California High-Speed Rail Authority

San Jose to Merced Project Section

Preliminary Compensatory Mitigation Plan

November 2019

CALIFORNIA High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

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ACRONYMS AND ABBREVIATIONS

Aquatic Resources Delineation Report	*San Jose to Merced Project Section: Aquatic Resources Delineation Report*
ATC	automatic train control
Authority	California High-Speed Rail Authority
Bay Area	San Francisco Bay Area
BO	biological opinion
C.F.R.	Code of Federal Regulations
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CWA	Clean Water Act
Draft EIR/EIS	*California High-Speed Rail San Jose to Merced Project Section Draft EIR/EIS*
EIR	environmental impact report
EIS	environmental impact statement
FESA	federal Endangered Species Act
FRA	Federal Railroad Administration
GIS	geographic information system
HCE	habitat credit exchange
HSR	high-speed rail
HUC	hydrologic unit code
I-	Interstate
ILF	in-lieu fee
MOU	memorandum of understanding
mph	miles per hour
MT	Main Track
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Fund
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
pCMP	preliminary Compensatory Mitigation Plan
POST	Peninsula Open Space Trust
PRM	permittee-responsible mitigation
Procedures	*State Wetland Definition and Procedures for Discharges of Dredge or Fill Material to Waters of the State*
project extent, project	portion of the San Jose to Merced Project Section from Scott Road in San Jose to Carlucci Road
RIBITS	Regulatory In-Lieu Fee & Bank Information Tracing System

RSA	resource study area
SCVHA	Santa Clara Valley Habitat Agency
SCVOSA	Santa Clara Valley Open Space Authority
SCVWD	Santa Clara Valley Water District
SOP	*Standard Operating Procedures for Determination of Mitigation Ratios*
SPD Guidelines	*Regional Compensatory Mitigation and Monitoring Guidelines for the South Pacific Division*
SR	State Route
SWRCB	State Water Resources Control Board
U.S.C.	United States Code
UPRR	Union Pacific Railroad
US	U.S. Highway
USACE	U.S. Army Corps of Engineers
USEO	U.S. Presidential Executive Order
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

The California High-Speed Rail Authority (Authority) proposes to construct, operate, and maintain an electric-powered high-speed rail (HSR) system in California, connecting the San Francisco Bay Area (Bay Area) and Central Valley to Southern California. When completed, the nearly 800-mile train system would provide new passenger rail service to more than 90 percent of the state's population. More than 200 weekday trains would serve the statewide intercity travel market. The system would be capable of operating speeds up to 220 miles per hour (mph) in certain HSR sections, with state-of-the-art safety, signaling, and automatic train control (ATC) systems. The California HSR System would connect and serve the state's major metropolitan areas, extending from San Francisco to Los Angeles and Anaheim in Phase 1, with extensions to Sacramento and San Diego in Phase 2.

The Authority and Federal Railroad Administration (FRA) commenced their tiered environmental planning process with the 2005 *Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California High-Speed Train System* (Authority and FRA 2005), followed by the *Bay Area to Central valley High Speed Train Final Program EIR/EIS* (Authority and FRA 2008). These documents established the HSR sections constituting the California HSR System and evaluated the effects of the proposed corridors. After completion of the first-tier programmatic environmental documents the Authority and FRA approved the HSR system, selected corridors and stations for further study, and began preparing second-tier project environmental evaluations for sections of the statewide HSR system.

This preliminary Compensatory Mitigation Plan (pCMP) addresses the portion of the San Jose to Merced Project Section from Scott Road in San Jose to Carlucci Road (project extent, or project), the western limit of the Central Valley Wye (the interconnection between the San Jose to Merced Project Section and the Merced to Fresno Project Section). The project would primarily follow Monterey Road, U.S. Highway (US) 101, and State Route (SR) 152 through Pacheco Pass. Information from this report will be summarized in the *California High-Speed Rail San Jose to Merced Project Section Draft EIR/EIS* (Draft EIR/EIS) and will be part of the administrative record supporting environmental review of the project.

Pursuant to 23 United States Code (U.S.C.) Section 327, under the National Environmental Policy Act (NEPA) Assignment Memorandum of Understanding (MOU) between the FRA and the State of California, effective July 23, 2019, the Authority is the federal lead agency for NEPA for the project. Under the MOU the Authority is the lead agency for environmental reviews and approval for all Phase 1 and Phase 2 projects.

1.1 Purpose of the Preliminary Compensatory Mitigation Plan

The primary purpose of the pCMP is to illustrate the availability of lands containing wetlands or waters of the U.S. to meet compensatory mitigation needs under Section 404 of the Clean Water Act (CWA). Secondarily, the pCMP also discusses availability of lands to meet compensatory mitigation needs under the California and federal Endangered Species Acts.

1.1.1 Compensatory Mitigation Plan Process

This pCMP supports the Checkpoint C Report, as described in the *Memorandum of Understanding [MOU] among the FRA, Authority, U.S. Environmental Protection Agency, and U.S. Army Corps of Engineers Regarding National Environmental Policy Act, Clean Water Act Section 404, and Rivers and Harbors Act Section 14 Integration Process for the California High-Speed Trail Program* (NEPA/404/408 MOU) (FRA et al. 2010). The purpose of the MOU and the checkpoint process is to facilitate compliance with NEPA, CWA Section 404 (33 U.S.C. § 1344), and Rivers and Harbors Act Section 14 (33 U.S.C. § 408) processes for the project-level (Tier 2) EISs for the sections of the proposed HSR system. Integrating these processes is intended to expedite decision making at the planning and permitting stages while improving the overall quality of those decisions. This pCMP supports those processes by identifying compensatory mitigation options to offset discharges associated with the preliminary preferred alternative.

This pCMP builds upon the *Preliminary Compensatory Mitigation Plan* developed for the Central Valley Wye (Authority 2018). Because the San Jose to Merced Project Section and the Central Valley Wye overlap in the San Joaquin Valley, there are overlaps in compensatory mitigation needs. Consequently, some of the mitigation options proposed in this document are also proposed in the Central Valley Wye pCMP (Authority 2018).

Consistent with Section 404 compensatory mitigation guidelines described in Section 2.1, Overview of Laws and Regulations, the mitigation strategy prioritizes options that are within the same watershed as the impacts. For species mitigation, the geographic boundaries within which mitigation should be undertaken are biologically relevant and species-specific as described in Section 4.5, Compensatory Mitigation Strategy. Also consistent with the guidelines, the compensatory mitigation strategy includes mitigation and conservation banks, in-lieu fee (ILF) programs, permittee-responsible mitigation (PRM) sites, and partnerships to perform restoration and enhancement activities on conserved lands.

Consistent with guidance provided by the USACE (2008, 2015), this pCMP recommends a combination of existing bank and ILF credits and PRM sites as well as partnerships to implement restoration and enhancement programs on existing protected lands. For each aquatic resource type, this pCMP presents and prioritizes existing mitigation options, describes opportunities to develop additional mitigation options, and summarizes the mitigation option that would be followed. A Marxan analysis was conducted to guide identification of potential PRM locations that would conserve high-value resources and that are well suited to mitigate the project's effects. Marxan is a conservation planning software tool that, for the purposes of this pCMP, was used to identify unprotected properties that most efficiently meet combined mitigation needs for aquatic and species resources.

The mitigation approach will undergo further development and refinement as the Authority works with the resource agencies to complete the compensatory mitigation planning process. As this planning progresses, and following publication of the Draft EIR/EIS, selection of the preliminary LEDPA, and continued agency coordination, the pCMP will be used as the basis for developing the Draft Compensatory Mitigation Plan and the Draft Mitigation Plan for special-status species. Pursuant to the NEPA/404/408 MOU (FRA et al. 2010), the Draft Compensatory Mitigation Plan will include the following elements:

- Objectives
- Site or credit selection
- Baseline information on proposed mitigation sites
- Determination of credits
- Mitigation work plan
- Maintenance plan
- Performance standards
- Monitoring requirements
- Long-term management plan
- Mitigation assurances

Activities involved in preparation of the Draft Compensatory Mitigation Plan include a variety of surveys and research that must be conducted at each potential mitigation site carried forward from the pCMP. These include the following:

- Reconnaissance-level biological surveys
- Delineations of potentially jurisdictional waters of the U.S., including wetlands
- California Rapid Assessment Method surveys
- Property title searches (liens, easements, encumbrances)

Once the Draft Compensatory Mitigation Plan has been completed and approved by the resource agencies, the Authority will prepare the Final Compensatory Mitigation Plan for the subset of mitigation options carried forward from the Draft Compensatory Mitigation Plan. Activities involved

in preparation of the Final Compensatory Mitigation Plan consist of a variety of additional site-specific studies and documents, including the following studies and plans (as applicable):

- Restoration and enhancement plan
- Grading plan
- Planting plan
- Short-term financial assurances
- Property analysis report (long-term management costs/endowment)
- Conservation easement
- Long-term management plan
- Agreement(s) with mitigation bank(s), conservation bank(s), and ILF program(s) (Bank/ILF credit purchases)
- Hydrologic study

With respect to planning and permitting milestones, it is anticipated that the Draft Compensatory Mitigation Plan, which will contain the necessary components outlined in the MOU, will be submitted with the permit applications, and the Final Compensatory Mitigation Plan will be necessary to receive permits from the USACE.

1.1.2 Preliminary Compensatory Mitigation Plan Objectives

This pCMP identifies and evaluates a range of compensatory mitigation options that would be sufficient to offset permanent, unavoidable losses regulated under Section 404 of the CWA and achieve no net loss of wetlands. The mitigation options evaluated and presented in the pCMP consist of:

- Mitigation or wetland banks
- Conservation banks (endangered species)
- ILF programs
- PRM, which can include creation, restoration, enhancement, and preservation

To the greatest extent possible, mitigation options for wetlands and waters other than wetlands would be undertaken within the same eight digit hydrologic unit code (HUC), or HUC-8 watershed, where the impact occurs.

1.1.3 Areas of Analysis

Three areas of analysis pertain to this pCMP:

- **Regional resource study area (RSA)**—The regional RSA is the planning boundary within which aquatic resources and species habitat were mapped to inform mitigation planning. The regional RSA boundaries are ecoregion boundaries that are, in some cases, truncated by county boundaries (as some ecoregions are very large).
- **Aquatic resource study area**—The aquatic resource study area consists of the project footprint plus a 250-foot buffer; it is within this study area that aquatic resources were mapped to inform the impact assessment. The aquatic resource study area is within the regional RSA. Mitigation options are proposed in this pCMP for each of the affected aquatic resource types.
- **HUC-8 watersheds**— The HUC-8 watershed boundaries are larger than the regional RSA. Mitigation options will be prioritized within the HUC-8 watershed where impacts occur to the greatest extent practicable; accordingly, the analysis discusses aquatic resource impacts and proposed mitigation options by the three overlapping HUC-8 watersheds: Coyote Creek, Pajaro River and Middle San Joaquin-Lower Chowchilla.

1.2 Overview of the San Jose to Central Valley Wye Project

The San Jose to Merced Project Section would provide HSR service between Diridon Station in downtown San Jose, with a Gilroy station in downtown Gilroy and a station in downtown Merced.

The project would connect San Jose to the Central Valley portion of the HSR system at the Central Valley Wye in Merced County, which in turn connects to the portion of the system running north to Merced and south to Fresno and Southern California. Because the portion of the Project Section between Carlucci Road and Merced has been analyzed in the *Merced to Fresno Section Final EIR/EIS* (Authority and FRA 2012) and the *Merced to Fresno Section: Central Valley Wye Draft Supplemental EIR/EIS* (Authority 2019a), the Draft EIR/EIS that this pCMP supports focuses on the project extent between Scott Boulevard and Carlucci Road (the project).

1.3 Overview of Preferred Alternative

Following an intensive alternatives development process and comprehensive environmental review of four end-to-end alternatives, the Authority and FRA selected Alternative 4 as the preferred alternative pursuant to Section 404(b)(1) of the federal CWA. The screening and selection process are detailed in the *San Jose to Merced Project Section: State's Preferred Alternative Staff Report for the San Jose to Central Valley Wye Project* (Authority 2019b).

Development of Alternative 4 was intended to extend blended electric-powered passenger railroad infrastructure from the southern limit of the Caltrain Peninsula Corridor Electrification Project through Gilroy. South and east of Gilroy, HSR would operate on a dedicated guideway. The objectives of this approach are to minimize property displacements and natural resource impacts, retain local community development patterns, improve the operational efficiency and safety of the existing railroad corridor, and accelerate delivery of electrified passenger rail services in the increasingly congested southern Santa Clara Valley corridor. The alternative is distinguished from the other three alternatives by a blended, at-grade alignment that would operate on two electrified passenger tracks and one conventional freight track predominantly within the existing Caltrain and Union Pacific Railroad (UPRR) rights-of-way. The maximum train speed of 110 mph in the blended guideway would be enabled by continuous access-restriction fencing; four-quad gates, roadway lane channels, and railroad trespass deterrents at all public road grade crossings; and fully integrated communications and controls for train operations, grade crossings, and roadway traffic. Caltrain stations would be reconstructed to enable directional running as part of blended operations. Overall, the HSR guideway would comprise 15.2 miles on viaduct, two tunnels totaling 15.0 miles, 25.9 miles on embankment, 30.3 miles at grade, and 2.3 miles in trench.

1.3.1 San Jose Diridon Station Approach Subsection

The project would begin at Scott Boulevard in blended service with Caltrain on an at-grade profile following Caltrain main track (MT) 2 and MT3 south along the east side of the existing Caltrain corridor. New UPRR track would start just south of Emory Street to maintain freight movement capacity north of San Jose Diridon Station. The new UPRR track would be east of Caltrain MT1. The existing Santa Clara Station would remain. The existing College Park Caltrain Station would be reconstructed just north of Emory Street on the west side of the Caltrain Corridor on the existing siding track to eliminate the existing holdout rule at the station. The blended at-grade alignment would continue along MT2 and MT3 to enter new dedicated HSR platforms at grade at the center of San Jose Diridon Station. HSR platforms would be extended south to provide 1,385-foot and 1,465-foot platforms and would be raised to provide level boarding with the HSR trains.

Continuing south, the blended at-grade three-track alignment would remain in the Caltrain right-of-way through the Gardner neighborhood. New standalone rail bridges over Prevost Street, SR 87, the Guadalupe River, and Willow Street would be built for MT3. MT1 and MT2 would remain on the existing structures.

1.3.2 Monterey Corridor Subsection

From the San Jose Diridon Station Approach Subsection at West Alma Avenue, just south of the Caltrain Tamien Station, the alignment would extend primarily southeast to Bernal Way in blended service with Caltrain on an at-grade profile within the Caltrain and UPRR right-of-way. HSR and Caltrain would operate on the electrified MT2 and MT3 tracks, while UPRR would operate on a nonelectrified MT1. The two existing tracks would be shifted to accommodate the third track. A new standalone bridge over West Alma Avenue would be constructed for MT3 and a maintenance track, with MT1 and 2 remaining on the existing structure. A new bridge over Almaden Road would be constructed for MT2 and MT3, while MT1 would remain on the existing structures. Capitol Caltrain Station would be reconstructed with a new center platform between MT2 and MT3. The Blossom Hill Caltrain Station would be reconstructed. Great Oaks Parkway would be realigned for approximately 1,350 feet to accommodate the widened rail corridor.

1.3.3 Morgan Hill and Gilroy Subsection

From Bernal Way in South San Jose, the project would extend through Morgan Hill and San Martin to the at-grade Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering the 1.4-mile Tunnel 1 at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, where it would transition to the Pacheco Pass Subsection. This portion of the project (Morgan Hill and Gilroy Subsection) would operate in blended service with Caltrain on an at-grade profile within the Caltrain and UPRR right-of-way. Past the Downtown Gilroy Station and south of the US 101 overpass, HSR would enter the fully grade-separated, dedicated track needed to operate HSR trains at speeds faster than 125 mph.

1.3.4 Pacheco Pass Subsection

The Pacheco Pass Subsection would be approximately 25 miles long. From the eastern limit of the Morgan Hill and Gilroy Subsection, the guideway would transition from aerial structure to embankment along the southern boundary of Casa de Fruta. This stretch of embankment would be on fill or in excavated hillside cuts to accommodate a level HSR guideway profile over varied surface elevations and to control unstable slopes known for vulnerability to landslip. The alignment would ascend to viaduct over Pacheco Creek along the south side of SR 152 and remain on viaduct to the Tunnel 2 portal. Tunnel 2 would extend approximately 13.5 miles northeast. Continuing east, the HSR guideway would be predominantly on a combination of embankment and aerial structures, with viaducts over Romero Creek and the California Aqueduct. East of Interstate (I-) 5, the alignment would cross over SR 33/Santa Nella Road and the CCID Outside Canal before transitioning to the San Joaquin Valley Subsection at Fahey Road.

1.3.5 San Joaquin Valley Subsection

The San Joaquin Valley Subsection would be approximately 18 miles long, from east of I-5 (at Fahey Road) to the intersection of Henry Miller Road and Carlucci Road in Merced County, where the alignment would connect to the Central Valley Wye. South of Fahey Road, the guideway would continue east and cross over three irrigation ditches, Cherokee Road, the CCID Main Canal, two additional irrigation ditches, and adjacent farmland on viaduct. Continuing east, the alignment would be on embankment before ascending on an approximately 1.4-mile-long viaduct over the San Luis Wasteway, the UPRR West Side branch line, and Ingomar Grade Road. The alignment would descend to embankment west of Volta Road and turn southeast to the south side of Henry Miller Road. The HSR embankment between the Volta Road overcrossing and Los Banos Creek would cross over two proposed culverts to maintain irrigation canals. The alignment would then ascend to cross over Los Banos Creek and Badger Flat Road on a 1.35-mile-long viaduct before descending onto embankment.

The alignment would continue east for 3.6 miles on embankment over several combined wildlife crossing/drainage culverts and drainage culverts. East of SR 165 and the Santa Fe Grade, the

alignment would ascend to an approximately 1.8-mile viaduct south of the Los Baños State Wildlife Area across Mud Slough to maintain wildlife movement within the Grassland Ecological Area. The alignment would continue on embankment to the eastern limit of the subsection and the project, where it would transition to the Central Valley Wye at Carlucci Road.

2 WATERS OF THE UNITED STATES

2.1 Overview of Laws, Regulations and Guidelines

2.1.1 Section 404 of the Clean Water Act (33 U.S.C. § 1251 et seq.)

The federal CWA is the primary federal law protecting the quality of the nation's surface waters, including wetlands. This pCMP sets forth compensatory mitigation for impacts regulated under Section 404 of the CWA. Under Section 404, the USACE regulates the discharge of dredged and fill materials into waters of the U.S., for which project proponents must obtain a permit from the USACE.

2.1.2 Protection of Wetlands (USEO 11990)

U.S. Presidential Executive Order (USEO) 11990 aims to avoid direct or indirect impacts on wetlands from federal or federally approved projects when a practicable alternative is available. If wetland impacts cannot be avoided, all practicable measures to minimize harm must be included.

2.1.3 2008 Final Rule (33 C.F.R. Part 332)

In 2008, *Compensatory Mitigation for Losses of Aquatic Resources: Final Rule* (33 Code of Federal Regulations [C.F.R.] Part 332) established national regulations for compensatory mitigation requirements for impacts regulated under Section 404 of the CWA. The 2008 Final Rule states that compensatory mitigation may be achieved using restoration, enhancement, establishment and, in certain circumstances, preservation (33 C.F.R. § 332.3). The Final Rule prioritizes restoration as the preferred mitigation method because it is typically most successful, has fewer upland impacts than establishment, and adds greater value in terms of aquatic resource function than enhancement or preservation.

Preservation may be used when all the following criteria are met (33 C.F.R. § 332.3(h)):

i. The resources to be preserved provide important physical, chemical, or biological functions for the watershed;

ii. The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;

iii. Preservation is determined by the district engineer to be appropriate and practicable;

iv. The resources are under threat of destruction or adverse modifications; and

v. The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).

Additionally, where preservation is used, it is generally required to be carried out in conjunction with aquatic resource restoration, establishment, or enhancement activities.

The 2008 Final Rule identifies three mechanisms for providing compensatory mitigation: PRM,[1] mitigation banks, and ILF mitigation. The regulation prioritizes (33 C.F.R. § 332.3(b)), from highest to lowest, use of:

1. Mitigation banks
2. ILF programs
3. PRM under a watershed approach

[1] PRM is defined in 33 C.F.R. Part 332 as "an aquatic resource restoration, establishment, enhancement and/or preservation activity undertaken by the permittee to provide compensatory mitigation for which the permittee retains full responsibility."

4. PRM through on-site and in-kind mitigation
5. PRM through off-site or out-of-kind mitigation

2.1.4 U.S. Army Corps of Engineers Mitigation Ratio Guidelines

The USACE South Pacific Division released *Standard Operating Procedures for Determination of Mitigation Ratios* (SOP) in 2013 (USACE 2013). The SOP provides procedures and guidelines for the USACE to establish compensatory mitigation ratios for unavoidable impacts on aquatic resources, applicable to CWA Section 404, Section 10 of the Rivers and Harbors Act, and Section 103 of the Marine Protection, Research, and Sanctuaries Act. Pursuant to the SOP, the USACE develops mitigation proposals and ratios and documents its decision-making process in the permitting action administrative record. The SOP includes, as an attachment, Instructions for Completing Mitigation Ratio-Setting Checklist. These instructions describe six basic categories that influence or affect the mitigation-to-impact ratios for resources regulated by the USACE under Section 404:

- Change in condition/function/value of waters of the U.S. (SOP Sections 2 and 3)
- Change in location of waters of the U.S. (SOP Section 4)
- Change in surface area of waters of the U.S. (SOP Section 5)
- Change in type of waters of the U.S. (SOP Section 6)
- Uncertainty of mitigation success of waters of the U.S. (SOP Section 7)
- Temporal loss of function of waters of the U.S. (SOP Section 8)

2.1.5 Regional Compensatory Mitigation and Monitoring Guidelines for the South Pacific Division

In 2015, the South Pacific Division of the USACE published the *Regional Compensatory Mitigation and Monitoring Guidelines for the South Pacific Division* (SPD Guidelines) (USACE 2015). The SPD Guidelines provide the regulated public guidance for selecting appropriate compensatory mitigation sites and preparing mitigation plans to compensate for unavoidable impacts on waters of the U.S. The SPD Guidelines are also intended to standardize compensatory mitigation procedures throughout the South Pacific Division region, and to assist the regulated public in preparing mitigation plans and in implementing successful compensatory mitigation projects using a watershed-based approach (USACE 2015). Final mitigation requirements are determined through consultation with the district engineer in coordination with state and federal resource agencies and may vary depending on the nature of project impacts.

2.2 Watershed Approach to Mitigation

As defined in the 2008 Final Rule (33 C.F.R. § 332.2), the watershed approach is:

> *…an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services caused by activities authorized by DA permits. The watershed approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for DA permits.*

The 2008 Final Rule requires use of a watershed approach to establish compensatory mitigation requirements to the extent appropriate and practicable (33 C.F.R. 332.3(c)). If available, a watershed plan should be used to guide the watershed approach. Where no such plan is available, the watershed approach should be based on other available sources.

2.3 Estimated Impacts on Waters of the U.S.

The construction of Alternative 4 would result in permanent and temporary impacts through the disturbance or removal of lands that have been determined to support or that could potentially support jurisdictional waters of the U.S. as defined under CWA Section 404. Appendix A, Impacts on Waters of the U.S., illustrates the locations of all waters of the U.S. that the project footprint intersects.

Jurisdictional waters of the U.S. include *wetlands* and *waters other than wetlands*. Wetland types identified within the aquatic resource study area comprise alkali marsh, alkali scrub wetland, alkali vernal pool, freshwater marsh, mixed riparian–natural watercourse, palustrine forested wetland, palustrine forested wetland–natural watercourse, seasonal wetland, and vernal pool. For the purposes of this report, riparian communities are considered wetlands if occur within the boundaries of the ordinary high water mark and meet the USACE definition of wetlands (i.e., they meet the three-parameter approach outlined by the USACE).

Waters other than wetlands identified in the aquatic resource study area comprise constructed basins, constructed watercourses, freshwater ponds, natural watercourses, and reservoirs. All natural and constructed waterways are considered potentially jurisdictional under the Preliminary Jurisdictional Delineation format (USACE 2008a).

The construction of roads, rail track, and associated infrastructure would permanently remove or alter or would temporarily affect waters of the U.S. through filling, hydrological interruption, or other mechanisms. In the case of artificial or constructed aquatic features (e.g., constructed basins), these impacts would remove or disrupt the limited biological functions these features provide. In natural areas, these activities would remove or disrupt the hydrology, vegetation, wildlife utilization, water quality conditions, and other biological functions the jurisdictional waters provide.

For the purposes of this pCMP, permanent and temporary effects are defined as follows:

- **Permanent**—Project activities (1) that would permanently alter land cover from its existing condition or (2) that would be of long-term duration (1–5 years) but that would be restored to pre-project conditions after project completion.
- **Temporary**—Project activities with a duration of 1 year or less that would result in temporary disturbance to existing land cover. Affected areas would be restored to pre-disturbance conditions after work is completed.

Impacts on vernal pools are calculated differently than those on other jurisdictional aquatic resources. If a portion of a vernal pool or swale is within the project footprint and therefore directly affected, then the whole vernal pool or swale is considered permanently affected for purposes of identifying impacts and mitigation. This approach is adopted to evaluate indirect bisected effects on vernal pool species—that is, both within the project footprint as well as adjacent areas, including areas more than 250 feet from the project footprint—to address impacts on regulated waters as well as on vernal pool wildlife and plant species. All impacts on vernal pools are considered permanent.

To determine impacts on aquatic resources, the project footprint was intersected with mapped jurisdictional waters of the U.S. using geographic information system (GIS) software. At the time this pCMP was prepared, the project footprint was at approximately 15 percent design and is therefore drawn conservatively. The right-of-way represented in project drawings is more extensive than the actual project footprint to allow for refinement in response to circumstances and ground conditions not known at this time. Furthermore, only a portion of the project footprint would be converted to rail infrastructure (rather than subject to temporary disturbance). Because the duration of disturbance cannot be guaranteed to be less than 1 year, the entire project footprint is assumed to be affected for the purposes of this analysis. Consequently, this analysis likely overestimates impact acreages.

The project would have effects within three HUC-8 watershed boundaries as defined by the U.S. Geological Survey: Coyote, Pajaro, and San Joaquin–Lower Chowchilla. This pCMP proposes compensatory mitigation within the same HUC-8 boundary where the impact would occur to the maximum extent possible. Any exceptions to this approach are described in detail in Section 2.4, Regional and Watershed Approach to Mitigation.

2.3.1 Wetlands

All wetlands identified within the aquatic resource study area are considered jurisdictional based on the Preliminary Jurisdictional Delineation option as described in the Jurisdictional Determinations, Regulatory Guidance Letter (USACE 2008a). For more information on methods and results of the delineation see the *San Jose to Merced Project Section: Aquatic Resources Delineation Report* (Aquatic Resources Delineation Report) (Authority 2019c). Impacts on wetlands by HUC-8 watershed are shown in Table 2-1.

Table 2-1 Impacts on Wetlands by HUC-8 Watershed

Aquatic Features	Permanent Impact (acres)[1]	Mitigation Multiplier[2]	Total Estimated Mitigation Need[3]
Coyote Creek, HUC 18050003 Watershed			
Alkali marsh[1]	0.0	n/a	0.0
Alkali scrub wetland[1]	0.0	n/a	0.0
Alkali vernal pool[2]	0.0	n/a	0.0
Freshwater marsh	0.1	3.0	0.3
Mixed riparian—natural watercourse[3]	0.0	n/a	0.0
Palustrine forested wetland	0.1	3.0	0.3
Palustrine forested wetland—natural watercourse[3]	<0.1	3.0	0.3
Seasonal wetland	0.0	n/a	0.0
Vernal pools	0.0	n/a	0.0
Pajaro River, HUC 18060002 Watershed			
Alkali marsh[1]	0.0	n/a	0.0
Alkali scrub wetland[1]	0.0	n/a	0.0
Alkali vernal pool[2]	0.0	n/a	0.0
Freshwater marsh	2.2	3.0	6.6
Mixed riparian—natural watercourse[3]	3.5	3.0	10.5
Palustrine forested wetland	1.8	3.0	5.4
Palustrine forested wetland—natural watercourse[3]	5.5	3.0	16.5
Seasonal wetland	6.8	3.0	20.4
Vernal pools	0.0	n/a	0.0
San Joaquin–Lower Chowchilla, HUC 18040001 Watershed			
Alkali marsh[1]	6.2	3.0	18.6
Alkali scrub wetland[1]	0.5	3.0	1.5

Aquatic Features	Permanent Impact (acres)[1]	Mitigation Multiplier[2]	Total Estimated Mitigation Need[3]
Alkali vernal pool[2]	0.0	n/a	0.0
Alkali vernal pool/California annual grassland	27.1	3.0	81.3
Freshwater marsh	0.1	3.0	0.3
Mixed riparian—natural watercourse[3]	0.1	3.0	0.3
Palustrine forested wetland	0.0	n/a	0.0
Palustrine forested wetland—natural watercourse[3]	0.0	n/a	0.0
Seasonal wetland	1.9	3.0	5.7
Vernal pools	0.3	5.0	1.5

[1] Permanent impacts include both permanent and long-term temporary impact acreage. Long-term temporary impacts are those that may last more than 1 year and include substantial ground disturbance but will be, upon construction completion, restored to a pre-project condition (or better). Short-term temporary impacts are assumed to be less than 1 year and involve low levels of ground disturbance; short-term temporary impacts will be restored on site, as needed, and mitigation will not be required (except for temporary impacts on vernal pool features where all impacts are assumed to be permanent).
[2] The multiplier applied to permanent impacts to determine the total mitigation need. The mitigation multiplier proposed here is conservative for the purposes of determining feasibility of achieving mitigation. Final mitigation ratios will be determined in conversation with the U.S. Army Corps of Engineers.
[3] The total estimated mitigation need is the product of permanent impacts multiplied by the mitigation multiplier.
[4] Areas of riparian vegetation were classified as wetlands when they were located within natural watercourses (i.e., below the limits of the ordinary high water mark).
[5] All impacts occur within the Pacheco Creek HUC-10 watershed.
[6] Alkali marsh and alkali scrub wetland impacts in the San Joaquin Valley are located along the centerline near Mud Slough.
[7] The alkali vernal pool impact includes three pools along Henry Miller Road that total 0.1 acre of impact.
[8] The alkali vernal pool feature on Romero Ranch is a 53.1-acre pool/grassland complex that is assumed to have a wetted footprint that is 45 percent of the total area (i.e., 23.9 acres).
[9] Includes permanent and temporary impacts because temporary impacts on vernal pools are considered permanent.

2.3.2 Waters Other Than Wetlands

Waters other than wetlands within the aquatic resource study area were delineated using the methods described in *A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States* (USACE 2008b) and USACE Regulatory Guidance Letter No. 05-05 (USACE 2005), where appropriate. These guidance materials provide an approach for identifying the lateral limits of jurisdictional waters other than wetlands using stream geomorphology and vegetation response to the dominant stream discharge. In 2010 and 2018, indicators of the ordinary high water mark (OHWM) that were evaluated in the field included natural lines impressed on banks, stain lines, depositional features, shelving, changes in soil character, changes in vegetation, destruction of terrestrial vegetation, and the presence of litter and debris. For more information on methods and results of the delineation see the Aquatic Resources Delineation Report (Authority 2019c). Impacts on waters other than wetlands by HUC-8 watershed are shown in Table 2-2.

Table 2-2 Impacts on Waters other than Wetlands by HUC-8 Watershed[1]

Aquatic Features	Permanent Impact (acres)[2]	Mitigation Multiplier[3]	Total Estimated Mitigation Need[4]
Coyote Creek, HUC 18050003 Watershed			
Constructed basin[1]	0.1	n/a	0.0
Constructed watercourse[1]	0.1	n/a	0.0

Aquatic Features	Permanent Impact (acres)[2]	Mitigation Multiplier[3]	Total Estimated Mitigation Need[4]
Freshwater pond	0.0	n/a	0.0
Natural watercourse	1.4	2.0	2.8
Reservoir	0.0	n/a	0.0
Pajaro River, HUC 18060002 Watershed			
Constructed basin[1]	0.1	n/a	0.0
Constructed watercourse[1]	3.1	n/a	0.0
Freshwater pond	4.5	2.0	9.0
Natural watercourse	9	2.0	18.0
Reservoir	0	n/a	0.0
San Joaquin–Lower Chowchilla, HUC 18040001 Watershed			
Constructed basin[1]	1.9	n/a	0.0
Constructed watercourse[1]	16.8	n/a	0.0
Freshwater pond	0	n/a	0.0
Natural watercourse	3.4	2.0	6.8
Reservoir	0	n/a	0.0

[1] Constructed basins and watercourses are considered waters other than wetlands but are not presented in this table because impacts on these aquatic features will occur on site or off site on a case-by-case basis in coordination with the landowner, thus negating the need to identify mitigation opportunities.
[2] Permanent impacts include both permanent and long-term temporary impact acreage. Long-term temporary impacts are those that may last more than 1 year and include substantial ground disturbance but will be, upon construction completion, restored back to a pre-project condition (or better). Short-term temporary impacts are assumed to be less than 1 year and involve low levels of ground disturbance; short-term temporary impacts will be restored on site, as needed, and mitigation will not be required.
[3] The multiplier that is applied to permanent impacts to determine the total mitigation need. The mitigation multiplier proposed here is conservative for the purposes of determining feasibility of achieving mitigation. Final mitigation ratios will be determined in conversation with the U.S. Army Corps of Engineers.
[4] The total mitigation need is the product of permanent impacts multiplied by the mitigation multiplier.

2.4 Confirmation of Impacts

The methods used to determine impacts on waters of the U.S. included a desktop survey using aerial imagery interpretation and field verification where access was granted or visual confirmation of aquatic features could be performed from publicly accessible locations. Because the ability to field verify aerial imagery interpretation was limited, the type and extent of aquatic features were conservatively determined and drawn. For this reason, the permitted discharges to waters of the U.S. would be confirmed during project construction in coordination with the USACE. If discharges to waters of the U.S. are less than anticipated in the permit as a result of changes in project design, adjustments to the amount of compensatory mitigation would be made accordingly. For a complete description of the methods used to determine the type and extent of waters of the U.S., see the *San Jose to Merced Project Section: Aquatic Resources Delineation Report* (Authority 2019c).

2.5 Approach to Mitigation

The mitigation strategy would apply several key principles to selecting and prioritizing the final mitigation package. These principles, in approximately the order of priority, are as follows:

- Mitigation for temporary impacts would be on site and in kind.

- Mitigation for long-term temporary impacts—temporary impacts that last longer than 1 year—would include on-site, in-kind restoration, but may also include off-site, in-kind preservation and restoration, rehabilitation, or enhancement. Off-site mitigation would be proposed, in some cases, to offset the temporal loss of resource function.
- Permanent impacts on constructed basin, constructed watercourse, and reservoir types would be mitigated on site; when and if this is not possible or agreeable, off-site mitigation would be performed in agreement with the landowner or manager.
- Permanent impacts would be offset with the purchase of bank or ILF program credits or with PRM sites. Bank or ILF credits or PRM sites would be in kind; when and where in-kind mitigation is not possible or agreeable, out-of-kind mitigation would be performed in agreement with relevant agencies.
- All permanent impacts on wetlands would be offset with in-kind creation or establishment at a ratio of 1:1 unless there is agreement from regulatory staff that out-of-kind creation or establishment or in-kind preservation and rehabilitation or enhancement is acceptable. Additional mitigation beyond 1:1 will primarily include in-kind preservation and management, which may include rehabilitation or enhancement.
- Available mitigation and conservation bank and ILF program credits would be prioritized over PRM sites except in those instances where a PRM site that has been selected to provide mitigation for another resource (where bank or ILF programs are lacking) would also provide a mitigation benefit to the resource in question.
- Conservation and mitigation banks within the affected HUC-8 watershed boundary would be prioritized over those outside the boundary.
- Conservation and mitigation banks outside the affected HUC-8 watershed boundary may be applied where in-watershed bank, ILF, or PRM opportunities are lacking and the impact area is within the bank's service area. In some particular instances, there may also be a biologically relevant reason to mitigate outside the HUC-8 boundary.
- PRM sites would target preservation of resource types for which bank or ILF programs are not available or sufficient to meet the mitigation need. In those cases where the mitigation need can be met by either a bank or a PRM site, the bank would be prioritized unless the PRM site would benefit other resources for which bank or ILF credits are not available. In these instances, a PRM site may be prioritized over a bank or ILF program.
- PRM sites that are within the affected HUC-8 or HUC-10 watershed boundary would be prioritized over those outside the affected boundary.
- PRM sites with restoration or enhancement opportunities would be prioritized over those without such opportunities.
- PRM sites that are occupied by, or are known to be used by (e.g., for foraging), targeted species would be prioritized over those that are not. However, because affected lands are not necessarily occupied, PRM sites do not necessarily have to be occupied.
- PRM sites that provide mitigation for multiple resources would be prioritized over those that do not. For example, freshwater pond creation or restoration on a PRM site could serve as mitigation under Section 404 as well as mitigation for effects on California red-legged frog breeding habitat under the federal Endangered Species Act (FESA) and California Endangered Species Act (CESA).
- Large properties would be prioritized for PRM sites. Larger properties have increased ecological value because *edge effects*—such as invasive species introduction or human-related disturbance that occurs at the edge of the property where adjoining properties are not managed or protected—can negatively affect habitat quality.

- PRM sites that are adjacent to existing conservation lands would be prioritized, helping to reduce edge effects and increasing the functional value for species with larger home ranges.
- PRM sites within known wildlife movement corridors would be selected to help connect discontinuous movement corridors and protect land near wildlife crossing features along the alignment.
- The Authority would seek partnerships with existing conservation organizations to purchase and manage PRM sites as well as to identify establishment, restoration, and enhancement opportunities on existing protected lands.
- Lands that are within designated critical habitat or core recovery planning units would be prioritized.

In addition, the mitigation strategy would be consistent with guidance from USACE staff as well as published guidance documents. USACE mitigation guidance documents are summarized in Section 2.1, Overview of Laws and Regulations.

2.6 Process for Identification of Compensatory Mitigation Options

Compensatory mitigation lands were identified through a step-wise process. First, mitigation banks with available credits within the HUC-8 watershed boundaries were identified by cross referencing the Regulatory In-Lieu Fee & Bank Information Tracing System (RIBITS) with the aquatic resource study area boundary. The available wetland types, as described in RIBITS, were cross referenced with the affected land cover types. This information was collected into a database where available credits were matched to mitigation needs.

The second step was to identify available credits through the National Fish and Wildlife Fund (NFWF) USACE Sacramento District ILF Program. The Program has advanced credits for aquatic resources and vernal pools.

The last step was to identify properties that could provide compensatory mitigation for those impacts on waters of the U.S. that did not have a compatible mitigation bank or ILF Program match. Wetlands and waters other than wetlands on these properties would be established, restored, or enhanced and protected as PRM sites. PRM sites would likely include a combination of turnkey projects, restoration and enhancement activities on conserved lands, and other types of partnerships with local and regional conservation organizations.

PRM sites that have potential to meet aquatic resource preservation and enhancement mitigation needs were identified by HSR stakeholders or through an analysis using Marxan. The Marxan analysis primarily identifies opportunities for aquatic resource and species preservation; however, in the case of sycamore alluvial woodland, restoration opportunities were identified using mapping resources produced by San Francisco Estuary Institute and H. T. Harvey (SFEI and H.T. Harvey 2017). Appendix B, Marxan Methods and Results, describes in greater detail how the software program was used to identify compensatory mitigation locations.

2.7 Description of Compensatory Mitigation Opportunities

2.7.1 On-Site Compensatory Mitigation

2.7.1.1 Temporary Effects

On-site compensatory mitigation is proposed for temporary impacts on all aquatic resources except vernal pools. All impacts on vernal pools and vernal pool species are considered permanent. Based on USACE guidance, fill placed within jurisdictional waters for less than 1 year is considered a temporary impact. All temporary construction areas would be returned to pre-project contours and revegetated. With respect to wetlands, to promote reestablishment of wetland conditions in temporary construction areas, the topsoil would be removed and stockpiled during construction and then returned to the disturbed areas and revegetated following construction activities.

2.7.1.2 Permanent Effects on Constructed Watercourses and Constructed Basins

On-site compensatory mitigation would be implemented to offset permanent impacts on constructed watercourses (irrigation canals and ditches) and constructed basins. Constructed features that are permanently affected would be replaced in kind either on site or adjacent to the project footprint and in coordination with the landowner or operator of the facility. The functions of the existing constructed features would be retained in the design of the restored or newly created feature.

The Authority would coordinate with the owner or operator to determine what course of action would be taken for each constructed feature. Four basic outcomes or scenarios could occur at each constructed feature:

- The constructed feature is currently used for conveyance or water storage and the current functions and storage capacity are still required. The capacity and function would be mitigated on site through the creation of a new or modified (expanded) feature adequate to meet the design function. If the need is increased or reduced as a result of the project, the mitigation would be increased or reduced to meet the revised need.
- The constructed feature is no longer required by the owner or operator, and no mitigation is proposed.
- A constructed basin is not currently used for water storage but provides wetland functions. The wetland functions would be mitigated through the off-site restoration or enhancement of vernal pools or seasonal wetlands at a 1:1 ratio.
- The constructed basin is not currently used for water storage and is not providing wetland functions; no mitigation is proposed.

The Authority, in coordination with owner or operator, would come to an agreement as to which course of action would be taken and communicate that decision for each affected feature to the USACE before affecting the features. All work affecting constructed features would be coordinated with the owner or operator of the constructed feature. Written demonstration of acceptancy by the owner or operator would be provided to the USACE.

2.7.2 Off-Site Compensatory Mitigation

2.7.2.1 Mitigation Banks

Based on RIBITS searches (USACE 2019) as well as outreach through stakeholders and third-party mitigation providers, three mitigation banks have been identified to provide compensatory mitigation for impacts on waters of the U.S.: Pajaro River Mitigation Bank, Grasslands Mitigation Bank, and Sparling Ranch Conservation Bank (Table 2-3). The Pajaro River bank provides partial compensation for wetland impacts in the Pajaro River HUC-8 watershed. The Grasslands bank is proposed to partially offset wetland impacts in the San Joaquin-Lower Chowchilla HUC-8 watershed.

The Pajaro River bank is approved by the USACE; project-level concurrence would be required before credits could be used to satisfy mitigation requirements of the USFWS or CDFW. The Grasslands bank has credits certified by the USACE to meet wetland impacts as well as credits certified by the USFWS and CDFW for giant garter snake.

Sparling Ranch Conservation Bank has USFWS-approved credits for California red-legged frog and California tiger salamander aquatic habitat; however, the site has potential for development of riparian and natural watercourse credits that could satisfy mitigation needs for impacts on waters of the U.S. Any credits used to satisfy compensatory mitigation needs for impacts on waters of the U.S. would have to be certified by the USACE.

Table 2-3 Mitigation Bank Options to Offset Project Impacts

Mitigation Bank or In-Lieu Fee Program	Approving Agency	Applicable HUC-8 Watershed	Wetland Type	Total Credits Available	Unreleased Credits
Pajaro River Mitigation Bank	USACE	Pajaro	Seasonal marsh and semi-permanent emergent marsh	5.4	139
Grasslands Mitigation Bank	USACE, USFWS, USEPA, CDFW	San Joaquin–Lower Chowchilla	Seasonal wetland	4.4	27.6
Sparling Ranch Conservation Bank	USFWS, CDFW	Pajaro	Freshwater marsh (California tiger salamander aquatic habitat)	0.76	–

Source: USACE 2019
USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service; USEPA = U.S. Environmental Protection Agency; CDFW = California Department of Fish and Wildlife.

Pajaro River Mitigation Bank

The Pajaro River Mitigation Bank is a 273-acre property east of Gilroy in the Soap Lake region. The bank includes seasonal wetland and freshwater marsh aquatic land cover types. Bank credits are approved by the USACE. The Pajaro River Mitigation Bank would provide compensatory Mitigation for impacts on seasonal wetlands and freshwater marsh within the Pajaro HUC-8 watershed. The Soap Lake region has been identified by regional conservation organizations and agencies as an ecologically important area. It is designated as an Audubon Important Bird Area (National Audubon Society 2019) and is part of the Santa Cruz Mountains to Diablo Range wildlife linkage mapped by Penrod et al. (2013). Currently, the bank has 5.4 available wetland credits and 139 wetland credits remaining to be developed. Wetland credits consist of seasonal marsh and semi-permanent emergent marsh.

Sparling Ranch Conservation Bank

The Sparling Ranch Conservation Bank is in the Diablo Range south of SR 152 near Pacheco Pass in both Santa Clara and San Benito Counties. The property is in the Pajaro HUC-8 watershed. Although this is a conservation bank for California red-legged frog and California tiger salamander, there is potential to develop riparian credits along a 1.3-mile stretch of the South Fork of Pacheco Creek (South Bay Conservation Resources 2019). Expansion of the riparian corridor by 20 feet on each bank would produce an estimated restoration potential of 6.3 acres. Because of its location, the restoration actions have the potential to produce a combination of mixed riparian and palustrine forested wetlands.

Grasslands Mitigation Bank

Grasslands Mitigation Bank is located in Merced County, north of the town of Volta, in the Grasslands Ecological Area (GEA). The bank is a 281-acre site with credits for seasonal wetlands and giant garter snake habitat. The bank is within the San Joaquin–Lower Chowchilla HUC-8 watershed boundary and could be used to offset effects on seasonal wetlands in the same watershed. Currently, the bank does not have any available credits but has 83.7 giant garter snake credits and 27.6 seasonal wetland credits that remain to be developed.

2.7.2.2 In-Lieu Fee Programs

At present, the only ILF program that provides credits to compensate for proposed impacts on wetlands and other waters within the aquatic resource study area is the NFWF Sacramento District ILF Program. The NFWF ILF Program, approved by a six-agency Interagency Review

Team[2] in October 2014, covers the geographic area under jurisdiction of the USACE Sacramento District. The program established two credit types: aquatic resource credits and vernal pool credits. Aquatic resource credits are eligible to offset impacts on wetlands (except vernal pools) and waters other than wetlands as well as impacts on waters of the state and aquatic species. Vernal pool credits are eligible to offset proposed impacts on vernal pools.

In general, NFWF ILF Program credits are *advance credits*—credits available for sale prior to completion or implementation of an approved mitigation plan. Advance credit sales are pooled, allocated toward mitigation site selection based on a watershed approach, and then allocated toward development and implementation of a mitigation plan.[3] A credit is *fulfilled* when the program has implemented an approved mitigation plan or has begun meeting site-specific performance standards pursuant to an approved mitigation plan. At that time, credits are *released* in order to fulfill former advance credit sales.

The project footprint overlaps with and has impacts within the San Joaquin aquatic resources service area, the Central Coast vernal pool service area, and the San Joaquin Valley vernal pool service area. The NFWF ILF Program's San Joaquin service area for aquatic resources includes the Middle San Joaquin–Lower Chowchilla HUC-8 watershed (18040001). The Central Coast vernal pool service area is the same as the Central Coast vernal pool recovery region; similarly, the San Joaquin Valley service area for vernal pool resources is the same as the San Joaquin Valley vernal pool recovery region (USFWS 2005). The NFWF Sacramento District ILF Program currently has advance credits available in all three service areas (Table 2-4).

Table 2-4 In-Lieu Fee Program Options to Offset Project Impacts

In-Lieu Fee Program	Approving Agency[1]	Applicable HUC-8 Watershed	Program Credit Types and Service Area	Credits Available in 2019	Unreleased Credits
NFWF Sacramento District ILF Program, San Joaquin Aquatic Resource	USACE USEPA NMFS CVRWQCB LRWQCB	Middle San Joaquin–Lower Chowchilla	Aquatic resource, Middle San Joaquin–Lower Chowchilla	11.1	–
NFWF Sacramento District ILF Program, Central Coast Vernal Pools	USACE USEPA NMFS CVRWQCB LRWQCB	Middle San Joaquin–Lower Chowchilla	Vernal pools, Central Coast	14.0	–
NFWF Sacramento District ILF Program, San Joaquin Vernal Pools	USACE USEPA NMFS CVRWQCB LRWQCB	Middle San Joaquin–Lower Chowchilla	Vernal pools, San Joaquin Valley	14.0	–

Source: USACE 2019

[1] Member agencies of the Interagency Review Team for the NFWF ILF Program: USACE, USEPA, NMFS, SWRCB, CVRWQCB, and LRWQCB.
NFWF = National Fish and Wildlife Fund; ILF = in-lieu fee; USACE = U.S. Army Corps of Engineers' USEPA = U.S. Environmental Protection Agency; NMFS = National Marine Fisheries Service; SWRCB = State Water Resources Control Board; CVRWQCB = Central Valley Regional Water Quality Control Board; LRWQCB = Lahontan Regional Water Quality Control Board

[2] Member agencies of the Interagency Review Team for the NFWF ILF Program are USACE, USEPA, NMFS, SWRCB, the Central Valley Regional Water Quality Control Board, and the Lahontan Regional Water Quality Control Board.

[3] Unless agreed otherwise by the applicable Interagency Review Team member(s), a program sponsor will complete land acquisition and initial physical and biological improvements with respect to an ILF project by the third full growing season (generally defined as the period between October 15 and May 15) after the first advance credit purchase.

2.7.2.3 Permittee-Responsible Mitigation

Another option the Authority has to offset impacts on wetlands and waters other than wetlands is PRM. PRM is defined in 33 C.F.R. 332 as "an aquatic resource restoration, establishment, enhancement and/or preservation activity undertaken by the permittee to provide compensatory mitigation for which the permittee retains full responsibility." There are three basic types of PRM presented in this section: owner-offered properties (properties with owners interested in selling for conservation purposes), restoration or enhancement opportunities on currently conserved lands, and potential PRM sites identified through Marxan. The owner-offered and restoration/enhancement opportunities being considered for PRM are shown in Table 2-5. The Marxan methods and results are presented following the description of owner-offered properties.

Table 2-5 Owner-Offered Permittee-Responsible Mitigation Options

Potential Permittee-Responsible Mitigation Locations	Applicable HUC- 8 Watershed	Land Cover Types with Mitigation Potential	Mitigation Action under Consideration
[redacted]	Coyote Creek, HUC 18050003	Seasonal wetland, mixed riparian	Preservation and enhancement
Lucky Day Ranch	Pajaro River, HUC 18060002	Freshwater marsh, seasonal wetland, freshwater pond, mixed riparian, natural watercourse	Preservation, restoration, establishment, and enhancement
[redacted] property	Pajaro River, HUC 18060002	Seasonal wetland, freshwater pond, mixed riparian, palustrine forested wetland, natural watercourse, California sycamore woodland	Preservation and enhancement
Paxton property	Pajaro River, HUC 18060002	Freshwater marsh, mixed riparian, seasonal wetland, natural watercourse	Restoration, establishment, and enhancement
Montes property	Pajaro River, HUC 18060002	Seasonal wetland, mixed riparian, palustrine forested wetland, natural watercourse	Restoration, establishment, and enhancement
Five Pillars Farm	SF Bay, HUC 18050004	Alkali vernal pool	Preservation and restoration

In addition to the PRM owner-offered opportunities shown in Table 2-5, several PRM sites associated with the Central Valley Wye (immediately east of the project extent) may present additional available mitigation opportunities. Four potential PRM locations have been identified in the *Central Valley Wye Preliminary Compensatory Mitigation Plan* (Authority 2018): Blasingame Ranch, Day Ranch, Fenston Ranch, and Roen–Le Grand Ranch. All four of these properties are in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed and have potential to provide preservation/restoration (rehabilitation) and enhancement opportunities for riparian, vernal pool, seasonal wetland, freshwater pond, and natural watercourse features.

PRM sites would be protected and managed in perpetuity under agreements with third-party land managers. Third-party managers may include mitigation or conservation banking firms or local or regional conservation organizations such as the Santa Clara Valley Habitat Agency or The Nature Conservancy.

In contrast to ILF programs and mitigation banks, PRM sites have not been evaluated or approved by the resource agencies for compensatory mitigation purposes. Therefore, each of these potential sites would need to be evaluated for its suitability to satisfy the range of agency needs. The following sections describe these sites in greater detail.

Owner-Offered Properties

[redacted]

This 36-acre privately owned property is on [redacted]. The primary land cover type is serpentine grassland, but there are also seasonal wetlands with some potential for restoration or enhancement. The property is in the Coyote Creek HUC-8 watershed, and the seasonal wetlands on the property were likely once part of the Coyote Creek floodplain. The site has approximately 0.51 acre of seasonal wetland and 1,162 linear feet of mixed riparian enhancement opportunity ([redacted]). The site also provides an opportunity to protect serpentine grassland, a species-specific compensatory mitigation need for which there are few mitigation opportunities.

Lucky Day Ranch

Lucky Day Ranch is located in the foothills of the Santa Cruz Mountains west of US 101 between San Martin and Gilroy in the Pajaro River HUC-8 and Uvas Creek HUC-10 watershed. The 2000-acre ranch supports vernal pools, freshwater marshes, ponds, and serpentine seeps as well as riparian and stream resources and serpentine rock outcroppings. The property also supports aquatic and upland habitat for California tiger salamander and California red-legged frog. Lucky Day Ranch is currently under consideration for mitigation and conversation bank development; however, until the bank is developed and credits are authorized, the property is considered an opportunity for PRM. Table 2-6 shows the opportunities that have potential to meet compensatory mitigation needs under CWA Section 404.

Table 2-6 Compensatory Mitigation Opportunities on Lucky Day Ranch

Land Cover Type	Mitigation Action under Consideration	Extent of Available Mitigation Opportunity
Freshwater marsh	Preservation and enhancement	3 acres
Seasonal wetland	Preservation and establishment	30 acres
	Preservation and enhancement	20 acres
	Preservation	33 acres
Freshwater pond	Preservation	4.5 acres
Mixed riparian	Preservation and establishment	7 acres
	Preservation and enhancement	7 acres
	Preservation	11 acres
Natural watercourse	Preservation and establishment	1.5 acres, 3,500 linear feet
	Preservation and enhancement	0.2 acre, 1,55 linear feet
	Preservation	0.6 acre, 11,000 linear feet

Source: Bello 2019

[redacted] *Property*

The [redacted] property encompasses approximately 2,600 acres in the Diablo/Inner Coast Range at the Santa Clara and San Benito County boundary; a portion of the property is located in each county. The property is in the Pajaro River HUC-8 watershed and overlaps with the South Fork of Pacheco Creek and Arroyo de Las Viboras subwatersheds.

The dominant terrestrial land cover types are annual grasslands and oak woodlands, but the property also includes serpentine types (chaparral, bunchgrass, seeps, and outcroppings). The [redacted] property contains 17.3 miles of streams and supports the following aquatic land cover types: palustrine forested wetlands, mixed riparian, seasonal wetland, freshwater pond, natural

watercourse, and California sycamore woodland. Restoration and enhancement opportunities are likely to exist on the property, but no quantitative data are available. Table 2-7 shows the aquatic land cover types that would be available for preservation.

Table 2-7 Compensatory Mitigation Opportunities on the [redacted] Property

Aquatic Land Cover Type	Amount
Seasonal wetland	1.0 acre
Freshwater pond	6.0 acres
Mixed riparian	–
Palustrine forested wetland	–
Natural watercourse	17.3 miles
Sycamore alluvial woodland	0.7 acre

Source: [redacted]

Five Pillars Farm

Five Pillars Farm is located in Alameda County approximately 0.8 mile north of I-580 along the eastern side of Laughlin Road. The 32.5-acre property is predominantly grazed annual grassland but also includes aquatic features such as seasonal wetlands and vernal pools (Kohlmann et al. n.d.). This site is outside the San Joaquin–Lower Chowchilla HUC-8 watershed and outside the aquatic resource study area boundary; however, because some vernal pool conservation banks have very large service areas, it is reasonable to assume this property has potential as a PRM site.

There is opportunity for approximately 2.1 acres of alkali vernal pool establishment/expansion on this property. The property is also occupied by California tiger salamander and western burrowing owl; restoration and enhancement opportunities for these and other species are likely available (Kohlmann et al. n.d.).

Fisher Bend

The Fisher Bend property is located on Fisher Creek between Laguna and Richmond Avenue and is owned by the Peninsula Open Space Trust (POST). The property includes approximately 3,000 linear feet of the riparian corridor along the right bank of the creek. Some riparian restoration actions have already taken place, but additional restoration plans are under development for at least another 20 feet of riparian restoration (Cowan 2019). Additional restoration plans may be considered in the future. It is presumed that restoration plans on the Fisher Bend property will be aligned with "conceptual opportunities for water resource enhancements in the (Coyote Valley) linkage area" identified in the Coyote Valley Landscape Linkage planning document by the Santa Clara Valley Open Space Authority (SCVOSA) (2017). Restoration goals in the Fisher Creek basin include establishment of a continuous riparian system, improved flood storage, enhanced groundwater recharge, restoration of rare or sensitive habitats, improved surface and groundwater quality, and carbon sequestration.

Paxton Property

The Paxton property is located in the Soap Lake region east of Gilroy. The property includes portions of San Felipe Lake, Pacheco Creek, and the Pajaro River, although in this location the Pajaro River is a modified channel. The following restoration and enhancement opportunities, outlined in *Restoration Opportunities on the Paxton Property and Surroundings* (PWA 2005), have potential to serve as compensatory mitigation:

- Restore the outlet of San Felipe Lake to its original level. This action would expand the flooded footprint of the lake to the southeast and increase emergent wetland (freshwater marsh) and open water habitat.

- Restore the eastern branch of Tequisquita Slough (Pacheco Creek Arm). This action would increase channel complexity, reduce erosion, and create a full riparian corridor.
- Restore the sag ponds as discontinuous wetlands by eliminating the western branch of the Tequisquita Slough drainage ditch. This action would increase residence times in the sag ponds and on the floodplain.
- Restore Tequisquita Slough as a sinuous channel. This action would restore a sinuous channel or swale connecting the sag ponds to encourage establishment of riparian communities.
- Modify the confluence of Tequisquita Slough and Pacheco Creek. This action would create a more natural confluence and reduce erosion at the existing confluence.
- Create a wetland on Tequisquita Slough. This action would restore a historic seasonal wetland near the confluence of Pacheco Creek and Tequisquita Slough.

In total, the restoration actions would improve and increase the extent of freshwater marsh, mixed riparian, seasonal wetland, and natural watercourse land cover types. Restoration of these land cover types in this region would benefit a number of species, including steelhead—a species that uses this region as a migration corridor between the San Francisco Bay and spawning habitat upstream of this location on Pacheco Creek.

Montes Property

The Montes property, located in Soap Lake east of Gilroy, includes the confluence of Llagas Creek and the (currently bypassed) course of the Pajaro River. The property is part of the 280-acre Pajaro River Agricultural Preserve owned and managed by the SCVOSA. This location is noted as being among the most desirable properties in the region for restoration (PWA 2004). Table 2-8 shows restoration opportunities on the Montes property.

Table 2-8 Compensatory Mitigation Opportunities on the Montes Property

Restoration Action	Land Cover Types	Quantity of Restored Type
Levee removal, setback, or breach and riparian corridor expansion along the left bank of the Llagas Creek levee	Palustrine forested wetland, natural watercourse	1.3 miles or approximately 31.5 acres of palustrine forested wetland (assuming a riparian restoration width of 200 feet)
Levee removal, setback, or breach and riparian corridor expansion along the Pajaro River	Palustrine forested wetland, natural watercourse	0.7 mile or 17.0 acres of palustrine forested wetlands (assuming a riparian restoration width of 200 feet)
Restoration of the freshwater wetland and lake/ponds mosaic at the confluence of the Pajaro River and Llagas Creek	Freshwater marsh, freshwater pond	Unspecified
Wetland and riparian woodland restoration	Freshwater marsh, mixed riparian, palustrine forested wetland	40 acres

Source: Smith 2019

Marxan Analysis to Identify Potential Permittee-Responsible Mitigation Sites

To identify land with the greatest potential to be developed as PRM sites for the project, a Marxan analysis was conducted. Marxan is a software package that identifies a set of lands that meets the mitigation need, or target, for aquatic and species resources with maximum efficiency (i.e., using the minimum number of land patches). This set of lands that meets the mitigation target

with the fewest land patches is called the *best solution*. In this analysis, the mitigation targets were the estimated mitigation needs for each aquatic or species resource type.

In the Marxan software package, different program functions can be used to increase the likelihood that properties with certain characteristics will be selected in the final, optimized result or best solution. Some of the spatial inputs applied in this Marxan analysis include land cover, existing conservation lands, prioritized preservation areas, and species habitat models. One of the most frequently used functions in Marxan is the *cost function*. The cost function allows users to increase or decrease the "cost" of a particular location based on a specified target. For example, the cost of a location could be lowered if the location is adjacent to, or in proximity of, an existing protected parcel. The cost might also be reduced if the location meets the conservation needs of more than one species. When the cost of a location is reduced, it is more likely to be selected in the final result.

As a specific example, the Authority's Marxan analysis applied a cost reduction to lands identified by GEA stakeholders as priorities for protection. The GEA stakeholders also used Marxan to identify priority lands (Huber 2019). A draft best solution of the GEA Marxan analysis was provided to the Authority and included in this analysis using the cost function. By reducing the cost of lands identified in the GEA Marxan analysis, those lands were more likely to be included in the Authority's best solution.

The GEA Marxan analysis was included in the Authority's Marxan analysis using a cost reduction (rather than requiring Marxan to include all GEA-selected lands) because the two analyses were created with different priorities. The GEA Marxan analysis prioritized lands based on stakeholder-specific priorities such as groundwater recharge potential, proximity to urban areas, and species habitat protection targets. While the species habitat protection goals in the GEA analysis overlap with species mitigation goals in the Authority's Marxan analysis, land protection goals related to groundwater recharge and confining urban sprawl are more consistent with mitigation goals the Authority has to offset other resource impacts (e.g., agricultural) or commitments. By using the cost reduction function, the GEA Marxan results could be included in the Authority's Marxan best solution where priorities aligned.

Using the best available information, only unprotected properties are considered in the Authority's Marxan analysis. However, the willingness of the owner of selected properties is unknown. For more information about the Marxan methods, including data inputs, targets, and cost functions, see Appendix B, Marxan Methods and Results.

The Marxan results for waters of the U.S. are shown in Table 2-9. Marxan identifies lands that are potentially available for preservation and restoration or enhancement; it does not identify opportunities for establishment or creation.

Table 2-9 Marxan Results for Waters of the U.S.

Aquatic Resource Type by HUC-8 Watershed	Total Mitigation Need or Target (acres)	Total Available Lands in the Regional RSA (acres)	Mitigation Need as a Percent of Total Available Acres in the Regional RSA	Marxan Run Output		
				Acres of Aquatic Resource in the Best Solution[1]	Percent of Mitigation Need Met by the Best Solution[1]	Difference between Mitigation Need and Acres Included in the Best Solution[1]
Coyote Creek HUC-8, Waters						
Freshwater marsh	0.3	7.8	3.9%	0.6	200%	0.3
Palustrine forested wetland/palustrine forested wetland–natural watercourse	0.6	45.8	1.3%	1.2	200%	0.6
Coyote Creek HUC-8, Waters other than Wetlands						
Natural watercourse	2.8	9.6	29.3%	1.2	43%	-1.6
Pajaro HUC-8 Watershed, Waters						
Freshwater marsh	6.6	29.4	22.4%	25.3	383%	18.7
Mixed riparian–natural watercourse	10.5	27.4	38.3%	2.9	28%	-7.6
Palustrine forested wetland/palustrine forested wetland–natural watercourse	21.9	2,189.2	1.0%	114.9	525%	93.0
Seasonal wetland	20.4	249.8	8.2%	73.9	362%	53.5
Pajaro HUC-8 Watershed, Waters other than Wetlands						
Freshwater pond	9.0	413.4	2.2%	31.3	348%	22.3
Natural watercourse	18.0	162.1	11.1%	95.2	529%	77.2

Aquatic Resource Type by HUC-8 Watershed	Total Mitigation Need or Target (acres)	Total Available Lands in the Regional RSA (acres)	Mitigation Need as a Percent of Total Available Acres in the Regional RSA	Marxan Run Output		
				Acres of Aquatic Resource in the Best Solution[1]	Percent of Mitigation Need Met by the Best Solution[1]	Difference between Mitigation Need and Acres Included in the Best Solution[1]
Middle San Joaquin-Lower Chowchilla HUC-8 Watershed, Waters						
Alkali marsh and alkali scrub wetland	20.1	1,501.9	1.3%	102.0	507%	81.9
Alkali vernal pool (Central Valley)	0.0	1,197.0	0.0%	0.0	0%	0.0
Alkali vernal pool/California annual grassland	81.3	1,912.3	4.3%	74.7	92%	-6.6
Freshwater marsh (Central Valley)	0.3	11,291.7	0.0%	90.1	30,033%	89.8
Mixed riparian–natural watercourse (Central Valley)	0.3	73.1	0.4%	3.9	1,300%	3.6
Seasonal wetland (Central Valley)	5.7	244.6	2.3%	6.1	107%	0.4
Vernal pools (Central Valley)	1.5	1197.0	0.1%	2.2	147%	0.7
Middle San Joaquin-Lower Chowchilla HUC-8 Watershed, Waters other than Wetlands						
Natural watercourse (Central Valley)	6.8	27.1	25.1%	15.3	225%	8.5

[1]Difference between the mitigation target and the acres of mitigation opportunity in the Marxan result. A positive number reflects a Marxan result greater than the target; a negative number reflects a Marxan result less than the target.
[2]This analysis assumes that mitigation opportunities to offset alkali vernal pool impacts along Henry Miller Road can be identified in the Witham et al. (2014) dataset used to map vernal pools, which includes 119,695 acres of unprotected vernal pool complex. Percentage of wetted pools in this region ranges from 1% to 5%; 1% wetted pool assumption was applied to the Marxan analysis results. A unique dataset was created to identify alkali vernal pool/California annual grassland mitigation opportunities on the eastern slope of the Diablo Range within the Central Coast vernal pool recovery area to offset pool impacts on Romero Ranch.

2.8 Mitigation Options by HUC-8 Watershed and Aquatic Resource Type

This section summarizes the off-site mitigation options, by HUC-8 watershed and aquatic resource type, for waters of the U.S. For each aquatic resource, applicable bank, ILF programs, owner-offered PRM sites, and Marxan results are described and the feasibility of meeting the total mitigation need is assessed. Table 2-10 shows a summary of the mitigation options. For a complete list of mitigation options, see Table C-1 in Appendix C, Mitigation Options.

The type of available mitigation will affect the feasibility and ease of accomplishing the mitigation target for each aquatic resource. Where bank credits, ILF program credits, or owner-offered PRM sites are available, meeting the mitigation need is expected to be relatively straightforward. The purchase of mitigation bank or ILF credits is the regulatory agencies' preferred mechanism because the quality of the mitigation land is known and has been certified by one or more of the agencies, credits provide aquatic resource creation or restoration, and the credits are relatively easy to obtain once there is agreement with the agencies about the impact-to-credit ratio and permission has been obtained for any out-of-kind mitigation requests.

Mitigation options that require partnerships with local stakeholders may require additional time for project identification and coordination, but they are still likely to be relatively straightforward, primarily because local stakeholders are engaged in planning efforts to identify and prioritize acquisitions and projects with high conservation value and because the stakeholders are often already engaged with agency partners. Local stakeholders are also committed to working with partners like the Authority so that mitigation efforts make meaningful contributions to regional conservation goals. In addition, an existing land manager is typically in place with an existing monitoring and management plan and budget so the incremental increase in effort and cost is relatively easy to determine and implement.

Owner-offered PRM sites are not certified by any regulatory agency but they have all been evaluated, to some degree, by biologists for preservation, restoration, and enhancement opportunities. Also, the owner-offered PRM sites have a known willing seller. Because the PRM sites are not pre-certified by the USACE, additional desktop and field work may be needed so that agency staff can verify the amount and quality of proposed mitigation lands (compared to quantified impacts), determine mitigation ratios, and agree to any proposed out-of-kind mitigation. Also, funding and implementation of long-term management will need to be identified and defined.

Where mitigation options are partially or completely limited to PRM sites identified by the Marxan analysis, accomplishing mitigation will be the most complex. This is particularly true where the mitigation need is relatively high compared to the total available acres. Also, the Marxan analysis can only identify unprotected lands where opportunities for rehabilitation or enhancement may exist. Because the Marxan analysis relies on existing land cover mapping, it cannot identify opportunities for creation or restoration (though such opportunities may exist on identified PRM sites).

Table 2-10 Summary of Mitigation Options, by HUC-8 Watershed and Aquatic Resource Type

Aquatic Resource by HUC-8 Watershed and Type	Mitigation Need (acres)	Total Estimated Mitigation Acres Available from Banks	Total Estimated Mitigation Acres Available from ILF Programs	Total Estimated Mitigation Acres from Permittee-Responsible Mitigation Sites[1]	Total Estimated Mitigation Opportunity
Coyote Watershed					
Freshwater marsh	0.3	0	0	3.6	3.6
Palustrine forested wetland/palustrine forested wetland—natural watercourse	0.6	0	0	2.6	2.6
Natural watercourse	2.8	0	0	2.6	2.6
Pajaro Watershed					
Freshwater marsh	6.6	0	0	38.3	38.3
Mixed riparian—natural watercourse	10.5	3.2	0	37.9	41.1
Palustrine forested wetland/palustrine forested wetland—natural watercourse	21.9	0	0	183.4	183.4
Seasonal wetland	20.4	0	0	157.9	157.9
Freshwater pond	9	0	0	41.8	41.8
Natural watercourse	18	3.2	0	139.2	142.4
Middle San Joaquin–Lower Chowchilla					
Alkali marsh and alkali scrub wetland	20.1	0	11.2	121.1	132.3
Alkali vernal pool	0	0	0	2.2	2.2
Alkali vernal pool/California annual grassland	81.3	0	0	76.9	76.9
Freshwater marsh	0.3	0	0	90.1	90.1
Mixed riparian–natural watercourse	0.3	0	11.2	3.9	15.1
Seasonal wetlands	5.7	27.6	0	6.1	33.7
Vernal pools	1.5	0	14	2.2	16.2
Natural watercourse	6.8	0	11.2	15.3	26.5

[1] Permittee-responsible mitigation sites include Marxan results (i.e., acreage from the best solution).

2.8.1 Coyote Creek HUC-8 Watershed

2.8.1.1 Wetlands

Freshwater Marsh

The project would result in impacts on freshwater marsh in the Coyote Creek HUC-8 watershed. The Authority would mitigate impacts on this wildlife resource through on-site, in-kind restoration and off-site, in-kind preservation, establishment, restoration, and enhancement. There is an estimated 0.3 acre of mitigation need to offset impacts on freshwater marsh. This mitigation need constitutes 3.9 percent of the total resource available.

There are no mitigation banks or ILF programs for freshwater marsh in this HUC-8 watershed, however, the [redacted] and Lucky Day Ranch both have opportunities for preservation and enhancement. The [redacted] site has 0.3 acres of seasonal wetlands, though this is an out-of-kind opportunity, it is proximate to the location of the impact. Lucky Day Ranch has 3 acres of freshwater marsh opportunity.

The Marxan analysis identified 0.6 acre of PRM sites that have potential to meet the freshwater marsh mitigation need within the Coyote Creek HUC-8 watershed (200 percent of the total mitigation need). Given the small acreage of the mitigation need and the number of identified mitigation opportunities, it is feasible to meet the mitigation need for freshwater marsh.

Palustrine Forested Wetland and Palustrine Forested Wetland–Natural Watercourse

These two aquatic resource types have high potential to co-occur, thus they are treated together here. The project would result in impacts on palustrine forested wetland and palustrine forested wetland–natural watercourse aquatic types in the Coyote Creek HUC-8 watershed. The Authority would mitigate impacts on palustrine forested wetland and palustrine forested wetland–natural watercourse with on-site, in-kind restoration and off-site, in-kind or out-of-kind protection, establishment, restoration, and enhancement. There is an estimated 0.3 acre of mitigation need to offset impacts on palustrine forested wetland and 0.3 acre of mitigation need to offset impacts on palustrine forested wetland–natural watercourse, for a combined mitigation need of 0.6 acre. This mitigation need constitutes 1.3 percent of the total resource available.

There are no mitigation banks or ILF programs that could meet this mitigation need. The main stem of Coyote Creek and Guadalupe River are the locations that provide the greatest potential to restore palustrine forested wetland in the Coyote Creek HUC-8 watershed. Given the small amount of mitigation that is required, it may be possible to achieve the restoration or enhancement opportunities adjacent to HSR construction locations. All temporary construction areas will be restored to pre-project conditions. This provides an opportunity to restore or enhance the adjacent vegetation community. Restoration or enhancement could be achieved by removing hardscape within the creek; removing, monitoring and controlling invasive riparian species; or levee setbacks or replacement of confined water structures such as culverts or bridges.

The Marxan analysis identified 1.2 acres of PRM sites that have potential to meet the palustrine forested wetland needs in the Coyote Creek HUC-8 watershed (200 percent of the total mitigation need) indicating there is sufficient opportunity to meet the mitigation needs.

2.8.1.2 Waters other than Wetlands

Natural Watercourse

The project would result in impacts on natural watercourses in the Guadalupe River and Coyote Creek HUC-10 watersheds in the following locations: Los Gatos Creek near San Carlos Road, Guadalupe Creek near the SR 87/I-680 intersection, and Coyote Creek near Metcalf Canyon Road. The Authority would mitigate natural watercourse impacts in the Coyote Creek HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind preservation and rehabilitation or enhancement. There is an estimated 2.8 acres of mitigation need to offset natural watercourse

impacts. This mitigation need constitutes approximately 29.3 percent of the total resource available.

There are no mitigation banks or ILF programs that could meet this mitigation need; however, POST has a restoration opportunity on Fisher Creek, a tributary of Coyote Creek, and is interested in partnering with the Authority to implement restoration. POST owns Fisher Bend, a property that includes approximately 3,000 linear feet of Fisher Creek, and is currently working on plans to rehabilitate and enhance the reach of Fisher Creek on its property.

Restoration plans on the Fisher Bend property will be aligned with "conceptual opportunities for water resource enhancements in the (Coyote Valley) linkage area" identified in the Coyote Valley Landscape Linkage planning document by the SCVOSA (2017). These conceptual opportunities include establishment of a continuous riparian system, improved flood storage, enhanced groundwater recharge, restoration of rare or sensitive habitats, improved surface and groundwater quality, and carbon sequestration (SCVOSA 2017).

Other locations in the Coyote Creek HUC-8 watershed that would be prioritized for the implementation of natural watercourse mitigation projects include Upper Penitencias and Los Gatos Creeks. These stream reaches have been identified for the preservation and restoration of water quality, flood control, and salmonid spawning habitat. Currently, the Santa Clara Valley Water District (SCVWD) has been developing a prioritized list of preservation and restoration opportunities for Coyote Creek through the One Water Plan. Through a stakeholder process, the SCVWD has collected a list of projects that are currently being evaluated and prioritized. SCVWD expects this list to be publicly released for review in August 2019 (Mendenhall 2019). A similar process would be undertaken for the Guadalupe River system, which includes Los Gatos Creek, but that process has not yet begun.

The Marxan analysis identified 1.2 acres of PRM sites that have potential to meet the natural watercourse mitigation need within the Coyote Creek HUC-8 watershed (43 percent of the total mitigation need). These sites are not the only locations where mitigation could be accomplished, but they represent the sites that would most efficiently meet the combined aquatic habitat and species mitigation needs.

Natural watercourse restoration opportunities on Fisher Creek and the PRM sites identified by Marxan indicate that there is sufficient opportunity to meet natural watercourse mitigation needs. In addition, a list of prioritized Coyote Creek projects is expected to be released by the SCVWD in fall or winter 2019. It is expected that there will be a number of projects on that list that could provide opportunities for partnerships between the Authority and the SCVWD in the Coyote Creek HUC-8 watershed. Based on this analysis, meeting the natural watercourse mitigation need is feasible.

2.8.2 Pajaro River HUC-8 Watershed

2.8.2.1 Wetlands

Freshwater Marsh

The project would result in impacts on freshwater marsh along Pacheco Creek just east of Casa de Fruta. The Authority would mitigate impacts on freshwater marsh through on-site, in-kind restoration and offsite, in-kind or out-of-kind establishment, rehabilitation, enhancement, and preservation. There is an estimated 6.6 acres of mitigation need to offset freshwater marsh impacts in the Pajaro HUC-8 watershed. This mitigation need constitutes approximately 22 percent of the total resource available based on available mapping data.

There are no banks or ILF programs that could meet this mitigation need. The Pajaro River Mitigation Bank has 5.4 seasonal wetland credits currently available, with the potential to develop another 139.2 credits (a total of 144.6 acres of opportunity) (USACE 2019). It may be possible to obtain agency approval to offset freshwater marsh impacts using seasonal wetland credits. It may also be possible to work with the Pajaro River Mitigation Bank to develop freshwater marsh credits. The Sparling Ranch Conservation Bank has 0.76 aquatic habitat credit available for

California tiger salamander and California red-legged frog with potential to develop more (South Bay Conservation Resources 2019). It is possible, with agency approval, that purchase of these credits could meet both freshwater marsh and species mitigation needs.

There are also partnership opportunities for the restoration, rehabilitation, and enhancement of freshwater marsh on the Paxton and Montes properties in the Soap Lake region of the Pajaro River HUC-8 watershed. The Nature Conservancy holds an easement on the Paxton property and the SCVOSA owns the Montes property. Mitigation projects could expand and improve freshwater marsh resources by:

- Restoring the outlet of San Felipe Lake to its original level
- Restoring the sag ponds as discontinuous wetlands by eliminating the western branch of the Tequisquita Slough drainage ditch
- Creating a willow wetland and lagoon on the Montes property

The exact spatial extent of the marsh creation opportunity on these properties is not known; however, it is estimated that 10 of the 40 acres of planned lagoon/marsh/riparian restoration on the Montes property has the potential to be used for freshwater marsh creation. The Nature Conservancy and the SCVOSA have an interest in partnering with the Authority to implement restoration and rehabilitation goals on their preserves.

If the estimates for restoration at the Montes and Paxton properties are correct, then the mitigation need for freshwater marsh could be met in full. If additional acres are needed to meet the total need, the owner-offered PRM site Lucky Day Ranch, located in the Pajaro HUC-8 watershed, has 3 acres of freshwater marsh available for preservation. In addition, the Marxan analysis has identified 25.3 acres of freshwater marsh (383 percent of the total mitigation need) available for preservation and possibly for rehabilitation or enhancement on properties that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites. With these available options, meeting the total mitigation is feasible.

Mixed Riparian–Natural Watercourse

The project would result in impacts on mixed riparian–natural watercourse in the Pajaro River HUC-8 watershed along SR 152 in the vicinity of Casa de Fruta. The Authority would mitigate these impacts in the Pajaro River HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind establishment, protection, restoration, or enhancement. There is an estimated 10.5 acres of mitigation need to offset mixed riparian–natural watercourse impacts. This mitigation need constitutes approximately 38 percent of the total resource available.

There are no mitigation banks or ILF programs that could meet this mitigation need within the Pajaro River HUC-8 watershed. However, based on its location, there may be some potential to develop mixed riparian credits at the Pajaro River Mitigation Bank.

The Sparling Ranch Conservation Bank has approximately 1.3 miles of riparian scrub or riparian woodland restoration opportunity along the South Fork of Pacheco Creek (Meyers 2019). Conservatively assuming a riparian restoration width of 20 feet on each bank, 1.3 miles would equate to approximately 6.3 acres of restoration opportunity. The analysis conservatively assumes that half the riparian types developed at the Sparling Ranch property (3.15 acres) would be mixed riparian.

There are also restoration, rehabilitation, and enhancement opportunities on the Paxton and Montes properties in the Soap Lake region of the Pajaro River HUC-8 watershed as described in Section 2.7.2.3, Permittee-Responsible Mitigation. The extent of restoration potential on the Paxton property is unknown. The Montes property has approximately 78.5 acres of riparian restoration opportunity. For the purposes of this analysis, only 10 of the 78.5 acres are assumed to be mixed riparian; the rest of the acres are assumed to be palustrine forested wetland because that is the primary type mapped in the Soap Lake region for the impact analysis.

The Lucky Day Ranch owner-offered PRM site has 7 acres of riparian enhancement, 7 acres of riparian establishment, and 11 acres of riparian protection available. Based on its location in the eastern foothills of the Santa Cruz Mountains, it is assumed that riparian habitat on Lucky Day Ranch is mixed riparian (as opposed to palustrine forested wetland). Assuming regulators would allow a portion of the mitigation to be fulfilled with enhancement and protection, the Lucky Day Ranch has potential to meet all the mixed riparian–natural watercourse mitigation needs and would likely be prioritized over Sparling Ranch Conservation Bank or the Montes property.

The Marxan best solution includes 2.9 acres of mixed riparian–natural watercourse within the Pajaro River HUC-8 watershed (28 percent of the total mitigation need). Land cover mapping outside the project footprint does not distinguish between riparian types that are within and outside the natural watercourse. To distinguish between those types that are within or outside the natural watercourse, riverine lines from the National Hydrologic Dataset (USGS 2016) were buffered in GIS to identify those portions of the riparian area that are within the natural watercourse (and those that are outside).

In addition, the land cover mapping outside the project footprint identifies valley foothill riparian. The valley foothill riparian land cover type includes both mixed riparian and palustrine forested wetlands. The Marxan analysis was completed using the valley foothill riparian land cover type and then the Marxan results for each type (mixed riparian and palustrine forested wetland) were estimated by applying a proportion based on the mitigation need. In this instance, 29 percent of all mixed riparian– and palustrine forested wetland–natural watercourse mitigation needs were for the mixed riparian type so this 29 percent was applied to the total available acres of valley foothill riparian within the watershed as well as the total acres of valley foothill riparian included in the Marxan best solution. The other 71 percent of the valley foothill riparian included in the Marxan results are assumed to be the palustrine forested wetland type.

Because of these land cover mapping constraints, the feasibility analysis for achieving mixed riparian–natural watercourse is considered conservative. That is, the analysis includes several very conservative assumptions that likely limit the Marxan results. However, the feasibility of achieving mixed riparian–natural watercourse mitigation is not solely reliant upon the Marxan analysis. Lucky Day Ranch has enough mitigation opportunity to meet the mixed riparian–natural watercourse mitigation need. If additional establishment acres are needed, the Montes and Paxton properties should readily provide sufficient acres of created or established mixed riparian–natural watercourse to meet the total mitigation need. With these opportunities as well as those identified in the Marxan best solution mitigation is feasible.

Palustrine Forested Wetland and Palustrine Forested Wetland–Natural Watercourse

Because these two aquatic resource types have high potential to co-occur, they are treated together here. The project would result in impacts on palustrine forested wetland and palustrine forested wetland–natural watercourse aquatic types in the Pajaro River HUC-8 watershed. The Authority would mitigate impacts on palustrine forested wetland and palustrine forested wetland–natural watercourse in the Pajaro River HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind or out-of-kind protection, establishment, restoration, and enhancement. There is an estimated 5.4 acres of mitigation need to offset impacts on palustrine forested wetland and 16.5 acres of mitigation need to offset impacts on palustrine forested wetland–natural watercourse, for a combined mitigation need of 21.9 acres. This mitigation need constitutes 1 percent of the total resource available.

There are no mitigation banks or ILF programs with available palustrine forested wetland or riparian credits that could provide this mitigation within the Pajaro River HUC-8 watershed. The Lucky Day Ranch and Sparling Ranch owner-offered PRM sites have riparian establishment, enhancement, and protection opportunities, but these opportunities are likely for mixed riparian types (rather than for palustrine forested wetland types). For the purposes of this analysis, the available riparian opportunities on Lucky Day Ranch and Sparling Ranch are assumed to be mixed riparian.

There are also restoration, rehabilitation, and enhancement opportunities on the Paxton and Montes properties in the Soap Lake region of the Pajaro River HUC-8 watershed as described in Section 2.7.2.3. The extent of restoration potential on the Paxton property is unknown. The Montes property has approximately 78.5 acres of riparian restoration opportunity. For the purposes of this analysis, 10 of the 78.5 acres are assumed to be mixed riparian and 68.5 acres are assumed to be palustrine forested wetland. This assumption is based on impact locations near the Montes property with a similar aerial image signature being mapped as palustrine forested wetlands.

The Marxan best solution includes 114.9 acres of palustrine forested wetland/palustrine forested wetland–natural watercourse aquatic types within the Pajaro River HUC-8 watershed (525 percent of the total mitigation need). Land cover mapping outside the project footprint does not distinguish between those palustrine forested wetland types that are within and outside the natural watercourse. To distinguish between those types that are within or outside the natural watercourse, riverine lines from the National Hydrologic Dataset (USGS 2016) were buffered in GIS to identify those portions of the riparian area that are within the natural watercourse (and those that are outside).

In addition, the land cover mapping outside the project footprint identifies valley foothill riparian. The valley foothill riparian land cover type includes both mixed riparian and palustrine forested wetlands. The Marxan analysis was completed using the valley foothill riparian land cover type and then the Marxan results for each type (mixed riparian and palustrine forested wetland) were estimated by applying a proportion based on the mitigation need. In this case, 71 percent of all mixed riparian– and palustrine forested wetland–natural watercourse mitigation needs were for the palustrine forested wetland type so this 71 percent was then applied to the total available of valley foothill riparian within the watershed as well as to the total acres of valley foothill riparian included in the Marxan best solution. The other 29 percent of the valley foothill riparian included in the Marxan results are assumed to be the mixed riparian land cover type.

Most of the impacts on palustrine forested wetland/palustrine forested wetland–natural watercourse could be offset by creation or establishment opportunities at the Montes property. If additional acres are needed, the Paxton property also has some palustrine forested wetland creation or establishment opportunities. With these options plus those included in the Marxan best solution, meeting the total mitigation need for palustrine forested wetland/palustrine forested wetland–natural watercourse is feasible.

Seasonal Wetlands

The project would result in impacts on seasonal wetland in the Pajaro River HUC-8 watershed primarily in the Pacheco Creek HUC-10 watershed in the vicinity of Casa de Fruta. The Authority would mitigate impacts on seasonal wetland in the Pajaro River HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind establishment, rehabilitation and preservation. There is an estimated 20.4 acres of mitigation need to offset seasonal wetland impacts in the Pajaro River HUC-8 watershed. This mitigation need represents 8 percent of the total resource available.

The Pajaro River Mitigation Bank has 5.4 seasonal wetland credits available with potential to develop 139.2 more (a total of 144.6 acres of opportunity) (USACE 2019). Two PRM sites have seasonal wetland preservation and restoration/enhancement opportunities in the Pajaro River HUC-8 watershed: Lucky Day Ranch and the [redacted] property. Lucky Day Ranch is in the Uvas HUC-10 watershed and the [redacted] property is in the Pacheco Creek HUC-10 watershed.

The Lucky Day Ranch has 30 acres of seasonal wetland preservation and establishment, 20 acres of preservation and enhancement, and 33 acres of preservation opportunities. The [redacted] property has one acre of seasonal wetland preservation opportunity. Because the Lucky Day Ranch has mitigation opportunities that exceed the need and is a property with potential to meet mitigation needs for multiple aquatic and species resources, it would be prioritized over the mitigation bank and the [redacted] property to meet seasonal wetland mitigation needs.

The Marxan analysis identified 73.9 acres of seasonal wetland resources available for preservation and potentially enhancement in the Pajaro River HUC-8 watershed (362 percent of

the total mitigation need). However, because the Lucky Day Ranch can meet the entire seasonal wetland mitigation need, it is unlikely that additional PRM sites would be needed to meet the total mitigation need. Based on this analysis, meeting the full mitigation need is feasible.

2.8.2.2 Waters other than Wetlands

Freshwater Pond

The project would result in impacts on freshwater pond in the Pajaro River HUC-8. The Authority would mitigate impacts on freshwater pond in the Pajaro River HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind establishment, rehabilitation, or enhancement and preservation. There is an estimated 9 acres of mitigation need to offset freshwater pond impacts in the Pajaro River HUC-8 watershed. This mitigation need represents 2 percent of the total resource available.

There are no mitigation banks with freshwater pond credits available. However, regulatory agencies may allow freshwater pond impacts to be offset with seasonal wetland credits at the Pajaro River Mitigation Bank. It may also be possible to develop freshwater pond credits at the Pajaro River Mitigation Bank. Sparling Ranch Conservation Bank has 0.76 acre of California tiger salamander aquatic breeding habitat credits available. Because freshwater ponds often serve as breeding habitat for California tiger salamander and there is also a need to offset project impacts on the species, a portion of the pond impact could offset (subject to agency approval) with the purchase of salamander credits.

The Lucky Day Ranch and the [redacted] property both have freshwater pond preservation opportunities in the Pajaro River HUC-8 watershed. The Lucky Day Ranch has 4.5 acres of freshwater pond available for preservation in the Uvas HUC-10 watershed, and the [redacted] property has 6 acres available in the Pacheco HUC-10 watershed. The Paxton and Montes properties may have opportunity for freshwater pond creation, but there is not enough certainty about the potential to include acreage estimates.

The Marxan analysis identified 31.3 acres of freshwater pond resources available for preservation and potentially rehabilitation or enhancement in the Pajaro River HUC-8 watershed (348 percent of the total mitigation need). However, like the mitigation opportunities at the Lucky Day Ranch and the [redacted] property, the Marxan PRM sites only offer opportunities for preservation. Assuming that the agencies would require at least a portion of the impact to be offset with wetland creation, opportunities for freshwater pond creation at the Paxton property and the Pajaro River Mitigation Bank would be explored. Similarly, the purchase of breeding pond credits for California tiger salamander could offset freshwater pond loss, subject to agency approval. Freshwater pond credits could also be developed at the Pajaro River Mitigation Bank. With the list of mitigation options for preservation and creation detailed here, meeting the mitigation need is feasible.

Natural Watercourse

The project would result in impacts on natural watercourse in the Pajaro River HUC-8 watershed. The Authority would mitigate impacts on natural watercourse in the Pajaro River HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind establishment, preservation, rehabilitation, or enhancement. There is an estimated 18 acres of mitigation need to offset impacts on natural watercourse in the Pajaro River HUC-8 watershed. This mitigation need represents 11 percent of the total resource available.

There are no mitigation banks or ILF programs with natural watercourse credits in the Pajaro River HUC-8 watershed. The Lucky Day Ranch PRM site has 1.5 acres of preservation and establishment, 0.2 acre of preservation and enhancement, and 0.63 acre of preservation opportunities. The [redacted] property supports 17.2 miles of natural watercourse and Sparling Ranch Conservation Bank has at least 1.3 miles. Assuming a 20-foot wide watercourse, these reaches equate to 41.7 and 3.2 acres, respectively, of preservation and enhancement opportunity.

There are restoration and enhancement opportunities for natural watercourse on the Paxton and Montes properties owned by The Nature Conservancy and SCVOSA, respectively. Levees will be removed, breached, or set back to allow the river or creek to naturally meander. Increasing river sinuosity increases the overall surface area of the bed and river. However, the available acreages for natural watercourse restoration are not known at this time.

Under the One Water Plan, the SCVWD will develop a watershed plan for the Pajaro River watershed that will identify preservation and restoration opportunities. However, that plan is not expected to be released for one or more years.

The Marxan analysis identified 95.2 acres of natural watercourse preservation and enhancement opportunities in the Pajaro River HUC-8 watershed (529 percent of the total mitigation need) (Table 2-9).

Opportunities to create or establish natural watercourse are limited; however, there are ample opportunities to protect and enhance natural watercourse aquatic resources. The Lucky Day Ranch, the Sparling Ranch Conservation Bank, and the [redacted] property all provide opportunities to protect streams and creeks in the Pajaro River HUC-8 watershed. The Marxan results further identify preservation opportunities. Fully offsetting this impact may require working closely with regulatory agencies to find an acceptable mitigation package that is more heavily reliant on preservation (and riparian restoration), but given the length of stream and rivers on potential mitigation properties, fully offsetting this mitigation target is feasible.

2.8.3 Middle San Joaquin–Lower Chowchilla HUC-8 Watershed

2.8.3.1 Wetlands

Alkali Marsh and Alkali Scrub Wetland

Mitigation options for alkali marsh and alkali scrub wetland are treated together because they often co-occur within the same landscape. Also, the land cover mapping used in the Marxan analysis to identify possible PRM sites is not precise enough to discriminate between these two types; in the land cover dataset alkali marsh and alkali scrub wetland are both cross-walked to alkali desert scrub, a California Wildlife Habitat Relationship (CWHR) type for which land cover mapping was available outside the project footprint.

The project would result in impacts on alkali marsh and alkali scrub wetland in Mud Slough where it crosses Henry Miller Road. The Authority would mitigate impacts on alkali marsh and alkali scrub wetland in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed with on-site, in-kind restoration and off-site, in-kind or out-of-kind establishment, preservation, and rehabilitation or enhancement. There is an estimated 20.1 acres of mitigation need to offset impacts on alkali marsh and alkali scrub wetland. This mitigation need represents 1.3 percent of the total resource available (Table 2-9).

There are no mitigation banks that specifically offer credits for alkali marsh or alkali scrub wetland types in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Grasslands Mitigation Bank has 27.6 seasonal wetland credits that could be developed. The seasonal wetlands that would be created are expected to produce salt-tolerant vegetation (e.g., saltbush [*Atriplex* spp.], saltgrass [*Distichlis spicata*], alkali heath [*Frankenia salina*], alkali weed [C*ressa truxillensis*]), and thus have potential to be considered appropriate to offset impacts on alkali marsh and alkali scrub wetland. This potentially out-of-kind mitigation arrangement would have to be approved by the regulatory agencies.

The NFWF Sacramento District ILF Program has 11.2 aquatic resource credits available. These credits can be applied to restore, enhance, create, or preserve non–vernal pool aquatic resources in the San Joaquin Valley service area (where project impacts would occur) including palustrine wetlands (NFWF 2018), which include alkali marsh and scrub wetland. The NFWF ILF Program also has 37.72 unallocated advanced credits available (USACE 2019). This program offers credits for large-scale regional planning or infrastructure projects that may exceed existing ILF credit needs.

There are no known owner-offered PRM sites (including those described in the Central Valley Wye pCMP) in the Central Valley portion of the regional RSA. However, the Grasslands Water District has proposed three properties for consideration as possible PRM sites. There are no official restoration plans for these sites, but based on soils data the properties have 19 acres of alkaline soils that would be conducive for establishing alkali marsh or scrub wetland. Restoration actions to establish alkali marsh or scrub wetland also have the potential to benefit giant garter snake and to provide other species mitigation needs (e.g., Swainson's hawk, tricolored blackbird).

The Marxan analysis identified 102 acres of alkali marsh and alkali scrub wetland (mapped as alkali desert scrub by CWHR) preservation and enhancement opportunities in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed (507 percent of the total mitigation need).

The PRM sites proposed by the Grasslands Water District suggest the availability of properties with alkali marsh and alkali scrub wetland creation or establishment potential. The Grasslands Mitigation Bank provides another potential option for meeting in-kind creation or establishment mitigation needs. The Marxan analysis identified opportunities for preservation and enhancement with multiple-species benefits. With these options, meeting the full mitigation need for alkali marsh and alkali scrub wetland is feasible.

Alkali Vernal Pool/California Annual Grassland Complex

The impacts on alkali vernal pool/California annual grassland complex would occur northwest of the confluence of Romero Creek and the California Aqueduct on Romero Ranch, west of I-5, in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This aquatic feature could not be field verified; accordingly, this analysis conservatively assumed it to be a vernal pool (as opposed to a seasonal wetland feature that does not meet the vernal pool criteria).

The Authority would mitigate impacts on alkali vernal pool/California annual grassland complex with off-site, in-kind preservation and rehabilitation or enhancement. On-site restoration of an affected vernal pool may not be possible if the vernal pool's impermeable layer or hydrology are disrupted during construction. However, pre-construction surveys may find that the feature does not have the qualifying characteristics of a vernal pool. If the feature does have vernal pool characteristics, it may be possible to avoid impacts on hydrology and the vernal pool's impermeable layer, eliminating the mitigation need. This analysis assumes that all impacts would occur, resulting in an estimated 81.3 acres of mitigation need to offset impacts on the wetted portion of the alkali vernal pool/California annual grassland complex. This mitigation need represents 4.3 percent of the total resource available.

The alkali vernal pool/California annual grassland complex impact on Romero Ranch is considered distinct from the impacts on alkali vernal pools along Henry Miller Road on the valley floor. The Romero Ranch feature is in the Central Coast vernal pool recovery region (as opposed to the San Joaquin Valley vernal pool region) (USFWS 2005) on the eastern slope of the Diablo Range. Accordingly, the mitigation approach is also considered separately.

There are no mitigation banks or ILF programs with specific alkali vernal pool/California annual grassland pool credits in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. However, as mentioned previously, there are vernal pool conservation banks with available credits. With agency approval, those credits could be used to partially or fully meet the mitigation need for impacts on alkali vernal pool/California annual grassland pool in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed.

The NFWF Sacramento District ILF Program has 14 credits available in the Central Coast service area, which includes the impact location. The NFWF ILF Program also has 37.72 unallocated advanced credits that may also be available to offset the impact (USACE 2019). This program offers credits for large-scale regional planning or infrastructure projects that may exceed existing ILF credit needs.

Five Pillars Farm, an owner-offered PRM site, is located on Frick Lake in Livermore and has opportunities to restore and rehabilitate alkali vernal pools (Kohlman et al. n.d.). This site is in the Livermore vernal pool recovery area and therefore outside the Middle San Joaquin–Lower

Chowchilla HUC-8 watershed and outside the Central Coast vernal pool recovery area. However, the property offers a unique opportunity to protect and restore wetted alkali vernal pools and alkali vernal pool complex. The Five Pillars Farm PRM site has 2.21 acres of wetted pool restoration potential.

The Marxan analysis identified 74.7 acres of additional alkali vernal pool/California annual grassland preservation and rehabilitation/enhancement opportunities in the same portion of the Central Coast vernal pool recovery area as the impact (92 percent of the total mitigation need).[4]

There are many options to meet the 81.3 acres of mitigation need for alkali vernal pool/California annual grassland in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed:

- Vernal pool credits from four different conservation banks
- Central Coast vernal pool credits from the NFWF ILF Program
- Unallocated vernal pool credits from the NFWF ILF Program
- Alkali vernal pool restoration opportunities at Five Pillar Farms
- PRM sites with multiple species benefit identified through the Marxan analysis

With these options, meeting the mitigation need for alkali vernal pool/California annual grassland is feasible.

Freshwater Marsh

The project would result in impacts on freshwater marsh in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Authority would mitigate impacts on freshwater marsh through on-site, in-kind restoration and preservation and offsite, in-kind rehabilitation or enhancement. There is an estimated 0.3 acre of mitigation need to offset freshwater marsh impacts in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes less than 0.01 percent of the total resource available.

There are no mitigation banks or ILF programs in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed that has credits available for freshwater marsh. However, the Grasslands Mitigation Bank has seasonal wetland credits available and it is possible that agencies may allow freshwater marsh impacts to be offset at this bank, especially in light of the small mitigation need.

The Marxan analysis identified 90.1 acres of freshwater marsh available for preservation, rehabilitation, and enhancement on properties that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites (30,033 percent of the total mitigation need). Because of the small mitigation need, the potential to purchase credits at the Grasslands Mitigation Bank, and the PRM sites identified by the Marxan analysis, mitigation for freshwater marsh is feasible.

Mixed Riparian–Natural Watercourse

The project would result in impacts on mixed riparian–natural watercourse in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Authority would mitigate impacts on mixed riparian–natural watercourse through on-site, in-kind restoration and preservation and offsite, in-kind preservation and rehabilitation or enhancement. There is an estimated 0.3 acre of mitigation need to offset impacts on mixed riparian–natural watercourse in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes approximately 0.4 percent of the total resource available.

There are no mitigation banks in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed that have credits available for mixed riparian–natural watercourse. The NFWF Sacramento District ILF program has 11.12 San Joaquin aquatic resource credits available. These credits can be applied to restore, enhance, create, or preserve non–vernal pool aquatic resources in the San

[4] The Central Coast vernal pool recovery area includes the eastern and western slopes of the Diablo Range, including Santa Clara Valley. To identify mitigation opportunities that are within the same HUC-8 watershed as the impacts, the portion of the Central Coast vernal pool recovery region that is on the eastern slope of the Diablo Range was used to confine the Marxan analysis for alkali vernal pool/California annual grassland type.

Joaquin Valley service area (where project impacts would occur) including palustrine, lacustrine, and riverine wetlands (NFWF 2018). This mitigation need would likely be combined with the natural watercourse mitigation need described in Section 2.8.3.2, Waters other than Wetlands, and the available aquatic resource credits through the NFWF program would satisfy both mitigation needs.

The Marxan analysis identified 3.9 acres of mixed riparian–natural watercourse available for preservation, rehabilitation, and enhancement opportunities (1,300 percent of the total mitigation need) on properties that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites. Because of the small mitigation need, the potential to purchase credits through the NFWF ILF Program, and the PRM sites identified through the Marxan analysis, mitigation for mixed riparian–natural watercourse is feasible.

Seasonal Wetlands

The project would result in impacts on seasonal wetlands in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Authority would mitigate impacts on seasonal wetland through on-site, in-kind restoration and preservation and offsite, in-kind rehabilitation or enhancement. There is an estimated 5.7 acres of mitigation need to offset impacts on mixed seasonal wetland in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes approximately 2.3 percent of the total resource available.

The Grasslands Mitigation Bank in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed has 27.6 seasonal wetland credits available for development. In addition, the Marxan analysis identified 6.1 acres of seasonal wetland available for preservation, rehabilitation, and enhancement (107 percent of the total mitigation need) on properties that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites. Largely due to the availability of mitigation bank credits, mitigation for seasonal wetland impacts is feasible.

Vernal Pools

The project would result in impacts on vernal pools in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The vernal pools are within an annual grassland area south of Henry Miller Road on either side of the Santa Fe Grade canal. The Authority would mitigate impacts on vernal pools through the purchase of NFWF ILF Program credits and offsite, in-kind preservation and rehabilitation or enhancement. On-site restoration of an affected vernal pool is not possible because of the assumed disruption to the pool's impermeable layer and hydrology caused by project construction.

There is an estimated 1.5 acres of mitigation need to offset impacts on the two vernal pools in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes 0.1 percent of the total resource available.

The NFWF Sacramento District ILF program has 14 San Joaquin vernal pool credits available, and the Marxan analysis identified 2.2 acres of available wetted vernal pool preservation opportunities in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed (147 percent of the total mitigation need). The land cover mapping for the regional RSA identifies vernal pool complex; the mapping is not specific enough to quantify wetted vernal pool. To estimate the acres of available wetted pool, a 1 percent wetted area assumption was applied to the vernal pool complex maps to estimate the actual acreage of available wetted pool. The wetted acreage assumptions produced by Witham et al. (2014) inform the analysis. Based on the available ILF program credits and the PRM sites identified in the Marxan analysis, meeting the mitigation need for vernal pools is feasible.

2.8.3.2 Waters other than Wetlands

Natural Watercourse

The project would result in impacts on natural watercourse in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Authority would mitigate impacts on mixed riparian–natural

watercourse through on-site, in-kind restoration and preservation and offsite, in-kind preservation and rehabilitation or enhancement. There is an estimated 6.8 acres of mitigation need to offset impacts on natural watercourse in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes 27 percent of the total resource available.

There are no mitigation banks in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed that have credits available for natural watercourse. The NFWF Sacramento District ILF program has 11.12 San Joaquin aquatic resource credits available. These credits can be applied to restore, enhance, create, or preserve non–vernal pool aquatic resources in the San Joaquin Valley service area (where project impacts would occur) including riverine wetlands (a classification that applies to natural watercourse) (NFWF 2018). It is reasonable that the mitigation needs for natural watercourse and mixed riparian–natural watercourse could both be met with the available aquatic resource credits because the combined mitigation need of 9.8 acres (sum of 0.9 acre and 8.7 acres) could be met with the 11.12 available credits.

The Marxan analysis identified 15.3 acres of natural watercourse available for preservation, rehabilitation, and enhancement on properties (225 percent of the total mitigation need) that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites. Based on the availability of aquatic resource credits through the NFWF ILF Program and the PRM sites identified by the Marxan analysis, meeting the mitigation need for natural watercourse is feasible.

2.9 Conclusion

Meeting the total mitigation need within each affected HUC-8 watershed is feasible (see Tables 2-10 and C-1 in Appendix C). In the Coyote Creek watershed, known opportunities for in-kind creation or restoration of the natural watercourse aquatic resource are limited. However, based on what is currently mapped as available for preservation and enhancement (9.6 acres) the mitigation target (2.2 acres) is feasible. Also, POST and the SCVWD are currently developing restoration goals and priorities in the watershed and are willing and interested in pursuing a partnership with the Authority to implement projects consistent with regional conservation goals.

In the Pajaro River Watershed, much of the waters of the U.S. mitigation need can be met on the Lucky Day Ranch and the Montes and Paxton properties. Where there are residual mitigation needs, Sparling Ranch Conservation Bank has opportunities to develop mitigation and conservation bank credits (or other mitigation vehicles) specific to the mitigation need. The [redacted] property also has substantial mitigation potential, but less detail on these opportunities is available at this time.

Mitigation needs in the Middle San Joaquin–Lower Chowchilla watershed can largely be met with available mitigation and conservation bank and NFWF Sacramento ILF program credits. If the agencies allow Grassland Mitigation Bank seasonal wetland credits to offset alkali marsh and alkali scrub wetland impacts, and if NFWF ILF program unallocated advanced credits are assumed to be broadly applicable (i.e., not isolated to one aquatic resource type or geography so long as the location is within the ILF program boundary), it is possible to meet all the mitigation needs with bank and ILF credits.

It is important to note that the Marxan results suggest that there is also substantial PRM restoration and preservation opportunity in the region. Although there are no known owner-offered PRM sites in the Middle San Joaquin–Lower Chowchilla watershed, the Grasslands Water District is an important stakeholder interested in partnering on conservation projects. In addition, it is possible that there will be residual mitigation opportunities on Central Valley Wye PRM sites, particularly for vernal pools.

3 STATE- AND FEDERALLY REGULATED FISH AND WILDLIFE RESOURCES

This section evaluates the feasibility of achieving mitigation needs for state- and federally-listed species regulated under the state and federal Endangered Species Act, respectively. This section also evaluates the feasibility of achieving mitigation needs for fish and wildlife resource impacts regulated under Section 1600. Because of the geographic extent of impacts on various species and habitats, off-site compensatory mitigation would likely entail a combination of mitigation and conservation banks, ILF programs, and PRM. All compensatory mitigation would be undertaken with agency oversight and approval so that the combination of mitigation approaches would collectively meet the project's mitigation needs.

For all proposed mitigation, the Authority would determine and verify that each mitigation site has appropriate mitigation and monitoring plans in place. Funding would be secured for initial restoration (if applicable) and ongoing management.

3.1 Overview of Laws and Regulations

3.1.1 Federal

3.1.1.1 Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.)

The FESA and subsequent amendments provide guidance for conserving federally listed species and the ecosystems upon which they depend. Section 7 requires federal agencies to consult with the USFWS or the National Marine Fisheries Service (NMFS), as appropriate, to establish that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered fish, wildlife, or plant species or to result in the destruction or adverse modification of designated critical habitat for any such species. As part of the consultation, the USFWS and NMFS issue a biological opinion (BO) and an incidental take statement for wildlife species to exempt the action from the Section 9 prohibition on taking species.

3.1.1.2 Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)

The amended Magnuson-Stevens Fishery Conservation and Management Act is also known as the Sustainable Fisheries Act (Public Law 104-297). It requires that all federal agencies consult with the NMFS on activities or proposed activities authorized, funded, or undertaken by that agency that may adversely affect Essential Fish Habitat for commercially managed marine and anadromous fish species.

3.1.1.3 U.S. Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)

The U.S. Fish and Wildlife Coordination Act applies to any federal project where any body of water is impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and the appropriate state wildlife agency.

3.1.1.4 Invasive Species (USEO 13112)

USEO 13112 requires federal agencies to work cooperatively to prevent and control the introduction and spread of invasive plants and animals. This executive order was developed pursuant to NEPA, as amended (42 U.S.C. § 4321 et seq.); the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. § 4701 et seq.); the Lacey Act, as amended (18 U.S.C. § 42); the Federal Plant Pest Act (7 U.S.C. § 150aa et seq.); the Federal Noxious Weed Act of 1974, as amended (7 U.S.C. § 2801 et seq.); and the FESA (16 U.S.C. § 1531 et seq.).

3.1.2 State

3.1.2.1 California Endangered Species Act (Cal. Fish and Game Code §§ 2050–2085)

The CESA prohibits the take of any fish, wildlife, or plant species that it lists as endangered or threatened or that is a designated candidate for listing. *Take* refers to mortality or injury of the listed species itself and not the modification of a listed species' habitat. CESA authorizes the CDFW to issue a Section 2081 incidental take permit to allow the take of listed and candidate species incidental to an otherwise lawful activity, subject to specified conditions, including that the impacts of the take are fully mitigated.

3.1.2.2 California Fish and Game Code Section 1600 et seq. (Lake and Streambed Alteration)

California Fish and Game Code section 1600 et seq. requires notifying the CDFW prior to any project activity that might (1) substantially divert or obstruct the natural flow of any river, stream, or lake; (2) substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or (3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. If after this notification the CDFW determines that the activity may substantially adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement would need to be obtained.

3.1.2.3 Porter-Cologne Water Quality Control Act (Cal. Water Code § 13000 et seq.)

The Porter-Cologne Water Quality Control Act provides for implementation of the federal CWA by the State Water Resources Control Board (SWRCB), including issuance of Section 401 certifications and Section 402 National Pollutant Discharge Elimination System permits. Issuance of a Section 401 certification requires documenting compliance with state water quality standards, including watershed plans, designated beneficial uses, and the total maximum daily load program.

Porter-Cologne regulates discharges that could affect the quality of waters of the state and requires that a waste discharge requirements form be obtained for discharges, including fill of wetlands, that are not otherwise authorized by Section 404 or Section 402 of the federal CWA. Application for waste discharge requirements requires filing a report of waste discharge.

On April 2, 2019, the SWRCB adopted its proposed *State Wetland Definition and Procedures for Discharges of Dredge or Fill Material to Waters of the State* (Procedures). Among other provisions, the Procedures define certain *wetlands* as *waters of the state* under the Porter-Cologne Water Quality Control Act. The Procedures also provide a jurisdictional framework for the determination of aquatic features as wetlands. Such wetland features under the Procedures are identified and analyzed as *aquatic resources* throughout this document. Project compliance with the Procedures would be achieved through adherence to the provisions set forth in an MOU between the SWRCB and the Authority (dated January 19, 2017; amended March 11, 2019).

The project may potentially affect waters of the state regulated under Porter-Cologne. However, these impacts are isolated to constructed basins and would be compensated in kind and on site or at an off-site location agreed upon with the property owner. Accordingly, this pCMP does not further address compensatory mitigation requirements under Porter-Cologne.

3.2 Compensatory Mitigation Guidance

3.2.1 U.S. Fish and Wildlife Service

The intent of this pCMP is to identify mitigation sites that can provide opportunities for the preservation and restoration of habitats of federally listed species to offset the overall impacts of project construction and operations.

Mechanisms for providing such mitigation consist of PRM projects or activities; mitigation and conservation banks; ILF programs; habitat credit exchanges (HCE); and third-party programs, projects, or arrangements (USFWS 2017). The following components are fundamental elements of a mitigation plan:

- Objectives
- Factors considered during the site selection process
- Site preservation instrument to establish durability
- Baseline information
- Mitigation work plan, including boundaries, methods and specifications, and timing of restoration activities
- Credit evaluation, including credit table and release schedule, as applicable
- Maintenance plan, including description and schedule of maintenance to support continued viability once construction is completed
- Performance standards for habitat restoration
- Monitoring requirements
- Long-term management plan
- Adaptive management plan
- Financial assurances

The USFWS has published compensatory mitigation ratio guidelines for some species, but none exist for the species that may be affected by the project. However, several programmatic BOs issued by USFWS to address impacts on vernal pool crustaceans (USFWS 1996) and the giant garter snake (USFWS 1997) provide recommendations for mitigation with replacement and restoration guidelines that would be applicable to the project. This section summarizes the requirements established in these documents.

3.2.1.1 Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat

The 1996 programmatic BO issued by the USFWS Sacramento Office addresses impacts on vernal pool crustaceans and provides guidance for mitigation. As stated in the BO, compensatory mitigation for the loss of vernal pool fairy shrimp and vernal pool tadpole shrimp habitat comprises both a preservation and a creation component (USFWS 1996).

- **Preservation component**—For every acre of habitat directly and indirectly affected, at least two vernal pool credits will be dedicated within a USFWS-approved ecosystem preservation bank (2:1 ratio) or, based on USFWS evaluation of site-specific conservation values, 3 acres of vernal pool habitat may be preserved within the regional RSA or at a non-bank site as approved by the USFWS (3:1 ratio). The USFWS generally considers any vernal pool within 250 feet of the regional RSA to be potentially affected. This buffer can sometimes be reduced at the discretion of the USFWS.
- **Creation component**—For every acre of habitat directly affected, at least one vernal pool creation credit will be dedicated within a USFWS-approved habitat mitigation bank (1:1 ratio) or, based on USFWS evaluation of site-specific conservation values, 2 acres of vernal pool habitat will be created and monitored within the regional RSA or at a non-bank site as approved by the USFWS (2:1 ratio).

3.2.1.2 Giant Garter Snake Habitat

The 1997 programmatic BO issued by the USFWS Sacramento office addresses impacts on the giant garter snake and provides guidelines for habitat restoration or replacement. Projects that qualify for coverage under the BO would be categorized as one of three levels based on the

amount of temporary and permanent impacts. Each level has specific mitigation requirements (Table 3-1).

Table 3-1 Mitigation Requirements for Impacts on Giant Garter Snake Habitat

Level of Impacts	Duration of Impact (seasons)	Area of Impact (acres)	Mitigation Method
Level 1	1 season	Less than 20 and temporary	Restoration
Level 2	2 seasons	Less than 20 and temporary	Restoration plus 1:1 replacement ratio
Level 3	More than 2 seasons and temporary; or permanent loss	Less than 20 and temporary Less than 3 acres total giant garter snake habitat AND Less than 1 acre aquatic habitat OR Less than 218 linear feet bank habitat	3:1 replacement ratio (or restoration plus 2:1 replacement ratio) 3:1 replacement ratio

Source: USFWS 1997

Appendix A, Replacement and Restoration Guidelines, of the BO (USFWS 1997) notes that replacement of habitat may also require restoration of some areas. Preserved habitat may additionally be improved by applying the USFWS guidelines (Table 4-3 of the BO). Specific details of the required replacement ratios and restoration components are addressed in Appendix A of the BO.

3.2.2 California Department of Fish and Wildlife

The CDFW has not established comprehensive policies or guidelines regarding mitigation requirements for authorized take of species listed under the CESA. However, some requirements are stated in the California Fish and Game Code: Section 2081(b)(2) prescribes that "the effects of the authorized take shall be minimized and fully mitigated" and that "the measures required to meet this obligation shall be roughly proportional in extent to the effect of the authorized taking on the species." Section 1797(h) states that "it is the intent of the Legislature that banking and all other forms of mitigation for wildlife species comply with regulatory requirements, are based on the best available scientific information, can be implemented successfully, and have adequate funding to achieve mitigation measures, and be monitored for compliance and effectiveness."

Also, in accordance with Section 2081(b)(4) and California Code of Regulations Title 14, Sections 783.2 and 783.4(a), adequate funding in an amount approved by the CDFW will be provided to allow the mitigation to be successfully implemented and that monitoring will be conducted to verify that the mitigation site complies with established performance standards.

In contrast to the USACE and USEPA, the CDFW has traditionally prioritized preservation of existing habitat rather than habitat restoration, establishment, or enhancement, particularly with its CESA program. Consistent with the *High-Speed Rail Fresno to Bakersfield Section Draft Compensatory Mitigation Plan* (Authority and FRA 2013), the CDFW is willing to consider off-site mitigation for impacts on special-status species (pursuant to CESA § 2081 program) through the following means, in order of decreasing desirability:

- Conservation bank credits (CDFW-approved)
- Fee-title acquisition
- Conservation easement
- Existing USFWS-approved conservation bank (banking instrument would require revision)

The CDFW has published compensatory mitigation ratio guidelines for several listed and special-status species. Such guidelines are available for two species that could be affected by the project: Swainson's hawk and western burrowing owl. The mitigation program for western burrowing owl is a guideline provided by the CDFW. CDFW considers burrowing owls to be a species of special concern and therefore not subject to the CESA. However, project-related

impacts on this species would be potentially significant under CEQA. This section summarizes mitigation guidelines for these species.

3.2.2.1 Swainson's Hawk

Mitigation ratios for Swainson's hawk are based on the distance from the project footprint to the closest active nest site (which for this species is defined as a nest used one or more times in the last 5 years), as follows (CDFG 1994):

- Where effects on foraging habitat occur within 1 mile of an active nest tree, compensation will occur at a 1:1 ratio on agricultural lands or other suitable foraging habitat; or at a 0.5:1 ratio where habitat can be managed for prey production (e.g., managed to support prey species consisting of small mammals).
- Where effects on foraging habitat occur within 5 miles but more than 1 mile from an active nest tree, compensation will occur at a 0.75:1 ratio.
- Where effects on foraging habitat occur within 10 miles but more than 5 miles from an active nest tree, compensation will occur at a 0.5:1 ratio.

3.2.2.2 Western Burrowing Owl

Western burrowing owl is not a state-listed species; however, the CDFW currently recommends mitigation for project-related impacts on this species. The *2012 Staff Report on Burrowing Owl Mitigation* described mitigation measures to effectively address impacts on the species at the project, local, and regional levels (CDFG 2012). The report identifies the following best management practices for mitigating impacts:

- **Temporarily disturbed habitat**—Restore the disturbed area to preproject conditions, including decompacting soil and revegetating. Permanent habitat preservation may be warranted if there is the potential that the temporary impacts may render a nesting site (nesting burrow and satellite burrows) unsustainable or unavailable depending on the time frame, resulting in reduced survival or abandonment. For the latter potential impact, see the discussion of permanent impacts.
- **Permanent impacts**
  - Mitigate impacts on nesting, occupied, and satellite burrows and burrowing owl habitat such that the habitat acreage, number of burrows and burrowing owls affected are replaced based on the information provided in Appendix A, Burrowing Owl Natural History and Threats, of the 2012 Staff Report (CDFG 2012). A minimum habitat replacement recommendation is not provided here because doing so has been shown to serve as a default, replacing any site-specific analysis and discounting the wide variation in natal area, home range, foraging area, and other factors influencing burrowing owls and burrowing owl population persistence in a particular area.
  - Mitigate using (1) permanent conservation of similar vegetation communities (grassland, scrublands, desert, urban, and agriculture) to provide for burrowing owl nesting, foraging, wintering, and dispersal (i.e., during breeding and nonbreeding seasons) comparable to or better than that of the impact area, and (2) sufficiently large acreage with presence of fossorial mammals. The mitigation lands may require habitat enhancements including enhancement or expansion of burrows for breeding, shelter and dispersal opportunity, and removal or control of population stressors. If the mitigation lands are adjacent to the affected burrow site, verify that the nearest neighbor artificial or natural burrow clusters are within 210 meters (Fisher et al. 2007).

The 2012 Staff Report provides additional details on the site selection process and recommends protecting mitigation lands through a conservation easement deeded to a nonprofit conservation organization or public agency with a conservation mission. If the impact area is within the service area of a CDFW-approved western burrowing owl conservation bank, the project proponent may purchase available western burrowing owl conservation bank credits. Moreover, to protect the long-term viability of the mitigation land, developing a long-term management plan and

establishing a long-term funding mechanism are also suggested. If no other feasible mitigation options are available and a lead agency is willing to establish and oversee a Burrowing Owl Mitigation and Conservation Fund that funds acquisition and permanent habitat conservation on a competitive basis, the project proponent may participate in the lead agency's program (CDFG 2012).

3.3 Estimated Impacts on Species, Designated Critical Habitat, and Wildlife Resources

3.3.1 Estimated Impacts on Species and Habitat

Species impacts were estimated by intersecting spatially explicit species habitat models and the project footprint using GIS software. The methods for estimating impacts on listed species are described in Chapter 4, Methods for Evaluating Effects, of the *San Jose to Merced Project Section: Biological and Aquatic Resources Technical Report* (Authority 2019d). The estimated impacts on species are shown in Table 3-2.

Table 3-2 Special-Status Species Impact Estimates[1]

Species by Relevant Geography (if applicable)	Species Habitat Impact[2]		Mitigation Multiplier[3]		Estimated Mitigation Need[4]		Total Estimated Mitigation Need[5]
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	
California red-legged frog							
Aquatic (Sierra Nevada foothills)	0.5	0.1	3.0	1.0	1.5	0.1	1.6
Upland (Sierra Nevada foothills)	94.4	30.2	2.0	1.0	188.8	30.2	219.0
Aquatic (South and East San Francisco)	18.0	3.7	3.0	1.0	54.0	3.7	57.7
Upland (South and East San Francisco)	253.6	57.9	2.0	1.0	507.2	57.9	565.1
Aquatic (Diablo Range / Salinas Valley)	76.9	27.7	3.0	1.0	230.7	27.7	258.4
Upland (Diablo Range / Salinas Valley)	1,368.7	383.9	2.0	1.0	2,737.4	383.9	3,121.3
California tiger salamander							
Breeding/primary upland (Central Valley + Outside RU)	19.0	51.3	5.0	1.0	95.0	51.3	146.3
Secondary upland (Central Valley + Outside RU)	852.7	365.6	2.0	1.0	1,705.4	365.6	2,071.0
Breeding/primary upland (East Bay RU)	17.8	5.0	5.0	1.0	89.0	5.0	94.0
Secondary upland (East Bay RU)	1,556.6	418.6	2.0	1.0	3,113.2	418.6	3,531.8
Foothill yellow-legged frog							
Primary breeding and foraging habitat	59.9	19.6	3.0	1.0	179.7	19.6	199.3
Secondary breeding and foraging habitat	66.9	20.3	2.0	1.0	133.8	20.3	154.1
Burrowing owl							
Occupied breeding and foraging habitat (SCVHP Conservation Area C)	0.7	0.1	3.0	1.0	2.1	0.1	2.2
Least bell's vireo							
Recolonization breeding habitat—core	46.8	31.9	3.0	1.0	140.4	31.9	172.3
Recolonization breeding habitat—potential	16.8	12.4	2.0	1.0	33.6	12.4	46.0

Species by Relevant Geography (if applicable)	Species Habitat Impact[2]		Mitigation Multiplier[3]		Estimated Mitigation Need[4]		Total Estimated Mitigation Need[5]
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	
Swainson's hawk							
Active nesting site (eastern side)	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Primary active foraging habitat (eastern side)	302.8	120.6	1.0	0.5	302.8	60.3	363.1
Secondary active foraging habitat (eastern side)	568.4	251.7	0.8	0.5	454.7	125.8	580.6
Tertiary active foraging habitat (eastern side)	121.7	47.3	0.5	0.0	60.9	0.0	60.9
Active nesting site (western side)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Primary active foraging habitat (western side)	14.0	21.9	1.0	0.5	14.0	11.0	25.0
Secondary active foraging habitat (western side)	13.5	28.3	0.8	0.5	10.8	14.1	25.0
Tertiary active foraging habitat (western side)	87.7	23.1	0.5	0.0	43.9	0.0	43.9
Tricolored blackbird							
Previously occupied colony habitat (eastern side)	2.5	3.1	3.0	0.5	7.5	1.5	9.1
Potentially suitable colony habitat (eastern side)	28.9	49.7	3.0	0.5	86.7	24.8	111.6
Breeding season foraging—natural (eastern side)	415.5	159.5	1.0	0.5	415.5	79.7	495.3
Breeding season foraging—agriculture (eastern side)	525.9	271.2	1.0	0.5	525.9	135.6	661.5
Previously occupied colony habitat (western side)	0.1	0.1	3.0	0.5	0.3	0.1	0.4
Potentially suitable colony habitat (western side)	45.6	28.2	3.0	0.5	136.8	14.1	150.9
Breeding season foraging—natural (western side)	442.8	178.4	1.0	0.5	442.8	89.2	532.0
Breeding season foraging—agriculture (western side)	325.5	132.2	1.0	0.5	325.5	66.1	391.6
Steelhead—Central Valley and South-Central California Coast DPSs							
Potential spawning, rearing, and migratory habitat	11.3	7.9	2.0	1.0	22.6	7.9	30.5
Potential migratory and rearing habitat	8.7	4.2	1.0	0.5	8.7	2.1	10.8

Species by Relevant Geography (if applicable)	Species Habitat Impact[2]		Mitigation Multiplier[3]		Estimated Mitigation Need[4]		Total Estimated Mitigation Need[5]
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	
Bay checkerspot butterfly							
Suitable habitat	10.9	14.5	3.0	1.5	32.7	21.8	54.5
Conservancy fairy shrimp							
Potentially suitable habitat (San Joaquin Valley RU)	0.4	0.0	2.0	1.0	0.8	0.0	0.8
Potentially suitable habitat (Central Coast RU)	0.0	0.0	2.0	1.0	0.0	0.0	0.0
Longhorn fairy shrimp							
Potentially suitable habitat (San Joaquin Valley RU)	0.4	0.0	2.0	1.0	0.8	0.0	0.8
Potentially suitable habitat (Central Coast RU)	0.0	0.0	2.0	1.0	0.0	0.0	0.0
Valley elderberry longhorn beetle							
Potentially suitable riparian habitat	1.0	0.4	3.0	1.0	3.0	0.4	3.4
Other potentially suitable habitat	205.2	56.9	1.0	1.0	205.2	56.9	262.1
Vernal pool fairy shrimp							
Potentially suitable habitat (San Joaquin Valley RU)	0.4	0.0	2.0	1.0	0.8	0.0	0.8
Potentially suitable habitat (Central Coast RU)	27.1	0.0	2.0	1.0	54.2	0.0	54.2
Vernal pool tadpole shrimp							
Potentially suitable habitat (San Joaquin Valley RU)	0.4	0.0	2.0	1.0	0.8	0.0	0.8
Potentially suitable habitat (Central Coast RU)	27.1	0.0	2.0	1.0	54.2	0.0	54.2
Fresno kangaroo rat							
Potentially suitable habitat	57.9	47.1	3.0	1.0	173.7	47.1	220.8

Species by Relevant Geography (if applicable)	Species Habitat Impact[2]		Mitigation Multiplier[3]		Estimated Mitigation Need[4]		Total Estimated Mitigation Need[5]
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	
San Joaquin kit fox							
High value suitable habitat (eastern side)	13.2	20.6	3.0	1.0	39.6	20.6	60.2
Moderate value suitable habitat (eastern side)	190.1	65.5	2.0	1.0	380.2	65.5	445.7
Low value suitable habitat (eastern side)	1,007.5	481.6	0.5	0.5	503.8	240.8	744.6
High value suitable habitat (western side)	0.0	0.0	3.0	1.0	0.0	0.0	0.0
Moderate value suitable habitat (western side)	7.7	1.1	2.0	1.0	15.4	1.1	16.5
Low value suitable habitat (western side)	1,135.5	282.1	0.5	0.5	567.8	141.1	708.8
Giant garter snake							
Potentially suitable aquatic habitat	24.8	19.0	3.0	1.0	74.4	19.0	93.4
Potentially suitable upland habitat	346.1	162.0	3.0	1.0	1,038.3	162.0	1,200.3
Potentially suitable movement habitat	10.5	5.5	3.0	1.0	31.6	5.5	37.0
Crotch bumble bee							
Western side of Pacheco Pass	512.3	170.1	3.0	1.0	1,536.9	170.1	1,707.0
Eastern side of Pacheco Pass	933.3	241.3	3.0	1.0	2,799.9	241.3	3,041.2

[1] The table includes all state- or federally listed species as well as several nonlisted species that have distinctive habitat requirements (e.g., western burrowing owl).
[2] Species habitat impacts are estimated by intersecting spatially explicit habitat models with the project footprint in GIS.
[3] The multiplier that is applied to permanent impacts to determine the total mitigation need. The mitigation multiplier proposed here is conservative for the purposes of determining feasibility of achieving mitigation. Final mitigation ratios will be determined in conversation with the U.S. Army Corps of Engineers.
[4] The estimated mitigation need is the product of impacts multiplied by the mitigation multiplier. Due to rounding, this column may appear to have a multiplication error of 0.1 acre; this is not an error.
[5] The total estimated mitigation need is the sum of estimated permanent and temporary mitigation needs.
SCVHP = Santa Clara Valley Habitat Plan; DPS = distinct population segment; RU = recovery unit.

3.3.2 Estimated Impacts on Designated Critical Habitat

Table 3-3 shows the impacts on designated critical habitat.

Table 3-3 Estimated Impacts on Designated Critical Habitat (acres)

Permanent Conversion or Degradation of Critical Habitat	Permanent Impacts	Temporary Impacts	
		Long-Term	Short-Term
Bay checkerspot butterfly	1.9	<0.1	19.1
California tiger salamander	213.1	60.3	5.2
California red-legged frog	739.5	179.8	4.3
Steelhead—Central Valley and south-central California coast DPSs	5.0	1.9	0.6
Total	**959.5**	**242.0**	**29.2**

DPS = distinct population segment

3.3.3 Estimated Impacts under Section 1600 et seq.

The impacts described in this section would affect land cover types that are regulated under Section 1600 but are not considered waters of the U.S. Where an impact would affect a land cover type that meets the definition of waters of the U.S. and is also a type regulated under Section 1600, the impact is reported in both Chapters 2 and 3. For example, impacts on palustrine forested wetland impacts reported in Chapter 2 are those that are, generally, below the OHWM—the upper boundary of Section 404 jurisdiction. The acres of impact shown in Table 3-4 are those acres that occur above the OHWM and are thus solely regulated under Section 1600 et seq.

For the purposes of this analysis, all riparian areas have been mapped to the outer dripline of riparian vegetation and are included as areas potentially regulated by the CDFW under Section 1600 et seq.

Table 3-4 Estimated Impacts Regulated under Section 1600 et seq. by HUC-8 Watershed[1]

Aquatic Feature	Estimated Impacts		Mitigation Multiplier[2]		Estimated Mitigation Need[3]		Total Estimated Mitigation Need[4] (acres)
	Permanent (acres)	Temporary (acres)	Permanent	Temporary	Permanent (acres)	Temporary (acres)	
Coyote Creek, HUC 18050003 Watershed							
California sycamore woodland	0	0	n/a	n/a	n/a	n/a	0
Mixed riparian	0.6	0.4	2.0	0.0	1.2	0.0	1.2
Palustrine forested wetland	0	0	n/a	n/a	n/a	n/a	0
Pajaro River, HUC 18060002 Watershed							
California sycamore woodland	9.4	3.2	4.0	1.0	37.6	3.2	40.8
Mixed riparian	6.7	7.1	3.0	0.0	20.1	0.0	20.1
Palustrine forested wetland	0.0	0.0	n/a	n/a	n/a	n/a	0

Aquatic Feature	Estimated Impacts		Mitigation Multiplier[2]		Estimated Mitigation Need[3]		Total Estimated Mitigation Need[4] (acres)
	Permanent (acres)	Temporary (acres)	Permanent	Temporary	Permanent (acres)	Temporary (acres)	
San Joaquin–Lower Chowchilla, HUC 18040001 Watershed							
California sycamore woodland	0	0	0	0	0	0	0
Mixed riparian	0.9	0.3	3.0	0.0	2.7	0.0	2.7
Palustrine forested wetland	0	0	0	0	0	0	0

[1] Impacts presented in this table involve aquatic types regulated solely under Section 1600 et seq.—that is, outside the jurisdictional limits of Section 404. Table 2-1 shows impacts regulated under both CWA Section 404 and Section 1600 et seq.
[2] The multiplier that is applied to permanent impacts to determine the total mitigation need. The mitigation multiplier proposed here is conservative for the purposes of determining feasibility of achieving mitigation. Final mitigation ratios will be determined in conversation with the U.S. Army Corps of Engineers.
[3] The estimated mitigation need is the product of the impact multiplied by the mitigation multiplier.
[4] The total estimated mitigation need is the sum of estimated permanent and temporary mitigation needs.

3.4 Confirmation of Impacts

In coordination with the USFWS and CDFW, the estimates for impacts would be adjusted during project construction to determine the amount of compensatory mitigation required. Impact estimates would be adjusted under the following circumstances:

- Impacts on habitat are reduced or increased as a result of changes in project design
- Pre-construction site assessments indicate that habitat features are absent (e.g., because of errors in land cover mapping or land cover conversion)
- The habitat is determined to be unoccupied based on negative results of species surveys

All areas of temporary and permanent loss of habitat for state- and federally listed species will be documented in compliance reporting. This documentation will include GIS data layers, associated metadata, and photo documentation of areas of habitat loss for each species. For each species, a cumulative acreage of habitat loss will be presented in tabular format.

3.5 Compensatory Mitigation Strategy

Based on USFWS, NMFS, and CDFW policies, as well as EIR/EIS mitigation requirements, compensatory mitigation is proposed for the impacts described in Section 3.3.1, Estimated Impacts on Species and Habitat.

Mitigation for species affected by the project may be provided by preserving habitat, restoring or enhancing and preserving habitat, restoring or enhancing habitat on land that has already been preserved (“additionality”), or reducing environmental stressors other than habitat loss or degradation that threaten the species. These mitigation actions may be implemented by development or purchase of credits from conservation banks or ILF programs, the development of PRM sites, participating in habitat credit exchanges, or funding projects by third parties.

The primary approach proposed for mitigating impacts on state- and federally listed species and communities focuses on the long-term preservation of habitat, supplemented by habitat restoration and enhancement. This habitat would be preserved at PRM sites and at conservation banks, where credits would be purchased, and through ILF programs. The preservation and enhancement of sites that make proportionately greater contributions to regional conservation needs would be prioritized as described in Section 2.5, Approach to Mitigation. These are larger sites that expand existing preserved areas, contribute to regional connectivity of core habitat

areas, or have been identified as a conservation priority by local and regional conservation organizations and agencies.

Preserving habitat in perpetuity minimizes the risk of incompatible land uses eliminating or degrading conservation sites. Furthermore, their enhancement and management for habitat values benefit species in perpetuity. These benefits for the long-term viability of species' populations would exceed the impacts of the project for several reasons. First, mitigation would consist of high-quality habitat or would be enhanced to be of high quality. Such areas generally could be considered *source habitats*, where mortality rates are relatively low and fecundity relatively high (i.e., habitats that have a positive effect on population viability). In contrast, affected habitats would be of all levels of quality, with a large portion being of lesser quality of which species make limited use.

Second, for many species, occupied habitat would be preserved, whereas much of the affected habitat would be unoccupied by listed species. Because access and schedule constraints preclude surveys that could conclusively determine occupancy for many species, potentially suitable habitat is assumed to be occupied. However, most of these species do not occupy most potentially suitable habitat, and some likely occupy only a small portion of potentially suitable habitat. The result of this difference between preserved and affected sites is that many more individuals would benefit from the mitigation than would be adversely affected by the project.

Third, the conservation of sites that expand on existing protected areas, provide connectivity, or have been identified as a conservation priority provides benefits to species extending beyond the limits of the preserved site, also enhancing the value of the existing protected areas, thus making a greater contribution to the viability of species' populations.

To be suitable for use as mitigation, sites would need to be consistent overall with the mitigation requirements of the project's BO and 2081 incidental take permit, and generally would meet both of the following criteria:

- Suitability of the site as habitat for the species based on the determination of a qualified biologist or of the USFWS or CDFW, as applicable
- Likely species' use of the site as determined by one or more of the following:
  - Documented observation of the species
  - Proximity to a documented observation of the species (e.g., an occurrence reported in the California Natural Diversity Database)
  - Site-specific preservation requirements in an existing conservation strategy or recovery plan

It may be challenging to ascertain occupancy for some species at a given site because of population fluctuations, difficulty of detection, or infrequency of species occurrence. In these instances, a mitigation site may be selected based only on the presence of suitable habitat.

A major consideration in the selection of sites is their use as mitigation for multiple species. The use of such sites would reduce the total acreage of land required as mitigation. Moreover, such sites tend to be more diverse, of greater importance for regional conservation efforts, or both.

The planned amount of compensatory mitigation will be based on a conservative (i.e., high) estimate of the project's direct permanent effects on habitat potentially suitable for each species. These estimates are provided in Section 4.2, Estimated Impacts on Special-Status Species Habitat and Designated Critical Habitat.

As described in Section 4.3, Confirmation of Impacts, these estimates will be adjusted during implementation to determine the amount of compensatory mitigation that is commensurate with the actual impacts. Adjustments will be based on pre-construction site assessments, and in some cases on surveys for particular species in the project's footprint. This adjustment process is necessary because the project's pre-permit impact estimates are based on limited access to only a small portion of the project footprint, some changes in land cover and land use will likely occur

prior to construction, and some revisions to the project footprint will likely be made during the design/build process.

3.6 Identification of Mitigation Options

This section summarizes the methods used to identify specific mitigation options, discusses the types of options and individual properties identified, and summarizes the preferred mitigation approach by species.

3.6.1 Identification Methodology

Consistent with the regulatory and resource agency priorities and policies described herein, the pCMP uses a watershed-based, landscape-scale approach to identify mitigation sites exhibiting high conservation values as well as opportunities to restore, enhance, establish, and preserve aquatic resources and special-status species habitats. In particular circumstances, the analyses supporting this pCMP considered biological and management-related geographic boundaries to evaluate potential mitigation opportunities that may be environmentally preferable for a particular resource.

The mitigation options evaluated in this pCMP were identified through the following sources:

- GIS analysis of sites that retain natural habitat and jurisdictional water features and that have been identified by the resource agencies as high priorities for conservation
- Interviews with regional mitigation and planning specialists
- Interviews with third-party mitigation providers (mitigation banks, ILF programs, and conservation banks)
- Outreach with interested landowners
- Review of USACE-USEPA RIBITS
- Review of USFWS Sacramento Office's conservation bank database (USFWS 2019)
- A Marxan analysis

3.6.2 Identified Options for Compensatory Mitigation

3.6.2.1 In-Lieu Fee Programs

There are no known ILF programs operating in the Santa Clara Valley or Pacheco Pass portions of the study area. However, in the San Joaquin Valley, several ILF programs focus on conserving lands for two groups of species: vernal pool species and aquatic species (most specifically steelhead). These ILF programs are shown in Table 2-3.

There are two ILF programs for vernal pool species—one with a service area that overlaps with vernal pools of the San Joaquin Valley (San Joaquin Valley vernal pools) and one with a service area that includes a portion of the eastern slopes of the Diablo Range west of I-5 (Central Coast vernal pools). The project would result in impacts on vernal pools in both ILF program service areas and are thus suitable for consideration.

The ILF program for aquatic resources may not be necessary to offset impacts on steelhead in the San Joaquin Valley because the species is very unlikely to be affected by the project; however, pending official concurrence from the NFMS, the program is included as an option for species mitigation. There are no ILF programs that target fish and wildlife resources protected under Section 1600.

3.6.2.2 Conservation and Mitigation Banks

Conservation banks (or mitigation banks, as applicable) that have potential to provide compensatory mitigation for species-specific resources are shown in Table 3-5 and in the sections that follow. A detailed RIBITS report of the available credits, by habitat type, is presented in Appendix D. All the banks summarized in Table 3-5 have service areas that overlap with all or

a portion of the affected acres. However, not all banks are within the study area; the county within which the bank occurs is shown in Table 3-5 to provide some geographic context to bank location.

Table 3-5 Conservation and Mitigation Banks with Potential to Provide Compensatory Mitigation for Species

Conservation or Mitigation Bank	Species	Approving Agency	County Where the Bank is Located
Alkali Sink Conservation Bank	Vernal pool and longhorn fairy shrimp, San Joaquin kit fox, burrowing owl, Swainson's hawk,	USFWS, CDFW	Fresno
Grasslands Mitigation Bank	Giant garter snake	USACE, USFWS, USEPA, CDFW	Merced
Deadman Creek Conservation Bank	Vernal pool fairy and tadpole shrimps, conservancy fairy shrimp, California tiger salamander, San Joaquin kit fox, burrowing owl, Swainson's hawk	USFWS	Merced
Dutchman Creek Conservation Bank	Vernal pool fairy and tadpole shrimp, conservancy fairy shrimp, California tiger salamander, San Joaquin kit fox, burrowing owl, Swainson's hawk, western spadefoot	USFWS, CDFW	Merced
Drayer Ranch Conservation Bank	Vernal pool tadpole shrimp	USFWS	Merced
Great Valley Conservation Bank at Flynn Ranch	Vernal pools, California tiger salamander, San Joaquin kit fox	USFWS	Merced
Ohlone West Preserve Conservation Bank	California red-legged frog, California tiger salamander	USFWS, CDFW	Alameda
Oursan Ridge Conservation Bank	California red-legged frog	USFWS, CDFW	Contra Costa
Nicolaus Ranch VELB Conservation Bank	Valley elderberry longhorn beetle	USFWS	Sacramento
River Ranch VELB Conservation Bank	Valley elderberry longhorn beetle	USFWS	Yolo
Sparling Ranch Conservation Bank[3]	California red-legged frog, California tiger salamander	USFWS, CDFW	San Benito
Viera–Sandy Mush Road Conservation Bank	California tiger salamander, San Joaquin kit fox, vernal pool fairy and tadpole shrimp	USFWS	Merced

Source: USACE 2019
USFWS = U.S. Fish and Wildlife Service; CDFW = California Department of Fish and Wildlife; USACE = U.S. Army Corps of Engineers; USEPA = U.S. Environmental Protection Agency

There are no mitigation banks available within the three affected HUC-8 watersheds that provide credits for the affected land cover types regulated under Section 1600: mixed riparian, California sycamore woodland and palustrine forested wetland. However, as discussed in Section 2.6.2.2, Mitigation Banks, Sparling Ranch may have opportunities to develop mixed-riparian or palustrine forested wetland credits.

3.6.2.3 Permittee-Responsible Mitigation Sites

There are two types of PRM sites recommended for consideration: owner-offered properties and potential sites identified through Marxan analysis. Owner-offered properties are those where the owner is proactively looking for conservation opportunities such as conservation bank development or direct sale to a project proponent in need of mitigation or to a conservation organization. The Marxan analysis identified a set of potential sites that could effectively meet the total mitigation need.

Owner-Offered Properties

The owner-offered properties described in this section have some associated level of reporting as to what land cover types and species habitat the property provides (Table 3-6).

Table 3-6 Potential Permittee-Responsible Mitigation Sites

Potential Permittee-Responsible Mitigation Properties	County	Listed Species Likely to Benefit from Property Preservation[1]	Mitigation Action under Consideration
[redacted]	Santa Clara	Bay checkerspot butterfly, Swainson's hawk, burrowing owl	Preservation and enhancement
Lucky Day Ranch	Santa Clara	California red-legged frog, California tiger salamander, burrowing owl (overwintering), Swainson's hawk, tricolored blackbird, golden eagle	Preservation, restoration, establishment, and enhancement
[redacted] property	Santa Clara and San Benito	California red-legged frog, California tiger salamander, San Joaquin kit fox, golden eagle	Preservation and enhancement
Paxton property	Santa Clara	Burrowing owl, Swainson's hawk, tricolored blackbird, golden eagle, steelhead, California red-legged frog, California tiger salamander	Restoration, establishment, and enhancement
Montes property	Pajaro River, HUC 18060002	Burrowing owl, Swainson's hawk, tricolored blackbird, golden eagle, steelhead, California red-legged frog, California tiger salamander	Restoration, establishment, and enhancement
Five Pillars Farm	SF Bay, HUC 18050004	Vernal pool fairy shrimp, California tiger salamander, burrowing owl, San Joaquin kit fox, California red-legged frog, tricolored blackbird,	Preservation, restoration, and enhancement

[1] The properties described in this table would likely benefit multiple species if protected. For the purposes of this table, only the species most likely to benefit are listed.

Several of the owner-offered properties shown in Table 3-6 and described in Section 2.7.2.3 have potential to offset impacts on fish and wildlife resources regulated under Section 1600 et seq. Section 404 and Section 1600 et seq. regulate similar land cover types that often coincide. For example, mixed riparian and palustrine forested wetlands are regulated under both sections, although the jurisdictional limits differ. The portion of mixed riparian or palustrine forested wetland below the OHWM is regulated under Section 404 and Section 1600 et seq. regulates the portions both below and above the OHWM. Consequently, the same PRM property could fulfill compensatory mitigation obligations under both sections. Moreover, mitigation under Section 1600 may not be required to be in kind because it is the fish and wildlife function of the mitigation that is most important. For example, impacts on mixed riparian types outside the OHWM could potentially be offset with palustrine forested wetlands if the CDFW agrees that the ecological value of the mitigation land is suitable to offset the loss.

The properties with known potential to offset impacts on mixed riparian or palustrine forested wetlands regulated under Section 1600 et. seq. are listed below:

- Lucky Day Ranch
- [redacted] property
- Paxton property
- Montes property
- Sparling Ranch

Of these, Sparling Ranch is the only owner-offered property with known potential to also restore California sycamore woodland (Meyers 2019). About 1.8 miles of the South Fork of Pacheco Creek runs through Sparling Ranch, at least 1.3 miles of which has potential for creek and mixed riparian/California sycamore woodland restoration.

Marxan Analysis to Identify Potential Permittee-Responsible Mitigation Sites

Marxan software was used to identify a set of potential PRM sites that could efficiently meet the entire mitigation need. The data inputs are GIS data sets regarding the suitability of land to be included in a PRM site (e.g., its current preservation status and proximity to conserved areas) and the mapped locations of species habitats. The Marxan software package uses these data to identify a set of lands that best meets the mitigation targets (best solution) identified for different types of habitats with maximum efficiency (i.e., a set of land that meets the mitigation targets with the minimum number of land patches). In this analysis, the targets were the estimated mitigation needs for each type of species habitat.

In the Marxan analysis, different program functions can be used to increase the likelihood that properties with certain characteristics will be selected in the final, optimized result. Some of the spatial inputs applied in this Marxan analysis include land cover, existing conservation lands, prioritized preservation areas, and species habitat models. One of the most frequently used functions in Marxan is the *cost function*. The cost function allows users to increase or decrease the "cost" of a particular location based on a specified target. For example, the cost of a particular location could be lowered if the location is adjacent to, or in proximity of, an existing protected parcel. The cost might also be reduced if the location meets the conservation needs of more than one species. When the cost of a location is reduced, it is more likely to be selected in the final result. Using the best available information, only unprotected properties are considered in the Marxan analysis. However, the willingness of the owner of selected properties is unknown. For more information about the methods see Appendix B, Marxan Methods and Results.

For the purposes of this pCMP, the Marxan analysis provides insight into lands best suited to meet the total compensatory mitigation need for impacts on species and wildlife resources. During development of the Draft and Final Compensatory Mitigation Plans, the Marxan analysis may be refined to identify potential mitigation lands for those species or habitat types that are not sufficiently available in existing ILF programs, conservation or mitigation banks, or owner-offered properties.

Marxan identified 9,574 acres of potential PRM sites on 34 unique, contiguous sites that, when combined, could meet the project's total mitigation needs. These sites are not the only locations where mitigation could be accomplished, but they represent the set of lands that would most efficiently meet the combined mitigation need. The Marxan output is presented in 25-acre hexagons called *planning units*. Individual planning units can span multiple property boundaries; similarly, they may not encompass an entire property. Assuming that entire properties and not just the planning unit portion of a property would have to be purchased, the total acreage that would have to be acquired to meet mitigation needs would likely be greater than the calculated mitigation needs.

The Marxan analysis was designed such that mitigation lands would be reasonably proximate to the impact location. For those species that occur in multiple portions of the study area, a biologically relevant geographic boundary was selected. Impacts were determined for this geographic area and the Marxan model was then confined to the same geography. For example,

the California tiger salamander occurs in the Santa Clara and San Joaquin Valleys as well as in Pacheco Pass. To constrain the selection of compensatory mitigation lands to the area proximate to the impact, recovery units were selected as biologically appropriate boundaries. The recovery units were large enough to cover the study area and are biologically relevant. Table 3-7 shows the species addressed in the Marxan analysis and applicable geographic boundaries assigned to each species. Tables 3-8 and 3-9 show the results of the Marxan analysis for species and wildlife resources, respectively. Table 3-10 shows a summary of these programs and properties and the species for which the properties may provide mitigation. The programs and properties are further evaluated and prioritized In Section 3.7, Evaluation of Mitigation Options.

Table 3-7 Species and Wildlife Resources Addressed in the Marxan Analysis and Applicable Geographic Boundaries

Species/Resource	Geographic Boundary for Marxan Analysis
California red-legged frog	Recovery Unit
California tiger salamander	Recovery Unit
Foothill yellow-legged frog	-
Burrowing owl	Santa Clara Valley Habitat Agency Conservation Zones
Least bell's vireo	-
Swainson's hawk	Eastern/Western Side of Pacheco Pass
Tricolored blackbird	Eastern/Western Side of Pacheco Pass
Steelhead	Distinct Population Segment
Bay checkerspot butterfly	-
Conservancy fairy shrimp	Vernal pool recovery units
Longhorn fairy shrimp	Vernal pool recovery units
Valley elderberry longhorn beetle	-
Vernal pool fairy shrimp	Vernal pool recovery units
Vernal pool tadpole shrimp	Vernal pool recovery units
Fresno kangaroo rat	-
San Joaquin kit fox	Eastern/Western Side of Pacheco Pass
Giant garter snake	-
California red-legged frog	Recovery Unit

Table 3-8 Marxan Results by Species and Specified Geography

Species	Total Mitigation Need (acres)	Total Available Acres in Regional RSA	Mitigation Need as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Need Included in Best Solution[1]	Acreage Difference between Mitigation Need and Acres Included in Best Solution[1]
California red-legged frog						
Aquatic (Sierra Nevada foothills)	1.5	27.5	5.5%	1.3	86.7%	(0.2)
Upland (Sierra Nevada foothills)	219.0	36,274.1	0.6%	248.5	113.5%	29.5
Aquatic (South and East San Francisco)	57.6	3,057.3	1.9%	56.9	98.8%	(0.7)
Upland (South and East San Francisco)	565.0	262,637.2	0.2%	1,377.8	243.9%	812.8
Aquatic (Diablo Range / Salinas Valley)	258.5	2,630.9	9.8%	290.0	112.2%	31.5
Upland (Diablo Range / Salinas Valley)	3,121.4	522,986.0	0.6%	3,826.4	122.6%	705.0
California tiger salamander						
Breeding/primary upland (Central Valley RU)	146.3	75,013.9	0.2%	774.3	530.1%	628.0
Secondary upland (Central Valley RU)	2,071.1	759,786.4	0.3%	2,397.9	115.8%	326.8
Breeding/primary upland (East Bay RU)	94.2	4,538.2	2.1%	347.8	369.2%	253.6
Secondary upland (East Bay RU)	3,531.9	736,428.5	0.5%	5,328.8	150.9%	1,796.9
Foothill yellow-legged frog						
Primary breeding and foraging habitat	199.2	26,841.1	0.7%	376.1	188.8%	176.9
Secondary breeding and foraging habitat	154.2	28,381.4	0.5%	259.7	168.4%	105.5
Burrowing owl						
Occupied breeding and foraging habitat (SCVHP Conservation Area C)	2.3	77.5	3.0%	32.9	1,430.4%	30.6
Least bell's vireo						
Recolonization breeding habitat—core	172.4	16,433.5	1.0%	409.8	237.7%	237.4
Recolonization breeding habitat—potential	46.1	6,651.7	0.7%	82.4	178.7%	36.3

Species	Total Mitigation Need (acres)	Total Available Acres in Regional RSA	Mitigation Need as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Need Included in Best Solution[1]	Acreage Difference between Mitigation Need and Acres Included in Best Solution[1]
Swainson's hawk						
Active nesting site (eastern side)	0.0	187.8	0.0%	0.0	0.0	0.0
Primary active foraging habitat (eastern side)	363.1	33,735.1	1.1%	376.8	103.8%	13.7
Secondary active foraging habitat (eastern side)	580.6	328,020.8	0.2%	1,582.7	286.7%	1,030.6
Tertiary active foraging habitat (eastern side)	60.9	349,099.9	0.0%	322.6	529.7%	261.7
Active nesting site (western side)	0.0	5.9	0.0%	0.0	0.0	0.0
Primary active foraging habitat (western side)	25.0	1,196.9	2.1%	18.2	72.8%	(6.8)
Secondary active foraging habitat (western side)	24.2	25,431.8	0.1%	34.4	142.1%	10.2
Tertiary active foraging habitat (western side)	43.8	49,755.9	0.1%	98.9	225.8%	55.1
Tricolored blackbird						
Previously occupied colony habitat (eastern side)	9.2	8,995.5	0.1%	44.9	488.0%	35.7
Potentially suitable colony habitat (eastern side)	111.6	13,534.2	0.8%	154.2	138.2%	42.6
Breeding season foraging—natural (eastern side)	495.2	431,289.9	0.1%	2,138.1	431.8%	1,642.9
Breeding season foraging—agriculture (eastern side)	661.5	613,011.9	0.1%	2,148.0	324.7%	1,486.5
Previously occupied colony habitat (western side)	0.3	458.2	0.1%	4.8	1,600.0%	4.5
Potentially suitable colony habitat (western side)	150.8	5,120.5	2.9%	435.5	288.8%	284.7
Breeding season foraging—natural (western side)	532.0	165,676.8	0.3%	2,303.8	433.0%	1,771.8
Breeding season foraging—agriculture (western side)	391.6	71,994.8	0.5%	726.5	185.5%	334.9
Steelhead—Central Valley and south-central California coast DPS						
Potential spawning, rearing, and migratory habitat	30.5	18,651.7	0.2%	294.9	966.9%	264.4
Potential migratory and rearing habitat	10.8	3,490.0	0.3%	60.7	562.04%	49.9

Species	Total Mitigation Need (acres)	Total Available Acres in Regional RSA	Mitigation Need as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Need Included in Best Solution[1]	Acreage Difference between Mitigation Need and Acres Included in Best Solution[1]
Bay checkerspot butterfly						
Suitable habitat	54.5	9,283.2	0.6%	57.7	105.9%	3.2
Conservancy fairy shrimp						
Potentially suitable habitat (San Joaquin Valley RU)[2]	0.8	258.2	0.3%	8.3	1,037.5%	7.5
Potentially suitable habitat (Central Coast RU)[3]	-	-	-	-	-	-
Longhorn fairy shrimp						
Potentially suitable habitat (San Joaquin Valley RU)[2]	0.8	258.2	0.3%	8.3	1,037.5%	7.5
Potentially suitable habitat (Central Coast RU)[3]	-	-	-	-	-	-
Vernal pool fairy shrimp						
Potentially suitable habitat (San Joaquin Valley RU)[2]	0.8	258.2	0.3%	8.3	1,037.5%	7.5
Potentially suitable habitat (Central Coast RU)[3]	54.2	860.5	6.3%	33.6	62.0%	(20.6)
Vernal pool tadpole shrimp						
Potentially suitable habitat (San Joaquin Valley RU)[2]	0.8	258.2	0.3%	8.3	1,037.5%	7.5
Potentially suitable habitat (Central Coast RU)[3]	54.2	860.5	6.3%	33.6	62.0%	(20.6)
Valley elderberry longhorn beetle						
Potentially suitable riparian habitat	3.5	8,751.3	0.0%	33.9	968.6%	30.4
Other potentially suitable habitat	262.1	71,877.6	0.4%	407.9	155.6%	145.8
Fresno kangaroo rat						
Suitable habitat	220.93	19,523.8	1.1%	973.0	440.4%	752.1

Species	Total Mitigation Need (acres)	Total Available Acres in Regional RSA	Mitigation Need as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Need Included in Best Solution[1]	Acreage Difference between Mitigation Need and Acres Included in Best Solution[1]
San Joaquin kit fox						
High value suitable habitat (eastern side)	60.1	26,418.9	0.2%	60.3	100.3%	0.2
Moderate value suitable habitat (eastern side)	445.7	148,808.0	0.3%	1,455.8	326.6%	1,010.1
Low Value suitable habitat (eastern side)	744.6	1,332,076.0	0.1%	3,217.5	432.1%	2,472.9
High value suitable habitat (western side)	0.0	819.1	0.0%	0.0	0.0	0.0
Moderate value suitable habitat (western side)	16.5	6,313.1	0.3%	33.7	204.2%	17.2
Low value suitable habitat (western side)	708.8	247,975.8	0.3%	4,449.8	627.8%	3,741.0
Giant garter snake						
Potentially suitable aquatic habitat	93.3	15,156.4	0.6%	162.8	174.5%	69.5
Potentially suitable upland habitat	1,200.4	97,681.5	1.2%	1,192.9	99.4%	(7.5)
Potentially suitable movement habitat	37.1	5,012.0	0.7%	71.8	193.5%	34.7
Crotch bumble bee						
Western side of Pacheco Pass	1,707.1	672,113.9	0.3%	1,624.8	95.2%	(82.3)
Eastern side of Pacheco Pass	3,041.2	325,480.3	0.9%	3,338.2	109.8%	297.0

RU = recovery unit; SCVHA = Santa Clara Valley Habitat Agency; DPS = distinct population segment

[1]The best solution is the one that meets the greatest number of mitigation targets with the lowest number of planning units.

[2] Percentage of wetted pools in the San Joaquin vernal pool recovery region ranges from 1% to 5%; 1% wetted pool assumption was applied to the Marxan analysis results.

[3] The impacted alkali vernal pool feature on Romero Ranch is assumed to have a wetted footprint that is 45 percent of the total area; the 45 percent wetted area assumption is applied to the Marxan analysis results.

Table 3-9 Marxan Results by Wildlife Resource and Specified Geography

Resource	Total Mitigation Need (Acres)	Total Available Acres in Regional RSA	Mitigation Need as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Coyote Creek HUC-8 Watershed						
Mixed riparian	1.2	823.3	0.1%	2.2	183.3%	1.0
Pajaro HUC-8 Watershed						
CA sycamore woodland	40.8	1,089.4	3.7%	215.0	527.0%	174.2
Mixed riparian	13.8	2,095.2	0.7%	107.7	780.4%	93.9
Middle San Joaquin–Lower Chowchilla HUC-8 Watershed						
Mixed riparian	2.7	3,950.3	0.1%	25.6	948.2%	22.9

[1]The best solution is the one that meets the greatest number of mitigation targets with the lowest number of planning units.

Table 3-10 Summary of Applicable Compensatory Mitigation Options by Species

Species/Wildlife Resource	Conservation Banks												NFWF ILF Programs			Permittee-Responsible Sites						
	Alkali Sink Conservation Bank	Grassland Mitigation Bank	Deadman Creek Conservation Bank	Dutchman Creek Conservation Bank	Drayer Ranch Conservation Bank	Great Valley Conservation Bank	Ohlone West Preserve Conservation Bank	Oursan Ridge Conservation Bank	Nicoluas Ranch VELB Conservation Bank	River Ranch VELB Conservation Bank	Sparling Ranch Conservation Bank	Viera-Sandy Much Road Conservation	San Joaquin Aquatic Resource	Central Coast Vernal Pools	San Joaquin Vernal Pools	[redacted]	Lucky Day Ranch	[redacted] Property	Paxton Property	Montes Property	Five Pillar Farm	Marxan Results
California red-legged frog							X	X			X						X	X	X	X	X	X
California tiger salamander			X	X		X	X				X	X					X	X	X	X	X	X
Foothill yellow-legged frog																	X	X				X
Burrowing owl	X															X	X	X	X	X	X	X
Least bell's vireo																						X
Swainson's hawk	X															X	X					X
Tricolored blackbird																X	X	X	X	X	X	X
Steelhead																						X
Bay checkerspot butterfly																X	X					X
Conservancy fairy shrimp				X											X							X
Longhorn fairy shrimp	X														X							X
Valley elderberry longhorn beetle									X	X												X
Vernal pool fairy shrimp	X		X	X								X			X						X	X
Vernal pool tadpole shrimp			X	X	X							X			X							X
Fresno kangaroo rat																						X
San Joaquin kit fox	X		X			X						X						?	?	?	X	X
Giant garter snake		X																				X
Total Species Mitigated	**5**	**1**	**4**	**4**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**4**	**0**	**0**	**4**	**4**	**7**	**5**	**4**	**4**	**6**	**17**

3.7 Evaluation of Mitigation Options

3.7.1 Methodology

To determine the efficacy and achievability of the compensatory mitigation plan, a simple, step-wise process was used in accordance with guidance from the USACE (2008). For each mitigation type—mitigation or conservation bank, ILF program, and PRM site—each property was evaluated against the mitigation need. When a property was determined appropriate to offset the impact, the mitigation burden was reduced by the known or estimated acreage.

For mitigation and conservation banks, so long as the impact location was within the bank's service area, credits were assumed applicable. For owner-offered properties, existing information was used to estimate mitigation acres.

Once all potential mitigation options within the specified geography were identified, they were prioritized following several key principles (as described in Section 2.5, Approach to Mitigation). These principles, in the approximate order of priority, are as follows:

- Permanent impacts would be offset with the purchase of bank or ILF program credits or PRM sites. Bank or ILF credits and PRM sites would be in kind; when and where in-kind mitigation is not possible or agreeable, out-of-kind mitigation would be implemented in agreement with relevant agencies.
- Available mitigation and conservation banks would be prioritized over PRM sites except in those instances where a PRM site that has been selected to provide mitigation for another resource (where banks are lacking) would also provide a mitigation benefit to the resource in question.
- Conservation banks within the affected geography (as defined in Table 3-7) would be prioritized over those outside the boundary.
- Conservation banks outside the affected geography (as defined in Table 3-7) may be applied where opportunities within the specific geography are lacking and the impact area is within the bank's service area. Under some circumstances, there may be a biologically relevant reason to mitigate outside the specified geography.
- PRM sites would target preservation of resource types for which bank credits are not available or sufficient to meet the mitigation need but would also likely provide mitigation for multiple, co-located resources. For these co-located resources, a PRM site may be prioritized over a bank or ILF program.
- PRM sites within the affected geography would be prioritized over those outside the affected geography.
- PRM sites with restoration or enhancement opportunities would be prioritized over those without such opportunities.
- PRM sites that are occupied or known to be used by (e.g., for foraging) targeted species would be prioritized over those that are not.
- PRM sites that provide mitigation for multiple resources would be prioritized over those that do not. For example, freshwater pond creation or restoration on a PRM site could serve as mitigation under Section 404 as well as mitigation for effects on California red-legged frog breeding habitat under the FESA and CESA.
- Large properties would be prioritized for PRM sites. Larger properties have increased ecological value because *edge effects*—such as invasive species introduction or human-related disturbance that occurs at the edge of the property where adjoining properties are not managed or protected—can negatively affect habitat quality.
- PRM sites that are adjacent to existing conservation lands would be prioritized, helping to reduce edge effects and increasing the functional value for species with larger home ranges.

- PRM sites within designated critical habitat or core recovery planning units would be prioritized.
- PRM sites within known wildlife movement corridors would be selected to help connect discontinuous movement corridors and protect land near wildlife crossing features along the HSR alignment.

The Authority would seek partnerships with existing conservation organizations to purchase and manage PRM sites as well as to identify establishment, restoration, and enhancement opportunities on existing protected lands.

In addition, where species mitigation is co-located with mitigation for waters of the U.S., the mitigation strategy would be consistent with guidance from USACE staff as well as published guidance documents as described in the Section 404 Compensatory Mitigation Plan. USACE mitigation guidance documents are summarized in Section 2.1, Overview of Laws and Regulations.

3.7.2 Mitigation Options by Species and Wildlife Resources Regulated under Section 1600 et. seq.

This section compares the mitigation need to the mitigation opportunities identified in Section 4.6.2, Identified Options for Compensatory Mitigation. This comparison is done by habitat type and geography where applicable. California red-legged frog, California tiger salamander and foothill yellow-legged frog all have aquatic and upland modeled habitat types so these three species are treated together in Table 3-11. Wildlife resources regulated under Section 1600 et. seq. are also shown in Table 3-11 because the same PRM sites that apply to aquatic species apply to these resources. All other species are treated together in Table 3-12. For a complete list of applicable banks and PRM sites, see Tables 2 and 3 in Appendix C, Mitigation Options.

Table 3-11 Comparison between Mitigation Needs and Opportunities for Amphibians and Section 1600 et seq.

Species	Estimated Mitigation Need		Bank Total[1]		Permittee-Responsible Mitigation[2]		Total Mitigation Opportunity		Outstanding Mitigation Need[3]	
	Aquatic	Upland	Aquatic	Upland	Aquatic	Upland	Aquatic	Upland	Aquatic	Upland
California red-legged frog										
Sierra Nevada Foothills	1.5	219.0	0.0	0.0	1.3	248.5	1.3	248.5	0.2	(29.5)
South and East San Francisco	57.6	565.0	1.0	244.1	62.1	2,144.7	63.1	2,388.8	(5.5)	(1,823.8)
Diablo Range/Salinas Valley	258.5	3,121.4	3.8	1,658.8	396.2	14943.3	400.0	16602.1	(141.5)	(13480.7)
California tiger salamander										
Central Valley[5]	146.3	2,071.1	106.1	1,101.5	774.3	2,397.9	880.4	3,499.4	(734.1)	(1,428.3)
East Bay	94.2	3,531.9	1.8	1,494.4	399.8	9,734.3	401.6	11228.7	(307.4)	(7,696.8)
Foothill yellow-legged frog										
Primary and secondary breeding and foraging habitat	199.2	154.2	0.0	0.0	456.5	600.1	456.5	600.1	(257.3)	(445.9)
Wildlife resources										
Mixed riparian, Coyote Creek HUC-8 watershed	0.0	1.2	0.0	0.0	0.0	27.7	0.0	27.7	0.0	(26.5)
Sycamore alluvial woodland, Pajaro River HUC-8 watershed	0.0	40.8	0.0	0.0	0.0	215.0	0.0	215.0	0.0	(174.2)
Mixed riparian, Pajaro River HUC-8 watershed	0.0	20.1	0.0	0.0	0.0	59.7	0.0	59.7	0.0	(39.6)
Mixed riparian, San Joaquin-Lower Chowchilla HUC-8 Watershed	0.0	2.7	0.0	0.0	0.0	25.6	0.0	25.6	0.0	(22.9)

(Parentheses) indicates negative values
[1] Available conservation bank credits per RIBITS (2019); see Appendix D for the RIBITS table.
[2] The acres of mitigation potential is a sum of owner-offered properties and Marxan results. Mitigation potential on owner-offered PRM sites was determined by intersecting the habitat models with the property boundaries using geographic information system software.
[3] A negative number indicates that the mitigation target has been met and exceeded by the value in the cell.
[4] Includes mitigation acreage targets for impacts incurred outside a recovery unit.
5 Wildlife resources are presented in this table because applicable banks and PRM sites are the same as those for amphibians. Data is provided in the upland column as these wildlife resource occur above the OHWM.
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Table 3-12 Comparison between Mitigation Needs and Opportunities for Listed Species (Except Amphibians and Section 1600 et seq.)

Species, Habitat Type/Geography	Mitigation Need (acres)	Conservation Bank Total (acres)[1]	PRM Total (acres)[2]	ILF Programs (acres)	Total Mitigation Opportunity	Outstanding Mitigation Need[3]
Burrowing owl						
Occupied breeding and foraging habitat (SCVHP Conservation Area C)	2.3	0.0	68.7	0.0	68.7	(66.4)
Least Bell's Vireo						
Recolonization breeding habitat—core	172.4	0.0	409.8	0.0	409.8	(237.4)
Recolonization breeding habitat—potential	46.1	0.0	82.4	0.0	82.4	(36.3)
Swainson's hawk						
Primary active foraging habitat (eastern side)	363.1	822.1	376.8	0.0	1,198.9	(835.8
Secondary active foraging habitat (eastern side)	552.1	0.0	1,582.7	0.0	1,582.7	(1,030.6)
Tertiary active foraging habitat (eastern side)	60.9	0.0	322.6	0.0	322.6	(261.7)
Primary active foraging habitat (western side)	25.0	0.0	18.2	0.0	18.2	6.8
Secondary active foraging habitat (western side)	24.2	0.0	71.03	0.0	71.0	(46.8
Tertiary active foraging habitat (western side)	43.8	0.0	2,604.04	0.0	2,604.0	(2,560.2)
Tricolored blackbird						
Previously occupied colony habitat (eastern side)	9.2	0.0	44.9	0.0	44.9	(35.7)
Potentially suitable colony habitat (eastern side)	111.6	0.0	154.2	0.0	154.2	(42.6)
Breeding season foraging—natural (eastern side)	495.2	0.0	2,138.1	0.0	2,138.1	(1,642.9)
Breeding season foraging—agriculture (eastern side)	661.5	0.0	2,148.0	0.0	2,148.0	(1,486.5)
Previously occupied colony habitat (western side)	0.3	0.0	4.8	0.0	4.8	(4.5)
Potentially suitable colony habitat (western side)	150.8	0.0	461.5	0.0	461.5	(310.7)
Breeding season foraging—natural (western side)	532.0	0.0	5,501.6	0.0	5,501.6	(4,969.6)
Breeding season foraging—agriculture (western side)	391.6	0.0	884.6	0.0	884.6	(493.0)

Species, Habitat Type/Geography	Mitigation Need (acres)	Conservation Bank Total (acres)[1]	PRM Total (acres)[2]	ILF Programs (acres)	Total Mitigation Opportunity	Outstanding Mitigation Need[3]
Steelhead—south (central California coast DPS						
Potential spawning, rearing, and migratory habitat	30.5	0.0	294.9	0.0	294.9	(264.4)
Potential migratory and rearing habitat	10.8	0.0	60.7	0.0	60.7	(49.9)
Bay checkerspot butterfly						
Potentially suitable habitat	54.5	0.0	148.7	0.0	148.7	(94.2)
Vernal pool crustaceans, by Vernal Pool Recovery Unit						
Vernal pool fairy shrimp (San Joaquin Valley)	0.8	133.5	8.4	15.0	156.9	(156.1)
Vernal pool fairy shrimp (Central Coast)	54.2	0.0	33.6	0.0	33.6	20.6
Longhorn fairy shrimp (San Joaquin Valley)	0.8	126.2	8.4	15.0	149.6	(148.8)
Longhorn fairy shrimp (Central Coast)	0.0	0.0	33.6	0.0	33.6	(33.6
Tadpole shrimp (San Joaquin Valley)	0.8	27.1	8.4	15.0	50.5	(49.7)
Tadpole shrimp (Central Coast)	54.2	0.0	33.6	0.0	33.6	20.6
Conservancy fairy shrimp (San Joaquin Valley)	0.8	3.2	8.4	15.0	26.6	(25.8)
Conservancy fairy shrimp (Central Coast)	0.0	0.0	33.6	0.0	33.6	(33.6)
Valley elderberry longhorn beetle						
Potentially suitable riparian habitat	3.5	0.0	33.9	0.0	33.9	(30.4)
Other potentially suitable habitat	262.1	0.0	407.9	0.0	407.9	(145.8)
Fresno kangaroo rat						
Potentially suitable habitat	220.9	0.0	973.0	0.0	973.0	(752.1)

Species, Habitat Type/Geography	Mitigation Need (acres)	Conservation Bank Total (acres)[1]	PRM Total (acres)[2]	ILF Programs (acres)	Total Mitigation Opportunity	Outstanding Mitigation Need[3]
San Joaquin kit fox						
High value suitable habitat (eastern side)	60.1	1,789.7	60.3	0.0	1,850.0	(1,789.9)
Moderate value suitable habitat (eastern side)	445.7	0.0	1,455.8	0.0	1,455.8	(1,010.1)
Low value suitable habitat (eastern side)	744.6	0.0	3,217.5	0.0	3,217.5	(2,472.9
High value suitable habitat (western side)	0.0	0.0	0.0	0.0	0.0	0.0
Moderate value suitable habitat (western side)	16.5	0.0	33.7	0.0	33.7	(17.2)
Low value suitable habitat (western side)	708.8	0.0	7,049.1	0.0	7,049.1	(6,340.3)
Giant garter snake						
Potentially suitable aquatic habitat	93.3	83.7	162.8	0.0	246.5	(153.2)
Potentially suitable upland habitat	1,200.4	0.0	1,192.9	0.0	1,192.9	7.5
Potentially suitable movement habitat	37.1	0.0	71.8	0.0	71.8	(34.7
Crotch bumble bee						
Western side of Pacheco Pass	1,707.1	0.0	4,166.0	0.0	4,166.0	(2458.8)
Eastern side of Pacheco Pass	3,041.2	0.0	4,761.5	0.0	4,761.5	(1,720.3)

(Parentheses) indicate negative values
[1] Available conservation bank credits per RIBITS (2019); see Appendix D for the RIBITS table.
[2] The acres of mitigation potential is a sum of owner-offered properties and Marxan results. Mitigation potential on owner-offered PRM sites was determined by intersecting the habitat models with the property boundaries using geographic information system software.
[3] A negative number indicates that the mitigation target has been met and exceeded by the value in the cell.
PRM = permittee-responsible mitigation; ILF = in-lieu fee; SCVHP = Santa Clara Valley Habitat Plan; DPS = distinct population segment.

3.7.3 Preferred Approach to Species and Wildlife Resources Mitigation

Tables 3-11 and 3-12 show that, for each species, mitigation opportunities are greater than the mitigation need within the specified geography. This indicates that meeting species mitigation needs within the specified geographies is feasible. In some cases, several options for achieving the estimated mitigation target are available. This section describes the preferred approach for achieving the mitigation target for each species in each specified geography. The prioritization of mitigation opportunities described in this section follow the principles described in Section 4.7.1, Methodology.

3.7.3.1 California Red-Legged Frog

Sierra Nevada Foothills Recovery Unit (San Joaquin Valley)

The Authority would mitigate impacts on California red-legged frog habitat in the Sierra Nevada Foothills Recovery Unit through the preservation of a combination of aquatic and upland habitat types. There is an estimated 221 acres of mitigation need (1.5 acre of aquatic habitat and 219 acres of upland habitat) for the California red-legged frog in the Sierra Nevada Foothills Recovery Unit where a portion of the project's impact would occur. This mitigation need represents approximately 5.5 and 0.6 percent, respectively, of the total habitat available. There are no conservation banks, ILF programs, or owner-offered properties that could provide mitigation in this recovery unit.

The Marxan best solution indicates 1.3 and 248.5 acres, respectively, of aquatic and upland modeled California red-legged habitat on properties that could contribute to multiple mitigation needs and have high potential for development as PRM sites. Based on this analysis, meeting the mitigation need is feasible.

South and East San Francisco Recovery Unit

The Authority would mitigate impacts on California red-legged frog habitat in the South and East San Francisco Recovery Unit with a combination of bank credit purchases and PRM sites. There is a total mitigation need of approximately 623 acres (58 acres of aquatic habitat and 565 acres of upland habitat). The Ohlone West Conservation Bank, within the South and East San Francisco Recovery Unit, has 1 aquatic and 224 upland credits available for purchase. The [redacted] owner-offered PRM site supports 2.2 acres of modeled aquatic habitat and 34.6 acres of modeled upland habitat for California red-legged frog. The bank credits are insufficient to meet the total mitigation need. However, the Marxan analysis identified 57 acres of available modeled aquatic habitat and 1,378 acres of available modeled upland habitat in the South and East San Francisco Recovery Unit. Based on this analysis, meeting mitigation needs for California red-legged frog habitat in the South and East San Francisco Recovery Unit is feasible.

Diablo Range/Salinas Valley

The Authority would mitigate impacts on California red-legged frog habitat with the purchase of bank credits and the preservation of PRM sites. There is an estimated 3,380 acres of mitigation need (259 acres of aquatic habitat and 3,121 acres of upland habitat). This mitigation need represents 9.8 percent and 0.6 percent, respectively, of the available habitat in the Diablo Range/Salinas Valley Recovery Unit. The Sparling Ranch Conservation Bank has 1,260 acres of available upland credits, and the Oursan Ridge Conservation Bank has 3.8 and 399 acres of aquatic and upland available credits, respectively.

The Lucky Day Ranch and the [redacted] property are owner-offered PRM sites with preservation opportunities. Based on the GIS habitat model for California red-legged frog, the Lucky Day Ranch has 16.5 acres of aquatic habitat mitigation potential and 1,959 acres of upland habitat mitigation potential. [redacted] has 32.8 acres of aquatic habitat mitigation potential and 2,570 acres of upland mitigation potential. When combined, the conservation banks and owner-offered PRM sites offer sufficient mitigation potential to meet the upland mitigation target, but additional PRM sites may be needed to fully offset the effect.

The Marxan best solution indicates 290 acres of aquatic habitat and 3,826 acres of upland habitat. Based on this analysis, meeting the total mitigation need for California red-legged frog in the Diablo Range/Salinas Valley recovery unit is feasible.

3.7.3.2 California Tiger Salamander

Central Valley

The Authority would mitigate impacts on California tiger salamander habitat through the purchase of conservation bank credits and preservation of a combination of aquatic and upland habitat on PRM sites. There is an estimated 2,217 acres of mitigation need (146 acres of aquatic/upland complex and 2,071 acres of upland habitat) in the Central Valley Recovery Unit. This mitigation need represents approximately 0.2 percent and 0.3 percent, respectively, of the total habitat available. Mitigation in this unit is proposed to offset impacts within the Central Valley Recovery Unit as well as impacts that occur outside the designated recovery units.

In the Central Valley, aquatic habitat for the species consists of vernal pools, alkali marsh, alkali wetland scrub, alkali vernal pool, freshwater marsh and pond, seasonal wetlands and constructed basins. Within the project footprint, aquatic habitat features are specifically mapped so that impacts can be more precisely determined. Outside the project footprint, where mitigation opportunities are evaluated, the land cover mapping uses a vernal pool complex data set mapped by Witham et al. (2014). The wetted areas or pools within the complex are not mapped; however, the wetted acres for potential mitigation lands can be estimated based on the percent wetted acre assumptions provided by Witham et al. (2014): between 1 and 5 percent wetted acre density. To be conservative, the lowest wetted acre percentage (1 percent) was assumed for all potential mitigation lands.

In the Central Valley recovery unit, there are three mitigation banks with available California tiger salamander credits: Deadman Creek, Great Valley, and Viera–Sandy Mush Road. Deadman Creek has 133 available upland credits. Great Valley has 106 aquatic and 950 upland credits available. Viera–Sandy Mush Road has 17 acres of upland credits available.

The Marxan best solution indicates 774 acres of aquatic/upland habitat (primarily vernal pool complex) and 2,398 acres of upland habitat (530 percent and 509 percent of the mitigation need, respectively). Based on this analysis, meeting the mitigation need for California tiger salamander in the Central Valley recovery unit is feasible.

East Bay

The Authority would mitigate impacts on California tiger salamander habitat in the East Bay Recovery Unit with a combination of conservation bank credits and PRM sites. There is an estimated 3,625 acres of mitigation need (94 acres of aquatic habitat and 3,531 acres of upland habitat). This mitigation need represents 2.1 percent and 0.5 percent, respectively, of the total habitat available.

The Ohlone West and Sparling Ranch Conservation Banks are within the East Bay Recovery Unit and have available credits. The Ohlone West Conservation Bank is listed as having 1.0 aquatic credit and 244 upland credits available (USACE 2019). The Sparling Ranch Conservation Bank has 0.8 aquatic credit and 1,250 upland credits. Sparling Ranch would be prioritized because it has opportunities to develop credits or PRM sites that would benefit additional species (South Bay Conservation Resources 2019).

Several owner-offered PRM sites also have potential to meet California tiger salamander mitigation needs: Lucky Day Ranch, the [redacted] property, and the [redacted]. Based on the land cover mapping data, the Lucky Day Ranch has 41.7 aquatic acres and 1,775 upland acres of mitigation potential. The [redacted] property has 9.5 aquatic acres and 2,595 upland acres of mitigation potential. The [redacted] has 0.8 aquatic acre and 36 upland acres of mitigation potential. Because the Lucky Day Ranch property has the potential to meet the full or partial mitigation need for several aquatic and species resource types, it would be prioritized; it is also a relatively large site. The [redacted] property also has strong potential and is a large site; however, less is known about the specific opportunities on that site. The [redacted]

[redacted], despite being small, would likely be prioritized because it is strategically situated to provide specific mitigation requirements for the Bay checkerspot butterfly and the WESTERN burrowing owl.

The Marxan best solution indicates 348 acres of aquatic habitat and 5,329 acres of upland habitat (369 percent and 151 percent of the mitigation need, respectively). Based on this analysis, meeting the mitigation need for California tiger salamander in the East Bay Recovery Unit is feasible.

3.7.3.3 Foothill Yellow-Legged Frog

The Authority would mitigate impacts on yellow-legged frog habitat through preservation of PRM sites. There is an estimated 353 acres of mitigation need (199 acres of aquatic breeding and foraging habitat and 154 acres of upland foraging habitat). This mitigation need represents approximately 0.7 and 0.5 percent, respectively of the total habitat available. There are no conservation banks or ILF programs that could provide this mitigation. However, the Lucky Day Ranch and the [redacted] property, based on land cover mapping, support potentially suitable habitat. The Lucky Day Ranch has 2.9 aquatic acres and 49 upland acres of mitigation opportunity. The [redacted] property has 37.3 aquatic acres and 121 upland acres of mitigation opportunity. In addition, the Marxan best solution indicates 376 acres of aquatic habitat and 260 acres of upland habitat. Based on this analysis, achieving the mitigation needs for foothill yellow-legged frog is feasible.

3.7.3.4 Western Burrowing Owl

The Authority would mitigate impacts on occupied breeding and foraging burrowing owl habitat in the Santa Clara Valley through preservation of occupied breeding and foraging habitat in the same region. For the purposes of this analysis, occupied breeding and foraging habitat is based on mapping by the Santa Clara Valley Habitat Agency (SCVHA) (County of Santa Clara et al. 2012).

There is an estimated 2.3 acres of mitigation need for the western burrowing owl in Conservation Zone C, a geographic boundary mapped by the SCVHA (County of Santa Clara et al. 2012). The owner-offered [redacted] is also mapped as breeding and foraging breeding habitat for the owl in Conservation Zone C. The site, based on land cover mapping, has 35.75 acres of available occupied breeding and foraging burrowing owl habitat. The Marxan best solution indicates 33 acres of available occupied breeding and foraging habitat in Conservation Zone C.

The mitigation opportunity in Conservation Zone C is approximately twice the mitigation need. Based on this analysis, achieving the mitigation need for western burrowing owl in Conservation Zone C is feasible, but it may be problematic because of the uncertainty typically attached to any specific opportunity. Because the [redacted] is an owner-offered property, the certainty about availability is high; however, agency approval of use of this site for burrowing owl mitigation will still be needed. If mitigation in Conservation Zone C is not feasible, opportunities in other conservation zones would be necessary.

3.7.3.5 Least Bell's Vireo

The Authority would mitigate impacts on potential least Bell's vireo recolonization habitat through preservation of core and potential recolonization habitat. There is an estimated 218 acres of mitigation need (172 acres of core recolonization habitat and 46 acres of potential recolonization habitat). This mitigation need represents approximately 1.0 and 0.7 percent, respectively of the total habitat available.

There are no conservation banks, ILF programs, or owner-offered properties with least Bell's vireo mitigation opportunities. The Marxan best solution indicates 410 acres of core recolonization habitat and 82 acres of potential recolonization habitat (238 and 179 percent of the mitigation need, respectively). In addition, the Marxan analysis identified 16,433 acres of core recolonization habitat and 6,652 acres of potential recolonization habitat in the regional RSA. While these acres

are not included in the best solution, they do indicate the potential on the landscape. Based on this analysis, meeting the mitigation need for least Bell's vireo is feasible.

3.7.3.6 Swainson's Hawk

East Side (Central Valley)

The Authority would mitigate impacts on Swainson's hawk habitat with a combination of conservation bank credits and PRM sites. There is an estimated 1,005 acres of mitigation need (363 acres of primary foraging habitat, 581 acres of secondary foraging habitat, and 61 acres of tertiary foraging habitat) in the eastern portion of the regional RSA. This mitigation need represents approximately 1.1 percent, 0.2 percent, and less than 0.1 percent, respectively, of the total habitat available.

The Alkali Sink Conservation Bank has 822 credits available for the Swainson's hawk, almost enough to completely offset the effect. There may be enough to completely offset the effect if the agencies allow reduced mitigation requirements for effects on secondary and tertiary foraging habitat types. The Marxan best solution indicates 377 acres, 1,583 acres, and 323 acres of primary, secondary, and tertiary foraging habitat types (104, 287, and 530 percent of the mitigation goal), respectively. Based on this analysis, achieving the mitigation need for Swainson's hawk in the eastern portion of the study area is feasible.

West Side (Santa Clara Valley)

The Authority would mitigate impacts on Swainson's hawk habitat with PRM sites. There is an estimated 93 acres of mitigation need (25 acres of primary foraging habitat, 24 acres of secondary foraging habitat, and 44 acres of tertiary foraging habitat) in the western portion of the regional RSA. This mitigation need represents approximately 2.1 percent, 0.1 percent, and 0.1 percent, respectively, of the total habitat available.

There are two owner-offered PRM sites with potential to provide mitigation for the Swainson's hawk: the Lucky Day Ranch and the [redacted] property. Based on land cover mapping, the Lucky Day ranch has 2,505 acres of tertiary foraging habitat mitigation opportunity and the [redacted] property has 37 acres of secondary habitat mitigation opportunity. While these PRM sites can meet the mitigation need for secondary and tertiary foraging types, they do not meet the mitigation need for primary foraging habitat; consequently, that need would need to be provided elsewhere.

The Marxan best solution indicates 18 acres, 34 acres, and 99 acres of primary, secondary, and tertiary foraging habitat types (73 percent, 142 percent, and 226 percent of the mitigation goal), respectively. Based on this analysis, achieving the primary foraging mitigation need may be somewhat challenging. However, it should be noted that although the Marxan best solution only indicates 18 acres of potential mitigation for primary foraging types, overall, the Marxan analysis identified 1,197 acres as available for preservation. Based on this analysis, achieving Swainson's hawk mitigation in the western part of the study area is feasible.

3.7.3.7 Tricolored blackbird

Eastern Side (Central Valley)

The Authority would mitigate impacts on tricolored blackbird habitat on PRM sites. There is an estimated 1,278 acres of mitigation need (9 acres of previously occupied colony habitat, 112 acres of potentially suitable colony habitat, 495 acres of natural breeding season foraging habitat, and 662 acres of agricultural breeding season foraging habitat) in the eastern portion of the regional RSA. This mitigation need represents approximately 0.1 percent, 0.8 percent, 0.1 percent, and 0.1 percent, respectively of the total habitat available.

There are no conservation banks or owner-offered PRM sites in the eastern side of the regional RSA. The Marxan best solution indicates 45 and 154 acres of previous and potentially occupied colony habitat, respectively, and 2,138 and 2,148 acres of natural and agricultural breeding season foraging habitat, respectively. Based on this analysis, particularly on the available

acreage of previously occupied colony habitat, achieving the mitigation need for tricolored blackbird in the eastern portion of the regional RSA is feasible.

Western Side (Santa Clara Valley)

The Authority would mitigate impacts on tricolored blackbird habitat on PRM sites. There is an estimated 1,075 acres of mitigation need (0.3 acres of previously occupied colony habitat, 151 acres of potentially suitable colony habitat, 532 acres of natural breeding season foraging habitat, and 392 acres of agricultural breeding season foraging habitat) in the western portion of the regional RSA. This mitigation need represents approximately 1.0 percent, 2.9 percent, 0.3 percent, and 0.5 percent, respectively, of the total habitat available.

The Lucky Day Ranch, the [redacted] property, and the [redacted] all have potential to contribute to tricolored blackbird mitigation needs. Based on land cover mapping data, the Lucky Day Ranch has 0.76 acre of potentially suitable colony habitat and 1,739 acres of natural breeding season foraging habitat. The [redacted] property has 24.37 acres of potentially suitable colony habitat, 1,423 acres of natural breeding season foraging habitat, and 158 acres of agricultural breeding season foraging habitat. The [redacted] has 0.83 acre of potentially suitable colony habitat and 35.6 acres of natural breeding season foraging habitat.

The Marxan best solution indicates 4.8 and 436 acres of previous and potentially occupied colony habitat, respectively, and 2,304 and 727 acres of natural and agricultural breeding season foraging habitat, respectively. As with Swainson's hawk and Central Valley tricolored blackbird, primary nesting habitat opportunities are somewhat limited in the best solution. However, as with the tricolored blackbird opportunities in the Central Valley, there is a significant acreage (458 acres) that the Marxan analysis identified as available. Based on this analysis, achieving the mitigation need for tricolored blackbird in the western portion of the regional RSA is feasible.

3.7.3.8 Steelhead (Central and South-Central California Distinct Population Segments)

The Authority would mitigate impacts on steelhead habitat on PRM sites. There is an estimated 42 acres of mitigation need (31 acres of potential spawning, rearing and migratory habitat and 11 acres of potential migratory and rearing habitat). This mitigation need represents approximately 0.2 and 0.3 percent, respectively, of the total habitat available.

There are no conservation bank or ILF program credits available for steelhead in this region. Based on the land cover mapping, there are no owner-offered PRM sites that include potential steelhead habitat. However, opportunities for habitat restoration, rehabilitation, and enhancement are available on the Montes and Paxton properties in the Pajaro River watershed. The opportunities on these properties are described in Section 2.7, Description of Compensatory Mitigation Opportunities, and include the expansion of existing waterways, the creation and improvement of on-channel rearing and holding habitat, riparian expansion and restoration of channel complexity, sediment removal and erosion control, and the creation or improvement of backwater habitat. While the quantity of restoration and enhancement opportunities on these properties is unknown, the easement holders (The Nature Conservancy and the SCVOSA) are known to be interested and willing partners. Mitigation actions in this area would primarily contribute to improvements to migration and rearing habitat.

There may be restoration and enhancement opportunities on Pacheco Creek, near Casa de Fruta, where the rail right-of-way overlaps with the creek but no permanent construction would occur. There may also be opportunities to partner on restoration and enhancement of habitat on the Pacheco Preserve, a property held by the SCVHA (an interested partner in the region). In this region, improvement projects would benefit spawning, rearing, and migration habitat.

The Marxan best solution indicates 295 acres of spawning, rearing, and migration habitat and 61 acres of migration and rearing habitat. Based on this analysis, achieving the mitigation need for steelhead is feasible.

3.7.3.9 Bay Checkerspot Butterfly

The Authority would mitigate impacts on Bay checkerspot butterfly through preservation of a PRM site. There is an estimated 55 acres of mitigation need, which represents approximately 0.6 percent of the total habitat available. Because there are no conservation banks or ILF programs that could provide this mitigation, the Authority would rely on PRM sites for this mitigation. The Lucky Day Ranch and the [redacted] have an estimated 57 and 34 acres of mitigation opportunity, respectively (based on land cover mapping). The Marxan best solution indicates 58 acres of available habitat on properties that could contribute to multiple mitigation needs and that have high potential for development as PRM sites. Based on this analysis, meeting the mitigation need for Bay checkerspot butterfly is feasible.

3.7.3.10 Vernal Pool Crustaceans, San Joaquin Valley and Central Coast Recovery Units

The Authority would mitigate impacts on vernal crustacean habitat in the San Joaquin Valley Recovery Unit through the purchase of conservation bank or ILF program credits or with the purchase of a PRM site. The mitigation need in the San Joaquin Valley Recovery Unit is 0.8 acre for each of the four covered crustacean species. The mitigation need for each species is the same because, for each affected vernal pool, occupancy is assumed for all four species. However, because mitigation pools would have to be occupied, different banks and properties would need to be used to meet the total mitigation need for each species.

There is an additional 54.2 acres of mitigation need in the Central Coast recovery unit for vernal pool fairy and tadpole shrimp. This is the result of the impact to one mapped pool feature on Romero Ranch.

Five conservation banks have available credits for one or more of the crustacean species in the San Joaquin Valley Recovery Unit. Table 3-13 shows the available credits.

Table 3-13 Available Credits at Conservation Banks within the San Joaquin Valley Vernal Pool Recovery Unit

Species	Mitigation Need	Conservation Bank				
		Alkali Sink	Dutchman Creek	Drayer Ranch	Great Valley	Viera–Sandy Mush Road
Vernal pool fairy shrimp	0.8	0.27	7.76	–	106.10	19.47
Longhorn fairy shrimp	0.8	0.01	–	20.10	106.10	–
Tadpole shrimp	0.8	–	7.76	–	–	19.47
Conservancy fairy shrimp	0.8	–	3.28	–	–	–

Source: USACE 2019

Dutchman Creek is the only conservation bank with available credits for Conservancy fairy shrimp so it would likely be prioritized; the bank also includes credits for vernal pool fairy and tadpole shrimp. Credits for longhorn fairy shrimp are available at the Drayer Ranch and Great Valley Conservation Banks. Great Valley credits may also be purchased for California tiger salamander and San Joaquin kit fox; if there are efficiencies to be gained from purchasing credits for multiple species at the same bank then Great Valley would likely be prioritized to meet vernal pool crustacean mitigation needs.

The NFWF Sacramento District ILF Program has 15 San Joaquin vernal pool credits available. The NFWF ILF program can be used, in certain instances, to obtain credits for species and therefore could be a mitigation option to offset vernal pool crustacean impacts.

There are no conservation banks with crustacean credits within the Central Coast vernal pool recovery area. Five Pillars Farm is located in the foothills of the eastern slope of Diablo Range,

just outside the northern extent of the Central Coast vernal pool recovery area, and has opportunity for the expansion and rehabilitation of existing alkali vernal pools with potentially suitable habitat for vernal pool fairy shrimp (Kohlmann et al. n.d.).

The Marxan best solution includes 8.3 acres of potential habitat for vernal pool crustaceans in the San Joaquin Valley recovery unit and 33.6 acres within the Central Coast recovery unit. Credits from the NFWF ILF Program would be prioritized if species and aquatic resource credits can be developed on the same property or series of proprieties. It is possible that a PRM site purchased to offset impacts on another species, such as California tiger salamander or San Joaquin kit fox, could have pools occupied by one or more crustacean species and could, therefore, contribute to or fully meet mitigation needs for one or more species. Based on this analysis, achieving mitigation goals for vernal pool crustaceans is feasible.

3.7.3.11 Valley Elderberry Longhorn Beetle

The Authority would mitigate impacts on valley elderberry longhorn beetle through either the purchase of conservation bank credits or preservation of a PRM site. There is an estimated 266 acres of mitigation need (4 acres of potentially suitable riparian habitat and 262 acres of other potentially suitable habitat).

Nicolaus Ranch and River Ranch Conservation Banks have 376 and 713 available credits, respectively. Both banks are outside the regional RSA: Nicolaus Ranch is in Sacramento County and River Ranch is in Yolo County. Within the regional RSA, the Marxan best solution indicates 34 acres of potentially suitable riparian habitat and 408 acres of other potentially suitable habitat. It is likely more economical to offset elderberry beetle impacts with PRM sites that overlap with multiple other species than purchase credits at a bank, especially for the other potentially suitable habitat type. One possible solution could be to purchase credits at a bank for potentially suitable riparian habitat and then offset the remaining impacts on a PRM site. Based on these results, achieving mitigation goals for valley elderberry longhorn beetle is feasible.

3.7.3.12 Fresno Kangaroo Rat

The Authority would mitigate impacts on Fresno kangaroo rat through preservation of one or more PRM sites. There is an estimated 221 acres of mitigation need, which represents approximately 1.1 percent of total available habitat. Because there are no conservation banks or ILF programs that could provide this mitigation, the Authority will rely on PRM sites. The Marxan best solution indicates 973 acres of potentially suitable habitat for Fresno kangaroo rat, or 440 percent of the mitigation need. Based on this analysis, achieving the mitigation goal for Fresno kangaroo rat is feasible.

3.7.3.13 San Joaquin Kit Fox

Eastern Side (Central Valley)

The Authority would mitigate impacts on high-, moderate-, and low-value habitat through the purchase of conservation bank credits and the preservation of one or more PRM sites. There is an estimated 1,250 acres of mitigation need (60 acres of high value habitat, 446 acres of moderate value habitat and 745 acres of low value habitat), which represents less than 0.3 percent of the total habitat available.

There are three conservation banks on the eastern side of the study area that have available credits for San Joaquin kit fox: Alkali Sink (822 acres), Great Valley (950 acres), and Viera–Sandy Mush Road (17.6 acres). Combined, Alkali Sink and Great Valley could fully meet mitigation needs on the eastern side of the regional RSA.

The Marxan best solution indicates 60 and 1,456 acres of high- and moderate-value habitat, 100 and 327 percent of the mitigation goals, respectively. There are enough conservation bank credits and available lands to fully achieve mitigation goals using either mechanism. Based on this analysis, achieving mitigation for the San Joaquin kit fox in the eastern portion of the regional RSA is feasible.

Western Side (Santa Clara Valley)

The Authority would mitigate impacts on moderate-, and low-value habitat through the purchase of conservation bank credits and the preservation of one or more PRM sites. There is an estimated 726 acres of mitigation need (17 acres of moderate-value and 709 acres of low-value habitat). This mitigation need represents 0.3 percent of the total habitat available.

There are no conservation banks with San Joaquin kit fox credits in the western portion of the regional RSA. However, the [redacted] property contains approximately 2,600 acres of low-value suitable habitat. The Marxan best solution identified 34 and 4,450 acres of moderate- and low-value habitat, respectively. Based on this analysis, achieving mitigation for the San Joaquin kit fox in the western portion of the regional RSA is feasible.

3.7.3.14 Giant Garter Snake

The Authority would mitigate impacts on potentially suitable aquatic, upland, and movement habitat through the purchase of conservation bank credits and the preservation of one or more PRM sites. There is an estimated 1,331 acres of mitigation need (93 acres of aquatic habitat, 1,200 acres of upland habitat, and 37 acres of movement habitat). This mitigation need represents approximately 0.6 percent, 1.2 percent, and 0.7 percent, respectively of the total available habitat.

The Grasslands Mitigation Bank has 83.7 acres of mitigation credit potential. The purchase of credits at this bank are likely to be prioritized to offset impacts on aquatic habitat. The development of a PRM site is also feasible because the Marxan best solution identified 163 acres, 1,193 acres, and 72 acres of potential aquatic, upland, and movement habitat respectively. The Marxan analysis for the aquatic habitat type just meets the mitigation target; however, because there are 15,156 acres of potentially suitable aquatic habitat, feasibility is not a considerable concern. However, it is likely that wildlife agencies would want at least a portion of the aquatic and upland impacts to be offset with habitat restoration, rehabilitation, or enhancement. For this portion of the mitigation requirement, purchasing credits may be most effective from the perspective of time and cost effectiveness. Based on this analysis, achieving mitigation for the giant garter snake is feasible.

3.7.3.15 Crotch Bumble Bee

The project would result in impacts to modeled Crotch bumble bee habitat on both the western and eastern sides of Pacheco Pass. This primarily includes Santa Clara County on the west side of the pass and Merced County on the east. The mitigation need on the west side is 1,707 acres and 3,041 acres on the east side.

There are no mitigation banks or ILF programs for bees in either geography. The owner-offered PRM sites Lucky Day Ranch and the [redacted] offer 2,505 and 35.8 of preservation opportunity, respectively, on the western side of Pacheco Pass. The [redacted] Property offers 1,423 acres of potential opportunity on the eastern side of the pass. In addition, the Marxan best solution included 1,625 acres on the western side and 3,338 acres on the eastern side. Combined, the preservation opportunities provide the needed mitigation and thus meeting the mitigation requirements is considered feasible.

3.7.3.16 Mixed Riparian, Coyote Creek HUC-8 Watershed

The project would result in impacts on mixed riparian in the Coyote Creek HUC-8 watershed. The Authority would mitigate impacts on this wildlife resource through on-site, in-kind restoration and off-site, in-kind preservation, establishment, restoration, and enhancement. There is an estimated 1.2 acres of mitigation need to offset impacts on mixed riparian. This mitigation need constitutes 0.1 percent of the total resource available.

There are no mitigation banks or ILF programs that could meet this mitigation need; however, POST has a restoration opportunity on Fisher Creek, a tributary of Coyote Creek, and is interested in partnering with the Authority to implement restoration. POST owns Fisher Bend, a

property that encompasses approximately 3,000 linear feet of Fisher Creek, and is currently working on plans to rehabilitate and enhance the reach of Fisher Creek on its property.

Restoration plans on the Fisher Bend property will be aligned with "conceptual opportunities for water resource enhancements in the (Coyote Valley) linkage area" identified in the Coyote Valley Landscape Linkage planning (SCVOSA 2017). These conceptual opportunities include establishment of a continuous riparian system, improved flood storage, enhanced groundwater recharge, restoration of rare or sensitive habitats, improved surface and groundwater quality, and carbon sequestration (SCVOSA 2017).

Other locations in the Coyote Creek HUC-8 watershed that would be prioritized for implementation of mixed riparian mitigation projects include Upper Penitencias and Los Gatos Creeks. These stream reaches have been identified for the preservation and restoration of water quality, flood control, and salmonid spawning habitat. Currently, the SCVWD has been developing a prioritized list of preservation and restoration opportunities for Coyote Creek through the One Water Plan. Through a stakeholder process, the SCVWD has collected a list of projects that are currently being evaluated and prioritized. The SCVWD expects this list to be publicly released for review in August 2019 (Mendenhall 2019). A similar process would be undertaken for the Guadalupe River system, which includes Los Gatos Creek, but that process has not yet begun.

The Marxan analysis identified 2.2 acres of PRM sites that have potential to meet the mixed riparian mitigation need in the Coyote Creek HUC-8 watershed (183 percent of the total mitigation need). The Fisher Bend opportunity, opportunities to partner with the Santa Clara Valley Water district, and the Marxan results indicate mitigation for mixed riparian in Coyote Creek watershed is feasible.

3.7.3.17 California Sycamore Woodland, Pajaro River HUC-8 Watershed

The project would result in impacts on sycamore alluvial woodland in the Pajaro River and San Joaquin–Lower Chowchilla HUC-8 watersheds. The Authority would mitigate impacts on this wildlife resource with on-site, in-kind restoration and off-site, in-kind preservation, establishment, restoration, and enhancement. There is an estimated 40.8 acres of mitigation need to offset impacts on sycamore alluvial woodland. This mitigation need constitutes 3.7 percent of the total resource available.

The Authority would potentially mitigate impacts on sycamore alluvial woodland through the purchase of conservation bank credits at Sparling Ranch Conservation Bank and the preservation of PRM sites. Sparling Ranch is an existing conservation bank with available credits for California red-legged frog and California tiger salamander. However, the site also has potential credit development for riparian resources regulated under Section 1600 et seq., including sycamore alluvial woodland (Meyers 2019), along 1.3 miles of the South Fork of Pacheco Creek. Conservatively assuming a 20-foot wide restoration corridor on each bank this equates to 6.3 acres of restoration potential. For the purposes of this analysis, it is assumed that half of this restoration opportunity (3.2 acres) has potential to provide California sycamore woodland restoration opportunity.

The Marxan best solution included 215 acres of land with preservation and enhancement opportunities within the Pajaro River HUC-8 watershed. This is 527 percent of the total mitigation need. Based on this analysis, achieving mitigation for sycamore alluvial woodland is feasible.

3.7.3.18 Mixed Riparian, Pajaro River HUC-8 Watershed

The project would result in impacts on mixed riparian in the Pajaro River HUC-8 watersheds. The Authority would mitigate impacts on this wildlife resource through on-site, in-kind restoration and off-site, in-kind preservation, establishment, restoration, and enhancement. There is an estimated 13.8 acres of mitigation need to offset impacts on mixed riparian. This mitigation need constitutes 0.7 percent of the total resource available.

There are no mitigation banks or ILF programs with available credits that could meet mixed riparian or palustrine forested wetlands mitigation need within the Pajaro River HUC-8 watershed. However, the Sparling Ranch Conservation Bank has approximately 1.3 miles of mixed riparian opportunity along the South Fork of Pacheco Creek (Meyers 2019). Conservatively assuming a 20-foot wide restoration corridor on each bank this equates to 6.3 acres of restoration potential. For the purposes of this analysis, it is assumed that half of this restoration opportunity (3.2 acres) has potential to provide mixed riparian restoration opportunity.

There are also restoration, rehabilitation, and enhancement opportunities on the Paxton and Montes properties in the Soap Lake region of the Pajaro River HUC-8 watershed as described in Section 2.7.2.3. The extent of restoration potential on the Paxton property is unknown. The Montes property has approximately 78.5 acres of riparian restoration opportunity. For the purposes of this analysis, only 10 of the 78.5 acres are assumed to be mixed riparian (Table 2-10); the rest of the acres are assumed to be palustrine forested wetland because that is the primary type mapped in the Soap Lake region for the impact analysis. It is unknown which portion of this opportunity will meet regulatory requirements under Section 404 and which portion meets regulatory requirements under Section 1600 et seq.

The Lucky Day Ranch owner-offered PRM site has 7 acres of riparian enhancement, 7 acres of riparian establishment, and 11 acres of riparian preservation available (see Table C-1 in Appendix C). Based on land cover mapping, this property likely includes mixed riparian (as opposed to palustrine forested wetland). Assuming regulators will allow a portion of the mitigation to be fulfilled with enhancement and preservation, the Lucky Day Ranch has potential to meet all the mixed riparian mitigation needs required under Section 404 and Section 1600 et seq.

The land cover dataset for the regional RSA does not have the same mapping specificity as has been applied within the project footprint; consequently, the Marxan analysis is only able to distinguish between mixed riparian and palustrine forested wetland opportunities within the mapped project footprint. Outside the mapped project footprint but within the regional RSA, only the total available acres of valley foothill riparian types can be estimated. Valley foothill riparian is comprised of both mixed riparian and palustrine forested wetland types. For this reason, these two resource types were combined in the Marxan analysis.

The Marxan best solution identified 108 acres of available mixed riparian in the Pajaro River HUC-8 watershed (780 percent of the total mitigation need) that could have high potential for development as PRM sites. In addition, the mitigation opportunities on the Lucky Day Ranch exceed the mixed riparian mitigation need for establishment and rehabilitation. If additional establishment acres are needed, the Montes and Paxton properties should readily provide sufficient acres of created or established mixed riparian to meet the total mitigation need; accordingly, mitigation is feasible.

3.7.3.19 Mixed Riparian, Middle San Joaquin–Lower Chowchilla HUC-8 Watershed

The project would result in impacts on mixed riparian in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. The Authority would mitigate impacts on mixed riparian through on-site, in-kind restoration and preservation and offsite, in-kind preservation and rehabilitation or enhancement. There is an estimated 2.7 acres of mitigation need to offset impacts on mixed riparian–natural watercourse in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed. This mitigation need constitutes approximately 0.1 percent of the total resource available.

There are no mitigation banks in the Middle San Joaquin–Lower Chowchilla HUC-8 watershed that have credits available for mixed riparian. The NFWF Sacramento District ILF program has 11.12 San Joaquin aquatic resource credits available (see Table C-1 in Appendix C). These credits can be applied to restore, enhance, create, or preserve non–vernal pool aquatic resources in the San Joaquin Valley service area (where project impacts would occur) including palustrine, lacustrine, and riverine wetlands (NFWF 2018). This mitigation need would likely be combined with the mixed riparian-natural watercourse and natural watercourse mitigation need described in

Section 2.8.3, Middle San Joaquin-Lower Chowchilla HUC-8 Watershed, and the available aquatic resource credits through the NFWF program would satisfy all mitigation needs.

The Marxan analysis identified 26 acres of mixed riparian available for preservation, rehabilitation, and enhancement opportunities (949 percent of the total mitigation need) on properties that could contribute to multiple mitigation needs and that exhibit high potential for development as PRM sites. Because of the small mitigation need, the potential to purchase credits through the NFWF ILF Program, and the PRM sites identified through the Marxan analysis, mitigation for mixed riparian is feasible.

3.8 Opportunities to Co-Locate Species Mitigation and Aquatic Resources Mitigation

3.8.1 Conservation and Mitigation Banks

There are several ways bank credit purchases can meet multiple resource needs. For example, vernal pool wetland mitigation needs and vernal pool crustacean mitigation needs can be met with bank credits where those credits are certified by both agencies. Also, mitigation bank credits certified by the USACE could possibly be used toward species mitigation needs. The use of existing banks with development potential to meet additional resource mitigation needs would be prioritized because of the cost and time efficiencies that can be gained by working with existing banks that have experience working with regulatory and permitting agencies, because determining the feasibility of co-locating resource mitigation requires close coordination with these agencies. The opportunities to co-locate credits at existing mitigation and conservation banks that would be prioritized for multiple-resource mitigation credit development are described in the following subsections.

3.8.1.1 Pajaro River Mitigation Bank

The Pajaro River Mitigation Bank has 5.39 available seasonal wetland credits certified by the USACE. The bank also has 139.27 potential credits to be developed. The undeveloped credits present an opportunity to work with the bank and regulatory agencies to meet several aquatic resource and species mitigation needs.

- Credits could be developed to meet multiple mitigation needs for wetlands or waters other than wetlands. For example, freshwater marsh, freshwater pond, and natural watercourse credits could be developed (rather than seasonal wetland credits).
- Seasonal wetland credits could potentially be used not only to meet seasonal wetland needs but also as mitigation for impacts on California red-legged frog breeding or tricolored blackbird nesting habitat. Upland areas could also be managed for western burrowing owl.

3.8.1.2 Sparling Ranch Conservation Bank

Sparling Ranch Conservation Bank has available aquatic and upland credits for California red-legged frog and California tiger salamander. These credits were developed as part of Phase I of bank development. Phase II has 2,002 acres with potential to develop restoration and enhancement plans for natural watercourse, riparian woodland, riparian scrub, and possibly California sycamore alluvial woodland along a 1.3-mile section of the South Fork of Pacheco Creek (Meyers 2019). In addition to red-legged frog and tiger salamander credit development, there is also potential to develop mitigation credits for burrowing owl, San Joaquin kit fox, and vernal pool crustaceans as well as non-listed species (e.g., western spadefoot, western pond turtle, American badger) (Meyers 2019; South Bay Conservation Resources 2019).

3.8.1.3 Grasslands Mitigation Bank

The Grasslands Mitigation Bank has 27.6 seasonal wetland and 83.7 giant garter snake credits remaining to be developed. Because the Grasslands bank site has alkali soils, it may be possible to develop some seasonal wetland credits as alkali scrub wetland and alkali marsh credits. Undeveloped seasonal wetland and giant garter snake credits could possibly be developed to provide credit for tricolored blackbird and Swainson's hawk as well.

3.8.2 NFWF Sacramento ILF Program, Aquatic Resources

The NFWF ILF aquatic resources credit program presents an opportunity for developing sites that meet mitigation needs for multiple resources. The program is approved to issue credits as mitigation for multiple agencies (e.g., USACE, USFWS, NMFS, EPA). Program credits are offered for a broad range of aquatic resource types: palustrine, lacustrine, and riverine wetlands and waters other than wetlands (which include mixed riparian types). With this flexibility and level of engagement by a broad range of regulatory agencies, the NFWF aquatic resources credit program would be maximized, especially where credits could be developed to meet mitigation needs for species and resources regulated under Section 1600 et seq. at the same location.

3.8.3 Owner-Offered PRM Sites

Owner-offered PRM sites would be developed to meet multiple species mitigation needs in excess of what is offered at conservation banks (or, in some cases, in lieu of a bank when and where there is agreement with wildlife agencies that such an approach is reasonable). The sites described in this section have been proposed to the Authority as potential mitigation sites and are in various stages of planning. These sites provide the Authority an opportunity to work with the owners to develop the properties to meet the targeted, multiple-species mitigation needs of the project. Each of these owner-offered properties has the potential to meet both aquatic and species mitigation needs.

[redacted]

The [redacted] is a 36-acre property on [redacted]. The primary land cover type is serpentine grassland, but there are also seasonal wetlands with some potential for restoration or enhancement. This property provides unique mitigation opportunities for preservation of habitat occupied by two important species: Bay checkerspot butterfly and burrowing owl. The site also has potential to meet mitigation needs for California red-legged frog, California tiger salamander, Swainson's hawk, and tricolored blackbird. In addition to species mitigation opportunities, the site offers potential to enhance or rehabilitate and preserve seasonal wetland and riparian wetland habitat. While there are no impacts on seasonal wetland and riparian aquatic types in the Coyote Creek HUC-8 watershed, there may be an opportunity to apply credits from this site to mitigation needs in the adjacent Pajaro River HUC-8 watershed.

3.8.3.2 Lucky Day Ranch

The Lucky Day Ranch is a 2,000-acre property that is currently being developed as a mitigation bank. As described in Section 2.7.2.3, the property has potential to provide mitigation credit for multiple aquatic resources and species, including freshwater marsh, freshwater pond, seasonal wetland, mixed riparian, natural watercourse, California red-legged frog, and California tiger salamander. Site planning has begun for this site, but credits have not yet been developed; the timing would provide the Authority an opportunity to work with permitting agencies to develop credits particular to the project.

3.8.3.3 [redacted] Property

The [redacted] property encompasses 2,600 acres in the Diablo/Inner Coast Range at the Santa Clara and San Benito County boundary; a portion of the property is located in each county. The property includes 17.3 miles of streams and offers opportunities for the preservation of the following aquatic types: riparian, seasonal wetland, freshwater pond, natural watercourse, and California sycamore woodland. Restoration and enhancement opportunities are likely to exist on the property, but no quantitative data are available. The property overlaps with mapped habitat for California red-legged frog, California tiger salamander, least Bell's vireo, tricolored blackbird, and foothill yellow-legged frog.

3.8.3.4 Five Pillar Farms

Five Pillars Farm is located near Livermore. The 32.5-acre property offers a rare opportunity to restore 2.1 acres of alkali vernal pools. The property is also occupied by California tiger

salamander, western burrowing owl, and American badger (Kohlmann et al. n.d.). This property is outside the San Joaquin–Lower Chowchilla HUC-8 watershed and outside the aquatic resource study area boundary; however, because some vernal pool conservation banks have very large service areas (e.g., Vierra–Sandy Mush Road Conservation Bank), it is reasonable to assume that this property may be accepted by the regulatory agencies as a PRM site, especially in view of the opportunity to restore alkali vernal pools.

3.8.4 Marxan Best Solution

While a portion of the mitigation need can be met through the purchase of credits, partnerships with local stakeholders, and owner-offered properties, there would be a residual mitigation need. The best solution from the Marxan analysis can be used to identify properties that meet the residual need while maximizing resource benefit and minimizing cost (e.g., number of acres, number of parcels). In identifying the lands that most effectively meet the complete mitigation need, the Marxan best solution maximizes the co-location of aquatic and species resources.

4 REFERENCES

Bello, Nathan. 2019. Conservation Biologist/Planner. WRA, Inc., San Francisco, CA. Email to Rebecca Sloan, ICF, describing approximate acreages and linear feet of mitigation opportunity at the Lucky Day Ranch. March 8, 2019.

California Department of Fish and Game (CDFG). 1994. *Staff Report Regarding Mitigation for Impacts on Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California*. November 8, 1994. Sacramento, CA.

———. 2012. *Staff Report on Burrowing Owl Mitigation*. Sacramento, CA. March 7, 2012.

California High-Speed Rail Authority (Authority). 2018. *Merced to Fresno Section: Central Valley Wye Preliminary Compensatory Mitigation Plan*. July 2018. Sacramento, CA:

———. 2019a. *Merced to Fresno Section: Central Valley Wye Draft Supplemental Environmental Impact Report/Environmental Impact Statement*. Volume 1: Report. May 2019. Sacramento, CA.

———. 2019b. *San Jose to Merced Project Section: State's Preferred Alternative Staff Report for the San Jose to Central Valley Wye Project*. August 2019. Sacramento, CA .

———. 2019c. *San Jose to Merced Project Section: Aquatic Resources Delineation Report.* November 2019. Sacramento, CA.

———. 2019d *San Jose to Merced Project Section: Biological and Aquatic Resources Technical Report*. November 2019. Sacramento, CA.

California High-Speed Rail Authority and Federal Railroad Administration (Authority and FRA). 2005. *Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California High-Speed Train System.*

———. 2008. *San Francisco Bay Area (Bay Area) to Central Valley High-Speed Train (HST) Program Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS).* May 2008.

———. 2012. *Final California High-Speed Train Project Environmental Impact Report/Environmental Impact Statement and Final Section 4(f) Statement and Draft General Conformity Determination—Merced to Fresno Section*. Volume I: Report. April 2012. Sacramento, CA and Washington, DC.

———. 2013. *High-Speed Rail Fresno to Bakersfield Section Draft Compensatory Mitigation Plan*. Sacramento, CA, and Washington, DC.

County of Santa Clara, City of San Jose, City of Morgan Hill, City of Gilroy, Santa Clara Valley Water District, and Santa Clara Valley Transportation Authority (County of Santa Clara et al.). 2012. *Santa Clara Valley Habitat Plan*. Final. Prepared by ICF International, August 2012. https://scv-habitatagency.org/178/Santa-Clara-Valley-Habitat-Plan (accessed December 11, 2019).

Cowan, Peter. 2019. Director of Conservation Science. Peninsula Open Space Trust, Palo Alto, CA. Phone conversation and email follow-up discussing existing and future restoration opportunities on POST properties. June 10, 2019

[redacted]

Federal Railway Administration (FRA), California High-Speed Rail Authority, U.S. Environmental Protection Agency, and U.S. Army Corps of Engineers (FRA et al.). 2010. *Memorandum of Understanding Among the United States Department of Transportation, Federal Railroad Administration, California High-Speed Rail Authority, and United States Army Corps of Engineers, National Environmental Policy Act and Clean Water Act Section 404, and Rivers and Harbors Act Section 14 Integration Process for the California High-Speed Train Program*. November 2010. www.hsr.ca.gov/docs/programs/eir_memos/Proj_Guidelines_NEPA404_408MOU.pdf (accessed December 2018).

Fisher, J.B., L. A. Trulio, G.S. Biging, and D. Chromczack (Fisher et al.). 2007. An Analysis of Spatial Clustering and Implications for Wildlife Management: a Burrowing Owl Example. *Environmental Management* 39:403–11.

Huber, Patrick. 2019. Consultant. Grasslands Water District, Davis, CA. Email to Greg Nichols, Senior GIS Analyst at ICF, transmitting draft Marxan results performed for GEA stakeholders. April 25, 2019

Kohlmann, S., J. Alvarez, C. Clark and R. Nuzum. n.d. *A Baseline Assessment of Environmental and Biological Conditions at Five Pillars Farms, Alameda County, California.* Draft. Prepared by Tierra Resource Management. Castro Valley, CA.

Mendenhall, Brian. 2019. Project Manager. Santa Clara Valley Water District, San Jose, CA. Telephone conversation with Rebecca Sloan, ICF, discussing the Coyote Creek projects identification and prioritization process and when it will be released at a public meeting. May 24, 2019

[redacted]

———. 2019. Senior Permitting Specialist. California High-Speed Rail Authority, Sacramento, CA. Email forwarding information regarding aquatic resource restoration and protection opportunities on Sparling Ranch. June 4, 2019.

National Audubon Society. 2019. *Important Bird Areas California: Upper Pajaro River (Bolsa de San Felipe)*. www.audubon.org/important-bird-areas/upper-pajaro-river-bolsa-de-san-felipe (accessed April 8, 2019).

National Fish and Wildlife Foundation (NFWF). 2018. Sacramento District California In-Lieu Fee Program—Enabling Instrument. Amended July 3, 2018. www.nfwf.org/ilf/Documents/Enabling%20Instrument.pdf (accessed June 30, 2019).

Penrod, K., P.E. Garding, C. Paulman, P. Beier, S. Weiss, N. Schafer, R. Branciforte, and K. Gaffney (Penrod et al.). 2013. *Critical Linkages: Bay Area & Beyond*. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA (www.scwildlands.org) in collaboration with the Bay Area Open Space Council's Conservation Lands Network (www.BayAreaLands.org.). GIS Model Outputs available at www.bayarealands.org/mapsdata.html.

Philip Williams and Associates, Ltd. (PWA) 2004. *Restoration Opportunities on the Montes Property, Soap Lake.* Prepared for The Nature Conservancy. Unpublished memo. December 17, 2004.

———. 2005. *Restoration Opportunities on the Paxton Property and Surroundings.* Prepared for The Nature Conservancy. Unpublished report. February 14, 2005.

San Francisco Estuary Institute–Aquatic Science Center (SFEI) and H.T. Harvey & Associates. 2017. *Sycamore Alluvial Woodland: Habitat Mapping and Regeneration Study*. February 2017. Publication #816. Prepared for California Department of Fish and Wildlife Local Assistance Grant Program. Richmond, CA. www.sfei.org/sites/default/files/biblio_files/SycamoreAlluvialWoodlands_SFEI_HTHarvey_2017_medres.pdf (accessed December 15, 2019).

Santa Clara Valley Open Space Authority (SCVOSA). 2017. *Coyote Valley Landscape Linkage. A Vision for a Resilient, Multi-benefit Landscape*. December 2017. San Jose, CA.

Smith, Jake. 2019. Conservation GIS Coordinator. Santa Clara Valley Open Space Authority, San Jose, CA. Email to ICF regarding restoration opportunities on the Montes Property. June 24, 2019.

South Bay Conservation Resources, LLC. 2019. *The Sparling Ranch Conservation Bank Summary of Conservation Credits and Description of Conservation Bank.* Confidential prospectus for the California High Speed Rail Authority. January 11, 2019.

U.S. Army Corps of Engineers (USACE). 2005. *Regulatory Guidance Letter 05-05. Ordinary High Water Mark Identification.* December 7, 2005. https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll9/id/1253/ (accessed April 15, 2019).

———. 2008a. *Interagency Long-Term Management Template.* May 2008.

———. 2008b. *A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States*. ERDC/CRREL TR-08-12. By R.W. Lichvar and S.M. McColley. Hanover, NH: U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory.

———. 2013. *Standard Operating Procedure for Determination of Mitigation Ratios*. USACE South Pacific Division. October 21, 2013.

———. 2015. *Habitat and Mitigation Monitoring Guidelines*. USACE South Pacific Division. January 2015.

———. 2019. *Regulatory In-lieu Fee and Bank Information Tracking System*. https://ribits.usace.army.mil/ribits_apex/f?p=107:2 (accessed February 2019).

U.S. Fish and Wildlife Service (USFWS). 1996. *Programmatic Biological Opinion to Address Impacts on Vernal Pool Branchiopods.*

———. 1997. *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California*. Sacramento Fish and Wildlife Office. November 13, 1997. Sacramento, CA.

———. 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon.* December 2005. Portland, OR: Region 1. www.fws.gov/sacramento/es/Recovery-Planning/Vernal-Pool/ (accessed April 15, 2019).

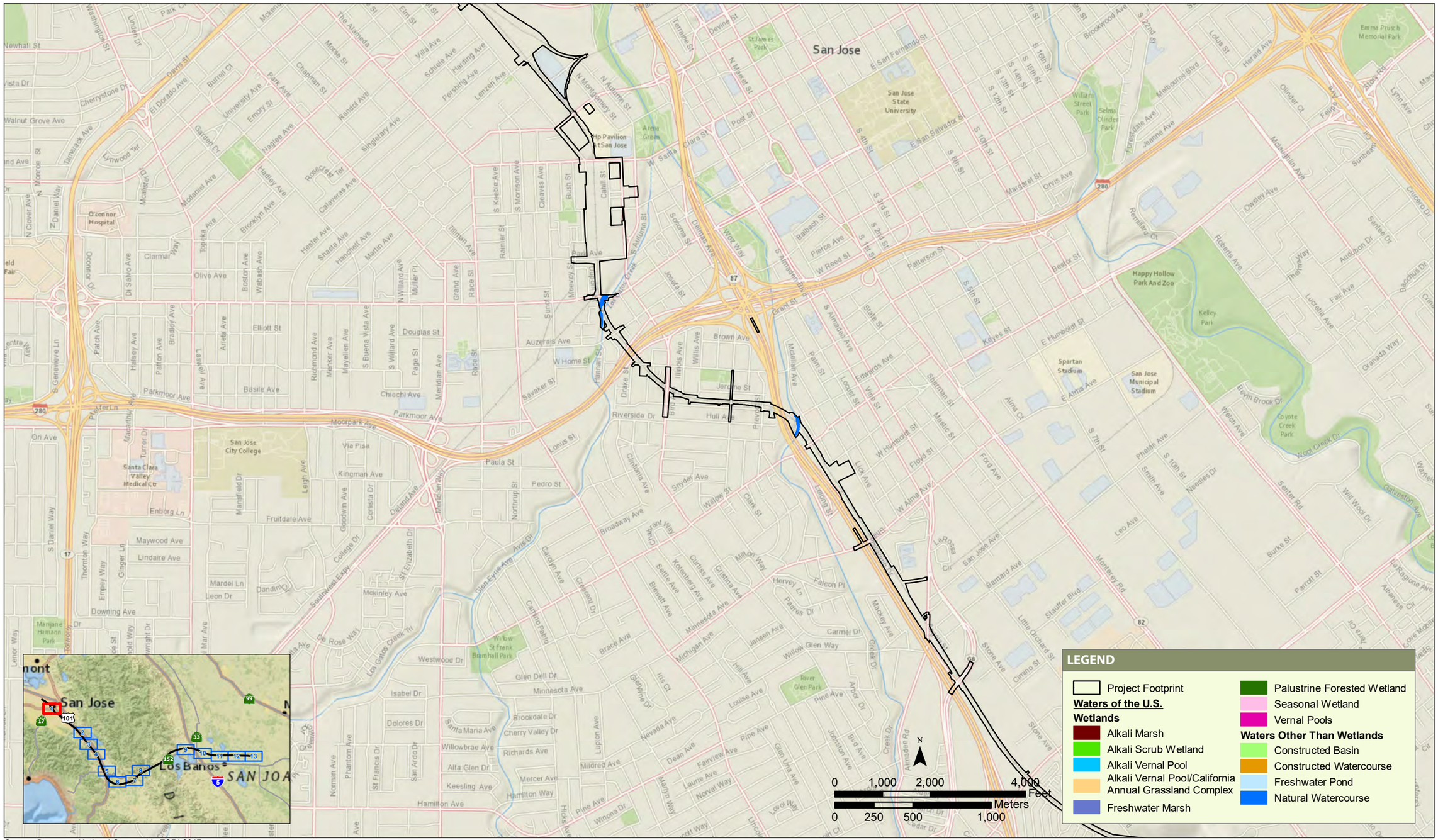
———. 2017. *Interim Guidance on Implementing the Final Endangered Species Act Compensatory Mitigation Policy*. January 17, 2017. www.fws.gov/endangered/improving_ESA/pdf/Interim_Guidance_for_Implementing_the_Endangered%20Species%20Act%20Jan%202017.pdf (accessed April 15, 2019).

———. 2019. *Conservation Banks within Our Service Area*. Sacramento Fish & Wildlife Office. Sacramento, CA. www.fws.gov/sacramento/es/Conservation-Banking/Banks/In-Area/ (accessed April 15, 2019).

U.S. Geological Survey (USGS). 2016. *National Hydrography Dataset*. http://nhd.usgs.gov/ (accessed April 2016).

Witham, C.W., R.F. Holland, and J. Vollmar (Witham et al.). 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012*. Sacramento, CA. Report prepared for CVPIA Habitat Restoration Program, U.S. Fish and Wildlife Service. Grant Agreement No. F11AP00169 with the USFWS. www.vernalpools.org/ (accessed December 2016).

APPENDIX A: SECTION 404 EFFECTS



Source: Basemap, National Geogrpahic ESRI 2017

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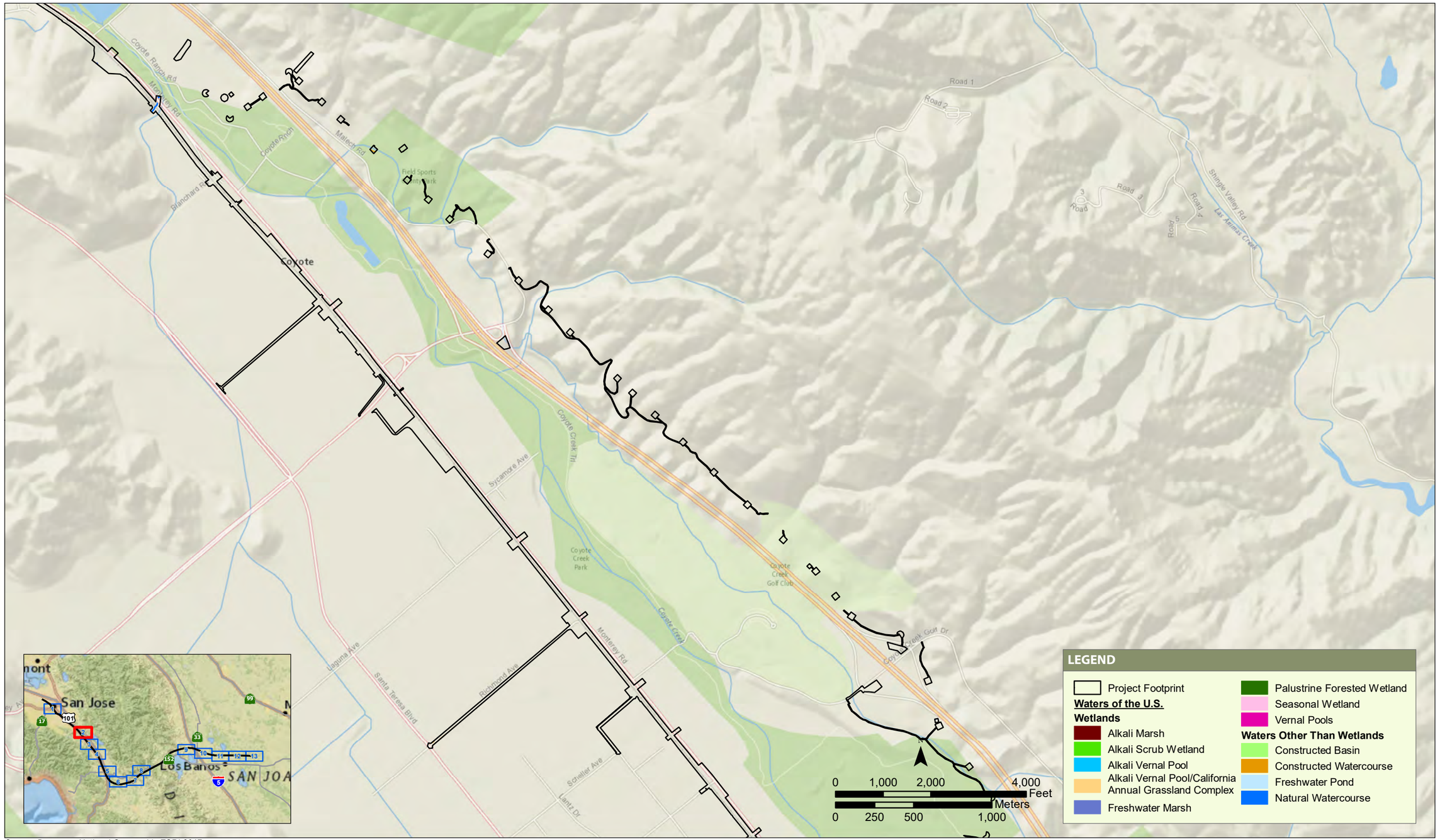
Impacts on Waters of the U.S.



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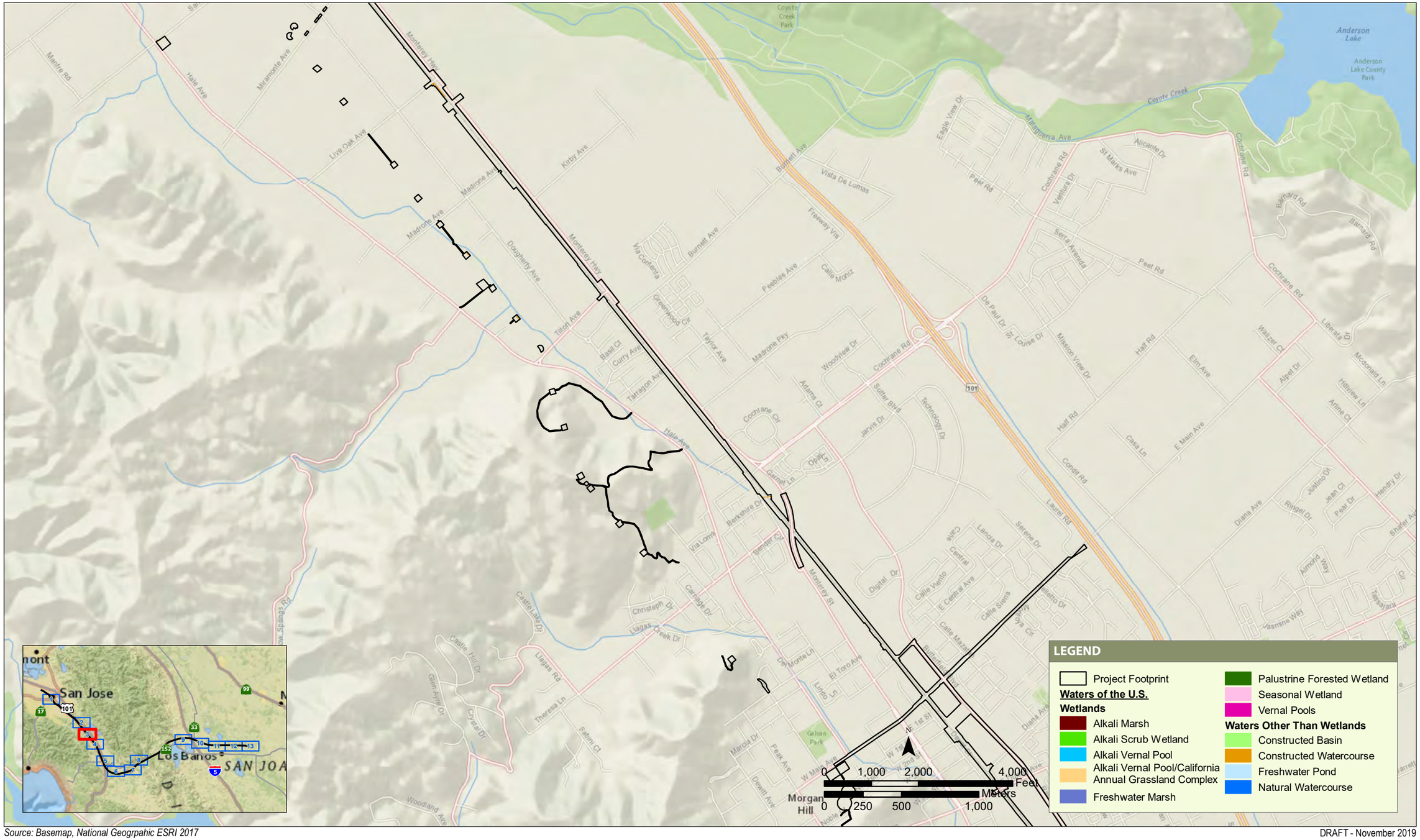

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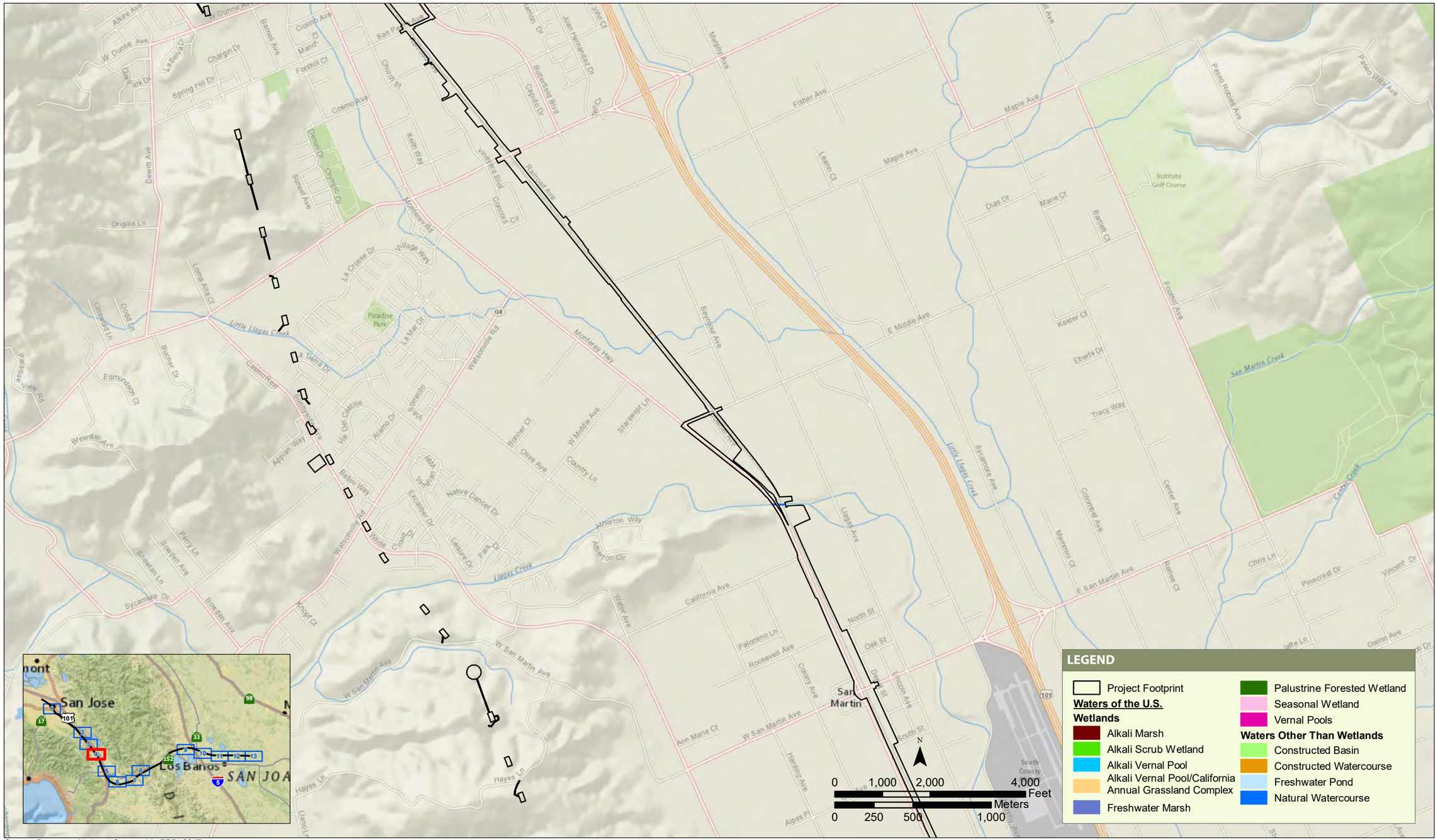

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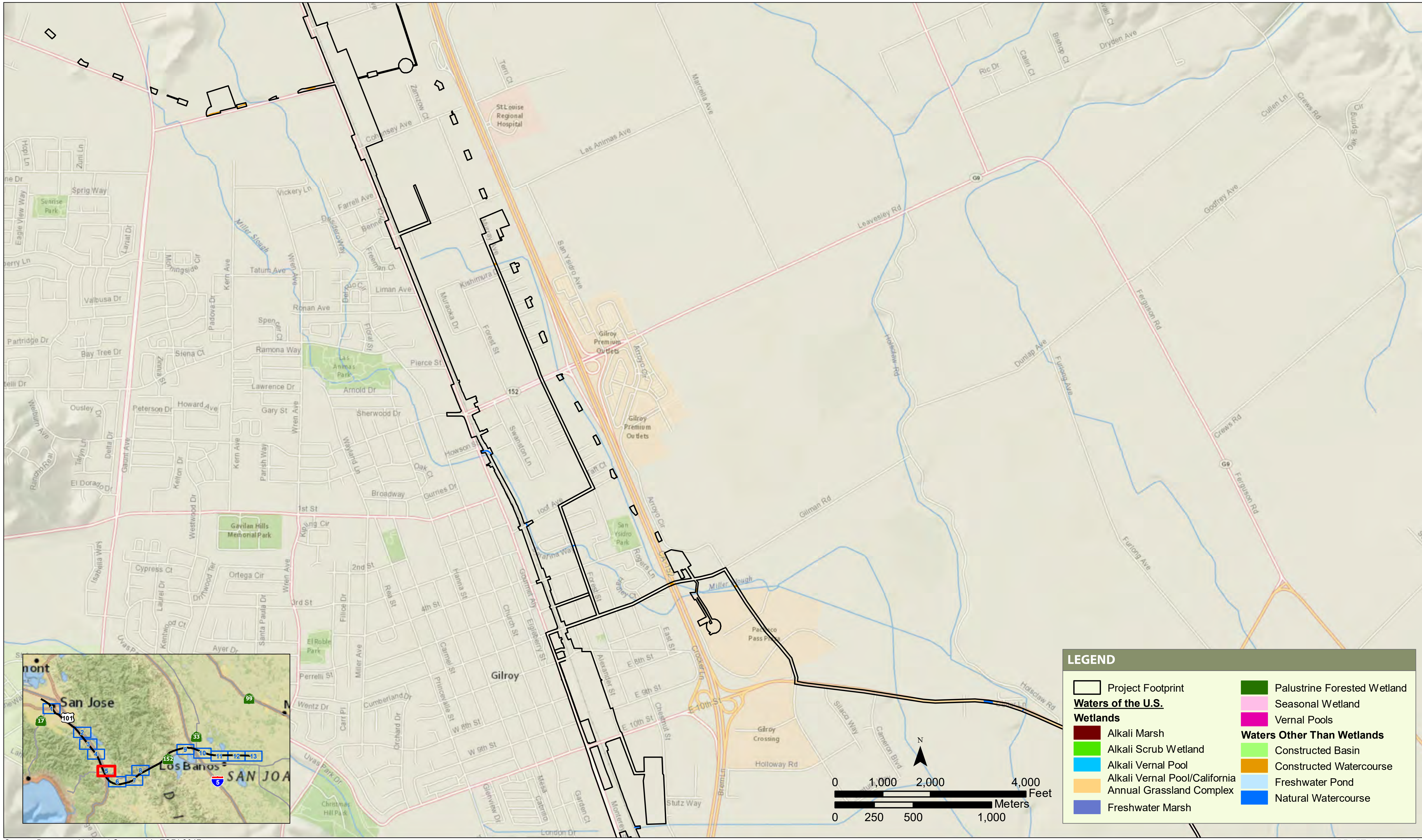

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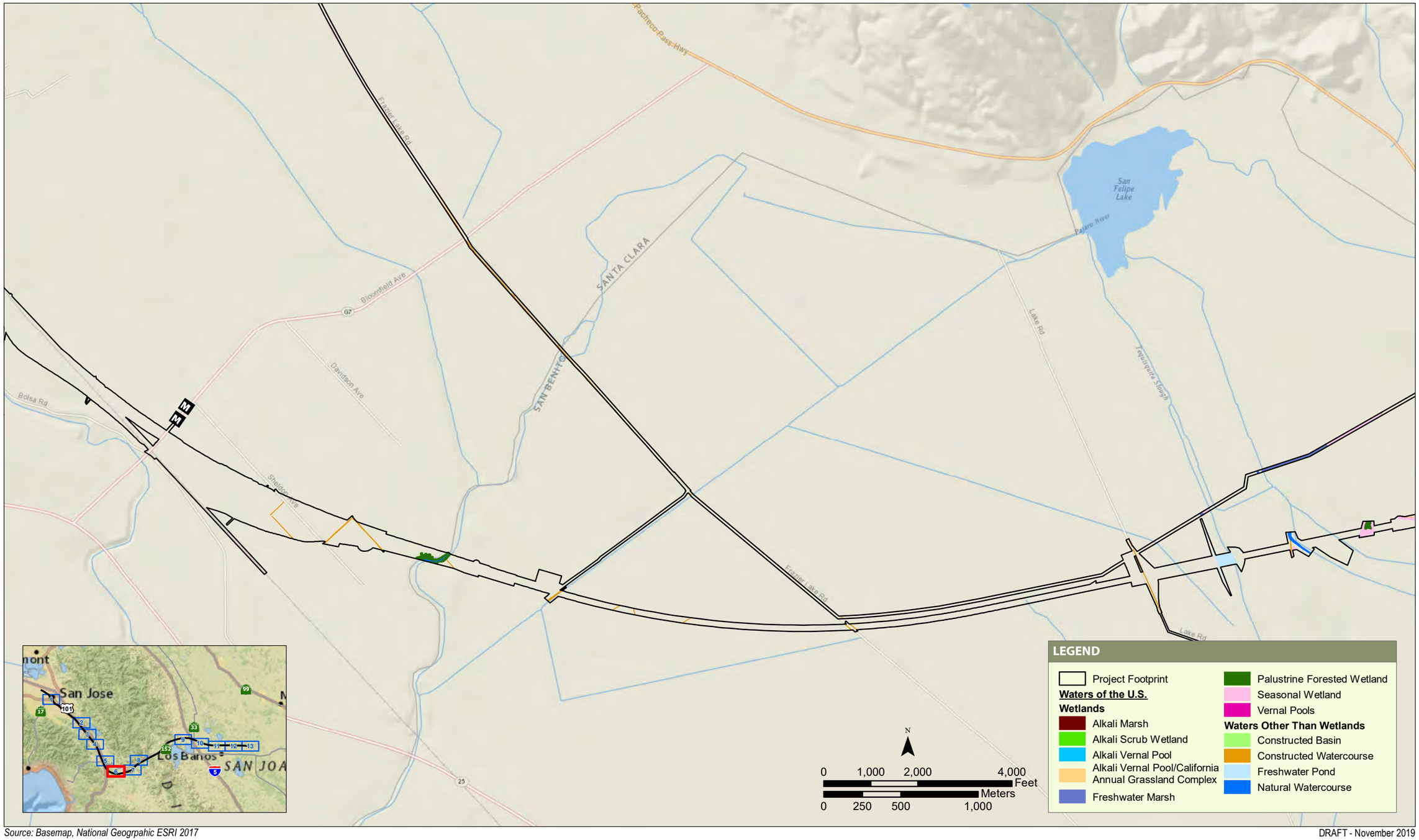

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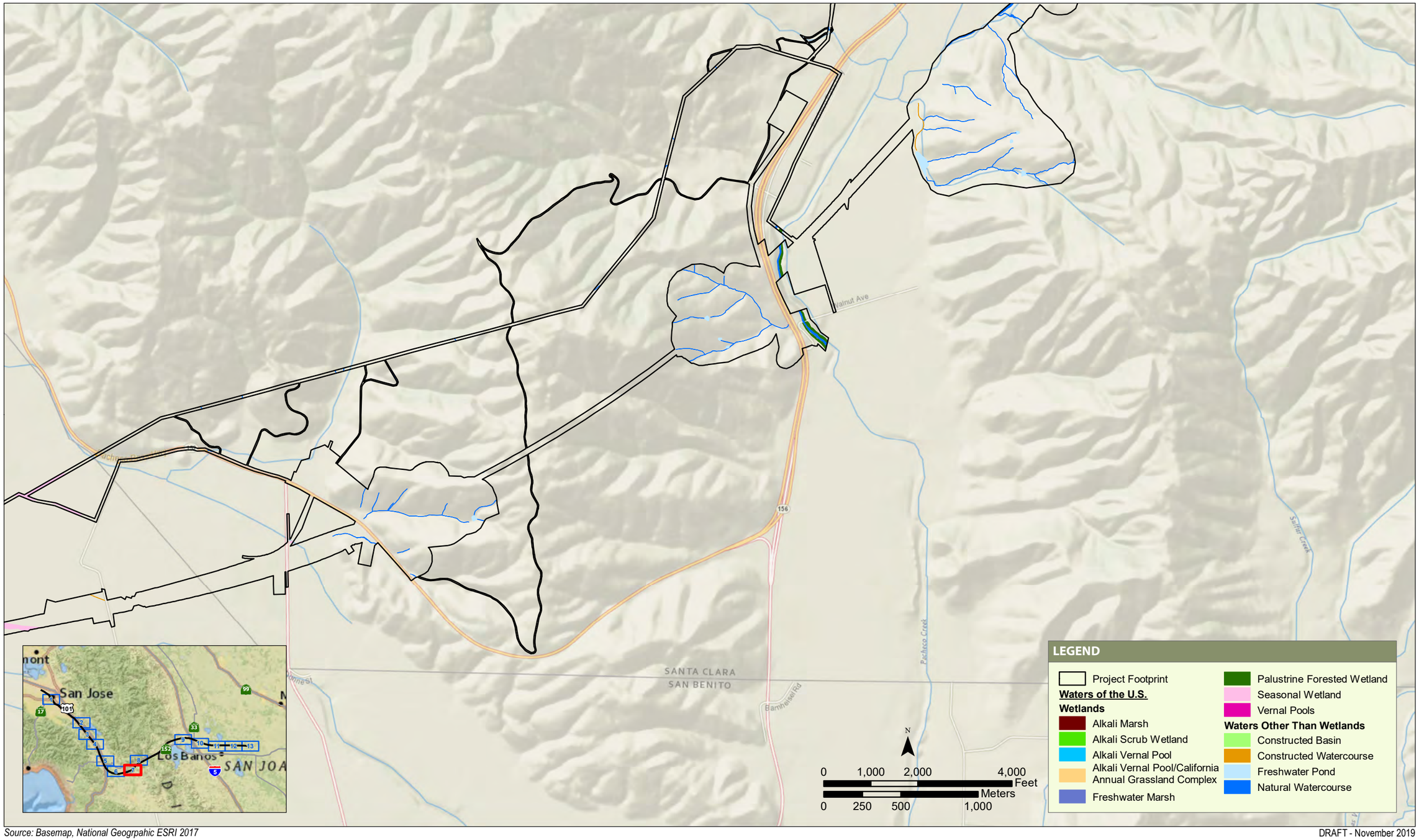

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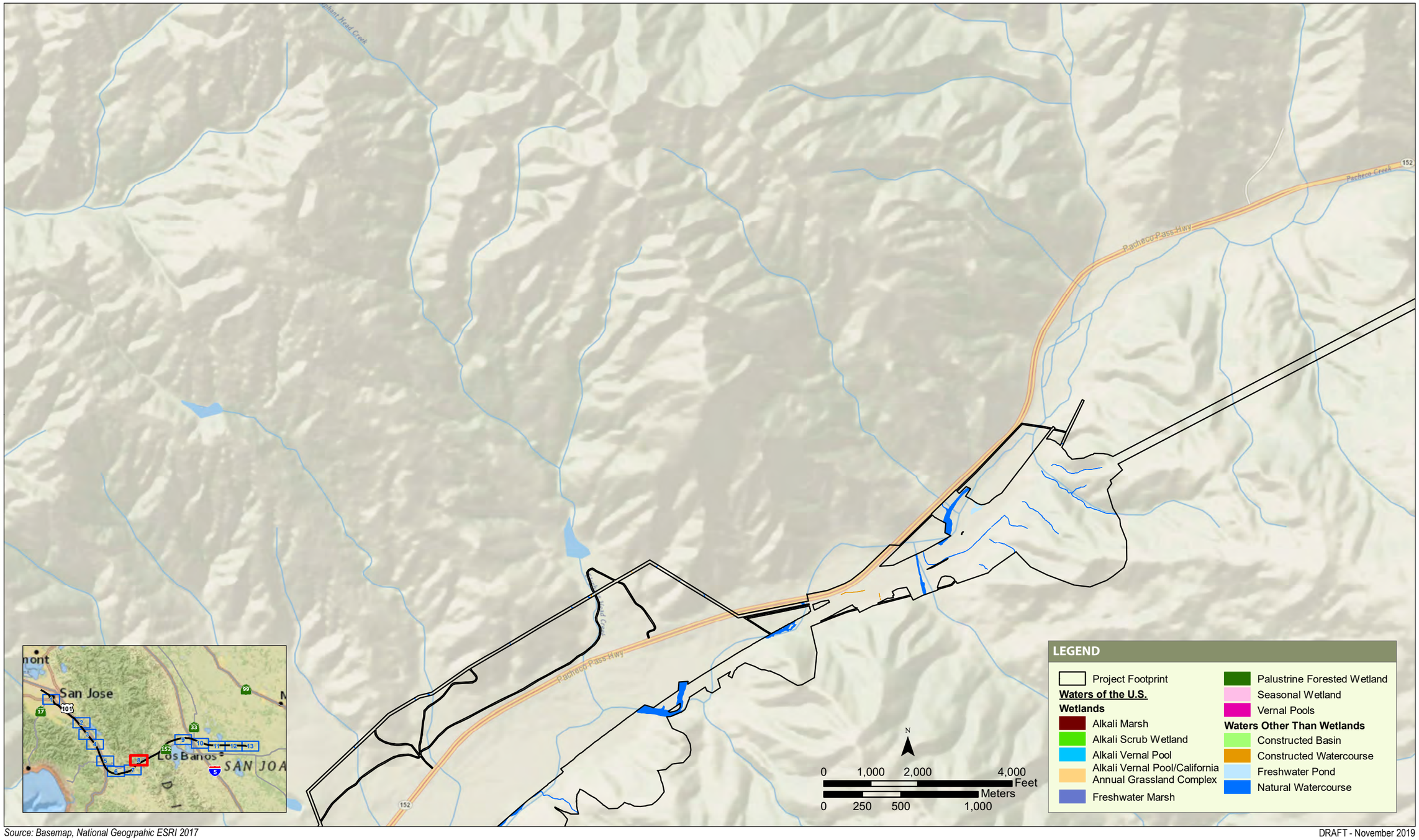

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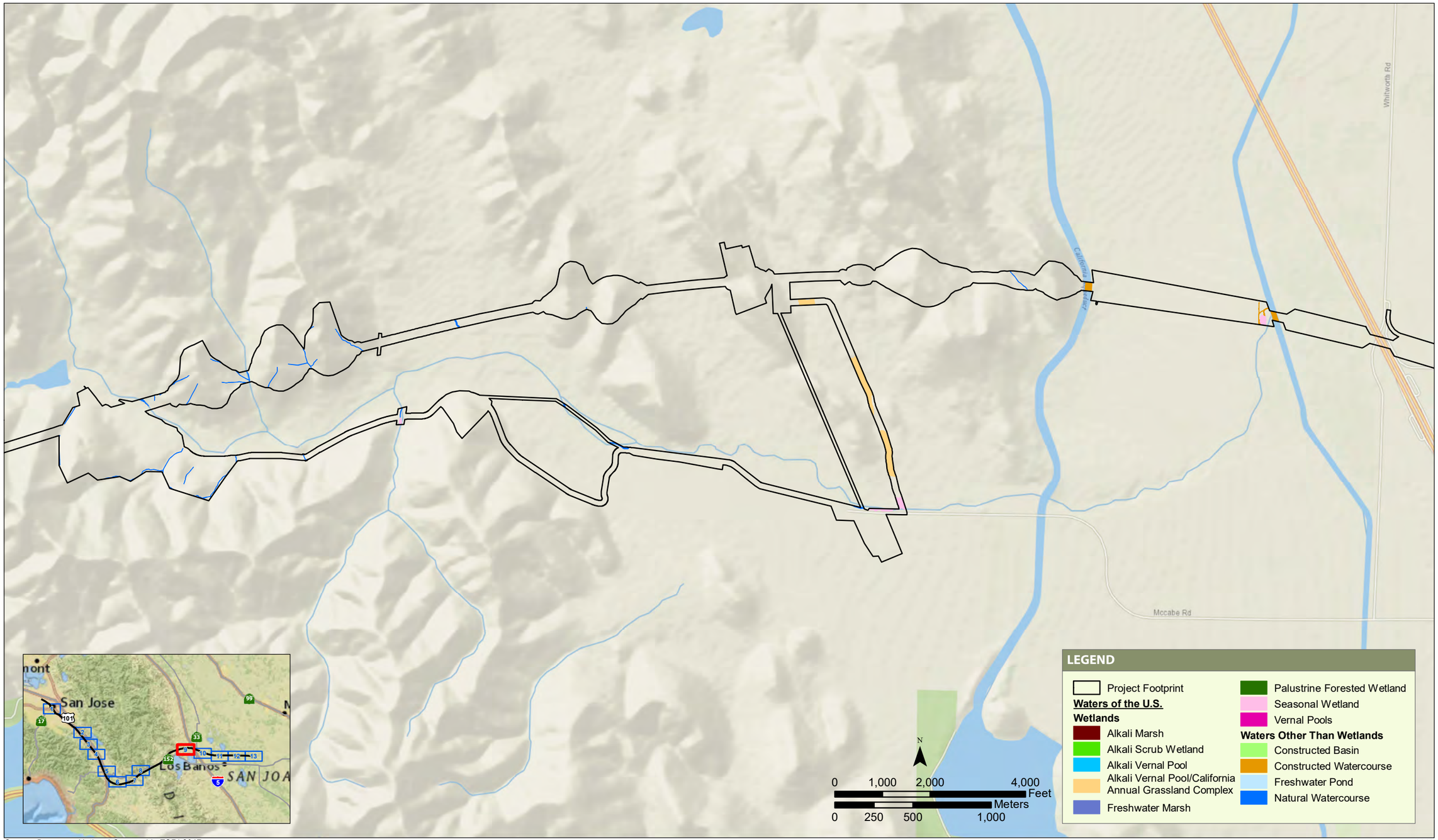

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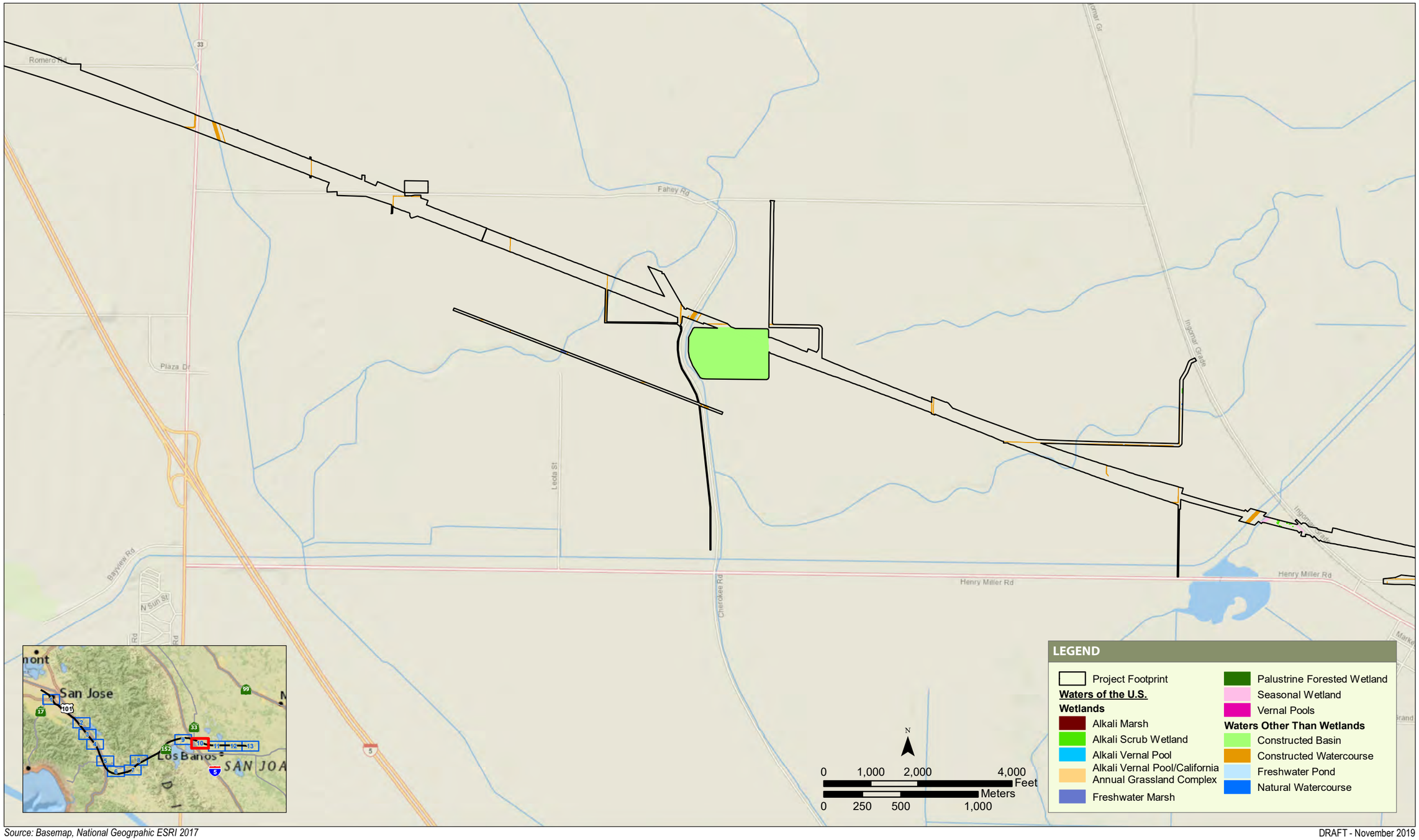

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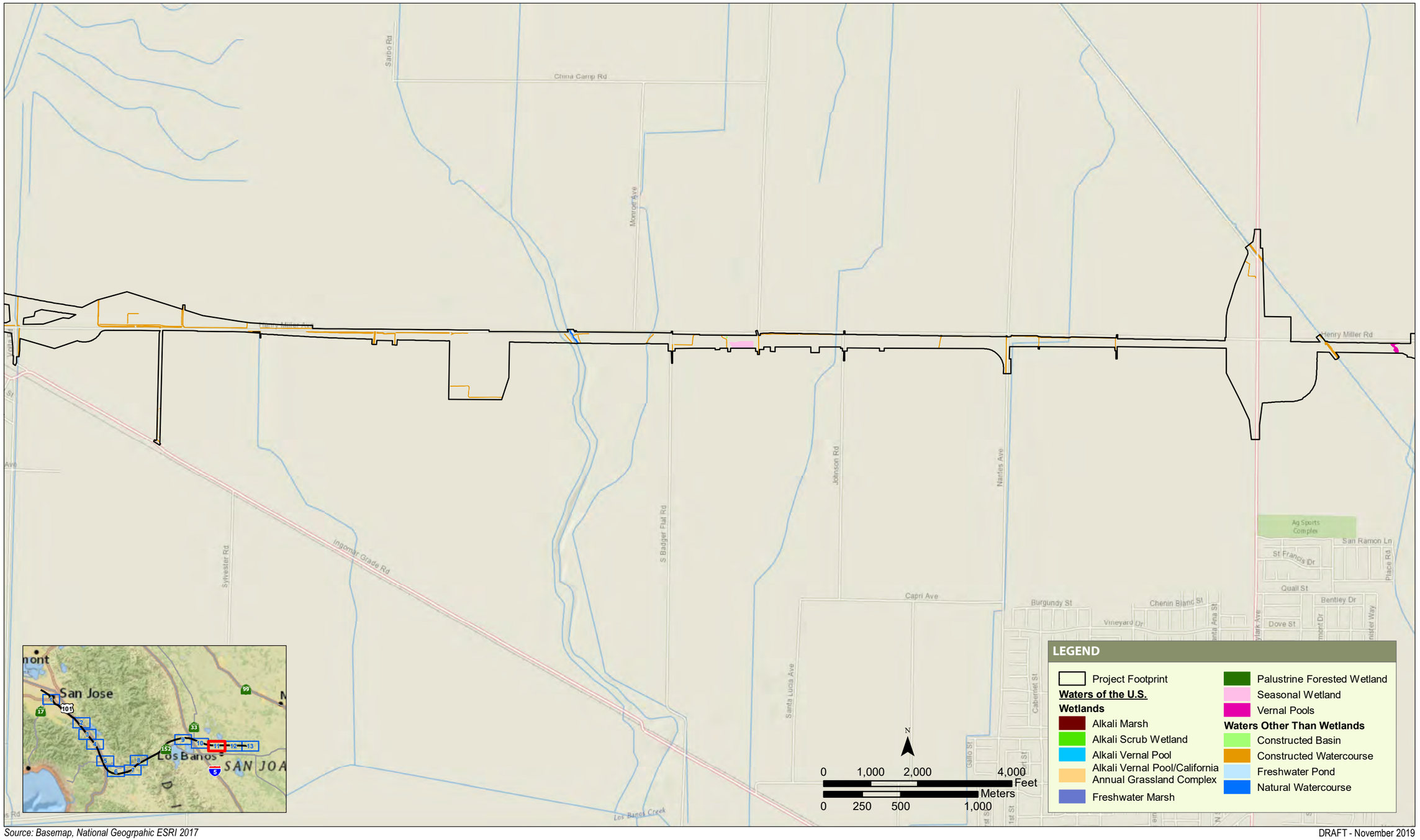
Impacts on Waters of the U.S.



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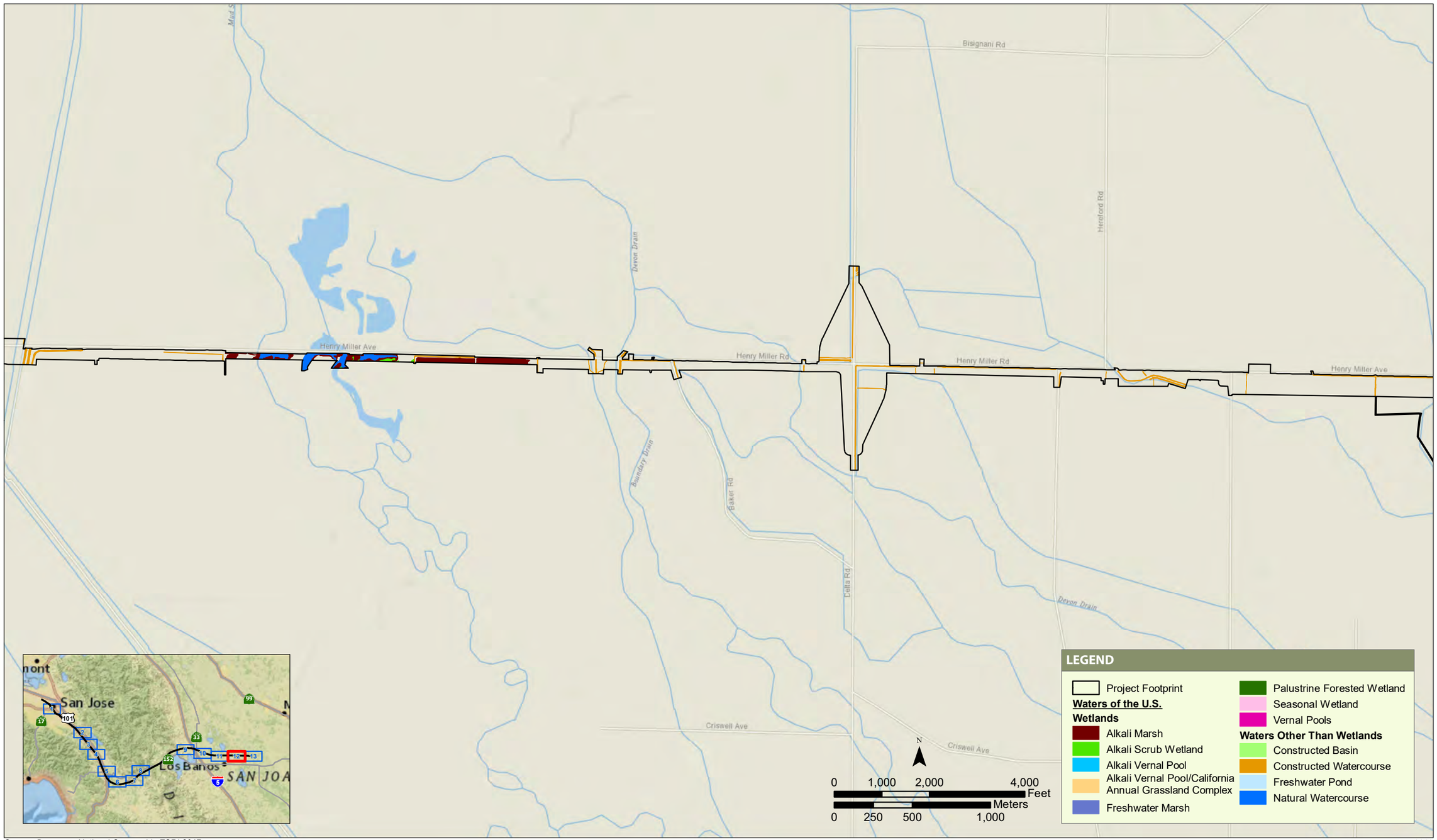
Impacts on Waters of the U.S.



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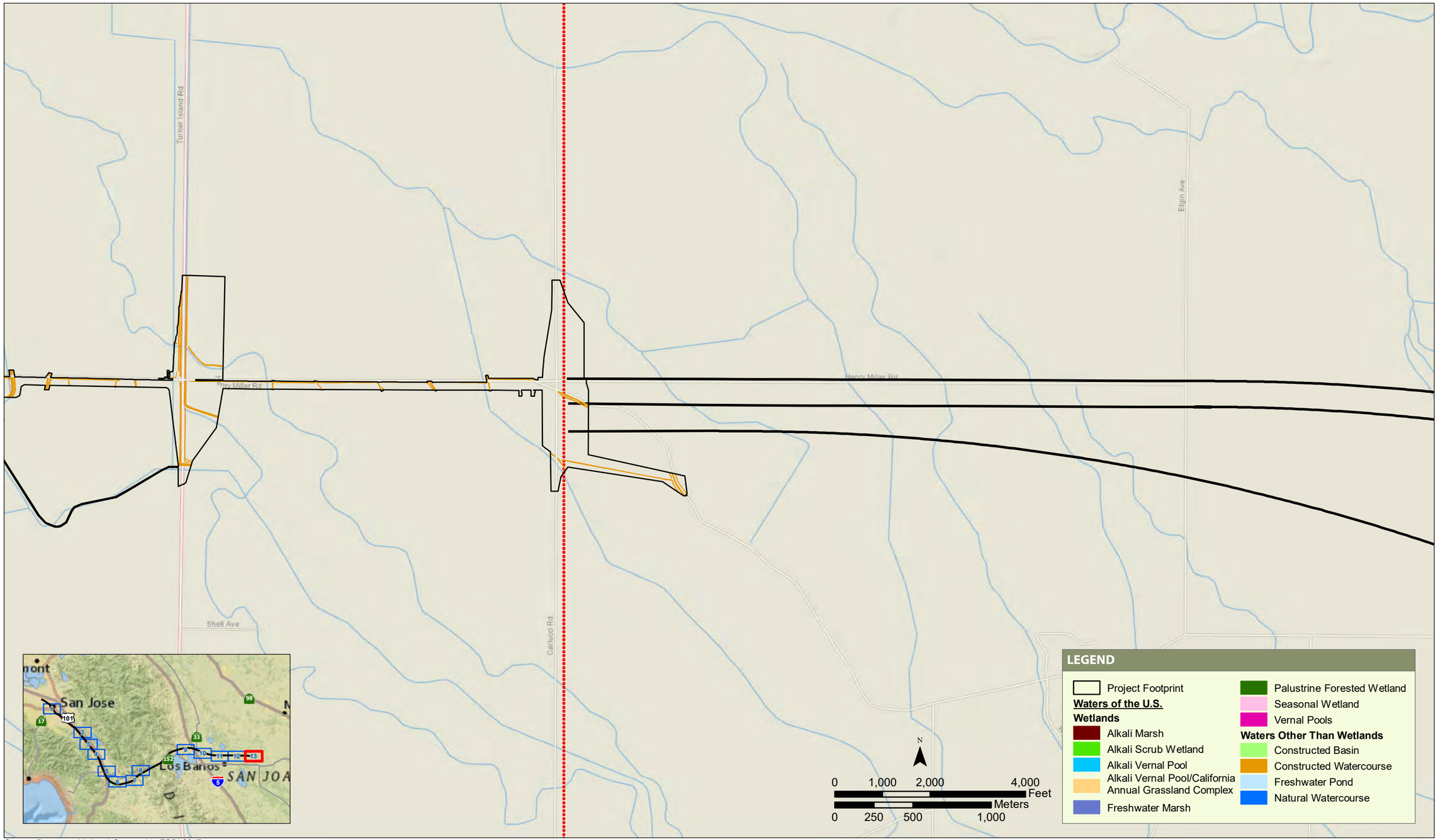
Impacts on Waters of the U.S.



Source: Basemap, National Geogrpahic ESRI 2017

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Impacts on Waters of the U.S.

APPENDIX B: MARXAN METHODS AND RESULTS

B.1 Baseline Analysis

B.1.1 Methods

Marxan software was used to determine, based on the spatial abundance and distribution of biological resources within the regional resource study area (RSA),[1] if the project mitigation requirements could be met and if so, how efficiently, in terms of total area needed. Marxan was originally developed for the planning of biological preserve systems (Ball et al. 2009). It is well suited to analyze the distribution of multiple biological resources and their associated conservation goals and, with the intention of meeting these goals in the most efficient way possible, to identify which lands are most valuable and thus best candidates for inclusion in a preserve system for permanent conservation. As this approach applies to the issue of satisfying project mitigation requirements, the Marxan conservation goals are the estimated mitigation acreages. These mitigation acreages are conservative estimates based on the upper end of potential impacts and mitigation ratios.

This section describes the methods used to formulate the types and amount of mitigation required for impacts on biological resources, to divide the landscape into units for the Marxan analysis, and to identify the other aspects of the configuration of the analysis in the Marxan software.

B.1.1.1 Data Requirements Overview

The specific data used to conduct Marxan analysis was compiled from multiple sources. Table 1 shows the data types and sources necessary to conduct the analysis.

Table 1 Description and Sources of Data Used in this Analysis

Data	Source
Species habitat models	Compiled by ICF 2019
Land cover maps	Compiled by ICF 2019
Protected lands	GreenInfo Network 2016a, 2016b; TNC 2017; Donovan 2019
Mitigation and conservation banks	Compiled by ICF 2019
SCVHP priority conservation areas	ICF International 2012
Modeled regional wildlife movement corridors	Penrod et al. 2013; Huber 2008
Watershed boundaries	USGS 2019
Vernal pool recovery areas	USFWS 2005
California red-legged frog and California tiger salamander recovery units	Hickman 2019
SCVHP burrowing owl conservation zones	ICF International 2012
San Joaquin kit fox habitat model	Constable et al. 2009
GEA stakeholder Marxan best solution	Huber 2019

Source: Compiled by ICF 2019
SCVHP = *Santa Clara Valley Habitat Plan; GEA = Grasslands Ecological Area*

[1] The regional RSA is defined in the *San Jose to Merced Project Section: Biological and Aquatic Resources Technical Report* (Authority and FRA 2019); it entails a combination of ecoregion and county boundaries.

B.1.1.2 Conservation Elements

A *conservation element* is the biological component (i.e., habitat type) for which a target is established. For species, the potential modeled habitat types were used because it is the impacts on these that must be mitigated. Each of the specific habitat categories (e.g., *breeding*, *foraging*) comprise individual conservation elements.

All species for which habitat was modeled in the study area were used as conservation elements. However, species for which no mitigation is anticipated were effectively excluded by setting their conservation targets to 0. Table 3-2, Special-Status Species Impact Estimates, of the preliminary Compensatory Mitigation Plan (pCMP), shows a complete list of all conservation elements (species), with their habitat type details. The species with conservation targets greater than 0 are listed below.

- **Invertebrates**—Bay checkerspot butterfly, valley elderberry longhorn beetle, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp
- **Fish**—Steelhead: Central Valley and South-central California coast distinct population segments
- **Amphibians**—California red-legged frog, California tiger salamander, foothill yellow-legged frog
- **Reptiles**—Blunt-nosed leopard lizard, giant garter snake
- **Birds**—Burrowing owl, least Bell's vireo, Swainson's hawk, tricolored blackbird, greater sandhill crane
- **Mammals**—Fresno kangaroo rat, San Joaquin kit fox
- **Regulated aquatic land cover types**—Alkali marsh, alkali scrub wetlands, alkali vernal pool, freshwater marsh, freshwater pond, mixed riparian, mixed riparian–natural watercourse, palustrine forested wetland, palustrine forested wetland–natural watercourse, seasonal wetland, vernal pools, natural watercourse, California sycamore woodland (restoration opportunity)

The conservation elements were divided into regions so that mitigation requirements could be satisfied in the same vicinity as the impact. For aquatic resources, the impacts and mitigation needs were divided by HUC-8 watershed. For species, the geographic boundary differed by species. See Table 3-7, Species Addressed in the Marxan Analysis and Applicable Geographic Boundaries, in the pCMP, for a list of species and geographic boundaries.

B.1.1.3 Conservation Targets

A *conservation target* is the minimum amount of a conservation element that Marxan needs to meet for a solution. A *solution* is a combination or suite of planning units that meets the total mitigation obligation (need).

Conservation targets for species were calculated based on the project's permanent and temporary impacts multiplied by corresponding permanent and temporary mitigation ratios. Conservation targets for aquatic resources were calculated based on permanent impacts, because temporary impacts were assumed to be restored on site. Impact acreages were calculated across all alternatives (1 through 4) for all conservation elements, and the greatest impact on each conservation element was used in this analysis. Similarly, to support a conservative analysis (i.e., one more likely to overestimate than underestimate the project's mitigation requirements), the greatest mitigation ratios from relevant sources (e.g., permits from the same geographic region and with similar levels of detail about the project) were selected.

To inform the conservative mitigation ratios applied in this analysis, existing biological opinions and 2081 incidental take permit applications were reviewed. Permits issued from the same geographic area were prioritized where they existed. The selected mitigation ratios for each species were based on several sources where such sources were available (see Attachment 1 for

a complete review by species). Where there were several sources, the greatest mitigation ratio was selected. Final mitigation ratios will be determined in coordination with the applicable state and federal agencies.

Analysts reviewed the U.S.Fish and Wildlife Service's (USFWS) biological opinion on the Fresno to Bakersfield HSR project section (USFWS 2014a) and applied ratios from that document to species that would also be affected by the San Jose to Central Valley Wye project (e.g., San Joaquin kit fox, blunt-nosed leopard lizard). USFWS programmatic consultations (USFWS 1997, 2014b) or species-specific guidelines that had been updated since the 2014 Fresno to Bakersfield BO (i.e., valley elderberry longhorn beetle [USFWS 2017]) were important sources for other federally listed species. Ratios for species covered under the Santa Clara Valley Habitat Plan (SCVHP) (ICF International 2012) were informed by dividing the total habitat acquisition commitment for a given species by the maximum allowable impact of covered activities on habitat for that species (e.g., 150-acre acquisition commitment for California tiger salamander breeding habitat divided by 31-acre maximum allowable impact on breeding habitat = 4.8 ≈ 5:1 ratio). Ratios for Swainson's hawk and tricolored blackbird were informed by those in the Section 2081 Incidental Take Permit (ITP) application for the California WaterFix project (ICF International 2016).

For some species, for example the American peregrine falcon, it was determined that compensatory mitigation would not be a requirement. Rather than remove these conservation elements and to maintain flexibility, these ratios were set to 0 to create conservation targets of 0 acres.

B.1.1.4 Planning Units

Planning units are the smallest geographic unit that Marxan is able to analyze. The planning units are 25-acre hexagonal areas with two exceptions. The first exception is where planning units straddle the edge of the regional RSA. Naturally, these planning units are not complete hexagons as they are cut short by the RSA boundary. The second exception is where the size of a planning unit would have no effect on the outcome of this analysis. This is the case with areas that are already in permanent conservation or are developed; such areas are in effect excluded from the analysis.

An important function of planning units is to instruct Marxan where land is available, meaning it can be selected to meet conservation element targets; where land is already managed for conservation and cannot be used to meet preservation targets; and where land is not available because of other conditions such as development.

Where more than 75 percent of a planning unit's area was a developed land cover type or was characterized by parcels smaller than 1 acre (indicative of subdivision development), the planning unit was coded as *not available*.

Conserved lands listed in available databases were used to code planning units as *already conserved*. The data sources used for this determination are shown in Table 2.

Table 2 Protected Land Datasets and Sources

Database Name	Source
California Conservation Easement Database	GreenInfo Network 2016a
California Protected Areas Database	GreenInfo Network 2016b
Soap Lake easement parcels (The Nature Conservancy)	TNC 2017
Pacheco Creek Preserve	Donovan 2019

Source: compiled by ICF 2019

The locations and boundaries of mitigation banks were researched and compiled; mitigation bank properties were coded as *already conserved*. The permittee-responsible mitigation (PRM) sites Lucky Day Ranch and Bengard property were coded as *earmarked*, instructing Marxan to include them in the initial solution set with the option to reject them later in favor of more valuable and strategic planning units. This approach allows Marxan to produce a result that meets the entire mitigation need; accordingly, the Marxan analysis will still be relevant even if banks or PRM sites become unavailable.

The regional RSA comprises 82,004 planning units. To reduce the number of planning units for processing efficiency, all *already conserved* planning units were combined into one large planning unit. The conservation elements in this combined planning unit were excluded from contributing to the conservation element targets. Similarly, the *excluded* planning units were combined into one large planning unit. The *earmarked* planning units were left as is. There were 183 *earmarked* planning units.

B.1.1.5 Special Consideration of the Regional Conservation Planning Context

Within the regional RSA, some areas are of strategic importance to conservation because they contribute to or complement regional conservation planning. For example, the Soap Lake area has been identified as important for wildlife movement. It is important that Marxan consider this type of value in addition to meeting conservation element targets as it evaluates planning units.

The mechanism used to influence Marxan to prioritize strategic areas over other comparable areas that are not situated in strategic locations was to artificially adjust the *cost* of the planning unit using the *cost function*. With all other factors being equal (e.g., geographic setting, element abundance, element target), the planning units that are the least costly are more likely to be included in a Marxan solution over those that are more costly. Therefore, the cost adjustments described in the following list and shown in Table 3 result in the selection of planning units with greater strategic importance to conservation whenever there are two or more planning units that would make the same areal contribution to the overall mitigation need.

- Conservation lands adjacent to or near development are traditionally considered to have reduced habitat quality. Therefore, the cost of planning units was *increased* up to a factor of 2 within 1 mile of urban development depending on the extent of the nearby development; the degree of cost increase is proportional to the amount of development.
- Planning units that are adjacent to or near public lands or conserved areas had a cost reduction of 25 percent. Because proximity, not exclusion or inclusion, is a consideration, this cost reduction gradually diminished outward over a distance of 1 mile.
- Planning units within priority conservation areas defined by the SCVHP had a cost reduction of 10 percent for high-priority areas and 5 percent for moderate-priority areas. The cost was unchanged for low-priority areas.
- Planning unit cost was downwardly adjusted by 35 percent for those lands identified as a priority by stakeholders in the Grasslands Ecological Area.
- Cost of the planning unit was decreased when within a regional wildlife linkage or movement corridor mapped by Penrod et al. (2013) or Huber (2008).

Table 3 Cost Adjustments for Strategic Lands

Cost Adjustment	Increase/Decrease and Magnitude
Development (proximity)	Increase up to 200%
Conserved lands (proximity)	Decrease up to 25%
SCVHP Priority Conservation Areas (inside)	Decrease by 5% for moderate priority or 10% for high priority
GEA stakeholders' priority conservation areas	Decrease up to 35%
Regional wildlife linkages mapped by Penrod et al. 2013 and Huber 2008 (inside)	Decrease by 10%

Source: Compiled by ICF 2019
GEA = Grasslands Ecological Area

For each planning unit, the cost was multiplied by the associated cost adjustment in a cumulative manner to determine the final cost of the planning unit.

B.1.1.6 Marxan Settings

The final Marxan settings are shown in Table 4. The values used for most of these settings are typical. The *repeat runs* needs to be a number high enough so that a pattern or trend can be detected by the summed runs. The *boundary length modifier* is used to influence the degree that selected planning units will be adjacent—or spatially clumped and contiguous—rather than dispersed across the landscape. This setting was adjusted over a series of Marxan runs as it was observed that values greater than 6 significantly increased (adversely) the total size of the solution, because planning units were added more to reduce boundary than on merit of meeting conservation element targets. The *cost threshold* is used to produce smaller, more efficient, solutions (generally speaking, since cost is a function of additional measurements as well). After runs with an unrestricted cost (no cost threshold) and observing the cost of the resulting best solutions, a gradually decreasing cost threshold was imposed until conservation element targets began not to be met.

Table 4 Final Marxan Settings

Setting	Value
Repeat runs (Marxan algorithm)	100
Boundary length modifier	6
Run options	Simulated annealing, iterative improvement (normal iterative improvement)
Iterations	10,000,000
Temperature decrease	10,000
Adaptive annealing	on
Species missing proportion	0.95
Cost threshold	Yes 10,000
Penalty formula	A=50, B=1
Starting prop	0.1
Spec random seed	off

Source: Compiled by ICF 2019

B.1.2 Results

Running Marxan a single time produces a subset of planning units that, taken together, represent an efficient way to meet the targets for the conservation element. This subset of planning units is called a *solution*.

Marxan can be automated to repeat multiple times; for each of these times a *solution* is produced. Marxan can be directed to count up the number of times each planning unit is included in each of these multiple solutions. This step yields a value count for each planning unit, indicating the number of times that planning unit was included in a solution: the *summed runs*. For example, if planning unit was included in three solutions, it would have a *summed run* value of 3; if a planning unit was included in 48 runs, it would have a *summed run* value of 48.

Each of the multiple solutions also has a single numeric score (a combination of cost and penalties), called the *objective function value*. This value represents how efficient the solution is at meeting targets at a minimal overall cost, with lower values being more efficient than higher values. From all the multiple solutions described earlier, there will be one solution that has the lowest *objective function value*; this solution is termed the *best* solution.

For this analysis, Marxan was automated to produce 100 solutions. The *best solution* was 9,574 acres in size, comprising 383 planning units grouped into 34 spatially contiguous units. These groupings of planning units varied in size from a single 1.26-acre planning unit to a 1,450-acre group. The *best solution* and *summed runs* are illustrated on Figure 1. The *best solution* for aquatic resources is shown in Table 5 and for species in Table 6.

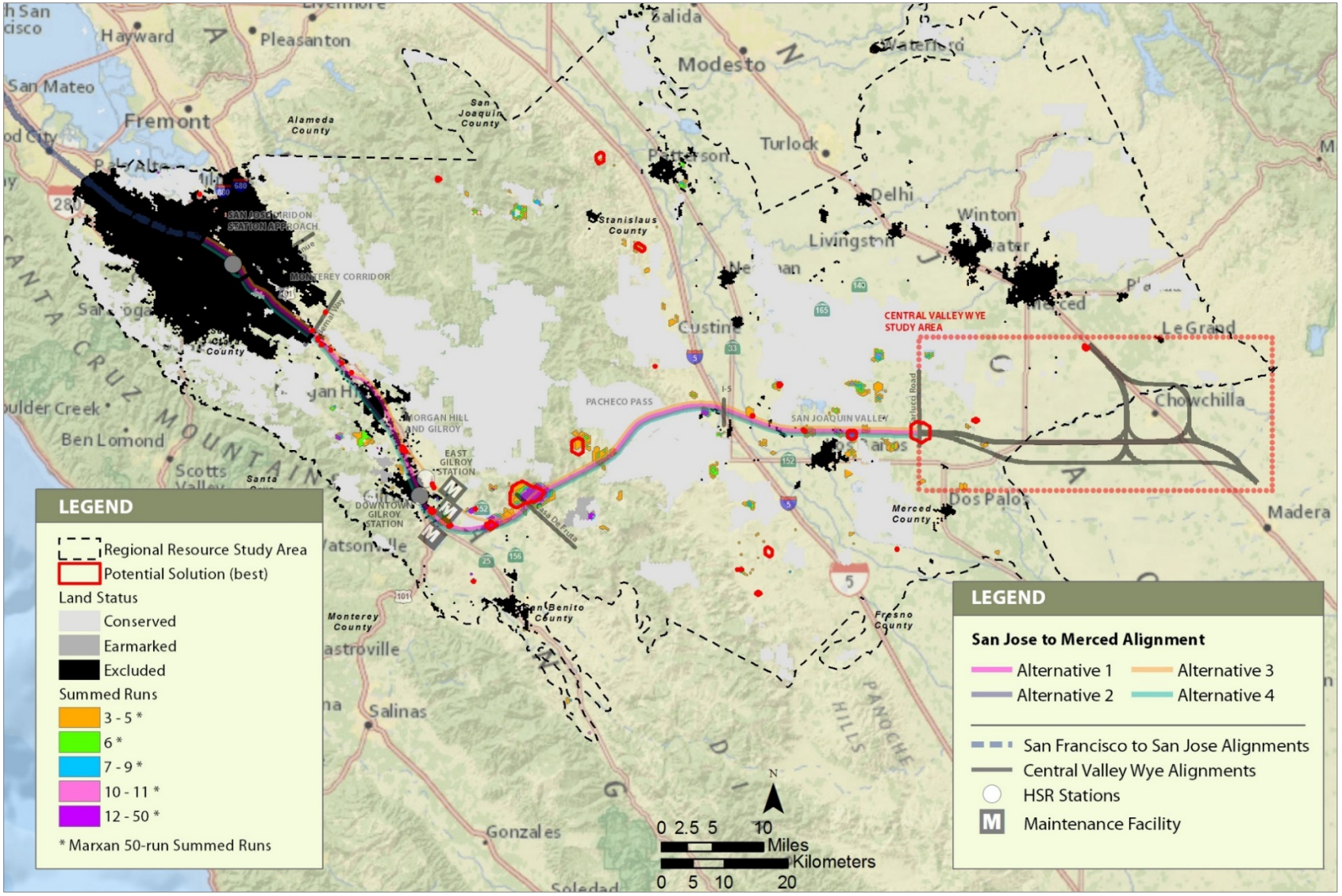

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Figure 1 Best Solution and Summed Run Values from Marxan (*E6*run)

Table 5 Marxan Results by HUC-8 Watershed and Aquatic Resource Type

Aquatic Resource Type by HUC-8 Watershed	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Coyote Creek HUC-8 Watershed						
Freshwater Marsh	0.3	7.8	3.9%	0.6	183%	0.3
Palustrine Forested Wetland/Palustrine Forested Wetland -Natural Watercourse	0.6	45.8	1.3%	1.2	200%	0.6
Natural watercourse	2.2	9.6	23%	1.2	53%	(1.0)
Pajaro River HUC-8 Watershed						
Freshwater marsh	7.2	29.4	22.4%	25.3	384%	18.7
Mixed riparian–natural watercourse	13.8	27.4	38.3%	2.9	28%	(7.6)
Palustrine forested wetland/palustrine forested wetland–natural watercourse	77.14	2,189.2	1.0%	114.9	525%	93.0
Seasonal wetland	15.9	249.8	8.2%	73.9	362%	53.5
Freshwater pond	4.6	413.4	2.2%	31.3	348%	22.3
Natural watercourse	18.6	162.1	11.1%	95.2	529%	77.2
Middle San Joaquin–Lower Chowchilla HUC-8 Watershed						
Alkali marsh	20.1	1501.9	1.3%	102.0	508%	81.9
Alkali scrub wetland	0.0	1197.0	0.0%	0.0	0%	0.0
Alkali vernal pool	81.3	1912.3	4.3%	74.7	92%	(6.6)
Alkali vernal pool/California annual grassland	0.3	11291.7	0.0%	90.1	30042%	89.8
Freshwater marsh	0.3	73.1	0.4%	3.9	1299%	3.6
Mixed riparian–natural watercourse	5.7	244.6	2.3%	6.1	108%	0.4
Seasonal wetland	1.5	1197.0	0.1%	2.2	143%	0.7

Aquatic Resource Type by HUC-8 Watershed	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Vernal pools	20.1	1501.9	1.3%	102.0	508%	81.9
Natural watercourse	6.8	27.1	25.1%	15.3	225%	8.5

Source: Compiled by ICF 2019
(Parentheses) indicate negative values
[1] Difference between the mitigation target and the acres of mitigation opportunity in the Marxan result. A positive number reflects a Marxan result greater than the target; a negative number reflects a Marxan result less than the target.
[2] There are 119,695 acres of unprotected vernal pool complex as mapped by Witham et al. (2014). Percentage of wetted pools in this region ranges from 1 to 5%; 1% wetted pool assumption was applied to the Marxan analysis results.

Table 6 Marxan Results by Species and Biologically Relevant Geographic Boundaries

Species	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
California red-legged frog (by recovery unit)						
Aquatic (Sierra Nevada foothills)	1.5	27.5	5.5%	1.3	82.7%	(0.3)
Upland (Sierra Nevada foothills)	219.0	36,274.1	0.6%	248.5	113.5%	29.6
Aquatic (South and East San Francisco)	57.6	3,057.3	1.9%	56.9	98.7%	(0.7)
Upland (South and East San Francisco)	565.0	262,637.2	0.2%	1,377.8	243.8%	812.8
Aquatic (Diablo Range/Salinas Valley)	258.5	2,630.9	9.8%	290.0	112.2%	31.5
Upland (Diablo Range/Salinas Valley)	3,121.4	522,986.0	0.6%	3,826.4	122.6%	705.0
California tiger salamander (by recovery unit)						
Breeding/primary upland (Central Valley)	93.0	79,961.0	0.1%	1,012.0	1088.3%	919.0
Secondary upland (Central Valley)	615.4	685,486.4	0.1%	3,130.1	508.7%	2,514.7
Breeding/primary upland (East Bay)	94.2	4,538.2	2.1%	347.8	369.2%	253.6

Species	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Secondary upland (East Bay recovery unit)	2,654.4	736,428.5	0.4%	5,328.8	200.8%	2,674.4
Breeding/primary upland (outside recovery unit)	93.0	79,961.0	0.1%	1,012.0	1088.3%	919.0
Secondary upland (outside recovery unit)	615.4	685,486.4	0.1%	3,130.1	508.7%	2,514.7
Foothill yellow-legged frog						
Primary breeding and foraging habitat	199.2	26,841.1	0.7%	376.1	188.8%	176.9
Secondary breeding and foraging habitat	154.2	28,381.4	0.5%	259.7	168.4%	105.5
Burrowing owl						
Occupied breeding and foraging habitat (SCVHP Conservation Area C)	2.3	77.5	3.0%	32.9	1418.8%	30.6
Least bell's vireo						
Recolonization breeding habitat—core	172.4	16,433.5	1.0%	409.8	237.7%	237.4
Recolonization breeding habitat—potential	46.1	6,651.7	0.7%	82.4	178.8%	36.3
Swainson's hawk (by east/west side of Pacheco Pass)						
Active nesting site (east side)	0.0	187.8	0.0%	0.0	0.0	0.0
Primary active foraging habitat (east side)	363.1	33,735.1	1.1%	376.8	103.8%	13.6
Secondary active foraging habitat (east side)	552.1	328,020.8	0.2%	1,582.7	286.6%	1,030.5
Tertiary active foraging habitat (east side)	60.9	349,099.9	0.0%	322.6	530.1%	261.8
Active nesting site (west side)	0.0	5.9	0.0%	0.0	0.0	0.0
Primary active foraging habitat (west side)	25.0	1,196.9	2.1%	18.2	73.0%	(6.7)
Secondary active foraging habitat (west side)	24.2	25,431.8	0.1%	34.4	142.1%	10.2
Tertiary active foraging habitat (west side)	43.8	49,755.9	0.1%	98.9	225.7%	55.1

Species	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Tricolored blackbird (by east/west side of Pacheco Pass)						
Previously occupied colony habitat (east side)	9.2	8,995.5	0.1%	44.9	488.7%	35.7
Potentially suitable colony habitat (east side)	111.6	13,534.2	0.8%	154.2	138.2%	42.6
Breeding season foraging—natural (east side)	495.2	431,289.9	0.1%	2,138.1	431.7%	1,642.9
Breeding season foraging—agriculture (east side)	661.5	613,011.9	0.1%	2,148.0	324.7%	1,486.5
Previously occupied colony habitat (west side)	0.3	458.2	0.1%	4.8	1428.2%	4.5
Potentially suitable colony habitat (west side)	150.8	5,120.5	2.9%	435.5	288.8%	284.7
Breeding season foraging—natural (west side)	532.0	165,676.8	0.3%	2,303.8	433.0%	1,771.8
Breeding season foraging—agriculture (west side)	391.6	71,994.8	0.5%	726.5	185.5%	334.9
Steelhead—Central Valley and south-central California coast DPSs						
Potential spawning, rearing, and migratory habitat	30.5	18,651.7	0.2%	294.9	966.3%	264.4
Potential migratory and rearing habitat	10.8	3,490.0	0.3%	60.7	559.9%	49.9
Bay checkerspot butterfly						
Suitable habitat	54.5	9,283.2	0.6%	57.7	105.9%	3.2
Conservancy fairy shrimp (by vernal pool recovery unit)						
Potentially suitable habitat (San Joaquin Valley)	0.8	25,818.5	0.0%	828.0	103496.8%	827.2
Potentially suitable habitat (Central Coast)	-	1,912.3	0.0%	74.7	-	74.7
Longhorn fairy shrimp (by vernal pool recovery unit)						
Potentially suitable habitat (San Joaquin Valley)	0.8	25,818.5	0.0%	828.0	103496.8%	827.2
Potentially suitable habitat (Central Coast)	-	1,912.3	0.0%	74.7	-	74.7

Species	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Valley elderberry longhorn beetle						
Potentially suitable riparian habitat	3.6	8,751.3	0.0%	61.7	17.0	58.0
Other potentially suitable habitat	215.1	71,877.6	0.3%	2,697.0	12.5	2,481.9
Vernal pool fairy shrimp (by vernal pool recovery unit)						
Potentially suitable habitat (San Joaquin Valley)	0.8	25,818.5	0.0%	828.0	103496.8%	827.2
Potentially suitable habitat (Central Coast)	54.2	1,912.3	2.8%	74.7	137.8%	20.5
Vernal pool tadpole shrimp (by vernal pool recovery unit)						
Potentially suitable habitat (San Joaquin Valley)	0.8	25,818.5	0.0%	828.0	103496.8%	827.2
Potentially suitable habitat (Central Coast)	54.2	1,912.3	2.8%	74.7	137.8%	20.5
Fresno kangaroo rat						
Potentially suitable habitat	220.93	19,523.8	1.1%	973.0	440.4%	752.1
San Joaquin kit fox (by east/west side of Pacheco Pass)						
High-value suitable habitat (east side)	60.1	26,418.9	0.2%	60.3	100.4%	0.2
Moderate-value suitable habitat (east side)	445.7	148,808.0	0.3%	1,455.8	326.7%	1,010.1
Low-value suitable habitat (east side)	744.6	1,332,076.0	0.1%	3,217.5	432.1%	2,473.0
High-value suitable habitat (west side)	0.0	819.1	0.0%	0.0	0.0	0.0
Moderate-value suitable habitat (west side)	16.5	6,313.1	0.3%	33.7	204.1%	17.2
Low value suitable habitat (west side)	708.8	247,975.8	0.3%	4,449.8	627.8%	3,741.0

Species	Total Mitigation Goal	Total Available Acres in Regional RSA	Mitigation Target as Percent of Total Available Acres in Regional RSA	Marxan Run Output		
				Acres of Habitat included in Best Solution[1]	Percent of Mitigation Target Included in Best Solution[1]	Acreage Difference between Mitigation Target and Acres Included in Best Solution[1]
Giant garter snake						
Potentially suitable aquatic habitat	93.3	15,156.4	0.6%	162.8	174.4%	69.5
Potentially suitable upland habitat	1,200.4	97,681.5	1.2%	1,192.9	99.4%	(7.6)
Potentially suitable movement habitat	37.1	5,012.0	0.7%	71.8	193.7%	34.7
Crotchs bee						
1,707.1	672,113.9	0.3%	1,624.8	1.0	(82.4)	1,707.1
3,041.2	325,480.3	0.9%	3,338.2	1.1	297.0	3,041.2

Source: Compiled by ICF 2019
RSA = resource study area; SCVHP = Santa Clara Valley Habitat Plan; DPS = distinct population segment
[1]The best solution is the one that meets the greatest number of conservation element targets with the lowest number of planning units.

B.1.3 Discussion

Figure 1 shows that some of the *best solution* groupings (red outlines in the figure) included planning units with high *summed run* values, whereas other *best solution* groupings included planning units with low *summed run* values. Some groupings were small and comprised only a few planning units with high *summed run* values, perhaps suggesting that only a small target was needed for a relatively scarce resource. Those planning units that are included in the *best solution* and have high *summed run* values should be placed on a high-priority list for further research and potential acquisition.

Interpretation of planning units that have low *summed run* values but are nonetheless included in the *best solution* can be more difficult. Comparing the total number of planning units with low *summed run* values to the number selected by the *best solution* can give an indication of the level of trade-offs that are possible. If the best solution contains a relatively high number of low value *summed run* planning units, it is likely that there is flexibility for trade-offs to reach targets.

B.2 Maintenance and Adaptive Analysis

B.2.1 Adaptive Analysis

Marxan is a valuable tool for determining which lands can be used to most efficiently meet mitigation targets. Accomplishing this objective necessitated an assumption that lands not currently in public ownership or under conservation easement would be available for acquisition and could be counted toward meeting mitigation targets. Analysts used the best available data but did not contact landowners to verify parcel availability. During implementation of a fully developed mitigation strategy, some land previously identified as available may not be because of unwilling sellers or other unforeseen circumstances. If a particular parcel that was part of the Marxan solution becomes unavailable, the mitigation value must be found on other parcels. Accordingly, the California High-Speed Rail Authority (Authority) may put in place an *adaptive analysis workflow* to facilitate updating the status of planning units and re-run Marxan to calculate a new set of lands to target for acquisition.

In addition to the availability of planning units changing, the conservation elements of specific planning units may also change. For example, a site-specific biological survey could determine that no viable habitat for a target species occurs on the subject parcel. In this instance, the data associated with the specific planning unit should be updated to reflect the current knowledge and Marxan rerun to account for the newer data. If such data revisions result in a shortfall toward reaching mitigation targets, Marxan can be used to identify a different planning unit to address the shortfall.

B.2.2 Analytic Requirements

- Marxan and associated configuration and input files should be installed on a secure computer system under Authority control. This could be an individual computer or on a server environment (e.g., RDS, Citrix, Terminal Services).
- It is suggested that *QGIS* GIS software be installed on the computer or server where Marxan resides. This open source software is free and comes with specific tools to update the status of planning units and create new input files for Marxan.
- Technical documents should be developed describing the steps to perform updates, run Marxan, and display the results (Ball and Possingham 2000).

B.3 References

Ball, I.R., and H. Possingham, 2000. MARXAN (V1.8.2). *Marine Reserve Design Using Spatially Explicit Annealing*. http://marxan.net/downloads/documents/marxan_manual_1_8_2.pdf (accessed August 2, 2019).

Ball, I.R., H.P. Possingham, and M. Watts. 2009. Marxan and Relatives: Software for Spatial Conservation Prioritization. Chapter 14: Pages 185–195 in *Spatial Conservation Prioritisation: Quantitative Methods and Computational Tools*. A. Moilanen, A., K.A. Wilson, and H.P. Possingham (eds.). Oxford University Press, Oxford, UK. [not in text]

Constable, J.L., B.L. Cypher, S.E. Phillips, and P.A. Kelly. 2009. *Conservation of San Joaquin Kit Foxes in Western Merced County, California.* Prepared for U.S. Bureau of Reclamation. http://esrp.csustan.edu/publications/reports/usbr/esrp_2009_wmercedkitfox_e.pdf

Donovan, Terah. 2019. Principal Program Manager, Santa Clara Valley Habitat Agency, Morgan Hill, CA. June 27, 2019—Email transmitting shapefiles of Pacheco Preserve to Rebecca Sloan, ICF senior biologist.

Hickman, Cheryl. 2019. GIS Branch Chief, U.S. Fish and Wildlife Service, Sacramento, CA. March 8, 2019—Email transmitting California red-legged frog and California tiger Salamander recovery unit shapefiles to Rebecca Sloan, ICF senior biologist.

GreenInfo Network. 2016a. *California Conservation Easement Database* (CCED). California Protected Areas Data Portal. www.calands.org/about/download/ (accessed February 7, 2017).

———. 2016b. *California Protected Areas Database (CPAD)*. California Protected Areas Data Portal. www.calands.org/about/download/ (accessed July 2, 2017).

Huber, P. 2008. *The Effects of Spatial and Temporal Scale on Conservation Planning and Ecological Networks in the Central Valley, California*. Ph.D. Dissertation, U.C. Davis.

———. 2019. Consultant, Grasslands Water District, Davis, CA. April 25, 2019—Email from Patrick Huber to Greg Nichols, Senior GIS Analyst at ICF, transmitting Marxan results performed for GEA stakeholders.

ICF International. 2012. *Final Santa Clara Valley Habitat Plan*. Santa Clara, CA. https://scv-habitatagency.org/178/Santa-Clara-Valley-Habitat-Plan (accessed August 2, 2019).

———. 2016. *State Incidental Take Permit Application for the Construction and Operation of Dual Conveyance Facilities of the State Water Project*. Prepared for California Department of Fish and Wildlife, Sacramento, CA. October.

Penrod, K., P.E. Garding, C. Paulman, P. Beier, S. Weiss, N. Schafer, R. Branciforte, and K. Gaffney. 2013. *Critical Linkages: Bay Area and Beyond*. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA (www.scwildlands.org) in collaboration with the Bay Area Open Space Council's Conservation Lands Network (www.BayAreaLands.org). GIS Model Outputs available at www.bayarealands.org/mapsdata.html

The Nature Conservancy (TNC). 2017. July 10, 2017—Email providing GIS shapefiles of the landowners for easement properties in the Soap Lake region from Abigail Ramsden, Associate Attorney, to Rebecca Sloan, ICF senior biologist.

U.S. Fish and Wildlife Service. 1997. *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Project with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California*. Sacramento Fish and Wildlife Office, Sacramento, CA. November 13, 1997. www.fws.gov/sacramento/es/Consultation/Programmatic-Consultations/Documents/ggs%20programmatic%20bo.pdf (accessed March 1, 2019).

———. 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon.* U.S. Fish and Wildlife Service, Region 1, Portland, OR. December. www.fws.gov/sacramento/es/Recovery-Planning/Vernal-Pool/ (accessed April 15, 2019).

———. 2014a. *Biological Opinion on the California High-Speed Train System: Fresno to Bakersfield Section Project, Fresno, Tulare, Kings, and Kern Counties*. April 1. Consultation Code: 08ESMF00-2012-F-0247.

———. 2014b. *Programmatic Biological Opinion for Issuance of Permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, including Authorizations Under 22 Nationwide Permits, for Projects that May Affect the Threatened California Red-Legged Frog in Nine San Francisco Bay Area Counties*, California. Sacramento Fish and Wildlife Office, Sacramento, CA. June 18, 2014.

———. 2017. *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (Desmocerus californicus dimorphus). Sacramento, CA. May 2017.

U.S. Geological Survey (USGS). 2019. *Water Boundary Dataset.* https://water.usgs.gov/GIS/huc.html. (accessed September February 11, 2019).

ATTACHMENT 1: RATIONALE FOR SPECIES MITIGATION RATIOS

A mitigation multiplier or ratio is applied to the impact total for each species in order to determine the total mitigation need. Mitigation ratios vary by project and are determined in coordination with state and federal wildlife agency staff. Because the purpose of this analysis is to determine the feasibility of implementing mitigation, it was important to use a conservative approach (i.e., one more likely to overestimate than underestimate the project's mitigation requirements). Part of this approach is to select conservative mitigation ratios or multipliers. This approach results in an overestimate of mitigation. If the overestimated acres of mitigation is considered feasible to achieve then the analysis can reasonably conclude feasibility.

To inform the conservative mitigation ratios applied in this analysis, existing biological opinions and 2081 take permit applications as well as agency guidance documents were reviewed. Permits issued from the same geographic area were prioritized where they existed. The selected mitigation ratios for each species were the greatest ratios based on several sources (where several sources were available). The table below summarizes the selected mitigation ratios and the rationale for the selection.

Vernal Pool Branchiopods

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Suitable habitat	2:1	2:1 (all impacts permanent for vernal pools)	Consistent with BO for HSR Fresno-Bakersfield (USFWS 2014: page 49): "the ratios for [vernal pool crustaceans] will be based on whether the proposed mitigation is preservation or creation and whether it occurs at an approved conservation bank or at a non-bank location. The ratio may range from 1:1 to 2:1 based on the guidance proposed in the 1996 [USACE Programmatic Consultation]" (USFWS 1996).

Valley Elderberry Longhorn Beetle

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Potentially suitable riparian habitat	3:1	1:1	Consistent with compensation ratio for impacts on riparian habitat in Table 1 of USFWS' *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017).
Other potentially suitable habitat	1:1	1:1	Consistent with compensation ratio for impacts on nonriparian habitat in Table 1 of USFWS (2017).

California Red-Legged Frog

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Breeding season aquatic habitat[1]	3:1	1:1	SCVHP maximum allowable impact on CRLF primary habitat (i.e., breeding and foraging) = 415 ac (Table 4-4[2]). SCVHP acquisition commitment for CRLF primary habitat = 1,300 ac (Table 5-17[3]). 1,300/415 = 3.13 ≈ 3:1 ratio. Consistent with compensation ratios in USFWS' Programmatic BO for issuance of CWA 404/RHA 10 permits for projects that may affect CRLF in nine Bay Area counties (USFWS 2014a: page 11). Consistent with standardized ratio in East Alameda County Conservation Strategy (EACCS) (ICF International 2010) for impacts and mitigation inside critical habitat. Mitigation outside critical habitat would require "site specific agency approval."
Nonbreeding aquatic habitat[4]	3:1	1:1	Same as above
Refugia/foraging habitat[5]	2:1	1:1	SCVHP maximum allowable impact on CRLF secondary habitat (i.e., refugia and dispersal) = 14,426 ac (Table 4-4). SCVHP acquisition commitment for CRLF secondary habitat = 30,000 ac. 30,000/14,426 = 2.08 ≈ 2:1 ratio.
Dispersal/seasonal movement habitat[6]	2:1	1:1	Same as above
Other potential movement habitat[7]	2:1	1:1	Same as above
Permeable movement area (dev, ag, disturbed)[8]	--	--	Compensatory mitigation for impacts on wildlife movement addressed through project design modifications, not preservation of habitat.

[1] Perennial water…to accommodate full breeding cycle.
[2] Chapter 4 available for download here: http://scv-habitatagency.org/DocumentCenter/View/126/Chapter-4-Impact-Assessment-and-Level-of-Take
[3] Chapter 5 available for download here: http://scv-habitatagency.org/DocumentCenter/View/127/Chapter-5-Conservation-Strategy
[4] Persistent aquatic habitats near breeding season aquatic habitat …used during nonbreeding periods.
[5] Nonurban land cover types with potential to provide moist leaf litter, dense under story, or small mammal burrows (within 317 feet [100 m] of breeding or nonbreeding aquatic habitat).
[6] Primary movement area between breeding or nonbreeding aquatic habitat (nonurban land cover types between 317 feet and 0.6 mile [1 km] from breeding or non-breeding aquatic habitat).
[7] Secondary movement area between breeding or nonbreeding aquatic habitat (nonurban land cover types between 0.6 mile and 2 miles from breeding or nonbreeding aquatic habitat).
[8] Developed areas that may be permeable to movement depending on size.

California Tiger Salamander

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Breeding and foraging aquatic habitat[1]	5:1	1:1	SCVHP maximum allowable impact on CTS breeding habitat = 31 ac (Table 4-4). SCVHP acquisition commitment for CTS breeding habitat = 150 ac (Table 5-17). 150/31 = 4.8 ≈ 5:1 ratio.

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Breeding, foraging, refugia, and dispersal habitat[2]	5:1	1:1	Same as above
Potential natural foraging and dispersal habitat[3]	2:1	1:1	SCVHP maximum allowable impact on CTS nonbreeding habitat = 14,382 ac (Table 4-4). SCVHP acquisition commitment for CTS nonbreeding habitat = 30,000 ac (Table 5-17). 30,000/14,384 = 2.1 ≈ 2:1 ratio.
Potential agricultural refugia and dispersal upland habitat	--	--	Compensatory mitigation for impacts on wildlife movement addressed through project design modifications, not preservation of habitat.

[1] Based on SCVHP CTS breeding habitat model.
[2] Based on Witham et al. (2014) vernal pool dataset to inform San Joaquin Valley portion of HSR model.
[3] Within 1.3 miles of and connected to aquatic habitat or potential agricultural…habitat, or within 1.3 miles of breeding, foraging, refugia, and dispersal habitat.

Foothill Yellow-Legged Frog

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Primary breeding and foraging habitat[1]	3:1	1:1	No other BOs have had to address this species. Assuming that this habitat similar enough to CRLF breeding and non-breeding aquatic habitat to propose equivalent mitigation.
Secondary breeding and foraging habitat[2]	2:1	1:1	Assuming that this habitat similar enough to CRLF refugia/dispersal habitat to propose equivalent mitigation.

[1] Primary breeding: Low-gradient (less than 4% slope) streams or rivers not regulated by a dam and within CWHR range. Primary foraging: Grassland, oak woodland, riparian, riverine, and lacustrine cover types within 165 feet of primary breeding habitat.
[2] Secondary breeding: Same as primary except 4-10% slope. Secondary foraging: Same cover types within 165 feet of secondary breeding habitat.

Blunt-Nosed Leopard Lizard

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Core suitable habitat[1]	3:1	1:1	Same ratio proposed by HSR and accepted by USFWS for impacts to "suitable upland habitat" in Fresno-Bakersfield BO (USFWS 2014b: page 49)
Potentially suitable habitat[2]	3:1	1:1	Same as above
Atypical habitat[3]	--	--	Compensatory mitigation for impacts on wildlife movement addressed through project design modifications, not preservation of habitat.

[1] Potentially suitable habitat with a patch size > 500 ha (1,326 ac), after being fragmented by roads.
[2] Alkali desert scrub, annual grassland, barren, and coastal scrub below 4,500 ft.
[3] Agricultural cover types within 906 ft of and contiguous with core or potentially suitable habitat.

Giant Garter Snake

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Potentially suitable aquatic habitat	3:1	1:1	Consistent with "3:1 Replacement" ratio in 1997 Programmatic BO for USACE 404 Permitted Projects in 11 Central Valley Counties (USFWS 1997: page 7).
Potentially suitable upland habitat	3:1	1:1	Same as above
Potentially suitable movement habitat	3:1	1:1	Same as above

Burrowing Owl

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Occupied nesting and foraging habitat	3:1	1:1	-Relatively high ratio to account for uncertainty over (1) owl occupancy of project footprint up to construction and (2) suitability of mitigation lands (i.e., may or may not support fossorial mammals that provide burrows). CDFW guidance (CDFG 2012) does not provide minimum habitat replacement recommendation because "[previous recommendations have] been shown to serve as a default, replacing any site-specific analysis and discounting the wide variation in natal area, home range, foraging area, and other factors influencing [BUOW] and [BUOW] population persistence." Consistent with 3:1 ratio for nonlisted species covered by EACCS (ICF International 2010).
Potential nesting and foraging habitat	1:1	1:1	See SCVHP table.
Overwintering	2:1	1:1	See SCVHP table. Also, recent work by Trulio et al. (2018) counted 91 overwintering owls at recent breeding locations and 23 in the Diablo Range and Santa Cruz Mtn. foothills, suggesting that overwintering habitat is a very important resource for both local and migratory owls.

SCVHP Acquisition Commitments and Maximum Allowable Impacts (for informational purposes)

Habitat Type	Acquisition Commitment[1]	Maximum Allowable Impact[2]	Ratio
Occupied or potential nesting habitat	5,300[3]	4,198 perm 624 temp **4,822 Total**	1.1:1
Overwintering habitat	17,000	9,671 perm 762 temp **10,433 Total**	1.6:1

[1] Table 5-17
[2] Table 4-4
[3] Of the 5,300 acres, at least 600 must be protected by acquiring land modeled as Occupied or Potential Nesting Habitat via fee title or conservation easement and adding to the SCVHP Reserve System. For the remaining 4,700 acres, land acquisition or management agreements may be used and the land may not be part of the Reserve System.

Swainson's Hawk

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Primary active foraging habitat	1:1	0.5:1	Consistent with proposed compensation ratios for permanent loss of modeled foraging and nesting habitat in ITP application for California WaterFix (ICF International 2016a).
Secondary active foraging habitat	0.75:1	0.5:1	Scaled from 1:1 for primary foraging habitat. Lower habitat quality.
Tertiary active foraging habitat	0.5:1	0.5:1	Scaled from 1:1 for primary foraging habitat. Lower habitat quality.

Nest tree mitigation (three planted for each one affected) not included because does not apply to Marxan analysis.

Tricolored Blackbird

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Nesting habitat[1]	3:1	1:1	Consistent with 3:1 ratio for non-listed species covered by EACCS (ICF International 2010) Consistent with 3:1 ratio for loss of "Breeding Habitat-Nesting" in ITP application for California WaterFix (ICF 2016a). SCVHP maximum allowable impact on TRBL primary habitat = 369 ac (Table 4-4). SCVHP acquisition commitment for TRBL primary habitat = 1,000 ac (Table 5-17). 1,000/369 = 2.7 ≈ 3:1 ratio.
Breeding season foraging—natural	1:1	0.5:1	Consistent with 1:1 ratio for loss of "Breeding Habitat-Foraging" in ITP application for BDCP. **Less** than SCVHP acquisition/maximum allowable impact ratio of 2.7:1 (SCVHP Primary Habitat includes "breeding and foraging habitat during breeding season).

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Breeding season foraging—agriculture	1:1	0.5:1	Same as above
Nonbreeding season foraging—natural	1:1	0.5:1	Consistent with 1:1 ratio for loss of "Nonbreeding Habitat-Foraging" in ITP application for BDCP. **Less** than SCVHP acquisition/max. allowable impact ratio of 1.6:1 (18,000/11,085 acres) for Secondary Habitat (foraging and wintering).
Nonbreeding season foraging—agriculture	1:1	0.5:1	Same as above

[1] Includes previously occupied colony habitat and potentially suitable colony habitat.

Greater Sandhill Crane

Habitat Type	Mitigation Ratio Perm	Mitigation Ratio Temp	Rationale
Known roosting and foraging habitat	3:1	1:1	Relatively high ratio to account for (1) GEA sensitivity and (2) habitat model based on published literature (Ivey et al. 2016).
Potential roosting and foraging habitat	1:1	0.5:1	Scaled from 3:1 for Known Roosting and Foraging Habitat. Also, California WaterFix ratio for impacts on roosting and foraging or foraging habitat = 1:1 (ICF International 2016b). [1]

[1] The Bay Delta Conservation Plan/California WaterFix mitigated for impacts on sandhill crane *habitat*, not individuals. Greater and lesser sandhill cranes are designated as fully protected species under the California Fish and Game Code and take of individuals is therefore prohibited (i.e., the CDFW cannot issue permits for take under CESA).

San Joaquin KIT FOX

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
High value suitable habitat (natural lands)	3:1	1:1	Fresno-Bakersfield BO (USFWS 2014b) proposes 3:1 for impacts on natural habitat inside USFWS recovery areas.

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Moderate value suitable habitat (natural lands)	2:1	1:1	Fresno-Bakersfield BO (USFWS 2014b) proposes 2:1 for impacts on natural habitat outside USFWS recovery areas. **Less** than SCVHP acquisition/max. allowable impact ratio of 16:1 (4,000/244 acres) for secondary habitat (movement and foraging: all grasslands and seasonal wetlands and ruderal cover types adj. to grassland).
Low value suitable habitat (urban or agricultural lands)	0.5:1	0.5:1	Fresno-Bakersfield BO (USFWS 2014b) proposes 0.5:1 for impacts on developed habitat inside Recovery Plan-Linkage. Project would affect linkage along west side of San Joaquin Valley. **Less** than SCVHP acquisition/max. allowable impact ratio of 3:1 (100/34 acres) for secondary low-use habitat: developed & ruderal areas connected to secondary habitat).

Fresno Kangaroo Rat

Habitat Type	Mitigation Ratio Permanent	Mitigation Ratio Temporary	Rationale
Potentially suitable habitat[1]	3:1	1:1	Assuming that this habitat similar enough to high value SJKF habitat to propose equivalent mitigation.

[1] Annual grassland, perennial grassland, or alkali desert scrub with sandy or clay soils with 7.3 alkalinity or above.

Other Notes

- MSR, 2/19/19: Entered "0" in cells for which compensatory mitigation (for species and/or habitat type) not required:
  - Western spadefoot
  - Coast horned lizard
  - San Joaquin whipsnake
  - Western pond turtle
  - American peregrine falcon
  - Bald eagle (compensation only required for active nests found during precon surveys (BIO-MM#47)
  - Grasshopper sparrow
  - Golden eagle (see bald eagle note)
  - Least Bell's vireo
  - Lesser sandhill crane
  - Loggerhead shrike
  - Mountain plover
  - Northern harrier
  - Olive-sided flycatcher
  - Purple martin
  - Short-eared owl
  - Western snowy plover (interior population)
  - White-tailed kite
  - Yellow warbler
  - Yellow-headed blackbird
  - Pacific lamprey
  - American badger
  - Pallid bat
  - Ringtail
  - SF dusky-footed woodrat
  - Townsend's big-eared bat
  - Western mastiff bat
  - Western red bat

B.3.1 References

California Department of Fish and Game (CDFG). 2012. *Staff Report on Burrowing Owl Mitigation*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83843. Accessed: March 4, 2019.

ICF International. 2010. *East Alameda County Conservation Strategy*. Final Draft. Prepared for East Alameda County Conservation Strategy Steering Committee, Livermore, CA. October.

ICF International. 2016a. *State Incidental Take Permit Application for the Construction and Operation of Dual Conveyance Facilities of the State Water Project*. Prepared for California Department of Fish and Wildlife, Sacramento, CA. October.

———. 2016b. *Final Environmental Impact Report/Environmental Impact Study (EIR/EIS) for the Bay Delta Conservation Plan/California WaterFix: Chapter 12, Terrestrial Biological Resources*. December. https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/exhibit102/docs/vol1/Final_EIR-EIS_Chapter_12_-_Terrestrial_Biological_Resources.pdf (accessed August 1, 2019).

Trulio, L., D. Chromczak, and P.G. Higgins. 2018. *Winter Burrowing Owl Monitoring, 2016-2018*. Prepared for California Department of Fish and Wildlife and San Francisco Bay Bird Observatory. Napa, CA and Milpitas, CA. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=161913&inline (accessed March 14, 2019).

U.S. Fish and Wildlife Service. 1997. *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Project with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California*. Sacramento Fish and Wildlife Office, Sacramento, CA. November 13. https://www.fws.gov/sacramento/es/Consultation/Programmatic-Consultations/Documents/ggs%20programmatic%20bo.pdf (accessed March 1, 2019).

U.S. Fish and Wildlife Service. 2014a. *Programmatic Biological Opinion for Issuance of Permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, including Authorizations Under 22 Nationwide Permits, for Projects that May Affect the Threatened California Red-Legged Frog in Nine San Francisco Bay Area Counties, California*. Sacramento Fish and Wildlife Office, Sacramento, CA. June 18.

U.S. Fish and Wildlife Service. 2014b. *Biological Opinion on the California High-Speed Train System: Fresno to Bakersfield Section Project, Fresno, Tulare, Kings, and Kern Counties*. April 1. Consultation Code: 08ESMF00-2012-F-0247.

U.S. Fish and Wildlife Service. 2017. *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*).* Sacramento, CA. May.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012. Sacramento, CA*. GIS data prepared for CVPIA Habitat Restoration Program, U.S. Fish and Wildlife Service. Grant Agreement No. F11AP00169 with the USFWS. GIS Data and metadata available at: http://www.vernalpools.org/. Accessed: December 2016

APPENDIX C: MITIGATION OPTIONS

C MITIGATION OPTIONS

Mitigation options were summarized for aquatic and species resources in Section 2.8, Mitigation Options by HUC-8 Watershed and Aquatic Resource Type, and Section 3.6, Identification of Mitigation Options, respectively. The mitigation or conservation banks, in-lieu fee (ILF) programs, owner-offered permittee-responsible mitigation (PRM) sites, and opportunities included in the Marxan best solution were described in the text of these sections and summarized in Tables 2-10, 3-11, and 3-12. The tables in this appendix include all applicable banks, ILF programs, and PRM sites that have potential to meet mitigation needs for the specified resource. The totals and subtotals from these tables are brought forward into Tables 2-10, 3-11, and 3-12 in the main document.

Table C-1 Mitigation Options, by HUC-8 Watershed and Aquatic Resource Type

Aquatic Resource by HUC-8 Watershed and Type	Mitigation Need (acres)	Mitigation and Conservation Banks			Total Estimated Mitigation Acres Available from Banks	In-Lieu Fee (ILF) Programs				Total Estimated Mitigation Acres Available from ILF Programs	Permittee-Responsible Mitigation Sites										Total Estimated Mitigation Acres Available from ILF Programs	Total Estimated Mitigation Opportunity
		Pajaro River Mitigation Bank	Sparling Ranch Mitigation Bank	Grasslands Mitigation Bank		NFWF ILF Program SJV Vernal Pool	NFWF ILF Program Central Coast Vernal Pool	NFWF ILF Program Unallocated	NFWF ILF Program SQV Aquatic Resource		Fisher Bend	Lucky Day Ranch (Establishment)	Lucky Day Ranch (Enhancement)	Lucky Day Ranch (Preservation)	Bengard Property (Preservation)	Paxton Property	Montes Property	Five Pillar Farm	Grasslands Water District Proposed Properties	Acres Included in Marxan Best Solution		
Coyote Watershed																						
Freshwater Marsh	0.3	–	–	–	0	–	–	–	–	0	–	–	–	3	–	–	–	–	–	0.6	3.6	3.6
Palustrine forested wetland/palustrine forested wetland—natural watercourse	0.6	–	–	–	0	–	–	–	–	0	1.4	–	–	–	–	–	–	–	–	1.2	2.6	2.6
Natural watercourse	2.8	–	–	–	0					0	1.4	–	–	–	–	–	–	–	–	1.2	2.6	2.6
Pajaro Watershed																						
Freshwater marsh	6.6	(144.6)[2]	(0.76)[3]	–	0	–	–	–	–	0	–	–	–	3	–[4]	–[4]	10	–	–	25.3	38.3	38.3
Mixed riparian—natural watercourse	10.5	(144.6)[2]	3.2	–	3.2	–	–	–	–	0	–	7	7	11	–[4]	–[4]	10	–	–	2.9	37.9	41.1
Palustrine forested wetland/palustrine forested wetland—natural watercourse	21.9	–	–	–	0	–	–	–	–	0	–		–	–	–[4]	–[4]	68.5	–	–	114.9	183.4	183.4
Seasonal wetland	20.4	(144.6)[2]	–	–	0	–	–	–	–	0	–	30	20	33	1	–	–	–	–	73.9	157.9	157.9
Freshwater pond	9	(144.6)[2]	(0.76)[3]	–	0	–	–	–	–	0	–	–	–	4.5	6	–[4]	–[4]	–	–	31.3	41.8	41.8
Natural watercourse	18	–	3.2	–	3.2	–	–	–	–	0	–	1.5	0.2	0.6	41.7	–	–	–	–	95.2	139.2	142.4
Middle San Joaquin–Lower Chowchilla																						
Alkali marsh and alkali scrub wetland	20.1	–	–	(27.6)[2]	0	–	–	(37.72)[2]	11.2	11.2	–	–	–	–	–	–	–	–	19	102.1	121.1	132.3
Alkali vernal pool	0	–	–	–	0	(14)[2]	–	–	–	0	–	–	–	–	–	–	–	–	–	2.2	2.2	2.2
Alkali vernal pool/California annual grassland	81.3	–	–	–	0	–	(14)[2]	(37.72)[2]	–	0	–	–	–	–	–	–	–	2.2	–	74.7	76.9	76.9
Freshwater marsh	0.3	–	–	(27.6)[2]	0	–	–	–	–	0	–	–	–	–	–	–	–	–	–	90.1	90.1	90.1
Mixed riparian—natural watercourse	0.3	–	–	–	0	–	–	–	11.2	11.2	–	–	–	–	–	–	–	–	–	3.9	3.9	15.1
Seasonal wetlands	5.7	–	–	27.6	27.6	–	–	–	–	0	–	–	–	–	–	–	–	–	–	6.1	6.1	33.7
Vernal pools	1.5	–	–	–	0	14	–	–	–	14	–	–	–	–	–	–	–	–	–	2.2	2.2	16.2
Natural watercourse	6.8	–	–	–	0	–	–	–	11.2	11.2	–	–	–	–	–	–	–	–	–	15.3	15.3	26.5

Parentheses indicate that the credit or PRM site will require approval by one or more regulatory agencies because the proposed mitigation is not in kind. These numbers are not included in the mitigation total column.
[1] Assumes improvements to 3,000 linear feet of Fisher Creek (average 20 feet wide).
[2] Requires approval by U.S. Army Corps of Engineers (USACE) as out-of-kind mitigation type; credit is therefore not included toward the total mitigation need.
[3] Conservation credits for tiger salamander and red-legged frog aquatic habitat will require agreement from USACE to apply conservation bank credits to aquatic mitigation needs; credit is therefore not included toward the total mitigation need.

[4] Estimates for the extent or type of establishment, restoration, or enhancement are not available for the Bengard and Paxton properties; however, both properties have restoration opportunities for freshwater marsh, mixed-riparian or palustrine forested wetland, natural watercourse, and freshwater pond aquatic types. In the vicinity of the Paxton and Montes properties, detailed land cover mapping within the project footprint mapped riparian features as palustrine forested wetland; consequently, it is reasonable to assume that restoration and enhancement projects in the region are likely to create and expand primarily palustrine forested wetlands.
[5]As shown in Table 2-8, there is a total of 88.5 acres of riparian, freshwater marsh, and pond restoration opportunities on the Montes Property. 48.5 acres are assumed to be one of the palustrine forested wetland types; for the purposes of this analysis, half is assumed to be palustrine forested wetland and half to be palustrine forested wetland–natural watercourse. The other 40 acres of restoration are assumed to be an even mix of freshwater marsh, mixed riparian, palustrine forested wetland, and freshwater pond.
[6]As shown in Table 2-8, it is assumed that there is at least 6.3 acres of mixed riparian and palustrine forested wetland restoration opportunity on Sparling Ranch. For the purposes of this analysis, half is assumed to be mixed riparian and half natural watercourse.
[7] The Bengard property supports 17.2 miles of natural watercourse and Sparling Ranch has at least 1.3 miles. Assuming a 20-foot wide watercourse, this equates to 41.7 and 3.15 acres, respectively, of preservation opportunity.
[8]The Marxan best solution includes 214.6 acres of vernal pool and alkali vernal pool. There are 119,695 acres of unprotected vernal pool/alkali vernal pool complex in the study area as mapped by Witham et al. (2014). Percentage of wetted pools in this region ranges from 1% to 5%; a 1% wetted pool assumption was applied to the Marxan best solution and total acres of vernal pool in the study area.
ILF = in-lieu fee; PRM = permittee-responsible mitigation

Table C-2 Comparison between Mitigation Needs and Opportunities for Amphibians and Section 1600 et seq.

Species	Estimated Mitigation Need		Available Conservation Bank Credits[1]												Bank Total		Permittee Responsible Mitigation Sites[2]								Permittee Responsible Mitigation Total		Total Mitigation Opportunity		Outstanding Mitigation Need[4]	
			Ohlone West		Sparling Ranch		Deadman Creek		Oursan Ridge		Great Valley		Viera Sandy Mush Road				Lucky Day Ranch		Bengard		Tulare Hill		Marxan Best Solution[3]							
	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Up	Aq	Upland	Aq	Up	Aq	Up	Aq	Up
California red-legged frog																														
Sierra Nevada Foothills	1.5	219.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	248.5	1.3	248.5	1.3	248.5	0.3	(29.6)
South and East San Francisco	57.6	565.0	1.0	244.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	244.1	1.0	244.1	2.0	488.2	2.2	34.6	56.9	1377.8	62.1	2144.7	63.1	2388.8	(5.5)	(1823.8)
Diablo Range/Salinas Valley	258.5	3121.4	0.0	0.0	0.0	1260.3	0.0	0.0	3.8	398.5	0.0	0.0	0.0	0.0	3.8	1658.8	16.5	1959.2	32.8	2570.6	56.9	6587.1	290.0	3826.4	396.2	14943.3	400.0	16602.1	(141.5)	(13480.7)
California tiger salamander																														
Central Valley5	146.3	2071.1	0.0	0.0	0.0	0.0	0.0	133.8	0.0	0.0	106.1	950.0	0.0	17.7	106.1	1101.5	0.0	0.0	0.0	0.0	0.0	0.0	774.3	2397.9	774.3	2397.9	880.4	3499.4	(734.0)	(1428.3)
East Bay	94.2	3531.9	1.0	244.1	0.8	1250.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1494.4	41.7	1774.8	9.5	2594.7	0.8	36.0	347.8	5328.8	399.8	9734.3	401.6	11228.7	(307.4)	(7696.8)
Foothill yellow(legged frog																														
Primary Breeding and Foraging Habitat	199.2	154.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	49.1	37.3	121.1	40.2	170.2	376.1	259.7	456.5	600.1	456.5	600.1	(257.3)	(445.9)
Wildlife resources																														
Mixed riparian, Coyote Creek HUC(8 watershed	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.5	0.0	2.2	0.0	27.7	0.0	27.7	0.0	(26.5)
Sycamore alluvial woodland, Pajaro River HUC(8 watershed	0.0	40.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	215.0	0.0	215.0	0.0	215.0	0.0	(174.2)
Mixed riparian, Pajaro River HUC(8 watershed	0.0	20.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.7	0.0	59.7	0.0	59.7	0.0	(39.6)
Mixed riparian, San Joaquin(Lower Chowchilla HUC(8 Watershed	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.6	0.0	25.6	0.0	25.6	0.0	(22.9)

(Parentheses) indicate negative values
[1] Available conservation bank credits per RIBITS (2019); see Appendix D for the RIBITS table.
[2] Acreage of mitigation potential is a sum of owner-offered properties and Marxan results. Mitigation potential was determined on owner-offered permittee-responsible mitigation sites by intersecting the habitat models with the property boundaries using geographic information system software.
[3] The best solution is the one of 50 iterations that meets the greatest number of conservation element targets with the lowest number of planning units.
[4] A negative number indicates that the mitigation target has been met and exceeded by the value in the cell.
[5] Includes mitigation acreage targets for impacts incurred outside a recovery unit.
[6] 1.3 miles of opportunity for mixed riparian and possibly California sycamore woodland restoration (Meyers 2019). Because the exact amount of opportunity is not known, this opportunity is not included in the outstanding mitigation need calculation.
[7] There are 7 acres of mixed riparian restoration, 7 acres of mixed riparian establishment, and 11 acres of mixed riparian preservation opportunity on Lucky Day Ranch.

Table C-3 Comparison between Mitigation Needs and Opportunities for Listed Species (except Amphibians and Section 1600 et seq.)

Species, Habitat Type/Geography	Mitigation Need	Conservation Banks[1]						Bank Total	Owner-Offered PRM Sites[2]				Permittee-Responsible Mitigation Total	NFWF ILF Program SJV Vernal Pools[1]	Total Mitigation Opportunity	Outstanding Mitigation Need
		Alkali Sink	Dutchman Creek	Drayer Ranch	Great Valley	Viera-Sandy Mush Road	Grasslands Mitigation Bank		Lucky Day	Bengard	Tulare Hill	Marxan Best Solution[3]				
Western Burrowing owl																
Occupied breeding and foraging habitat (SCVHP Conservation Area C)	2.3	–	–	–	–	–	–	0.0	–	–	35.8	32.9	68.7	0.0	68.7	-66.4
Least Bell's Vireo																
Recolonization breeding habitat—core	172.4	–	–	–	–	–	–	0.0	–	–	–	409.8	409.8	0.0	409.8	(237.4)
Recolonization breeding habitat—potential	46.1	–	–	–	–	–	–	0.0	–	–	–	82.4	82.4	0.0	82.4	(36.3)
Swainson's hawk																
Primary active foraging habitat (eastern side)	363.1	822.1	–	–	–	–	–	822.1	–	–	–	376.8	376.8	0.0	1198.9	(835.8)
Secondary active foraging habitat (eastern side)	552.1	–	–	–	–	–	–	0.0	–	–	–	1582.7	1582.7	0.0	1582.7	(1030.6)
Tertiary active foraging habitat (eastern side)	60.9	–	–	–	–	–	–	0.0	–	–	–	322.6	322.6	0.0	322.6	(261.7)
Primary active foraging habitat (western side)	25.0	–	–	–	–	–	–	0.0	–	–	–	18.2	18.2	0.0	18.2	6.8
Secondary active foraging habitat (western side)	24.2	–	–	–	–	–	–	0.0	–	–	36.6	34.4	71.0	0.0	71.0	(46.8)
Tertiary active foraging habitat (western side)	43.8	–	–	–	–	–	–	0.0	2505.1	–	–	98.9	2604.0	0.0	2604.0	(2560.2)
Tricolored blackbird																
Previously occupied colony habitat (eastern side)	9.2	–	–	–	–	–	–	0.0	–	–	–	44.9	44.9	0.0	44.9	(35.7)
Potentially suitable colony habitat (eastern side)	111.6	–	–	–	–	–	–	0.0	–	–	–	154.2	154.2	0.0	154.2	(42.6)
Breeding season foraging—natural (eastern side)	495.2	–	–	–	–	–	–	0.0	–	–	–	2138.1	2138.1	0.0	2138.1	(1642.9)
Breeding season foraging—agriculture (eastern side)	661.5	–	–	–	–	–	–	0.0	–	–	–	2148.0	2148.0	0.0	2148.0	(1486.5)
Previously occupied colony habitat (western side)	0.3	–	–	–	–	–	–	0.0	–	–	–	4.8	4.8	0.0	4.8	(4.5)
Potentially suitable colony habitat (western side)	150.8	–	–	–	–	–	–	0.0	0.8	24.4	0.8	435.5	461.5	0.0	461.5	(310.7)
Breeding season foraging—natural (western side)	532.0	–	–	–	–	–	–	0.0	1738.9	1423.3	35.6	2303.8	5501.6	0.0	5501.6	(4969.6)
Breeding season foraging—agriculture (western side)	391.6	–	–	–	–	–	–	0.0	–	158.1	–	726.5	884.6	0.0	884.6	(493.0)
Steelhead—south-central California coast DPS																
Potential spawning, rearing, and migratory habitat	30.5	–	–	–	–	–	–	0.0	–	–	–	294.9	294.9	0.0	294.9	(264.4)
Potential migratory and rearing habitat	10.8	–	–	–	–	–	–	0.0	–	–	–	60.7	60.7	0.0	60.7	(49.9)
Bay checkerspot butterfly																
Potentially suitable habitat	54.5	–	–	–	–	–	–	0.0	57.0	–	34.0	57.7	148.7	0.0	148.7	(94.2)
Vernal pool crustaceans, by Vernal Pool Recovery Unit																
Vernal pool fairy shrimp (San Joaquin Valley)	0.8	0.3	7.7	–	106.1	19.4	–	133.5	–	–	–	8.4	8.4	15.0	156.8	(156.0)
Vernal pool fairy shrimp (Central Coast)	54.2							0.0				33.6	33.6	0.0	33.6	20.6

Species, Habitat Type/Geography	Mitigation Need	Conservation Banks[1]						Bank Total	Owner-Offered PRM Sites[2]				Permittee-Responsible Mitigation Total	NFWF ILF Program SJV Vernal Pools[1]	Total Mitigation Opportunity	Outstanding Mitigation Need
		Alkali Sink	Dutchman Creek	Drayer Ranch	Great Valley	Viera-Sandy Mush Road	Grasslands Mitigation Bank		Lucky Day	Bengard	Tulare Hill	Marxan Best Solution[3]				
Longhorn fairy shrimp (San Joaquin Valley)	0.8	0.0		20.1	106.1	–	–	126.2	–	–	–	8.4	8.4	15.0	149.6	(148.8)
Longhorn fairy shrimp (Central Coast)	0.0							0.0				33.6	33.6	0.0	33.6	(33.6)
Tadpole shrimp (San Joaquin Valley)	0.8	–	7.7	–	–	19.4	–	27.1	–	–	–	8.4	8.4	15.0	50.5	(49.7)
Tadpole shrimp (Central Coast)	54.2							0.0				33.6	33.6	0.0	33.6	20.6
Conservancy fairy shrimp (San Joaquin Valley)	0.8	–	3.2	–	–	–	–	3.2	–	–	–	8.4	8.4	15.0	26.6	(25.8)
Conservancy fairy shrimp (Central Coast)	0.0							0.0				33.6	33.6	0.0	33.6	(33.6)
Valley elderberry longhorn beetle																
Potentially suitable riparian habitat	3.5	–	–	–	–	–	–	0.0	–	–	–	33.9	33.9	0.0	33.9	(30.4)
Other potentially suitable habitat	262.1	–	–	–	–	–	–	0.0	–	–	–	407.9	407.9	0.0	407.9	(145.8)
Fresno kangaroo rat																
Potentially suitable habitat	220.9	–	–	–	–	–	–	0.0	–	–	–	973.0	973.0	0.0	973.0	(752.1)
San Joaquin kit fox																
High value suitable habitat (eastern side)	60.1	822.1	–	–	950.0	17.6	–	1789.7	–	–	–	60.3	60.3	0.0	1850.0	(1789.9)
Moderate value suitable habitat (eastern side)	445.7	–	–	–			–	0.0	–	–	–	1455.8	1455.8	0.0	1455.8	(1010.1)
Low value suitable habitat (eastern side)	744.6	–	–	–	–	–	–	0.0	–	–	–	3217.5	3217.5	0.0	3217.5	(2472.9)
High value suitable habitat (western side)	0.0	–	–	–	–	–	–	0.0	–	–	–	0.0	0.0	0.0	0.0	0.0
Moderate value suitable habitat (western side)	16.5	–	–	–	–	–	–	0.0	–	–	–	33.7	33.7	0.0	33.7	(17.2)
Low value suitable habitat (western side)	708.8	–	–	–	–	–	–	0.0	–	2599.3	–	4449.8	7049.1	0.0	7049.1	(6340.3)
Giant garter snake																
Potentially suitable aquatic habitat	93.3	–	–	–	–	–	83.7	83.7	–	–	–	162.8	162.8	0.0	246.5	(153.2)
Potentially suitable upland habitat	1200.4	–	–	–	–	–	–	0.0	–	–	–	1192.9	1192.9	0.0	1192.9	7.5
Potentially suitable aquatic habitat	37.1	–	–	–	–	–	–	0.0	–	–	–	71.8	71.8	0.0	71.8	(34.7)
Crotchs bee																
Western Side of Pacheco Pass	1707.1	–	–	–	–	–	–	0.0	2505.4		35.8	1624.8	4166.0	0.0	4166.0	(2458.8)
Eastern Side of Pacheco Pass	3041.2	–	–	–	–	–	–	0.0	–	1423.3		3338.2	4761.5	0.0	4761.5	(1720.3)

(Parentheses) indicate negative values
[1] Available conservation bank credits per RIBITS (2019); see Appendix D for the RIBITS table.
[2] Acreage of mitigation potential was determined on owner-offered PRM sites by intersecting the habitat models with the property boundaries using geographic information system software.
[3] The best solution is the one of 50 iterations that meets the greatest number of conservation element targets with the lowest number of planning units.
[4] A negative number indicates that the mitigation target has been met and exceeded by the value in the cell.
[5] There are 828 acres of unprotected vernal pool complex as mapped by Witham et al. (2014) included in the Marxan best solution. The percentage of wetted pools in this region ranges from 1 to 5 percent (Witham et al. 2014); a 1 percent wetted pool assumption was applied to the Marxan best solution, yielding 8.3 acres of wetted pool opportunity.
PRM = permittee-responsible mitigation; NFWF = National Fish and Wildlife Foundation; ILF = in-lieu fee; SJV = San Joaquin Valley SCVHP = Santa Clara Valley Habitat Plan; DPS = distinct population segment.

APPENDIX D: RIBITS REPORT FOR MITIGATION AND CONSERVATION BANKS

Table 1 Conservation Banks within the Study Area with Potential to Provide Compensatory Mitigation[1]

Conservation Bank	Type in RIBITS	Credit Potential	HUC 8 Watershed
Deadman Creek Conservation Bank	Group: Vernal Pool Preservation (VPFS/VPTS)	39.447	SJV
Deadman Creek Conservation Bank	Group: CTS/SJKF Upland	133.804	SJV
Great Valley Conservation Bank at Flynn Ranch	Group: Vernal Pool Preservation	106.176	SJV
Great Valley Conservation Bank at Flynn Ranch	Group: Upland Preservation	950	SJV
Grasslands Mitigation Bank	Giant Garter Snake	83.7	SJV
Dutchman Creek Conservation Bank	Group: 01. Federal - CTS / VPFS / VPTS	4.48	SJV
Dutchman Creek Conservation Bank	Group: 02. Federal - CTS / VPFS / VPTS / COFS	3.28	SJV
Dutchman Creek Conservation Bank	Group: 03. CTS / WSFT(State) / VPTS / VPFS	0	SJV
Dutchman Creek Conservation Bank	Group: 04. CTS / WSFT(State) / COFS / VPFS / VPTS	0	SJV
Dutchman Creek Conservation Bank	Group: 05. CTS-U / SJKF / SWHA / BUOW	0	SJV
Ohlone West Conservation Bank	Group: CTS(Fed)/CRF/AWS(Fed)	0	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS(Fed)/ CRF/ AWS(Fed)/ AWS(State)	145.8	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS(Fed)/ CRF/ AWS(Fed)/ AWS(State)/ CSB	77.19	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS(Fed)/ CTS-U(State)/ CRF/ AWS(Fed)/ AWS(State)/ CSB	27.3	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS(Fed)/CRF-Pond habitat	0.44	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS (Fed)/ CRF/ AWS(Fed)/ CSB	0	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS-B(State)/CTS (Fed)/CRF-Pond	0.58	Coyote/Pajaro
Ohlone West Conservation Bank	Group: CTS(Fed)/ CTS-U(State)/ CRF/ AWS(Fed)/ CSB	125.15	Coyote/Pajaro
Alkali Sink Conservation Bank	Vernal Pool Fairy Shrimp (VPFS) - preservation	0.27	SJV
Alkali Sink Conservation Bank	Longhorn Fairy Shrimp	0.01	SJV
Alkali Sink Conservation Bank	Group: Upland Species Preservation (BUOW+/-SWHA+/-SJKF)	822.13	SJV
Alkali Sink Conservation Bank	Group: Vernal Pool Preservation (LHFS+/-VPFS)	0	SJV

[1] RIBITS download data of February 9, 2019.

Conservation Bank	Type in RIBITS	Credit Potential	HUC 8 Watershed
Drayer Ranch Conservation Bank	San Joaquin Kit Fox (SJKF)	0	SJV
Drayer Ranch Conservation Bank	Vernal Pool Tadpole Shrimp (VPTS) - preservation	20.188	SJV
Drayer Ranch Conservation Bank	Group: SJKF/CTS	0	SJV
Great Valley Conservation Bank at Flynn Ranch	Group: Vernal Pool Preservation	106.176	SJV
Great Valley Conservation Bank at Flynn Ranch	Group: Upland Preservation	950	SJV
Oursan Ridge Conservation Bank	California red-legged frog (CRF)	3.78	Coyote
Oursan Ridge Conservation Bank	Group: CRF/AWS	398.45	SF Bay
Sparling Ranch Conservation Bank	Group: California Red-legged Frog and California Tiger Salamander	1250.28	Coyote/Pajaro/SJV
Sparling Ranch Conservation Bank	CTS aquatic habitat and CRLF credits	0.76	Coyote/Pajaro/SJV
Sparling Ranch Conservation Bank	CRLF-only	9.96	Coyote/Pajaro/SJV
Vieira-Sandy Mush Road Conservation Bank	California Tiger Salamander - Central DPS - upland (CTS Cental upland)	0	SJV
Vieira-Sandy Mush Road Conservation Bank	Group: CTS + SJKF Preservation	17.66	SJV
Vieira-Sandy Mush Road Conservation Bank	Group: VPFS + VPTS Preservation	19.47	SJV