting suitability. The suitability assessment was based on the following criteria:

- Adequate open space for planting and eventual growth of revegetation plantings (area not occupied by native plants or project infrastructure);
- Adequate soil moisture for targeted planting species; and
- Soil characteristics (nutrients, salinity, and permeability).

Measurements of soil moisture in each proposed revegetation area were made in September 2021 using an Aquaterr EC-300 portable soil measurement instrument with capacitance sensors connected to a stainless steel 30-inch probe (0.5 inch in diameter). Soil moisture measurements were made at 8 inches and 12 inches below ground surface (bgs) where possible. In some locations, cobble, gravel, or compacted soils prevented penetration of the moisture probe; where practical in such locations, soil was excavated into a bucket with a narrow shovel and measurements were taken in a bucket. Soil data collection locations are shown on Figure 4.

All locations were chosen ahead of time and subject to utility locate protocols. In addition, a 2-cup sample of soil was taken from each sampling location for laboratory analysis of soil nutrients, salinity, and texture.

2.1.4 Assessment of Soil Moisture Adjacent to Naturally-occurring Young Riparian Shrubs and Trees

Naturally-occurring riparian trees often become established during major rain events when soil moisture extends deep into soil layers and germinating seedlings send roots deep below the ground surface. Mature blue palo verde can produce roots that extend more than 20 feet bgs and mature honey mesquite can produce roots that extend more than 40 feet bgs. Catclaw acacia (*Senegalia greggii*) and desert smoke tree tend to occupy drier washes than blue palo verde or mesquite, although mixed stands also occur. Seedlings established during sparse rainfall events tend to produce shallower root systems initially.

To assess soil moisture availability to young riparian shrubs and trees with presumably shallower roots, soil moisture measurements were taken in September 2021 adjacent to young individuals (1 to 2 feet tall) of four riparian woody species proposed for planting (Figure 4): blue palo verde, honey mesquite, desert smoke tree, and

catclaw acacia. These measurements allowed for a general comparison of soil moisture around naturally occurring riparian tree and shrub young individuals with soil moisture in locations where container plantings (grown in 10-inch to 18-inch containers) would be placed.

2.1.5 Selection of Final Mitigation Planting Areas

Soil moisture data collected at the Site suggest that young riparian trees such as honey mesquite and palo verde become established when soil moisture equals or exceeds the following values: 65 percent at 12 inches bgs for honey mesquite and 79 percent at 12 inches bgs for blue palo verde. Young desert smoke tree and catclaw acacia occurred in natural areas where subsurface moisture was 32 percent to greater than 50 percent, if areas with compacted soils are excluded.

Using a minimum threshold of 30 percent subsurface soil moisture to support riparian shrubs and trees in the hot month of September, the following proposed revegetation areas were excluded for riparian shrub and tree establishment:

- RHR-1-1, RHR-2-1, RHR-3-1, and RHR-4-1;
- All HFR areas;
- All of Area A; and
- All of Area B.

Proposed mitigation planting areas that could support riparian shrubs and trees, based on soil moisture data, include RHR-5-1, RHR-6-1 (which overlaps Area C), all of Area C, and most of Area D margins.

Based on soil moisture data, Area D was suitable for desert smoke tree and catclaw acacia on the drier west side, and honey mesquite and blue palo verde in moister soils. The higher soil moisture in Area C suggested it was more suitable for blue palo verde and honey mesquite, which have higher soil moisture requirements.

2.1.6 Final Mitigation Planting Areas

Final mitigation planting areas included two main areas:

- Floodplain mitigation planting areas—Area C (which includes RHR-6) and margins of Area D, reconfigured and renamed as Areas 1 through 5; and
- One upland mitigation planting area—UHR-1.

RHR-5-1 was not selected because of a its distance from the other proposed mitigation planting areas and its relatively undisturbed conditions.

PG&E submitted Work Variance Request No. 11, which proposed the new mitigation planting areas mentioned above, to the United States Department of Interior (DOI) and DTSC for approval on January 10, 2022. PG&E received approval from DOI for the work variance request No. 11 on January 14, 2022, and from DTSC on January 19, 2022.

2.1.7 Floodplain Mitigation Planting Areas (Area 1, Area 2, Area 3, Area 4, and Area 5)

The final floodplain mitigation planting areas include five contiguous planting areas with slightly different environmental features (Figure 5A).

Areas 1 and 2 are located east of the Remediation Project access road that bisects the floodplain from north to south. Area 1 is bordered to the north by the easement for the Burlington Northern Railroad bridge and to the south by a monitoring well access road and Area 2. A 15-foot-wide Transwestern gas pipeline bisects Area 1 from west to east. The Interstate 40 bridge is located near the southern perimeter of Area 1 and the northern perimeter of Area 2. Area 2 is bordered by marshlands to the south.

Areas 3, 4, and 5 are located west of the Remediation Project access road that bisects the floodplain mitigation planting areas. Area 3 is the southwesternmost floodplain mitigation planting area and is located immediately south of the Interstate 40 bridge and associated infrastructure. A small wash drains from west to east within Area 3. Area 4 consists of a small area with compacted soils adjacent to and under the Interstate 40 bridge. Area 5 is the northwesternmost floodplain mitigation planting area and is located immediately north of the Interstate 40 bridge and associated infrastructure. A small wash drains from west to east within Area 5.

Areas 1 through 5 have a potentially high-water table because of their proximity to the Colorado River, particularly the two eastern areas (Area 1 and Area 2) adjacent to the river. Vegetation cover by saltcedar was high in Areas 1 and 2 and lower in Areas 3 through 5 before revegetation implementation (Section 2.2.1.1); saltcedar takes up salts with deep roots and extrudes them in its leaves. The soil analysis data for Areas 1 through 5 indicated elevated levels of soluble salts in soil, primarily sodium and chloride, but also sulfate and potentially toxic levels of boron based on optimal ranges for soil nutrients provided by FGL (FGL 2021a). In most of the soils, exchangeable and soluble calcium levels were also elevated; however, sodium adsorption ratio values were greatly inflated because of extreme excessive levels of soluble and exchangeable sodium. Most measured salts were in a soluble form based on optimal ranges for soil constituents provided by FGL.

After consultation with the director of the soil sampling laboratory (Ben Waddell at FGL), an intensive soil leaching effort was initiated as described in detail in Section 2.2.1.4 (FGL 2021b).

2.1.7.1 Upland Mitigation Planting Area (UHR-1)

UHR-1 is an upland site dominated by naturally occurring creosote bush (*Larrea tridentata*) along with other associated native species. The soil in this area is rocky and compacted, with low soil moisture retention (Figure 5B). UHR-1 has served as a receiver site for salvaged beavertail cacti over the past 5 years (Sections 2.2.7 and 5.6).

2.2 Site Preparation

Site preparation for revegetation commenced in summer 2021 so that mitigation planting areas were ready to receive container plants for the first planting event in March 2022.

2.2.1 Floodplain Revegetation Areas

Site preparation included saltcedar removal and debris cleanup in the floodplain mitigation planting areas, irrigation system installation, soil leaching in mitigation planting Areas 1 through 5, installation of herbivore-deterrent fencing, access road demarcation, and initial weed abatement.

2.2.1.1 Saltcedar Removal

Large stands of saltcedar predominated in Areas 1 through 5 before revegetation implementation, including sizeable saltcedar trees and accumulations of fallen debris. Saltcedar concentrates salts in the stems and leaves, and these high-salt debris are toxic to the species planted in Areas 1 through 5.

Beginning on November 9, 2021, and continuing for 17 working days, the HNWR team used a skid steer and other heavy equipment to grub the stems, branches, and roots of all saltcedar individuals within Areas 1 through 5. Saltcedar debris, including branches, twigs, leaves, roots, and other parts, were staged in a large pile for later removal from the mitigation planting areas by Groundwater Partners. Additional grubbing was conducted by Groundwater Partners after HNWR left the site and was completed by February 7, 2022. The saltcedar debris was subsequently loaded into dump trucks and hauled off site, for a total of 95 truckloads of saltcedar debris removed from revegetation areas.

After saltcedar and associated debris removal, an irrigation system was installed to leach the excess salts before planting as well as to provide a source of supplemental water once plantings were in the ground.

2.2.1.2 Irrigation System Installation

The main irrigation system infrastructure for the mitigation planting areas was installed between January 3 and February 3, 2022, with soil leaching commencing immediately thereafter. Additional irrigation system installation included installation of DEEP DRIP Watering Stakes and irrigation emitters for the container plantings. Figures 6A and 6B show a simple schematic of the irrigation system as built.

Fresh water for the floodplain irrigation system is supplied by the Site's potable water system, which uses pumped groundwater as a water source with water delivery through an 8-inch freshwater line that terminates in the drip irrigation system. Water for UHR-1 is trucked from the TCS to a plastic water tank located on the west side of UHR-1 (Figure 6B).

DEEP DRIP Watering Stakes were installed around each planting to encourage the development of deep root systems. All floodplain mitigation planting areas received three 36-inch DEEP DRIP Watering Stakes installed around each planting. A detailed description of the irrigation system is provided below in Section 2.2.1.3.1 and 2.2.1.3.2 and a summary of the soil leaching is provided in Section 2.2.1.4.

2.2.1.2.1 Irrigation System Design and Layout

In Areas 1 through 5, the irrigation system consists of 3-inch-diameter Schedule 40 polyvinyl chloride (PVC) pipe installed as main lines, which were connected to 1-inch-diameter Schedule 40 PVC laterals running to within 20 feet of each leaching/planting location. Three manifolds were constructed and inserted into the 1-inch-diameter PVC laterals at the closest point to each leaching/planting location. From the manifolds, three 0.25-inch black flexible "spaghetti hoses" were installed to supply each leaching/planting location, with each hose controlled by a small in-line valve. Each hose was fitted with a 1-gallon-per-hour (gph) emitter that was then fed into a DEEP

DRIP Watering Stake (Section 2.2.1.3.2), but the system was modified for the leaching process, as described in Section 2.2.1.4.

2.2.1.2.2 DEEP DRIP Watering Stake Installation

DEEP DRIP Watering Stakes were installed around each planting to encourage the development of deep root systems. All floodplain mitigation planting areas (Areas 1 through 5) received three 36-inch DEEP DRIP Watering Stakes placed around each planting. In the upland planting site (UHR-1), three 24-inch DEEP DRIP Watering Stakes were installed around each planting. Three 24-inch DEEP DRIP Watering Stakes were also installed around each salvaged beavertail cactus placed in UHR-1.

In Areas 1 through 5, the three DEEP DRIP Watering Stakes were configured in a triangle around the base of each planting and positioned approximately 14 to 16 inches from the stem of each planting. In UHR-1, each DEEP DRIP Watering Stake was positioned approximately 12 to 14 inches from the container plant center and/or salvaged cactus.

After stake installation, two 0.25-inch irrigation hoses, each with a 1 gph emitter, were placed in two of the DEEP DRIP Watering Stakes and closed with a DEEP DRIP Watering Stake cap. The remaining irrigation hose was attached to a riser and terminated with a 17 gph spray jet to water a 2-foot-diameter area around each planting.

2.2.1.3 Soil Leaching

Leaching of salts was required in Areas 1 through 5 to remove excess salts documented during soil sampling. The irrigation system installation for the leaching effort was completed on February 3, 2022. During leaching, one of the three 0.25-inch irrigation hoses was employed to water a 2-foot-diameter area with adequate moisture to saturate the soil to a depth of 18 inches; this hose end was fitted with a 17 gph spray jet attached to a riser.

The irrigation system was run for up to 8 hours to achieve soil saturation at a depth of 18 inches below ground surface (bgs). Once soil saturation was achieved, the irrigation system was turned off for 24 hours followed by a repeat of the “irrigation on followed by 24 hours off cycle.” Leaching continued until planting was conducted at a given location. After planting, irrigation of container plantings was then initiated, which continued leaching on a modified schedule that allowed for plant establishment without overwatering.

After a month of leaching, the results from the February 28, 2022 soil sampling event revealed a drop in soil salinity at most of the soil sampling points (Table 2-1). Despite decreased salinity, only three of the soil sampling locations exhibited soil salinity measurements less than 10 deciSiemens per meter (dS/m), all on the west side of the bare remediation infrastructure area farthest from the Colorado River. By March 24, 2022, when the first planting event was complete, all of the soil sampling points inside the leaching area exhibited soil salinity measurements less than 11 dS/m, with the control site remaining at 44.1 dS/m. In summary, the soil leaching effort successfully reduced soil salinity in floodplain planting areas at the time of planting to levels allowing for mitigation planting survival and growth.

Soil salinity sampling locations are shown on Figure 7.

Table 2-1 Soil Salinity Data in Floodplain Mitigation Planting Areas

Soil Salinity Sampling Location	Soil Salinity (dS/m)[1] on 9/22/2021	Soil Salinity (dS/m)[1] on 2/28/2022	Soil Salinity (dS/m)[1] on 3/24/2022	Soil Salinity (dS/m)[1] on 4/14/2022	Soil Salinity (dS/m)[1] on 6/15/2022	Soil Salinity (dS/m)[1] on 8/11/2022
C1	66.00	47.00	3.84	6.74	9.99	6.57
C2	91.00	107.00	1.67	5.13	7.46	6.40
C3	36.50	1.63	--	--	3.76	2.88
C4	150.00	70.40	10.40	16.60	32.90	4.03
C5	4.18	2.53	--	--	1.02	2.09
C6[a]	--	21.20	44.10	66.70	10.20	8.24
C7	--	--	1.27	3.87	1.04	7.33
C8	--	--	0.95	1.55	1.12	5.22
C9	--	--	0.93	1.40	3.68	3.5
C10	--	--	1.29	5.20	4.42	2.82
C11	--	--	0.82	1.97	1.50	4.77
C12	--	--	3.91	9.62	7.92	8.03
C13	--	--	1.04	2.54	5.88	1.06
D1	172.00	67.50	6.99	5.16	--	18.20
D2	284.00	236.00	5.77	7.98	--	5.40
D3	596.00	216.00	4.75	4.97	--	4.42
D4	240.00	40.00	4.73	5.49	--	9.54
D5	250.00	8.35	--	--	--	6.2

Notes:

[a] Control soil sampling location, not leached.

2.2.1.4 Access Road Demarcation

Site access is confined to existing access routes used to service infrastructure or other site activities. To clearly delineate the access roads for use by both remediation and revegetation teams, the access roads were demarcated by stakes and pin flags prior to fence installation.

2.2.1.5 Herbivore-deterrent Fencing

Before planting, fencing was installed around the perimeters of Areas 1, 2, 3, and 5 to deter herbivory during plant establishment (Figure 8A). The 6-foot-tall herbivore-deterrent fencing consists of 14-gauge galvanized metal welded wire with 1-inch by 3-inch openings and is attached with ultraviolet-resistant sturdy zip ties to 6-foot-tall metal posts set every 6 feet. The DeerBusters fencing system was installed according to manufacturer's instructions.

Fence post sleeves were installed in the ground and the posts inserted into the sleeves. Fence post corners and gates are supported with diagonal support poles, as needed for added stability. To deter animal burrowing under the fence, the bottom of the fencing extends an extra 6 inches outside of the fence line, where it lays flush with the ground. Four metal stakes driven into the ground secure the bottom of the fence between every fence post. Attention was paid to close small holes where rabbits could enter the mitigation planting area.

Eight 6-foot-tall personnel access gates consisting of a metal frame covered with fencing wire, and 4 wire access gates were installed in designated locations for site access. Animal deterrence features at each gate include constructed hardware cloth aprons attached to the bottom and sides of the fence or gate, which minimize gaps between the gate, the top of the soil in the entry location, and the surrounding fence (Figures 8A and 8B). The wire aprons were constructed from galvanized wire hardware cloth and cut to fit the openings, with an extra 2-inch extension to overlap the adjacent fencing when the gate is closed. All gates have latches to hold them securely closed.

Reflective tape was attached to planting area fences to improve visibility from access roads or other points of entry. The flexible 1.5-inch-wide, non-adhesive tape was woven between the cells of the fence wire and secured with a brass clasp on either end. In addition, signs stating "Restoration Area" were attached to the fencing in visible locations to identify mitigation planting areas.

Unlike the plantings in Areas 1, 2, 3, 5, and 6 and UHR-1, the plantings in Area 4 are surrounded by individually constructed wire cages made from the same materials as the perimeter fence. Each wire cage is 6 feet wide and 6 feet deep, with 6-foot-tall fencing attached to four metal 6-foot posts. The cage bottom is secured with four stakes between each post. As with the other fences, the bottom of the fencing extends an extra 6 inches, where it is staked. An access point in the fence allows entry to the wire cage for monitoring and weeding, as needed.

Herbivore-deterrent fencing was also installed in the upland revegetation area as described in Section 2.2.1.6. (Figure 8B).

2.2.2 Upland Revegetation Area

No leaching was required in UHR-1. An irrigation system was installed along with herbivore-deterrent fencing.

2.2.2.1 Irrigation System Installation

A drip irrigation system was installed in UHR-1 with a configuration similar to that of the floodplain revegetation areas (Figure 6B). An approximately 5,000-gallon water tank was installed in February 2022, which serves as a water source for the system and is filled by a water truck. Three 24-inch DEEP DRIP Watering Stakes were installed around each mitigation planting and supplied by a 0.25-inch irrigation hose. Three 0.25-inch irrigation hoses were also installed around each salvaged beavertail cactus transplanted into UHR-1 (see Section 2.2.7).

2.2.2.2 Herbivore-deterrent Fencing

Before planting, 6-foot-tall metal mesh fencing was installed around the perimeter of UHR-1 to deter herbivory during plant establishment using the same methods as those used in the floodplain mitigation planting areas (Figure 8B).

2.2.3 Initial Invasive Species and Other Plant Species Abatement

A total of 14 invasive plant species requiring treatment and/or removal were documented in floodplain mitigation planting areas before the October 2022 planting event (Table 2-2). These included species that covered large portions of the mitigation planting areas before planting: saltcedar and common reed (*Phragmites australis*). One other native plant species, arrowweed, also covered large portion of mitigation planting areas before planting.

Invasive plant species with a patchier distribution in scattered locations, especially near disturbance areas, include Russian-thistle (*Salsola tragus*), Sahara mustard *(Brassica tournefortii*), puncturevine (*Tribulus terrestris*), Bermuda grass (*Cynodon dactylon*), and giant reed (*Arundo donax*), as well as several other non-native species present in small numbers (Table 2-2).

Invasive plant treatment methods are described in Section 4.4.

Table 2-2 Invasive Plants in Mitigation Planting Areas

Scientific Name	Common Name	Growth Habit	Mitigation Planting Area(s) Were Observed	Abundance in Area Were Observed	California Invasive Plant Council Rating [a]
Arundo donax	giant reed	rhizomatous perennial grass	Area 2 (just outside and overhanging)	uncommon	high
Brassica tournefortii	Saharan mustard	annual forb	Area 3	uncommon	high
Chenopodium murale	nettleleaf goosefoot	annual forb	Areas 1 and 3	uncommon	no rating
Cynodon dactylon	Bermuda grass	rhizomatous perennial grass	Areas 1, 2, 3, 4, and 5	occasional	moderate

Scientific Name	Common Name	Growth Habit	Mitigation Planting Area(s) Were Observed	Abundance in Area Were Observed	California Invasive Plant Council Rating [a]
Gossypium hirsutum	upland cotton	annual to shrub	Area 1	uncommon	no rating
Kochia scoparia	summer-cypress	annual forb	Area 3	uncommon	limited
Phragmites australis	common reed	rhizomatous perennial grass	Areas 1 and 2	common	no rating
Polygonum argyrocoleon	silversheath knotweed	annual forb	Area 3	uncommon	no rating
Portulaca oleracea	common purslane	annual forb	Area 2	uncommon	no rating
Salsola tragus	Russian-thistle	annual forb	Areas 1, 3, and 5	scattered	limited
Schismus barbatus	Mediterranean grass	annual grass	Areas 1 and 3/ UHR-1	occasional/ common	limited
Sonchus oleraceus	sow-thistle	annual forb	Area 3	uncommon	no rating
Tamarix ramosissima	saltcedar	tree or shrub	Areas 1, 2, 3, 4, and 5	common	high
Tribulus terrestris	puncturevine	annual forb	Areas 1, 2, and 3	occasional	limited

Note:
[a] California Invasive Plant Inventory (California Invasive Plant Council 2023)

2.2.3.1 Floodplain Revegetation Areas Initial Invasive Plant Species Abatement

Pre-planting non-native species removal initially focused on saltcedar removal in floodplain revegetation areas. Subsequent invasive plant removal before planting included removal of a non-native subspecies of common reed. Extensive stands of common reed occur adjacent to the Colorado River and extended into the margins of Areas 1 and 2 prior to planting. Common reed is rhizomatous and quickly re-colonized the eastern margins of Area 1 and the eastern and southern margins of Area 2 after the removal of saltcedar. Removal of common reed from Areas 1 and 2 required multiple manual and herbicide treatments.

Other invasive plant species occurred occasionally within mitigation planting areas and were removed in a timely manner before planting.

2.2.3.2 Other Plant Species Abatement

Arrowweed is a native rhizomatous perennial that grows in large dense patches on the floodplain in Areas 1, 2, and 3. Although native, arrowweed rhizomes grow rapidly towards water sources such as the drip emitters installed for mitigation plantings. It has the capacity to out-compete mitigation plantings before they are large enough to compete for light and access to deep water sources. It is an ethnobotanically significant species requiring coordination with Tribes (Colorado River Indian Tribes, Chemehuevi Indian Tribe, Fort Mojave Indian Tribes, Hualapai Indian Tribe, Cocopah Indian Tribe, and Quechan Indian Tribe) for treatment and preservation (U.S. Bureau of Land Management 2012).

Arrowweed removal methods are described in Section 4.4.2

Table 2-3 Other Plants in Mitigation Areas Requiring Removal

Scientific Name	Common Name	Growth Habit	Mitigation Planting Area(s) Were Observed	Abundance in Area Were Observed
Pluchea sericea	arrowweed	rhizomatous perennial forb	Areas 1 and 2	common

2.2.3.3 Upland Revegetation Area Initial Invasive Plant Species Abatement

Invasive plant species monitoring was conducted in UHR-1 by walking throughout the revegetation area, visually assessing for presence of any invasive plant species, and manually removing them by hand or with a shovel.

No invasive species were observed before revegetation implementation; therefore, no initial invasive species abatement occurred in UHR-1.

2.3 Mitigation Plant Types and Sources

There are three types of mitigation plant sources for the Revegetation Project: container-grown plantings, volunteer recruits of individuals included in the required plant palette, and seeded areas (for honey mesquite only), as shown on Figures 9A through 9F. In addition, salvaged beavertail cactus are monitored for health and survival, and are documented separately from the required mitigation plants.

2.3.1 Container Plantings

Site-collected seeds and cuttings were used to propagate the required mitigation container plants for native species impacted by the Project. The required number of mitigation plants was calculated based on the number of impacted individuals multiplied by 3 to generate a 3:1 mitigation ratio (mitigation plantings: impacted plants). The final number of mitigation plants included an extra 10 percent of the required total for each species to allow for potential mortality (Table 2-4).

Table 2-4 Required Native Mitigation Plantings and Total Mitigation Plants

Scientific Name	Common Name	Total Plants Impacted	Total Plantings at 3:1 Mitigation Ratio	Total Mitigation Plants (plus 10 percent of required total)
Riparian and Wash Species				
Parkinsonia florida	blue palo verde	163	489	538
Prosopis glandulosa	honey mesquite	22	66	73
Prosopis pubescens	screwbean mesquite	5	15	17
Psorothamnus spinosus	desert smoke tree	8	24	26
Senegalia greggii	catclaw acacia	1	3	3
Upland Species				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	4	12	13
Cylindropuntia acanthocarpa	buckhorn cholla	2	6	7
Cylindropuntia echinocarpa	silver cholla	6	18	20
Lycium andersonii	Anderson's desert thorn	1	3	3
Opuntia basilaris var. *basilaris*	beavertail cactus	3	9	10
	Total Plants	**215**	**645**	**710**

All seeds and cuttings were collected on site by an Arcadis biologist and specialists from the MDLT. No more than 25 percent of available seed was collected from any individual or population. No more than 25 percent of available cutting material was taken from any individual plant when cuttings were taken. Most species germinated or rooted soon after planting in appropriate media at the MDLT nursery. Before delivery for planting, container plants were housed outdoors in a shade house with shade cloth retracted 2 months before planting in fall 2022 to allow for plantings to harden off.

Prior to plant delivery, nursery-grown honey mesquite plants were infested with root aphids at the MDLT nursery. Because there were many volunteer recruits of both honey mesquite and screwbean mesquite in floodplain planting areas prior to planting, a decision was made to use volunteer recruits as mitigation plants for these two species instead of container plantings. Also, with all the recruits at the Site, adding additional container plants would have overcrowded the site with plants.

A total of 726 plants were installed (710 mitigation plants and 16 additional plants) or designated as mitigation plants from volunteer recruits in 2022. Sixty-nine plantings of upland species were installed in UHR-1. A total of 562 riparian and wash species mitigation container plants were planted during two planting events, and 95 volunteer recruits were selected as mitigation plants in the floodplain mitigation planting areas (Areas 1 through 5), for a total of 657 mitigation plants in the floodplain as of October 8, 2022.

Twenty-six beavertail cactus plantings were installed, although only 10 mitigation plants were required. The remaining 16 beavertail cactus plantings will serve potential needs from future project impacts.

Spring 2022 planting event: A total of 509 mitigation plants were installed during the spring planting event: 496 blue palo verde in Areas 1, 2, and 3; three catclaw acacia in Area 5; and 10 beavertail cactus in UHR-1.

Fall 2022 planting event: A total of 106 mitigation plants were installed during the fall planting event: 37 blue palo verde and 26 desert smoke tree individuals were planted in Areas 3 and 5, and 43 plantings were installed in UHR-1 including cattle spinach, also commonly known as allscale saltbush (*Atriplex polycarpa*), buckhorn cholla (*Cylindropuntia acanthocarpa*), silver cholla (*Cylindropuntia echinocarpa*), and Anderson's desert thorn (*Lycium andersonii*).

Table 2-5 provides a summary of container plantings installed in 2022.

Table 2-5 Installed Container Plantings

Scientific Name	Common Name	Number of Mitigation Plants Required	Number of Plants Installed in Spring 2022	Number of Plants Installed in Fall 2022	Total Plants Installed in 2022
Floodplain Species (Areas 1 through 5)					
Parkinsonia florida	blue palo verde	538	496	37	533
Prosopis glandulosa	honey mesquite	73	0	0	0
Prosopis pubescens	screwbean mesquite	17	0	0	0
Psorothamnus spinosus	desert smoke tree	26	0	26	26
Senegalia greggii	catclaw acacia	3	3	0	3
Upland Species (UHR-1)					
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	0	13	13
Cylindropuntia acanthocarpa	buckhorn cholla	7	0	7	7
Cylindropuntia echinocarpa	silver cholla	20	0	20	20
Lycium andersonii	Anderson's desert thorn	3	0	3	3
Opuntia basilaris var. *basilaris*	beavertail cactus	10	26	0	26
Upland Species (UHR-1) Plantings Subtotal		**53**	**10**	**43**	**53**

Scientific Name	Common Name	Number of Mitigation Plants Required	Number of Plants Installed in Spring 2022	Number of Plants Installed in Fall 2022	Total Plants Installed in 2022
Floodplain Species (Areas 1 through 5) Plantings Subtotal		**657**	**499**	**63**	**562**
All Species Plantings Total		**710**	**509**	**106**	**615**

2.3.2 Volunteer Recruits

Many natural volunteer recruits germinated from the pre-existing seedbank in the floodplain after the floodplain had been cleared of saltcedar, leached of high salts, fenced from herbivores, and irrigated. Native volunteer recruits appeared most frequently near irrigation emitters associated with mitigation plantings. Several summer monsoon rain events also contributed to natural recruitment. Because of the abundance of these volunteer recruits, and the overcrowding of recruits with mitigation plantings in the majority of the Site, PG&E received agency approval to designate mesquite volunteer recruits (both honey mesquite and screwbean mesquite [*Prosopis pubescens*]) as mitigation plants in lieu of the planned mesquite container plantings to meet the success criteria. In addition, five blue palo verde recruits were monitored and maintained as mitigation plants to offset any mortality. Three 0.25-inch irrigation hoses were installed around each volunteer recruit mitigation plant to provide supplemental irrigation at the same time at which the container plantings are receiving water.

The following criteria were used while selecting volunteer recruits for use as mitigation plantings.

- Volunteer recruits were at least 8 inches tall, with vigorous growth.
- Volunteer recruits were at least 5 feet from another mitigation plant (stem to stem).
- Volunteer recruits were not crowded or likely to shade out another mitigation planting.
- Volunteer recruits did not have notable pests, damage, or health concerns.
- Volunteer recruits were not located in low-lying areas of the Site that have or may have anoxic soil and where their long-term survival was questionable because of poor habitat suitability.
- Volunteer recruits were not growing where previously installed mitigation plantings were observed to be struggling or to have already died.

Total mitigation plants in January 2023, when a baseline census was completed, are summarized in Table 2-6.

*Table 2-6 Total Mitigation Plants (Container Plants and Recruits)**

Scientific Name	Common Name	Total Mitigation Plants Required	Total Container Plantings Installed in 2022	Total Recruits Designated as Mitigation Plants in January 2023	Total Mitigation Plants (Container and Recruits)
Floodplain Species (Areas 1 through 5)					
Parkinsonia florida	blue palo verde	538	533	5	538
Prosopis glandulosa	honey mesquite	73	0	73	73
Prosopis pubescens	screwbean mesquite	17	0	17	17
Psorothamnus spinosus	desert smoke tree	26	26	0	26
Senegalia greggii	catclaw acacia	3	3	0	3
Upland Species (UHR-1)					
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	13	0	13
Cylindropuntia acanthocarpa	buckhorn cholla	7	7	0	7
Cylindropuntia echinocarpa	silver cholla	20	20	0	20
Lycium andersonii	Anderson's desert thorn	3	3	0	3
Opuntia basilaris var. *basilaris*	beavertail cactus	10	10	0	10

Scientific Name	Common Name	Total Mitigation Plants Required	Total Container Plantings Installed in 2022	Total Recruits Designated as Mitigation Plants in January 2023	Total Mitigation Plants (Container and Recruits)
Upland Species (UHR-1) Subtotal		**53**	**53**	**0**	**53**
Floodplain Species (Areas 1 through 5) Subtotal		**657**	**562**	**95**	**657**
All Species Total		**710**	**615**	**95**	**710**

* Final baseline January 2023

2.3.3 Honey Mesquite Seeding Areas

Honey mesquite seeds were planted in designated planting areas to potentially augment the number of honey mesquite mitigation plants. Seeds used for planting were collected during the initial seed collection effort in 2021 and stored at the MDLT nursery as described in Section 2.2.4.

In January 2023, the 276 seeds were scarified with 220 grit sandpaper before planting to improve germination. Scarification included holding each seed and gently sanding through the seed coat in one location without notably affecting the embryo. Seeds were then planted into 1-square-foot seeding areas within Areas 1, 2, 3, and 5 in 44 locations, with approximately seven seeds planted at each location at a depth of 0.25 inch (Figure 10).

Irrigation was installed in 41 seeding locations using 0.25-inch irrigation tubes hooked to the master irrigation system and run at the same interval as the mitigation plantings. No irrigation was installed in three locations to assess germination response with lack of supplemental water.

Six honey mesquite mitigation plants resulted from the seeding effort (Table 2-7).

Table 2-7 Honey Mesquite Seeding Summary

Area Name	Number of Seeded Areas	Number of Seeds Germinated	Number of Mitigation Plants from Germinated Seeds as of September 2023
1	24	0	0
2	4	6	4
3	7	1	0
5	9	2	2
Totals	**44**	**9**	**6**

2.3.4 Salvaged and Transplanted Beavertail Cactus

During the remedy project, three beavertail cactus individuals were transplanted near the construction area and died. Between 2018 and August 2022, 12 beavertail cactus individuals were salvaged from work areas associated with the remedy project and transplanted into UHR-1 (Table 2-8). All beavertail cactus transplants in UHR-1 have survived.

Nine surviving beavertail cactus individuals served to mitigate for the loss of three beavertail cactus at a 3:1 ratio and with the addition of one more beavertail cactus, a 10% contingency was added, for a total of 10 beavertail cactus mitigation plants.

Beavertail cactus transplants were watered initially after transplant and then monthly during the drier and hotter months of the year. When the irrigation system was installed in UHR-1, the revegetation team installed three 24-inch DEEP DRIP Watering Stakes and three 0.25-inch irrigation hoses around each salvaged beavertail cactus to provide supplemental irrigation. These salvaged plantings were monitored and tracked separately from other mitigation plantings during monitoring events, with resulting data included in Section 5.6.

*Table 2-8 Beavertail Cactus Salvaged and Transplanted in UHR-1**

Date of Transplanting	Total Individuals Salvaged and Transplanted	Total Individuals Alive (September 2023)
November and December 2018	7	**7**
2020 to 2021	2	**2**
April and August 2022	3	**3**
Total Salvaged and Transplanted Beavertail Cactus	**12**	**12**

* Final baseline January 2023

2.4 Mitigation Plants in Each Mitigation Planting Area

A summary of each mitigation planting area is provided below. The numbers and types of mitigation plants in each area are shown in Table 2-9, based on a baseline census conducted in January 2023 to verify the number of container plantings and volunteer recruits treated as mitigation plants.

At the time of planting and in January 2023, all mitigation plants were documented using hand-held devices (phones or tablets) equipped with GIS data collection apps (ArcGIS Field Maps). An individual geo-referenced point with a unique plant identification number was created for each mitigation plant (installed and volunteer recruits) along with a photograph and the following data (Figures 9A through 9F):

- Species;
- Planting type (e.g., installed or recruit);
- Date planted; and
- Mortality (alive or dead).

In addition, the following baseline monitoring data were collected and recorded using ArcGIS Field Maps:

- Monitoring date;
- Plant health assessments;
- Height and width measurements;
- Vegetative and reproductive phenology (e.g., leaves, fruits);
- Herbivory issues;
- Evidence of disease;
- Salinity issues;
- Irrigation issues; and
- General notes.

Representative photographs of mitigation plants in each area are shown in Appendix B. Photographs taken at designated photo stations that show the mitigation planting areas before planting and in Year 1 are presented in Appendix C.

Area 1

Area 1, which occurs in the floodplain area of the Site, was dominated by saltcedar before initiation of revegetation. It is relatively flat and underlain by silty and sandy soils depending on the location. Soil salinity measurements were high before soil leaching but dropped to less than 10 dS/m in March 2022 (Section 2.2.1.4). Stands of arrowweed grow throughout Area 1, and common reed formed large colonies along the eastern margin at the time of planting.

A total of 286 blue palo verde individuals were planted in Area 1 in March 2022. In addition, 20 volunteer honey mesquite and 10 screwbean mesquite volunteer recruits were monitored as mitigation plants along with the container plantings. There were 316 mitigation plants in Area 1 during the baseline census in January 2023 (Figure 9A).

Area 2

Area 2 is located in the floodplain area south of Area 1. It was previously dominated by saltcedar before the initiation of revegetation and is underlain by sandy and silty soils. Soil salinity measurements were high before leaching but generally dropped to less than 10 dS/m in March 2022 (Section 2.2.1.4). Patches of arrowweed occurred along the eastern and southern boundaries, along with colonies of common reed, at the time of planting.

A total of 194 blue palo verde plantings were installed in Area 2 in March 2022. In addition, 15 volunteer honey mesquite and five screwbean mesquite volunteer recruits were monitored as mitigation plants along with the container plantings. There were 214 mitigation plants in Area 2 during the baseline census in January 2023 (Figure 9B).

Area 3

Area 3 is located at the base of a small wash that descends from National Trails Highway from west to east down to the floodplain on the south side of the Interstate 40 bridge and associated infrastructure. A large naturally occurring blue palo verde tree occurs at the upper western edge of Area 3, with native vegetation on surrounding slopes. The soil in this area is a mix of sand, silt, gravel, and rock. Before leaching, soil salinity was relatively low in the western corner of Area 2 but much higher near the Interstate 40 bridge in the northeastern corner. After leaching in March 2022, all locations recorded soil salinity measurements of less than 10 dS/m (Section 2.2.1.4).

A total of 37 blue palo verde individuals were planted in Area 3 in March and October 2022, and five volunteer blue palo verde recruits were selected in October 2022 as mitigation plants. In addition, 18 volunteer honey mesquite and seven screwbean mesquite volunteer recruits were monitored as mitigation plants along with the container plantings. There were 62 mitigation plants in Area 3 during the baseline census in January 2023 (Figure 9C).

Area 4

Area 4 is located in mostly compacted soil immediately adjacent to the footings under the Interstate 40 bridge. It consists of four separate small, fenced enclosures that range in size from 31.3 to 100.3 square feet, each containing one blue palo verde container planting.

A total of four blue palo verde individuals were planted in Area 4 in October 2022 (Figure 9D).

Area 5

Area 5 is located at the base of a small wash that descends from National Trails Highway from west to east down to the floodplain on the north side of the Interstate 40 bridge and associated infrastructure. Native plants occur in the surrounding area, with soils in this area consisting of gravels and sands. Only one soil sampling location occurs at the southeastern end of Area 5 near the Interstate 40 bridge; salinity measurements were high before leaching but dropped to less than 7 dS/m after leaching in March 2022 (Section 2.2.1.4).

Three catclaw acacia individuals were planted in Area 5 in March 2022. A total of 17 blue palo verde individuals and 19 desert smoke tree individuals were planted in October 2022. In addition, 20 volunteer honey mesquite and two screwbean mesquite volunteer recruits were monitored as mitigation plants along with the container plantings. There were 61 mitigation plants in Area 5 during the baseline census in January 2023 (Figure 9E).

UHR-1

UHR-1 is a rocky upland site dominated by naturally occurring creosote bush along with other associated native species such as cattle spinach, beavertail cactus, silver cholla, and Sonoran sandmat (*Euphorbia micromera*). The soil in this area is rocky and compacted, with low soil moisture retention.

Fifty-three mitigation plantings were planted in UHR-1 in 2022. These include 13 cattle spinach individuals, seven buckhorn cholla individuals, 20 silver cholla individuals, three Anderson's desert thorn individuals, and 10 beavertail cactus individuals (Figure 9F).

Table 2-9 summarizes the number of mitigation plants by area including container plantings and recruits.

*Table 2-9 Total Mitigation Plants (Containers and Recruits) by Area**

Scientific Name	Common Name	Total Container Plantings Installed in 2022	Total Recruits Designated as Mitigation Plants	Total Mitigation Plants (Container and Recruits)
Area 1				
Parkinsonia florida	blue palo verde	286	0	286
Prosopis glandulosa	honey mesquite	0	20	20
Prosopis pubescens	screwbean mesquite	0	10	10
Area 2				
Parkinsonia florida	blue palo verde	194	0	194
Prosopis glandulosa	honey mesquite	0	15	15
Prosopis pubescens	screwbean mesquite	0	5	5
Area 3				
Parkinsonia florida	blue palo verde	32	5	37
Prosopis glandulosa	honey mesquite	0	18	18
Psorothamnus spinosus	desert smoke tree	7	0	7
Area 4				
Parkinsonia florida	blue palo verde	4	0	4
Area 5				
Parkinsonia florida	blue palo verde	17	0	17

Scientific Name	Common Name	Total Container Plantings Installed in 2022	Total Recruits Designated as Mitigation Plants	Total Mitigation Plants (Container and Recruits)
Prosopis glandulosa	honey mesquite	0	20	20
Prosopis pubescens	screwbean mesquite	0	2	2
Psorothamnus spinosus	desert smoke tree	19	0	19
Senegalia greggii	catclaw acacia	3	0	3
UHR-1				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	0	13
Cylindropuntia acanthocarpa	buckhorn cholla	7	0	7
Cylindropuntia echinocarpa	silver cholla	20	0	20
Lycium andersonii	Anderson's desert thorn	3	0	3
Opuntia basilaris var. *basilaris*	beavertail cactus	10	0	10
	Upland Species (UHR-1)	**53**	**0**	**53**
	Floodplain Species (Areas 1 through 5)	**562**	**95**	**657**
	Totals	**6151**	**95**	**710**

* Final baseline January 2023

3 Revegetation Monitoring Methods

A robust monitoring and reporting program allows managers to assess progress on completion of revegetation tasks, to establish quality control, and to hasten implementation of corrective actions as needed, which greatly increases the overall success and cost-effectiveness of a revegetation project. Methods for routine monthly revegetation assessments and annual quantitative monitoring are summarized in this section.

3.1 Monthly Assessments

Mitigation planting areas were assessed and maintained monthly during the first year after planting. The mitigation planting areas were assessed for health and survival of mitigation plants, establishment of invasive plant species, and recruitment of new native and/or invasive plant species. These assessments have been crucial for implementation of adaptive management measures, a process in which the findings from direct monitoring provide the evidence and basis for rapid response to revegetation issues as needed.

Monthly data collection includes:

- Evaluation of mitigation plant survival;
- Plant health summary (subsample of 10 mitigation plants in each mitigation planting area);
- Documentation of plant height and width (subsample of 10 mitigation plants in each mitigation planting area);
- Documentation of phenology (presence of leaves, flower buds, open flowers, fruits in a subsample of 10 mitigation plants in each mitigation planting area);
- Inventory of the flora within planting areas (Appendix D);
- Evidence of wildlife usage (native species, herbivores, and other pests; inventory of species in Appendix E);
- Signs/quantity of pests or pathogens (e.g., sap, nodules, chewed leaves); and
- Soil moisture data collected adjacent to a subsample of plantings in each area to verify that all plantings are receiving adequate moisture.

3.1.1 Survival Census and Health Assessment

A monthly census of all dead mitigation plants in each area is conducted to determine survival percentages. In addition, the health of a subset of 10 mitigation plants in each of the six mitigation planting areas was assessed during each monitoring event using a modified index initially developed by Bainbridge et al. 2001:

0 = dead, stems brown and brittle with no green or purple;

1 = poor health, barely alive, stems still flexible with some green or purple;

2 = fair health, some green or purple on stem, a few green leaves;

3 = good health, green or purple stem and a number of green leaves; and

4 = excellent health, green or purple stem and green leaves, vigorous.

General site photographs document the progress of mitigation plant growth in each mitigation planting area and are taken during each monitoring visit (Appendix B).

3.1.2 Species Richness Data Collection

Observed plant species used in the planting palette (as well as all plant species found in a recognizable condition during Year 1 monitoring) were recorded, and the record will be updated annually (Appendix D). Nomenclature follows the second edition of The Jepson Manual: Vascular Plants of California (Baldwin et al. 2012) with online updates. A list of observed species compiled for each mitigation planting area allowed managers to assess native plant recruitment into mitigation planting areas as well as presence of invasive species and their potential source(s).

In addition, wildlife species were recorded each month to document ecosystem function (Appendix E). Because the herbivore-deterrent fencing prevents access by many animals, those observed around the fence perimeter were also documented.

3.1.3 Invasive Plant Species Assessments and Monitoring

The biologists survey all revegetation areas for non-native species during each monitoring event and document invasive plant observations using hand-held devices (phones or tablets) equipped with ArcGIS Field Maps, a geographic information system (GIS) data collection app, and a Trimble® R1 antennae for improved accuracy. Documentation for each invasive plant species observation includes coordinates, mitigation planting area, invasive plant species, date observed, number of individuals or area covered by each invasive plant observation, treatment recommendation, and treatment method used in each location during invasive plant species treatment events.

3.1.4 Maintenance Assessments

The biologists survey all revegetation areas monthly for maintenance issues associated with the irrigation system, herbivore exclusion fencing, and erosion. The irrigation system is assessed for pipe breakage and damage, proper flow, and emitter placement throughout the Site. The herbivore exclusion fencing is inspected for damage due to wind, erosion, or wildlife, and monitoring includes a perimeter walk to assess potential wildlife entry above or below ground level. All signs of erosion are assessed and documented including natural flow paths and erosion associated with the irrigation system and/or storm events.

Topock remediation system operations and maintenance (O&M) staff inspect the Site for problems and make necessary repairs, including after rain events, to identify and address irrigation, fencing, or erosion concerns. These inspections generally occur weekly but may be scheduled more frequently if needed.

3.2 Annual Quantitative Monitoring

Annual quantitative monitoring was conducted between September 12 and 18, 2023 to evaluate the survival and health of mitigation plantings as well as to document species richness and variables that might affect successful completion of the Revegetation Project. Although the data collected during annual quantitative monitoring events are similar to monthly assessments, only the annual quantitative monitoring data are used to assess progress in meeting performance targets.

3.2.1 Survival Census and Health Assessment

Annual Survival Census: All mitigation plants were censused during the annual quantitative monitoring event. This included the following:

- Recording every mitigation plant by number in Field Maps (container plantings, recruits, seeding areas)
- Estimating the number of recruits by species in each area as described in Section 2.3,
- Conducting a census of every honey mesquite seeding area as described in Section 2.3;
- Documenting locations of any removal/trimming of mitigation plants as described in Section 5.4.2;
- Health assessment metrics:
  - Height and width in feet for each species within each area;
  - Phenology (presence of leaves, flower buds, open flowers, fruits);
  - Signs/quantity of pests or pathogens (e.g., sap, nodules, chewed leaves);
  - Assessment of the health of all mitigation plantings using a modified index initially developed by Bainbridge et al. 2001, with additional modifications to "3" based on field surveys:
    - 0 = dead, stems brown brittle with no green or purple (not included in health assessment, which only focused on surviving plants);
    - 1 = barely alive, stems still flexible with some green or purple (poor health);
    - 2 = stems flexible and containing living tissue, often with some green or purple on stems, with or without a few green leaves (fair health);
    - 3a = stems flexible and containing living tissue, often with green or purple stems and a number of green leaves, if present on the species (good health);
    - 3b = stems flexible and containing living tissue, often with leafless on a seasonal basis (good health);
    - 4 = healthy stems containing living tissue, green leaves (excluding cacti), vigorous (excellent health).
- Photo documentation of each mitigation planting.

3.2.2 Species Richness Data Collection

Observed plant species used in the planting palette (as well as all plant species found in a recognizable condition during Year 1 monitoring) were recorded (Appendix D). Nomenclature follows the second edition of The Jepson Manual: Vascular Plants of California (Baldwin et al. 2012) as well as updates provided in the online Jepson eFlora (Jepson Flora Project 2023). An observed species list for mitigation planting areas allowed managers to assess native plant recruitment into mitigation planting areas as well as presence of invasive species and their potential source(s).

During monitoring events, the revegetation areas were also surveyed for the presence of wildlife using the habitat created by revegetation plantings (Appendix E). Incidental wildlife observations resulted from searching for and identifying wildlife species' diagnostic signs including audible calls, prints, scat, nests, skeletal remains, burrows, and habitat features. When a wildlife species was observed, the name of the wildlife species was recorded along with date, name of biologist(s) making observation, location, number of individuals observed, habitat type and condition, and if feasible, photographs of species. Identifications were made using appropriate technical manuals and websites such as Birds of the World (Cornell 2023), CaliforniaHerps (2023), field guides, and other resources. When accurate species identification was not possible, identification to genus or family was documented.

3.2.3 Photomonitoring

Twelve photo-monitoring stations have been established in the mitigation planting areas to document pre-planting conditions, post-planting mitigation plant establishment, natural recovery, and site conditions in mitigation planting areas. Photo-monitoring occurred before planting in March 2022, as well as immediately after fall planting was complete in October 2022 (Appendix C). Photo-documentation was conducted at the end of Year 1 and will continue annually for another 4 years during the annual quantitative monitoring period. Photographs are appropriately archived to document vegetation change and serve as a resource during adaptive management events.

The following methods and procedures are adapted from the U.S. Department of Agriculture's Photo Point Monitoring Handbook (Hall 2002).

The objectives of the photo-monitoring include:

- Document site conditions of mitigation planting areas before planting.
- Document changes in vegetation over time in the mitigation planting areas including natural recruitment of native plants.
- Document mitigation planting areas including vegetation changes over time as well as general qualitative documentation of plant cover and vegetation condition.

Photo-monitoring is conducted electronically using a smart phone or tablet with preloaded photo-monitoring data sheets in Microsoft Excel as well as ArcGIS Field Maps. A Trimble® R1 antenna is used to obtain sub-meter location accuracy. Photo-monitoring stations in mitigation planting areas are shown on Figures 11A and 11B.

At each photo-monitoring station, data collection includes the compass direction of the camera view in cardinal directions (e.g., north, south, southwest); as well as plant species; percent vegetative cover; disturbance (if any), and commentary on general plant health, vegetation condition, and other variables. Subsequent photographs taken from the same photo point will be taken in the same direction each time. During subsequent photo-monitoring events, the previous photographs at each photo-monitoring station should be used as an example to create a comparable photograph that documents current conditions.

3.3 Adaptative Management Monitoring

Adaptive management monitoring involves dynamically identifying and monitoring site characteristics as changes or challenges arise. The following adaptive management actions were implemented during Year 1: soil sampling and stress symptom monitoring.

3.3.1 Soil Sampling

Soil sampling has been conducted at designated locations beginning in 2021 to compile comparative data for such characteristics as nutrients, salinity, and permeability (Figure 7). Before a soil sampling event, required activities include coordination with an archaeologist and completion of a utility clearance.

Each sample consists of three cups of soil extracted to a depth of up to 18 inches. An approximately 8-inch-diameter hole is dug using a narrow trenching shovel or auger. Soil core samples are placed in a clean bucket and thoroughly mixed before putting in a labeled Ziploc bag. All soil sample bags are labeled with the location ID, date, Arcadis, and sampling biologist name before being shipped to FGL in Santa Paula, California for comprehensive soil suitability testing and/or salinity testing.

3.3.2 Stress Symptom Monitoring

On July 25, 2023, during routine monthly monitoring, a biologist first observed the presence of sap and/or sap-containing nodules originating at the juncture between branches and the trunks of blue palo verde mitigation plants. Symptoms were also observed on a nearby naturally occurring blue palo verde tree. Observation of stress symptoms resulted in initiation of adaptive management planning to identify the cause(s) and distribution of symptoms in revegetation areas along with appropriate follow-up activities.

With approval from PG&E, biologists contacted plant pathologists at the University of California Cooperative Extension (UCCE) Riverside Office. Plant pathologist Dr. Philippe Rolshausen visited the Topock revegetation Site on August 11 and collected plant tissue samples to determine whether a pathogen could be the cause of the unexplained sap and nodule formations. A biologist and on-site archaeologist met Dr. Rolshausen in the floodplain and were present during all sampling. Dr. Rolshausen used hand tools for the sampling event.

Three blue palo verde mitigation plants were destructively excavated, and two others were pruned. Roots extending about 1 foot below ground were collected as part of the sample. Plants with large amounts of sap dripping off multiple parts of the plant were selected.

All tissue samples were individually bagged, labeled with mitigation plant number, stored in a cooler, and transported back to Dr. Rolshausen's lab at University of California, Riverside on the same day. Samples of the tissues were grown on agar.

During the August monthly monitoring event, a survey of most palo verde mitigation plants was conducted to quantify the number of blue palo verde mitigation plants exhibiting stress symptoms as well as those with no symptoms.

3.4 Reference Sites

Reference sites were selected in early 2022 to provide comparative data between naturally occurring individuals of mitigation plant species in the project area with the mitigation plants being monitored in mitigation planting areas. Reference site data can be used to assess performance issues in mitigation planting areas compared with nearby natural sites to evaluate if a region-wide issue is affecting the revegetation success and to refine performance standards if needed.

Reference sites were monitored at the time of planting (2022) and will be monitored in Years 3 and 5. Initial reference site monitoring was conducted on October 7 and October 8, 2022 at six locations (Figure 12). Mitigation species present at each reference site were documented using hand-held devices (phones or tablets) equipped with GIS data collection apps (ESRI® Field Maps). An individual geo-referenced point with a unique plant identification number was created for each reference mitigation plant along with a photograph and the following data:

- Species;
- Date monitored;
- Mortality (alive or dead);
- Monitoring date;
- Plant health assessments (see Section 5.2 for description of health assessment classes);
- Height and width measurements;
- Vegetative and reproductive phenology (e.g., leaves, fruits);
- Herbivory issues if any;

- Evidence of disease if any;
- Salinity issues if any; and
- General notes.

In addition, associated plant species and site characteristics have been documented, and photographs have been taken of mitigation species and the reference site area.

A summary of mitigation plants observed at each reference site in 2021, along with associated species and site characteristics, is provided in Table 3-1. Photographs of each reference site are included in Appendix F. No reference site monitoring was undertaken during Year 1.

Table 3-1 Reference Site Summary

Reference Site Name	Reference Site Mitigation Plant Species	Other Plant Species Present	Site Characteristics
REF-1	blue palo verde, honey mesquite, catclaw acacia, desert smoke tree, buckhorn cholla	creosote bush, cheesebush, sweetbush, fringed amaranth	wash with sandy/silty soils, large cobble, rocks, and gravel
REF-2	blue palo verde, honey mesquite	creosote bush	wash with areas of abundant soil cracking
REF-3	blue palo verde, screwbean mesquite, catclaw acacia	three-awn, Wright's boerhavia, Sonoran sandmat, creosote bush, cheesebush, sweetbush, Bermuda grass, fountain grass	wash with sandy/silty soils and gravel and cobble
REF-4	screwbean mesquite, catclaw acacia, silver cholla, beavertail cactus, honey mesquite	sweetbush, creosote bush, trailing windmills, Sonoran sandmat, desert lavender, Bermuda grass	gravelly and rocky wash surrounded by rocky slopes that support upland species
REF-5	screwbean mesquite	cheesebush, sweetbush, creosote bush, Fremont cottonwood, arrowweed, cattail, fan-leaved crinklemat, doveweed, Bermuda grass, saltcedar	adjacent to waterway on east side of Colorado River
REF-6	cattle saltbush, beavertail cactus, silver cholla	Sonoran sandmat, creosote bush	rocky areas adjacent to mitigation plantings in UHR-1

4 Revegetation Maintenance Methods

The Revegetation Manager verifies that native plant health and survival and invasive plant species abatement performance standards are met through site maintenance activities during the 5-year maintenance period. These maintenance activities include invasive plant species eradication, irrigation, herbivore exclusion, general site housekeeping and cleanup, and the general care and nurturing of plantings within the mitigation planting areas.

Site access for maintenance is on foot within mitigation planting areas. Wheelbarrows or equivalent are used to transport tools and other supplies within the mitigation planting areas.

4.1 Irrigation Operation, Maintenance, and Repair

After container plant installation, each plant was irrigated twice a week by slowly filling each DEEP DRIP Watering Stake to the top and letting it infiltrate into the surrounding soil for 2 hours. During irrigation events, DEEP DRIP Watering Stakes were checked to verify that the tubes were filling properly so that the resulting subsurface moisture encouraged development of deep roots. In addition, one of the three drip emitters was placed near the base of the plant to provide moisture to the rootball of the planting. As plants enlarged in size, the surface emitter was moved into the opening of the third DEEP DRIP Watering Stake.

Irrigation events were suspended if more than 1 inch of precipitation fell in the preceding 7 days. Subsurface soil moisture was monitored with a Aquaterr EC-350 soil moisture probe monthly to quarterly, depending on rainfall. Soil moisture was measured next to a mitigation plant near the 13 photo-monitoring stations.

The following procedures were followed during irrigation events:

- Provide adequate moisture to the entire root zone of each mitigation plant during the normal growth period of the plant.
- Operate the irrigation system in a manner that minimizes disturbance to mitigation plantings.
- Prevent erosion, damage to plants, runoff, or damage to existing or colonizing vegetation.
- Provide immediate attention and repairs to any irrigation activity that results in excess water flow in a given location (e.g., overflow out of the DEEP DRIP Watering Stakes, pipe breaks) as well as reporting issues and proposing maintenance solutions to the Revegetation Manager.

Daily water use in the floodplain and UHR-1 is tracked.

4.2 Herbivore-deterrent Fence Maintenance and Repair

The herbivore-deterrent fencing was repaired as needed during Year 1 to protect mitigation plantings from herbivores. Metal re-bar “J” stakes were installed at the base of the fence to prevent access by small mammals such as desert cottontail rabbits (*Sylvilagus audubonii*). Steel baling wire was used for wire fence attachment after zip ties slowly deteriorated in extreme weather conditions.

Where monsoon rains caused significant water flow and erosion under fencing, gravel bags were installed to slow the flow of water during future rain events and to prevent small animals from accessing the mitigation planting area through the new openings.

4.3 Erosion Control Best Management Practices

Straw wattles were installed on the east sides of Areas 1 and 2 to prevent stormwater flow from transporting sediments from the mitigation planting areas to the Colorado River. Wattles were installed and secured with wooden stakes.

Erosion in high-flow ephemeral channel areas in Areas 3 and 5 was controlled using 50-pound gravel bags. After large rain events, the gravel bags generally required some adjustment to prevent small animal entry under the fence.

4.4 Invasive Species and Other Plant Species Abatement Methods

Invasive plant species removal was required to deter the establishment of invasive plant species in mitigation planting areas. A biologist conducted or oversaw abatement of invasive plant species including providing guidance on correct species identification before removal.

Monthly invasive plant species removal was conducted in all mitigation planting areas as needed. The biologist pulled isolated invasive plant species during monitoring events if the number of individuals in a given location was small and the invasive plants could be removed without tools or herbicide. For larger infestations, a subcontractor removed the invasive plant species with the goal of keeping all mitigation planting areas free of invasive plant species during the maintenance period according to these specifications:

- Remove invasive plant species before reaching 4 inches in height or forming flower heads.
- Bag and remove invasive plant material from the Site during each invasive plant species abatement event.
- Bag and remove all parts of the invasive saltcedar, including resprouts and debris, from the Site during each weeding event, unless they are being monitored after herbicide application.

Two general invasive plant species treatment methods were employed to abate weeds: manual removal and herbicide application.

4.4.1 Manual Invasive Plant Species Removal

As project biologists documented weeds during monitoring events, they removed small colonies of weeds by hand, bagged the weeds, and removed them from the Site.

Larger weed infestations requiring mechanical removal methods, such as pulling, digging, or hoeing, were treated by a subcontractor. When possible, mechanical weed removal was conducted before weed flowering and seed set. All weeds subject to manual treatments were bagged and removed from the Site. All access within mitigation planting areas was on foot, and invasive plant species treatment crews adhered to previously disturbed corridors.

4.4.2 Herbicide Treatments

Herbicides were employed in the floodplain to treat common reed, giant reed, and saltcedar. All field herbicide application was monitored by a biologist to identify locations of target weeds, assist with species identification, and monitor sensitive species and mitigation planting locations.

A brief written weed management plan was submitted to PG&E to coordinate herbicide application by the PG&E licensed pesticide applicator. The licensed applicator provided PG&E and the Revegetation Manager with a description of any herbicide used at the Site including application rates and dilution, manufacturer's name, application equipment and methods, and a Safety Data Sheet for each herbicide intended for use. The information provided also included measures to protect workers and the public (e.g., signs, barriers, notifications), measures to avoid spraying native plants, measures to protect wildlife, measures to avoid discharge into river water, and a statement that the herbicide is approved by HNWR for use in the environment at the Site.

Nufarm Polaris® (active ingredient Imazapyr) was used for herbicide treatments. Polaris was mixed with bottled water, water-based non-toxic dye, and the surfactant Competitor. It was applied with a backpack sprayer.

The following guidelines, in conjunction with the weed management plan, were followed the biologist and the licensed applicator for herbicide treatments:

- Herbicides were not applied when wind speeds exceeded 8 miles per hour.
- Prevention of drift and overspray was achieved using air induction spray nozzles. In addition, the use of off-center spray nozzles kept the application locked on target weed species.
- A water-based, non-toxic dye was added to the herbicide to distinguish treated areas from untreated areas.
- Wildlife protection measures included use of non-toxic or least-toxic herbicides (as stated on the product label and Safety Data Sheet), scheduling application dates to avoid impacts to nesting wildlife, and biological monitoring during all herbicide application events.
- Once the herbicide killed the target weeds, the dead plants were excavated, bagged, and removed from the Site to prevent them from eventually breaking off and blowing around the Site as vegetative propagules or spreading viable seeds.

4.4.3 Other Plant Species Removal

Arrowweed was also subject to manual removal where it invaded mitigation planting sites. Because it is an important ethnobotanical species, PG&E coordinated with Tribal representatives and the Revegetation Manager to develop a removal approach. A biologist was present to oversee all weed abatement and assist the weed crew with differentiating target weeds from unintended targets including all work near arrowweed. Arrowweed was removed in the following situations using the following methods:

- Arrowweed plants and rhizomes were removed using a two-step process if they occurred within a 3-foot radius of any mitigation plantings. First, a shovel was carefully used to cut roots and rhizomes below ground where they enter the mitigation plant rooting zone. Second, all arrowweed stems and rhizomes within 3 feet of plantings were pulled out and removed.
- Arrowweed plants were cut at ground level and removed from the Site if they occurred within a 3- to 5-foot radius of a mitigation plant.
- Arrowweed that was cut or dug out was bagged and removed from the mitigation planting area to prevent it from resprouting or blowing around the Site. All arrowweed stems greater than 3 feet long were retained on site in an accessible location for retrieval and use by the Tribes in coordination with PG&E and the Tribes.
- Within herbicide treatment areas, if arrowweed was observed growing close to weeds (e.g., saltcedar and common reed) with the potential to be impacted by overspray, the arrowweed was cut at ground level so that it could resprout later.

4.5 General Site Maintenance

In addition to maintenance of plantings and the irrigation system, the mitigation planting areas were routinely inspected and maintained in Year 1. These maintenance activities included trash cleanup, “Restoration Area” sign maintenance, and repair of fencing reflective tape. Trash accumulated quickly from the Interstate 40 highway above the floodplain and was distributed by wind. Heat and wind caused the reflective tape on the herbivore exclusion fencing to degrade, which required cleanup and repair. Fence gates needed regular adjustments and repair to continue to operate correctly. Signage was maintained to properly identify the Site as a Habitat Revegetation Area. Site access for maintenance was on foot within mitigation planting areas. Wheelbarrows or equivalent were used to transport tools and other supplies within the mitigation planting areas.

5 Year 1 Revegetation Monitoring Results

The HNWR Habitat Restoration Plan (Appendix G to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2015]), the Topock Groundwater Remediation Project Mitigation and Monitoring Plan for Culturally Significant Plants (Appendix A to Appendix H to the C/RAWP [CH2M Hill and GANDA. 2014]), the Topock Compressor Station Groundwater Remediation Project Aesthetics and Visual Resources Protection and Revegetation Plan (Appendix N to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2014a]), and the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2014b]) also specify on-site revegetation success criteria; monitoring and reporting requirements; and adaptive management guidelines for salvage and replanting of trees, shrubs, and perennial species.

In accordance with the habitat revegetation plans, removal of riparian trees (e.g., blue palo verde trees) were replaced at a 3:1 ratio (i.e., planting three trees in revegetation areas for each tree removed during construction). The success criterion for mitigation plantings is a final minimum plant replacement ratio of 2.25:1 (75 percent overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

Annual quantitative monitoring was conducted between September 12 and 18, 2023 and data analysis was complete by October 31, 2023. Monthly monitoring was conducted during 1 week of every month from November 1, 2022 to October 31, 2023.

5.1 Mitigation Plant Survival

Mitigation planting areas include five floodplain mitigation planting areas (Areas 1 through 5) and one upland mitigation planting area (UHR-1). As described in Section 2, required mitigation plants include five species in floodplain areas: blue palo verde, honey mesquite, screwbean mesquite, desert smoke tree, and catclaw acacia. Five species of mitigation plants were also planted in the upland mitigation planting area: cattle saltbush, buckhorn cholla, silver cholla, Anderson's desert thorn, and beavertail cactus.

A total of 710 required mitigation plants were monitored in the six mitigation planting areas in Year 1, culminating in the Year 1 mitigation plant survival census in September 2023. All surviving individuals of mitigation plants were censused as described in Section 3.2.1 and summarized in Tables 5-1 and 5-2. Volunteer recruits of the mesquite species were also counted (Table 5-3).

A summary of survival by species follows.

Floodplain species (all mitigation plantings in Areas 1 through 5). A total of 657 mitigation plants were monitored in floodplain mitigation areas in Year 1. Mean survival of floodplain mitigation plants is 95.6 percent (Table 5-1). Further details on survival of mitigation plants by species and area are provided in Table 5-2.

Blue palo verde: Blue palo verde mitigation plants occur in all floodplain mitigation planting areas (Areas 1 through 5) in various quantities, with the majority in Areas 1 and 2. A total of 538 blue palo verde mitigation plants were monitored in Year 1, and in the September 2023 census, there were 510 surviving individuals, a 94.8 percent survival rate. Blue palo verde mitigation plants include mostly container plantings as well as several volunteer recruits. Survival of blue palo verde averaged more than 89 percent in all mitigation planting areas, and exceeded 100 percent in Area 5, where 14 volunteer recruits were classified as mitigation plants to offset mortality of blue palo verde elsewhere, especially in compacted soils adjacent to access roads.

Honey mesquite: Honey mesquite mitigation plants occur in four floodplain mitigation planting areas (Areas 1, 2, 4, and 5), with the greatest number of individuals in Area 1. A total of 73 honey mesquite mitigation plants were monitored in Year 1, and in the September 2023 census, there were 73 surviving individuals, a 100 percent survival rate. Honey mesquite mitigation plants include mostly volunteer recruits as well as several individuals from honey mesquite seeding areas.

Screwbean mesquite: Screwbean mesquite mitigation plants occur in three floodplain mitigation planting areas (Areas 1, 2, and 5), with the greatest number of individuals in Area 1. A total of 17 screwbean mesquite mitigation plants were monitored in Year 1, and in the September 2023 census, there were 17 surviving individuals, a 100 percent survival rate. Screwbean mesquite mitigation plants consist entirely of volunteer recruits.

Desert smoke tree: Desert smoke tree mitigation plants occur in two floodplain mitigation planting areas (Areas 3 and 5), both small washes draining into the lower floodplain area. The greatest number of desert smoke tree mitigation plants is in Area 5. A total of 26 desert smoke tree mitigation plants were monitored in Year 1, and in the September 2023 census, there were 25 surviving individuals, a 96.2 percent survival rate. Desert smoke tree mitigation plants consist of container plantings.

Catclaw acacia: Catclaw acacia mitigation plants occur in one floodplain mitigation planting area (Area 5), a small wash draining into the lower floodplain area. A total of three catclaw acacia mitigation plants were monitored in Year 1, and in the September 2023 census, there were three surviving individuals, a 100 percent survival rate. Catclaw acacia mitigation plants consist of container plantings.

Upland Species (all mitigation plantings in UHR-1). A total of 53 mitigation plants were monitored in the upland mitigation area in Year 1. Mean survival of upland mitigation plants is 100 percent (Table 5-1).

Cattle saltbush: A total of 13 cattle saltbush mitigation plants were monitored in Year 1, and in the September 2023 census, there were 13 surviving individuals, a 100 percent survival rate. Cattle saltbush mitigation plants consist of container plantings.

Buckhorn cholla: A total of seven buckhorn cholla mitigation plants were monitored in Year 1, and in the September 2023 census, there were seven surviving individuals, a 100 percent survival rate. Buckhorn cholla mitigation plants consist of container plantings.

Silver cholla: A total of 20 silver cholla mitigation plants were monitored in Year 1, and in the September 2023 census, there were 20 surviving individuals, a 100 percent survival rate. Silver cholla mitigation plants consist of container plantings.

Anderson's desert thorn: A total of three Anderson's desert thorn mitigation plants were monitored in Year 1, and in the September 2023 census, there were three surviving individuals, a 100 percent survival rate. Anderson's desert thorn mitigation plants consist of container plantings.

Beavertail cactus: A total of 10 beavertail cactus mitigation plants were monitored in Year 1, and in the September 2023 census, there were 10 surviving individuals, a 100 percent survival rate. Beavertail cactus mitigation plants consist of container plantings.

Mean survival of all mitigation plant species (96 percent) exceeds the required performance standard of 75 percent survival.

Table 5-1 Mitigation Plant Survival Summary

Scientific Name	Common Name	Total Required Mitigation Plants 2022 (Container and Volunteer Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival in 2023
Floodplain Species (Areas 1 through 5)				
Parkinsonia florida	blue palo verde	538	510	94.8%
Prosopis glandulosa	honey mesquite	73	73	100%
Prosopis pubescens	screwbean mesquite	17	17	100%
Psorothamnus spinosus	desert smoke tree	26	25	96.2%
Senegalia greggii	catclaw acacia	3	3	100%
Upland Species (UHR-1)				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	13	100%
Cylindropuntia acanthocarpa	buckhorn cholla	7	7	100%
Cylindropuntia echinocarpa	silver cholla	20	20	100%
Lycium andersonii	Anderson’s desert thorn	3	3	100%
Opuntia basilaris var. *basilaris*	beavertail cactus	10	10	100%
	Total	**710**	**681**	**96.0%**

Table 5-2 Mitigation Plant Survival by Area

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Volunteer Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023
Area 1				
Parkinsonia florida	blue palo verde	286	256	89.5%
Prosopis glandulosa	honey mesquite	20	20	100%
Prosopis pubescens	screwbean mesquite	10	10	100%
Area 2				
Parkinsonia florida	blue palo verde	194	183	94.8%
Prosopis glandulosa	honey mesquite	15	15	100%
Prosopis pubescens	screwbean mesquite	5	5	100%
Area 3				
Parkinsonia florida	blue palo verde	37	51	137.8%
Prosopis glandulosa	honey mesquite	18	18	100%
Psorothamnus spinosus	desert smoke tree	7	7	100%
Area 4				
Parkinsonia florida	blue palo verde	4	4	100%

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Volunteer Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023
Area 5				
Parkinsonia florida	blue palo verde	17	16	94.1%
Prosopis glandulosa	honey mesquite	20	20	100%
Prosopis pubescens	screwbean mesquite	2	2	100%
Psorothamnus spinosus	desert smoke tree	19	18	94.7%
Senegalia greggii	catclaw acacia	3	3	100%
UHR-1				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	13	100%
Cylindropuntia acanthocarpa	buckhorn cholla	7	7	100%
Cylindropuntia echinocarpa	silver cholla	20	20	100%
Lycium andersonii	Anderson's desert thorn	3	3	100%
Opuntia basilaris var. *basilaris*	beavertail cactus	10	10	100%
	Total UHR-1	**53**	**53**	**100%**
	Total Floodplain Areas (1 through 5)	**657**	**628**	**95.6%**

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Volunteer Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023
	Totals	**710**	**697**	**96.0%**

The estimated number of volunteer recruits of mitigation plant species that were not recorded as mitigation plants was also documented during the annual quantitative monitoring event (Table 5-3). In floodplain mitigation areas, there were three extra volunteer recruits of blue palo verde plant (one each in Areas 1, 2, and 3); there were five extra honey mesquite volunteer recruits (one in Area 1 and four in Area 2); there were 63 extra screwbean mesquite volunteer recruits (41 in Area 1, 20 in Area 2, and two in Area 5); there were no volunteer recruits of desert smoke tree; and there were two extra catclaw acacia container plantings installed in 2022, but no additional volunteer recruits.

In the upland mitigation area (UHR-1), there were four extra volunteer recruits of cattle spinach, one extra volunteer recruit of buckhorn cholla, two extra volunteer recruits of silver cholla, no extra volunteer recruits of Anderson's desert thorn and 16 extra beavertail cactus container plantings installed in 2022, but no additional volunteer recruits.

Table 5-3 Mitigation Plant Survival by Area including Estimated Number of Volunteer Recruits and/or Extra Container Plantings Observed but Not Recorded or Monitored as Mitigation Plants

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023	Number of Volunteer Recruits and/or Extra Container Plantings that were not Recorded or Monitored as Mitigation Plants
Area 1					
Parkinsonia florida	blue palo verde	286	256	89.5%	1
Prosopis glandulosa	honey mesquite	20	20	100%	1
Prosopis pubescens	screwbean mesquite	10	10	100%	41
Area 2					
Parkinsonia florida	blue palo verde	194	183	94.3%	1
Prosopis glandulosa	honey mesquite	15	15	100%	4
Prosopis pubescens	screwbean mesquite	5	5	100%	20
Area 3					
Parkinsonia florida	blue palo verde	37	51	137.8%	1
Prosopis glandulosa	honey mesquite	18	18	100%	0
Psorothamnus spinosus	desert smoke tree	7	7	100%	0
Area 4					

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023	Number of Volunteer Recruits and/or Extra Container Plantings that were not Recorded or Monitored as Mitigation Plants
Parkinsonia florida	blue palo verde	4	4	100%	0
Area 5					
Parkinsonia florida	blue palo verde	17	16	94.1%	0
Prosopis glandulosa	honey mesquite	20	20	100%	0
Prosopis pubescens	screwbean mesquite	2	2	100%	2
Psorothamnus spinosus	desert smoke tree	19	18	94.7%	0
Senegalia greggii	catclaw acacia	3	3	100%	2
UHR-1					
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	13	100%	4
Cylindropuntia acanthocarpa	buckhorn cholla	7	7	100%	1
Cylindropuntia echinocarpa	silver cholla	20	20	100%	2
Lycium andersonii	Anderson’s desert thorn	3	3	100%	0

Scientific Name	Common Name	Total Mitigation Plants 2022 (Container and Recruits)	Total Surviving Mitigation Plants 2023 (Including Container Plants, Volunteer Recruits, and Plants in Seeded Areas)	Percent Survival 2023	Number of Volunteer Recruits and/or Extra Container Plantings that were not Recorded or Monitored as Mitigation Plants
Opuntia basilaris var. *basilaris*	beavertail cactus	10	10	100%	16
	Total Upland (UHR-1)	**53**	**53**	**100%**	
	Total Floodplain Areas (1,2,3,4,5	**657**	**628**	**95.6%**	
	Totals	**710**	**681**	**96.0%**	

5.2 Mitigation Plant Health Summary

During the annual survival census, a health assessment of each of the surviving required mitigation plants followed a modified Health Index initially developed by Bainbridge et al. 2001:

- 0 = dead, stems brown brittle with no green or purple (not included in health assessment, which only focused on surviving plants);
- 1 = barely alive, stems still flexible with some green or purple (poor health);
- 2 = stems flexible and containing living tissue, often with some green or purple on stems, with or without a few green leaves (fair health);
- 3a = stems flexible and containing living tissue, often with green or purple stems and a number of green leaves, if present on the species (good health);
- 3b = stems flexible and containing living tissue, often with leafless on a seasonal basis (good health); and
- 4 = healthy stems containing living tissue, green leaves (excluding cacti), vigorous (excellent health).

The Health Index ranking of 3 was modified because healthy plants that were leafless or losing leaves seasonally would have been classified as only in fair health (Health Index 2) based on the original ranking system.

Results are presented in Table 5-4 and briefly summarized below by species.

Floodplain species (all mitigation plantings in Areas 1 through 5). A total of 657 mitigation plants were monitored in floodplain mitigation areas in Year 1. Mean survival of floodplain mitigation plants is 95.6 percent (Table 5-1), and survival by mitigation planting area is provided in Table 5-2.

Blue palo verde: Blue palo verde mitigation plants occur in all floodplain mitigation planting areas (Areas 1 through 5) in various quantities, with the majority in Areas 1 and 2. Most blue palo verde mitigation plants were in excellent health (Health Index 4 – 61 percent), followed by plants entering seasonal dormancy (Health Index 3a and 3b – 30 percent) despite challenges presented by the expression of stress symptoms in July and August (see Section 5.4). By September, stress symptoms had disappeared, and only a few plants were in fair (Health Index 2 – 7 percent) to poor health (Health Index 1 - 2 percent). A few blue palo verde individuals growing in compacted soils near access roads exhibited slow growth and poor health compared with plants in well-drained substrates.

Honey mesquite: Honey mesquite mitigation plants occur in four floodplain mitigation planting areas (Areas 1, 2, 4, and 5), with the greatest number of individuals in Area 1. All honey mesquite mitigation plants were in excellent health (Health Index 4 - 100 percent).

Screwbean mesquite: Screwbean mesquite mitigation plants occur in three floodplain mitigation planting areas (Areas 1, 2, and 5), with the greatest number of individuals in Area 1. All screwbean mesquite mitigation plants were in excellent health (Health Index 4 - 100 percent).

Desert smoke tree: Desert smoke tree mitigation plants occur in two floodplain mitigation planting areas (Areas 3 and 5), both small washes draining into the lower floodplain area. Most desert smoke tree mitigation plants were in excellent health (Health Index 4 - 80 percent), followed by three plants entering seasonal dormancy (Health Index 3a and 3b - 12 percent) with no major health issues. Only one plant was in fair health (Health Index 2 - 4 percent), and one was in poor health (Health Index 1 - 4 percent).

Catclaw acacia: Catclaw acacia mitigation plants occur in one floodplain mitigation planting area (Area 5), a small wash draining into the lower floodplain area. All catclaw acacia mitigation plants were in excellent health (Health Index 4 - 100 percent).

Upland Species (all mitigation plantings in UHR-1). A total of 53 mitigation plants were monitored in the upland mitigation area in Year 1. Mean survival of upland mitigation plants is 100 percent (Table 5-1). Of the five planted species in UHR-1, three are cactus species, all of which are stem succulents that lack leaves for almost the entire year, only producing rudimentary leaves on new growth in spring. Leafless cacti are categorized as being in excellent health, despite the lack of leaves, unless there is scarring or indications of poor health.

Cattle saltbush: Cattle saltbush mitigation plants consist of container plantings, and at the time of the September quantitative health assessment, most individuals were entering or maintaining good health in seasonal dormancy, with loss of most or all leaves. As a result, the majority of cattle saltbush mitigation plants were either in excellent health with foliage (Health Index 4 - 24 percent) or were entering or maintaining seasonal dormancy (Health Index 3a and 3b - 64 percent). No plants were in fair health, and only two individuals were in poor health (Health Index 1 - 12 percent).

Buckhorn cholla: Buckhorn cholla mitigation plants consist of container plantings. All buckhorn cholla mitigation plants were in excellent health (Health Index 4 - 100 percent).

Silver cholla: Silver cholla mitigation plants consist of container plantings. All silver cholla mitigation plants were in excellent health (Health Index 4 - 100 percent).

Anderson's desert thorn: Anderson's desert thorn mitigation plants consist of container plantings. All of the Anderson's desert thorn mitigation plants were seasonally leafless at the time of the September 2023 assessment and categorized as healthy but seasonally dormant (Health Index 3a and 3b - 100 percent).

Beavertail cactus: Beavertail cactus mitigation plants consist of container plantings. All of beavertail cactus mitigation plants were in excellent health (Health Index 4 - 100 percent).

Table 5-4 Plant Health Assessment Summary

Scientific Name	Common Name	Total Mitigation Plants	Number of Plants Ranked as '4'	Mean of Plants Ranked as '4'	Number of Plants Ranked as '3a'	Mean of Plants Ranked as '3a'	Number of Plants Ranked as '3b'	Mean of Plants Ranked as '3b'	Number of Plants Ranked as '2'	Mean of Plants Ranked as '2'	Number of Plants Ranked as '1'	Mean of Plants Ranked as '1'
Floodplain Species (Areas 1 through 5)												
Parkinsonia florida	blue palo verde	510	312	61%	97	19%	57	11%	36	7%	8	2%
Prosopis glandulosa	honey mesquite	73	73	100%	0	-	0	-	0	-	0	-
Prosopis pubescens	screwbean mesquite	17	17	100%	0	-	0	-	0	-	0	-
Psorothamnus spinosus	desert smoke tree	25	20	80%	1	4%	2	8%	1	4%	1	4%
Senegalia greggii	catclaw acacia	3	3	100%	0	-	0	-	0	-	0	-
Upland Species (UHR-1)												
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	17	4	24%	10	58%	1	6%	0	-	2	12%
Cylindropuntia acanthocarpa	buckhorn cholla	7	7	100%	0	-	0	-	0	-	0	-
Cylindropuntia echinocarpa	silver cholla	20	20	100%	0	-	0	-	0	-	0	-

Scientific Name	Common Name	Total Mitigation Plants	Number of Plants Ranked as '4'	Mean of Plants Ranked as '4'	Number of Plants Ranked as '3a'	Mean of Plants Ranked as '3a'	Number of Plants Ranked as '3b'	Mean of Plants Ranked as '3b'	Number of Plants Ranked as '2'	Mean of Plants Ranked as '2'	Number of Plants Ranked as '1'	Mean of Plants Ranked as '1'
Lycium andersonii	Anderson's thornbush	3	0	-	0	-	3	100%	0	-	0	-
Opuntia basilaris var. *basilaris*	beavertail cactus	10	10	100%	0	-	0	-	0	-	0	-
	Totals	***681***	***466***	***68%***	***108***	***16%***	***63***	***9%***	***37***	***5%***	***11***	***2%***

Mean height and width were measured for mitigation plants at the time of planting in 2022 and in September 2023. Resulting data are summarized in Tables 5-5a and 5-5b.

Floodplain mitigation plants

Blue palo verde: Mean height of blue palo verde individuals increased 1.5 feet during Year 1, with a few plants reaching 12 feet. Blue palo verde often produce branches that result in plants being wider than they are tall. Mean width of blue palo verde increased 1.9 feet during Year 1.

Honey mesquite: Mean height of honey mesquite individuals increased 0.3 foot during Year 1, primarily because many of these mitigation plants were tall volunteer recruits when they were designated as mitigation plants. Mean width of honey mesquite increased 0.5 foot during Year 1, and mitigation plants were as wide as they were tall.

Screwbean mesquite: Mean height of screwbean mesquite individuals increased 3.7 feet during Year 1, reflecting the rapid growth of this species in the floodplain. Mean width of screwbean mesquite increased 4.1 feet. In Year 1, and mitigation plants were as wide as they were tall. Screwbean mesquite exhibits greater salt tolerance than honey mesquite (Miyamoto et al. 2004) and grows more rapidly in the floodplain.

Desert smoke tree: Mean height of desert smoke tree individuals increased 1.4 feet during Year 1, reflecting the rapid growth of this species in the washes associated with Areas 3 and 5. Mean width of desert smoke tree increased 1.2 feet in Year 1, and mitigation plants were slightly taller than they were wide.

Catclaw acacia: Mean height of catclaw acacia individuals increased 1.6 feet during Year 1, reflecting rapid growth of this species in Area 5. Mean width of catclaw acacia increased 1.9 feet in Year 1, and mitigation plants were taller than they were wide.

Upland mitigation plants

Cattle saltbush: Mean height of cattle saltbush individuals increased 0.8 foot during Year 1 in UHR-1. Mean width of cattle saltbush increased 1.4 feet in Year 1. Mitigation plants were slightly wider than they were tall and more than double the width at the time of planting.

Buckhorn cholla: Mean height of buckhorn cholla individuals increased 0.3 foot during Year 1 in UHR-1. Mean width of buckhorn cholla increased 0.2 foot in Year 1, exhibiting the slow growth that is typical of cacti.

Silver cholla: Mean height of silver cholla individuals appeared to decrease 0.1 foot during Year 1 in UHR-1, although the difference in height over the preceding year is likely attributed to sampling error. Mean width of silver cholla increased 0.1 foot in Year 1, exhibiting the slow growth that is typical of cacti.

Anderson's desert thorn: Mean height of Anderson's desert thorn individuals increased 0.3 foot during Year 1 in UHR-1. Mean width of Anderson's desert thorn increased 1 foot, a reflecting of young individuals of this plant to produce lateral growth more rapidly than vertical growth.

Beavertail cactus: Mean height of beavertail cactus individuals increased 0.2 foot during Year 1 in UHR-1. Mean width of silver cholla increased 0.3 foot in Year 1, exhibiting the slow growth that is typical of cacti.

Table 5-5a Living Mitigation Plants Average Height by Species

Scientific Name	Common Name	Number of Living Mitigation Plants	Mean Height of Plants in Feet Measured during Initial Planting or Documentation as Mitigation Plant (2022)	Mean Height of Plants in Feet Measured during Year 1 Assessment (September 2023)
Floodplain Species (Areas 1 through 5)				
Parkinsonia florida	blue palo verde	510	3.1	4.6
Prosopis glandulosa	honey mesquite	73	3.8	4.1
Prosopis pubescens	screwbean mesquite	17	3.0	6.7
Psorothamnus spinosus	desert smoke tree	25	1.8	3.2
Senegalia greggii	catclaw acacia	3	2.7	4.3
Upland Species (UHR-1)				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	1.1	1.9
Cylindropuntia acanthocarpa	buckhorn cholla	7	0.6	0.9
Cylindropuntia echinocarpa	silver cholla	20	0.9	0.8
Lycium andersonii	Anderson's thornbush	3	1.4	1.7
Opuntia basilaris var. *basilaris*	beavertail cactus	10	0.7	0.9
	Totals	**681**	**1.9**	**2.9**

Table 5-5b Living Mitigation Plants Average Width by Species

Scientific Name	Common Name	Number of Living Mitigation Plants	Mean Width of Plants in Feet Measured during Initial Planting or Documentation as Mitigation Plant (2022)	Mean Width of Plants in Feet Measured during Year 1 Assessment (September 2023)
Floodplain Species (Areas 1 through 5)				
Parkinsonia florida	blue palo verde	510	3.5	5.4
Prosopis glandulosa	honey mesquite	73	3.5	4.0
Prosopis pubescens	screwbean mesquite	17	2.3	6.4
Psorothamnus spinosus	desert smoke tree	25	1.4	2.6
Senegalia greggii	catclaw acacia	3	1.1	3
Upland Species (UHR-1)				
Atriplex polycarpa	cattle spinach, cattle saltbush, allscale	13	1.0	2.4
Cylindropuntia acanthocarpa	buckhorn cholla	7	0.4	0.6
Cylindropuntia echinocarpa	silver cholla	20	0.7	0.8
Lycium andersonii	Anderson's thornbush	3	0.8	1.8
Opuntia basilaris var. *basilaris*	beavertail cactus	10	0.7	1.0
	Totals	**681**	**1.5**	**2.8**

5.3 Native Species Richness in Revegetation Areas

All observed plant species found in mitigation planting areas in a recognizable condition during the first year of monitoring were recorded by species and mitigation area (Appendix D). Nomenclature follows the second edition of The Jepson Manual: Vascular Plants of California (Baldwin et al. 2012) with online updates (Jepson Flora Project 2023).

A total of 71 vascular plant species were observed in mitigation planting areas in Year 1 including 49 native plant species and 22 non-native plant species.

Six native tree species were observed including five planted species and one species that produced volunteer recruits in Areas 1 and 2: Fremont cottonwood (*Populus fremontii*).

Seven native shrub species were observed including two planted species (cattle saltbush and Anderson's desert thorn) as well as naturally occurring creosote bush (*Larrea tridentata*) in UHR-1 and other species of volunteer recruits in floodplain mitigation areas such as cheesebush (*Ambrosia salsola*), sweetbush (*Bebbia juncea*), and others. One native shrub species in floodplain areas (arrowweed) is native but aggressively rhizomatous, resulting in competition for resources with native plantings (see Sections 2.2.3 and 4.4). In addition, one non-native invasive shrub (saltcedar) repeatedly appeared in floodplain mitigation areas and was removed.

Three native cactus species were planted in UHR-1, and naturally occurring individuals of these cacti are present in UHR-1 as well.

Thirty-three native herbaceous annual and perennial forbs and grasses appeared in mitigation planting areas in Year 1, providing direct evidence of the native plant species richness at the Site. These include both winter/early spring annuals such as Arizona lupine (*Lupinus arizonicus*) and golden suncup (*Chylismia brevipes* subsp. *brevipes*) as well as summer annuals that appeared after monsoonal rains such as trailing windmills (*Allionia incarnata* var. *incarnata*) and scarlet spiderling (*Boerhavia coccinea*). Twenty-one non-native herbaceous species were treated as weeds and removed routinely.

The enhanced functional value of the mitigation plantings to wildlife was exhibited in Year 1 by the presence of approximately 20 wildlife species observed by field biologists during monitoring events (Appendix D). These included:

- Two native reptile species: desert iguana (*Dipsosaurus dorsalis*) and western side-blotched lizard (*Uta stansburiana*);
- Seven native bird species including killdeer (*Charadrius vociferus*), greater roadrunner (*Geococcyx californianus*), and black phoebe (*Sayornis nigricans*);
- Four native mammal species including gray fox (*Urocyon cinereoargenteus*) and desert cottontail; and
- At least six native invertebrate species including Mediterranean mantis (*Iris oratoria*) and golden-colored velvet ant (*Mutillidae* suborder).

5.4 Adaptative Management Monitoring Results

Adaptive management monitoring and planning in Year 1 included soil sampling for elevated salts and other nutrients and stress symptom monitoring.

5.4.1 Soil Sampling Results

Soil sampling was conducted on July 27, 2023 at 18 locations within the floodplain area that had been previously sampled for soil salinity and periodically sampled for other soil nutrients. Table 5-6 presents the comparative soil salinity results for targeted soil sampling locations between September 2021 and July 2023 (FGL 2021a, 2022a, 2022b, 2022c, 2022d, 2022e, 2023). Soil sampling locations are presented on Figure 7, and a summary of 2023 results is shown on Figure 13.

Table 5-6 Soil Salinity Data: 2021-2023

Soil Sampling Location	Revegetation Area	Soil Salinity (dS/m)[1] on *9/22/2021*	Soil Salinity (dS/m)[1] on *2/28/2022*	Soil Salinity (dS/m)[1] on *3/24/2022*	Soil Salinity (dS/m)[1] on *4/27/2022*	Soil Salinity (dS/m)[1] on *6/15/2022*	Soil Salinity (dS/m)[1] on *8/11/2022*	Soil Salinity (dS/m)[1] on *7/27/2023*
C1	Area 1	**66.00**	**47.00**	3.84	6.74	9.99	6.57	**24.20**
C2	Area 1	**91.00**	**107.00**	1.67	5.13	7.46	6.40	**25.20**
C3	Area 1	**36.50**	1.63	0.00	--	3.76	2.88	**34.90**
C4	Area 2	**150.00**	**70.40**	10.40	16.60	**32.90**	4.03	7.58
C5	Area 3	4.18	2.53	0.00	--	1.02	2.09	1.30
C6	Area 1	--	**21.20**	**44.10**	**66.70**	**10.20[2]**	8.24	**18.1**
C7	Area 1	--	--	1.27	3.87	1.04	7.33	**62.9**
C8	Area 1	--	--	0.95	1.55	1.12	5.22	**26.8**
C9	Area 1	--	--	0.93	1.40	3.68	3.5	2.94
C10	Area 2	--	--	1.29	5.20	4.42	2.82	**17.50**
C11	Area 2	--	--	0.82	1.97	1.50	4.77	4.27
C12	Area 2	--	--	3.91	9.62	7.92	8.03	**16.5**
C13	Area 1	--	--	1.04	2.54	5.88	1.06	**11.1**
D1	Area 2	**172.00**	**67.50**	6.99	5.16		**18.20**	**52.3**
D2	Area 3	**284.00**	**236.00**	5.77	7.98		5.40	**22.5**

Soil Sampling Location	Revegetation Area	Soil Salinity (dS/m)[1] on *9/22/2021*	Soil Salinity (dS/m)[1] on *2/28/2022*	Soil Salinity (dS/m)[1] on *3/24/2022*	Soil Salinity (dS/m)[1] on *4/27/2022*	Soil Salinity (dS/m)[1] on *6/15/2022*	Soil Salinity (dS/m)[1] on *8/11/2022*	Soil Salinity (dS/m)[1] on *7/27/2023*
D3	Area 2	**596.00**	**216.00**	4.75	4.97		4.42	5.8
D4	Area 1	**240.00**	**40.00**	4.73	5.49		9.54	**28.4**
D5	Area 5	**250.00**	8.35	0.00	--		6.2	**11.9**

[1] deciSiemens per meter
[2] this soil sampling location was moved into Area 1 from a location to the north in June 2022
bold font = **soil salinity results > 10 dS/m**

As summarized in Section 2.2.1.4, leaching of salts was required in Areas 1 through 5 to remove excess salts documented during soil sampling in September 2021. Leaching was initiated in early February 2022. By March 24, 2022, when the first planting event was complete, all of the soil sampling points inside the leaching area exhibited soil salinity measurements less than 11 dS/m, with a control site remaining at 44.1 dS/m. Soil salinity measurements remained below 10 dS/m through August 2022, except for the sample from D-1.

The July 2023 soil salinity data, however, indicate an increase in soil salinity during the subsequent 11 months at 16 locations, with soil salinity measurements exceeding 10 dS/m at 13 locations. Consultations in August 2023 with Ben Waddell, the director of FGL in Santa Paula, resulted in several follow-up actions.

- Placement of one of the three 0.25-inch irrigation hoses on the ground surface to facilitate leaching because all three hoses were placed in DEEP DRIP stakes after initial leaching to encourage deep root development (Completed in November 2023).
- Initiation of a future irrigation event during rainfall to flush excess salts.
- Request by Ben Waddell to review potential salinity source data to evaluate potential external sources of elevated salinity. In September 2023, biologists provided Mr. Wadell with recent groundwater, surface water, and irrigation water salinity, conductivity, and ion data to aid in his evaluation of soil salinity data. After his data review, Mr. Waddell stated that the irrigation water did not contain elevated salts, nor did monitoring wells suggest elevated salts comparable to the July 2023 soil salinity data. The previous presence of saltcedar in areas with elevated salinity may suggest that conditions will improve over time as further leaching occurs during rainfall and during irrigation events if there is irrigation tubing on the soil surface (ongoing monitoring and data review).
- Ongoing annual soil sampling in 2024 and subsequent years to monitor soil salinity and take corrective actions if needed (planned for spring 2024).

5.4.2 Stress Symptom Data and Assessment

As detailed in Section 3.3.2, many blue palo verde mitigation plants exhibited stress symptoms in the form of sap and/or nodules containing a sap-like substance during the July monthly monitoring event. Biologists took immediate action and engaged the professional services of plant pathologist Dr. Philippe Rolshausen of the UCCE Riverside Office. Dr. Rolshausen visited the Site on August 11, 2023 with a biologist and returned to his laboratory with samples from three excavated blue palo verde mitigation plants and branches from two additional individuals.

During the August monthly monitoring event, biologists documented the presence and distribution of stress symptoms on blue palo verde mitigation plants in Areas 1 through 5. Findings of this assessment are summarized in Table 5-7 and presented on Figure 14.

Stress symptoms were observed on blue palo verde mitigation plants in Areas 1, 2, 3, and 5 at a mean of 27.1 percent. The average number of blue palo verde mitigation plants exhibiting stress symptom remained below 30 percent in Areas 1, 2, and 5, whereas 57.1 percent of blue palo verde mitigation plants in Area 3 exhibited stress symptoms. Area 3 only supported 35 blue palo verde mitigation plants, a smaller number than in Areas 1 and 2, and soil moisture is generally lower in Area 3 as a result of well-drained substrates in the wash in this location.

Approximately 1.5 inches of precipitation fell at the Site between August 13 and September 3 2023 during summer monsoonal rain events. During the September 2023 annual quantitative sampling event, active stress symptoms were no longer observed.

Table 5-7 Plant Stress Symptom Summary (August 2023)

Area Name	Living Blue Palo Verde Assessed (Number of individuals)	Living Blue Palo Verde Exhibiting Stress Symptoms (Number of individuals)	Living Blue Palo Verde Exhibiting Stress Symptoms (Percent)	Mean Number of Nodules/Plant (of all Affected Individuals)	Mean Number of Locations with Dripping Sap (of all Affected Individuals)
Area 1	239	58	24.3%	3.2	2.5
Area 2	163	41	25.2%	4.5	3.3
Area 3	35	20	57.1%	4.5	0
Area 4	3	0	0.0%	0	0
Area 5	17	5	29.4%	5	0
Totals	**457**	**124**			
Mean			**27.1%**	**3.4**	**1.1**

After extensive analysis, Dr. Philippe Rolshausen of UCCE provided the following summary of his assessment of stress symptoms in September 2023:

> *Symptomatic wood tissues were cultured on bacterial (nutrient agar) and fungal (potato dextrose agar and V8 agar) media. Bacteria and fungi recovered from tissues were identified by DNA sequencing of the 16S and ITS region, respectively. The fungus Aspergillus and bacterium Bacillus were recovered from all 3 trees and 2 branches samples. Those are not known to be causing disease in trees although little information is available in the scientific literature on Palo Verde. No known pathogenic bacteria and fungi were isolated from trunk and branch samples.*

Dr. Rolshausen suggested that the sap may have been extruded after boring insect(s) created holes in the wood.

No further steps will be taken regarding stress symptoms on blue palo verde mitigation plants.

5.5 Performance Standards

The HNWR Habitat Restoration Plan (Appendix G to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2015]), the Topock Groundwater Remediation Project Mitigation and Monitoring Plan for Culturally Significant Plants (Appendix A to Appendix H to the C/RAWP [CH2M Hill and GANDA. 2014]), the Topock Compressor Station Groundwater Remediation Project Aesthetics and Visual Resources Protection and Revegetation Plan (Appendix N to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2014a]), and Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O to the C/RAWP [CH2M Hill and E2 Consulting Engineers 2014b]) also specify on-site revegetation success criteria; monitoring and reporting requirements; and adaptive management guidelines for salvage and replanting of trees, shrubs, and perennial species.

In accordance with the habitat revegetation plans and Mitigation Measure BIO-1a as detailed in the MMRP Exhibit 2 to the Statement of Decision and Resolution of Approval (DTSC 2018), removal of riparian trees (e.g., blue palo verde trees) were replaced at a 3:1 ratio (i.e., planting three trees in revegetation areas for each tree removed during construction). The success criterion for mitigation plantings is a final minimum plant replacement ratio of 2.25:1 (75 percent overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

In accordance with the habitat revegetation plans the following performance standards and adaptive management is required for mitigation plantings:

> Mitigation plantings shall exhibit 75 percent survival of required plantings by species. Survival of any mitigation planting species that drops below a 2.25:1 mitigation ratio (number of plants planted : number of plants impacted, or 75 percent survival of mitigation plantings) will require remedial planting. Replacement plantings will be monitored for five years from the time of their initial planting.

Mean survival of all mitigation plant species (96 percent) exceeds the required performance standard of 75 percent survival.

5.6 Salvaged Beavertail Cactus Survival

Between 2018 and August 2022, 12 beavertail cactus individuals were salvaged from work areas and transplanted into UHR-1 (see Section 2.2.7). As of September 2023, all individuals of salvaged and transplanted beavertail cactus have survived (Table 5-8), exhibiting 100 percent survival.

Table 5-8 Salvaged Beavertail Cactus Survival

Date of Transplanting	Total Individuals Salvaged and Transplanted	Total Individuals Alive (September 2023)
November and December 2018	7	**7**
2020 to 2021	2	**2**
April and August 2022	3	**3**
Total Salvaged and Transplanted Beavertail Cactus	**12**	**12**

6 Year 1 Revegetation Maintenance Results

Revegetation maintenance included invasive plant species eradication, irrigation, herbivore exclusion, general Site housekeeping and cleanup, and the general care and nurturing of plantings within the mitigation planting areas in Year 1.

Revegetation maintenance, including inspections and equipment operation, was conducted on the following dates:

2022

October – 10-12, 14, 17-19, 21, 24-26, 28

November – 3, 8, 11, 16, 19, 21-23, 28

December – 2, 6-8, 30

2023

January – 6, 13, 18-20, 27

February – 3, 10, 15-17, 24

March – 10, 14-16, 24, 31

April – 4-6, 14, 21

May – 3, 5, 12, 16-18, 26

June – 2, 9, 19, 20-22, 25-27

July – 7, 14, 28

August – 11, 15-17, 24

September – 13, 29

6.1 Irrigation Maintenance

During Year 1, the irrigation maintenance involved operating, inspecting, repairing, and improving the system. The dates of irrigation maintenance are listed above.

The irrigation system was operated weekly from October 2022 through July 2023, except after rain events, when the irrigation system was generally not operated if adequate rainfall and soil moisture were achieved. Beginning in July 2023, irrigation frequency was reduced to every 2 weeks to start hardening off the mitigation plants and mimic natural non-irrigated conditions. Beginning in September 2023, the irrigation frequency was reduced to every 3 weeks. During all irrigation events, the system operated for 2 hours in all mitigation planting areas.

In addition to routine operation and inspection, irrigation system maintenance entailed adding, replacing, adjusting, or repairing portions of the system. After planting was complete, along with associated soil leaching, all 0.25-inch irrigation hoses on the ground surface were inserted into DEEP DRIP stakes to encourage the development of deep roots in mitigation plantings. Maintenance efforts also included replacement of pipe couplings, bushings, valves, 0.25-inch flexible hose, and PVC pipe. Extreme seasonal heat at the Site resulted in the white PVC pipes turning black and bending, causing connections to loosen and leak.

Irrigation tubing was to provide supplemental water to newly designated volunteer recruit mitigation plants as well as honey mesquite seedlings and juveniles.

6.2 Fencing Maintenance

The following maintenance was performed during Year 1 to maintain the integrity of the herbivore exclusion fence:

- Seasonal extreme weather conditions resulted in most of the ultraviolet-resistant heavy-duty zip ties, which held the wire fence to the fence posts, to slowly degrade and break. The zip ties were replaced with steel baling wire.
- Routine monitoring of the fence perimeter was conducted to assess potential erosion or animal damage. Desert cottontail rabbits created holes under the fence on separate occasions. These animals were trapped or excluded from the mitigation planting area(s), and metal J-stakes were used to better fasten the fencing to the ground.
- Several heavy rain events resulted in sudden water flow under the fence of Areas 3 and 5, leaving large openings. Additional fencing was used to make repairs along with additional metal baling wire and metal J-stakes. Gravel bags were placed to slow water flow and reduce sediment transport.
- Heavy and persistent wind caused one of the fence posts in Area 5 to break at the base and require replacement.
- The signs on each Mitigation Planting Area indicating a “Restoration Area” needed to be re-attached on several occasions, as screws came loose.
- Reflective tape on the fence was re-attached on multiple occasions.

6.3 Erosion Control Best Management Practice Maintenance

Several heavy rain events during Year 1 caused sudden water flow under the wildlife exclusion fence on the west side of Areas 3 and 5. In some instances, this caused gravel bags to be pushed downgradient and required replacement to reduce the energy of water flow. Gravel bags were positioned to allow water to readily pass during smaller flow events. During large rain events, heavy water flow pushed some of the gravel bags out of position. Considerable sediment was transported into Areas 3 and 5, which scoured natural channel in some areas and spread out in others.

The straw wattles placed along the east side of the Areas 1 and 2, separating them from the Colorado River, were replaced to maintain effectiveness.

6.4 Invasive Plant Species Abatement Results

Biologists or maintenance subcontractors conducted invasive plant species treatments monthly or during monitoring events (and on other occasions by subcontractors). All invasive plant species treatment events are summarized in Table 6-1 and shown on Figures 15A and 15B.

Weeds pulled by biologists during monthly monitoring events generally consisted of small patches of infrequently observed non-native species that could be easily removed by hand. Subcontractors treated large infestations of weeds subject to manual removal, as directed and monitored by Arcadis, including removal of saltcedar seedlings, Russian-thistle, Sahara mustard, puncturevine, and Bermuda grass. These weeds required a shovel, loppers, or a saw to remove. All weeds were bagged and removed from the Site for disposal.

The licensed applicator conducted herbicide treatments biannually. Herbicide treatment events included an initial site inspection to assess the types of invasive plant species and their extent to plan for treatment methods and

chemicals. Two qualified pesticide applicators using backpack sprayers performed the herbicide treatment visit. The crew sprayed herbicide on all common reed in the mitigation planting areas and also treated common reed and giant reed (*Arundo donax*) immediately outside the fencing to minimize future spread of the rhizomatous plants into the revegetation areas. Herbicide was sprayed in the early morning, when wind was minimal, to prevent overspray. The crew used a dye to mark areas already treated.

Table 6-1 Invasive Plant Species Abatement Summary

Scientific Name	Common Name	Area Name(s)	Abatement Type(s)	Date(s) of Abatement
Brassica tournefortii	Saharan mustard	Area 1, 2, 3, 4, and 5	Pull	11/19/2022, 12/8/2022, 2/14/2023, 2/15/2023, 3/15/2023, 3/17/2023 4/5/2023
Chenopodium murale	nettleleaf goosefoot	Area 1, 2, 3, 4, and 5	Pull	11/3/2022, 11/19/2022, 12/8/2022, 2/14/2023, 2/15/2023, 3/15/2023, 3/17/2023, 6/22/2023, 7/25/2023, 7/26/2023
Cynodon dactylon	Bermuda grass	Area 1, 2, 3, and 5	Dig	11/3/2022, 11/19/2022, 12/8/2022, 1/19/2023, 2/15/2023, 3/15/2023, 6/22/2023, 8/16/2023, 9/13/2023, 9/15/2023
Gossypium hirsutum	upland cotton	Area 1	Pull	12/8/2022
Kochia scoparia	summer-cypress	Area 2, 3, 4, and 5	Pull	3/15/2023, 6/22/2023
Phragmites australis	common reed	Area 1 and 2	Herbicide, Dig, Pull	10/11/2022, 12/8/2022, 11/19/2022, 1/18/2023, 2/15/2023, 7/27/2023, 7/28/2023
Polygonum argyrocoleon	silversheath knotweed	Area 1, 2, and 3	Pull	11/19/2022, 12/8/2022, 3/15/2023
Portulaca oleracea	common purslane	Area 2 and 5	Pull	11/3/2022, 12/8/2022
Salsola tragus	Russian-thistle	Area 1, 2, 3, 4, and 5	Pull	3/15/2023, 6/22/2023, 9/13/2023, 9/17/2023
Schismus barbatus	Mediterranean grass	Area 1, 2, 3, and 5	Pull	12/8/2022, 2/14/2023, 2/15/2023, 2/16/2023, 3/15/2023, 3/17/2023, 6/22/2023
Sonchus oleraceus	sow-thistle	Area 1, 2, 3	Pull	11/3/2023, 2/14/2023, 3/15/2023, 3/17/2023, 7/26/2023, 9/13/2023

Scientific Name	Common Name	Area Name(s)	Abatement Type(s)	Date(s) of Abatement
Tamarix ramosissima	saltcedar	Area 1, 2, 3, and 5	Herbicide, Pull, Dig	10/11/2022, 10/26/2022, 11/3/2022, 12/8/2022, 1/18/2023, 1/19/2023, 1/20/2023, 3/15/2023, 3/17/2023, 7/27/2023, 7/28/2023, 9/13/3023
Tribulus terrestris	puncturevine	Area 2, 3, and 5	Pull, Dig	12/8/2022, 1/19/2023, 2/14/2023, 6/22/2023, 7/25/2023, 9/15/2023

6.5 Other Plant Species Abatement Results

Following the abatement methods detailed in Section 4.4.3, arrowweed was removed using a two-step process if it occurred within a 3-foot radius of any mitigation plantings or was cut at ground level and removed from the Site if it occurred within a 3- to 5-foot radius of a mitigation plant.

Arrowweed that was cut or excavated was bagged and removed from the mitigation planting area so that it would not resprout or blow around the Site. The cuttings were offered to the Tribes and stored in a designated location for retrieval.

Table 6-2 Other Plant Species Abatement Summary

Scientific Name	Common Name	Area Name(s)	Abatement Type(s)	Date(s) of Abatement
Pluchea sericea	arrowweed	Area 1, 2, and 3	Pull, Dig	11/3/2022, 11/19/2022, 1/18/2023, 1/19/2023, 2/14/2023, 3/17/2023, 5/17/2023, 6/21/2023, 7/27/2023, 8/16/2023, 9/13/2023, 9/17/2023

7 Summary and Conclusion

A total of 657 mitigation plants were monitored in floodplain mitigation areas in Year 1. Mean Year 1 survival of floodplain mitigation plants is 95.6 percent, well above the performance standard of 75 percent survival. A total of 53 mitigation plants were monitored in the upland mitigation area in Year 1. Mean Year 1 survival of upland mitigation plants is 100 percent. Only a small number of blue palo verde and one desert smoke tree died in Year 1.

Mean survival of all mitigation plant species (96 percent) exceeds the required performance standard of 75 percent survival.

Mitigation plant species remained in good to excellent health in all areas, with only a few individuals in fair to poor health. A few blue palo verde individuals growing in compacted soils near access roads exhibited slow growth and poor health compared with plants in well-drained substrates, and these individuals were offset by new volunteer recruits of the same species that were growing vigorously. Two cattle saltbush individuals were also assigned poor health assessments but may recover during the growing season.

A total of 10 native plant species were planted in the mitigation areas in 2022. By September 2023, an additional 39 native plant species were observed in revegetation areas. Six native tree species, seven native shrub species, three native cactus species, and 33 native herbaceous annual and perennial forbs and grasses were recorded in Year 1, a rapid increase in native plant richness, which provides enhanced ecological value for wildlife utilizing revegetation areas. A total of 24 wildlife taxa were observed in Year 1 in revegetation areas including 19 native wildlife species, two non-native species, and three invertebrate taxa identified only to taxonomic grouping.

Adaptive management included soil sampling and stress symptom observations and assessments. Soil sampling in July 2023 indicated an increase in soil salinity during Year 1. Consultations in August 2023 with Ben Waddell, the director of FGL in Santa Paula, resulted in several follow-up actions that are currently being implemented.

During the July and August monthly monitoring events, Biologists documented the presence and distribution of stress symptoms (such as dripping sap) on blue palo verde mitigation plants in Areas 1 through 5. Biologists engaged the professional services of plant pathologist Dr. Philippe Rolshausen of the UCCE Riverside Office to assess potential presence of plant pathogens on site. Dr. Rolshausen collected samples and completed laboratory analysis, including tissue culture and DNA sequencing, which indicated a lack of known pathogens in the samples. Dr. Rolshausen suggested that the sap may have been extruded after boring insect(s) created holes in the wood.

Revegetation maintenance included invasive plant species eradication, irrigation, herbivore exclusion, general site housekeeping and cleanup, and the general care and nurturing of plantings within the mitigation planting areas in Year 1.

The Topock Revegetation Project is on a positive trajectory to successfully revegetate the floodplain area and upland planting area with native species that provide cover, richness, structural diversity, and enhanced ecological functioning during each successive monitoring year. This Project is anticipated to continue to meet required performance standards in Year 5.

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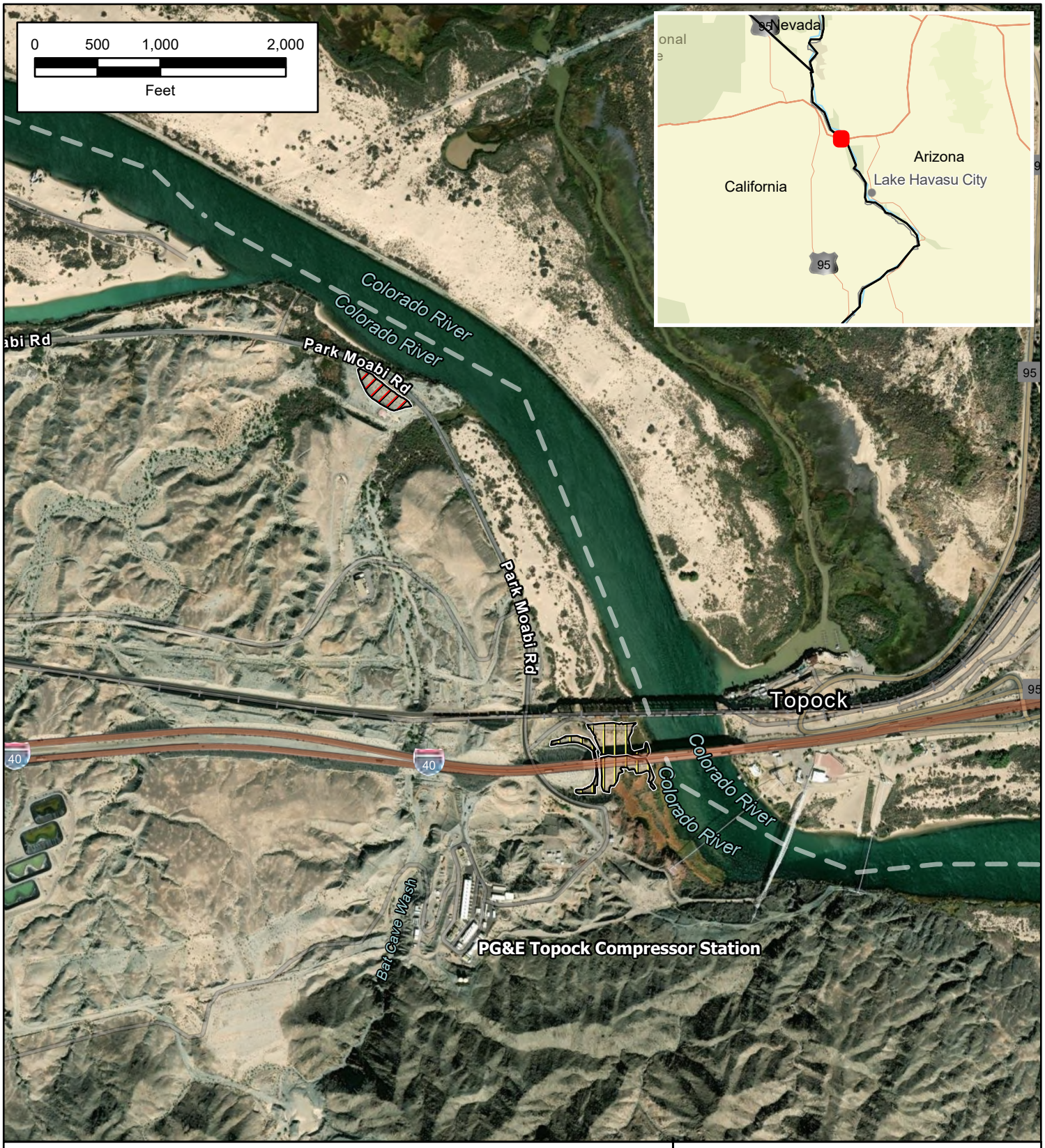
Figures



Legend

- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)
- UHR-1 (Upland Planting Area)

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Site Location

N

ARCADIS

FIGURE
1

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx/Figure 1 Site Location_02_final

Legend

- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)
- UHR-1 (Upland Planting Area)

N

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Site Overview

ARCADIS

FIGURE 2

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx

Legend

- Previously Approved Planting Areas as of 2015
- Area A
- Area B
- Area C
- Area D

N

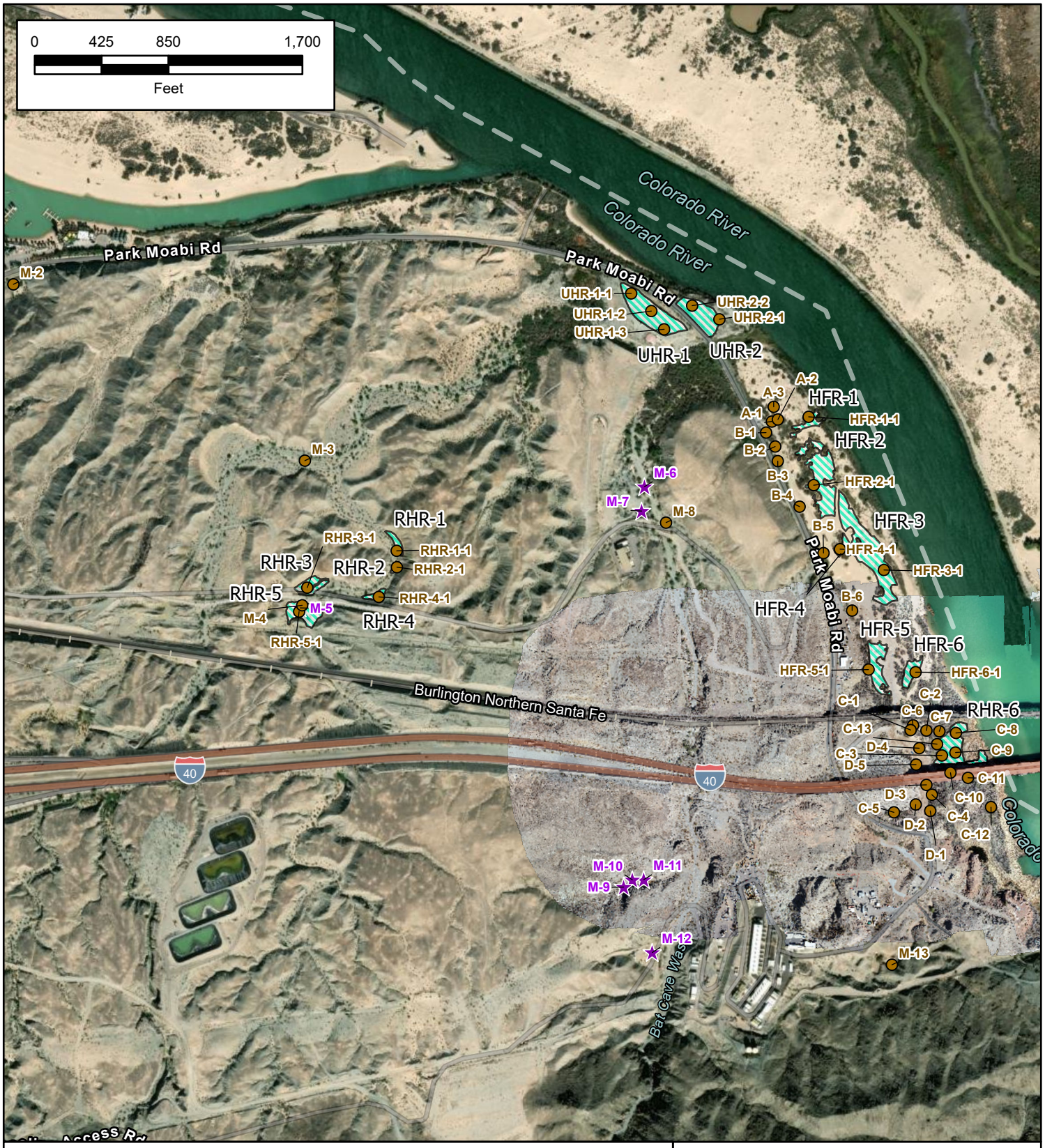
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Proposed Planting Areas

ARCADIS

FIGURE
3

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Topock_2024.aprx



Legend

- Previously Approved Planting Areas as of 2015
- Soil Moisture Measurement Location
- Soil Sampling Point (soil samples and soil moisture measurement location)

Note: Planting areas reduced for 10' setback from TransWestern gas pipeline, BNSF ROW, and PG&E water pipelines. Actual planting of large trees may be set back 20' or more from TransWestern gas pipeline and other infrastructure to allow for setback of spreading and overhanging branches of planted trees.

N

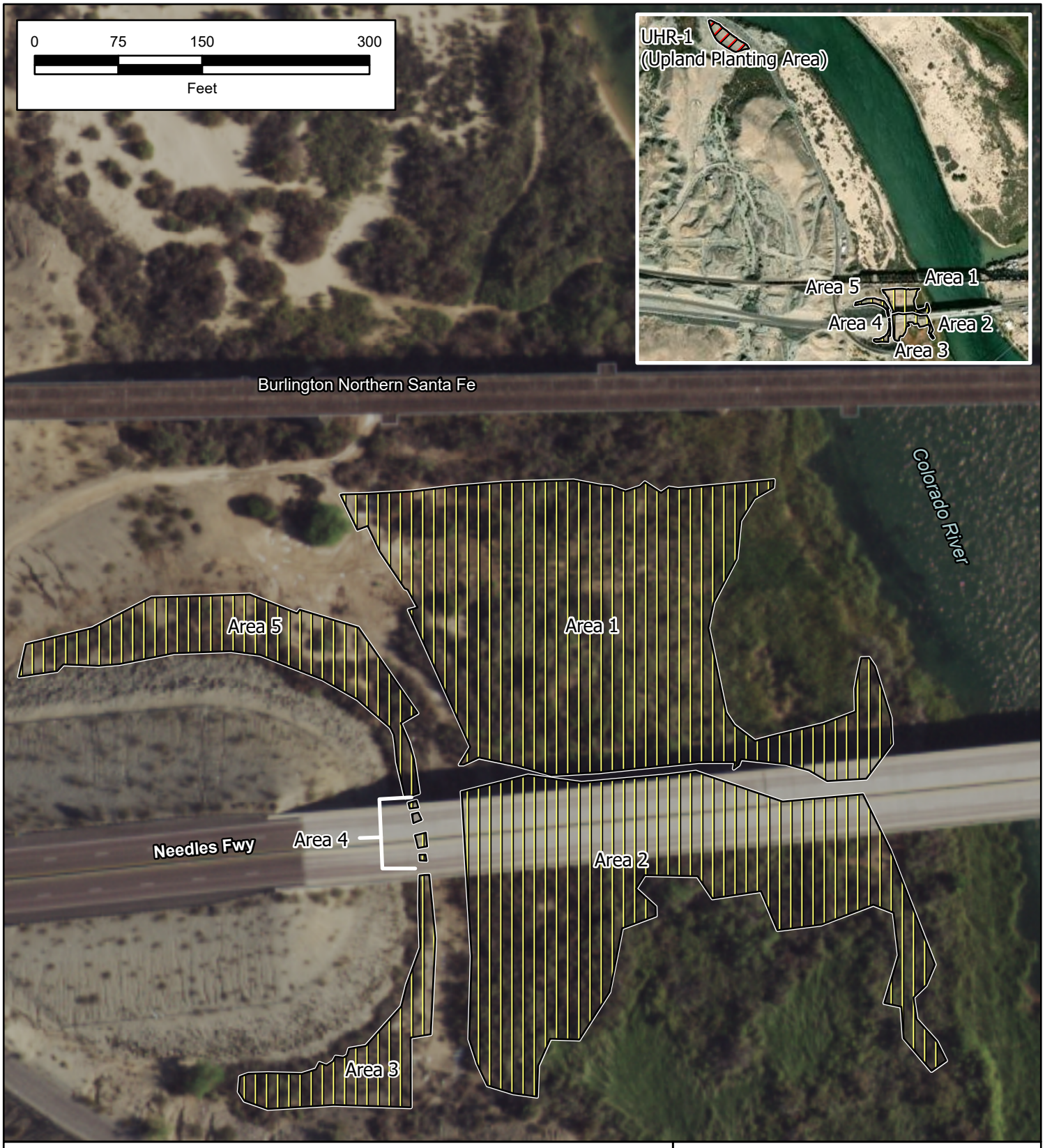
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Soil Data Collection Locations

ARCADIS

FIGURE 4

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\PGE_Topock_Revegetation 2024.aprx



Legend

Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

Note: Planting areas reduced for 10' setback from TransWestern gas pipeline, BNSF ROW, and PG&E water pipelines. Actual planting of large trees may be set back 20' or more from TransWestern gas pipeline and other infrastructure to allow for setback of spreading and overhanging branches of planted trees.

N

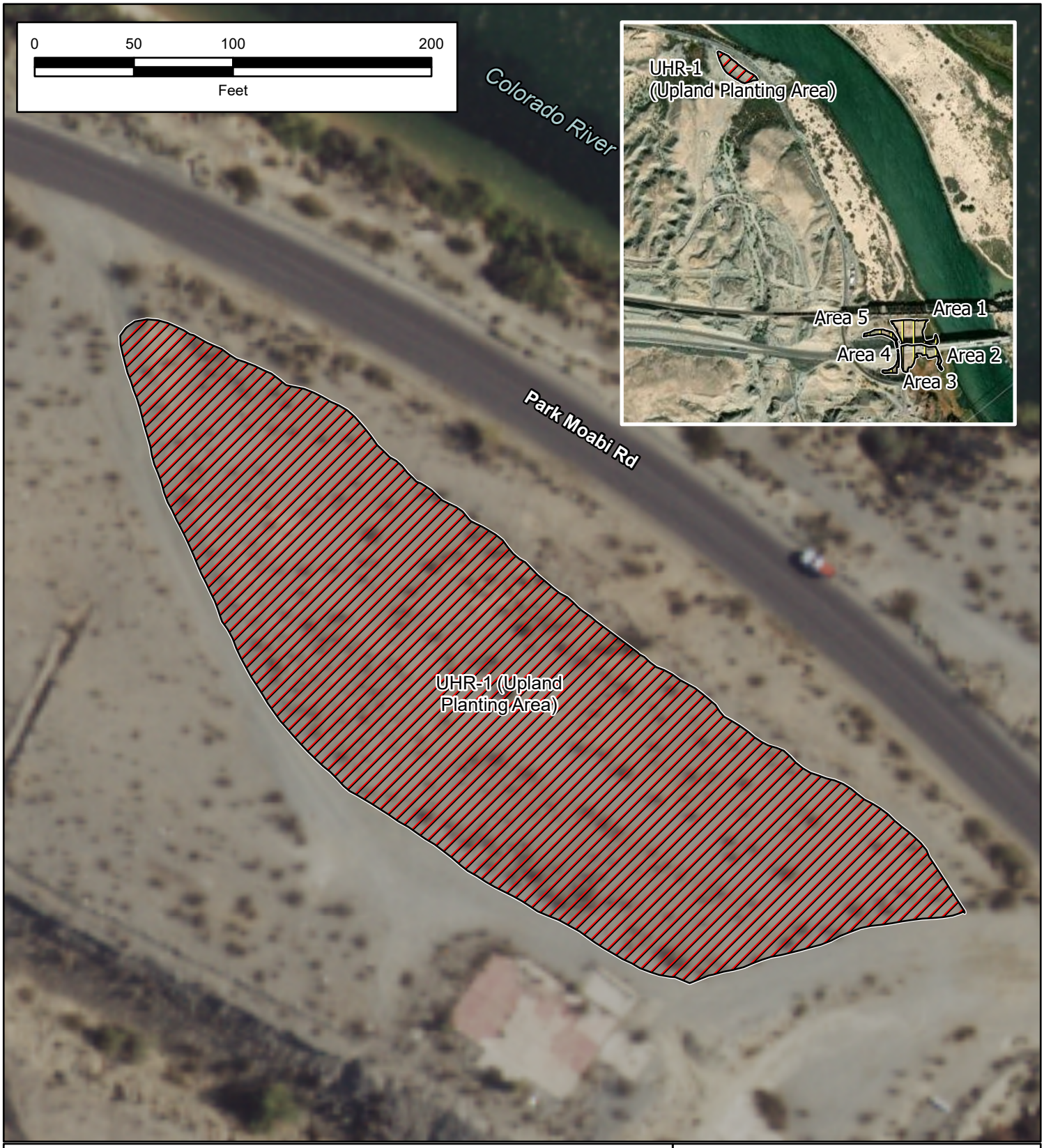
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Final Mitigation Planting Areas in Floodplain

ARCADIS

FIGURE 5A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

UHR-1 (Upland Planting Area)

Note: Planting areas reduced for 10' setback from TransWestern gas pipeline, BNSF ROW, and PG&E water pipelines. Actual planting of large trees may be set back 20' or more from TransWestern gas pipeline and other infrastructure to allow for setback of spreading and overhanging branches of planted trees.

N

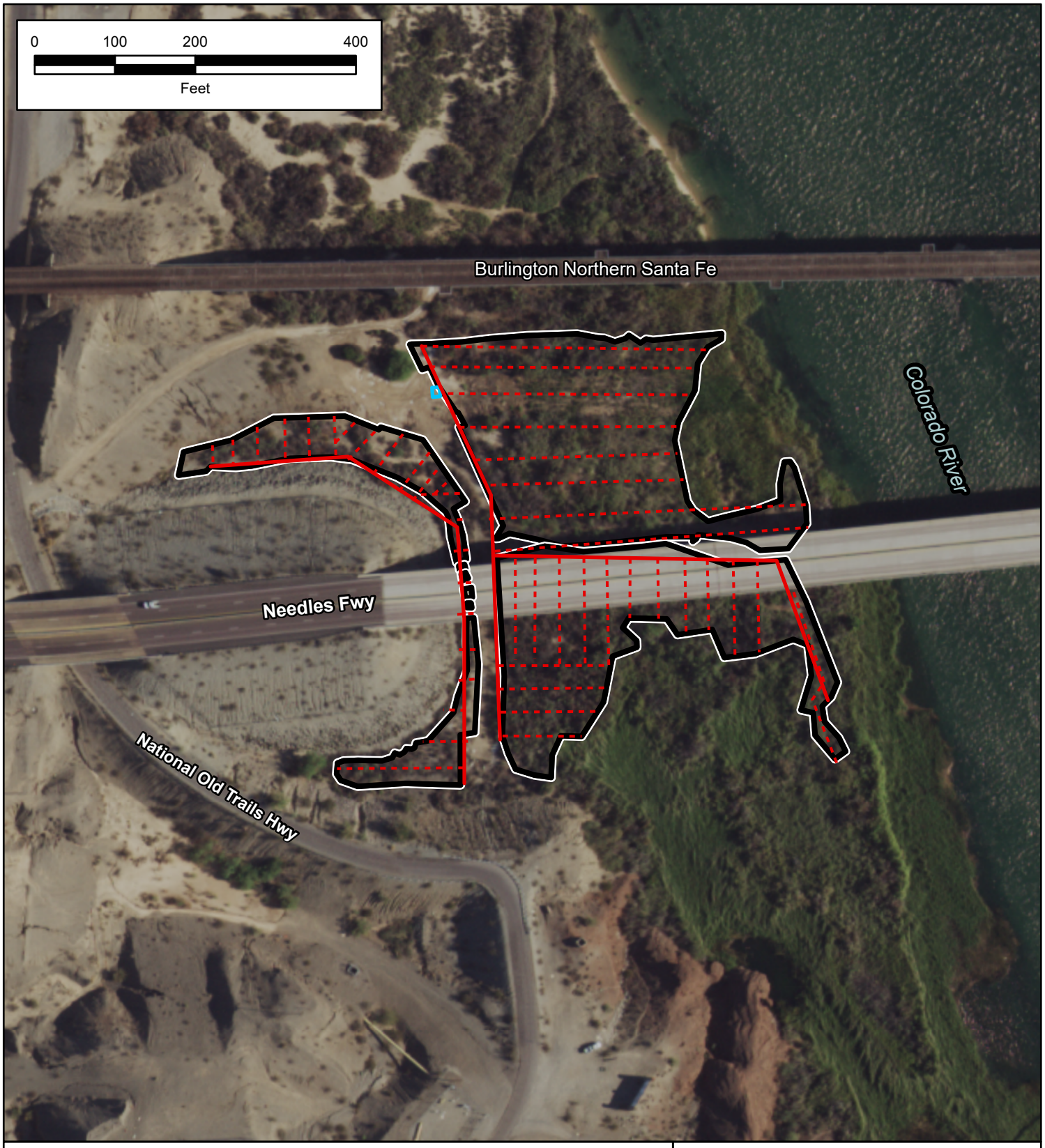
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Final Mitigation Planting Area in UHR-1

ARCADIS

FIGURE 5B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- 3" Schedule 40 Polyvinyl Chloride (PVC)
- 1" Schedule 40 PVC
- Well Vault (Water Source)
- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

Notes:
1. 1/4" tubing not pictured.

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

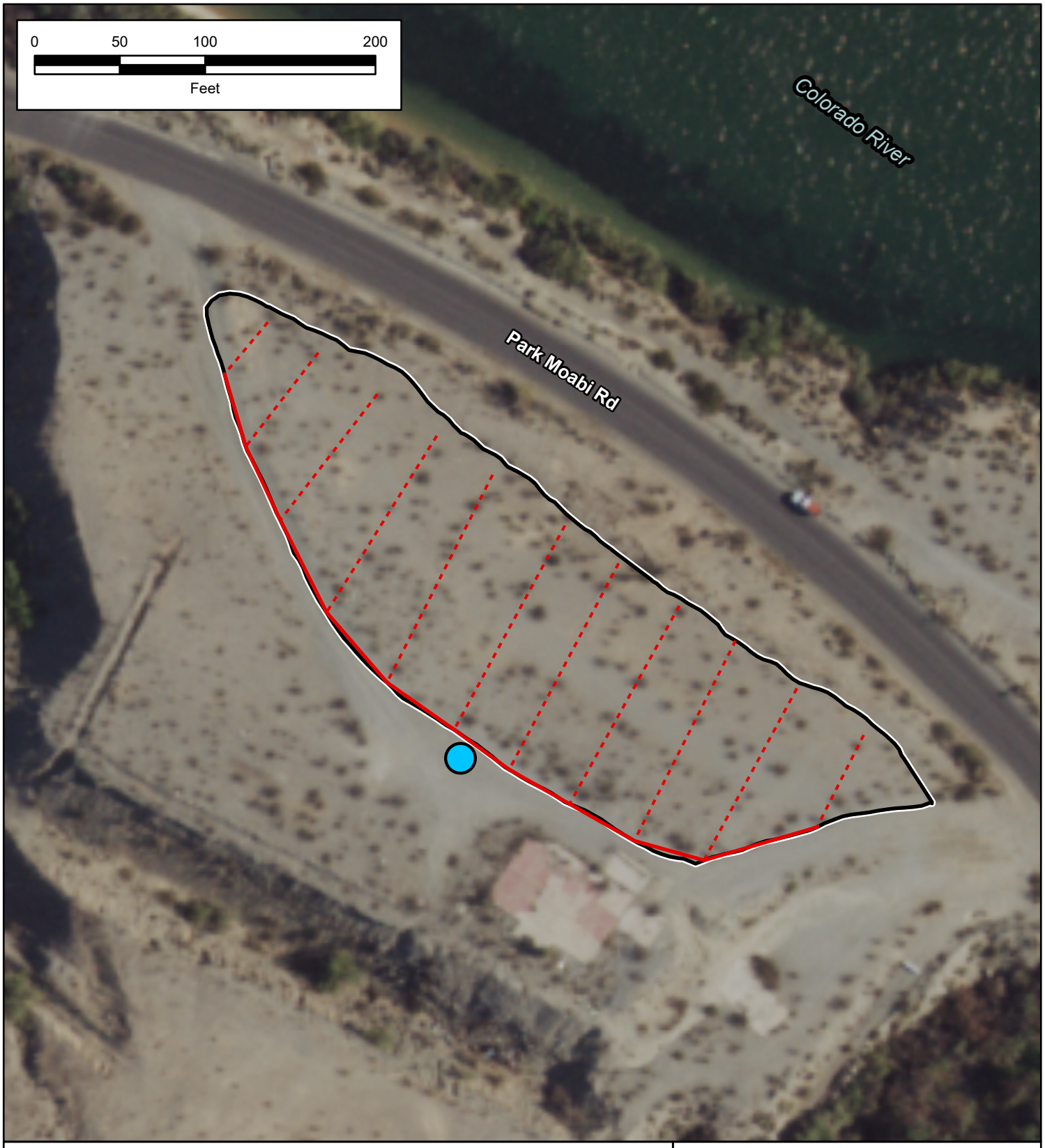
Irrigation System As-Built (Floodplain Mitigation Planting Areas)

N

ARCADIS

FIGURE
6A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Water Tank
- 3" Schedule 40 Polyvinyl Chloride (PVC)
- 1/2" Schedule 40 PVC
- UHR-1 (Upland Planting Area)

Notes:
1. 1/4" tubing not pictured.

N

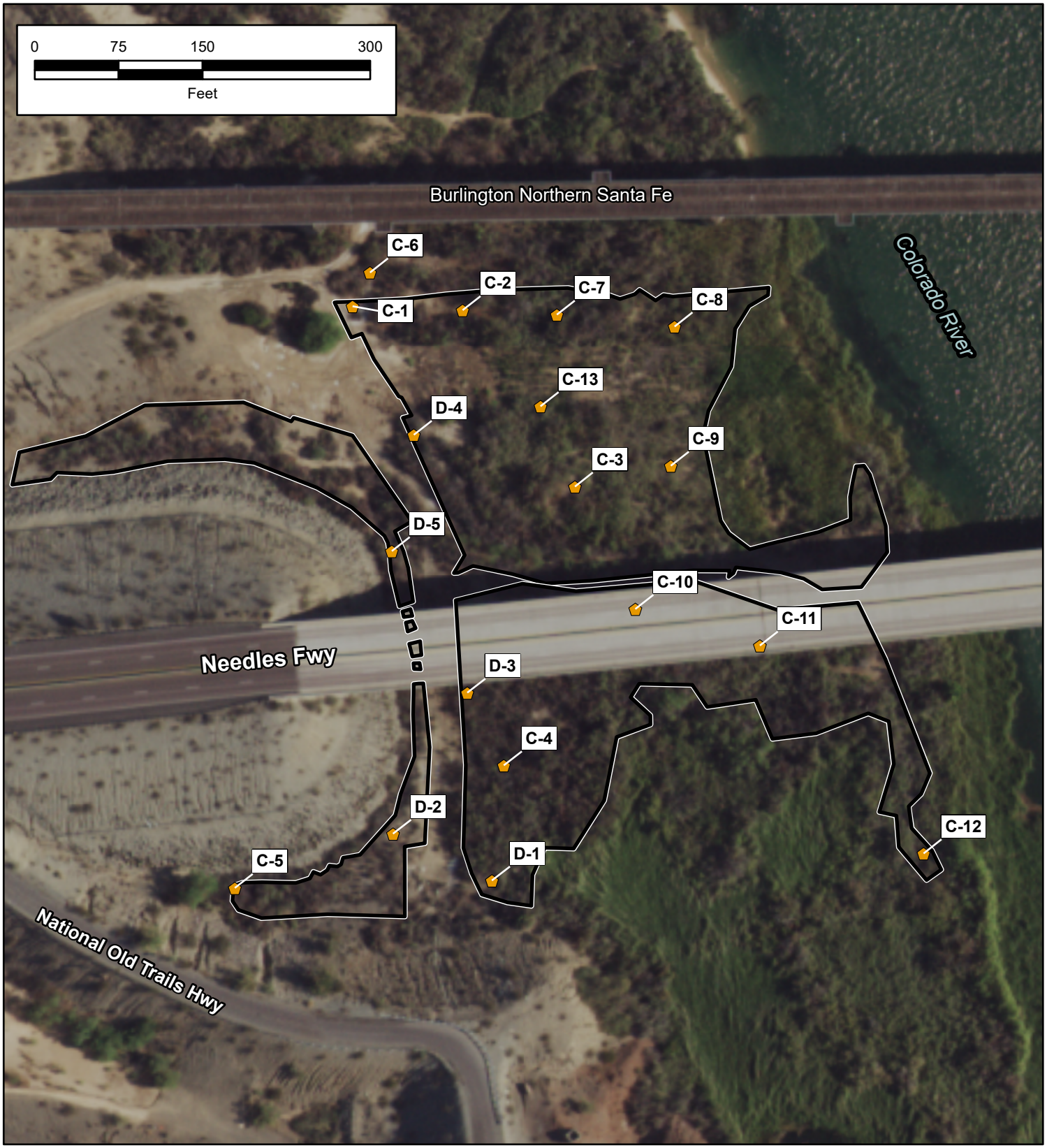
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Irrigation System As-Built (UHR-1)

ARCADIS

FIGURE 6B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Soil Sampling Location
- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

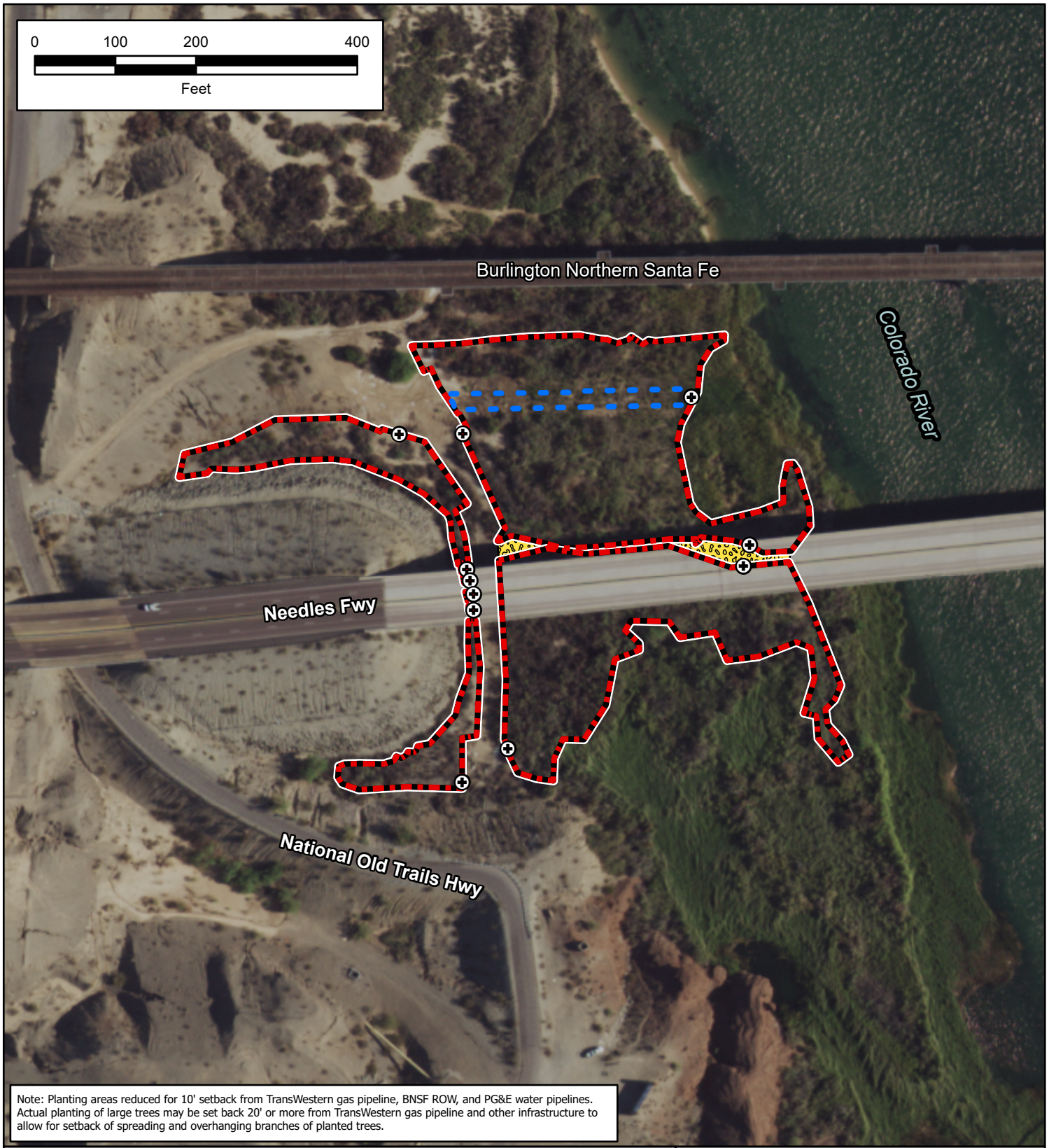
Soil Sampling Locations

N

ARCADIS

FIGURE
7

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Note: Planting areas reduced for 10' setback from TransWestern gas pipeline, BNSF ROW, and PG&E water pipelines. Actual planting of large trees may be set back 20' or more from TransWestern gas pipeline and other infrastructure to allow for setback of spreading and overhanging branches of planted trees.

Legend

- 10' Pipeline Buffer
- Monitoring Well Access Road
- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)
- 6-foot-tall Wire Wildlife Exclusion Fence
- Pedestrian Gate

N

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Herbivore-Deterrent Fencing As-Built (Floodplain Mitigation Planting Areas)

ARCADIS

FIGURE 8A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx

Legend

- Pedestrian Gate
- UHR-1 (Upland Planting Area)
- 6-foot-tall Wire Wildlife Exclusion Fence

N

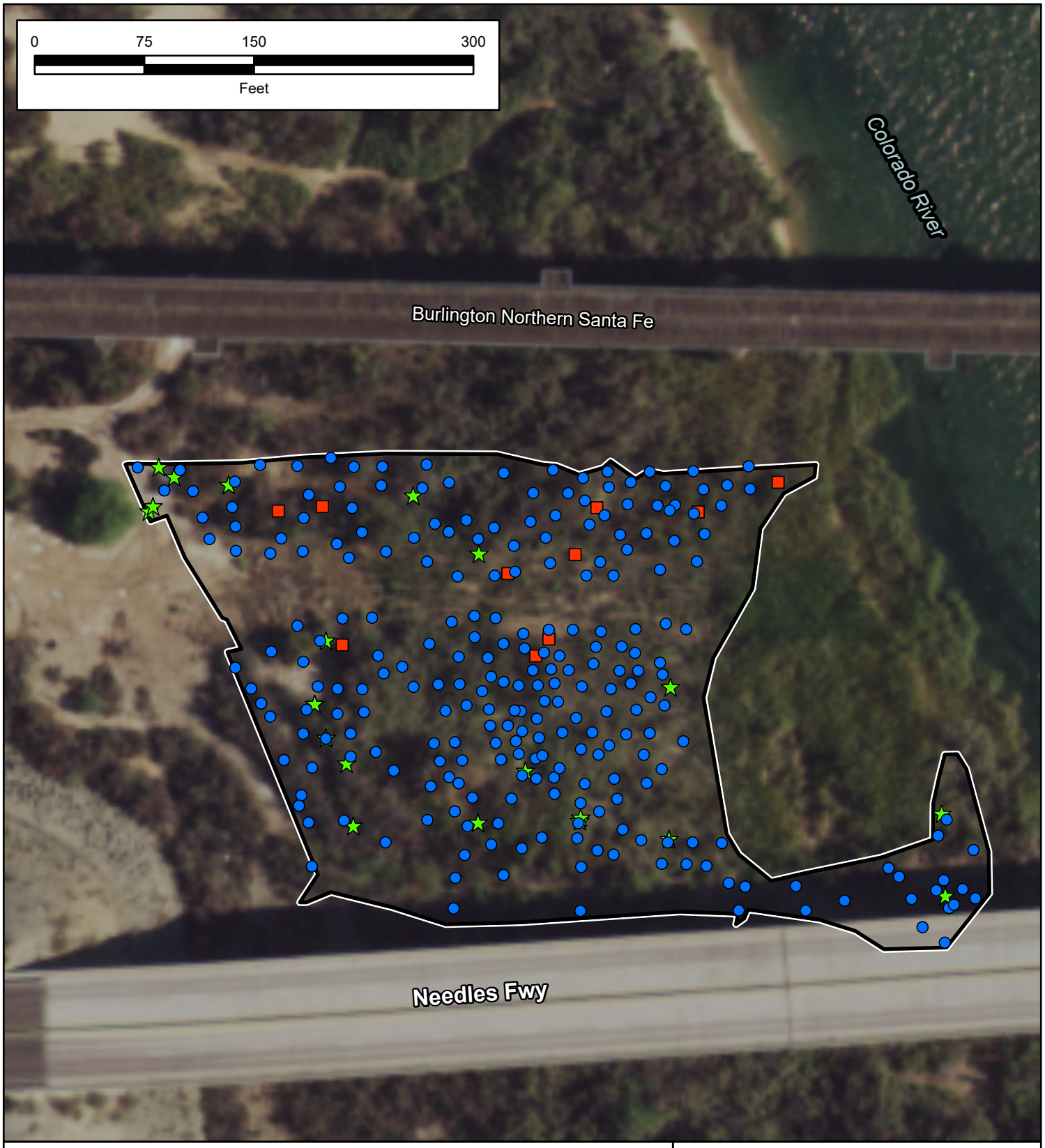
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Herbivore-Deterrent Fencing As-Built (UHR-1)

ARCADIS

FIGURE 8B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Area 1
- Blue palo verde (Container Planting)
- Honey mesquite (Volunteer Recruit)
- Screwbean mesquite (Volunteer Recruit)

N

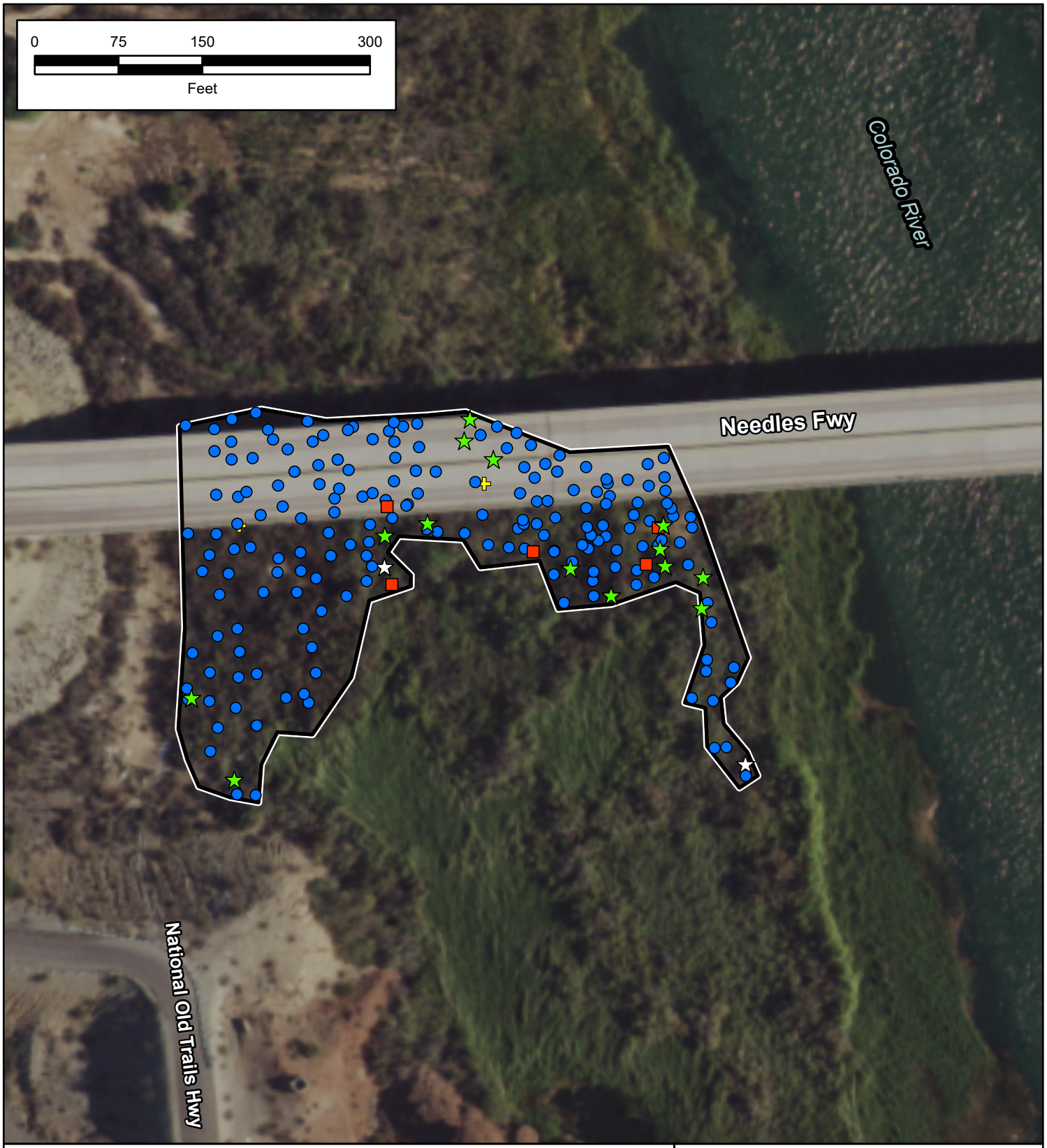
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
Area 1

ARCADIS

FIGURE
9A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Area 2
- Blue palo verde (Container Planting)
- Honey mesquite (Volunteer Recruit)
- Screwbean mesquite (Volunteer Recruit)
- Blue palo verde (Volunteer Recruit)
- Honey mesquite (Seeded)

N

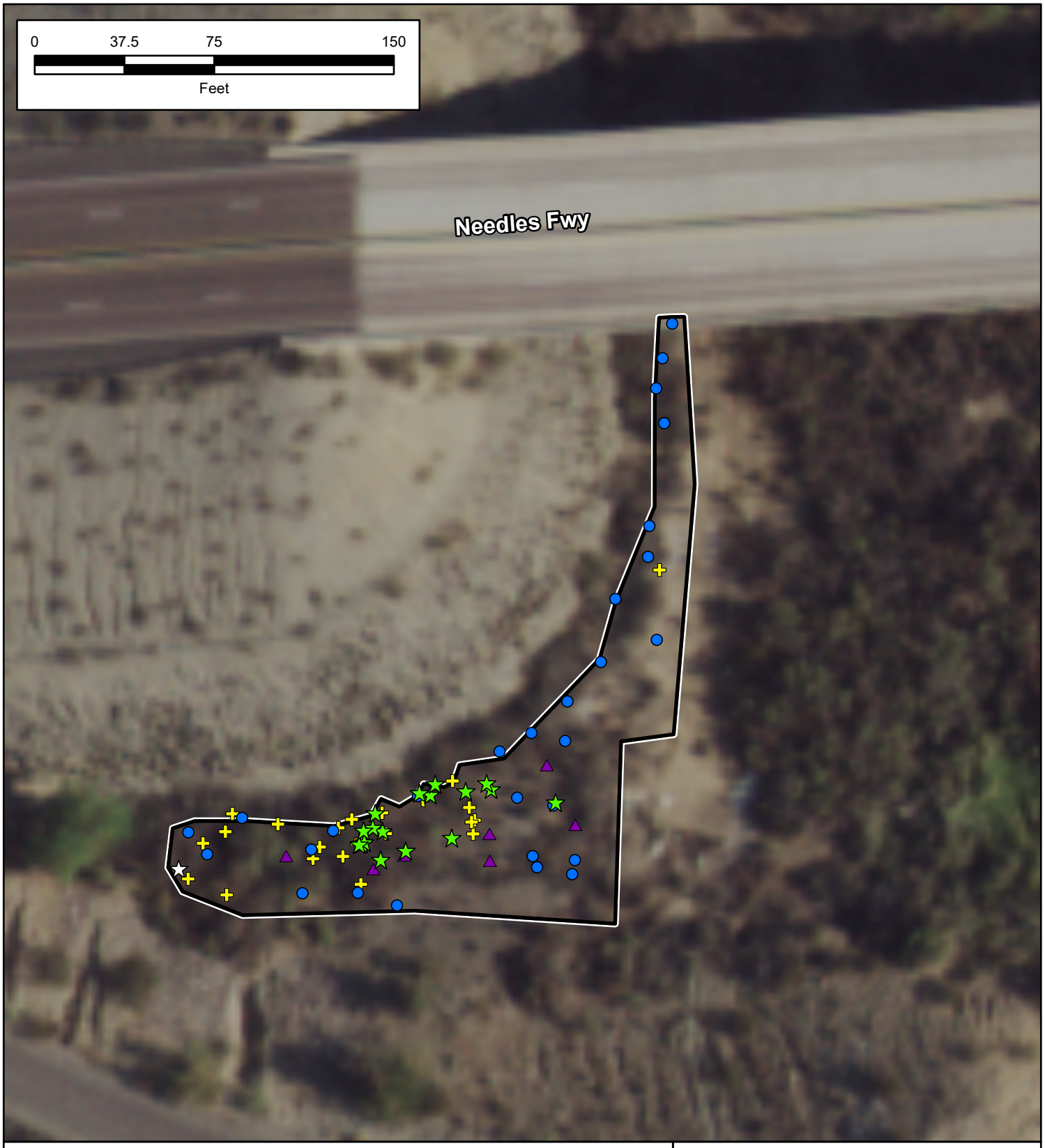
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
Area 2

ARCADIS

FIGURE
9B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Area 3
- Blue palo verde (Container Planting)
- Honey mesquite (Volunteer Recruit)
- Desert smoke tree (Container Planting)
- Blue palo verde (Volunteer Recruit)
- Honey mesquite (Seeded)

N

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
Area 3

ARCADIS

FIGURE
9C

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx

Legend

- Area 4
- Blue palo verde (Container Planting)
- Blue palo verde (Volunteer Recruit)

N

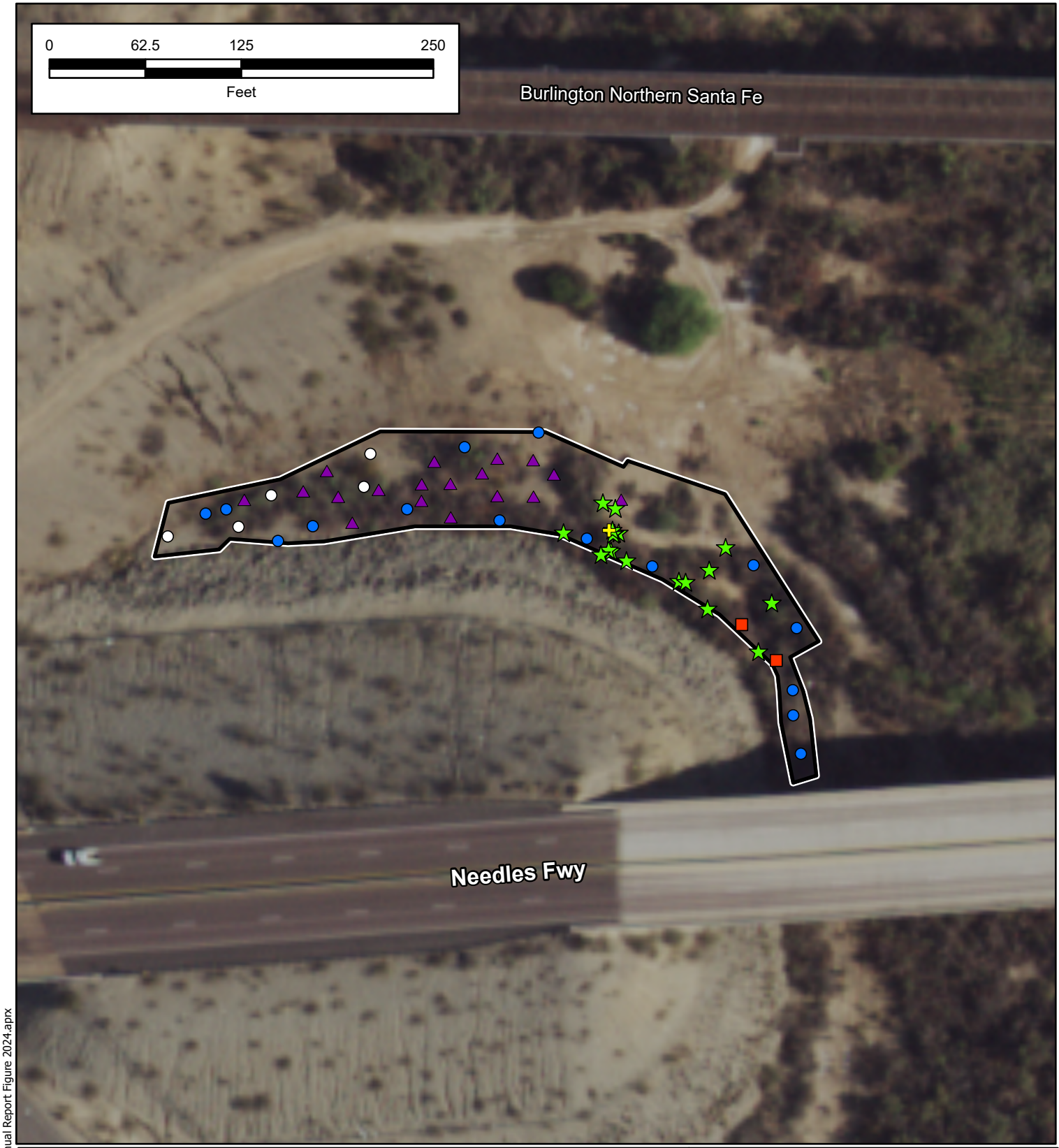
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
Area 4

ARCADIS

FIGURE
9D

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Area 5
- Blue palo verde (Container Planting)
- Blue palo verde (Volunteer Recruit)
- Honey mesquite (Volunteer Recruit)
- Screwbean mesquite (Volunteer Recruit)
- Desert smoke tree (Container Planting)
- Catclaw acacia (Container Planting)

N

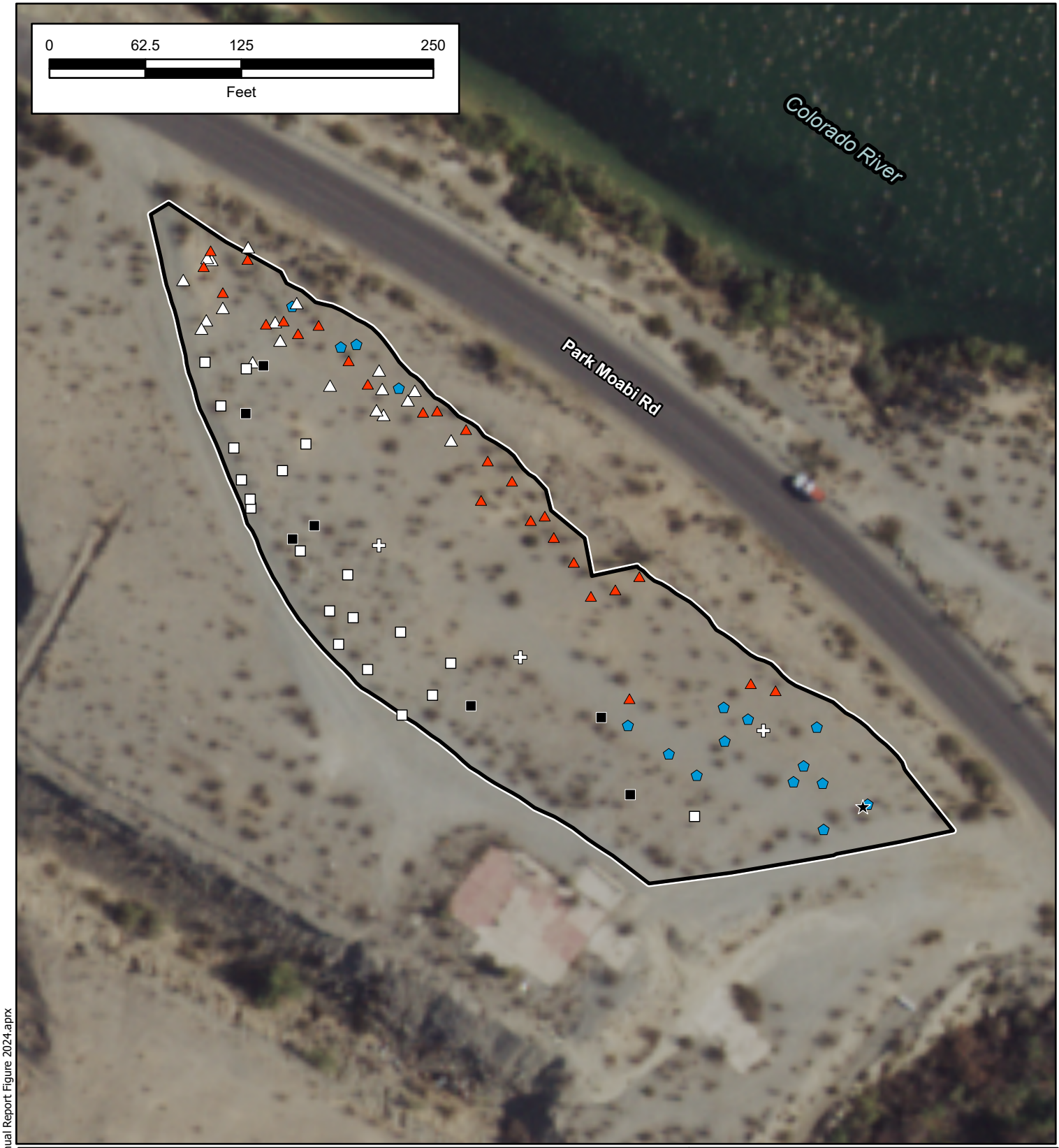
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
Area 5

ARCADIS

FIGURE 9E

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- UHR-1 (Upland Planting Area)
- Buckhorn cholla (Container Planting)
- Silver cholla (Container Planting)
- Anderson's desert thorn (Container Planting)
- Beavertail cactus (Container Planting)
- Beavertail cactus (Salvaged)
- Cattle saltbush (Volunteer Recruit)
- Cattle saltbush (Container Planting)

N

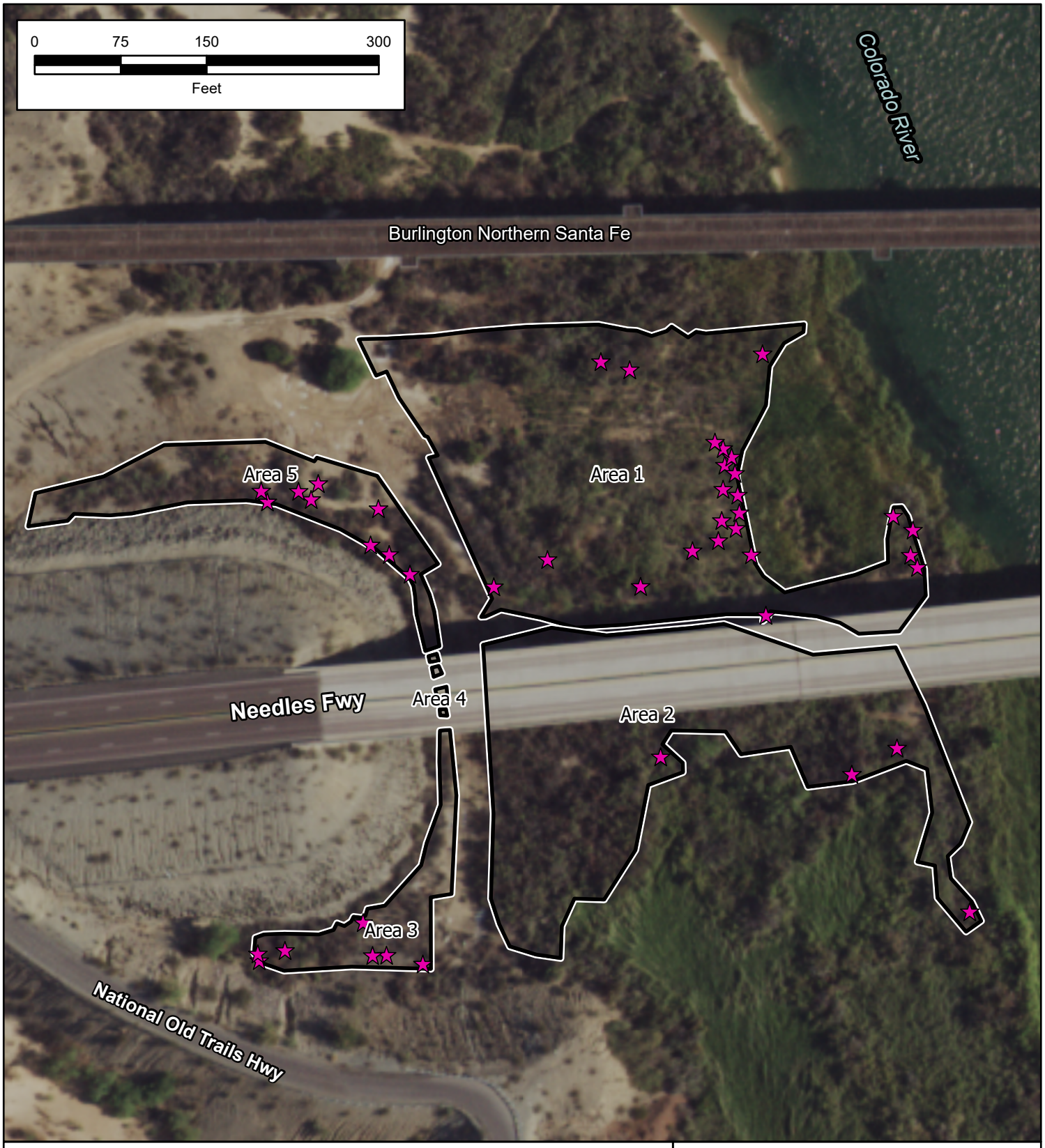
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Mitigation Plants By Planting Area
UHR-1

ARCADIS

FIGURE 9F

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Honey Mesquite Seeding Area
- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

Note: Planting areas reduced for 10' setback from TransWestern gas pipeline, BNSF ROW, and PG&E water pipelines. Actual planting of large trees may be set back 20' or more from TransWestern gas pipeline and other infrastructure to allow for setback of spreading and overhanging branches of planted trees.

N

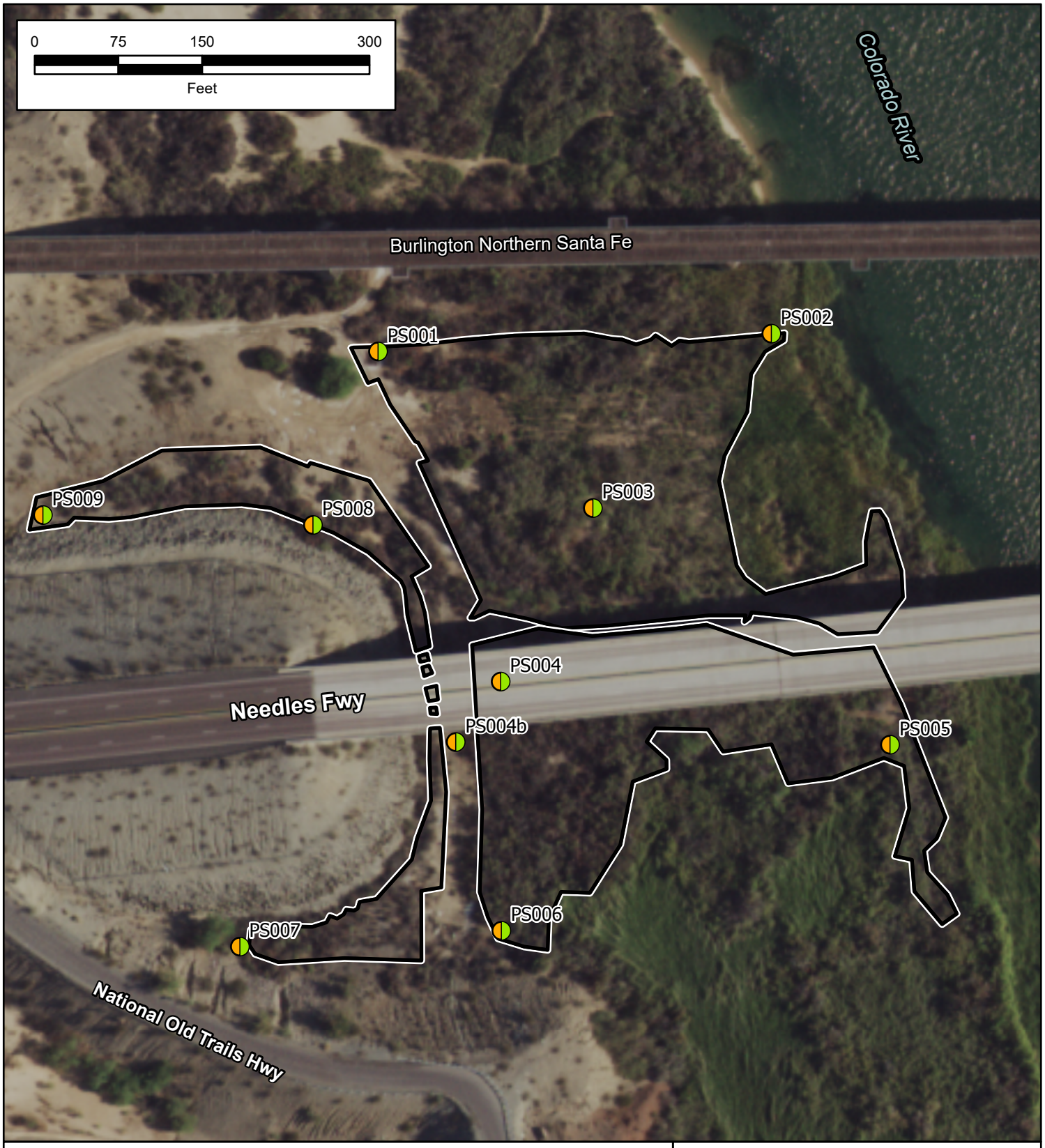
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Honey Mesquite (*Prosopis glandulosa*) Seeding Areas

ARCADIS

FIGURE 10

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)
- Photo Stations

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

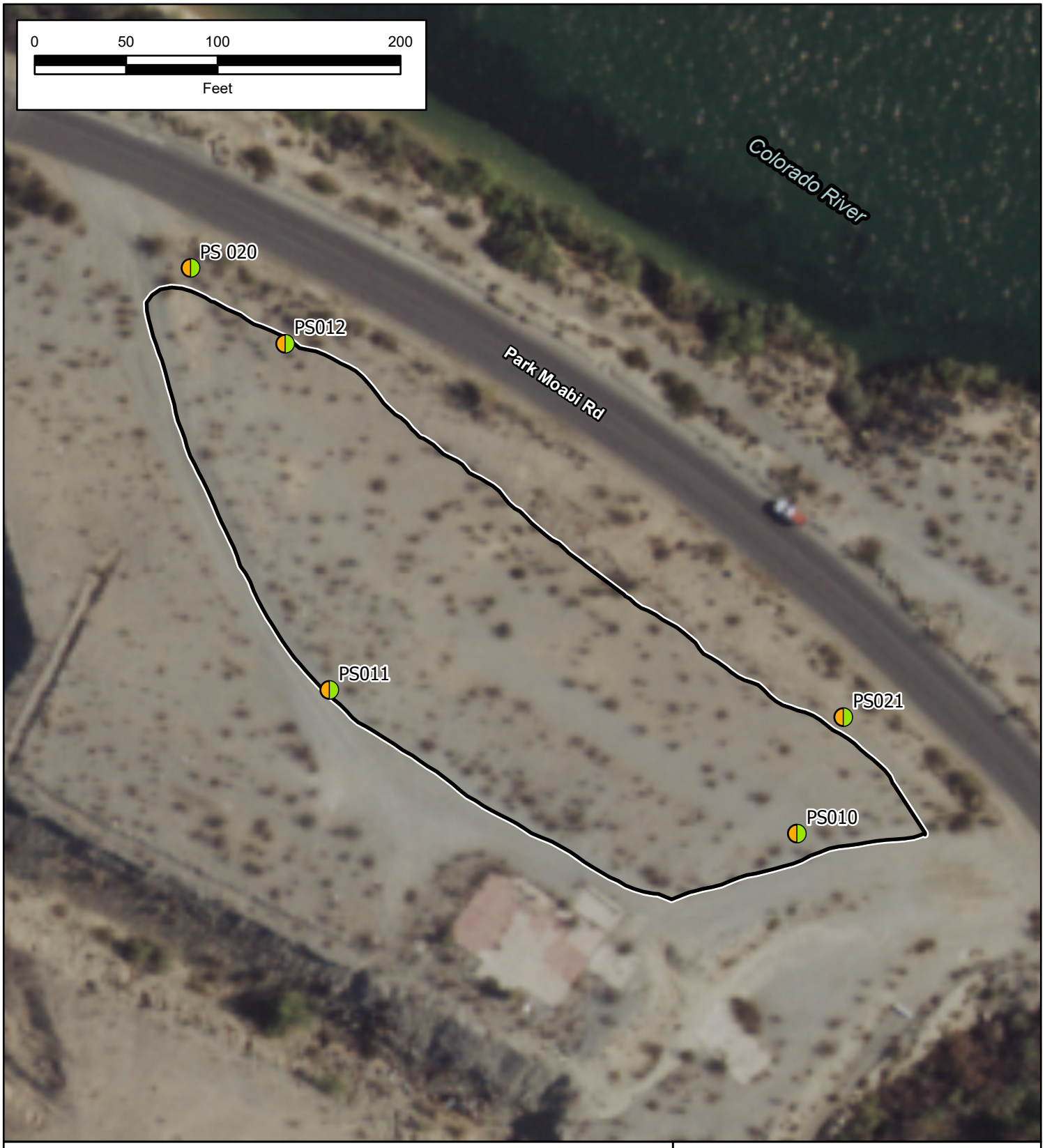
Planting Area Photo-monitoring Stations (Floodplain Mitigation Planting Areas)

N

ARCADIS

FIGURE 11A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- UHR-1 (Upland Planting Area)
- Photo Stations

N

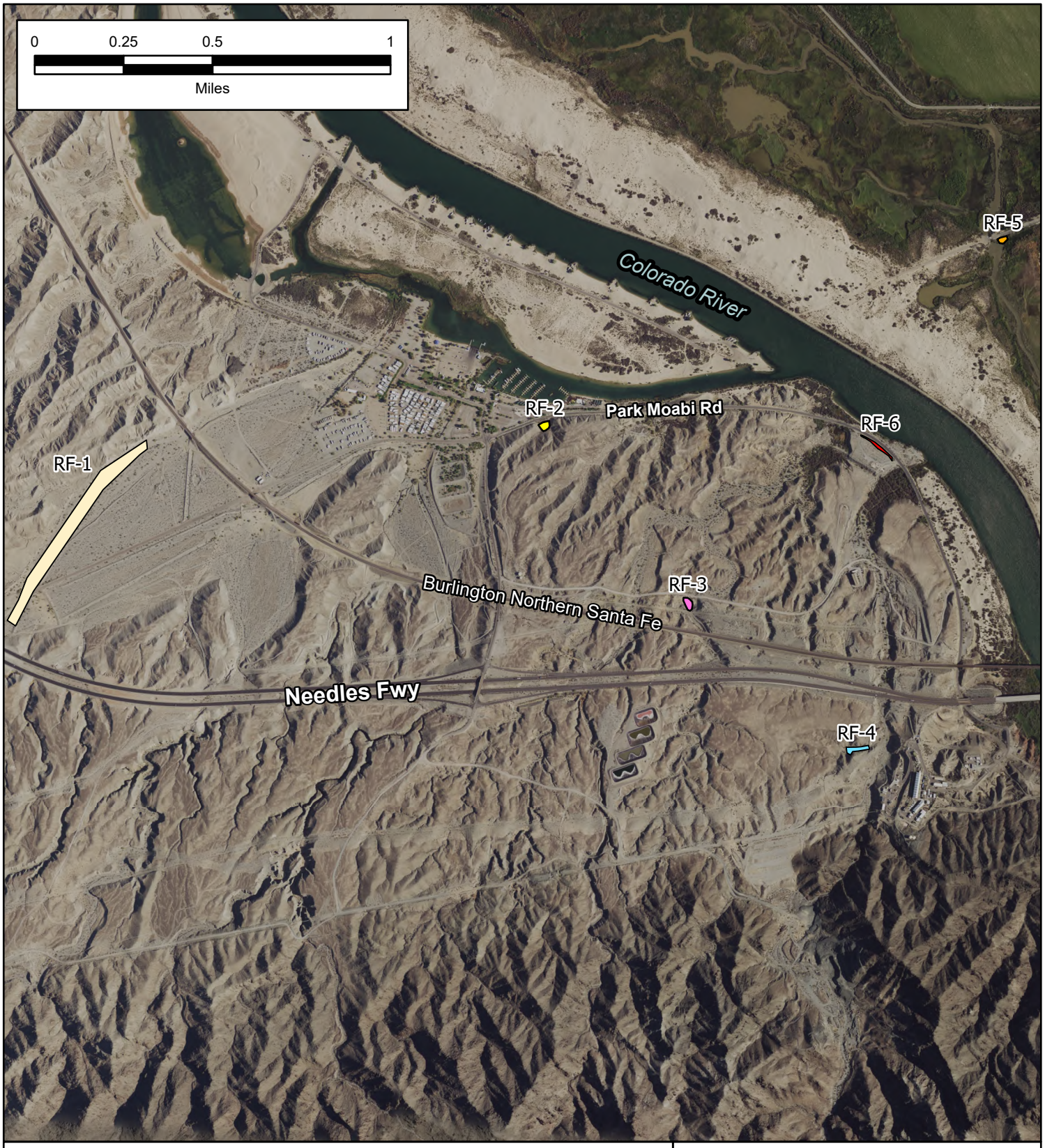
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Planting Area Photo-monitoring Stations (UHR-1)

ARCADIS

FIGURE 11B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- RF-1
- RF-2
- RF-3
- RF-4
- RF-5
- RF-6

N

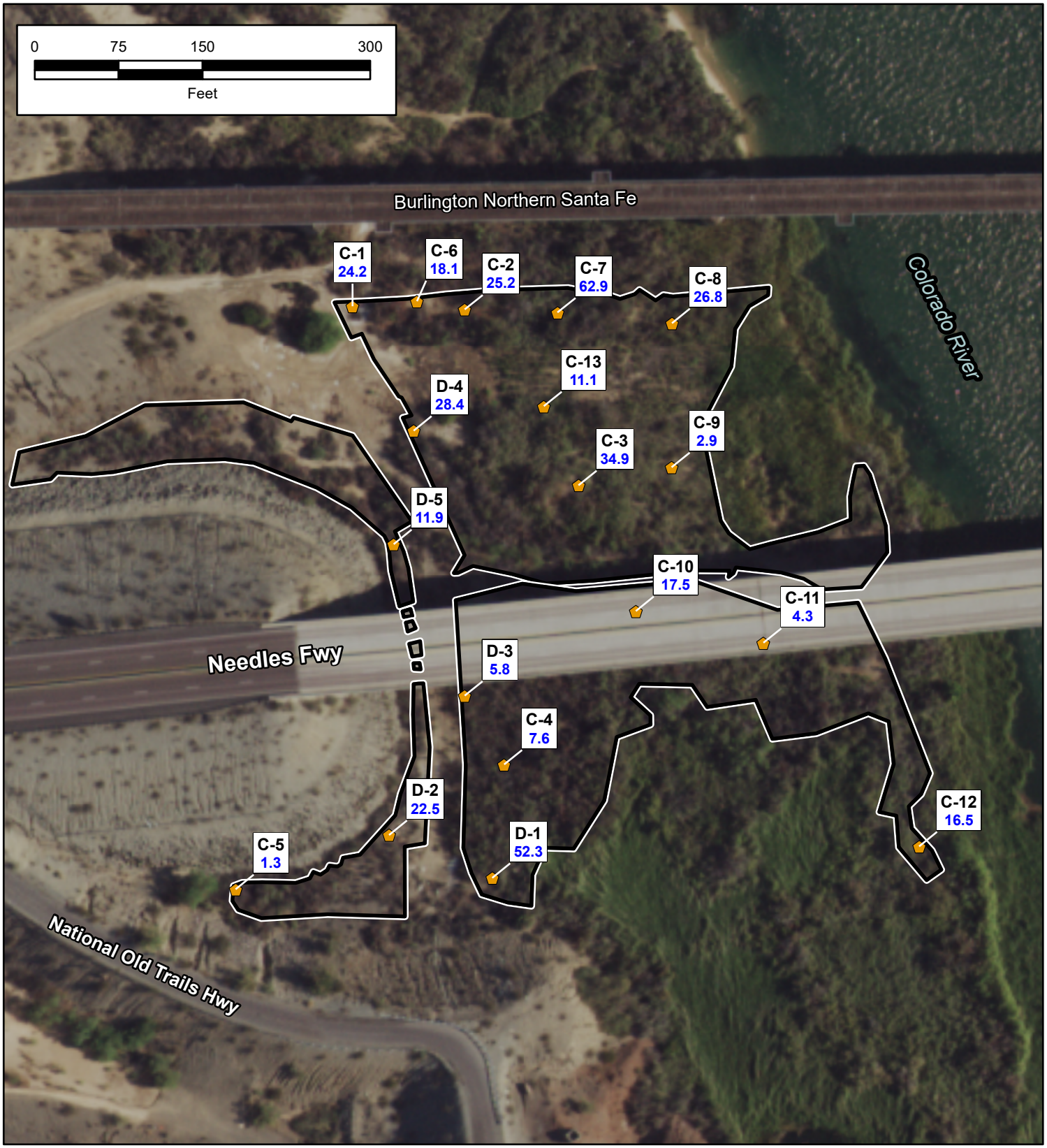
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Reference Site Locations

ARCADIS

FIGURE 12

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

- C-5 / 1.3 — Soil Sampling Location Name; July 2023 salinity measurement (deciSiemens per meter [dS/m])
- Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

N

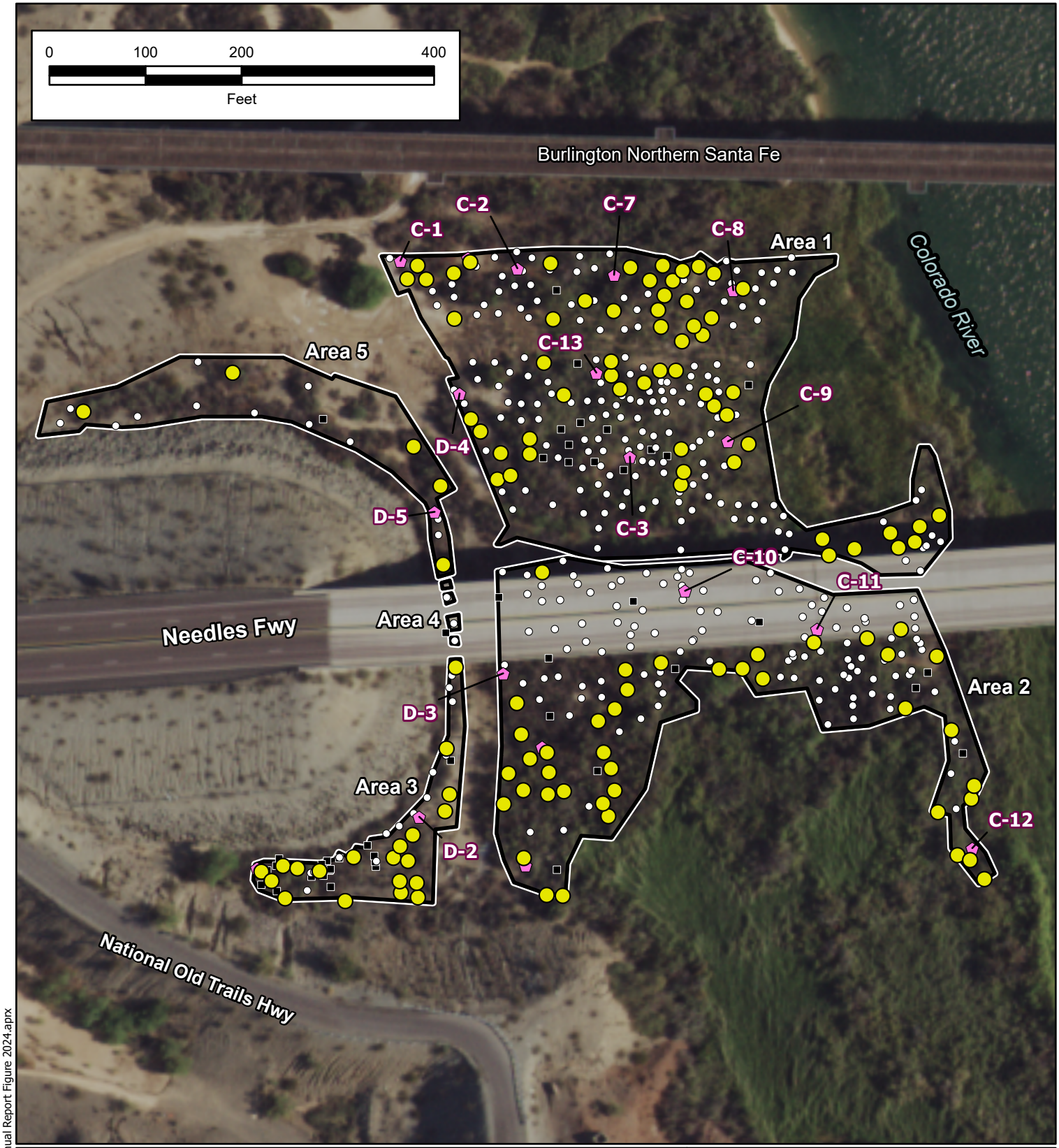
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Soil Sampling Results – July 2023

ARCADIS

FIGURE 13

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

Blue Palo Verde Locations

- Stress Symptoms Present
- No Stress Symptoms
- Unassessed

Soil Sampling Point

Planting Areas

N

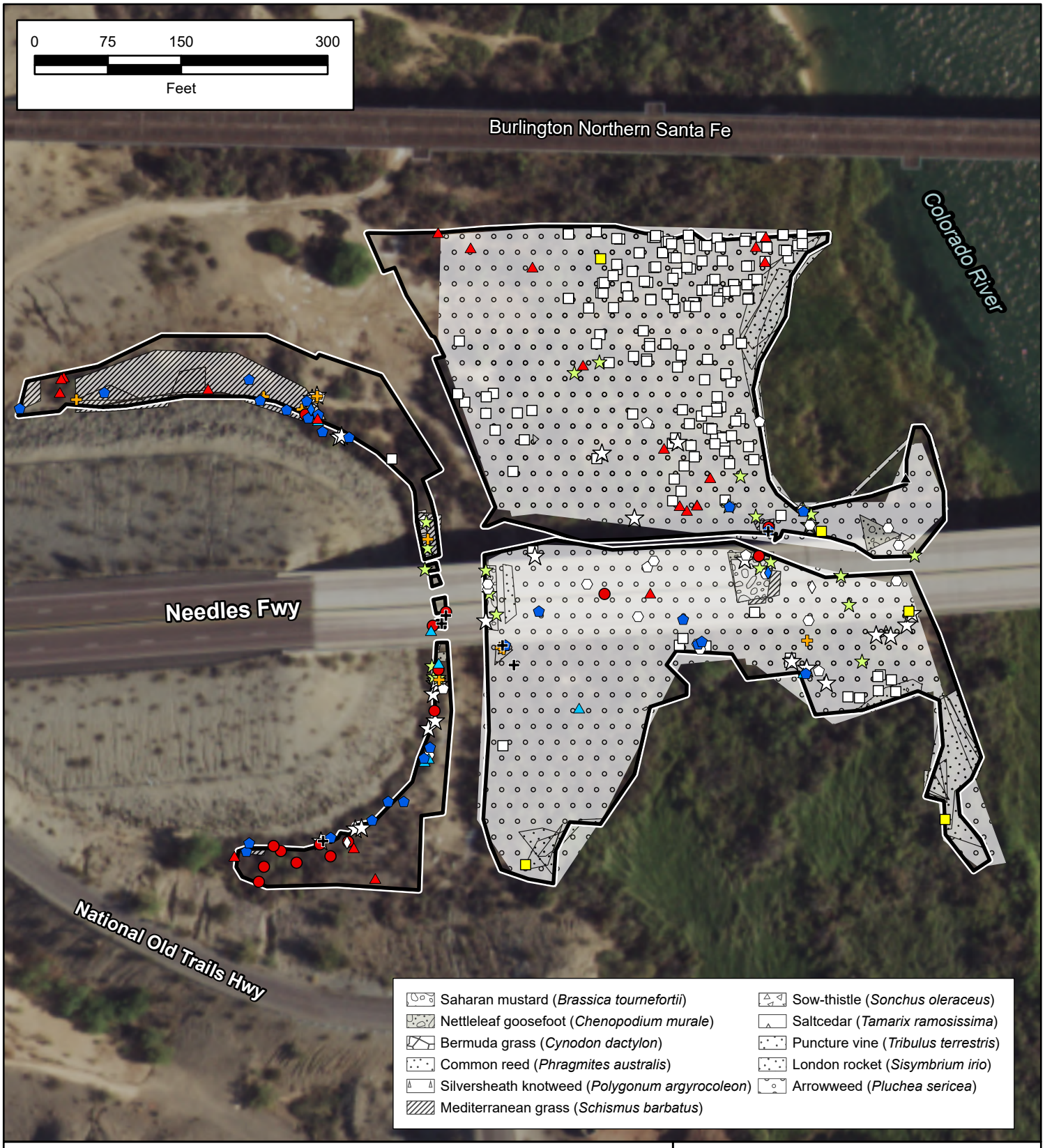
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1 MITIGATION MONITORING REPORT

Blue Palo Verde Stress Symptom Locations – August 2023

ARCADIS

FIGURE 14

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

Note: All weeds shown on this figure were treated during Year 1 (October 2022-October 2023)

Areas 1, 2, 3, 4, 5 (Floodplain Planting Area)

Invasive Plant Species

- Saharan mustard (*Brassica tournefortii*)
- Nettleleaf goosefoot (*Chenopodium murale*)
- Bermuda grass (*Cynodon dactylon*)
- Upland cotton (*Gossypium hirsutum*)
- Summer-cypress (*Kochia scoparia*)
- Common reed (*Phragmites australis*)
- Silversheath knotweed (*Polygonum argyrocoleon*)
- Common purslane (*Portulaca oleracea*)
- Russian thistle (*Salsola tragus*)
- Mediterranean grass (*Schismus barbatus*)
- Sow-thistle (*Sonchus oleraceus*)
- Saltcedar (*Tamarix ramosissima*)
- Puncture vine (*Tribulus terrestris*)
- London rocket (*Sisymbrium irio*)

Other Plant Species

- Arrowweed (*Pluchea sericea*)

N

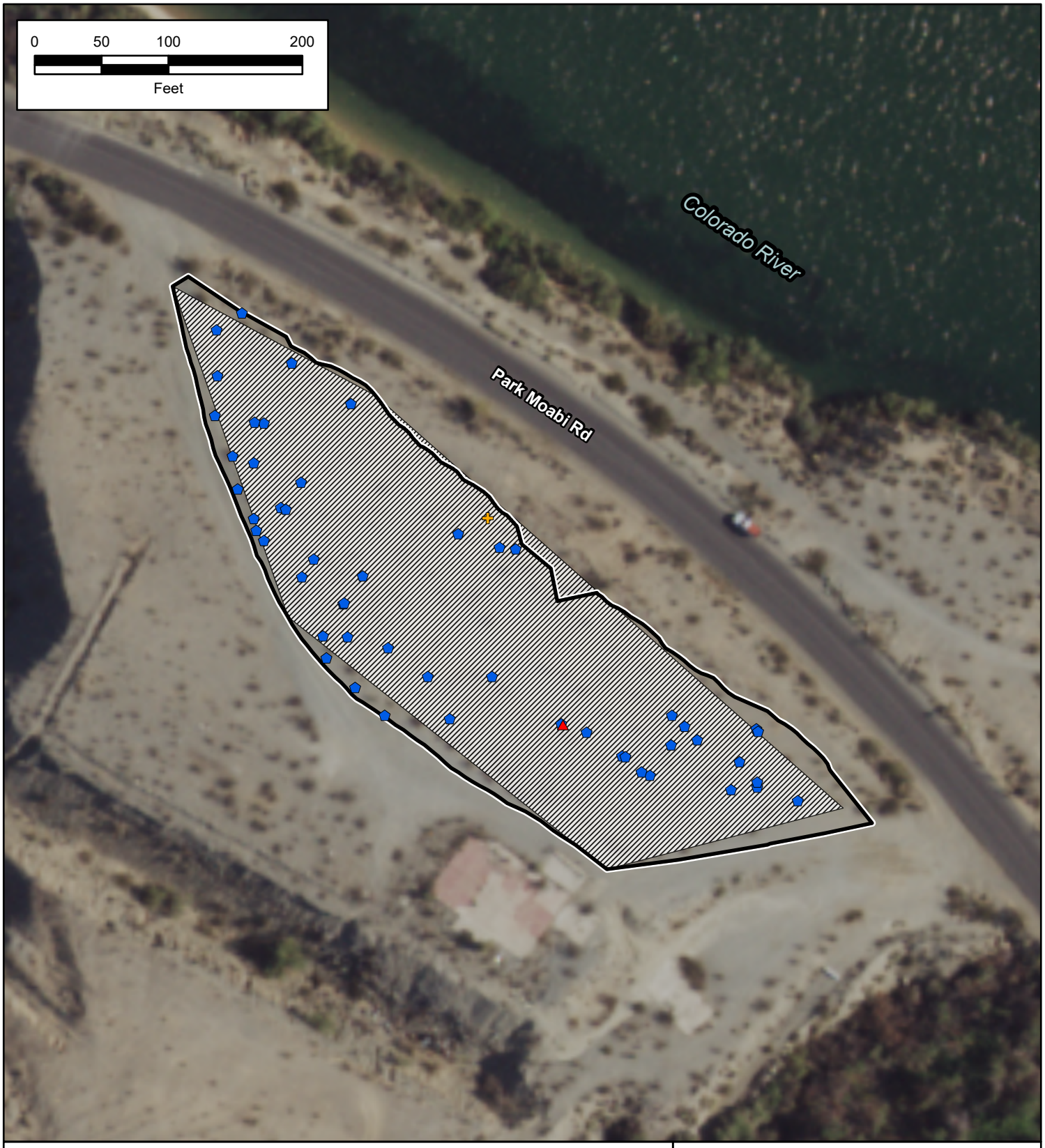
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Invasive Plant Species and Other Plant Species Locations (Floodplain Mitigation Planting Areas) – Year 1

ARCADIS

FIGURE 15A

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx



Legend

Note: All weeds shown on this figure were treated during Year 1 (October 2022-October 2023)

- UHR-1 (Upland Planting Area)

Invasive Plant Species

- Mediterranean grass (*Schismus barbatus*)
- Saltcedar (*Tamarix ramosissima*)
- Puncture vine (*Tribulus terrestris*)
- Mediterranean grass (*Schismus barbatus*)

N

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
TOPOCK REVEGETATION YEAR 1
MITIGATION MONITORING REPORT

Invasive Plant Species Locations (UHR-1) - Year 1

ARCADIS

15B

Path: T:_ENV\PGE_Topock\GEC\Pro\2024\Annual Report Figure 2024.aprx

Appendix A

Applicable Project Mitigation Measures

Mitigation Measure Title	Mitigation Measure Description
Mitigation Measure AES-1: Substantial Adverse Effects on Scenic Vistas (Groundwater FEIR Measure with Revisions).	(Groundwater FEIR Measure with Revisions). The proposed Project, including the Future Activity Allowance, shall be designed and implemented to adhere to the design criteria presented below: (f) The requirements of the Aesthetics and Visual Resources Protection and Revegetation Plan (C/RAWP Appendix N) shall be implemented throughout the construction, operation and maintenance, and decommissioning phases of the Project, including but not limited to replacement planting procedures (see Section 4.3), maintenance and adaptive management (see Section 5.2), and photo-monitoring (see Section 5.3). These measures apply to new Project components added as part of the Future Activity Allowance, should they be visible from Key View 5 or any of the other key views identified in the SEIR.
Mitigation Measure BIO-1a: No-net-loss of Jurisdictional Wetlands/Waters Function or Value (New Measure).	Unavoidable direct impacts to jurisdictional areas shall be documented by a wetland specialists or Field Contact Representative (FCR) during implementation of the proposed Project. To document unavoidable direct impacts, the extent of work areas near jurisdictional areas shall be delineated in the field using GPS technology and pre- and post-impact conditions of jurisdictional areas documented with photographs. The nature of construction within work areas shall also be described, including the Project facilities installed, equipment utilized, and duration of construction activities. Documentation of unavoidable impacts shall be submitted to CDFW and DTSC to ensure adequate mitigation is provided consistent with the requirements below. Unavoidable direct impacts to non-disturbed jurisdictional ephemeral waters (estimated at up to approximately 1.61 acres including direct impacts resulting from planned facilities and additional facilities constructed under the Future Activity Allowance) shall be mitigated to ensure no-net-loss of function or value. Mitigation shall include both (a) and (b) detailed below. Mitigation for ground disturbance associated with restoration and enhancement activities shall not be required. a) In-place restoration of jurisdictional areas directly impacted by construction at a 1:1 ratio (i.e., 1 acre of restoration for each acre of direct impact to non-disturbed jurisdictional area) shall occur in accordance with the Havasu National Wildlife Refuge Habitat Restoration Plan (Appendix G to the C/RAWP (CH2M Hill 2015b)) and Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O to the C/RAWP (CH2M Hill 2015b)). In-place restoration of areas directly impacted during construction will occur in two phases. The first phase will involve restoration within the areas directly impacted by construction where it will not interfere with continued operation and maintenance of the proposed Project (e.g., restoration of temporary construction work areas). The first phase of restoration shall begin within 1 year of completing construction. The second phase will involve restoration of areas that will be occupied by Project facilities to occur following decommissioning of the proposed Project. Restoration of jurisdictional areas following decommissioning of the proposed Project will be guided by a Final Habitat Restoration Plan (refer to Mitigation Measure BIO-1b). b) To address temporal loss of jurisdictional areas directly impacted by construction, PG&E shall provide compensatory mitigation at a minimum 2:1 ratio (2 acres of compensation for each acre of direct impacts to non-disturbed jurisdictional area). Compensatory mitigation to address temporal loss shall be agreed upon with CDFW prior to the start of construction, involve the same amount and quality of jurisdictional area(s) disturbed, and include one or more of the following approaches: 1) acquisition and preservation in perpetuity; 2) restoration; and/or 3) enhancement. Acquisition and preservation may include establishment of a conservation easement or purchase of credits from a CDFW- and/or USACE -approved mitigation banking program, or compliance with an applicable CDFW and/or USACE-approved in-lieu fee program. Restoration may include conversion of non-wetland habitat to functioning wetland habitat. Enhancement may include removal of non-native species in existing wetland habitat. As summarized in the technical memorandum, Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, included as Appendix V to the C/RAWP (CH2M Hill 2015b), PG&E has identified restoration areas within the historical floodplain of the Colorado River. The historical floodplain no longer functions as a riparian habitat with hydrologic connectivity to the river; therefore, restoration in the historical floodplain may qualify as compensatory mitigation to address temporal loss if hydrologic function can be restored. PG&E shall prepare a mitigation plan prior to the start of construction to specify methodology, criteria for meeting the 2:1 mitigation requirement, and monitoring and reporting for compensatory mitigation. The plan shall be subject to CDFW approval and in conformance with the identified performance standards, and submitted to DTSC, BLM, BOR, USFWS, DOI, Interested Tribes, and other appropriate landowners for review and comment within 60 days prior to finalization, as appropriate based on location of impacts. Restoration of jurisdictional areas within the Project Area shall be guided by the Havasu National Wildlife Refuge Habitat Restoration Plan (Appendix G to the C/RAWP [CH2M Hill 2015b]) and Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O to the C/RAWP [CH2M Hill 2015b]), as approved by CDFW, USFWS, and DOI. Implementation of these plans will be informed by the technical memorandum, Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, included as Appendix V to the C/RAWP (CH2M Hill 2015b), which provides preliminary information on the condition within fourteen proposed mitigation planting areas. The habitat restoration plans also specify on-site restoration success criteria, monitoring and reporting requirements, and adaptive management guidelines for salvage and replanting of trees, shrubs, and perennial species. In accordance with the habitat restoration plans, removal of riparian trees (e.g., palo verde trees) shall be replaced at a 3:1 ratio (i.e., planting 3 trees in restoration areas for each tree removed during construction). The success criteria for mitigation plantings shall be a final minimum plant replacement ratio of 2.25:1 (75% overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period. Adaptive management guidelines outline modifications to restoration approaches, as appropriate, to ensure successful establishment of native vegetation and desired density of cover of plants. As required by the plans, the following adaptive management actions shall be implemented if success criteria are not being met: weed control, irrigation modification, herbivory protection, and additional plantings. Reporting to DTSC, CDFW, and USFWS shall be completed within 90 days of completing each monitoring year. The habitat restoration plans also specify design and construction avoidance and minimization measures, including: -Locating pipelines, wells, and staging and storage areas along roadways, pipeline rights-of-way, and other previously disturbed areas to avoid impacts to vegetation to the extent feasible. -Performing pre-activity surveys prior to ground disturbance to identify and demark with flagging, fencing, and/or signage areas of native vegetation and sensitive habitats in the immediate vicinity of the construction areas. -Providing construction workers with environmental awareness training regarding biological resources including sensitive species and habitats.

Mitigation Measure Title	Mitigation Measure Description
Mitigation Measure CuI-1a-5: Avoidance of Indigenous Plants of Biological and Cultural Significance (Groundwater FEIR Measure with Revisions).	During construction, operation and maintenance, and decommissioning of the Project, should any indigenous plants of traditional cultural significance and list Project, should any indigenous plants of traditional cultural significance and listed in Appendix PLA of the Groundwater FEIR be identified within the Project Area, PG&E shall avoid, protect, and encourage the natural regeneration of the identified plants. In the event that impacts to the identified plants cannot be avoided and such plants are displaced, provisions included in the Plan for Culturally Significant Plants (Appendix A of the CIMP) shall be implemented. This mitigation measure is not meant to replace or subsume any actions required by state or federal entities with regard to the protection of species listed as rare, threatened, or endangered. Appendix A of the CIMP requires preconstruction surveys of works areas, staging areas, and access routes to identify and demarcate culturally significant plants; protocols for transplanting culturally significant trees and plants; protocols for salvaging topsoil for re-use during site rehabilitation to encourage regrowth of desert annuals; collecting seeds for future planting; protocols for replacement planting by container grown plants/trees; and future monitoring of transplanted trees and shrubs.

Appendix B

Photographs of Revegetation Implementation Activities

Photo: 1

Date:
September 16, 2023

Description:
Overview of Areas 1, 2 and 3 as seen from National Trails Highway facing north.

Location:
National Trails Highway south of Highway I-40.

Photo: 2

Date:
September 16, 2023

Description:
Overview of Areas 1 (background) and 5 (foreground) as seen from National Trails Highway facing east.

Location:
National Trails Highway north of Highway I-40.

Photo: 3

Date:
September 13, 2023

Description:
Blue palo verde mitigation plants (left foreground) and arrowweed in Area 1.

Location:
Area 1

Photo: 4

Date:
August 17, 2023

Description:
Screwbean mesquite and honey mesquite mitigation plants in the southern portion of Area 1.

Location:
Area 1

Photo: 5

Date:
September 16, 2023.

Description:
Blue palo verde growing in the western half of Area 2.

Location:
Area 2.

Photo: 6

Date:
September 13, 2023

Description:
Dense screwbean mesquite, honey mesquite, and blue palo verde mitigation plants in the eastern half of Area 2.

Location:
Area 2.

Photo: 7

Date:
August 17, 2023

Description:
Desert smoke tree mitigation plants (right), blue palo verde mitigation plants, and naturally-occurring honeysweet (left) in Area 3.

Location:
Area 3

Photo: 8

Date:
August 17, 2023

Description:
Overview of
Area 3 as seen from National Trails Highway.

Location:
Area 3

Photo: 9

Date:
September 15, 2023

Description:
A mixture of mitigation plantings and naturally-occurring native species provides diverse habitat in Area 5 (facing west).

Location:
Area 5

Photo: 10

Date:
September 16, 2023

Description:
Naturally-occurring creosote bush and mitigation plantings in the northwestern portion of UHR-1.

Location:
UHR-1

Photo: 11

Date:
September 17, 2023

Description:
Blue palo verde mitigation plantings in individual enclosures underneath the Highway 1-40 bridge in Area 4. Natural salt crusts evident in depressions.

Location:
Area 4

Photo: 12

Date:
September 13, 2023

Description:
Blue palo verde mitigation
Plants have enlarged in size during Year 1, often growing as wide as tall.

Location:
Area 1

Photo: 13

Date:
August 15, 2023

Description:
Stress related sap emerging from a blue palo verde mitigation plant in August.

Location:
Area 1

Photo: 14

Date:
September 16, 2023

Description:
Desert smoke tree mitigation plant has greatly increased in size in Year 1.

Location:
Area 5

Photo: 15

Date:
September 16, 2023

Description:
Catclaw acacia mitigation plant in Area 5.

Location:
Area 5

Photo: 16

Date:
September 13, 2023

Description:
Honey mesquite mitigation plant.

Location:
Area 2

Photo: 17

Date:
September 13, 2023

Description:
Screwbean mesquite mitigation plant.

Location:
Area 1

Photo: 18

Date:
September 13, 2023

Description:
Butterflies (*Apodemia* sp.) pollinating screwbean mesquite flowers.

Location:
Area 2

Photo: 19

Date:
March 16, 2023

Description:
Silver cholla mitigation plant with flower buds.

Location:
UHR-1

Photo: 20

Date:
September 16, 2023

Description:
Buckhorn cholla mitigation plant.

Location:
UHR-1

Photo: 21

Date:
April 5, 2023

Description:
Beavertail cactus mitigation plant displaying flowers and flower buds.

Location:
UHR-1

Photo: 22

Date:
May 4, 2023

Description:
Cattle saltbush mitigation plant has increased in width and height in Year 1.

Location:
UHR-1

Photo: 23

Date:
December 7, 2022

Description:
Flowering Anderson's desert thorn mitigation plant.

Location:
UHR-1

Photo: 24

Date:
October 19, 2022

Description:
Anderson's desert thorn mitigation plant.

Location:
UHR-1

Photo: 25

Date:
October 11, 2023

Description:
Greater roadrunner foraging in Area 2.

Location:
Area 2

Photo: 26

Date:
September 17, 2023

Description:
Desert cottontail rabbit between Areas 1 and 5.

Location:
Along the road between Areas 1 and 5.

Appendix C

Photographs from Photo-Monitoring Stations

Photostation-001

View: East

Photo: 3/21/2022
Pre-planting

Located on the **n**orthwest corner of Area 1 below and south of railroad bridge

Photostation-001

View: East

Photo 9/13/2023
Year 1

Located on the **n**orthwest corner of Area 1 below and south of railroad bridge

Restoration Area 1 planted with blue palo verde. Cover of blue palo verde within the portion of this area is approximately 7%. Arrowweed is also present, with approximately 4% cover. Natural recruitment of screwbean mesquite and honey mesquite is high in Area 1, with cover by these species at approximately 3% (honey mesquite visible in the foreground). This area experiences ponding and visible salt crusts at the north end.

Photostation-002

View: Southwest

Photo: 3/21/2022
Pre-planting

Located on the northeast corner of Area 1 just west of the Colorado River

Photostation-002

View: Southwest

Photo 9/13/2023
Year 1

Located on the northeast corner of Area 1 just west of the Colorado River

Cover of blue palo verde within the portion of this area is approximately 3%. Arrowweed is dense in this area (27% cover). A 4.5-foot-tall screwbean mesquite mitigation plant is visible in the foreground. This area experiences ponding and visible salt crusts have formed, especially along the areas closest to the Colorado River.

Photostation-003

View: Southwest

Photo: 3/21/2022
Pre-planting

Located in the center of Area 1 between the I-40 bridge and the railroad bridge

Photostation-003

View: Southwest

Photo 9/13/2023
Year 1

Located in the center of Area 1 between the I-40 bridge and the railroad bridge

The greatest cover by mitigation plants in Area 1 occurs between the I-40 bridge and the railroad bridge: blue palo verde (20% cover), honey mesquite (5% cover), and screwbean mesquite (15% cover) within the portion of this area is the highest in Area 1. This portion of Area 1 also supports large stands of arrowweed (20% cover). Volunteer mesquite mitigation plants tower over blue palo verde in this area, with some individuals over 8 feet tall.

Photostation-004

View: Southeast

Photo: 3/21/2022
Pre-planting

Located in Area 2 in the northwest corner under the I-40 bridge

Photostation-004

View: Southeast

Photo 9/13/2023
Year 1

Located in Area 2 in the northwest corner under the I-40 bridge

Area 2, like Area 1, was planted with blue palo verde and supports volunteer recruit mitigation plants of honey mesquite and screwbean mesquite. Cover in this section of Area 1 is dominated by blue palo verde (10% cover) with a few honey mesquite (1% cover) and screwbean mesquite (2% cover) mitigation plants. Arrowweed (5% cover) is scattered throughout this portion of Area 2.

Photostation-004b

View: Southeast

Photo: 3/21/2022
Pre-planting

Located between Area 2 and Area 4

Photostation-004b

View: Southeast

Photo 9/13/2023
Year 1

Located between Area 2 and Area 4

Area 4 consists of four separate enclosures, each with one planted blue palo verde. The enclosures also support some naturally-occurring native species such as Emory's rock daisy, Arizona lupine and silky dalea.

Photostation-005

View: North

Photo: 3/21/2022
Pre-planting

Located in Area 2 near the eastern boundary south of the I-40 bridge.

Photostation-005

View: North

Photo 9/14/2023
Year 1

Located in Area 2 near the eastern boundary south of the I-40 bridge.

This portion of Area 2 supports tall blue palo verde and a dense stand of volunteer screwbean mesquite recruits. In this section of Area 2, cover by blue palo verde (8% cover) is similar to that of screwbean mesquite (7% cover), with lower cover by honey mesquite (2% cover). This portion of Area 2 supports relative high cover of arrowweed (13% cover).

Photostation-006

View: North

Photo: 3/21/2022
Pre-planting

Located in Area 2 near its western boundary in the southwest corner.

Photostation-006

View: North

Photo 9/14/2023
Year 1

Located in Area 2 near its western boundary in the southwest corner.

This portion of Area 2 supports blue palo verde (4% cover) and arrowweed (6% cover). Natural recruitment of screwbean and honey mesquite is relatively low in this portion of Area 2, with cover by these species at approximately 1%. This area experiences ponding and visible salt crusts are present.

Photostation-007

View: East

Photo: 3/21/2022
Pre-planting

Located in Area 3 at the western end

Photostation-007

View: East

Photo 9/14/2023
Year 1

Located in Area 3 at the western end

Area 3 supports plantings of blue palo verde (4% cover) and desert smoketree (2% cover), as well as honey and screwbean mesquite volunteer recruits (4% cover). In addition, Area 3 supports a dense stand of arrowweed (6% cover), and a range of native species, including Arizona lupine, alkali mallow, Emory's rock daisy, notch-leaved phacelia, and others. During rain events, Area 3 can experience energetic flows of water.

Photostation-008

View: Northwest

Photo: 3/21/2022
Pre-planting

Located in Area 5 along the southern perimeter

Photostation-008

View: Northwest

Photo 9/14/2023
Year 1

Located in Area 5 along the southern perimeter

Area 5 supports mitigation plantings of blue palo verde (2% cover) desert smoketree (3% cover), and catclaw acacia (1% cover), as well as honey mesquite and screwbean mesquite mitigation plants from volunteer recruits (4% cover). A large existing honey mesquite tree occurs in this area (not shown in photo). Area 5 also supports mature naturally-occurring shrubs, including cheesebush, sweetbush, and creosote bush. Like Area 3, Area 5 experiences elevated water flow during heavy rain events.

Photostation-009

View: Northwest

Photo: 3/21/2022
Pre-planting

Located in Area 5 near the furthest west corner

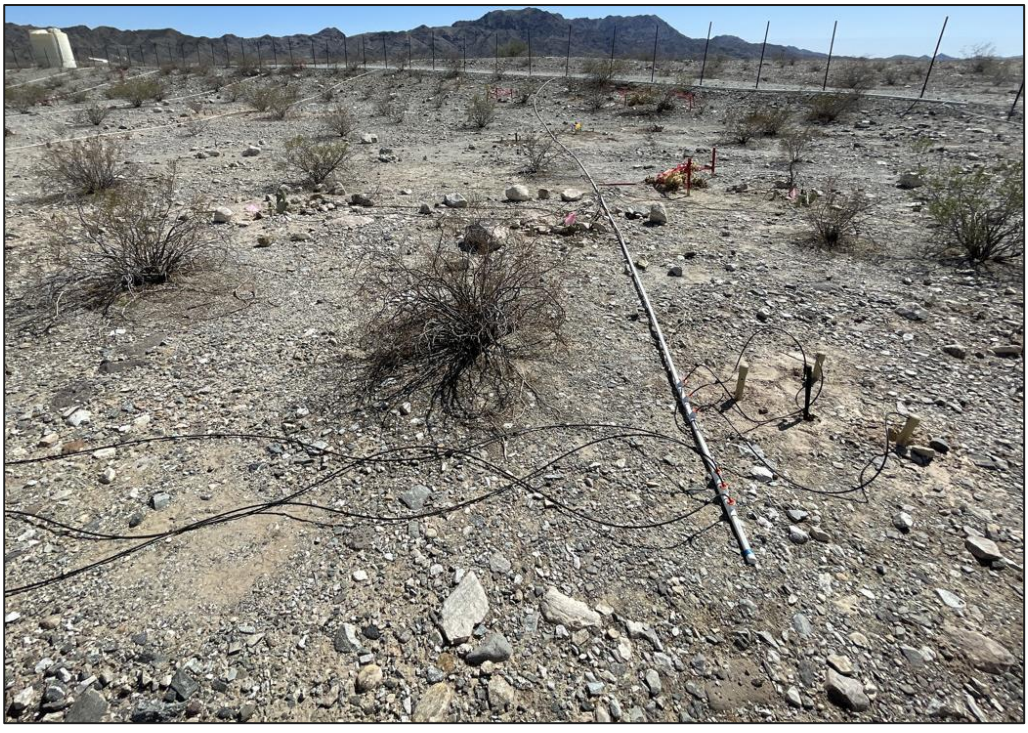
Photostation-009

View: Northwest

Photo: 9/14/2023
Year 1

Located in Area 5 near the furthest west corner

This portion of Area 5 supports desert smoketree and catclaw acacia mitigation plantings along with naturally-occurring native shrubs such as creosote bush and cheesebush. Note the large cobble typical of desert washes.



Photostation-012

View: South

Photo: 3/21/2022
Pre-planting

Located in UHR-1 in the northernmost corner

Photostation-012

View: South

Photo: 9/14/2023
Year 1

Located in UHR-1 in the northernmost corner

UHR-1 supports upland mitigation plantings, including beavertail cactus (middle foreground), buckhorn cholla, silver cholla, cattle saltbush, and Anderson's thornbush. UHR-1 was not cleared prior to planting and continues to support a stand of mature creosote bush that is dominant with 28% cover.

Appendix D

Observed Plant Species in Mitigation Planting Areas

Appendix D. Observed Plant Species in Mitigation Planting Areas

Topock Revegetation Annual Report - Year 1

Pacific Gas and Electric Company

Scientific Name	Common Name	Native/Non-native	Area 1	Area 2	Area 3	Area 4	Area 5	UHR-1
Trees								
Parkinsonia florida	blue palo verde	native	x	x	x	x	x	
Populus fremontii	Fremont cottonwood	native	x	x				
Prosopis glandulosa var. torreyana	honey mesquite	native	x	x	x		x	
Prosopis pubescens	screwbean mesquite	native	x	x	x		x	
Psorothamnus spinosus	desert smoketree	native			x		x	
Senegalia greggii	catclaw acacia	native					x	
Shrubs								
Ambrosia salsola	cheesebush	native		x			x	
Atriplex polycarpa	allscale saltbush	native			x			x
Baccharis salicifolia	mulefat	native		x				
Bebbia juncea	sweetbush	native					x	
Larrea tridentata	creosote bush	native	x	x	x	x	x	x
Lycium andersonii	Anderson’s thornbush	native						x
Pluchea sericea	arrowweed	native	x	x	x		x	
Tamarix ramosissima	salt-cedar	non-native	x	x	x	x	x	
Cacti								
Cylindropuntia acanthocarpa	buckhorn cholla	native						x
Cylindropuntia echinocarpa	silver cholla	native						x
Opuntia basilaris var. *basilaris*	beavertail	native						x

Appendix D. Observed Plant Species in Mitigation Planting Areas

Topock Revegetation Annual Report - Year 1

Pacific Gas and Electric Company

Scientific Name	Common Name	Native/Non-native	Area 1	Area 2	Area 3	Area 4	Area 5	UHR-1
Herbaceous Species (annuals, herbaceous perennials, graminoids)								
Allionia incarnata var. *incarnata*	trailing windmills	native			x		x	
Amaranthus palmeri	Palmer's amaranth	native		x				
Amsinckia tessellata	desert fiddleneck	native						x
Aristida adscensionis	three-awn	native			x		x	
Avena fatua	wild oats	non-native					x	
Bassia (Kochia) scoparia	summer-cypress	non-native		x	x	x	x	
Boerhavia coccinea	scarlet spiderling	native		x			x	
Boerhavia wrightii	Wright's spiderling	native					x	x
Bouteloua barbata var. *barbata*	sixweeks grama	native			x			
Brassica tournefortii	Saharan mustard	non-native		x	x	x	x	
Bromus rubens	red brome	non-native	x					
Chenopodium murale	nettleleaf goosefoot	non-native	x	x	x	x	x	
Chylismia brevipes subsp. *brevipes*	golden suncup	native			x			
Croton setiger	doveweed, turkey-mullein	native		x	x		x	
Cryptantha maritima	Guadalupe cryptantha	native			x	x	x	x
Cryptantha micrantha var. *micrantha*	purple-root cryptantha	native				x		
Cynodon dactylon	Bermuda-grass	non-native	x	x	x	x	x	
Dalea mollis	silky dalea	native		x		x		
Dalea mollissima	silky dalea	native						x
Datura wrightii	jimson-weed	native					x	
Echinochloa colona	jungle rice	non-native		x				
Erigeron bonariensis	flax-leaved fleabane	non-native		x				
Eriogonum thomasii	Thomas' wild buckwheat	native					x	x
Euphorbia albomarginata	rattlesnake weed	native					x	

Appendix D. Observed Plant Species in Mitigation Planting Areas

Topock Revegetation Annual Report - Year 1

Pacific Gas and Electric Company

Scientific Name	Common Name	Native/Non-native	Area 1	Area 2	Area 3	Area 4	Area 5	UHR-1
Euphorbia micromera	Sonoran sandmat	native		x				
Euphorbia polycarpa	small-seeded sandmat	native		x	x	x	x	x
Festuca microstachys	sixweeks fescue	native		x	x		x	x
Festuca myuros	rattail fescue	non-native				x	x	
Geraea canescens	desert-sunflower	native			x			
Gossypium hirsutum	upland cotton	non-native	x					
Heliotropium curassavicum var. oculatum	alkali heliotrope	native	x					
Hordeum murinum	foxtail barley	non-native					x	
lasiocarpum	shaggyfruit pepperweed	native		x		x	x	x
Linanthus jonesii	Jone's linanthus	native					x	
Lupinus arizonicus	Arizona lupine	native	x	x	x	x	x	
Malvella leprosa	alkali mallow	native			x			
Nicotiana obtusifolia	desert tobacco	native			x			
Palafoxia arida	Spanish needle	native					x	x
Perityle emoryi	Emory's rock daisy	native		x	x	x		
Phacelia crenulata subsp. *ambigua*	notch-leaved phacelia	native			x		x	
Phragmites australis	common reed	native/non	x	x				
Plantago ovata subsp. *fastigiata*	desert plantain	native	x					x
Polygonum argyrocoleon	silversheath knotweed	non-native	x	x			x	
Portulaca oleracea	common purslane	non-native		x			x	
Salsola tragus	Russian-thistle	non-native	x	x	x	x	x	
Salvia hispanica	Mexican chia	non-native					x	
Schismus barbatus	Mediterranean grass	non-native	x	x	x		x	x
Schoenoplectus californicus	California bulrush	native		x				

Appendix D. Observed Plant Species in Mitigation Planting Areas

Topock Revegetation Annual Report - Year 1

Pacific Gas and Electric Company

Scientific Name	Common Name	Native/Non-native	Area 1	Area 2	Area 3	Area 4	Area 5	UHR-1
Sisymbrium irio	London rocket	non-native	x	x	x	x	x	
Solanum americanum	American black nightshade	native		x				
Sonchus oleraceus	sow-thistle	non-native		x	x	x		
Spergula arvensis	corn spurrey	non-native			x			
Stephanomeria pauciflora	brownplume wirelettuce	native		x		x		
Tidestromia suffruticosa var. oblongifolia	honeysweet	native			x		x	
Tribulus terrestris	puncture vine	non-native	x	x	x		x	
Typha angustifolia	narrow-leaved cattail	non-native		x				

Appendix E

Observed Wildlife Species in Mitigation Planting Areas

Appendix E
Observed Wildlife Species in Mitigation Planting Areas
Topock Revegetation As-Built Report
Topock Groundwater Remediation Project
Pacific Gas Electric Company

Scientific Name	Common Name	Native/Non-native
Birds		
Charadrius vociferus	killdeer	Native
Chordeiles acutipennis	lesser nighthawk	Native
Circus hudsonius	northern harrier	Native
Geococcyx californianus	greater roadrunner	Native
Quiscalus mexicanus	great-tailed grackle	Native
Sayornis nigricans	black phoebe	Native
Streptopelia decaocto	Eurasian collared-dove	Non-native
Zonotrichia leucoprys	white-crowned sparrow	Native
Mammals		
Equus asinus	wild burro	Non-native
Mephitis mephitis	striped skunk	Native
Procyon lotor	racoon	Native
Sylvilagus audubonii	desert cottontail	Native
Urocyon cineoargenteus	gray fox	Native
Reptiles		
Dipsosaurus dorsalis	desert iguana	Native
Uta stansburiana	western side-blotched lizard	Native
Invertebrates		
Agapostemon mellicentris	honey-tailed striped sweat bee	Native
Apodemia sp.	butterfly	Unknown
Cicadoidea superfamily	cicada	Native
Iris oratoria	Mediterranean mantis	Native
Lepidoptera order	caterpillar	Unknown
Mallodon dasystomus	hardwood stump borer	Native
Mutillidae suborder	golden colored velvet ant	Native
Pepsis thisbe	Thisbe's tarantula-hawk wasp	Native
Zygoptera suborder	blue damselfly and gray damselfly	Unknown

Appendix F

Photographs of Reference Sites

PS013 - RF-1 (October 7, 2022). Natural large wash supporting native mitigation plant species, including blue palo verde and desert smoke tree. Note large blue palo verde dominate the northern section of RF-1. Native cover = 10%. View looking northeast.

PS013 - RF-1 (October 7, 2022). Large wash with rocks, cobble, and gravel, with desert smoke tree in foreground and large blue palo verde in the background. Other species in this reference area that are not visible include buckhorn cholla, honey mesquite, and catclaw acacia. Native cover = 10%. View looking southwest.

PS014 - RF-1 (October 8, 2022). Large natural wash supporting native mitigation plant species, including blue palo verde, honey mesquite, catclaw acacia, desert smoke tree, and buckhorn cholla. Note desert smoke tree in foreground. Native cover = 10%. View looking northeast.

PS014 - RF-1 (October 8, 2022). Large natural wash supporting native mitigation plant species, particularly desert smoke tree (southern end near Interstate 40 bridge in background). Native cover = 10%. View looking southwest.

PS015 – RF-2 (October 7, 2022). Small natural wash supporting large honey mesquite, as well as seedlings and juveniles (not visible). Native cover = 25%. View looking southeast.

PS016 – RF-3 (October 8, 2022). Natural wash supporting blue palo verde with a range of age classes (very large individual in the background and three smaller individuals in the middle). Catclaw acacia also present. Native cover = 10%. View looking south.

PS016 – RF-3 (October 8, 2022). Wash adjacent to recently constructed road (note culverts) supporting primarily blue palo verde, as well as a large swath of non-native Bermuda grass growing under and around native shrubs. Native cover = 10%. View looking north.

PS017 – RF-4 (October 8, 2022). This reference area in Bat Cave Wash supports catclaw acacia, with silver cholla and beavertail cactus occurring on slopes above wash. Note catclaw acacia in foreground and background. Native cover = 10%. View looking west.

PS018 – RF-4 (October 8, 2022). Another view of Bat Cave Wash with catclaw acacia individuals along the wash with non-native Bermuda grass occurring under shrubs and along the slope edge. Native cover = 10%. View looking east.

PS019 – RF-5 (October 8, 2022). Reference site located at the edge of a tributary to the Colorado River within the Havasu National Wildlife Refuge supporting a range of wash, riparian, and upland species, including screwbean mesquite (in foreground). Native cover = 90%. View looking southeast.

PS020 – RF-6 (October 7, 2022). Reference site located adjacent to UHR-1, a rocky slope that supports mitigation plant species, including cattle spinach, beavertail cactus, and buckhorn cholla . Native cover = 10%. View looking south.

PS021 – RF-6 (October 7, 2022). Rocky slope just outside or UHR-1 supports mature individuals of mitigation plant species, including mature individuals of cattle spinach and beavertail cactus within a creosote bush-dominated community. Native cover = 10%. View looking east.

Arcadis U.S., Inc.
101 Creekside Ridge Court, Suite 200
Roseville
California 95678
Phone: 916 786 0320
Fax: 916 786 0366
www.arcadis.com