SAN DIEGO REGIONAL LAGOON OVERVIEW PHASE 1 PLANNING STUDY

I-5 North Coast Corridor Project
San Diego County, California

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1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The California Department of Transportation (Caltrans), District 11, is developing plans and supporting environmental studies for the proposed Interstate 5 (I-5) North Coast Corridor Project. The project would improve an approximately 27-mile-long portion of I-5 within the County of San Diego, extending from the City of San Diego north to the City of Oceanside. Improvements may include widening of existing bridge structures along this portion of I-5, specifically at coastal lagoons, and would therefore have impacts to tidal and nontidal wetlands that will require mitigation. The I-5 North Coast Corridor Project will permanently impact 24.4 to 32 acres of wetland habitat depending on the alternative chosen. The majority of those impacts will be at the lagoons. Approximately 23 to 29 acres of the habitat impacted is Army Corps of Engineers (Corps) jurisdictional waters of the U.S, including up to 8 acres of coastal salt marsh habitat (San Diego Association of Governments [SANDAG] 2005). Such impacts would require permits from federal and state agencies that would mandate mitigation for any permitted fill placement in wetlands.

Caltrans is investigating opportunities to expand, restore, or enhance existing tidal wetlands as part of a potential mitigation program. Mitigation measures that result in “no net loss” of wetland habitat values and functions are being considered and would include creation of wetland in upland habitats, restoration of historic wetland areas that have been filled, and enhancement of existing degraded wetlands. Federal and state agencies generally prefer creation and restoration activities because they increase wetland habitat resources. In this report, this type of mitigation is referred to as “conventional restoration,” as it involves the removal of fill materials and/or restoration of wetland hydrology to sites that are currently uplands.

Enhancement activities can also lead to improved wetland values and sometimes increased wetland habitat. One approach being considered for this project is the enhancement of the tidal range within coastal lagoons. Most of the coastal lagoons in Southern California have been filled for linear transportation features (e.g., railroads and roadways) that run parallel to the coastline and perpendicular to the lagoon inlets. This fill has resulted in restriction of tidal flows into the lagoon areas. This restricted tidal range compared to the tidal range occurring within the Pacific Ocean is referred to as “muted” and results in a narrower band of tidally influenced areas within the lagoon. Because the I-5 North Coast Corridor Project will involve the reconstruction of some of the bridges that span these coastal lagoons and associated flood plains, there is an opportunity to consider bridge designs that would minimize the muting of tidal exchange in the wetlands east of I-5 and lead to possible expansion and enhancement of existing wetlands. This type of mitigation is referred to as the “hydrodynamic approach” and results in improved tidal flows within existing wetlands. In cases where the upper portion of the tidal range is expanded, this mitigation results in additional tidal wetland habitat around the fringes of the lagoon.

Both conventional and hydrodynamic wetland mitigation opportunities were investigated for six coastal lagoons traversed by I-5—Buena Vista, Aqua Hedionda, Batiquitos, San Elijo, San Dieguito, and Los Peñasquitos (listed north to south). These opportunities were evaluated in a uniform manner to develop a list of lagoons where mitigation would result in expanded and/or enhanced wetland habitats without having significant adverse impacts on existing natural resources.

1.2 PURPOSE OF THE REPORT

The purpose of this report is to document the current status and potential restoration opportunities for wetland habitat within six southern California coastal lagoons (Figure 1-1). The report provides an overview of the current status of each of the lagoons, particularly the physical and biological issues that may affect restoration, completed restoration projects, and future restoration actions being considered. This Phase I Study evaluates two key potential restoration opportunities within these lagoons, specifically: (a) conventional earthmoving restoration opportunities, and (b) those that could occur as a result of changes in bridge structures that might remove tidal muting east of I-5 (hydrodynamic approach). The study is based on a review of existing information, contact with local lagoon managers and nonprofit groups, initial field investigations of potential restoration opportunities, and summary of data in a consistent manner.

Chapter 8 presents the conclusion of this study and identifies lagoons representing the highest potential opportunity for restoration. One key lagoon is identified for conventional restoration, and three for hydrodynamic restoration opportunities. Lagoons already being studied for comprehensive restoration projects are not included in the hydrodynamic evaluation. More detailed hydrologic studies on the potential for the hydrodynamic approach will then be conducted in Phase II of this study at the three lagoons reflecting the most potential opportunity for hydrodynamic mitigation.

1.3 OVERVIEW OF STUDY AND DOCUMENT

1.3.1 Methodology

The methodology for this report consisted of the following steps:

- Gathering and summarizing background information for each of the lagoon systems, consisting of previous or existing restoration plans, biological studies, environmental documentation, hydrologic studies, and other reports on natural resources.
- Gathering information within the Study Area for each lagoon and preparing maps on property ownership parcels, natural habitats, sensitive species locations, Federal Emergency Management Agency (FEMA) maps, and other baseline data. These data were gathered from the San Diego Geographic Information Source (SANGIS) system, from available reports on each lagoon, and from restoration and/or monitoring plans prepared for these lagoons.
- Determining potential areas for restoration based on review of literature and examination of aerial photographs. Conducting preliminary field investigations by visiting each of the lagoons, walking or driving their perimeters, and determining potential areas that could be used for creation, restoration, or enhancement.
- Conducting a detailed field investigation of each potential mitigation area to determine its potential for restoration based on the preliminary identification of restoration opportunities. The detailed methodology for the field investigation is provided as Appendix A. Field investigations examined both the potential for restoration at each site and the constraints that may be imposed by issues such as existing natural resources, topography, access for restoration, and location of utilities.

- Ranking each site for mitigation potential from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints). Preparing a detailed chapter for each lagoon in this Phase I study, which summarizes the background information and the restoration opportunities.

This report will provide project planners at Caltrans and SANDAG with a ranked set of restoration opportunities to consider for additional analysis and evaluation in the Phase II study.

1.3.2 Document Structure

Section 1.0 of this report provides the background, context, and methodology of the Phase I lagoon study. Sections 2.0 to 7.0 provide a summary of the historical setting, ownership, hydrology, biological resources, and historic or ongoing restoration activities for each of the six lagoons (one per section). The results of field investigations and mitigation opportunities and constraints for each lagoon are provided within each respective section. Study Area figures are included at the end of each section, and other supporting information for each lagoon is presented in Appendices A to E. Sections 2.0 to 7.0 are based on the most up-to-date information available, which varies for each lagoon. Section 8.0 provides a summary of the field data and presents a comparative analysis of the sites at each of the lagoons to identify those with the highest potential for use in mitigation for the North Coast Corridor Project.

1.3.3 Preparers

This work was directed by WRA, Inc of San Rafael, CA under contract with AECOM of San Diego, CA. Data collection and report text was performed collaboratively between WRA and AECOM. The authors of this report included Michael Josselyn, Rosie Wilson, Dan Chase, Cindy Kinkade, and Shirley Innecken. Drs. Howard Chang and Scott Jenkins also contributed to this work. Peer review was conducted by Tom Held and Teri Fenner.

1.4 OVERVIEW OF REGIONAL CONSERVATION PLANNING

Regional habitat and species conservation planning encompasses the entire area under investigation for the North Coast Corridor Project. This overall conservation planning setting is described below for context, but each individual lagoon has a unique place in the regional system, and that unique status is discussed in the individual lagoon sections. To avoid repetition, the overall context is described only once in this section.

The Natural Community Conservation Planning (NCCP) program is a state-wide effort to protect habitats and species on an ecosystem basis while accommodating compatible land use. The program began in 1991 under the California's Natural Community Conservation Planning Act, and is broader in its perspective and goals than the California and Federal Endangered Species Acts. Under the NCCP, subregional planning areas were identified to allow for area-specific planning needs.

There are several large multiple jurisdictional habitat planning efforts in the San Diego region, each of which constitutes a subregional plan under the State of California's NCCP Act of 1991. The two subregional plans that have been approved are the San Diego County Multiple Habitat Conservation Program (MHCP) and the San Diego County Multiple Species Conservation Plan (MSCP). A third subregional plan within the county is being prepared, titled the County of San Diego North County Multiple Species Conservation Plan (NCMSCP).

The MHCP is implemented through subarea jurisdictions that are generally defined by the limits of local municipalities. The MHCP guides the preparation of individual sub-area plans for each

jurisdiction within the planning area of northwestern San Diego County. Lagoons within the MHCP and/or associated sub-area plan boundaries include Buena Vista, Agua Hedionda, Batiquitos, and San Elijo lagoons.

The MSCP is the subregional plan that the City of San Diego and 10 other jurisdictions have adopted for the southwestern county. The MSCP delineates a Multi-Habitat Planning Area (MHPA). The MHPA is a “hard-line” preserve that delineates core biological resource areas and corridors targeted for conservation. San Dieguito and Los Peñasquitos lagoons are located within the MSCP subregion.

The NCMSCP subregion includes unincorporated areas of North County, excluding tribal lands, federal lands, and most water districts. It stretches from coastal to inland areas, and includes communities such as Bonsall, Fallbrook, and Rancho Santa Fe, and encompasses regional features such as the San Luis Rey River, Santa Margarita River, and Escondido Creek. A draft of the NCMSCP is currently out for public review. No lagoons are encompassed within the NCMSCP subregion.

1.5 REFERENCES

San Diego Association of Governments (SANDAG). 2005. Interstates 805 / 5 South Corridor Study. June. 79 pp.

Figure 1-1. Location Map

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0 1 2 4 Miles

SANDAG
San Diego County, CA

wra
ENVIRONMENTAL CONSULTANTS

Date: September 2009
Map By: Sundaran Gillespie
Filepath:I:\Acad2000\16000\16165\
gis\Arcmap\Location Map.mxd

2.0 BUENA VISTA LAGOON

This chapter characterizes existing conditions within Buena Vista Lagoon based on existing information and current and proposed restoration plans (Figure 2-1). The lagoon is located in the Buena Vista watershed, which encompasses approximately 20 square miles.

The Study Area for this chapter includes approximately 278 acres of tidal wetlands within the lagoon, extending from the Pacific Ocean approximately 1.5 miles inland to the edge of the lagoon's northeasternmost basin (I-5 Bridge Basin). The Study Area includes the California Department of Fish and Game (CDFG) Buena Vista Lagoon Ecological Reserve in the cities of Carlsbad and Oceanside. Large-scale restoration of Buena Vista Lagoon is currently in the planning stages. This chapter focuses on distinct areas that may be individually restored on a smaller scale; however, the nature of restoration in those areas will depend on how they will be integrated with the selected restoration alternative for the entire lagoon.

2.1 PHYSICAL SETTING

2.1.1 Historical Profile

Conservation efforts surrounding Buena Vista Lagoon date back to the 1930s, when the Buena Vista Lagoon Association reached an agreement with the San Diego County Board of Supervisors to zone 100 acres of the lagoon as a wildlife refuge (Huckabay, nd). Currently estimated at 220 to 350 acres, the lagoon is documented to have historically supported approximately 666 acres of wetlands. Modifications to the lagoon's natural conditions began as early as 1883 with construction of the Atchison, Topeka, and Santa Fe Railway (Santa Fe Railway) crossing. During the early 1900s, salt evaporation ponds were constructed; in the 1950s, effluent from wastewater treatment facilities began to be released into the lagoon (BVLF in California Wetlands Information System 1983). In 1948, a weir located at the mouth of the lagoon was installed to regulate water levels in the lagoon (State Coastal Conservancy in Everest International Consultants, Inc. [EIC] 2004), and approximately one-fourth of the lagoon was developed in the late 1960s for the Plaza Camino Real Shopping Center (Huckabay, nd). Grazing and agricultural practices, as well as rapid urbanization, have dominated the land surrounding the lagoon since the 1970s.

In 1972, a concrete weir and reinforced channel were built in response to the flooding concerns of adjacent residents. A naturally formed berm was also artificially breached to protect homes from flooding. Ultimately, sedimentation became a serious threat to the lagoon's ecological health. Land conversion activities that have affected sedimentation and the lagoon's physical characteristics include construction of the Santa Fe Railroad trestle (currently the North County Transit District [NCTD] Railroad), the Coast Highway/Carlsbad Boulevard crossing, the I-5 overpass, and the Jefferson Street crossing. These projects perpendicularly traverse the lagoon and divide the lagoon into four distinct basins. The construction of Highway 78 along the lagoon's north shoreline has further restricted the lagoon.

In 1982, the State of California Coastal Conservancy (SCC) initiated a sediment control program within the lagoon's watershed (SCC 2008). The City of Carlsbad initiated an excavation project to remove sediment from the lagoon's easternmost section a year later (SCC 2008). In 1984, a model erosion control ordinance was implemented, and a Joint Powers Committee (JPC) between the Cities of Carlsbad, Oceanside, and Vista (SCC 2008) was established. Three years later, the SCC approved and funded the Buena Vista Watershed Sediment Control Plan.

Consequently, three detention basins were constructed within the upper watershed of Buena Vista Creek. Additional channel stabilization projects have also been implemented within the City of Vista's jurisdiction.

2.1.2 Surrounding Land Uses

Currently Buena Vista Lagoon is owned by both private landowners and the State of California. The Buena Vista Lagoon Ecological Reserve has been owned and managed by CDFG since 1968.

The lagoon is bordered primarily by commercial and residential development, as well as transportation infrastructure. Plaza Camino Real Shopping Center is located at the east end of the lagoon. Jefferson Street borders more than 1 mile of the lagoon's eastern and southeastern periphery. A small park is located south of the lagoon at the corner of Laguna Drive and State Street, and there is some open space associated with the lagoon along Jefferson Street. The northeast edge of the lagoon are bordered by Vista Way/Highway 78 and commercial development. The northwest edge of the lagoon, west of I-5, is primarily bordered by residential development.

2.1.3 Topography and Bathymetry

The Study Area, which extends from Jefferson Street east of I-5 to the Pacific Ocean, consists of a broad, relatively flat floodplain surrounded by gentle to relatively steep hillsides and coastal bluffs. The most prominent landforms within and adjoining the Study Area include the following:

- Beach area located southwest of the river mouth;
- Four distinct basins from west to east (shallow, freshwater) – Weir, Railroad Bridge, Coast Highway Bridge, and I-5 Bridge;
- A sediment basin within the I-5 Bridge basin;
- Buena Vista Creek entering the I-5 Bridge basin from the east;
- Bird nesting islands within the I-5 Bridge basin created from material dredged from the western portion of the basin; and
- A soft mud layer of 2.3 to 4.6 feet in thickness covering much of the lagoon, with mud line contours generally parallel to those of the firm bottom (Coastal Environments 2000 in EIC, Inc. 2004).

2.1.4 Surrounding Transportation System

The principal elements of the surrounding transportation system consist of the following:

- The NCTD railroad, which traverses the west end of the lagoon, separating the Coast Highway Bridge Basin on the east and Railroad Bridge Basin on the west;
- Carlsbad Boulevard/Coast Highway, which parallels the NCTD Railroad and separates the Railroad Bridge Basin on the east from the Coast Highway Bridge Basin on the west;
- I-5, which traverses the central part of the lagoon, separating the Coast Highway Bridge Basin on the west from the I-5 Bridge Basin east of I-5;
- Lagoon View Drive, a short driveway north of the eastern end of the lagoon;

- El Camino Real, which intersects Highway 78 and traverses north-south through the lagoon;
- Jefferson Street, which borders the lagoon's eastern and southeastern periphery; and
- Vista Way/Highway 78, which borders the northern edge of the lagoon.

2.1.5 Utilities

According to the Buena Vista Lagoon Restoration Analysis Report (EIC, Inc. 2004), a series of gas, electricity, communications, water, and sewer lines lie within the Study Area. The following is a summary of these utilities as described in the 2004 report:

- Gas – A 4-inch gas line runs along Coast Highway crossing Buena Vista Lagoon via the Coast Highway bridge on the west side of the bridge. In the southwest portion of the lagoon, a 2-inch gas line runs along Jefferson Road and a 1½-inch gas line runs along Buena Vista Drive. The Southern California Gas Company (SOCAL) 12¾-inch TM gas main line runs along the west side of the railroad bridge. Other gas lines within the Study Area run mostly underground along the residential roads bordering the lagoon.
- Electricity – Overhead electric cable lines are found in the Study Area along Coast Highway and along Garfield Street with lines farther to the west that run northward crossing the ocean outlet weir and continuing along into the residential communities in Oceanside. Additional areas with overhead electric cables are found along Jefferson Street and Buena Vista Circle. Several underground electric cables run along Laguna Drive except where these cables transition to overhead cables crossing Carlsbad Boulevard.
- Communications – Several communication cables are located within the Study Area and are owned by Pacific Bell, MCI, AT&T, and Adelphia. Overhead and underground communication cables are found along Coast Highway. Additional overhead cables are found along the outlet weir near Saint Malo Beach, Jefferson Street, and Buena Vista Circle, while underground cables run along the railroad bridge and Laguna Drive.
- Water – No water lines are within the Study Area. East of I-5, there is a 12-inch water pipe that runs along Jefferson Street, and additional water lines are located within the residential neighborhood of Saint Malo and in the streets north of the Coast Highway Basin.
- Sewer – Sixteen-inch and 24-inch sewer mains run underground along Jefferson Street to the north and east of I-5. These lines continue underground in the existing lagoon viewing area near the intersection of Jefferson Street and Marron Road. Additional sewer lines are found along the residential streets north of the Study Area within the City of Oceanside.

2.1.6 Storm Water Discharges

Storm discharge information is summarized in the Buena Vista Lagoon Restoration Analysis Report (EIC, Inc. 2004) and is included below.

Local runoff from the surrounding areas enters the lagoon through several storm drains and via Buena Vista Creek. The City of Carlsbad monitors three of these outfalls during the dry season; two outfalls are located in the I-5 Basin and one is located in the Coast Highway Bridge Basin. Typical dry weather flows from these outfalls ranged from 0 to 4 gallons per minute based on

data collected during the period of 2002–2003. Oceanside does not monitor the storm drains within its city limits that discharge into the lagoon.

All storm drains enter the lagoon from outfalls and terminate. There are no active storm drains crossing the lagoon. In Carlsbad, there are parallel 66-inch and 48-inch storm drain outfalls and an 18-inch storm drain outfall in the western portion of the lagoon. Along the north side of the Study Area, in Oceanside, a 16-inch pipe drains into the western portion of the lagoon.

Nine additional storm drains terminate in the central and eastern portions of the Study Area, the largest of which is a 72-inch storm drain that enters the I-5 Basin just west of Marron Road. A 24-inch storm drain runs parallel to I-5 and empties into the lagoon; five 18-inch storm drains run from Jefferson Street to the I-5 Basin; and on the north side of the I-5 Basin, two storm drains of unknown diameter enter the lagoon.

2.2 OWNERSHIP

The lagoon is in the Buena Vista watershed in the cities of Carlsbad and Oceanside, adjacent to the Pacific Ocean shoreline. Land ownership as recorded by SANGIS is shown in Figure 2-2.

2.2.1 Private Properties within Study Area

The majority of private property within the Study Area belongs to private family trusts. There are also a number of private commercial holdings, as well as individual ownership. The majority of these parcels are located along the northern boundary of the Study Area, closer to the western end of the lagoon. One parcel, which was listed for sale during the site visit and has been identified as BV-1 (discussed in Section 2.6.1), is currently owned by a private landowner. For a list of private parcel owners and locations as listed in SANGIS, see Figure 2-2.

2.2.2 Public Properties adjacent to the Study Area

Public property owners within and adjacent to the Study Area include the City of Oceanside, the City of Carlsbad, CDFG, and the NCTD Board. I-5 and the associated right-of-way are owned by Caltrans.

2.2.3 Land Use within Study Area

The predominant land uses within the Study Area are recreation and ecological preservation. CDFG maintains and operates an ecological reserve in all four basins of the lagoon, which is open for fishing, hiking, wildlife viewing, and nature tours. Restoration activities are being planned and/or implemented within portions of the Study Area. In addition, the lagoon serves as a flood basin and conveyance facility to store and transfer upstream flows and local runoff to the ocean (EIC, Inc. 2004).

2.3 HYDROLOGY

2.3.1 Flood and River Data

The Buena Vista watershed extends approximately 10.6 miles inland from the coast, totaling 14,437 acres and draining 21 square miles. Estimates place approximately 80 percent of the watershed as either urbanized or developed. The Study Area is located within the FEMA 100-year flood zone as shown in Figure 2-3.

As part of the Buena Vista Restoration Feasibility Analysis, which looked at various flooding scenarios and how the sedimentation rate within the lagoon affects the passage of water through the system, one-dimensional hydrodynamic simulations were used to determine the flood impacts for various restoration options within the lagoon. The 5-, 10-, 25-, 50-, and 100-year flood events were simulated. Factors such as high urbanization within the watershed and significant amount of sediment deposition within the lagoon reduced the storage capacity to contain flood flows (EIC, Inc. 2004). Excavation of this material within the lagoon would restore some of the capacity lost to infilling, thereby reducing the risk of flooding. The 2004 Buena Vista Lagoon Restoration Feasibility Analysis provides additional flood information and modeling (Everest International Consultants, Inc [EIC, Inc.] 2004, http://www.bvlrestoration.org).

2.3.2 Tidal Data

Terra Costa Consulting Group, Inc. (TCCG) conducted a lagoon tide and sea level study of Buena Vista Lagoon in 2008. In the resultant document, *Tide and Sea Level Study for Southern California Buena Vista Lagoon Restoration*, tide and sea level data, analysis, and other related information are applicable to the ocean just outside the entrance to Buena Vista Lagoon and along the coast in much of Southern California (TCCG 2008). However, this work does not consider if, or to what extent, sea level or tide conditions inside the lagoon may be different from those of the ocean once the lagoon is reopened (TCCG 2008).

The general characteristics of the tide at Buena Vista Lagoon are well represented by tide conditions at Scripps Pier in northern La Jolla, where tide measurements began in 1925 (Appendix B, TCCG 2008).

2.4 BIOLOGICAL INFORMATION

Extensive biological data have been collected on Buena Vista Lagoon over the years and is beyond the scope of this brief synopsis to provide in detail. The Buena Vista Lagoon Restoration Feasibility Analysis (EIC, Inc. 2004) provides the most recent data available for the Study Area. This section is based on existing biological survey data; no new surveys were conducted as part of this study. Overall vegetation maps, soil maps, national wetlands inventory, and sensitive species occurrences for the vicinity of the Study Area are provided in Figures 2-4, 2-5, 2-6, 2-7, and 2-8 respectively. Sources of existing information used to create these figures include SANGIS and the California Natural Diversity Database (CNDDB). Updated mapping and surveys will be conducted as part of the Buena Vista Lagoon Restoration Project; however, this information is not currently available.

Observed flora and fauna recorded during the August 31, 2009 site visit are presented in Appendix C. Additionally, special-status species that are documented within 5 miles of the Study Area and utilize habitats similar to those found within Buena Vista Lagoon are provided in Appendix D.

2.4.1 Regional Habitat and Species Conservation Planning

The Study Area is located within the jurisdiction of the draft Oceanside Subarea Habitat Conservation Plan/Natural Communities Conservation Plan (HMP/NCCP) and the approved City of Carlsbad (Carlsbad) Habitat Management Plan (HMP). Both the Oceanside HCP/NCCP and the Carlsbad HMP serve as subarea plans under the San Diego County Multiple Habitat Conservation Program (MHCP). The Oceanside HMP/NCCP is currently being reviewed by the regulatory agencies. Until approved, portions of Buena Vista Lagoon that fall within the City of Oceanside's jurisdiction will be regulated according to the MHCP.

2.4.2 Biological Communities

According to SANGIS data (Figure 2-4), the Buena Vista Study Area is comprised of the following vegetation communities:

Disturbed habitat	Estuarine
Eucalyptus woodland	Freshwater
Coastal and valley freshwater marsh	Urban/developed
Southern riparian scrub	

During site visits, the Study Area was found to be dominated by open freshwater and coastal and valley freshwater marsh. Freshwater marsh habitat is characterized by perennial and emergent monocots (*Typha* spp. in Buena Vista Lagoon) occurring in calm areas permanently inundated by fresh water (Holland 1986). Southern riparian scrub is typically dominated by several willow species (*Salix* spp.), often with occasional Fremont's cottonwood (*Populus fremontii*) and western sycamore (*Platanus racemosa*) (Holland 1986). Small patches of the southern riparian scrub community, dominated by arroyo willow (*Salix lasiolepis*), were found in the Study Area. Small areas of disturbed habitat, characterized by bare ground and weedy species such as fennel (*Foeniculum vulgare*) and crystalline iceplant (*Mesembranthymum* spp.) were observed along roadsides and in the northeast portion of the Study Area.

Eucalyptus woodland, dominated by blue gum (*Eucaluptus globulus*) occurs along the southern end of the Study Area. The outer fringes and transportation corridors running through the Study Area are urban and developed land. The developed areas within the Study Area include man-made features that exist within or along the margins of the lagoon (EIC, Inc. 2004). Species observed within developed areas are mainly cultivated California native plants used in landscaping around the Audubon Nature Center (EIC, Inc. 2004). Species include Catalina cherry (*Prunus lyonii*), Monterey pine (*Pinus radiata*), giant coreopsis (*Coreopsis gigantea*), and Monterey cypress (*Cupressus macrocarpa*) (EIC, Inc. 2004). Estuarine habitat was not observed during Phase I Study site visits.

2.4.3 Special-Status Species

2.4.3.1 Wildlife

Despite numerous transportation corridors across the lagoon and substantial urban development in the surrounding land, the Study Area serves as a habitat island for many species. The lagoon is dominated by freshwater, with only the occasional overtopping of saltwater during larger ocean tide and/or storm events. This results in a large population of invasive fish species (such as largemouth lass, green sunfish and brown bullhead catfish) that

are sought by local fisherman. Appendix D provides a list of special-status species, along with their sensitivity status, that are documented to occur within a 5-mile radius of the Study Area and utilize habitat types similar to those found in the lagoon. State and federally listed threatened or endangered species that utilize the lagoon for critical portions of their life history (such as breeding) are mentioned below.

Belding's savannah sparrow, a state-listed endangered species, has been consistently observed at Buena Vista Lagoon as breeding pairs and as year-round residents. Based on CNDDB records, an Audubon Society survey for Belding's savannah sparrow documented 39 individuals in 2001.

The light-footed clapper rail, a state and federal listed endangered species and a state fully-protected species, has been documented to occur in Buena Vista Lagoon as a small breeding population since at least the 1990s. In 1997, seven breeding pairs were identified. Annual census surveys for this species have been conducted in the lagoon by the Clapper Rail Study Team since 1980, and their surveys have documented eight breeding pairs in 2006 and 2007 (Zembal et al 2007).This species occupies the cattail marsh predominantly within the Coast Highway and I-5 Basins, although individuals have been documented in all basins (EIC, Inc. 2004).

An additional species to note is the coastal California gnatcatcher, which is a federally listed threatened species and a state-listed species of special concern that has been well documented to occur within the Buena Vista Lagoon Study Area. This species of gnatcatcher is a permanent resident of coastal sage scrub in Southern California, and prefers coastal sage scrub located in arid washes, slopes, and mesas. Several breeding pairs have been documented within the Study Area (DFG 2009), and this species was observed within upland portions of the Study Area during the course of the site investigations

2.4.3.2 Plants

Orcutt's pincushion (*Chaenactis glabriuscula* var. *orcuttiana*) is documented to occur in the Study Area, and is presumed extant. Thirty eight additional species are known to occur in, or within 5 miles of the Study Area. A list of these additional species, and their sensitivity status, is included in Table D-1.

2.4.4 Invasive Plants

Due to seasonal runoff and precipitation, as well as an impeded tidal flow, excessive freshwater areas exist within the lagoon and are known to support nonnative species such as the invasive purslane (*Ludwigia uruguayensis*) (EIC, Inc. 2004).

A number of invasive plant species have been documented (EIC, Inc. 2004) in disturbed areas, including:

- Pampas grass (*Cortaderia selloana*)
- Castor bean (*Ricinus communis*)
- Australian eucalyptus (including *Eucalyptus globulus* and *E. Polyanthemos*)
- Wattle (*Acacia latifolia*)
- Tree tobacco (*Nicotiana glauca*)
- Tree of heaven (*Ailanthus altissima*)
- Fan palm (*Washingtonia robusta*)
- Giant cane (*Arundo donax*)
- Tamarisk (*Tamarix ramosissima* and *T. parviflora*)
- Ngaio (*Myoporum laetum*)
- Brazilian pepper (*Schinus terebinthifolius*)
- Cocklebur (*Xanthium strumarium*)

Oleander (*Nerium oleander*)	Red apple iceplant (*Aptenia cordifolia*)
Fountaingrass (*Pennisetum setaceum*)	Algerian ivy (*Hedera canariensis*)
Black mustard (*Brassica nigra*)	

Many of these invasive species occur within the disturbed periphery of the lagoon (EIC, Inc. 2004).

Nonnative grasses and forbs are abundant in the uplands, and include:

Wild oats (*Avena barbata*)	Red brome (*Bromus rubens*)
Soft chess (*Bromus hordaceous*)	Ripgut (*Bromus diandrus*)
European redtop (*Agrostis stolonifera*)	Foxtail fescue (*Vulpia myuros*)
Ryegrass (*Lolium* spp.)	Filaree (*Erodium cicutarium*, *E. brachycarpum*, *E. botrys*, and *E. moschatum*)
Australian brass-buttons (*Cotula australis*)	Australian saltbush (*Atriplex semibaccata*)
Telegraph weed (*Heterotheca grandiflora*)	Crown daisy (*Chrysanthemum coronarium*)
Brass buttons (*Cotula coronopifolia*)	Hottentot fig (*Carpobrotus edulis*)

2.5 RESTORATION ACTIONS IN STUDY AREA

2.5.1 Past Restoration Activities in Study Area

Past restoration efforts have generally been constrained due to a number of factors, including the lack of a comprehensive plan for a sustainable hydrologic system, multiple parcel owners within the lagoon, conflicting views on what the system should include and the long-term future of the lagoon. These factors, compounded by the fact that little data exist on many of the key environmental components necessary to develop a sustainable long-term management plan, have prevented significant restoration actions from taking place. In 2004, the Buena Vista Lagoon Foundation distributed a restoration feasibility study and analysis for Buena Vista Lagoon completed by EIC, Inc. in an attempt to close some of these data and management gaps. This report outlined several aspects of restoration and sustainable management for the system, which have been incorporated into this planning study where pertinent. Many of the potential restoration areas identified in this document and the restoration goals posed for this project align with the guiding doctrine presented in the 2004 feasibility analysis.

2.5.2 Future Restoration in Study Area

Since 2000, a number of entities have contributed to restoration planning projects within the lagoon, including the Southern California Wetland Recovery Project, the State Coastal Conservancy SCC, the State Water Resources Control Board (SWRCB), CDFG, and the U.S. Fish and Wildlife Service (USFWS). Previous activities have lacked an inclusive approach to restoration (e.g., were focused on decreasing erosion). Currently, Phase II of a comprehensive restoration project is being planned for the lagoon. This project is jointly funded by the SCC, USFWS, and the cities of Carlsbad and Vista (settlement funds for a 2007 sewage spill in the lagoon).

The restoration analysis primarily focuses on ways to remedy the increasing amount of sediment deposition that threatens the continued existence of the water body. In 2006, EIC and KTU+A completed conceptual and schematic designs in GIS that looked at several restoration options, including a "no action" (existing conditions), a freshwater alternative, a saltwater alternative, and a mixed system alternative combining freshwater and saltwater. This information was presented to the public; a determination has not yet been made as to which alternative should be pursued for the lagoon. Assuming that the "no action" or freshwater alternative is not selected, major lagoon restoration work will cause an increase in the tidal prism.

2.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, five potential restoration areas were identified within Buena Vista Lagoon (Figure 2-9). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Upon visiting the area designated BV-3, it was determined that the site should be analyzed as two separate areas, BV-3a and BV-3b, due to significant differences in habitat type and restoration options, as described below. Details on the methodologies employed have been described in Section 1.3 of this report.

2.6.1 Conventional Restoration

2.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration lie within areas that previously were part of the tidal inundation zone. Particularly in the eastern portion of the Study Area, unvegetated flats and upland habitat have transitioned closer to the water line because tidal action has been blocked for the lagoon. The removal of the weir would reintroduce tidal conditions to the lagoon and would lead to the lagoon functioning in a more natural state for coastal lagoons, where there is a varying spectrum of salinity. The western portion of the lagoon would have more saline conditions, which would enable salt marsh habitat to thrive, and the eastern portion would experience an increase in marsh zone due to the fluctuating water level characteristic of tidal regimes. However, if the weir is removed, there is still a substantial sedimentation issue that would have to be corrected with extensive dredging, otherwise the mouth of the lagoon could not maintain an open (i.e., stable) ocean inlet/outlet configuration (EIC, Inc. 2004).

If the weir is not removed, the greatest opportunity for the creation and enhancement of marsh habitat within the lagoon would be to excavate areas down to a level that allows for more frequent inundation, permitting freshwater emergent marsh vegetation to become established. Salt marsh habitat would not be possible in the eastern portion of the lagoon if the weir is not removed because the lagoon is currently cut off from saltwater and the tidal action that would cause salinity to mix within the lagoon. The existing weir is the greatest constraint on restoring salt marsh habitat to Buena Vista Lagoon, and its removal would provide the greatest opportunity for salt marsh restoration.

Additional constraints in restoring salt marsh habitat to the lagoon lie in the existing restriction points caused by bridge structures of South Coast Highway, I-5, and the railroad. If the weir is removed from the mouth of the lagoon, increasing the tidal prism east of these structures will

help increase the health and size of the salt marsh habitat by increasing the amount of area that receives tidal inundation.

One of the advantages of restoration within the Buena Vista Lagoon Study Area would be an increase in the amount of healthy functional wetland, which will help to improve water quality. This is vital to not only the natural community but also to the public, which utilizes the lagoon for fishing, among other passive recreational activities.

A summary of the wetland restoration potential for each of the sites evaluated in the Buena Vista Lagoon Study Area is provided in Table 2-1. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in Appendix A to this report. Representative photographs are provided in Appendix E.

Table 2-1. Mitigation Potential in the Buena Vista Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments
BV-1	3	34.3	Access was not permitted for site at the time of the field visit; however, property was listed for sale. The site is within the flood plain of Buena Vista Creek, and moderate excavation would be required to bring restoration area contours down to water level.
BV-2	5	N/A	Existing wetland habitat; pickleweed dominates the site, and signs exist of inundation and dried algal mats. No wetland creation mitigation credits possible with this site.
BV-3a	5	N/A	Site completely dominated by wetland vegetation and has high quality upland habitat along the upper margins. No wetland creation mitigation credits possible with this site.
BV-3b	3	34.3	Close proximity to road and easy access for equipment. Site has expansive unvegetated sand flat. Area is popular place for public use; several people observed fishing during site visit. Site most likely suitable for enhancement credits and is likely a wetland under the California Coastal Commission guidelines.
BV-4	2	28.6	Site would require 5 to 10 feet of excavation. Possible removal of parking lot, which is currently fenced off from the public, would create habitat restoration options. Fill material scattered throughout site.
BV-5	2	42.9	Site previously identified as potential mitigation site. Size of area provides opportunity to provide transitional habitat. Area has a large amount of invasive iceplant. Majority of the site does not demonstrate wetland hydrology.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

2.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 2 (BV-4 and BV-5) 5.7 total acres. A breakdown of acreage per study site is listed in Appendix A.

2.6.1.3 Next Steps

Buena Vista Lagoon offers a few opportunities for wetland creation and enhancement. Much of the land within the Study Area is held by public agencies and restoration would serve the vision of preservation the ecological reserve seeks to maintain. The extent of successful marsh restoration, particularly salt marsh restoration, is contingent upon the reestablishment of the tidal prism within the lagoon.

Coordination with CDFG is warranted to identify those areas of highest priority for restoration. BV-5 has previously been identified by Caltrans as a potential restoration area, and the area within BV-1 is currently listed for sale and may warrant additional studies to determine restoration opportunities.

2.6.2 Hydrodynamic Restoration

2.6.2.1 Opportunities and Constraints

Assuming the weir is removed and corrective actions are taken to allow for the tidal prism to be restored to the lagoon (i.e., dredging), the combination of the railroad trestle bridge and I-5 may provide two significant points of tidal muting in the year-round tidal lagoon. If that proves to be the case, increasing the amount of tidal flow passing through one or both of these structures would improve the tidal range.

2.6.2.2 Potential Mitigation Acreage

The acreage that might benefit from improved tidal action cannot be determined at this time because (1) the restoration alternative for the lagoon has not been selected and (2) the degree of tidal muting should the weir be removed is not known. There is no proposal at this time to change the I-5 bridge over the lagoon, however if a longer bridge is determined to be needed across the lagoon, Caltrans has indicated that it would comply as much as possible.

2.6.2.3 Next Steps

No further action can be taken until the final restoration plan for the lagoon is selected.

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BUENA VISTA STUDY AREA FIGURES

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Figure 4-1.
Aerial Site Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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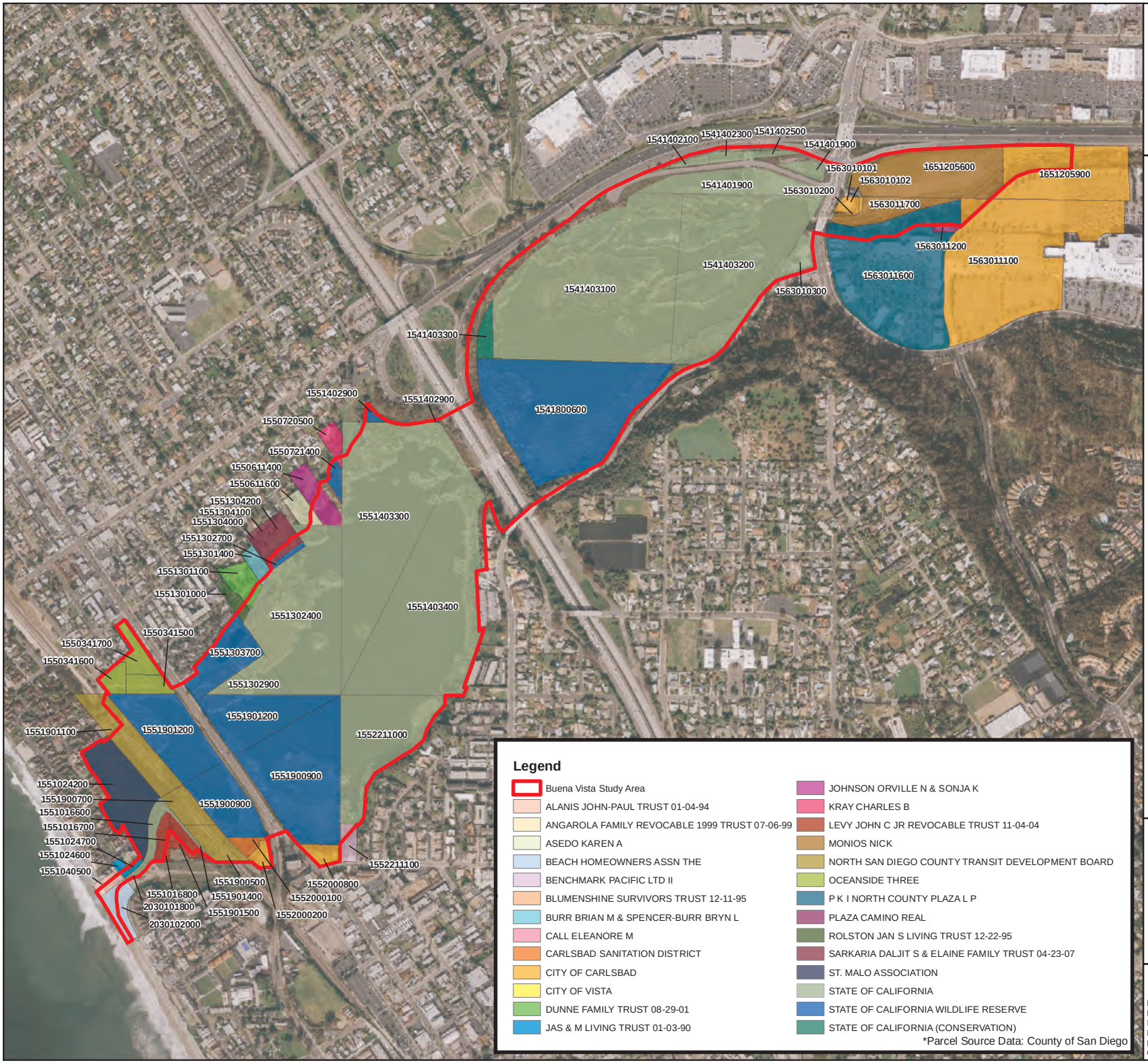

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Figure 2-2.
Parcel Owners within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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Figure 2-3.
FEMA Zones within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Buena Vista\FEMA.mxd

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Figure 2-4.
Vegetation Communities within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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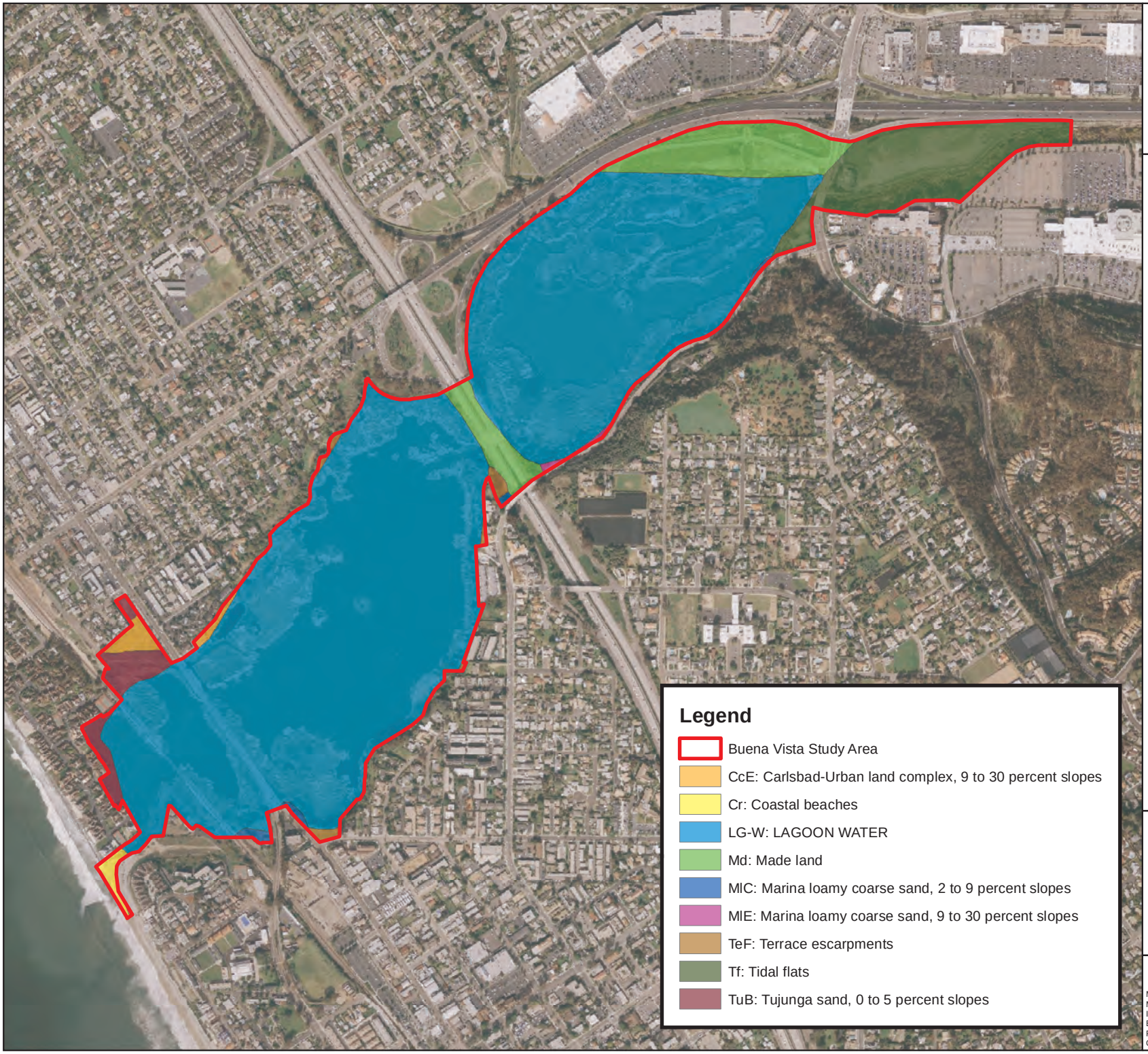

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Figure 2-5.
Soils Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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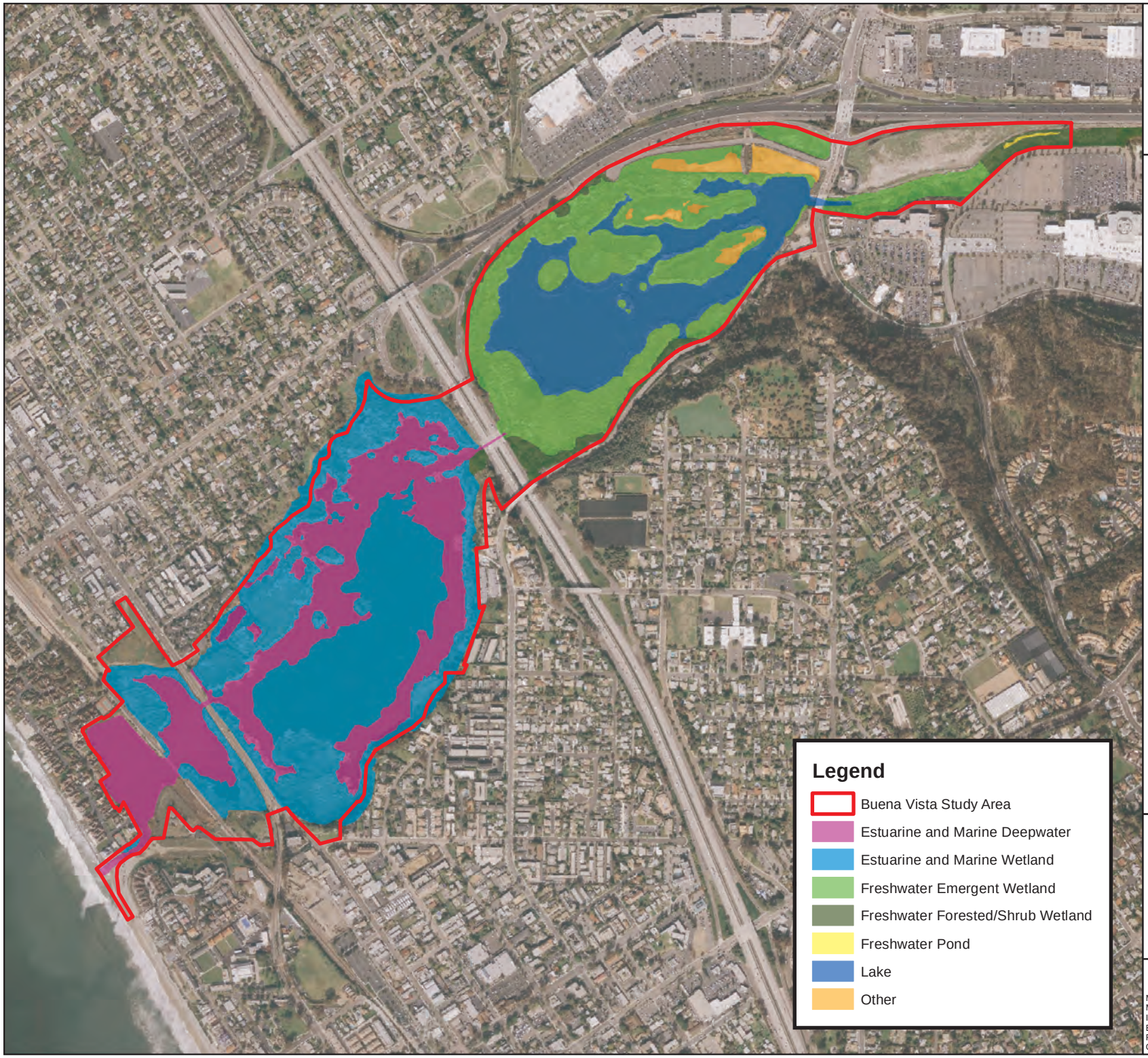

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Figure 2-6.
NWI Data (May 2002)
within the
Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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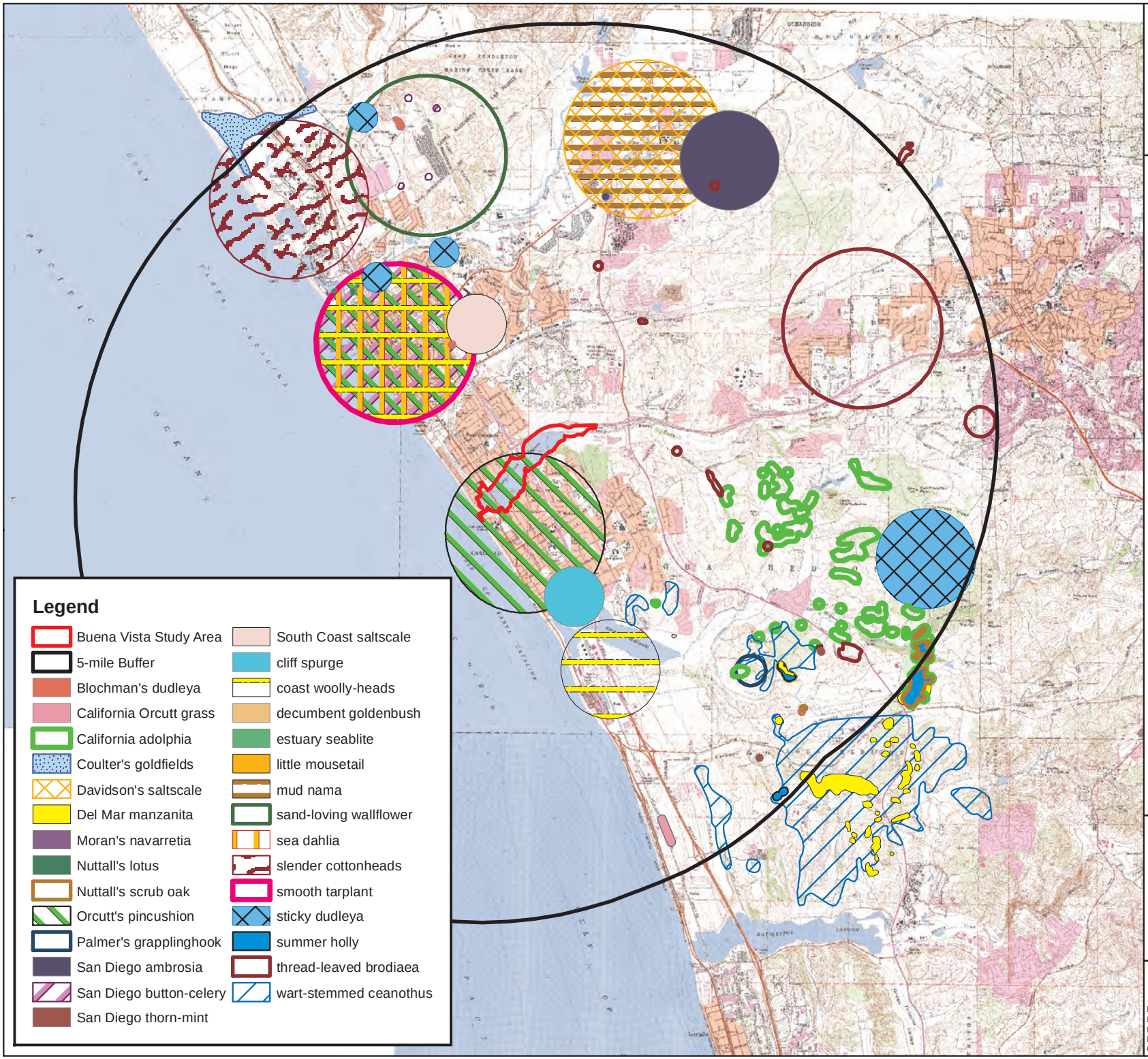

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Figure 2-7.
Special Status Plant Species within 5-mile Radius of the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Buena Vista\CNDDBPlant.mxd

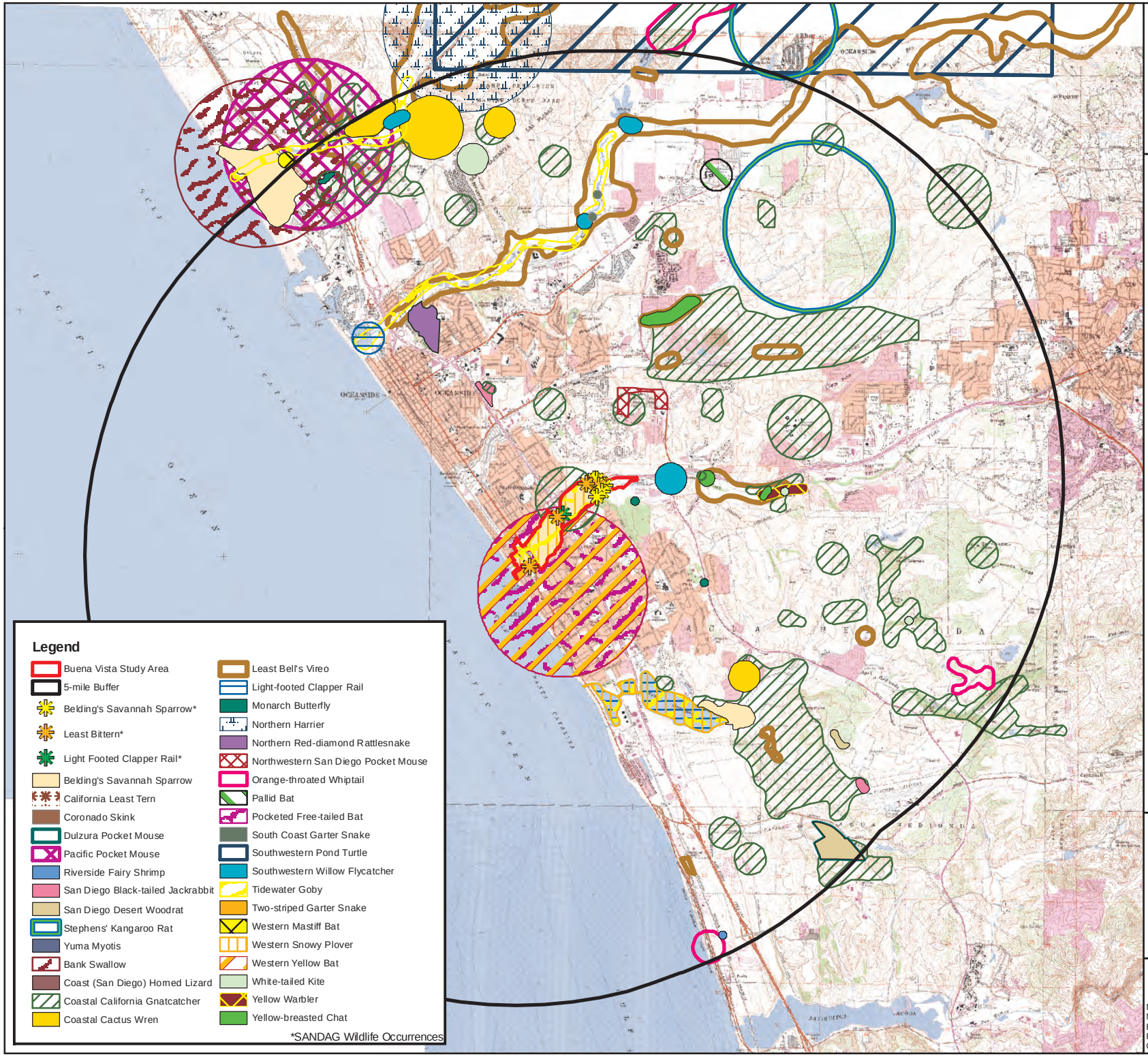

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Figure 2-8.
Special Status Animal Species within 5-mile Radius of the Study Area

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Buena Vista\CNDDBAnimal.mxd

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Figure 2-9.
Potential Restoration Areas

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Buena Vista\RestorationAreas.mxd

3.0 AGUA HEDIONDA LAGOON

Agua Hedionda Lagoon is in the City of Carlsbad, at the discharge points for Agua Hedionda Creek and Macario Creek within the Carlsbad Hydrologic Unit (Figure 3-1). The Agua Hedionda watershed covers 18,837 acres, draining 30 square miles in San Diego County. It extends 1.7 miles inland from the Pacific Ocean to the mouth of Agua Hedionda Creek and at its widest point is 0.5 mile wide. The Study Area is defined as the area between the Pacific Ocean on the west to the intersection of El Camino Real and Cannon Road to the east (Figure 3-1) and it encompasses 529 acres.

Agua Hedionda Lagoon is unique for Southern California lagoons since commercial, industrial, and recreational use is permitted. The lagoon is a fully tidal system with significant wetlands at the head of the lagoon that support several sensitive species. However, opportunities to further restore and enhance the wetlands within this system are possible and details on the lagoon and these potential restoration opportunities are provided below.

3.1 PHYSICAL SETTING

Historical Profile

Historically, the area that is now Agua Hedionda Lagoon was a slough composed of shallow marsh channels that were filled with anaerobic hyper-saline water that was only flushed during periods of high tides or large rain events that would breach the barrier berm across the lagoon inlet. The current geomorphic formation and hydraulic regime exhibited by the lagoon are a function of anthropogenic influence and are approximately 60 years old. The lagoon was originally built for the sole purpose of providing a retention basin for the cooling water required for the operation of the Encina Power Plant (Le Page 2007).

The creation of a tidal lagoon began in 1954 when San Diego Gas and Electric (SDG&E) completed a large-scale dredging project to provide a deep water basin and cooling water for the Encina Power Plant and was later completed with the creation of two pairs of jetties to maintain tidal flow for power plant circulation. Because the lagoon provides a sink for sand from offshore that moves into the western basin, the entrance to the lagoon undergoes maintenance dredging generally every 2 to 3 years and the dredged materials are used to replenish beaches within the vicinity.

The lagoon is approximately 330 acres and consists primarily of open water habitat. The lagoon is currently divided into three basins, which are formed, in part, by the railroad bridge and the I-5 transportation corridor. The outer basin, which is the westernmost feature, is 66 acres; the middle basin is 27 acres; and the inner basin, which is the largest, is the eastern portion of the lagoon and is 140 acres. Cabrillo Power leases a portion of its property to the YMCA, the City of Carlsbad, and private businesses. The outer lagoon basin supports commercial shellfishing aquaculture, and a marine fish hatchery. The middle basin supports recreational swimming and the inner basin is also used for recreational boating, swimming and public access.

3.1.1 Surrounding Land Uses

Agua Hedionda Lagoon is located within an urbanized area and most of the land uses surrounding the Study Area consist of commercial and residential uses. Agricultural uses occur on the lands to the south of the bluffs bordering the inner basin. The largest landowner is Cabrillo Power, which owns and operates the SDG&E Encina Power Plant owns the majority of the land within the outer and inner basins. Additionally, the State of California and SDG&E are significant landowners adjacent to Cabrillo Power's holdings. A number of residential parcels

line the north central portion of the lagoon. CDFG owns a portion of the inner basin along the northern and eastern sides and manages it as an ecological reserve. The Aqua Hedionda Lagoon Foundation Interpretive Facility is on the far eastern end of the inner basin. Agua Hedionda Lagoon is unique among lagoons in Southern California, as commercial, industrial, recreational, and ecological uses are all active within its boundaries. The Hubbs-SeaWorld fish hatchery and White Seabass research facility and the Carlsbad Aquafarm (commercial mussel farm) operate in the lagoon. Additionally, there is a public beach in the northern portion of the lagoon that provides access for recreation and a YMCA summer camp that is held at the lagoon.

3.1.2 Topography and Bathymetry

The Study Area, which extends from the intersection of Cannon Road and El Camino Real west to the Pacific Ocean, consists of a broad, relatively flat floodplain surrounded by gentle to relatively steep hillsides and coastal bluffs. The existing ground elevations typically range from +3 feet National Geodetic Vertical Datum (NGVD) to +80 feet NGVD; however, the majority of the Study Area is below 20 feet NGVD. The most prominent landforms within and adjoining the project site include the following:

- Public beach areas along the north of the inner basin.
- A small marina located east of I-5.
- The Encina Power Plant owned by Cabrillo Power operating in the southwest portion of the Study Area and draws water from the lagoon for cooling.
- Terraced agricultural lands along the southern portion of the historic lagoon floodplain east of I-5.
- Eroded, south-facing bluffs east of I-5 and north of the lagoon.
- A railroad trestle bridge spanning the divide between the outer and middle basins.
- Average lagoon depths ranging between -8 and -11 feet, and maintenance dredging occurs every 2 to 3 years.
- Intertidal zones of the lagoon ranging from narrow sandy beaches to mud-clay banks.
- Near the outlet of Agua Hedionda Creek, the degraded remnants of a once extensive salt marsh totaling approximately 100 acres and now primarily consist of mudflats and high marsh interspersed with salt flats, alluvial fans, and riparian habitat.

3.1.3 Surrounding Transporation Systems

The surrounding road systems consist of the following local roads:

- A series of local roads runs along the northern portion of the Study Area. Park Drive provides the majority of access east of I-5, and Chinquapin Avenue provides access west of I-5.
- Cannon Road, a four-lane road, roughly parallels the southern portion of the Study Area from I-5 in the west to El Camino Real in the east.
- Carlsbad Boulevard is a four-lane road crossing the lagoon between the outer and middle basins.
- The NCTD railroad, which traverses the western end of the lagoon, separating the outer basin on the east and middle basin on the west;

- I-5, which traverses the middle of the lagoon and separates the middle basin and the inner basin.

3.1.4 Utilities

- Available background information on public utilities running through or adjacent to the Study Area includes the following:
- Electricity – Major overhead power lines run along Cannon Road, on the south side of the Study Area. A portion of these lines cross the lagoon from near the Agua Hedionda Lagoon Foundation north to Park Drive. One large transformer tower is positioned adjacent to Agua Hedionda Creek, within the Study Area.
- Sanitary sewer lines – During the site visit, a sewer main was documented to run underground within the northern portion of the Study Area, south of Park Drive.

3.1.5 Storm Water Discharges

There are 23 storm drains that terminate at the lagoon (California Wetlands Information System 1997). Local surface drains discharge to the lagoon from I-5, Cannon Road, El Camino Real, Carlsbad Boulevard, and a series of residential roads along the northern portion of the Study Area. In addition to urban runoff, agricultural runoff enters the lagoon from the south.

3.2 OWNERSHIP

The project area is within the Agua Hedionda Creek watershed, adjoining the Pacific Ocean. Land ownership as recorded by SANGIS is shown in Figure 3-2. A discussion of landowners within the individual Study Areas is provided below.

3.2.1 Private Properties within Study Area

Based on parcel data from SANGIS (2009), the dominant private landowner within the lagoon is the Encina Power Plant (owned by Cabrillo Power), which owns all but a small parcel in the outer basin and the major portion of the inner basin (which includes nearly all the aquatic habitat). The other major private landowner within the Study Area is SDG&E, which owns the remaining parcel in the outer basin, the majority of the inner basin (aquatic habitat included), and a large parcel along the Study Area's southern boundary of the inner lagoon. Additionally, multiple homeowners and several small private trusts are cited as parcel owners of Study Area land within the northern portion of the inner and middle basins; see Figure 3-2.

3.2.2 Public Properties Adjacent to the Study Area

Parcels falling under the ownership of public property in the Study Area are dominated by the CDFG Agua Hedionda Lagoon Ecological Reserve. Lands within I-5 and the associated right-of-way are owned by Caltrans. Additionally, the former Hallmark Property in the northern portion of the inner lagoon was recently purchased by Caltrans for restoration purposes, and the new ownership of this parcel is not reflected in Figure 3-2.

3.2.3 Land Use within Study Area

Land use within the Study Area is divided between commercial/industrial use in the outer basin, with water being used for the Encina Power Plant cooling and commercial aquaculture. Another major land use within the lagoon is habitat preservation. CDFG maintains and operates an ecological reserve within the eastern portion of the Study Area. The Agua Hedionda Lagoon Foundation also owns a portion of land within the lagoon and encourages ecologically sound

practices within this area. Additionally, recreational use is popular within the lagoon, with YMCA summer camps and various water sports permitted.

3.3 HYDROLOGY

Agua Hedionda Creek, including its major tributaries Buena Creek, La Mirada Creek, Roman Creek, Calavera Creek, and Little Encinas Creek, drains an area of 30 square miles. The watershed extends about 10.6 miles from the San Marcos Mountains to the Pacific Ocean. Only about 27 percent of the watershed remains in a natural, relatively undisturbed area (Tetra Tech 2008a). Besides the lagoon, there are two other significant standing bodies of water in the watershed, Lake Calavera and Maerkle Reservoir.

3.3.1 Flood and River Data

Average rainfall for the area ranges between 10 and 13 inches per year and generally falls between November and February. According to the Carlsbad Desalination Project EIR (Poseidon Resources 2005):

> The San Diego County coastal zone is subject to climate cycles of about 20-30 years duration known as the Pacific/North American (PNA) pattern (for atmospheric pressure) or the Pacific Decadal Oscillation or PDO (for sea surface temperature). A dry La Niña dominated period extended from about 1945-1977, followed by an episodically wet period from 1978-1998 that included the occurrence of 6 strong El Niño events. The average annual rainfall increases by about 38% from the dry to the wet portions of the cycle. Furthermore, both the minimum and maximum ranges in rainfall are higher in the wet period, while the averages of the 6 major rainfall events in 21-year periods before and after the climate change (1977/78) are about 8 to 9 inches greater during the wet period. The PNA/PDO climate cycles accentuate the inter-annual variability and produce the extremes in the natural ranges of variability of ocean temperature and salinity.

The Study Area is located within the FEMA 100-year flood zone as shown in Figure 3-3.

3.3.2 Tidal Data

The general characteristics of the tide at Agua Hedionda Lagoon can be represented by tide conditions recorded at the Scripps Pier in northern La Jolla (Appendix B). Tide measurements are recorded from Tide Gauge No. 9410230 and began in 1925. In the Study Area, the maximum tidal range is about 9 feet, with the lowest annual tide at about -1.8 feet Mean Lower Low Water (MLLW) datum and the highest annual tide about 7.2 feet MLLW (Elwany et al 2005). MLLW is 2.75 feet below mean sea level.

Elwany et al. (2005) conducted a hydrodynamic study and literature review of the tidal regime within Agua Hedionda Lagoon regarding the function and alteration of the lagoon for the use of power generation. Agua Hedionda Lagoon was found to differ from other Southern California lagoons as it is dominated by a nearly continual incoming surge of seawater and littoral sediment. The Encina Power Plant relies on 625 to 670 million gallons a day (mgd) of water for cooling purposes, which is then discharged through a set of jetties known as the outlet jetties. This has altered the hydrodynamics of the lagoon. This process reduces the ebbing tides volume from the lagoon by about 40 to 50 percent.

3.4 BIOLOGICAL INFORMATION

Extensive biological data have been collected on Agua Hedionda Lagoon over the years and is beyond the scope of this brief synopsis to provide. The Agua Hedionda Watershed Management Plan (Tetra Tech 2008a) and the Carlsbad Desalination Plant EIR (Poseidon Resources 2006) provide the most recent data available for the project site.

Overall vegetation maps, soil maps, national wetlands inventory, sensitive species occurrences, and critical habitat for the vicinity of the Study Area are provided in Figures 3-4, 3-5, 3-6, 3-7, 3-8, and 3-9.

3.4.1 Regional Habitat and Species Conservation Planning

The Study Area lies within the City of Carlsbad and therefore is subject to the HMPs associated with the MHCP for that city. The HMP for the City of Carlsbad describes conservation strategies and implementation processes to comply with the umbrella MHCP (City of Carlsbad 2004).

3.4.2 Biological Communities

According to the SANGIS digital data, 13 habitat types are present within the Study Area. These habitat types are composed of the following vegetation communities:

Coastal and valley freshwater marsh	Diegan coastal sage scrub
Southern riparian scrub	Disturbed habitat
Disturbed wetland	Estuarine
Eucalyptus woodland	Marine
Maritime succulent scrub	Nonnative grassland
Riparian scrub	Southern coastal salt marsh
Urban/developed	

Because this study is focused on terrestrial restoration options, the estuarine habitat designation will suffice for the diversity of habitat found below the waterline (including eelgrass, algal cover, mudflat, sandy substrate, etc.).

The most dominant habitat community within the lagoon is estuarine, with southern coastal salt marsh being the second most dominant type. Large patches of coastal and valley freshwater marsh and southern riparian scrub are also found in the eastern portion of the Study Area.

3.4.3 Special-status Species

The Agua Hedionda Lagoon EIR/EIS (Tetra Tech 2008a) and the watershed management plan (Poseidon Resources 2006) contain an extensive discussion of special-status species that have the potential to occur within the Study Area; refer to those documents for more information. A map illustrating the known occurrences of special-status species is provided in Figures 3-7 and 3-8. While the site has potential for a variety of species, the only confirmed observations are for the Belding's savannah sparrow, coastal California gnatcatcher, light-footed clapper rail, and several plant species, discussed below. An observed species list from the September 1, 2009, site visit is provided in Appendix C. A list of special-status species that are documented to occur within a 5-mile vicinity of the Study Area and use similar habitats to the ones listed in Section 3.4.2 are provided in Appendix D.

3.4.3.1 Wildlife

Belding's savannah sparrow, a state-listed endangered species, has been consistently observed at Agua Hedionda Lagoon. Pairs were observed in association with the salt marsh in the eastern portion of the lagoon during the breeding season. Based on CNDDB records, a survey for Belding's savannah sparrow documented 22 breeding pairs in 2001. All birds observed were along the edge of the inland lagoon, primarily in areas dominated by pickleweed. The creation and restoration of salt marsh habitat within the lagoon would benefit this species.

The light-footed clapper rail has been documented to occur in Agua Hedionda Lagoon sporadically over the past 20 years. Early detections have breeding pairs documented in 1980; however, this species was not detected or observed within the lagoon from 1986 through 1995 (CDFG 2009). Recently, breeding pairs have been increasing and the population would benefit from the creation of additional salt marsh habitat and the restoration of cordgrass and pickleweed-dominated areas.

The coastal California gnatcatcher has been well documented to occur within the Agua Hedionda Lagoon Study Area. This species of gnatcatcher is a permanent resident of coastal sage scrub in Southern California, and prefers coastal sage scrub located in arid washes, slopes and mesas. Several breeding pairs have been documented within the Study Area (CDFG 2009), and this species was observed within the CDFG Ecological Reserve during the course of the site investigations. Agua Hedionda Lagoon has also been designated as part of the coastal California gnatcatcher's critical habitat. Areas in the eastern portion of the inner basin fall into this designation, as depicted in Figure 3-9. While a large portion of the Study Area have the critical habitat designation, much of these areas are saltmarsh/wetland habitat or open water, which is not part of the species Primary Constituent Elements (PCEs).

Tidewater goby is a federally endangered and a state-listed species of special concern that is currently considered extirpated from Agua Hedionda Lagoon. This California endemic species thrives in slow-moving, but not stagnant, shallow brackish coastal lagoons. They will often seek cover from predators along vegetated shorelines during periods of tidal inundation. Agua Hedionda Lagoon is the documented southern extent of this species' range. The creation of additional tidal sloughs or restoring native wetland vegetation could potentially support reintroduction of this species into the lagoon.

3.4.3.2 Plants

The following four special-status plant species are documented to occur within the Study Area and are presumed extant: coast woolly heads (*Nemacaulis denudata* var. *denudata*), cliff spurge (*Euphorbia misera*), wart-stemmed ceanothus (*Ceanothus verrucosus*), and Orcutt's pincushion (*Chaenactis glabriuscula* var. *orcuttiana*) (CDFG 2009). CNDDB records indicate occurrences of 38 additional special-status species within 5 miles of the Study Area (CDFG 2009). A list of all special-status plant species documented in the vicinity of the Study Area can be found in Appendix D, and a figure depicting the approximate location of those occurrences is included as Figure 3-7.

3.4.4 Invasive Plants

Many nonnative species occur within the Study Area, but giant reed (*Arundo donax*) and pampas grass (*Cortaderia selloana*) are particularly invasive species found along the lagoon margins (Carlsbad Watershed Network 2002). These species are known to occur throughout the Agua Hedionda Creek watershed, and therefore eradication efforts at the lagoon are dependent on watershed-wide weed removal initiatives.

3.5 RESTORATION ACTIONS IN STUDY AREA

3.5.1 Past Restoration Activities in Study Area

Initial dredging to create the current geomorphic conditions found within the functioning tidal lagoon began in the 1950s. In 1999 the entire lagoon was redredged to an average depth that ranged from -8 to -11 feet MLLW. Continued biannual dredging occurs in the outer basin to help offset the substantial sediment deposition that occurs from the prevailing current and flood-dominated tidal prism characteristic of the lagoon (Le Page 2008, Tetra Tech 2008).

In 2001, an intensive effort began to remove the highly destructive *Caulerpa taxifolia* invasive marine plant. This is a common aquarium plant that has decimated marine habitats in the Mediterranean by completely covering all substrate with a thick carpet of inedible fronds and outcompeting native marine vegetation. An aggressive restoration and eradication program led by Merkel and Associates (M&A) and the newly formed Southern California Caulerpa Action Team was able to successfully eliminate the invasive organism using a combination of black tarps and concentrated chlorine distributed by SCUBA divers. Several years of monitoring within the lagoon ensured the restoration and eradication program was successful (M& A 2006).

3.5.2 Future Restoration in Study Area

The Caltrans purchase of the Hallmark Property in the northeast portion of the Study Area was made with a preliminary objective of restoring the property back to a healthy natural state. This area currently serves as the largest restoration plan for the lagoon. The spread of invasive plant species within the system has been identified as a concern documented in the watershed management plan (Tetra Tech 2008b).

The advancement and contribution of sedimentation through watershed runoff continue to threaten the lagoon. The inner lagoon, which has the largest portion of open water habitat and directly receives runoff from the watershed, has become significantly shallower due to sedimentation (Weaver pers comm 2009). The Encina Power Plant, which operates primarily in the outer basin, owns and is responsible for the maintenance dredging of the inner lagoon. Continued maintenance dredging to maintain the health of the lagoon and the volume of the tidal prism is required and is considered future restoration for the purpose of this document.

3.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, 6 potential restoration areas were identified within Agua Hedionda Lagoon (Figure 3-10). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Details on the methodologies employed have been described in Section 1.3 of this report.

3.6.1 Conventional Restoration

3.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration are the removal of existing berms and the conversion of low-quality upland areas along the banks of the lagoon and outlet of the Agua Hedionda Creek. Much of this land is part of the CDFG Ecological Reserve;

however, there are also privately owned parcels. Advancements have been made on this front, as Caltrans has recently purchased the former Hallmark Property for habitat restoration (Hallmark Property). Excavation of upland areas to bring them within the range of tidal action is a technique used in other lagoons in the region for previous CDFG and SCE restoration actions, and would likely prove to be a successful method for wetland creation within Agua Hedionda Lagoon. Any restoration and conversion of upland habitat would have to consider public access and the impact that public use would have on the restoration area. Several of the sites exhibit substantial habitat alteration as the result of public use, including areas built up for bike ramps.

Cabrillo Power, which owns and operates the Encina Power Plant, maintains the opening of the lagoon by performing maintenance dredging usually every 2 years. Dredging, along with the two sets of jetties, helps ensure Agua Hedionda Lagoon stays tidal year-round. The last lagoon-wide dredging operation occurred in 1999, and while Cabrillo Power is currently responsible for dredge maintenance within Agua Hedionda, in 2010 dredge stewardship will transfer to Poseidon Resources which is in the process of developing a desalination plant along the south side of the outer basin. The I-5 bridge and the railroad bridge just east of the power plant and future desalination plant from pinch points within the lagoon for tidal flow. Increasing the tidal prism east of these structures will help increase the health and size of the salt marsh habitat by increasing the amount of area that receives tidal inundation. Because the lagoon opening is maintained, there is a unique opportunity to create a thriving tidal salt marsh in the inner basin area. The removal of several berms and upland fill can aid in the reduction of salt marsh habitat fragmentation in much of the lagoon.

The removal and impact to upland habitat will have to be carefully measured prior to restoration due the designation of coastal California gnatcatcher critical habitat that covers much of the inner basin. Several pairs of gnatcatcher are documented to breed within the Study Area, and any restoration of salt marsh habitat should not be done at the expense of this species' reliance on upland habitat.

One of the advantages for restoration within the Agua Hedionda Lagoon Study Area is that the majority of the lands to the east that provide most of the restoration opportunity are owned by CDFG. The existing salt marsh is fragmented and shows areas of substantial impact from human alteration, but these areas have the opportunity to be converted back to a functioning tidal marsh and can provide a large amount of rare habitat for the species of the area. Additionally, increasing the amount of healthy functional wetland will help to increase water quality, which is vital to not only the natural community but also to the public that has frequent recreational contact with the water.

A summary of the wetland restoration potential for each of the sites evaluated within the Agua Hedionda Study Area is provided in Table 3-2 and representative photographs are provided in Appendix E. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in Appendix A.

Table 3-1. Mitigation Potential in the Agua Hedionda Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments

AH-1	4	82.9	Most of site is likely a jurisdictional wetland. A berm area could be removed but access to the berm is through an existing wetland. Signs of tidal activity in salt flats. Wetland delineation recommended for the site to determine extent of wetland habitat in potential restoration areas.
AH-2	1	28.6	Site not likely to be within jurisdiction of the Army Corps of Engineers. Excavation of large mound and fill soils. Within area designated as critical habitat for California gnatcatcher.
AH-3	1	34.3	Significant disturbance to the area, enhancement and creation opportunity along series of berms near salt marsh and in the weedy uplands. Within area designated as critical habitat for California gnatcatcher, although much of the area identified as potential restoration acreage does not fall into the critical habitat Primary Constituent Elements for this species. Former Hallmark property purchased by Caltrans for restoration.
AH-4	1	42.9	Site would require 8 to 10 feet of fill removal. Habitat may need to be created behind a beach berm to maintain public use. Public access trail to the beach within site would also need to be maintained.
AH-5	1	37.1	Enhancement and creation opportunity with the excavation of fill. High public use and access, and concerns over eelgrass in adjacent waters if dredging takes place.
AH-6	2	48.6	Good access trail. Area has high-quality transitional habitat. Roadway could possibly be removed and transition zone lowered, but a sewer line runs along the path/roadway and would require movement to another location.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

3.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 1 or 2 is 9.3 acres. A breakdown of acreage per study site is listed in Appendix A.

3.6.1.3 Next Steps

Agua Hedionda Lagoon offers several opportunities for wetland creation and enhancement. Much of the land in the eastern portion of the lagoon is held by public agencies and restoration would serve the ecological reserve's goal of preservation. Excavation associated with these projects would make their costs relatively high and the impact to coastal California gnatcatcher critical habitat needs to be determined.

Coordination with CDFG is warranted to identify those areas of highest priority for restoration. AH-2 and AH-3 have already been identified by Caltrans as potential restoration areas and primary studies have been initiated.

3.6.2 Hydrodynamic Restoration

3.6.2.1 Opportunities and Constraints

The degree of tidal muting caused by bridge structures in the lagoon is not known; however, any increase in tidal range east of I-5 could result in some additional area of salt marsh habitat, especially on the northern and eastern portions of the inner basin. The southern edge of the inner basin is very steep, so any increase in habitat there would be limited.

The increased tidal prism would likely also result in an increased amount of sediment permitted into the inner basin from the dominant longshore current along the coast. This might require more frequent dredging in the inner lagoon to help maintain the increased tidal prism. Further study may be required to determine the frequency of dredging required.

3.6.2.2 Potential Mitigation Acreage

By removing the tidal muting at the bridges, the high tide range could increase, inundating additional areas. This would extend to all areas of the lagoon regardless of whether they are within the restoration areas identified in this analysis. Further analysis of potential tidal prism improvement and the topography of the surrounding lagoon would quantify an approximate acreage of anticipated increased inundation.

3.6.2.3 Next Steps

Further analysis is required of any potential increased tidal prism from altering the railroad or I-5 bridge structures.

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AGUA HEDIONDA STUDY AREA FIGURES

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Agua Hedionda Lagoon
San Diego County,
California

Figure 3-1.
Aerial Site Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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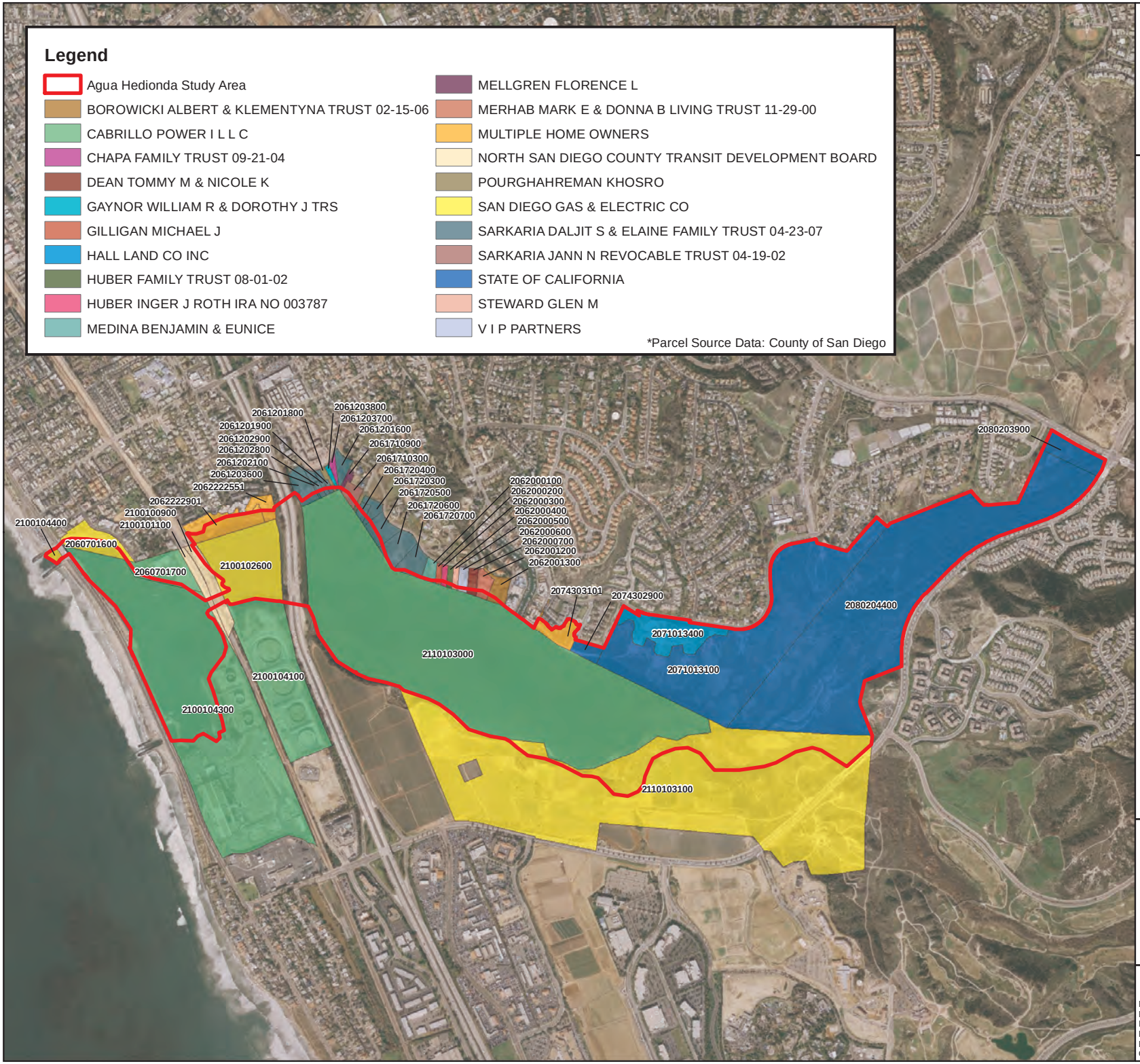

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California

Figure 3-2.
Parcel Owners within the Study Area

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Image Date: Jan 08
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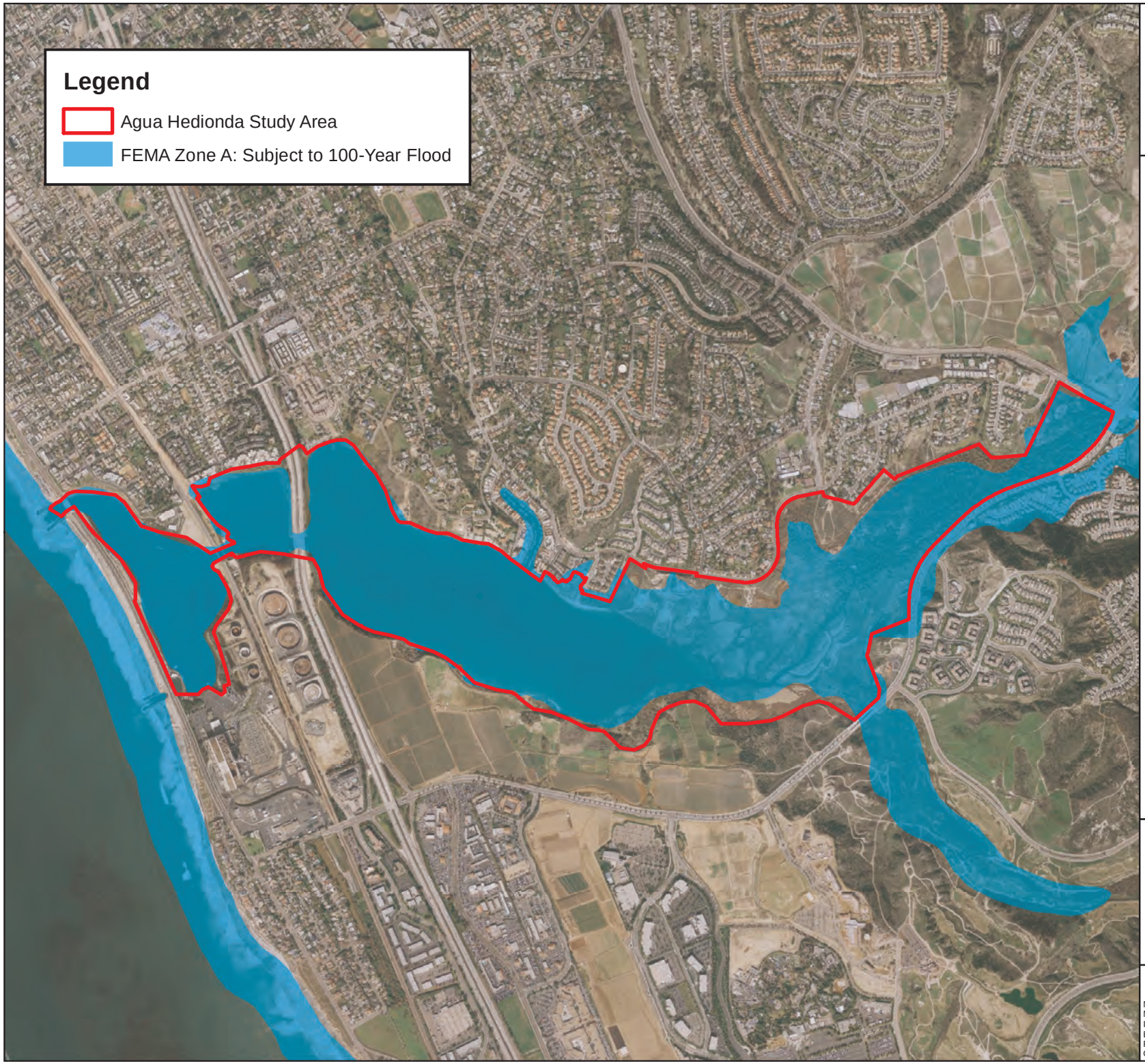

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California

Figure 3-3.
FEMA Zones within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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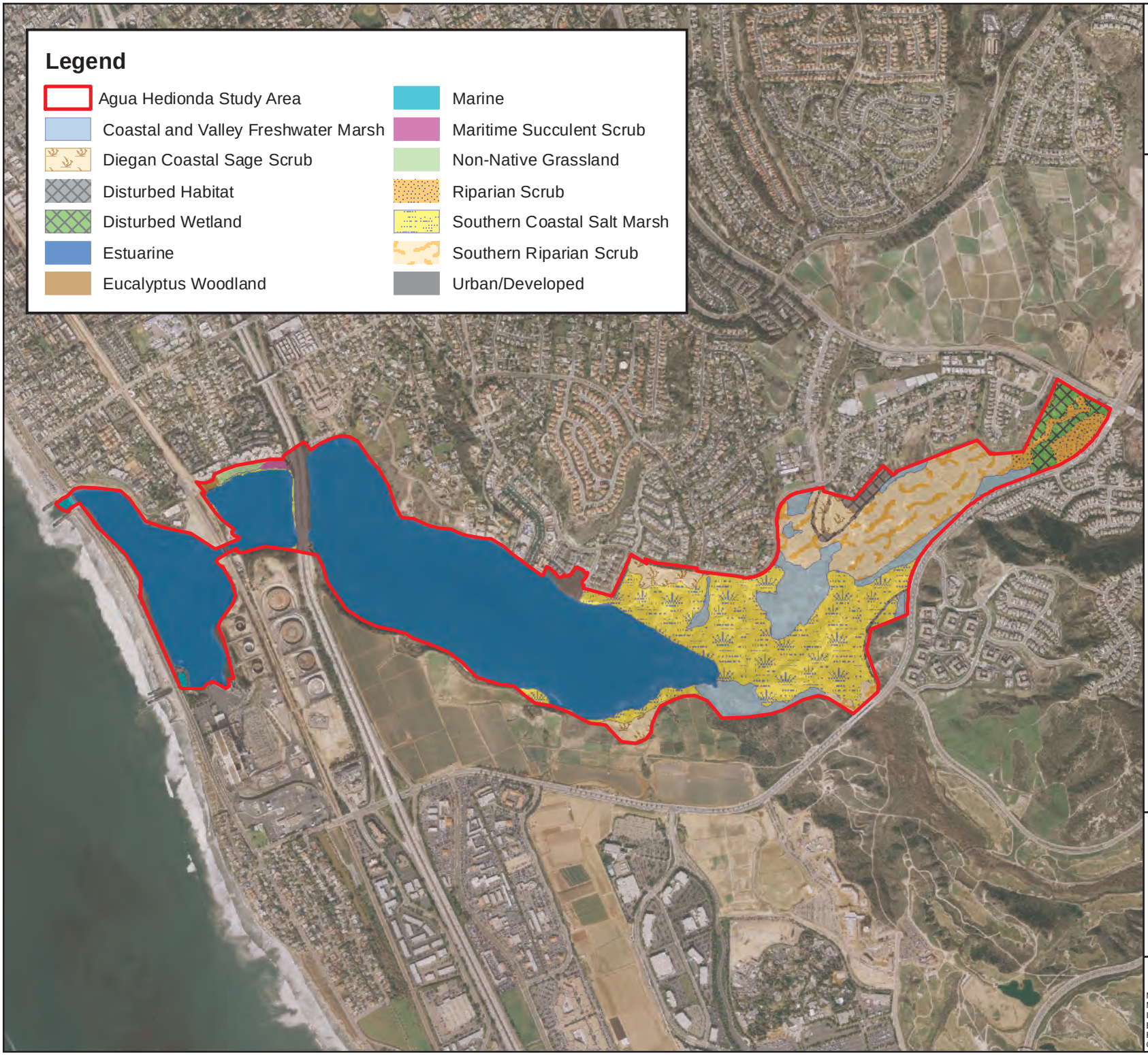

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Figure 3-4.
Vegetation Communities within the Study Area

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Feet

Map Date: Sept 09
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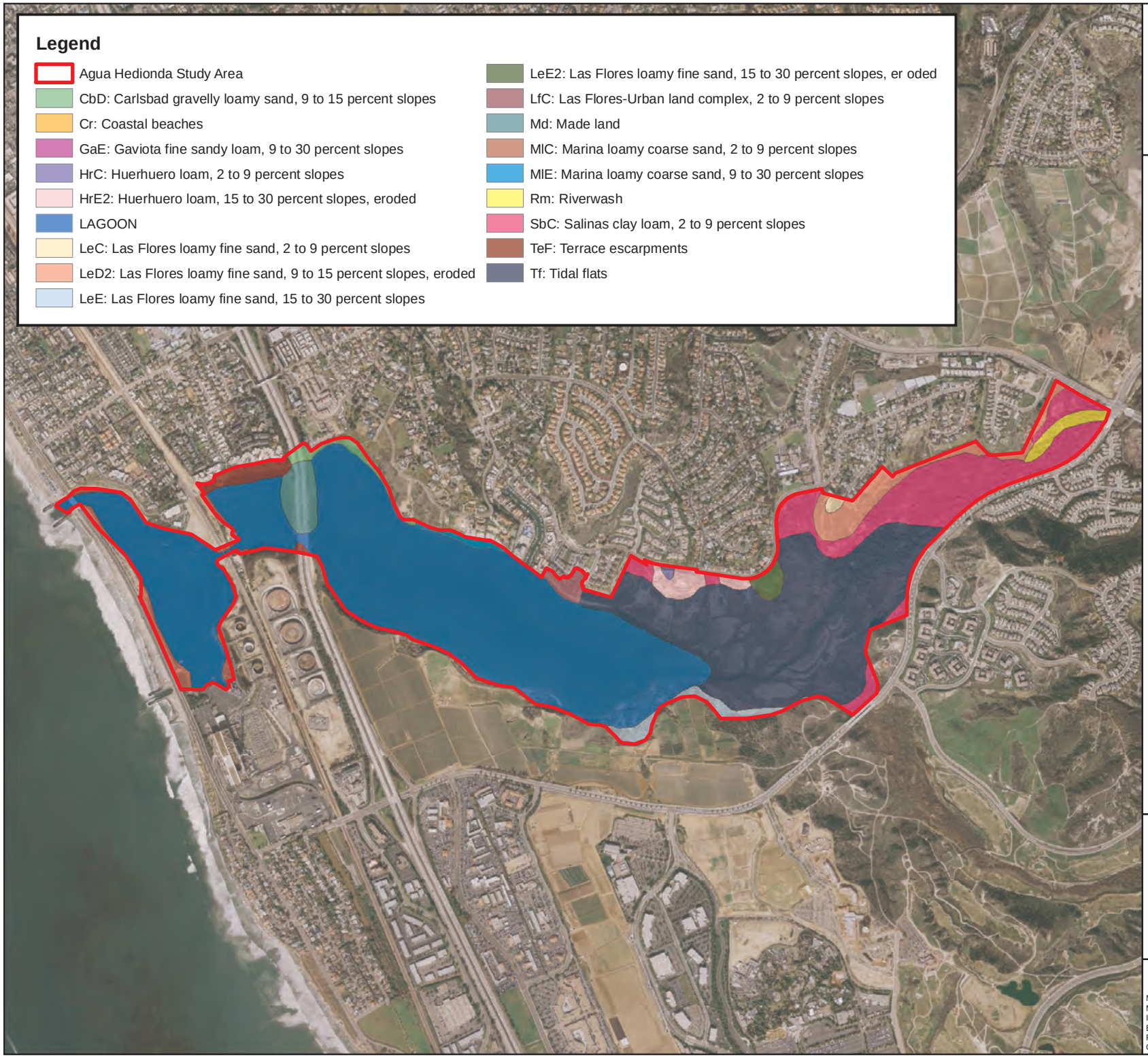

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Agua Hedionda Lagoon
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Figure 3-5.
Soils Map

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Feet

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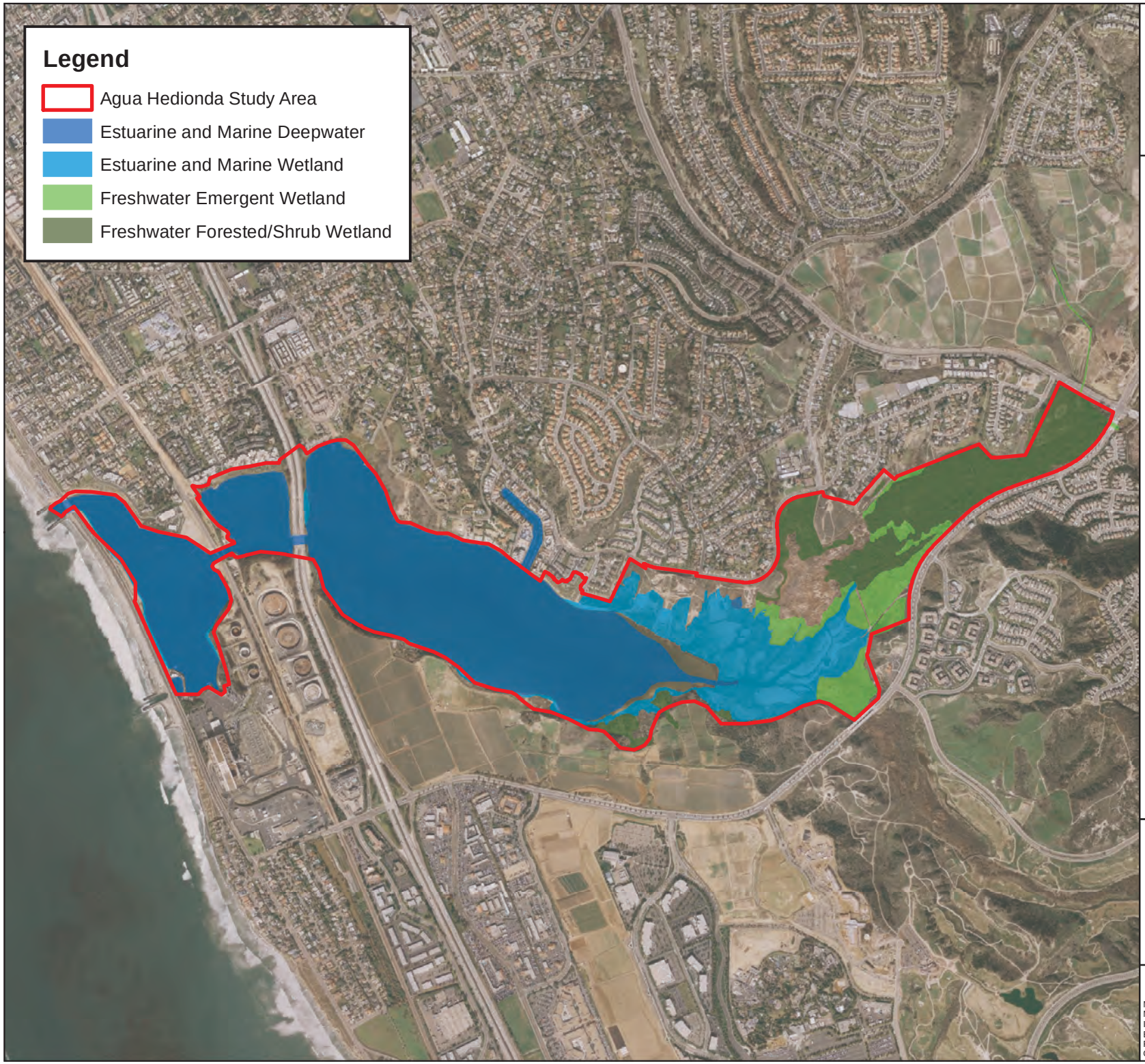

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Agua Hedionda Lagoon
San Diego County,
California

Figure 3-6.
NWI Data (May 2002)
within the
Study Area

N
W E
S

0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\
GIS\ArcMap\Agua Hedionda\NWI.mxd

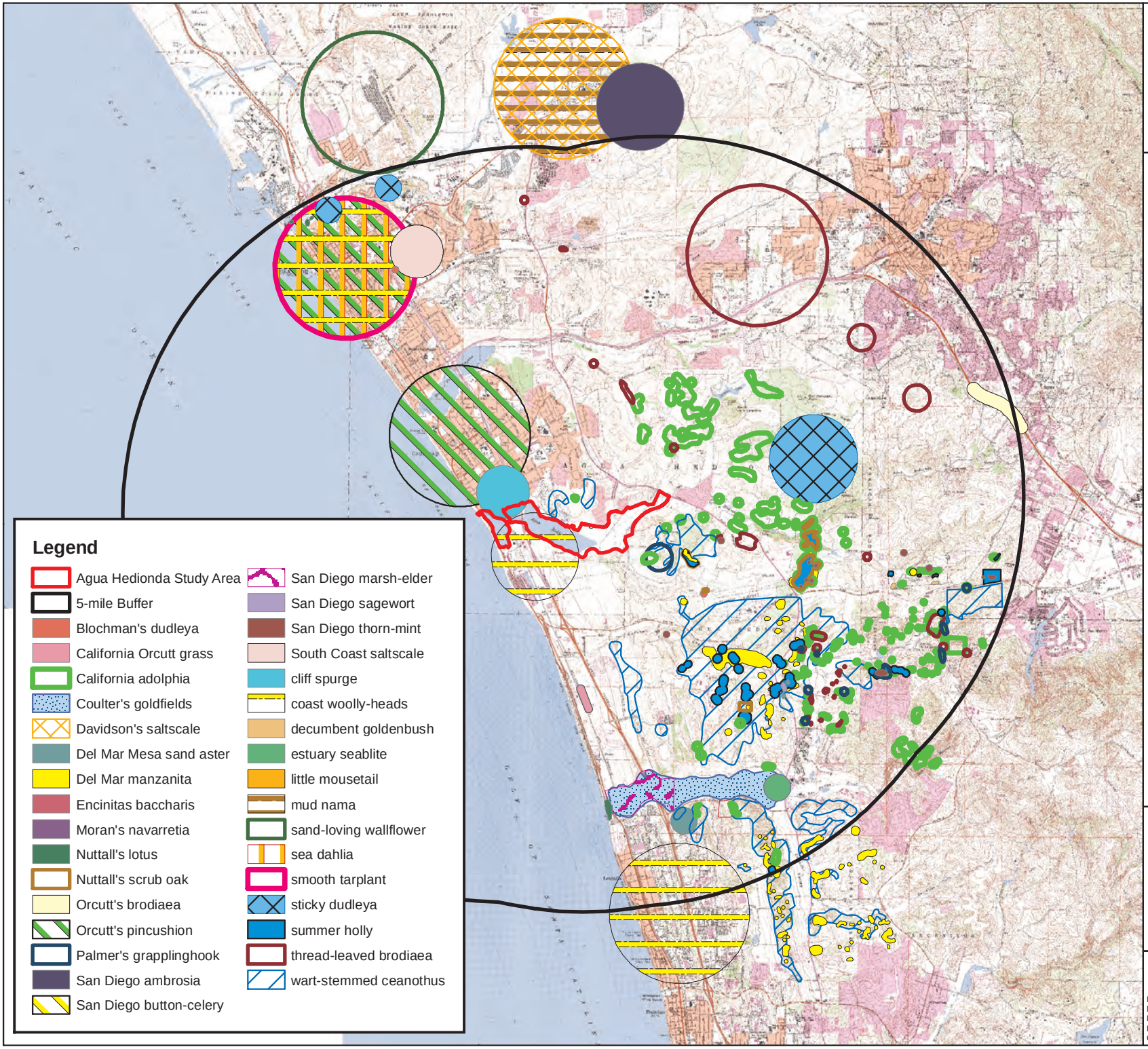

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Figure 3-7.
Special Status Plant Species within 5-mile Radius of the Study Area

N
W E
S

0 0.5 1 2
Miles

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Agua Hedionda\CNDDBPlant.mxd

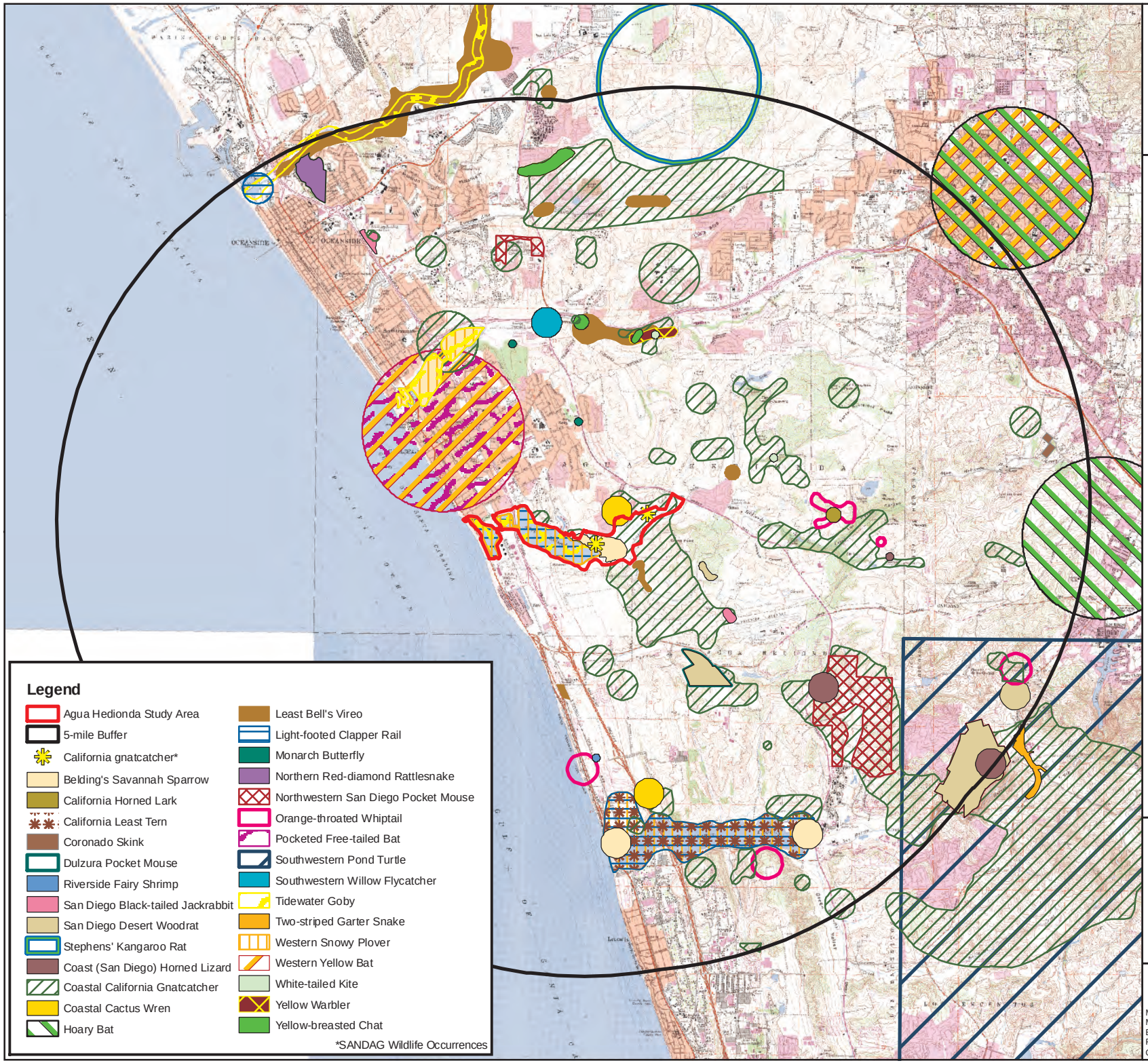

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Figure 3-8.
Special Status Animal Species within 5-mile Radius of the Study Area

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Agua Hedionda\CNDDBAnimal.mxd

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Figure 3-9.
California Coastal Gnatcatcher Critical Habitat

N
W E
S

0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Agua Hedionda\FEMA.mxd

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Figure 3-10.
Potential Restoration Areas

N
W E
S

0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Agua Hedionda\RestorationAreas.mxd

4.0 BATIQUITOS LAGOON

The Batiquitos Lagoon Study Area (Study Area) is comprised of an approximately 600-acre coastal lagoon and adjacent undeveloped lands located in the City of Carlsbad in San Diego County, California (Figure 4-1). It is bounded by Pacific Coast Highway/Carlsbad Boulevard on the west, La Costa Avenue on the south, El Camino Real on the east, and Batiquitos Drive and the Aviara Community to the north. The lagoon is the discharge point for San Marcos Creek and Encinitas Creek, and the majority of the Study Area is a CDFG ecological reserve.

Batiquitos Lagoon has undergone a major wetland restoration project; however, opportunities for further restoration have been studied. Details on the lagoon and these potential restoration opportunities are provided in the following sections.

4.1 PHYSICAL SETTING

4.1.1 Historical Profile

Over the past 5,000 years, persistent flows entering from San Marcos Creek and other tributaries discharged sediments and scoured the lagoon's substrate, while wave and tidal influence from the Pacific Ocean shifted coarse sediments at the lagoon's outlet. These processes created a long, narrow open water feature with tidal marsh habitat on the northern and southern borders, and an opening at the mouth of the lagoon that was periodically but infrequently closed to tidal action due to blockage by sand and gravel. With the arrival of Europeans, transportation corridors, agriculture, and other development, the ecological regime of the lagoon and the surrounding watershed changed. A large portion of the eastern basin of the lagoon was diked and used as salt evaporation ponds for approximately 10 years in the early 1900s. In the late 1960s and 70s, treated wastewater was discharged into the lagoon, and the mouth began to close more frequently due to deposition of sediment in the lagoon from erosion caused by major modifications within and surrounding the lagoon (City of Carlsbad 1989).

As a result of such major modifications in a relatively short period of time, the lagoon began to show signs of eutrophication, sedimentation, and ecological degradation to the point that natural habitats were confined to supporting only a small suite of native species (City of Carlsbad 1989). In an effort to re-establish historic hydrological and ecological processes, and as mitigation for work conducted by the Port of Los Angeles, restoration of the lagoon was conducted in the early 1990s and is described in more detail in Section 4-6 below. Post-restoration monitoring of the ecological processes of the lagoon show a marked increase in biological diversity, and sustained tidal influence throughout the lagoon (M&A 2009).

4.1.2 Surrounding Land Uses

El Camino Real and commercial and residential lands are to the east of the lagoon. A golf course, agricultural lands, and additional residential development are to the north. La Costa Avenue lies along the southern edge of the lagoon and separates the lagoon from steep bluffs. The area south of La Costa Avenue includes open land and residential development. I-5, Carlsbad Boulevard, and South Carlsbad State Beach are to the west.

4.1.3 Topography and Bathymetry

The Study Area consists of a narrow estuary surrounded by gentle to relatively steep hillsides and coastal bluffs. The most prominent landforms within and adjoining the project site include the following:

- Beach area located to the north and south of the lagoon mouth
- Steep south-facing bluffs along La Costa Boulevard to the south and more gradual slopes to the north
- Tidal basin in the CDFG Ecological Reserve
- Newly created tidal marsh and mudflat habitats east and west of I-5
- Three newly created nesting sites for shorebirds within the east basin

The lagoon is divided by several transportation corridors into eastern, central and western basins. In the larger eastern basin, post-restoration (1996 as-built) depths extended to -8 feet MLLW along a channel extending from the San Marcos Creek outlet to the I-5 underpass. Over the 10-year restoration monitoring period, sedimentation, presumably from major storm events, has filled the eastern end of the east basin and lagoon depths there have risen by 2 to 4 feet. The central and west basins restoration as-built depths generally extended to -8 feet as well, with some deeper pools at the I-5 crossing. Soon after restoration (2000), flood shoals began to develop in these basins from tidal action, bringing portions of the basins up by 2 feet or more (M&A 2009). Dredging of each of the basins has influenced the bathymetric profile of the lagoon, but according to M&A, more frequent and consistent dredging would be required to regain as-built depths and the resulting tidal prism.

4.1.4 Surrounding Transportation Systems

Major components of the transportation systems in the vicinity of the lagoon consist of the following:

- La Costa Boulevard, a two-lane road bordering the southern end of the Study Area;
- Avenida Encinas, which provides access to residential roads to the northwest of I-5 adjacent to the Study Area
- Batiquitos Drive, which provides access to other residential two-lane roads to the north of the Study Area
- El Camino Real, a four-to -two lane road along the eastern side of the Study Area
- The NCTD railroad, which traverses the west end of the lagoon, separating the west and central basins
- Coast Highway/ Highway 101, which separates the west basin and the beach; and
- I-5, which traverses the central part of the lagoon, separating the central basin and the east basin

4.1.5 Utilities

A major sewer trunk line runs along La Costa Boulevard, with a pump station located on the southern edge of the eastern basin. According to the restoration project's EIR (City of Carlsbad 1989), the following utilities occur in or adjacent to the Study Area:

- A 12-inch-diameter high-pressure natural gas line attached below the Carlsbad Boulevard bridge,
- A 15-foot telephone easement exists 25 feet east of the high-pressure gas line,
- Power lines run along the railroad berms, and
- An ocean outfall pipeline is located at the Encinitas Creek beach nourishment site.

4.1.6 Storm water Discharges

Storm water discharges into various locations within the Study Area. Local surface drains discharge to the Lagoon from I-5, La Costa Boulevard, El Camino Real, and residential streets adjacent to the lagoon. Caltrans has constructed a storm water basin adjacent to the La Costa

exit ramp off I-5. This storm water basin has been designed to treat storm water from I-5 prior to discharge into the lagoon. Another significant storm water outfall is located on the northern portion of the eastern basin that discharges storm water from the Aviara community and golf course detention basin. Storm water discharges also occur in the northeastern corner of the eastern basin from the developments bordering Alga Boulevard.

4.2 OWNERSHIP

Land ownership as recorded by the SANGIS is shown in Figure 4-2. The State of California (CDFG) and the State of California Lands Commission are the only two public entities holding land ownership in the Study Area. Several private entities own parcels in the Study Area.

4.2.1 Land Use within Study Area

The predominant land use within the Study Area is an ecological reserve under the direction of CDFG. While the Reserve is not open for public use, trails along the northern edge of the eastern basin are used for recreational purposes and an Interpretive Center operated by the Batiquitos Lagoon Foundation (the Foundation) is located there. A relatively small parcel of land in the northeast portion of the Study Area is used for agricultural production.

4.3 HYDROLOGY

The Batiquitos Lagoon watershed is approximately 52 square miles and is drained by three stream systems that empty into the eastern end of the lagoon. San Marcos Creek is a major tributary, with headwaters in the coastal mountain range to the northeast of the city of San Marcos, and is dammed at Lake San Marcos within 5 miles of the lagoon. An unnamed tributary joins San Marcos Creek less than 1 mile upstream of the lagoon, and this small tributary drains a small area to the northeast. Encinitas Creek enters the lagoon under La Costa Avenue, draining lands to the southeast. Additionally, water levels in the lagoon are controlled by tidal waters entering and exiting through the lagoon's outlet.

4.3.1 Flood and River Data

According to data presented in the Batiquitos Lagoon Enhancement project EIR/EIS (City of Carlsbad 1989), total average runoff for 6-hour storms for several return periods was estimated in 1989. The total 2-, 5- and 100-year return is 1,147, 1,428, and 2,423 cfs, respectively; Figure 4-3 shows the extent of the Study Area subject to 100-year events.

4.3.2 Tidal Data

The mean tide range in the Pacific Ocean nearest this location is about 3.7 feet, with the lowest annual tide at about -2.0 feet MLLW and the highest annual tide about 7.8 feet MLLW (USACE 1989, 1990). MLLW is 2.75 feet below mean sea level. The diurnal range is 5.4 feet while the extreme range is near 10 feet. A table showing the mean tide levels at the La Jolla tide station is included in Appendix B.

Tidal surveys in 1997 by Moffatt and Nichol and in 2008 by M&A indicate that, as with similar systems in the area, there is significant tidal lag and tidal muting of the low tide, due in part to the "pinch points" at transportation corridor crossings and increased sediment accumulating in the lagoon's basins. In the 2008 study, tide levels were comparable between the lagoon and ocean during high tides, but the lagoon remained 1 foot MLLW higher as tides receded. Tidal lag was observed during both high and low tides. The tidal range of the eastern basin was observed to be 92 percent of the mean tidal range of the ocean in the 1997 study and 84

percent in the 2008 study (Moffatt and Nichol 1997; M&A 2009). An example of the ecological implications of tidal muting and lag has been observed in the displacement of middle marsh habitat by vegetation typical of low marsh communities in the east basin over time (M&A 2009).

4.4 BIOLOGICAL INFORMATION

Extensive biological data has been collected on Batiquitos Lagoon over the years and is beyond the scope of this brief synopsis to provide in detail. The Batiquitos Lagoon Long-term Biological Monitoring Program Final Report (Final Monitoring Report, M&A 2009) is the most recent data available for the Batiquitos Lagoon restoration area, which covers the majority of the Study Area. This final report summarizes the status of avian, fish, benthic, and vegetation communities, as well as the evolution of physical processes and results of a pilot eelgrass restoration project in the restored area.

Overall vegetation maps, soil maps, sensitive species occurrences, and critical habitat areas for the vicinity of the Study Area are provided in Figures 4-4 through 4-10.

4.4.1 Regional Habitat and Species Conservation Planning

The Study Area lies within the City of Carlsbad and City of Encinitas subareas, and therefore is subject to the Habitat Management Plans (HMPs) associated with the MHCP for those cities. The HMP for the City of Carlsbad, which describes conservation strategies and implementation processes to comply with the umbrella MHCP, was approved in 2003. The HMP for the City of Encinitas has not been finalized, but the City generally follows the methods outlined in the draft HMP and MHCP when evaluating projects within its jurisdiction (Westbridge Capitol, LLC 2009).

Batiquitos Lagoon is within the MHCP “hardline” preserve area, which refers to lands that will be conserved and managed for biological resources under the MHCP. The lagoon is also considered within the City of Carlsbad “Core 8” focused planning area and in The City of Encinitas “hardline area,” indicating 100% conservation of open space.

4.4.2 Biological Communities

The Final Monitoring Report provides a detailed inventory of the most recent biological community mapping and assessment efforts at Batiquitos Lagoon. The following 16 biological communities were documented using aerial photo interpretation, GIS processing, ground truthing, and transect monitoring during restoration monitoring (1995–2006):

Open water (including eelgrass) (233.8 acres)	Intertidal sand beach/shoal (15.9 acres)
Nesting site (32.7 acres)	Intertidal mudflat (44.7 acres)
Eelgrass bed (79.3 acres)	Salt panne (16.1 acres)
Southern coastal salt marsh (pickleweed dominated) (118.2 acres)	Southern coastal salt marsh (cordgrass dominated) (52.9 acres)
Brackish marsh (14.3 acres)	Goldenbush saline meadow (6.6 acres)
Southern willow scrub (14.1 acres)	Freshwater marsh (40.2 acres)
Diegan coastal sage scrub (29.1 acres)	Tamarisk scrub (0.4 acres)
Eucalyptus woodland (5.6 acres)	Disturbed upland (14.7 acres)

The remaining habitats within the Study Area that were not surveyed during restoration monitoring consist mostly of mowed agricultural lands. Vegetation data collected from multiple

sources through the SANGIS map library (SANGIS 2007) is shown in Figure 4-4, but does not reflect the acreages of biological communities mapped in more detail for the lagoon restoration monitoring. A list of species observed during Phase I Study site visits is included in Appendix C.

4.4.3 Special-Status Species

While post-restoration monitoring has focused on a handful of special-status species, there are many federally- and state-listed species that utilize the lagoon or occur in its vicinity. Those species recently documented by restoration monitoring efforts, as well as those recorded as occurring within the vicinity of the lagoon through the CNDDB, are described in the following sections.

4.4.3.1 Wildlife

Extensive biological monitoring of fauna has been conducted in Batiquitos Lagoon by M&A. Several special-status species have been documented to utilize the lagoon for various aspects of their life history. Critical habitat has been designated for the snowy plover (Figure 4-9) in three locations within the lagoon, and for the coastal California gnatcatcher (Figure 4-10) in the northern portion of the Study Area. Appendix D provides a list of special-status species that are documented to occur within a 5-mile radius of the Study Area and utilize habitat types similar to those found within the lagoon. State and federally listed threatened or endangered species that utilize the lagoon for critical portions of their life history (such as breeding) are mentioned below.

Belding's savannah sparrow has been consistently observed at Batiquitos Lagoon as breeding pairs and as year-round residents. Recent population studies conducted by M&A documented 247 individuals and 52 pairs during a survey in April 2006. This number is up significantly from previous year's surveys. The increased numbers are attributed to restoration work done within the lagoon that helped increase the health and size of salt marsh habitat, particularly pickleweed, which is a major habitat component for this species (M&A 2009). Any additional salt marsh creation and enhancement or increase in the tidal prism would serve to benefit the required habitat for this species.

The light-footed clapper rail has been well documented to occur in Batiquitos Lagoon as a small but increasing breeding population since at least the early 1990's. M&A documented an increase in breeding pairs within the lagoon; a steady increase in breeding pairs has occurred since 2001 when two pairs were detected, up to 19 pairs in 2006. The increase in breeding pairs is attributed to transplants of the species' preferred habitat, Pacific cordgrass, which has expanded (M&A 2009). Any additional salt marsh creation, or increases made to the tidal prism will benefit this species.

The western snowy plover is a federally threatened species that has designated critical habitat in three separate areas that occur throughout the Study Area. M&A documented varying success rates of snowy plover reproduction within the lagoon. A total of16 nests were detected during a 2006 survey (M&A 2009).

The California least tern, a federal and state endangered species, nests in Batiquitos Lagoon. This species requires very specific sandy areas with friable soils that are generally free of vegetation for nesting. Several nest sites were constructed in Batiquitos Lagoon to help support this species. M&A documented that, following the construction of the nest sites, nesting numbers rose to 200 nests from less than 100, where they remained until a sharp increase in 2003 (documented around 600). While the nest sites appear to be successful and have contributed to least tern reproduction, nest site E-2, in the northeast portion of the Study Area has had no documented reproductive activity (nesting, egg laying, etc.) since 1999 (M&A 2009).

4.4.3.2 Plants

The following five special-status plant species are documented to occur within or immediately adjacent to the Study Area and are presumed extant: Nuttall's lotus (*Lotus nuttallianus*), Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*), California adolphia (*Adolphia californica*) , estuary seablite (*Suaeda esteroa*), San Diego marsh-elder (*Iva hayesiana*) (CDFG 2009). CNDDB records indicate occurrences of 27 additional special-status species within 5 miles of the Study Area (CDFG 2009). A list of all special-status plant species documented in the vicinity of the Study Area can be found in Appendix D, and a figure depicting the approximate location of those occurrences is included as Figure 4-7.

4.4.4 Invasive Plants

Several weedy species occur throughout the Study Area, the most invasive of which is generally found along the periphery of the lagoon on more disturbed, ruderal lands (M&A 2009, Carlsbad Watershed Network 2002). Nonnative plants that are invading some upland areas, especially in the northeastern portion of the Study Area, include pampas grass (*Cortaderia selloana*), fan palm (*Washingtonia robusta*), and giant cane (*Arundo donax*). The report on the Restoration of Riparian/Wetlands Habitat in the Carlsbad Hydrologic Unit by the San Elijo Conservancy (SLC 2007) describes the distribution of weedy species in the San Marcos Creek watershed and provides control measures to manage populations in the future.

4.5 RESTORATION ACTIONS IN STUDY AREA

4.5.1 Past Restoration Activities in Study Area

In 1987, a Memorandum of Agreement was signed between five federal and state resource agencies and the Port of Los Angeles to establish the Batiquitos Enhancement Project. The purpose of the Enhancement Project was to “re-establish marine resources in the lagoon through the restoration of tidal flushing” and to act as mitigation for work conducted by the Port of Los Angeles (Port of Los Angeles 2009). The primary action taken was the construction of a new tidal inlet and Pacific Coast Highway bridge, the construction of five tern/plover nesting islands, and the excavation of nearly 3 million cubic yards of sediment (1.5 million of which were used for beach nourishment) to improve the overall tidal prism. Other activities included planting of salt marsh vegetation, including cordgrass (*Spartina foliosa*), pickleweed (*Salicornia virginica*), and the submerged aquatic plant, eelgrass (*Zostera marina*). In 1989, construction for these restoration actions began, and final construction was completed in 1996. The history and process of the Batiquitos Enhancement Project has been well-documented by the Port of Los Angeles on their website (Port of Los Angeles 2009). An EIR/EIS for the project was also published by the City of Carlsbad and the USACE, which provides extensive background information (City of Carlsbad and USACE 1989).

With restoration of tidal flushing as the key component of the Enhancement Project, the lagoon ecosystem was dramatically altered to the benefit of biodiversity and native species habitat. According to the final mitigation monitoring report for the 10-year restoration monitoring period, there has been a significant increase in fish and invertebrate community structure, stability of benthic invertebrate populations, and shorebird species diversity (M&A 2009). Whereas salt pannes dominated the lagoon prior to restoration, the lagoon now supports a more diverse mix of vegetation communities, including almost 100 acres of eelgrass habitat. Pressures such as non-point source pollution and urban runoff still threaten the health and stability of the lagoon, but formal mitigation monitoring has ended and the lagoon restoration has been considered a success.

4.5.2 Future Restoration in Study Area

The Foundation, a non profit organization formed in part "to help conserve, restore and enhance the environmental and aesthetic features of Batiquitos Lagoon," and CDFG engage in ongoing trail maintenance and open space management. The Foundation recently acquired an 18-acre property adjacent to the Study Area and began establishment of an open space easement and public access trails. Some restoration associated with this acquisition may be implemented in upland areas (F. Sandquist, pers. comm.).

4.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, eight potential restoration areas were identified within Batiquitos Lagoon (Figure 4-11). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Details on the methodologies employed have been described in Section 1.3 of this report.

4.6.1 Conventional Restoration

4.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration exist between portions of the Aviara community and golf course and the tidal marsh on the northern side of the lagoon, corresponding to sites BL-5, BL-6, and BL-8 in Table 4-1 below. Eucalyptus trees and other nonnative weedy species dominate this area, and a public access trail winds its way through the trees. At the northwestern end of the east basin, the trail could potentially be relocated up the slope and the existing trail converted to wetland. This area is low relative to the gentle slopes of the golf course, and excavation of soils in this area would be minimal to introduce tidal action. This area can be accessed by heavy equipment with little disturbance to native vegetation and is in public ownership. Some portions may be within CCC or USACE jurisdiction, and a wetland delineation would be required to confirm this before any planning occurs.

A privately owned parcel in the northern portion of the Study Area (BL-3) may provide an excellent opportunity for conventional wetland restoration, although this site was not traversed on foot during field surveys, as permission to access it was not given by the landowner. The site appears to be managed for grazing and, thus, does not support high-quality native habitats. However, the site may receive flooding during high tides or storms, and a wetland delineation would be required to confirm the presence or absence of wetlands. The site adjacent to the agricultural land (BL-1) has a small berm feature that may be excavated to a level that would allow the establishment of wetland conditions.

A summary of the wetland restoration potential for each of the sites evaluated within the Batiquitos Study Area is provided in Table 4-1 and photographs are included in Appendix E. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in the Appendix A.

Table 4-1. Mitigation Potential in the Batiquitos Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments
BL-1	2	91.4	Site has a low berm-like feature that could be converted to wetlands, although the surrounding habitat appears to be good quality transitional habitat and some areas may

			be within USACE, CCC, and/or CDFG jurisdiction.
BL-2	N/A	N/A	Site is a human-made sensitive bird species nesting island and is in snowy plover Critical Habitat. Site could be excavated 4-5 feet to be subject to tidal influence, but additional nesting habitat would need to be created. Credit for enhancement may be possible for invasive weed removal.
BL-3	1	60	Site is on private property, no access granted for survey. Area is mowed or grazed and may be easily excavated to promote tidal action. A closer site survey and delineation would be required.
BL-4	4	74.3	Area consists of tidal salt panne and transition zone; most of the site is jurisdictional and subject to high tide inundation, but there are small areas that may benefit from restoration.
BL-5	2	42.9	Majority of site is dominated by non-native upland species; however, a jurisdictional delineation would be required to confirm jurisdiction under Section 404 and the Coastal Act. Site could be easily excavated to introduce tidal action.
BL-6	1	45.7	Majority of site is dominated by non-native upland species; some portions may be in CCC jurisdiction. Site could be easily excavated to introduce tidal action.
BL-7	N/A	N/A	Site appears to support planted native wetland and riparian species, likely suitable for habitat restoration. Little disturbance and good quality habitat.
BL-8	2	28.6	Site is primarily a compacted public access trail surrounded by moderate quality transition habitat. Site could easily be excavated to introduce tidal action. There may be special-status species issues associated with riparian and scrub habitat nearby.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

4.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 1 or 2 is 12.6 acres.

4.6.1.3 Next Steps

As mentioned above, a jurisdictional delineation would be required for the sites that appear to offer the greatest opportunity for mitigation and restoration, particularly sites BL-1, BL-5, and BL-6. Coordination with the private property owner and a delineation at BL-3 would be needed to gain an estimate of the lands appropriate for wetland restoration or creation.

Further discussions with the Batiquitos Lagoon Foundation regarding potential acquisitions may yield information on mitigation opportunities in the vicinity of the Study Area.

4.6.2 Hydrodynamic Restoration

4.6.2.1 Opportunities and Constraints

The majority of the eastern basin has gently sloping edges confined within either trail systems or roads (e.g., La Costa Boulevard). If muting of the high tide is occurring through the I-5 bridge opening, any changes that would reduce that muting could result in greater excursion of the tide along the entire shoreline of the lagoon and, therefore, provide for increased tidal marsh habitat. The exact extent of such restoration is dependent upon the slopes adjoining the lagoon and the increase in the tidal height.

In addition, those areas identified as potentially providing opportunities for conventional restoration would also be candidate areas for hydrodynamic restoration. Sites BL-1, BL-3, BL-5, BL-6, and BL-8 do not appear to have effective barriers to tidal action, and an increased tidal prism introduced in the east basin of the lagoon due to modifications to the I-5 overpass could provide the appropriate conditions for wetland establishment in these areas. Some excavation may be necessary for hydrodynamic restoration, but likely less than for conventional restoration.

Site BL-4 may establish wetland conditions if subject to hydrodynamic modifications, although the wetland area gained would likely be minimal. The majority of the site is dominated by wetland plants; however, a small portion on the upland side of the site could establish wetland conditions due to increased tidal prism.

4.6.2.2 Potential Mitigation Acreage

Portions of the Study Area may establish wetland conditions if hydrodynamic modification to the lagoon is pursued as an approach to mitigation. By removing the tidal muting at the bridges, the high tide range could increase, inundating additional areas. This would extend to all areas of the lagoon regardless of whether they are within investigated restoration areas.

4.6.2.3 Next Steps

Further analysis is required of any changes that may occur with either an increased tidal prism or an enlarged tidal basin east of I-5.

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BATIQUITOS STUDY AREA FIGURES

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Batiquitos Lagoon
San Diego County,
California

Figure 4-1.
Aerial Site Map

N
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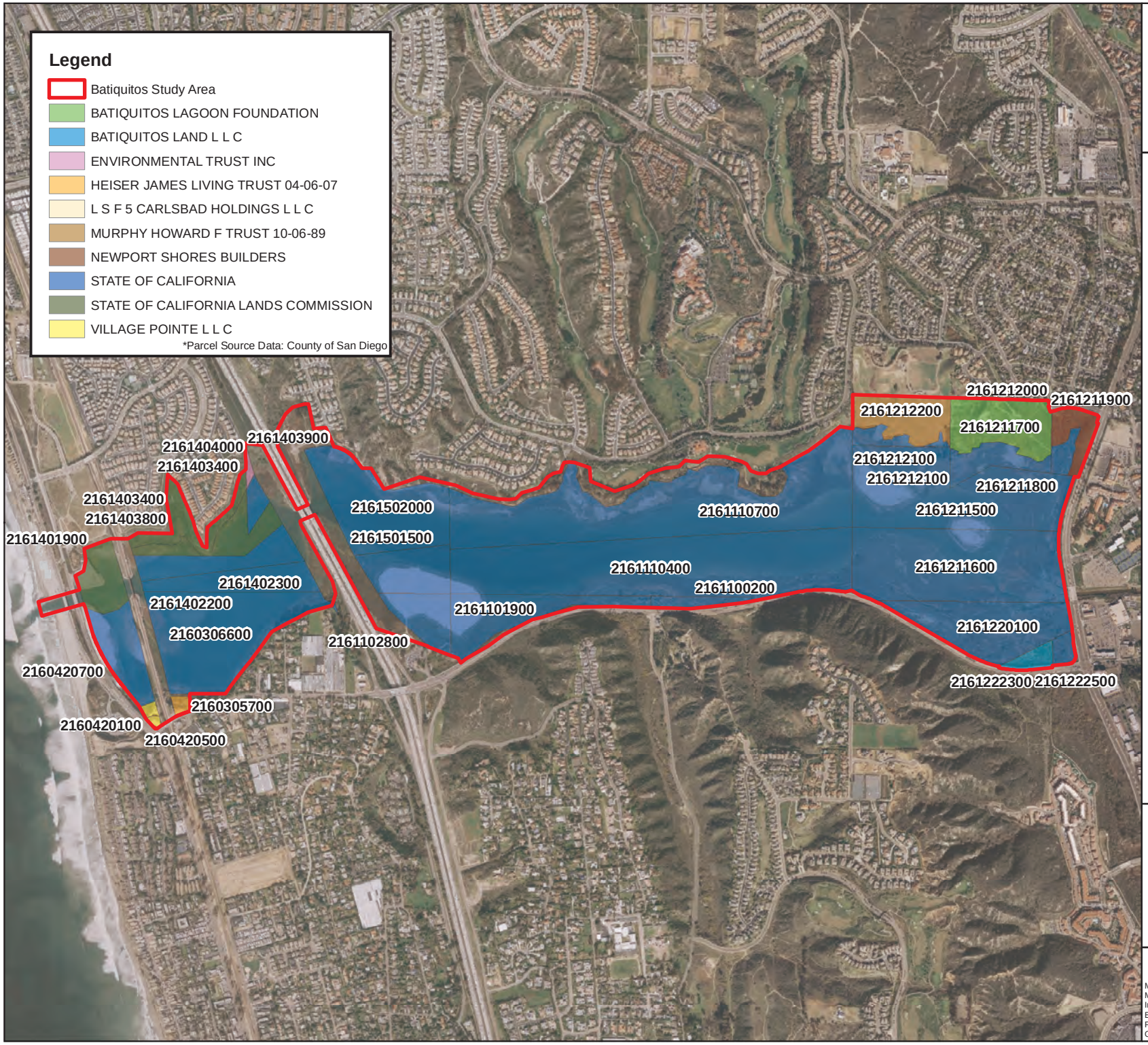
0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Aerial.mxd



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Batiquitos Lagoon
San Diego County,
California

Figure 4-2.
Parcel Owners within the Study Area

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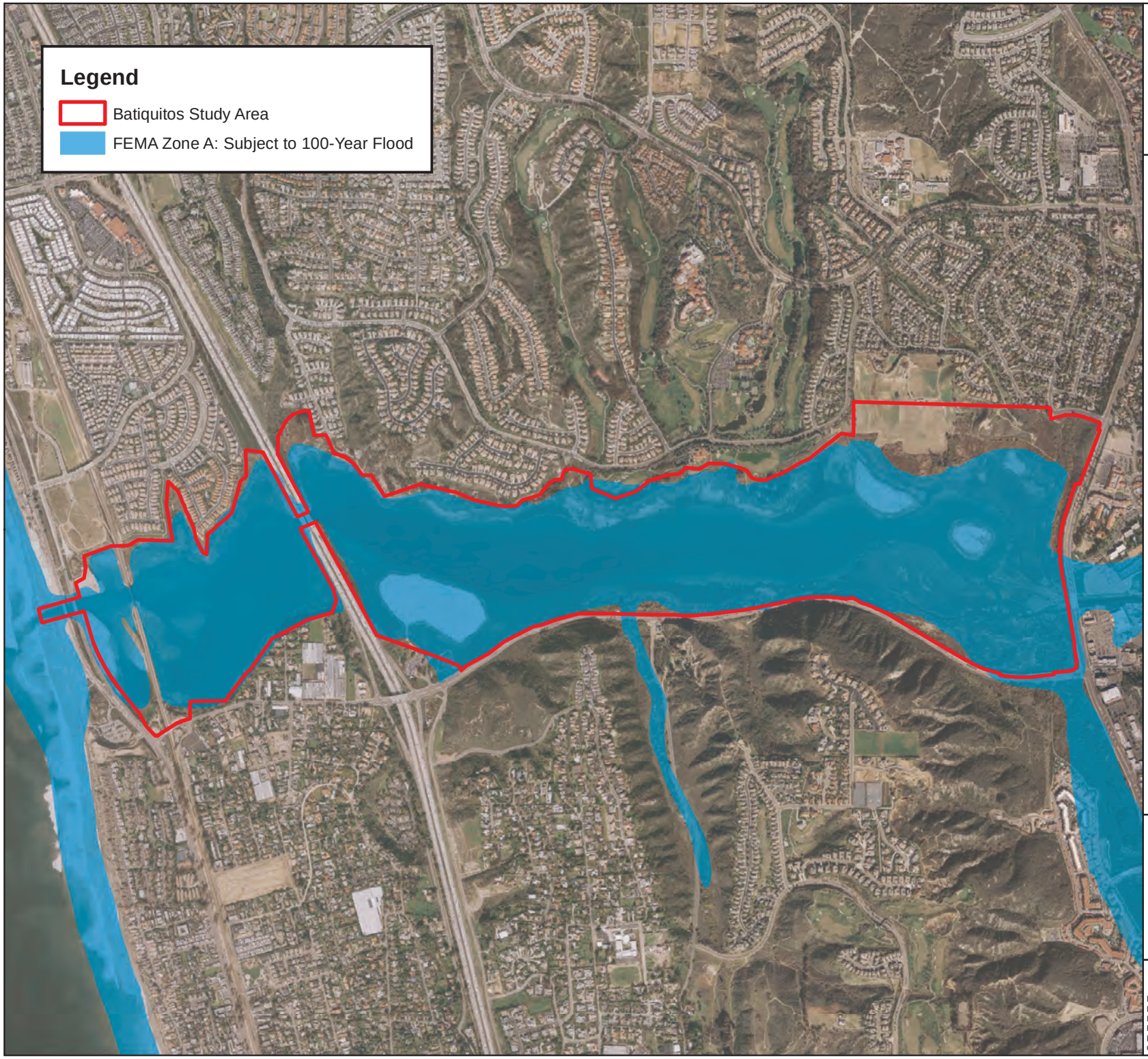
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Parcels.mxd



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Batiquitos Lagoon
San Diego County,
California

**Figure 4-3.
FEMA Zones
within the
Study Area**

N
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Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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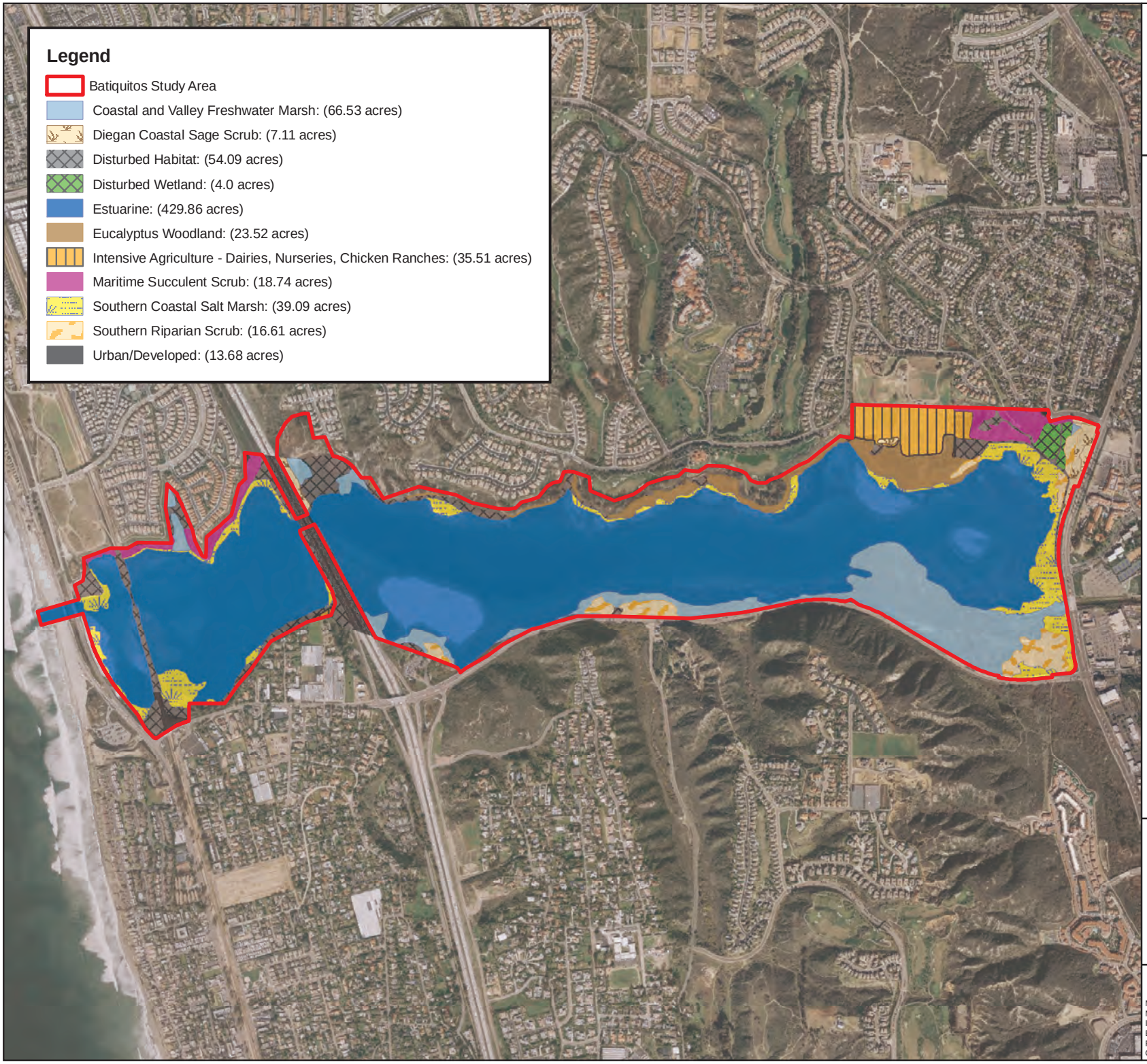

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Batiquitos Lagoon
San Diego County,
California

Figure 4-4.
Vegetation Communities within the Study Area

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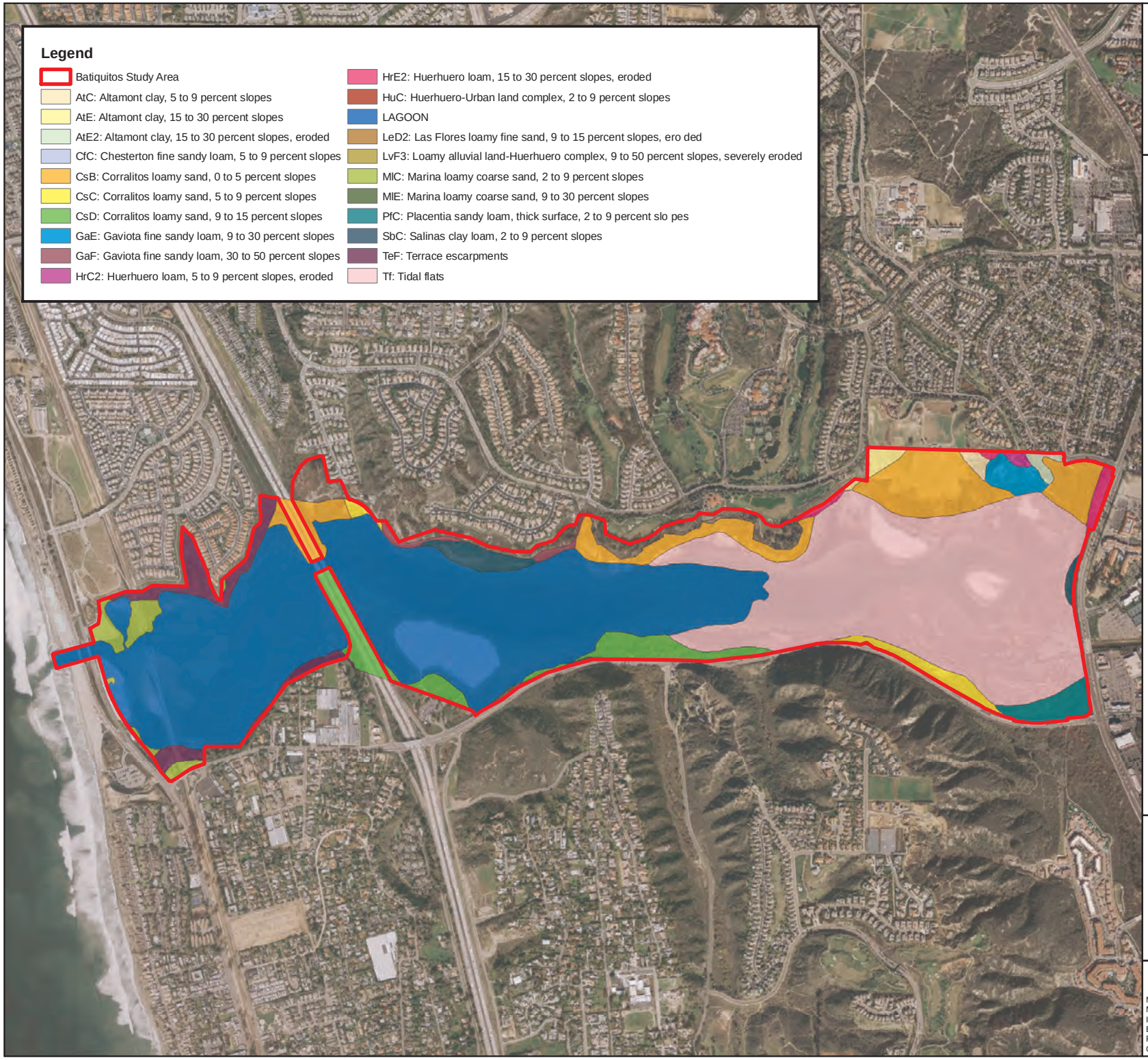
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Veg_Comm.mxd



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Batiquitos Lagoon
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California

Figure 4-5.
Soils Map

N
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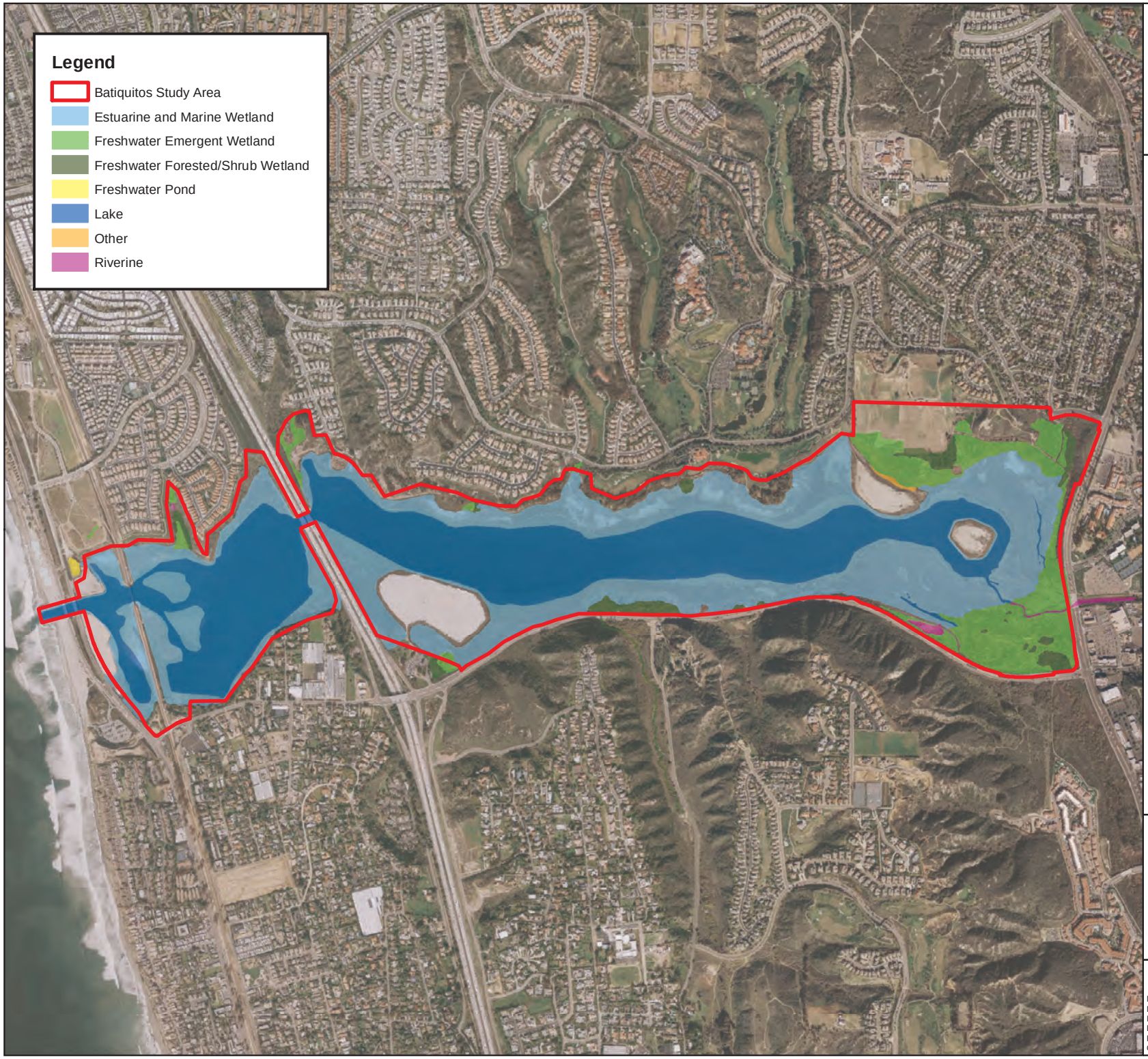
0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\
GIS\ArcMap\Batiquitos\Soils.mxd



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Batiquitos Lagoon
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Figure 4-6.
NWI Data (May 2002)
within the
Study Area

N
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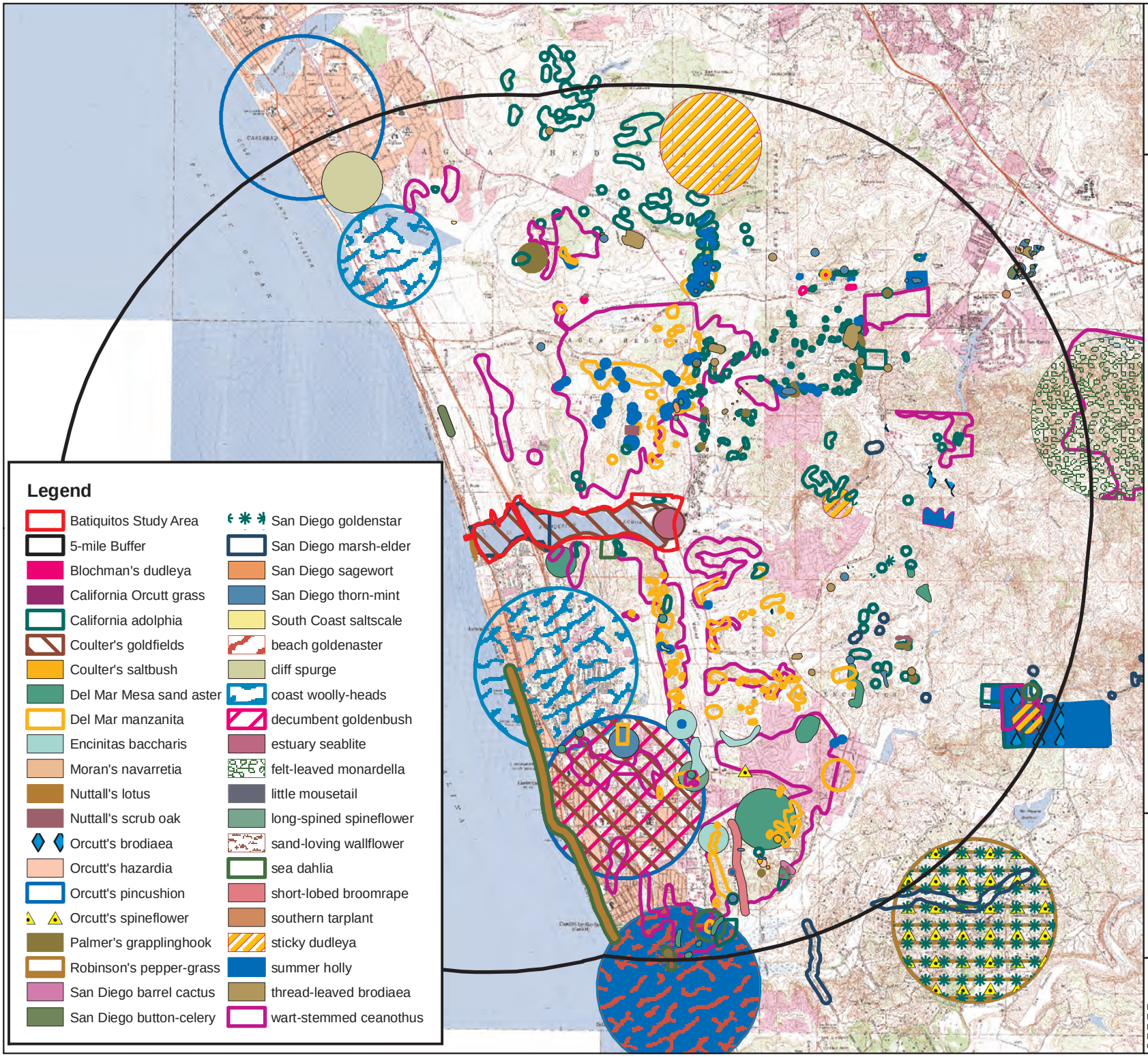
0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\
GIS\ArcMap\Batiquitos\NWI.mxd



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Batiquitos Lagoon
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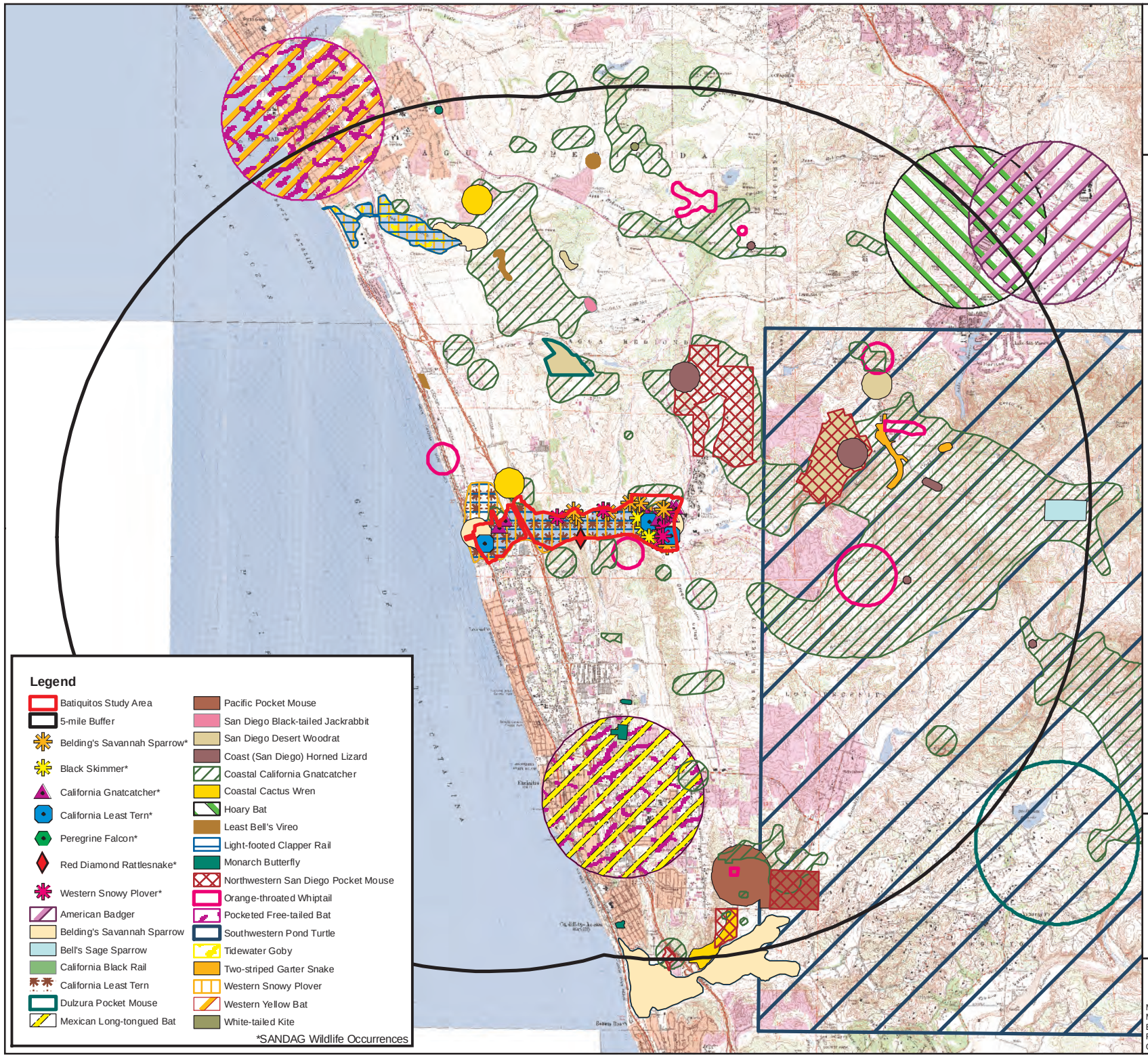
Figure 4-7.
Special Status Plant Species within 5-mile Radius of the Study Area

N
W E
S

0 0.5 1 2
Miles

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\CNDDBPlant.mxd



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Batiquitos Lagoon
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Figure 4-8.
Special Status Animal Species within 5-mile Radius of the Study Area

N
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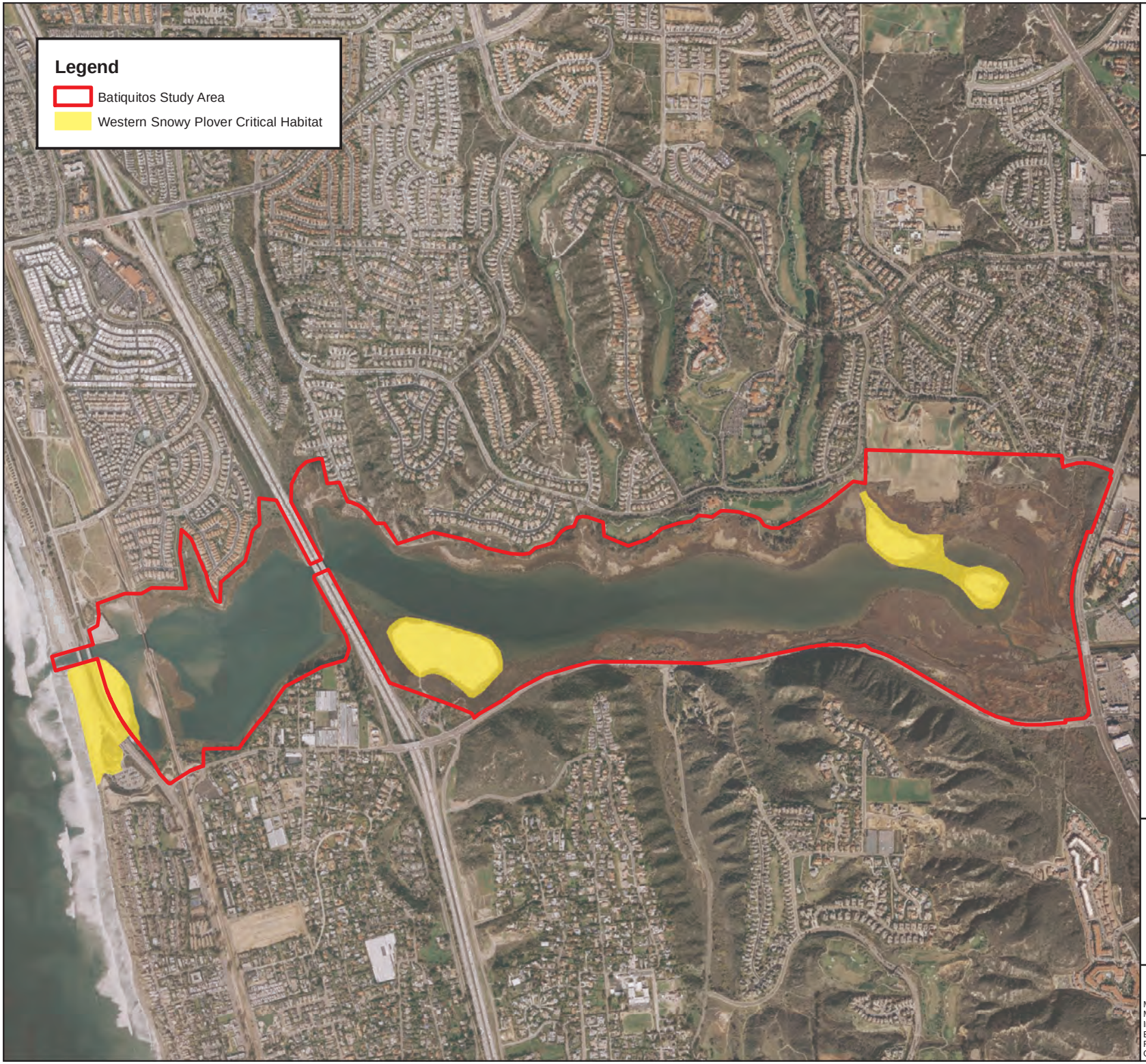
0 0.5 1 2
Miles

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\CNDDBPlant.mxd



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Batiquitos Lagoon
San Diego County,
California

Figure 4-9.
Western Snowy Plover Critical Habitat

N
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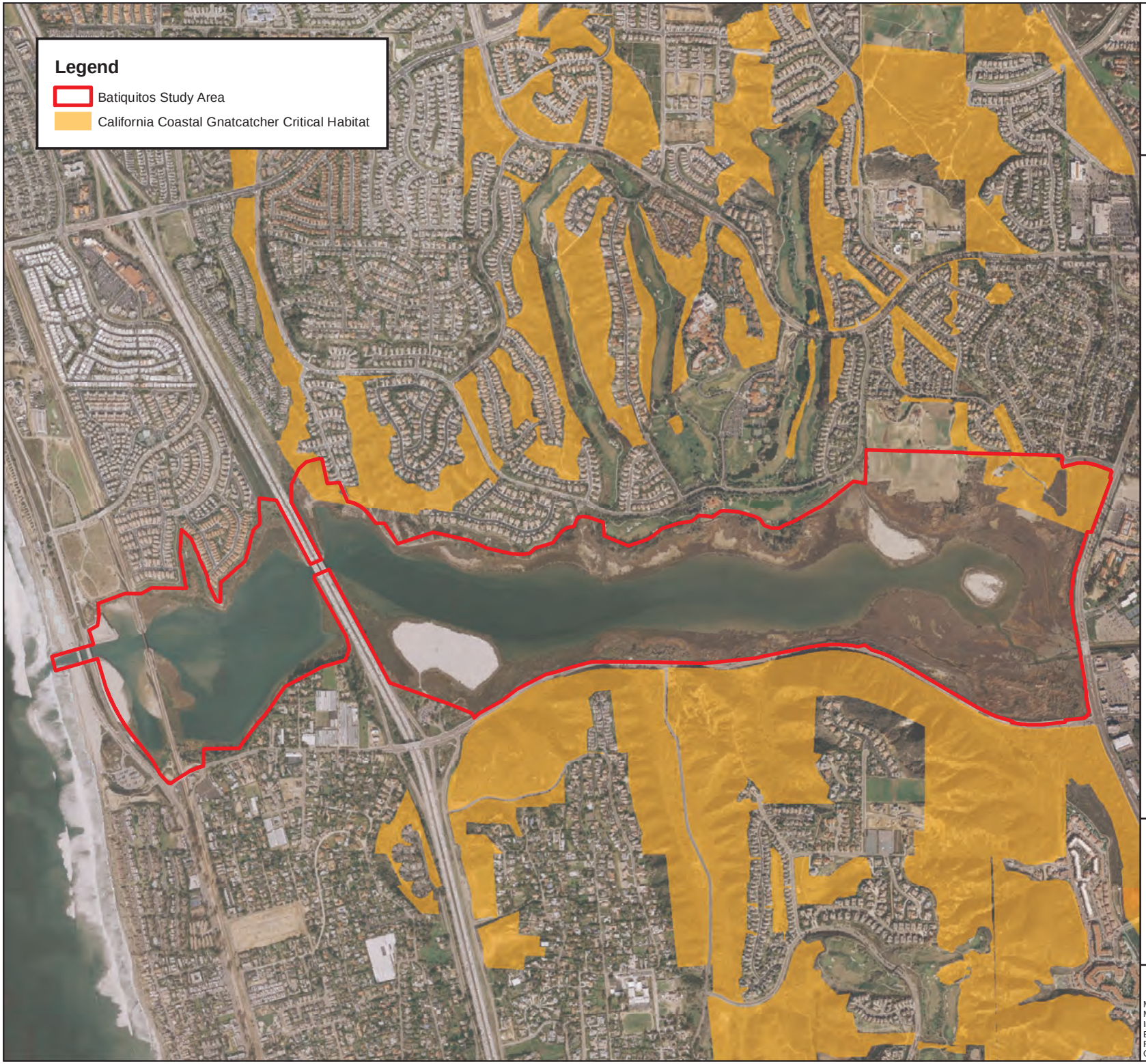
0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Plover.mxd



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Batiquitos Lagoon
San Diego County,
California

Figure 4-10.
California Coastal Gnatcatcher Critical Habitat

N
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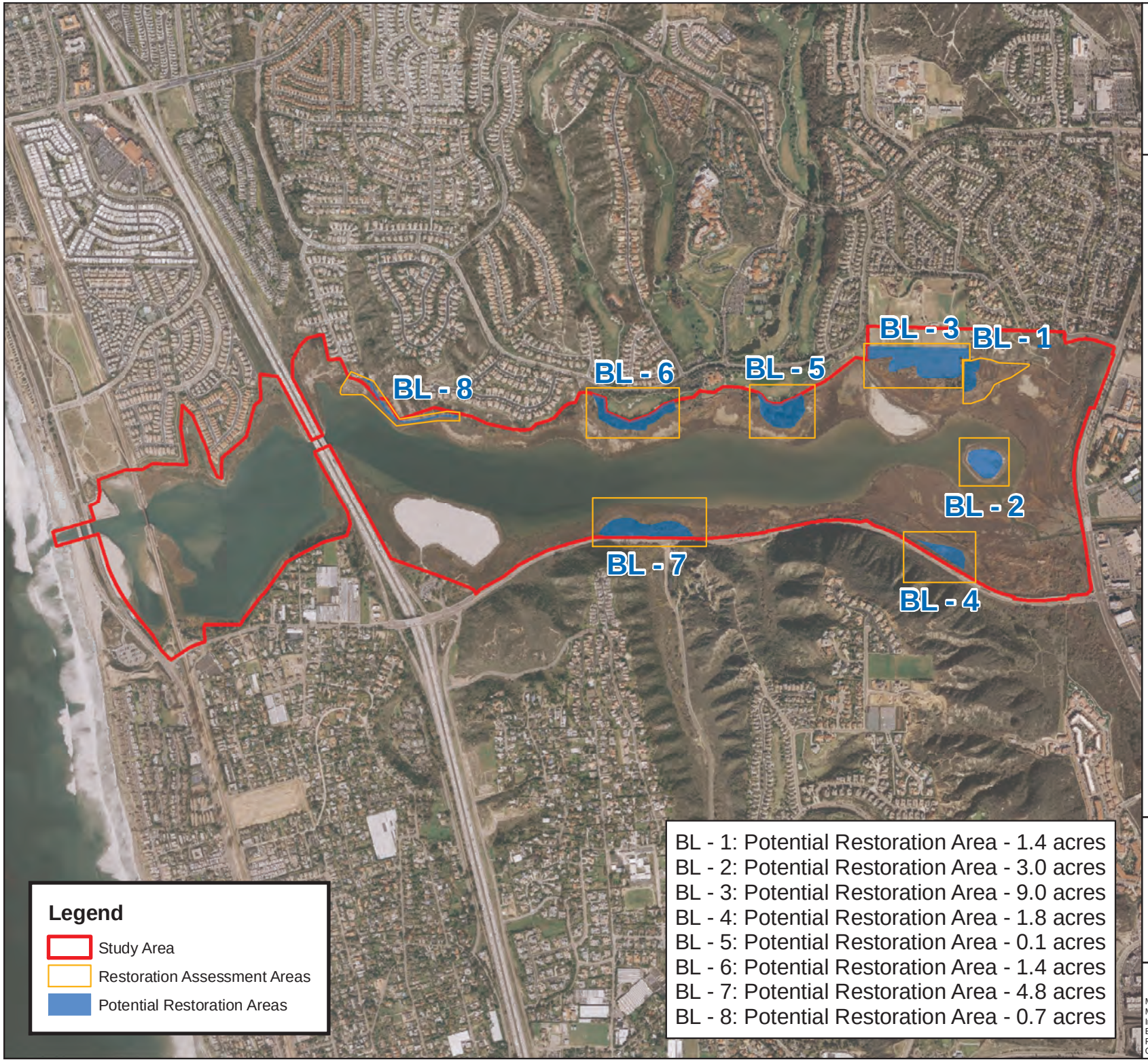
0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Plover.mxd



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Batiquitos Lagoon
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California

Figure 4-11.
Potential Restoration Areas

N
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0 500 1,000 2,000
Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Batiquitos\Aerial 8x11.mxd

5.0 SAN ELIJO LAGOON

San Elijo Lagoon is located in the City of Encinitas, just north of the City of Solana Beach, and at the terminus of the Escondido Creek and La Orilla Creek watersheds. The lagoon is approximately 20 miles north of San Diego. The lagoon is owned and managed by the CDFG, San Diego County Department of Parks and Recreation, and the San Elijo Lagoon Conservancy (SELC). The lagoon is the second largest coastal lagoon in San Diego County (Coastal Environments 2001), with a watershed that encompasses approximately 77 square miles. For this report, the approximately 713-acre Study Area extends from Highway 101 east past the San Elijo Lagoon Ecological Reserve boundary (Figure 5-1). The Study Area primarily encompasses the wetland and riparian areas associated with the lagoon, as well as the lagoon mouth at the Pacific Ocean.

The San Elijo Lagoon Restoration Project (SELRP) is a comprehensive lagoon restoration plan being developed for San Elijo Lagoon. The SELRP will evaluate various alternatives for improving the ecological function of the lagoon at a system level. This report focuses on specific mitigation actions that could be implemented in the event that the SELRP is delayed. Details on the lagoon and specific restoration opportunities are provided below.

5.1 PHYSICAL SETTING

5.1.1 Historical Profile

The San Elijo Lagoon Area Enhancement Plan (San Diego County Department of Parks and Recreation 1996) summarizes the lagoon's historic development. Beginning more than 10,000 years ago, Native Americans inhabited the San Elijo area and likely had minor impacts on the lagoon function and resources. By the early 1800s, Europeans had settled in the area and established cattle ranches. Permanent settlements were established by the 1880s, and several dikes and levees were constructed after that to modify the lagoon to serve community needs. Installation of the Santa Fe Railroad (currently NCTD) in 1887 and later construction of a plank road (now Highway 101) in 1891 constrained the lagoon mouth and restricted it to the northern end of the beach. Permanent structures for the railroad and Highway 101 were constructed in 1925 and 1932, respectively. A concrete dike built in the 1930s controls water level in the eastern basin through two floodgates (Coastal Environments 2001). More recently, the lagoon has been constrained even further through infrastructure projects constructed across the lagoon. I-5 was built through the middle of the lagoon in 1965; in 1981, CDFG and the County of San Diego built the east basin water management project to control flooding and mosquito populations.

Additional factors affected the flows coming into the lagoon, including the construction of upstream reservoirs, which reduced freshwater inflows to the lagoon. Sewage was discharged into the lagoon between 1940 and 1973, causing a further shift from a saltwater to a brackish system. More recently, development within the watershed has resulted in increasing amounts of freshwater flow during storm events, as well as more nutrients and sediment-rich runoff entering the lagoon.

Due to encroachment by development, San Elijo Lagoon has gradually been constrained and its ecological function compromised. The Highway 101, NCTD railroad, and I-5 transportation corridors have resulted in a lagoon with three distinct basins, the west, central, and east basins, each connected by a single channel undercrossing allowing water flow between basins. These development factors, as well as sedimentation from the watershed, have modified the lagoon hydrology and restricted the tidal prism within the lagoon. Such modifications have led to a consistent degradation of the lagoon resources and water quality, leading to beach closures,

water quality issues, and bacteria problems. The SELRP is an effort to restore lagoon functions and values given the constraints from historical development.

5.1.2 Surrounding Land Uses

West of I-5, the lagoon is characterized by residential development along the northern and southern edges of the lagoon. East of I-5, the surrounding area is less urbanized, and primarily agricultural land is adjacent to the north side of the lagoon. East and south of the lagoon, an upland buffer within the CDFG Ecological Reserve provides an undeveloped distance between the lagoon and residential development.

5.1.3 Topography and Bathymetry

San Elijo Lagoon occupies a relatively flat coastal plain that has gradually filled with sediment, forming a shallow, dynamic lagoon system. Relatively steep slopes generally characterize the margin of the lagoon, although the northeast and southeast ends are composed of flat alluvial plains developed from the discharge points of two major creek systems. The western end of the Study Area consists of a narrow band of beach sands at Cardiff State Beach.

A large water impoundment in the eastern basin is managed as a duck pond by CDFG. Water levels in the duck pond range from approximately 5.5 feet above mean sea level (MSL), which is the height of a berm bisecting the east basin, to -1 feet MSL, the dredge level established through the San Elijo Lagoon East Basin Water Management Plan (Smith/Williams Group 1976; City of Encinitas 2002). Although there are many small channels and open water areas throughout the lagoon, extensive bathymetric data have been collected on the “main” channel. The main channel extends from the tidal inlet at the lagoon’s extreme northwestern end, passes below the Highway 101 and NCTD Railroad bridges, meanders widely through the central basin, and passes under I-5 at the northwestern end of a large berm in the middle of the lagoon. The railroad and I-5 bridges are major pinch points for tidal flow into the lagoon. Bathymetric studies conducted by Coastal Environments in 2000 and E. Terrill in 2001 of the main channel from the tidal inlet to the I-5 overpass indicate the thalweg ranges from approximately -4.8 feet NGVD to +1.3 feet NGVD (City of Encinitas 2002).

5.1.4 Surrounding Transportation Systems

The transportation system in the vicinity of the lagoon consists of the following:

- Manchester Avenue, a two-lane road extending along the northern edge of the lagoon;
- South Coast Highway 101, which serves as the western edge of the west basin and spans the lagoon mouth at the north end;
- I-5, which traverses the lagoon between the central and east basins; and
- The NCTD railroad, which bisects the lagoon, creating the boundary between the west and central basins.

5.1.5 Utilities

A pipeline extends perpendicular from the beach at Cardiff State Beach into the open sea waters. A transmission line runs north-south across the Study Area at its eastern end and along a dirt road generally parallel to the NCTD railroad tracks.

5.1.6 Storm water Discharges

Storm water discharges enter the Study Area from discrete drain systems and via surface flow from adjacent roads and lands. The City of Encinitas performed an urban storm water runoff monitoring study in the late 1990s and early 2000s, offering a detailed look at the pattern of storm water discharges to the lagoon. From approximately 17 discharge points, wet weather flows ranged from 0.68 cubic feet per second (cfs) to 5.2 cfs (City of Encinitas 2002).

5.2 OWNERSHIP

Figure 5-2 shows the ownership of various parcels covering the Study Area.

5.2.1 Private Properties within Study Area

The Study Area is primarily owned and managed by public entities. There are some privately owned parcels located along the southern edge of the reserve (homeowner's associations outside the Study Area) and along Restaurant Row adjacent to the western basin. Privately owned parcels within the western basin total approximately 3 acres.

5.2.2 Public Properties Adjacent to the Study Area

Public property owners in and adjacent to the Study Area include the State of California, the County of San Diego, the City of Solana Beach, and NCTD. I-5 and the associated right-of-way are owned by Caltrans. SELC also owns lands in the western portion and just outside of the northeastern portion of the Study Area.

5.2.3 Land Use within Study Area

The CDFG Ecological Reserve constitutes the primary land use within the Study Area and includes preserved wetland and upland areas. The San Elijo Lagoon Conservancy Nature Center is located along the northwest edge of the lagoon, and trails allow passive recreational uses within the lagoon riparian and upland areas. No active recreational uses are allowed within the wetland portions of the reserve, although fishing and horseback riding are permitted in some locations.

5.3 HYDROLOGY

San Elijo Lagoon is influenced by a complex hydrologic regime of both freshwater and saltwater inputs. The lagoon receives freshwater discharged from Escondido Creek in the northeast and from La Orilla Creek in the southeast end of the lagoon. The watershed drained by the lagoon is 77 square miles, and four main reservoirs exist within the watershed: Lake Wohlford, Olivehain Reservoir, and Dixon Lake in the Escondido Creek drainage, and San Dieguito Reservoir in the Orilla Creek drainage. A narrow tidal inlet is located in the far northeastern portion of the lagoon system. An in-depth review of the lagoon's hydrology is presented in the San Elijo Lagoon Restoration Project Draft Environmental Impact Statement (City of Encinitas 2002).

5.3.1 Flood and River Data

Flow rate modeling studies conducted in the late 1980s found that peak 6-hour discharge rates for 100-year flood events at Escondido Creek are approximately 10,000 cfs, and at La Orilla Creek approximately 1200 cfs. Figure 5-3 shows the extent of the Study Area subject to 100-year events. The 2- and 5-year peak 6-hour flood event discharge rates at Escondido Creek

are 465 and 1413 cfs, respectively, and at La Orilla Creek are 12 and 76 cfs, respectively (City of Encinitas 2002). According to the Carlsbad Watershed Network, the Escondido Creek watershed may be more prone to winter flood events than the other watersheds within the Carlsbad Hydrologic Unit due to the location of headwaters in the foothill zone where winter rainfall amounts are generally greater than along the coast (Carlsbad Watershed Network 2002).

Although Escondido and La Orilla Creeks were once seasonal or ephemeral drainages, a 1993 study found that Escondido Creek now flows year-round due to drainage of water brought in to the watershed for urban and agricultural uses (Soil Conservation Service 1993). This study estimated the total discharge of freshwater into the lagoon as approximately 3.06 cfs, or almost 2 million gallons per day from both surface and subsurface sources combined.

5.3.2 Tidal Data

The lagoon receives tidal waters from the inlet, and tidal influence extends past the berm on the eastern side of I-5, past the Mean High Tide Line of 4.62 MLLW to the Mean Higher High Water line of 5.37 MLLW. A table showing the mean tide levels at the La Jolla tide station is included in Appendix B. Tidal waters move through the lagoon via the main channel, and eventually move past the east basin berm via gate valve culverts on the berm's northern end. The tidal flows moving into the lagoon are constricted and muted by the narrow main channel, as well as by dense vegetation patches that have established as a result of excess sediment that is accumulating in the lagoon. Flushing of the west basin occurs when tidal elevations reach +3.04 MLLW, and of the central basin when elevations surpass +3.29 to +4.29 feet MLLW (City of Encinitas 2002).

Active management of the inlet is required to maintain tidal mixing in the lagoon. There have been many artificial inlet openings in the last several decades, and, in 2000, an endowment was established to support the permanent opening of the inlet (City of Encinitas 2002). Despite this active management, the tidal prism of the lagoon is not sufficient to prevent undesirable sedimentation of the lagoon, and dredging of the majority of the west and central basins would be necessary to maintain the inlet. Major planning efforts to restore a "healthy" balance to the lagoon tidal regime have been made, especially through modeling of tidal inlet and channel relocation alternatives (USACE nd); these studies are discussed in more detail in Section 5-5.

5.4 BIOLOGICAL INFORMATION

Extensive biological data have been collected within San Elijo Lagoon by various volunteer groups, the County of San Diego, and SELC. The majority of these surveys are updated each year, including existing vegetation communities and species distribution changes (EDAW 2009). Much of this information has not been published in report form and/or is based on informal surveys or point observation data; therefore, it is beyond the scope of this brief synopsis to provide detailed information on these results. This section is based on existing biological survey data; no new surveys were conducted as part of this project. The most recent documentation that summarizes the biological conditions within the lagoon are monitoring data from internal surveys conducted by SELC. These data have not been compiled into formal reports or mapping. Therefore, SANGIS and the CNDDB information was used to create these figures. General vegetation maps, soil maps, and sensitive species occurrences for the vicinity of the Study Area are provided in Figures 5-4 through 5-9.

5.4.1 Regional Habitat and Species Conservation Planning

The Study Area is located within the San Diego County MHCP. The City of Encinitas is currently preparing an Open Space Management Plan to complete their Draft Subarea Plan. Before approval of the plan, the City must meet with the other participating north county cities, then the resource agencies.

The Study Area is also governed by a Local Coastal Program (LCP) presided over by the City of Encinitas. Pursuant to the California Coastal Act, LCPs are required to be prepared by all local coastal jurisdictions to implement policies in the Coastal Act. The Coastal Commission retains jurisdiction over projects directly impacting the San Elijo Lagoon Ecological Reserve (SDCDPR 1996).

5.4.2 Biological Communities

According to 2006 SANGIS mapping efforts, 17 vegetation communities occur within the Study Area:

Alkali marsh	Beach,
Brackishwater	Chaparral
Cismontane alkali marsh	Coastal and valley freshwater marsh
Diegan coastal sage scrub	Estuarine
Eucalyptus woodland	Non-native grassland
Orchards and vineyards	Saltpan/mudflats
Southern coastal salt marsh	Southern maritime chaparral
Southern riparian scrub	Urban/developed areas
Valley and foothill grassland	

The eastern basin is characterized by riparian and freshwater marsh, with some alkali marsh and salt pan. Some grasslands are also located along the Escondido Creek discharge to the east basin. In addition, constructed avian islands and coastal salt marsh exist east of I-5. In the central and west basins, the habitat is more tidally influenced and characterized by more subtidal habitats, including salt marsh, mudflats and open water. Coastal salt marsh and riparian areas edge the basins.

Changes in circulation patterns due to development constraints have resulted in lagoon habitat rapidly transitioning from mudflats to mid- and high-marsh. This shift is reflected in the rapid and ongoing expansion of two key species, cordgrass (*Spartina* spp.) and pickleweed (*Sarcoconia pacifica*), which have been documented through focused vegetation mapping performed by SELC from 2001 through 2008. If no action is taken to restore the lagoon, it will continue to transition from an open water/mudflat lagoon to a saltmarsh and riparian habitat that would further restrict the tidal prism (EDAW 2009).

5.4.3 Special-Status Species

5.4.3.1 Wildlife

The following four special-status plant species are documented to occur within or immediately adjacent to the Study Area and are presumed extant: California least tern (*Sternula antillarum browni*), Belding's savannah sparrow (*Passerculus sandwichensis*), coastal California gnatcatcher (*Polioptila californica californica*), and California black rail (*Laterallus jamaicensis coturniculus*). CNDDB records indicate occurrences of 30 additional special-status species

within 5 miles of the Study Area (CDFG 2009). A list of all special-status wildlife species documented in the vicinity of the Study Area can be found in Appendix D, and a figure depicting the approximate location of those occurrences is included as Figure 5-8.

5.4.3.2 Plants

The following five special-status plant species are documented to occur within or immediately adjacent to the Study Area and are presumed extant: Summer holly (*Comarostaphylis diversifolia*), Orcutt's pincushion (*Chaenactis glabriuscula* var. *orcuttiana*), sea dahlia (*Coreopsis maritime*), beach goldenaster *(Heterotheca sessiliflora* ssp. *sessiliflora)*, and wart-stemmed ceonothus (*Ceanothus verrucosus*) (CDFG 2009). CNDDB records indicate occurrences of 52 additional special-status species within 5 miles of the Study Area (CDFG 2009). A list of all special-status plant species documented in the vicinity of the Study Area can be found in Appendix D, and a figure depicting the approximate location of those occurrences is included as Figure 5-7.

5.4.4 Invasive Plants

According to the Feasibility Study and Conceptual Plan for the Relocation of the San Elijo Lagoon Inlet, there are 1.40 acres of invasive plant species in San Elijo Lagoon's Central Basin (Coastal Environments 2001). On behalf of the Carlsbad Watershed Network, SELC has administered a regional invasive species control program since 2004 (SELC 2008).

Weed management activities implemented by SELC focus on control of giant reed (*Arundo donax*), pampas grass (*Cortaderia selloana*), perennial pepperweed (*Lepidium latifolium*), tamarisk (*Tamarix ramosissima*), and several palm species (SELC 2008).

5.5 RESTORATION ACTIONS IN STUDY AREA

5.5.1 Past Restoration Activities in Study Area

The SELRP has evolved over the years and a number of studies have been prepared for various aspects. Since 1996, various interested parties have devised restoration concepts and considered alternative configurations of key infrastructure spanning the lagoon. Most recently, a Gap Analysis effort was undertaken to consolidate available information, highlight data gaps, identify necessary coastal engineering and environmental studies, and list anticipated regulatory requirements for implementation of the proposed SELRP (EDAW 2008). Most past studies have identified broad planning concepts to enhance the tidal prism, such as dredging and modifications to known infrastructure "choke points" such as the NCTD bridge and I-5.

5.5.2 Future Restoration in Study Area

In coordination with SCC and SANDAG, SELC is developing the San Elijo Lagoon Restoration Project. Encroaching development has constrained and compromised the ecological function of the lagoon. Restoration of the lagoon would enhance regional wetland resources and increase ecological function of the system. Major transportation infrastructure traversing the lagoon, including Highway 101, the NCTD railroad track, and I-5, are each proposed for replacement or rehabilitation. A unique opportunity therefore exists to substantially modify existing channels by relocating and/or enlarging openings in the structures. Examples could include relocation of the lagoon inlet south to provide a direct tidal exchange, or enlarging the channel extending under I-5 to minimize interference with fluvial flows. The potential to substantially improve the function of the lagoon is being pursued by the SELC through coordination with the lagoon stakeholder

group. The lagoon stakeholder group has identified a preliminary purpose and need for the project, and SELC is moving forward with the preliminary engineering and environmental compliance for the project, beginning in fall of 2009. It is anticipated that the restoration plan Study Area will encompass the entire reserve, will focus on restoration of wetland areas within the lagoon through increasing the tidal prism, and will be based on existing in-depth studies of tidal inlet relocation and tidal channel reconfiguration alternatives.

A stakeholders group has been meeting at the City of Encinitas approximately every 2 months since late 2007. The stakeholders group consists of representatives of the following agencies/entities:

USFWS	USACE
National Marine Fisheries Service	CDFG
CCC	SCC
Caltrans	Regional Water Quality Control Board
County of San Diego Department of Parks and Recreation	City of Encinitas
City of Solana Beach	SANDAG
NCTD	SELC

The development of a comprehensive restoration plan for San Elijo Lagoon would facilitate identification of mitigation opportunities to enhance the coastal environment at an ecosystem level. Mitigation for impacts associated with large projects, including but not necessarily limited to, the I-5 North Coast Corridor Project and grant opportunities for regional coastal restoration efforts (e.g., Proposition 84 grants), could then be based on implementing components of the restoration plan. Funding comprehensive restoration of a lagoon system, including infrastructure modification, would enhance ecological functions that form the foundation for wetland health. These types of ecosystem based opportunities are rare, and generally provide the largest benefit to the system as a whole.

5.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, five potential restoration areas were identified within San Elijo Lagoon (Figure 5-10). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Details on the methodologies employed were described in Section 1.3 of this report.

5.6.1 Conventional Restoration

5.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration exist on the western side of I-5 in the central basin, corresponding to sites SE-4 and SE-5 in Table 5-1 below. These sites are directly adjacent to areas with tidal influence, and minor excavation would be required to promote tidal action. However, site SE-4 consists of high-quality transitional habitat and coastal sage scrub, and there is a known occurrence of California gnatcatcher in the immediate vicinity (CDFG 2009). Site SE-5 contains lower quality habitat, although this area is already in use for several public uses. The basins in this area are used for research and the upland pads are used for passive recreation.

There is a small drainage draw at the base of a bluff in the eastern basin in site SE-2 that does not appear to support jurisdictional wetlands or waters but slopes into existing wetland areas. Minimal excavation would be needed to lower a small portion of this draw to an elevation that would promote wetland conditions. The site supports a number of native plant species, and appears to be in good condition for wildlife foraging and refugia. Access to this site may be impeded by the steep slopes surrounding the draw.

A summary of the wetland restoration potential for each of the sites evaluated within the San Elijo Study Area is provided in Table 5-1 and representative photographs are included in Appendix E. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in Appendix A.

Table 5-1. Mitigation Potential in the San Elijo Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments
SE-1	N/A	N/A	Site is already being used as a mitigation area and there are no additional opportunities. No further data taken.
SE-2	2	65.7	Majority of site is 30' above wetland areas, minor opportunity in small draw, but vegetation is in good condition. Site access may be impeded by steep slopes to potential mitigation area.
SE-3	N/A	N/A	Site is located on a high bluff with steep slopes; wetland creation would be infeasible. Site consists of high quality transition habitat.
SE-4	2	85.7	Site consists of high quality transitional habitat with known occurrences of gnatcatcher nearby. Tidal action could be promoted with minimal excavation, but impacts to coastal sage scrub from excavation and access may occur. Site is on western side of I-5.
SE-5	1	45.7	Site is a former waste treatment area, currently used for research in inundated areas. Upland areas consist of compacted soils and ruderal vegetation, access is easy and minimal excavation would be required to promote tidal action. Site is on western side of I-5.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

5.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 1 or 2 is 3.5 acres.

5.6.1.3 Next Steps

As mentioned above, a more focused assessment of the vegetation communities in these sites would be required to determine whether they are within agency jurisdiction. Coordination with SELC would be beneficial in developing an acceptable restoration and mitigation plan for these areas that is consistent with existing and future habitat management in the lagoon.

5.6.2 Hydrodynamic Restoration

As noted above, the tidal regime is muted by the inlet and by the restrictions within the main tidal channel. An inlet maintenance program has been implemented; however, the inlet continues to be subject to closure events. In addition, the beach berm reduces the tidal prism. The flow in the main tidal channel is restricted by the Highway 101, NCTD and I-5 bridges, as well as sand bars in the eastern basin.

It is anticipated that the San Elijo Lagoon Restoration Plan will analyze a range of habitat distribution alternatives to restore the lagoon. Modifications to the lagoon inlet, as well as Highway 101, NCTD railroad, and I-5 channels and bridge structures are being considered under this project. Depending on the alternative selected, the tidal prism within the lagoon may be increased through either grading or infrastructure modifications. I-5 bridge improvements are proposed in this location and the channel under the bridge will be increased, which would decrease flow restriction at this location.

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SAN ELIJO STUDY AREA FIGURES

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Figure 5-1.
Aerial Site Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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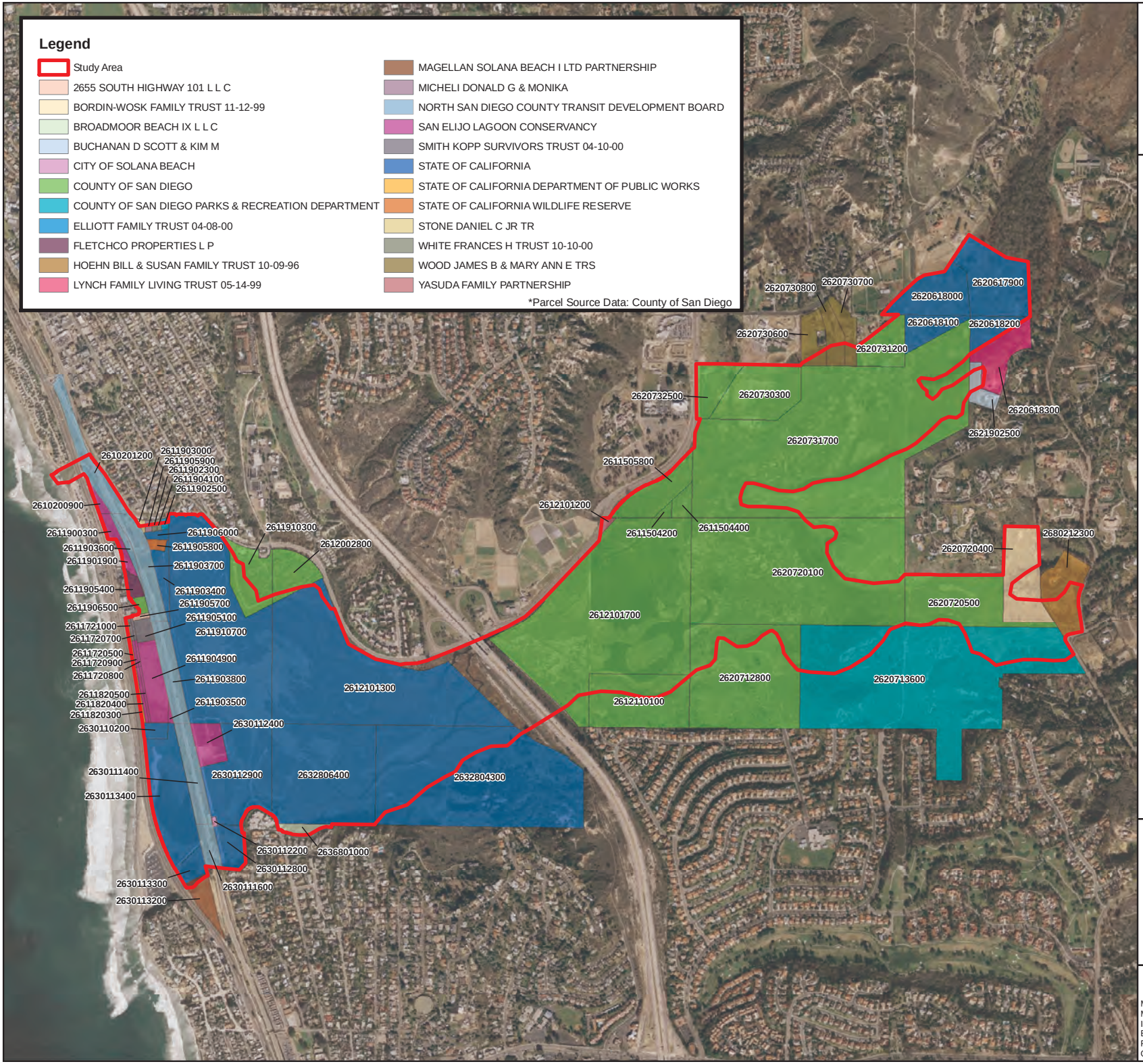

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Figure 5-2.
Parcel Owners within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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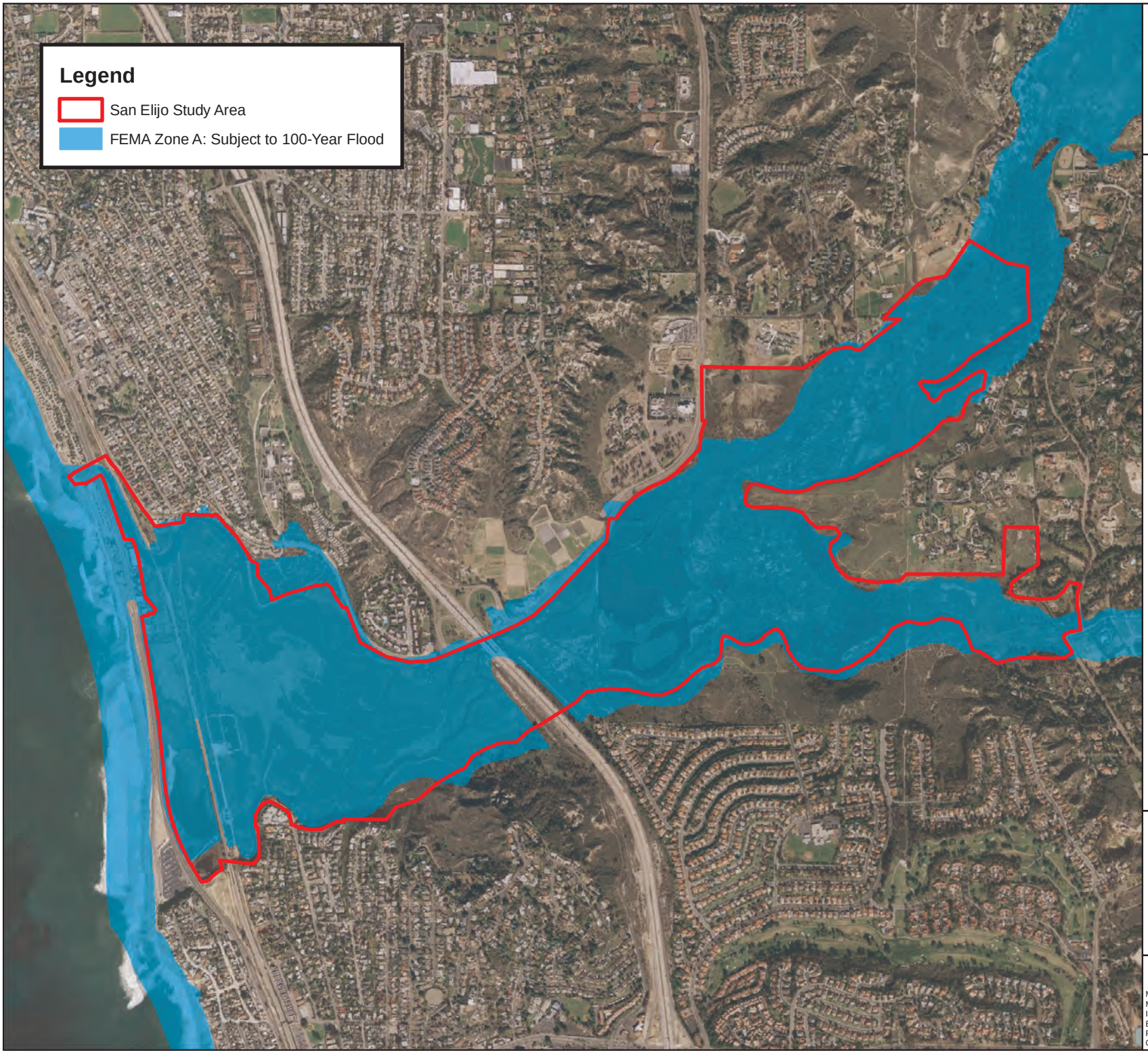

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Figure 5-3.
FEMA Zones within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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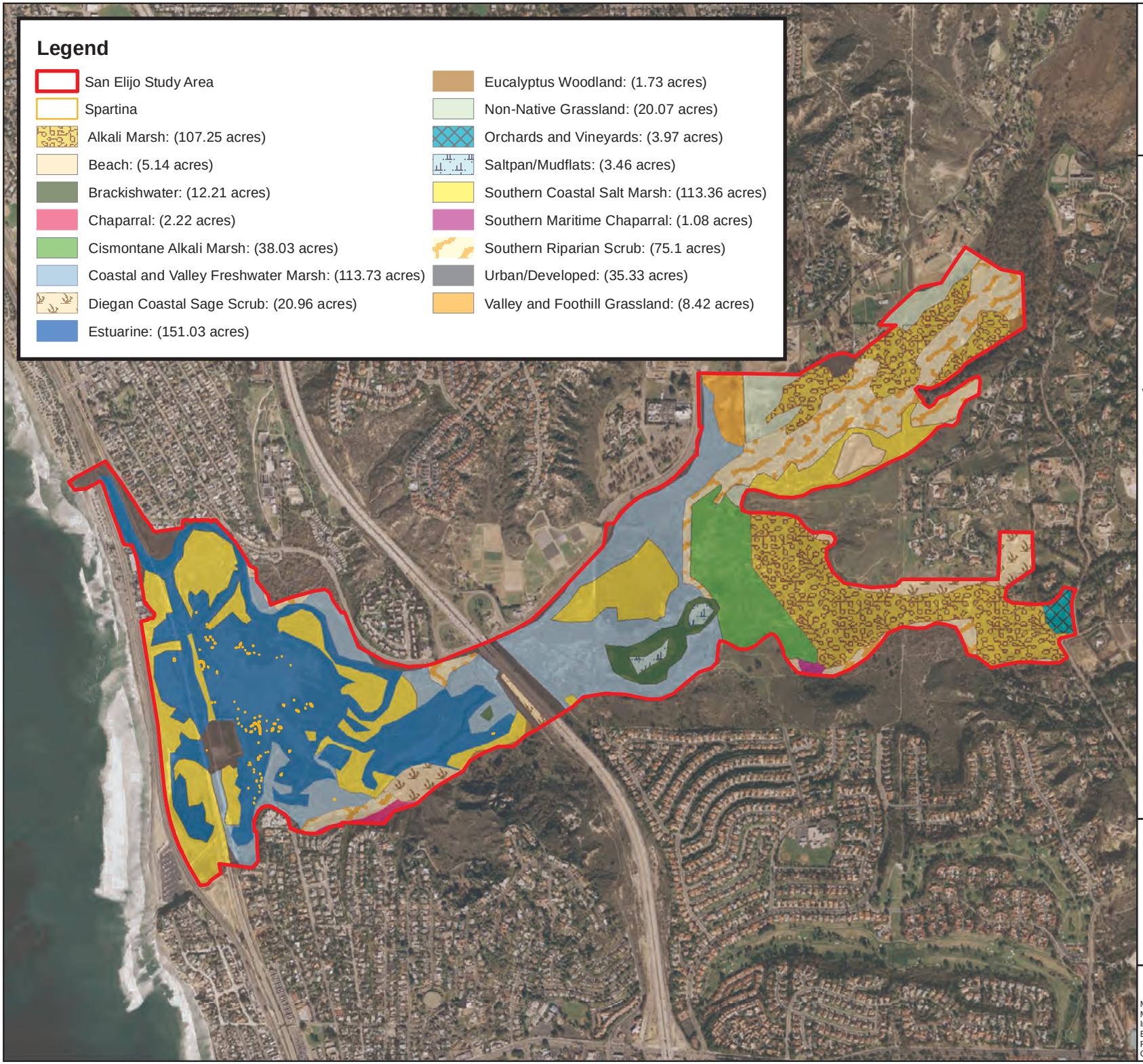

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Figure 5-4.
Vegetation Communities within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\San Elijo\Veg Comm.mxd

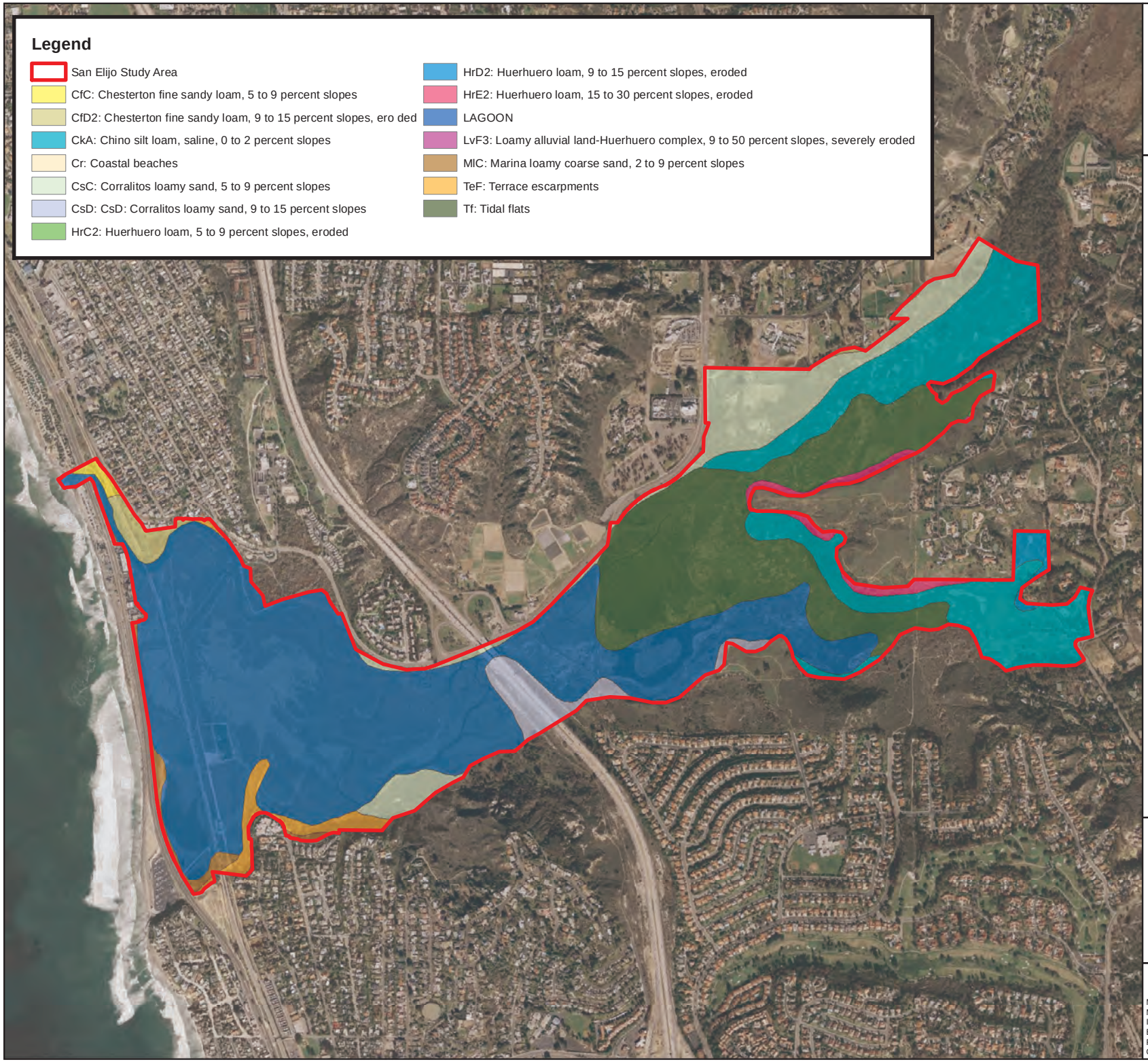

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Figure 5-5.
Soils Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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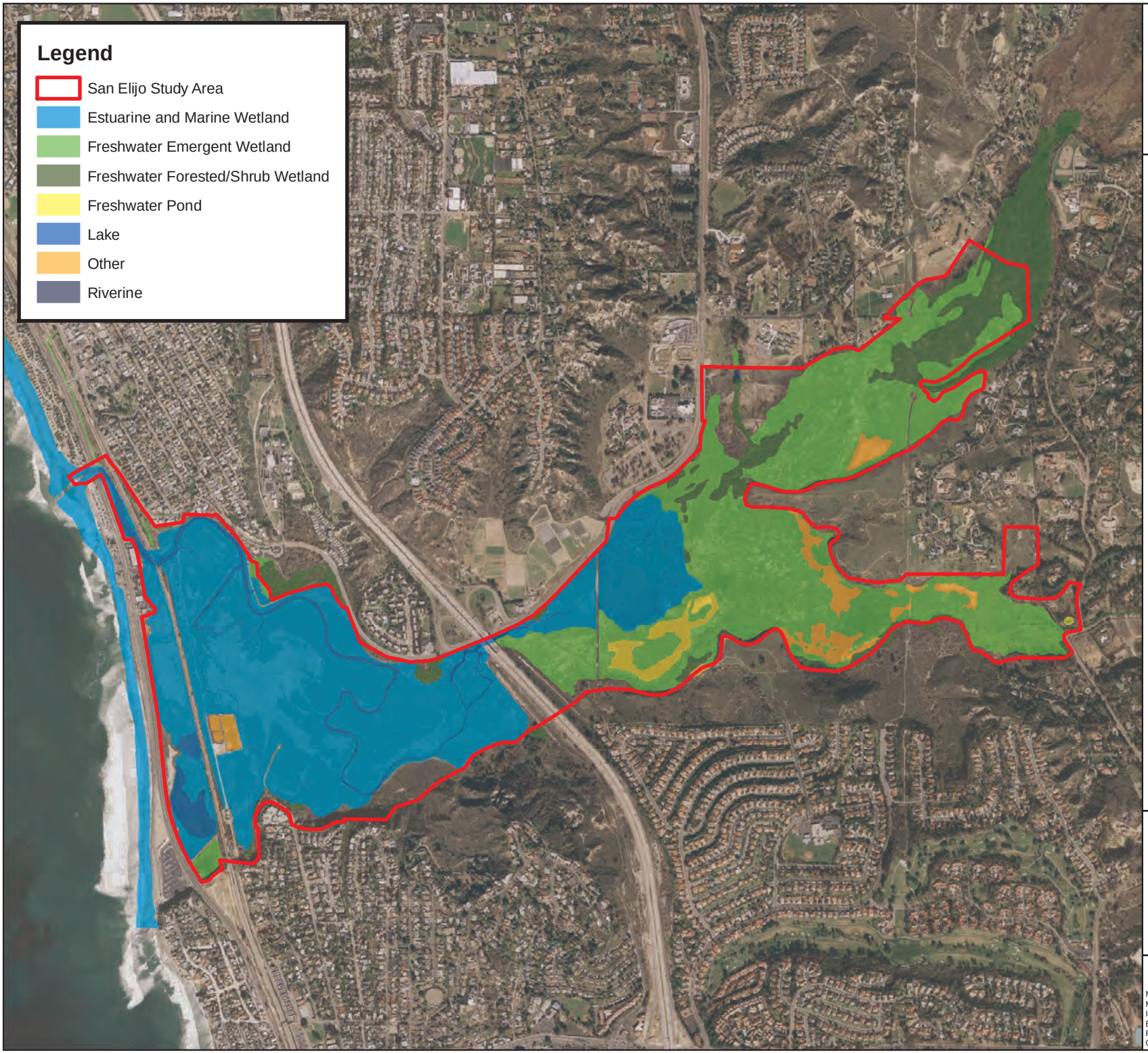

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Figure 5-6.
NWI Data (May 2002)
within the
Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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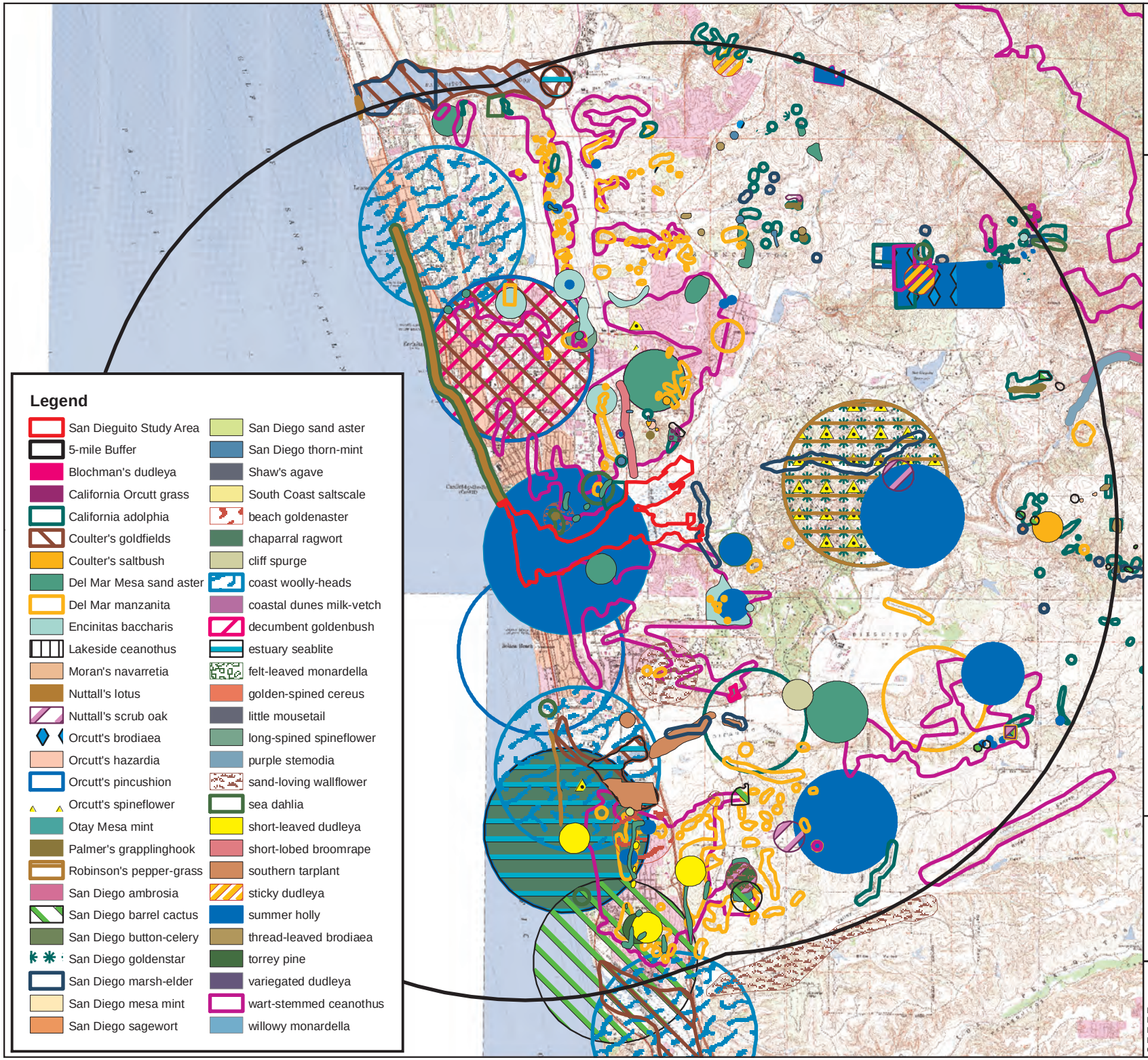

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Figure 5-7.
Special Status Plant Species within 5-mile Radius of the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: USGS Quad
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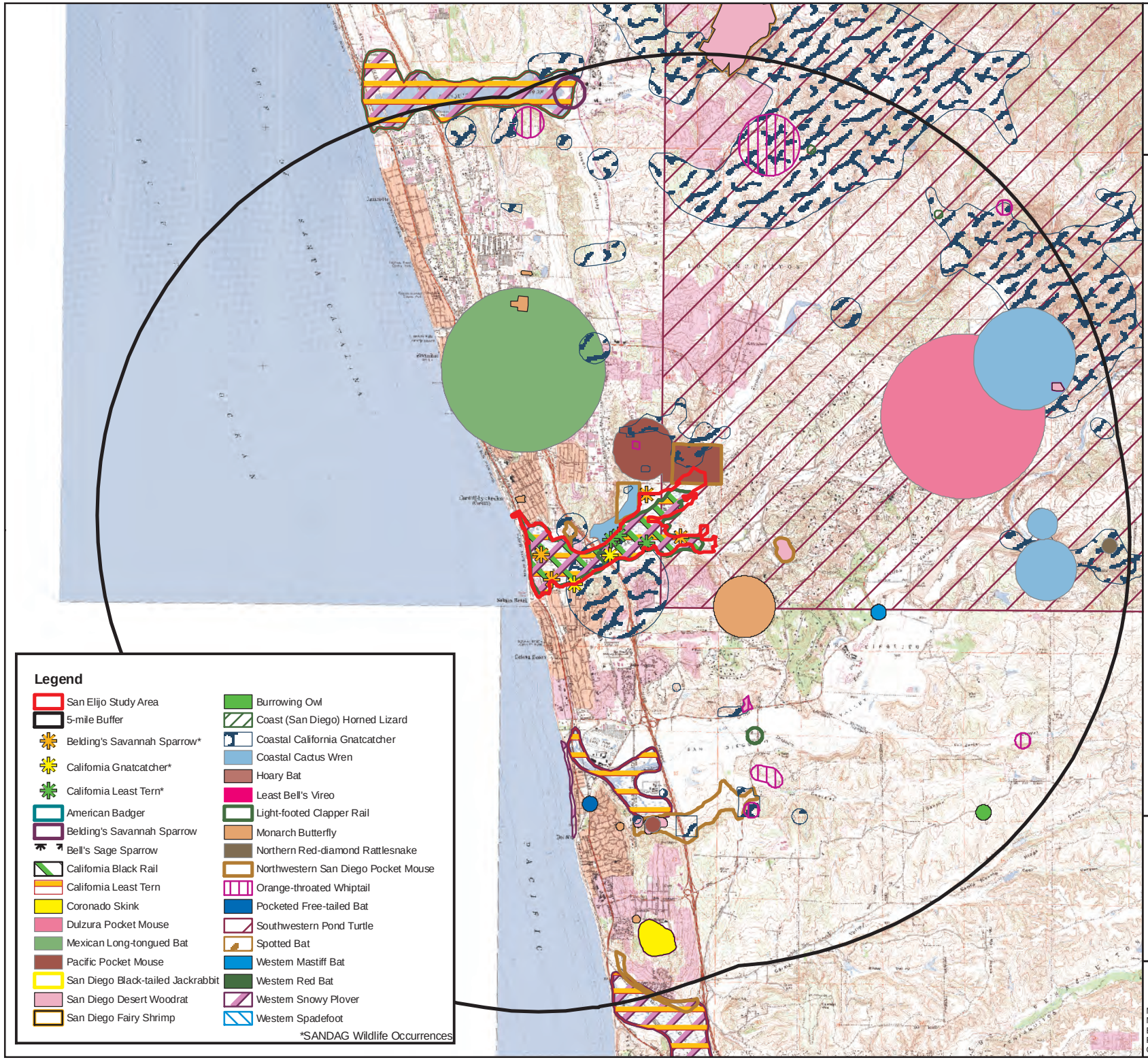

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Figure 5-8.
Special Status Animal Species within 5-mile Radius of the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
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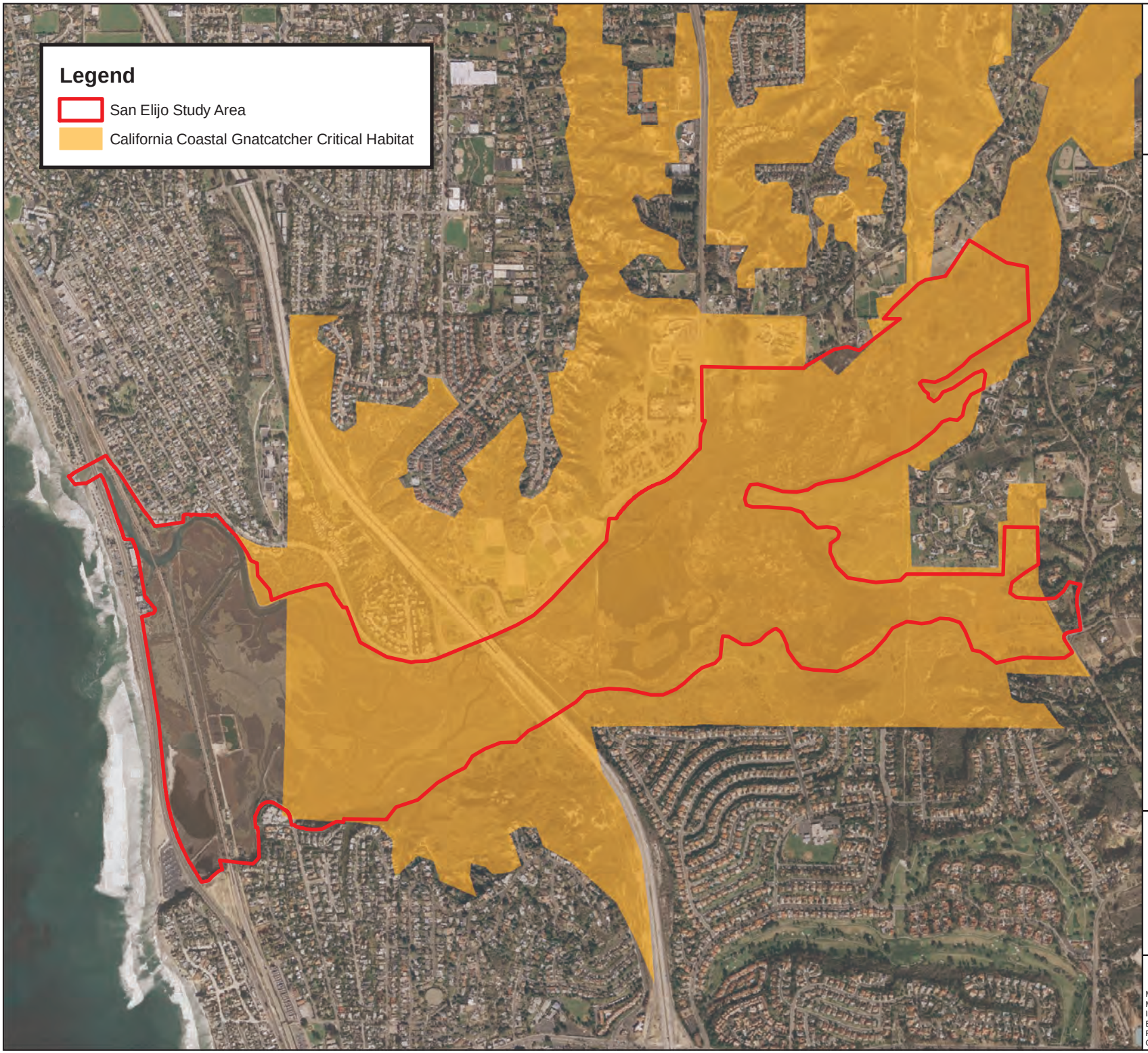

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Figure 5-9.
California Coastal Gnatcatcher Critical Habitat

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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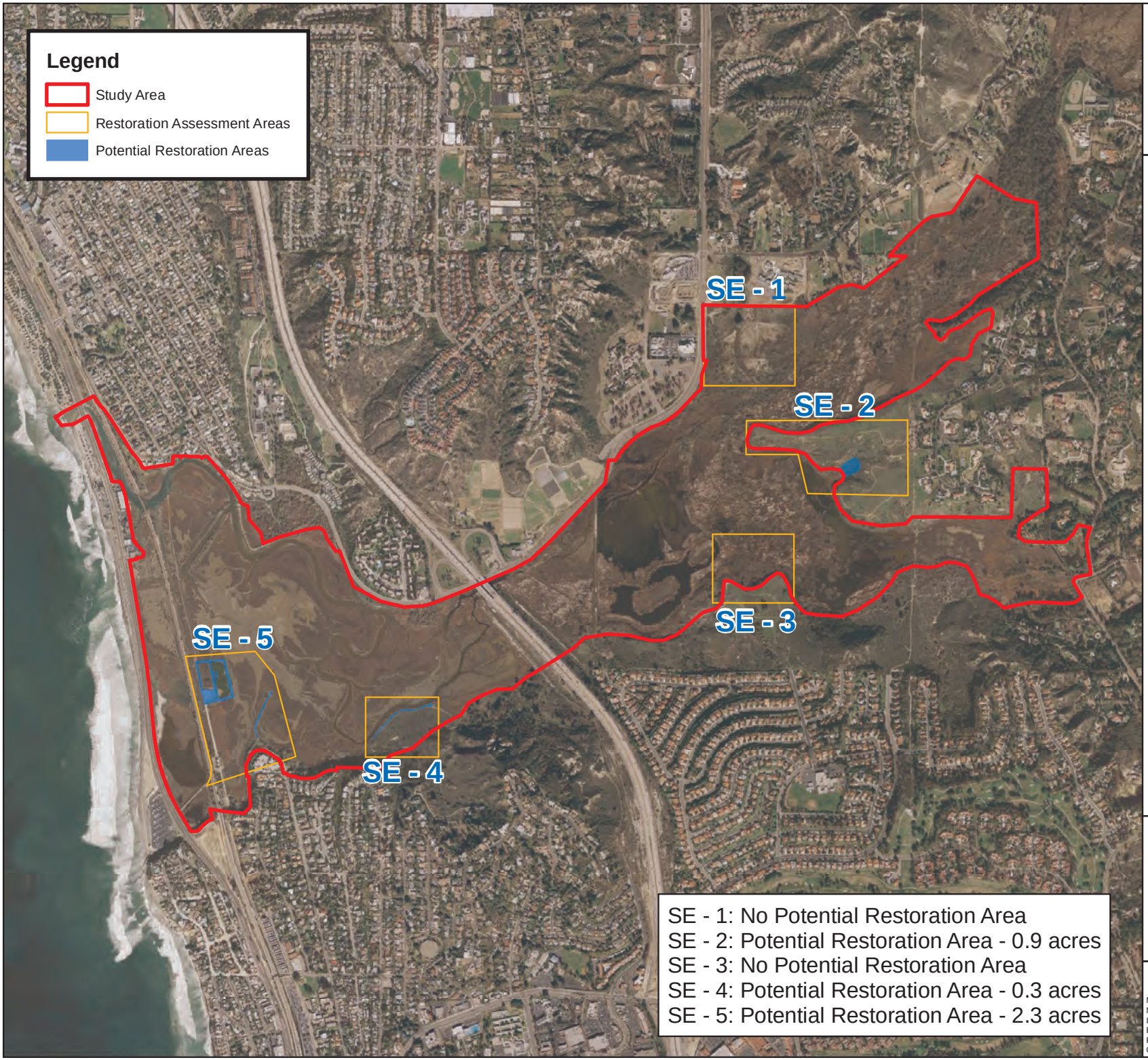

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Figure 5-10.
Potential Restoration Areas

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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6.0 SAN DIEGUITO LAGOON

San Dieguito Lagoon is located in the cities of San Diego and Del Mar, at the discharge point for the San Dieguito River (Figure 6-1). The watershed of the San Dieguito River that flows into the lagoon covers 345 square miles in the County of San Diego. The Study Area is defined as the area between the Pacific Ocean on the west to the bridge over the river at El Camino Real. The Study Area encompasses 768 acres. The Study Area is within the jurisdiction of the City of Del Mar and partly under the jurisdiction of the City of San Diego, within the County of San Diego.

San Dieguito Lagoon is currently undergoing a major wetland restoration project as mitigation for the SCE San Onofre Nuclear Generating Station (SONGS) Units 2&3 project; however, opportunities for further restoration have been studied. Details on the lagoon and these potential restoration opportunities are provided below.

6.1 PHYSICAL SETTING

6.1.1 Historical Profile

The San Dieguito Lagoon was once a major tidal lagoon extending eastward from the ocean to approximately the current location of El Camino Real. As typical for many drowned river valleys, the Lagoon is bounded by marine terraces through which the river cut a river canyon. As sea level has risen over the past 8,000 years, the canyon has been filled with sediments creating a channel containing the San Dieguito River with its surrounding floodplain. The lower part of this floodplain supported an extensive tidal marsh system. The 1889 U.S. Coast and Geodetic Survey Map depicts a braided river channel west of the present location of El Camino Real. Written accounts of the area at that time identify much of the western valley floor as swamp, overflow lands and tidelands. The Coastal Conservancy estimates that historically the marsh area of the San Dieguito wetlands covered over 600 acres, while the entire lagoon probably covered 1,000 acres (California Coastal Conservancy 1989).

Many major construction projects in the San Dieguito River Valley over the last century have had both direct and indirect effects on the lagoon. Direct impacts include the placement of fill and construction of a major racetrack-fairgrounds complex, a shopping center, a historic naval airship airbase, and several transportation corridors. Indirect impacts that have affected water flow, sedimentation, and land use within the lagoon include two dams on the river and extensive agricultural operations. By the 1920s, much of the freshwater flow that had previously reached the San Dieguito Lagoon from the upland areas to the east had diminished as a result of the construction of the Hodges Dam. By the early 1940s, the lagoon mouth was closed most years and the functions and values of the wetland habitat steadily declined.

6.1.2 Surrounding Land Uses

San Dieguito Lagoon is located within an urbanized area and most of the land uses surrounding the Study Area consist of commercial and residential uses. The largest landowner in the adjacent area is the 22nd Agricultural District, which operates the Del Mar Fairgrounds and Racetrack northwest of the Study Area. Temporary parking areas are also located along Jimmy Durante Boulevard and border the Study Area.

Residential land uses occur along Racetrack View Drive and along the northern side of Via de la Valle.

6.1.3 Topography and Bathymetry

The project Study Area, which extends from El Camino Real west to the Pacific Ocean, consists of a broad, relatively flat floodplain surrounded by gentle to relatively steep hillsides and coastal bluffs. The most prominent landforms within and adjoining the project site include the following:

- Beach area north and south of the river mouth;
- Steep, east-facing slopes of Scripps Bluff at the coast just north of the river mouth;
- Steep, south-facing bluffs along Via de la Valle with canyons that contain ephemeral streams flowing into the lagoon;
- Existing tidal basin located in the CDFG Ecological Reserve;
- Newly created tidal marsh and a deep water basin with depths to -6 feet west of I-5;
- Newly created tidal marsh and mudflat habitats east of I-5;
- Newly created disposal areas to be revegetated with native vegetation at the completion of the SCE project;
- Former agricultural lands bordering the south side of the San Dieguito River and immediately south and west of El Camino Real;
- Five newly created nesting sites for shorebirds within the restoration site;
- Remnant seasonal wetlands located just to the east of I-5 and south of the river;
- Eroded, west-facing bluffs also east of I-5 and south of the river; and
- Naturally vegetated hillsides near the southeast edge of the Study Area that separate the lower lying properties within the river valley from the Carmel Valley community.

Detailed bathymetric data have been collected as part of the as-builts for the SCE restoration project and is available to assist with any modeling that would be necessary to look at tidal dynamics within the basin under any proposed changes in the bridge structures. Some of these data have been applied to an analysis of a proposed tidal restoration project east of I-5 in restoration Study Area SD-2 (Jenkins and Wasyl 2008).

6.1.4 Surrounding Transportation Systems

Transportation systems in the Study Area vicinity consist of the following:

- Via de la Valle, a four- to two-lane road, which borders the northeastern portion of the Study Area;
- Jimmy Durante Boulevard, a four-lane road between the fairgrounds and the Study Area;
- Racetrack View Drive, a two-lane road serving the residential areas south of the CDFG Ecological Reserve, west of I-5;
- El Camino Real, a four- to two-lane road along the eastern side of the Study Area;
- The NCTD railroad, which traverses the west end of the Study Area;
- Coast Highway, which parallels the NCTD Railroad and separates the tidal inlet and the remainder of the Study Area; and
- I-5, which traverses the central part of the Study Area.

6.1.5 Utilities

The public utility services and facilities within the Study Area were described in the San Dieguito Wetlands Draft EIR/EIS (2000). The utilities include telephone and cable television lines, gasoline and oil pipelines, gas and electric lines, and sanitary sewer and water lines.

- Telephone – AT&T owns a duct bank consisting of 30 4-inch ducts, nine located along the eastern edge of the I-5 right-of-way. The duct bank runs under the San Dieguito River within a buried 42-inch diameter steel casing. The casing is 1 foot below the soil surface. AT&T also owns an overhead telephone line on the southwestern boundary of the Study Area. Other telephone lines owned by Telco are strung along poles on Via de la Valle.
- Gasoline and Oil Pipelines – Santa Fe Pacific Pipeline, Inc. owns one 16-inch pipeline and one 10-inch pipeline that cross near the eastern portion of the project area within the SDG&E utility corridor. The utility corridor is 150 feet wide and also contains a gas transmission main and overhead electric lines. The 16-inch and 10-inch pipelines are used to carry fuels (gasoline and oil) between Los Angeles and San Diego counties.
- Gas lines – SDG&E owns a 30-inch gas transmission main that is in the main utility corridor where the gas and oil pipelines are located. Another gas line, a 12-inch high-pressure line, is within the Study Area. This 12-inch line is owned by Southern California Gas Company and crosses the San Dieguito River attached to the side of the Camino Del Mar bridge.
- Electricity – Various sizes of overhead electric lines exist within and around the project area. Three 230-kilovolt (kV) lines run through SDG&E's 150-foot-wide utility corridor. Three 69-kV lines also cross the site at various locations. One 69-kV line crosses the San Dieguito River near Jimmy Durante Boulevard, a second crosses the river and the site between I-5 and El Camino Real (this latter line was moved as part of the SCE project to cross the river upstream of the project and parallel Via del Valle), and a third crosses the southwestern portion of the site close to Racetrack View Drive.
- Sanitary Sewer Lines – The City of Del Mar owns several sewer lines that are within the Study Area. The 22nd District Agricultural Association has a 6-inch sanitary force main located in the San Dieguito River, approximately midway between the Jimmy Durante Boulevard bridge and the railroad bridge. The sewer line extends from the existing lift station at the Del Mar Fairgrounds and conveys sewage to the Del Mar sewage system. The force main ranges in depth from 0 to 5 feet below the river channel and is depicted in "as-built" profiles as having less than 2 feet of cover.
- Water – Water lines within the Study Area are owned by the cities of Del Mar and San Diego. The only locations where the water lines cross the Study Area are attached to the Jimmy Durante Boulevard bridge over the San Dieguito River, along portions of Racetrack View Drive, and within the area south of the Del Mar Fairgrounds on the south side of the San Dieguito River.

6.1.6 Storm water Discharges

Storm water discharges into various locations within the Study Area. Local surface drains discharge to the Lagoon from I-5, Jimmy Durante Boulevard, El Camino Real, and Via Del Valle. The largest storm water discharge occurs at the end of San Andreas. This discharge is now directed into a storm water management wetland system created by the San Dieguito River Park Joint Powers Authority (JPA) before being discharged into the newly restored tidal wetlands. Another discharge just east of San Andres Drive discharges groundwater into the newly restored wetlands.

6.2 OWNERSHIP

Land ownership recorded by SANGIS is shown in Figure 6-2. The Study Area is located within the Focused Planning Area of the San Dieguito River Park.

6.2.1 Private Properties within Study Area

There are a number of small property owners along the western edge of the CCDFG Ecological Reserve; otherwise, most of the Study Area is under public ownership.

6.2.2 Public Properties Adjacent to the Study Area

Public property owners in the project area include the JPA, the City of Del Mar, the City of San Diego, the 22nd District Agricultural Association, CDFG, and the NCTD. Lands within I-5 and the associated right-of-way are owned by Caltrans.

6.2.3 Land Use within Study Area

The predominant land use within the Study Area is habitat restoration. CDFG maintains and operates an ecological reserve in the western portion of the Study Area. JPA operates part of the San Dieguito River Park in the Study Area.

6.3 HYDROLOGY

The San Dieguito River, including its major tributaries Guejito Creek, Santa Maria Creek, and Santa Ysabel Creek, drains an area of 345 square miles. The watershed extends from the higher elevations on Volcan Mountain in the Laguna Mountains near Julian to the Pacific Ocean and has a total approximate length of 48 miles. Approximately 88 percent of the total drainage area is controlled by dams. Lake Hodges, located approximately 10.5 miles upstream from the coast, traps virtually the entire bed material load (coarse sediment) from upstream sources; only wash load (clays and silts) travel through the reservoir during floods.

6.3.1 Flood and River Data

USACE and the County of San Diego have performed hydraulic studies of the San Dieguito River and its tributaries to define the design flows (i.e., floods that occur, on average, once in a specified period) at various locations within the watershed. Under existing conditions, the 100-year flood would essentially cover the entire valley floor, extending from near Via de la Valle on the north to the base of the southerly valley sidewalls (Figure 6-3). However, under most storm conditions, flows to the lagoon are highly controlled by the Lake Hodges Dam, which is operated to store water during most storm events.

The existing low-flow river channel may contain a 2-year flood event, whereas all other flood events can be expected to overflow the channel and spill out onto the valley floor. Intermediate flood flows, after breaching the low-flow channel, quickly spread out across the valley floor, causing significant areal inundation. The El Niño-induced flooding in the early 1980s flooded low-lying lands throughout the valley, including the residential area east of Camino Del Mar, just south of the river. Extensive flooding permeated much of the fairgrounds, including the parking both east and west of Jimmy Durante Boulevard; the alluvial floor of Crest Canyon to the south; the westerly, southerly, and easterly margins of the Via de la Valle shopping center just east of I-5; and a 2,000-foot-width of low-lying lands extending from I-5 up to El Camino Real.

Dr. Howard Chang, working for SCE, conducted extensive hydraulic studies on the San Dieguito River to determine flooding levels and erosion under various river flood conditions, with a focus on the 100-year flood (Chang 1997). He determined that the flows that affect sedimentation and erosion within the river channel are most controlled by the topography and cross-sectional area within a region referred to as the “effective flow area.” The maintenance of existing topography

within this region and the control of the river flooding through the construction of berms along the north and south sides of the wetland restoration project were determined to be essential to maintaining existing conditions within the channel segment in the SCE restoration area. The river berms also minimize sedimentation in the newly created basins from storm events.

6.3.2 Tidal Data

The mean tide range in the Pacific Ocean at this location is about 3.7 feet, with the lowest annual tide at about -2.0 feet MLLW datum and the highest annual tide about 7.8 feet MLLW. MLLW is 2.75 feet below mean sea level. The diurnal range is 5.4 feet while the extreme range is near 10 feet. A table showing the mean tide levels at the La Jolla tide station is included in Appendix B.

Jenkins and Wasyl (2001) conducted extensive modeling of the tidal regime within San Dieguito Lagoon following the restoration project to be completed by SCE. They determined that under the proposed plan, tidal height within the lagoon would reach approximately 7.1 feet MLLW. The lowest tides depend on the depth of the sill at the lagoon mouth. SCE proposes to maintain the open ocean inlet with a depth of +0.5 feet MLLW; however, this will vary with the frequency of inlet opening and the degree of shoaling that may occur within the beach area.

Coastal Environments has been collecting tidal data within San Dieguito Lagoon since grading was completed by SCE. These data will be useful in modeling any future changes in the lagoon using various restoration designs for additional areas.

6.4 BIOLOGICAL INFORMATION

Extensive biological data has been collected on the San Dieguito Lagoon over the years and is beyond the scope of this brief synopsis to provide in detail. The San Dieguito Wetland Restoration Project EIR/EIS (2000) is the most recent data available for the project site and is available on line:

In addition, CCC is responsible for long-term monitoring of the restored site and is in the process of collecting and reporting on the use of the restored wetlands by fish and wildlife.

Overall vegetation maps, soil maps, sensitive species occurrences, and the wetland types from the National Wetlands Inventory for the vicinity of the Study Area are provided in Figures 6-4 through 6-8. The vegetation map is out of date as it was prepared prior to the SCE restoration project. Updated vegetation mapping will be required for an environmental analysis for future restoration activities.

6.4.1 Regional Habitat and Species Conservation Planning

The Study Area lies within the northern portion of the City of San Diego Subarea Plan and the project site includes a Biological Core Area and a 90 percent Habitat Preserve Area. In addition, several species within the project area that are not listed by the resource agencies are considered “covered” by the MSCP. These species are described in the following section.

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6.4.2 Biological Communities

The SCE restoration project is currently ongoing and vegetation communities have changed since the SANGIS data presented in Figure 6-4 were published. The project involves the excavation of existing wetlands, and upland areas will be excavated to create approximately 175 acres of subtidal, intertidal mudflat, seasonal salt marsh, and transitional wetlands. A relatively large portion of the floodplain was excavated to create these coastal wetland habitats.

Coastal wetland habitat includes subtidal, intertidal mudflats, coastal salt marsh (low, mid, and high), transitional wetland, and seasonal salt marsh habitat. The existing ground elevations typically range from +3 feet, NGVD to +12 feet NGVD; the restoration project involved excavation to elevations ranging from –6 feet, NGVD to +5 feet NGVD.

Five sensitive bird nesting areas consisting of shell cover sand areas were created as part of the restoration project. In addition, approximately 120 acres of upland habitat areas are to be established on the disposal areas and berms that were constructed as part of the project. These areas have been hydromulched with native coastal sage scrub species.

The remaining habitats within the project area consist mostly of ruderal lands that have been subject to past agricultural practices, remnant areas of seasonal wetland and seasonally ponded areas, and riparian habitat.

6.4.3 Special-Status Species

The EIR/EIS contains an extensive discussion of special-status species that have the potential to occur within the Study Area. A map illustrating the known occurrences of special-status species is provided in Figures 6-7 and 6-8. While the site has potential for a variety of species, the only confirmed observations are of Belding's savannah sparrow, light-footed clapper rail, and several plant species, discussed below.

6.4.3.1 Wildlife

Belding's savannah sparrow has been consistently observed at San Dieguito Lagoon. Pairs were observed in association with the salt marsh during the breeding season. Large flocks congregate in the salt marsh and forage in upland areas outside of the breeding season. Surveys conducted from April 1992 through April 1993 recorded 884 Belding's savannah sparrows at San Dieguito Lagoon. Belding's Savannah Sparrow habitat in the San Dieguito River area consists mainly of salt marsh in the intertidal zones where *Salicornia virginica* is prevalent. Slightly higher elevations are often dominated by *Salicornia subterminalis* or vegetated with nonnative weedy species such as mustard and grasses. The primary Belding's Savannah Sparrow habitat, therefore, occurs immediately adjacent to the shoreline.

The light-footed clapper rail has been irregularly reported at San Dieguito Lagoon over the past 10 years; it was not detected during any annual census conducted between 1998 and 1999 (Zembal 1998; Fancher, J. pers. comm. 2000). Recently, a number of breeding pairs have been detected near the El Camino bridge in brackish water habitat (Nordby, C. pers. comm., 2004), and this population appears to be relatively stable.

The coastal California gnatcatcher has been documented to occur within the San Dieguito Lagoon Study Area. This species of gnatcatcher is a permanent resident of coastal sage scrub in Southern California, and prefers coastal sage scrub located in arid washes, slopes and mesas. Breeding pairs have been documented within scrub habitat within the central portion of the Study Area (CDFG 2009). Slopes surrounding the lagoon with coastal sage scrub provide suitable habitat for this species.

6.4.3.2 Plants

No federally or state-listed plant species are present within the Study Area. However, there are a number of sensitive plant species listed as potentially present in the EIR/EIS. Two species have been confirmed to be present, and specific mitigation measures related to the EIR/EIS process were necessary to minimize impacts to less than significant:

Southern tarplant (*Hemizonia parryi* ssp. *australis*)

Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*)

These species are associated with drainages and seasonal wetlands and would still be expected to be found in areas within the Study Area with suitable habitat.

6.4.4 Invasive Plants

Because of the past use of the area for agricultural uses and the land disturbance associated with the construction of the SCE restoration area, invasive weeds have the potential to colonize these disturbed areas. Once SCE has completed the grading and hydroseeding of the disposal sites, berms, and nesting sites constructed as part of the San Dieguito Wetland Restoration Project, a weed management program will be instituted to manage the invasive weeds in these areas. SCE is responsible for initial weed management and will transfer the long-term management to the JPA after meeting project performance criteria. The 22nd Agricultural District is responsible for the long-term weed management at the nesting sites.

As of May 2008, several weed species have already started to colonize in some areas of the disposal sites. These species include crystalline ice plant (*Mesembryanthemum crystallinum*), Russian thistle (*Salsola tragus*), fivehook bassia (*Bassia hyssopifolia*), and *Chenopodium* sp.

A weed management plan has been prepared by SCE and is being implemented for the project site.

6.5 RESTORATION ACTIONS IN STUDY AREA

6.5.1 Past Restoration Activities in Study Area

In 1974, the San Dieguito Lagoon Committee was formed by the City of Del Mar for the purpose of revitalizing and managing the lagoon ecosystem west of I-5. In 1979, through the efforts of this committee, the SCC, technical consultants and representatives of numerous public agencies, the City of Del Mar developed the “San Dieguito Lagoon Resource Enhancement Program,” which outlined a plan for achieving this goal. To date, several projects described in the program have been carried out; most notably a tidal basin was dredged in a 70-acre area of the southern lagoon by CDFG in 1983.

In 1989, JPA was formed. JPA is an independent local government agency established by the County of San Diego and the cities of Del Mar, Escondido, Poway, San Diego and Solana Beach for the purpose of creating a greenway and natural open space park system throughout the San Dieguito River Valley, including the tidal lagoon. In 1994, JPA adopted a Concept Plan for the San Dieguito River Park that endorsed many of the same concepts for the San Dieguito Lagoon that had been proposed in the Conceptual Plan for the Expanded San Dieguito Lagoon Resource Enhancement Program. Partners were then sought to accomplish the goals for the lagoon area.

In 1992, CCC directed SCE to create 150 acres of wetlands at the San Dieguito Lagoon to mitigate for effects of thermal effluent discharge SONGS. This direction was subsequently amended to require that SCE maintain an open tidal inlet for the operating life of SONGS in return for 35 acres of wetlands credits and to substantially create 115 acres of wetlands at San Dieguito Lagoon through excavation of uplands. To accomplish this direction, SCE and the JPA entered into an agreement that gave SCE the right to use JPA property in the lagoon area to earn the mitigation credits it needed.

A Park Master Plan for the entire lagoon was prepared in 2000 by JPA. The Master Plan incorporated the tidal wetland restoration project proposed by SCE and also provided details on public access, educational opportunities, and upland habitat restoration measures.

An EIR/EIS was prepared in 2000 for the San Dieguito Wetland Restoration Project, which included not only the elements of the SCE mitigation project, but other restoration elements as well:

- Restoration and enhancement of tidal wetlands,
- Inlet maintenance to keep an open connection to the ocean,
- Development of native upland habitat,
- Enhancement and expansion of several freshwater and seasonal coastal wetland areas,
- Creation of a storm water management basin,
- A public access and interpretation component.

The restoration plan is shown in Figure 6-9, which presents restoration areas described in the EIR/EIS. SCE is responsible for creation of tidal wetlands within modules W1, W2, W3, W4, W10, W16, and W17. It is also responsible for creation of five nesting sites, NS11 to NS14, and the rehabilitation of NS15 for CDFG.

A final EIR/EIS was completed in September 2000. After permit authorization from local, state, and federal agencies, project construction was initiated in the fall of 2006. The bulk of the project was completed in the spring of 2009, but dredging of the river and outlet opening is scheduled in Fall 2009/Winter 2010.

6.5.2 Future Restoration in Study Area

In 2004, the 75-acre Boudreau property, just east of El Camino Real, was purchased by the Trust for Public Land and transferred to JPA for habitat restoration purposes. This essentially placed the entire floodplain area of the lower San Dieguito River under public ownership. JPA also owns a 40 acre area (referred to as W19) east of the Boudreau property. A memorandum of understanding (MOU) exists between JPA, Caltrans and SANDAG to perform wetland and upland creation on these properties. Restoration in these areas would provide for an intertidal channel surrounded by tidal marsh habitat. The restoration plan would also result in an increased tidal prism, benefiting the other tidal restoration areas completed by SCE, and would reduce inlet maintenance frequency (Jenkins and Wasyl 2008).

6.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, nine potential restoration areas were identified within San Dieguito Lagoon (Figure 6-10). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Details on the methodologies employed have been described in Section 1.3 of this report.

6.6.1 Conventional Restoration

6.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration lie within upland areas along the banks of the San Dieguito River and within the CDFG Ecological Reserve lands. As has been done for the previous CDFG and SCE restoration actions at San Dieguito Lagoon, excavation of upland areas to bring them within the range of tidal action is required. The very fine sands excavated are not suitable for disposal on the beach and therefore must be placed in other portions of the lands on-site or trucked off-site for use elsewhere. A number of disposal

areas have been used in the past for both CDFG and SCE restoration projects and may be available for future use. Access for construction and disposal of materials is very good.

At present, SCE is responsible for maintenance of the tidal inlet such that tidal action is maintained to both the west and eastern sides of I-5. This is an improvement over past conditions when the inlet was closed more than 60 percent of the time. Restoration of additional tidally influenced areas may reduce the amount of maintenance within the tidal inlet through increasing the tidal currents within the channel. It may also require some changes in the channel beneath the bridge. The current I-5 bridge structure is wider than the San Dieguito River, with 1.5 spans over the river channel and several others over dry ground, but still within the flood plain. This condition leaves two-thirds of the bridge length underlain by fill while the bridge was designed to support flow (S. Scatolini, pers. comm.) However, any change to the floodway will require careful analysis of flood levels and velocities, as the current infrastructure surrounding the San Dieguito River was built in conformance with existing conditions. The river berms associated with the SCE project were built to ensure that flood levels and velocities would remain the same within the floodway (or "effective flow area") and that the wetlands created behind the berms would be protected from excessive sedimentation during flood events.

Perhaps the greatest advantage for restoration within the San Dieguito Study Area is the fact that the lands are publicly owned for the most part and JPA has set forth a Master Plan for restoration. Much of the land has been in agricultural production in the past or consists of undeveloped land adjacent to the river that could be restored to tidal action or used for the creation of seasonal wetlands.

A summary of the wetland restoration potential for each of the sites evaluated within the San Dieguito Study Area is provided in Table 6.1 and photographs are included in Appendix E. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in Appendix A.

Table 6-1. Mitigation Potential in the San Dieguito Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments
SD-1	1	43	Site is within floodplain. Excavation may be prohibited in this area because of impacts to the floodway unless berms are constructed; however, the creation of seasonal or freshwater wetlands is possible. Nearby population of light-footed clapper rail.
SD-2	1	43	A preliminary plan for tidal restoration has been prepared and hydrologically evaluated by Chang and Jenkins. Excavated materials could be placed on nearby disposal area.
SD-3	3	37	Area included within original JPA Master Plan for tidal restoration
SD-4	N/A	N/A	Site was rejected because it is within floodway of river and also provides some protection to newly constructed river berms.

Table 6-1. Mitigation Potential in the San Dieguito Study Area

Assessment Site	Mitigation Potential*	Site Condition Score	Comments
SD-5	1	54	Both areas are upland disposal areas located with CDFG ecological reserve and are proximate to existing natural wetlands. SD-6 is non-functional nesting area. Access is difficult and potential impacts to existing resources.
SD-6	2	57	
SD-7	1	37	Numerous private parcels abutting channel currently covered with hottentot fig. Would require excavation to tidal action but access is good. Utilities through middle of this parcel may be difficult to work around.
SD-8	1	45	Majority of site is currently wetland; only edges provide opportunity for restoration to create slightly larger wetland area. Property is held by transit agency and may be used for its mitigation needs.
SD-9	3	31	Site is used seasonally for parking; however, portions considered wetland by USACE and CCC. While there are no physical constraints to restoration, determination of wetland status needs to be resolved.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

6.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 1 or 2 is 73.8 acres.

6.6.1.3 Next Steps

San Dieguito Lagoon offers some of the largest areas of restoration from nonwetland area to wetland of the six lagoons studied. The lands are held by public agencies and a Master Plan has been prepared for the restoration of wetlands on these properties. However, the excavation costs associated with these projects may make restoration costs relatively high. Coordination with JPA is warranted to identify those areas of highest priority for restoration. SD-2 has already been identified by Caltrans as a potential restoration area and primary studies have been initiated.

6.6.2 Hydrodynamic Restoration

6.6.2.1 Opportunities and Constraints

Most of the areas examined for restoration are well above tidal action and, therefore, would not be affected by changes in the bridge structures that reduce tidal muting. However, should tidal restrictions be reduced through changes in either (1) the channel configuration through the existing I-5 abutments or (2) enlargement of the tidal prism through increased tidal areas (e.g., SD-3), these changes could result in an increase in potential tidal prism within the recently restored SCE lands north of the river and east of I-5.

6.6.2.2 Potential Mitigation Acreage

By removing the tidal muting at the bridges, the high tide range could increase, inundating additional areas. This would extend to all areas of the lagoon regardless of whether they are within the restoration areas identified in this analysis. Further analysis of potential tidal prism improvement and the topography of the surrounding lagoon will quantify an approximate acreage of anticipated increased inundation.

6.6.2.3 Next Steps

Further analysis is required of any changes that may occur with either an increased tidal prism or an enlarged tidal basin east of I-5.

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SAN DIEGUITO STUDY AREA FIGURES

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Figure 6-1.
Aerial Site Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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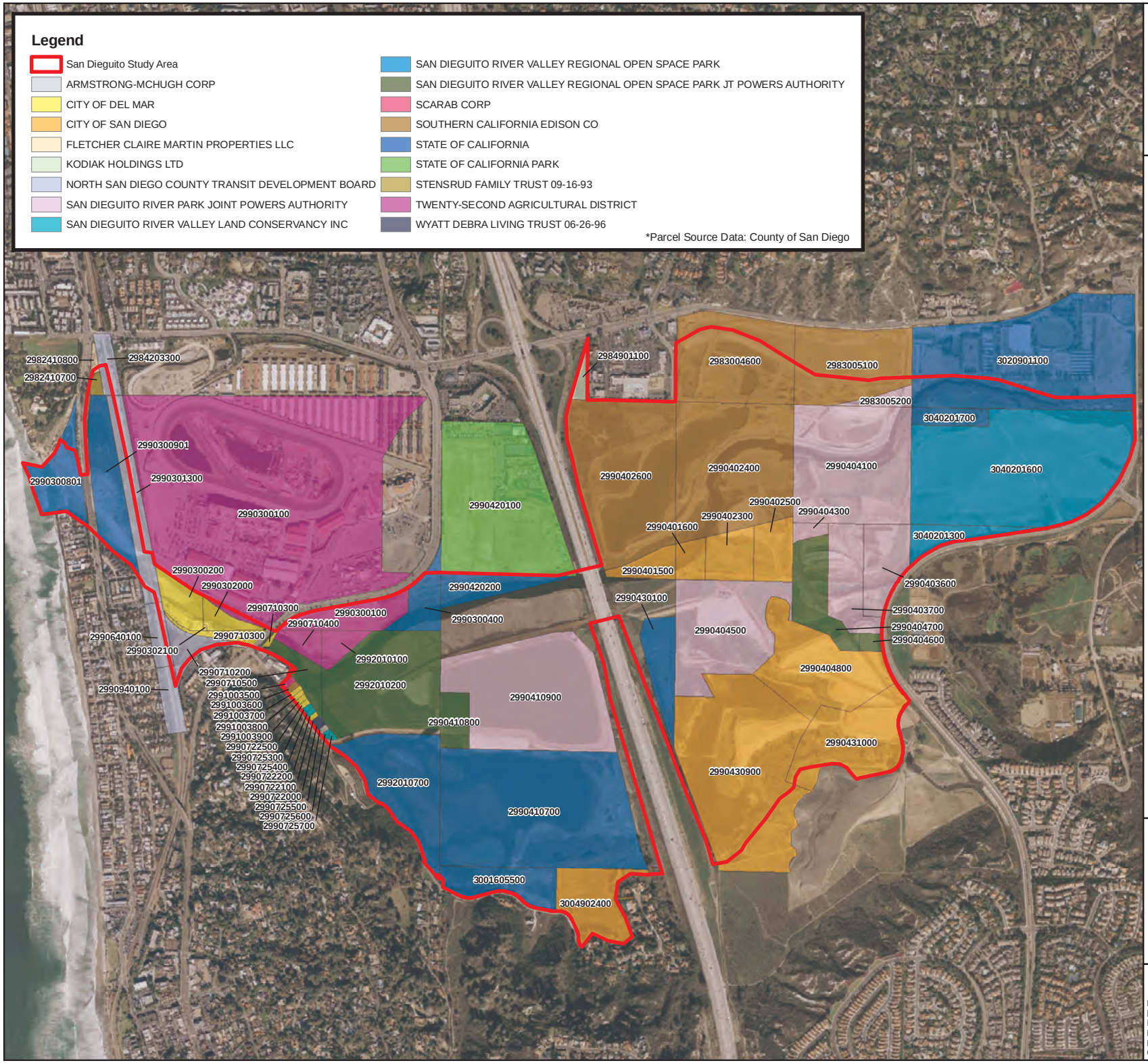

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Figure 6-2.
Parcel Owners within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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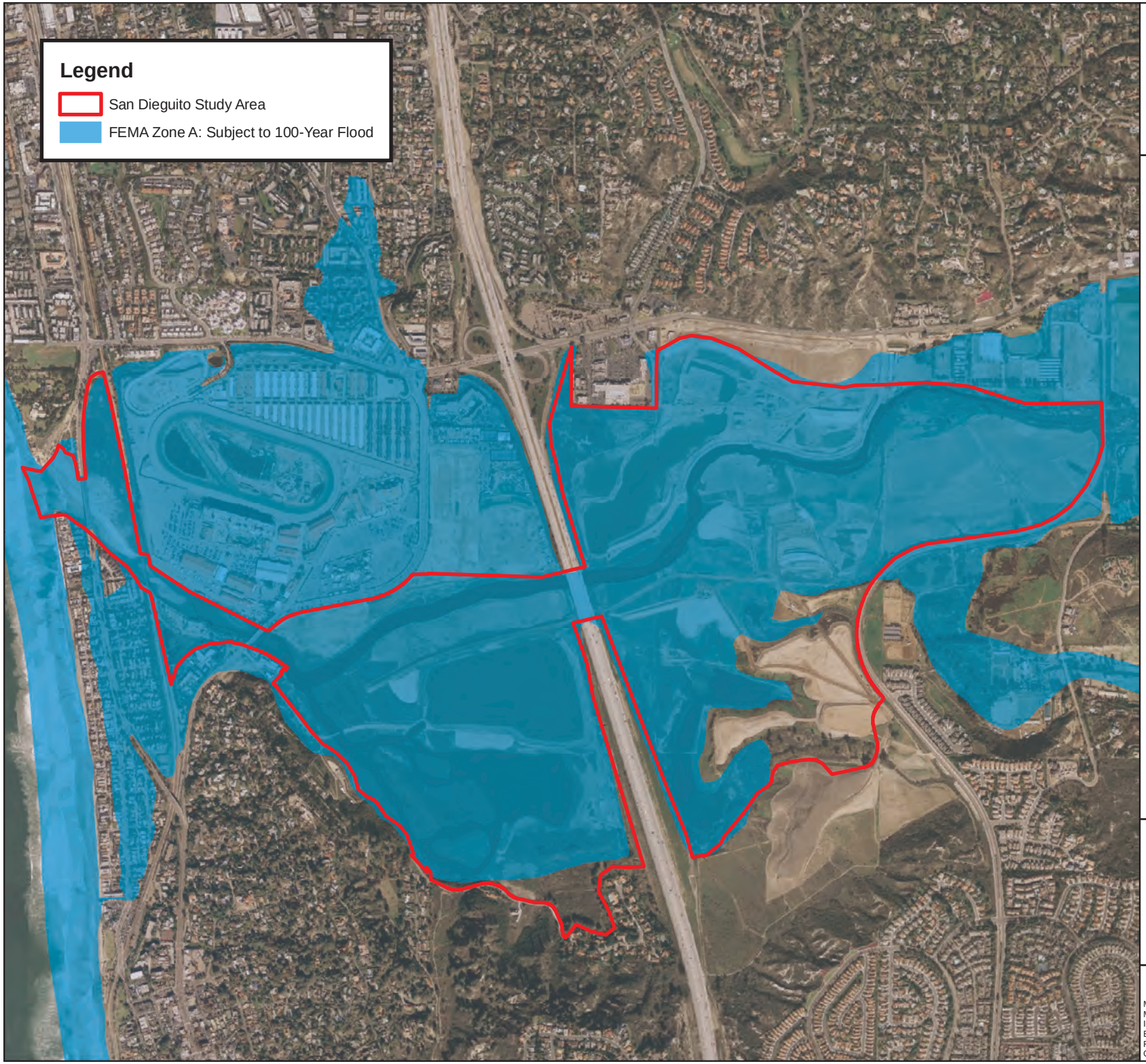

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**Figure 6-3.
FEMA Zones
within the
Study Area**

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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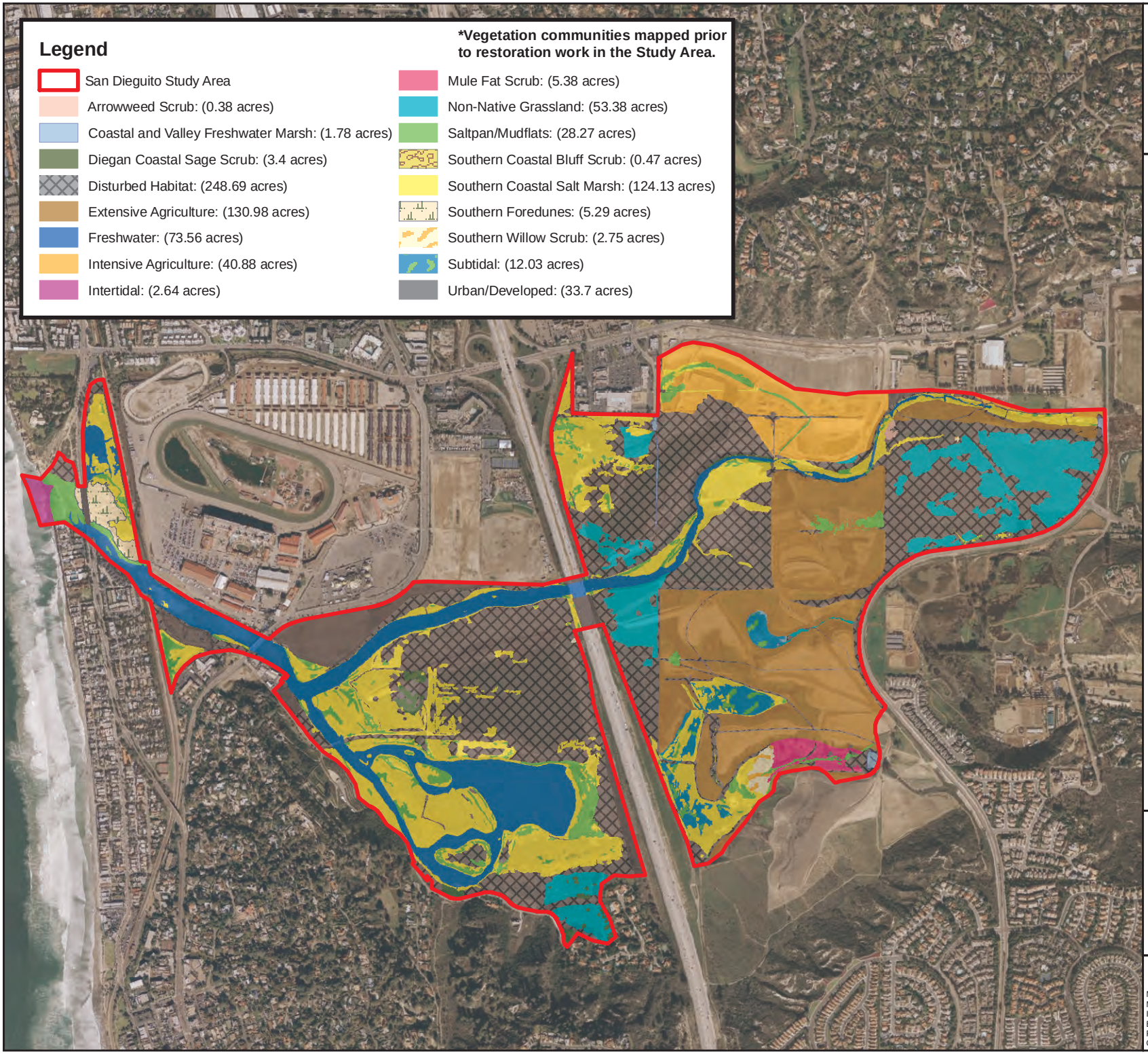

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Figure 6-4.
Vegetation Communities within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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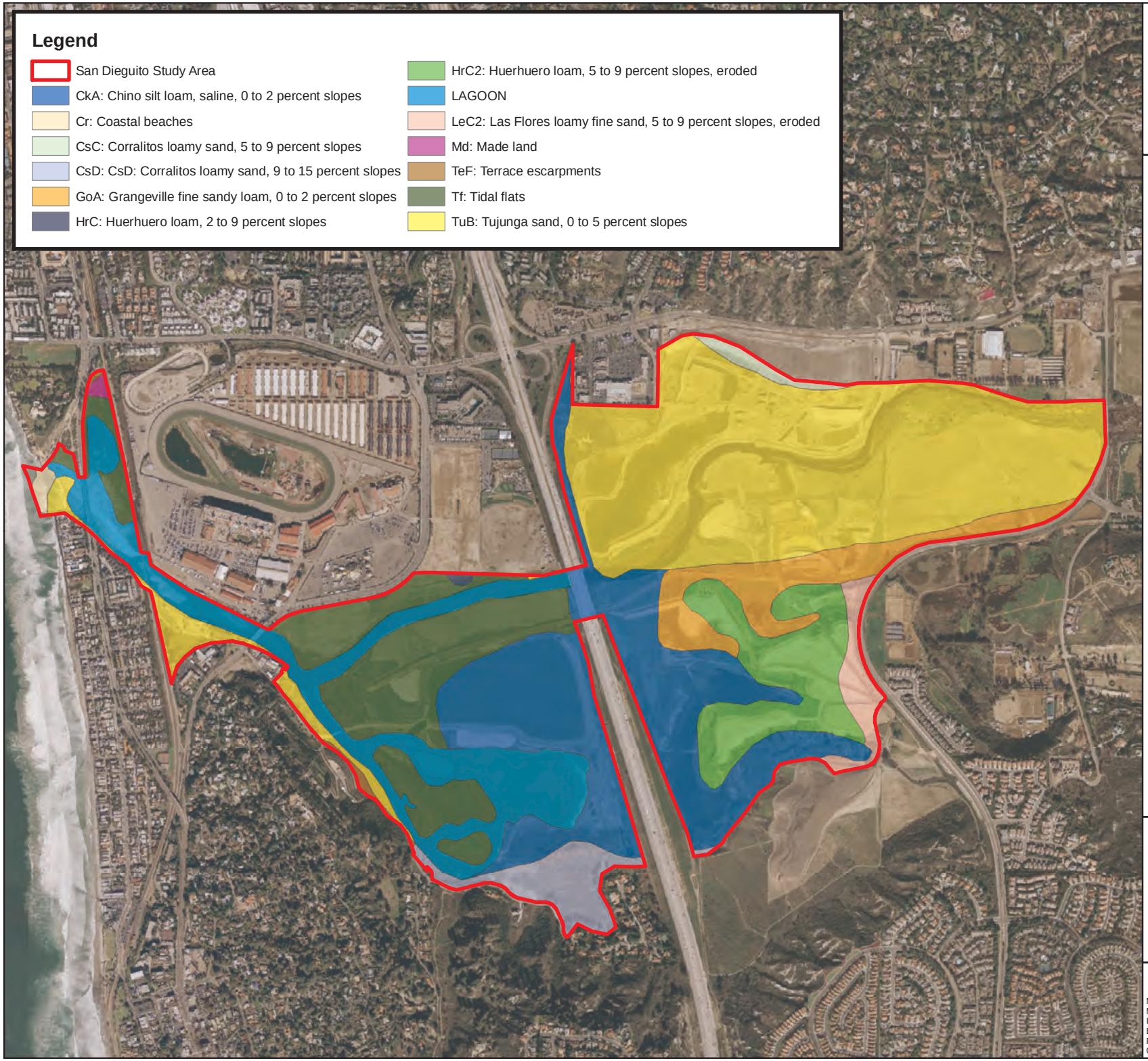

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Figure 6-5.
Soils Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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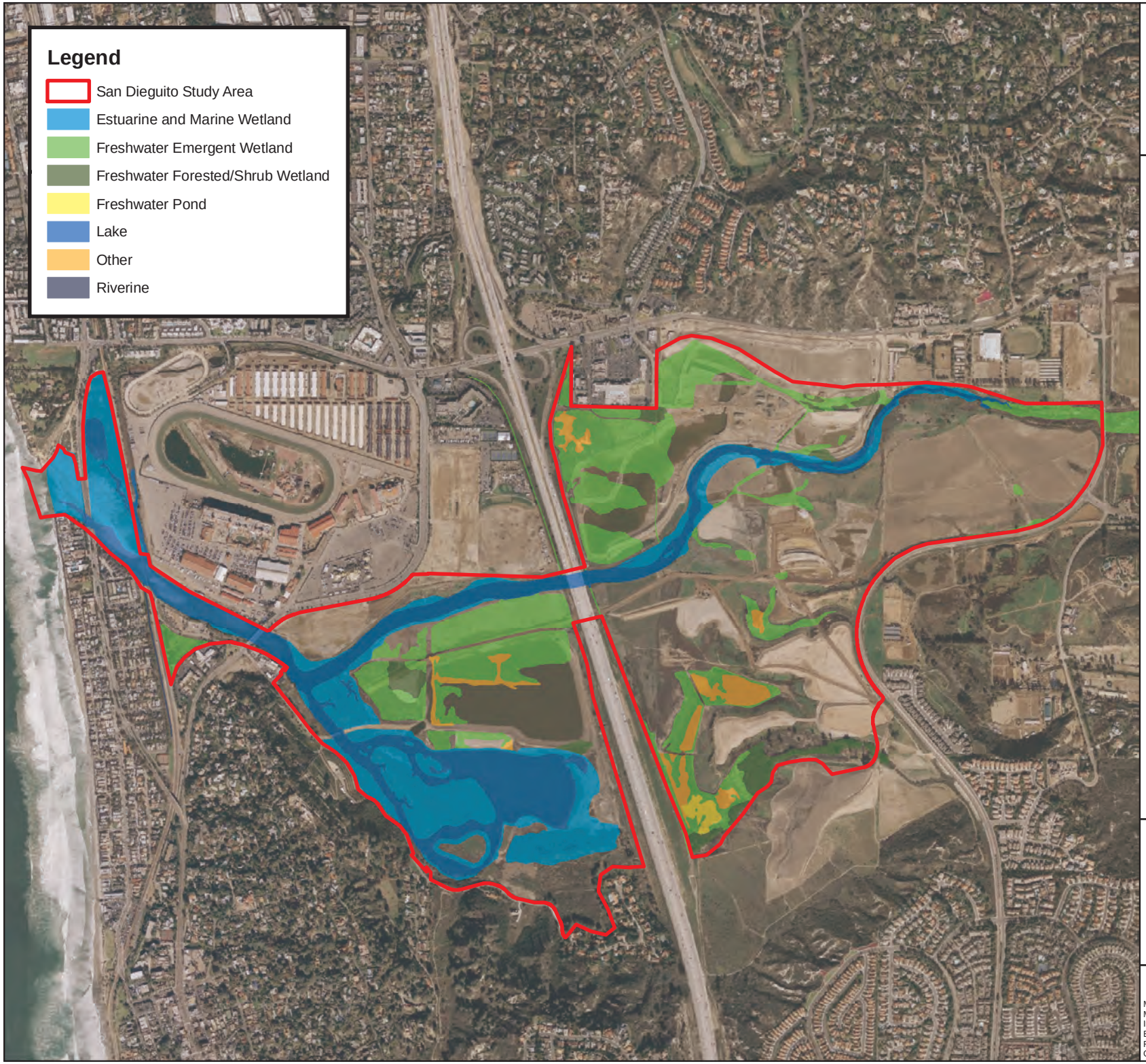

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Figure 6-6.
NWI Data (May 2002)
within the
Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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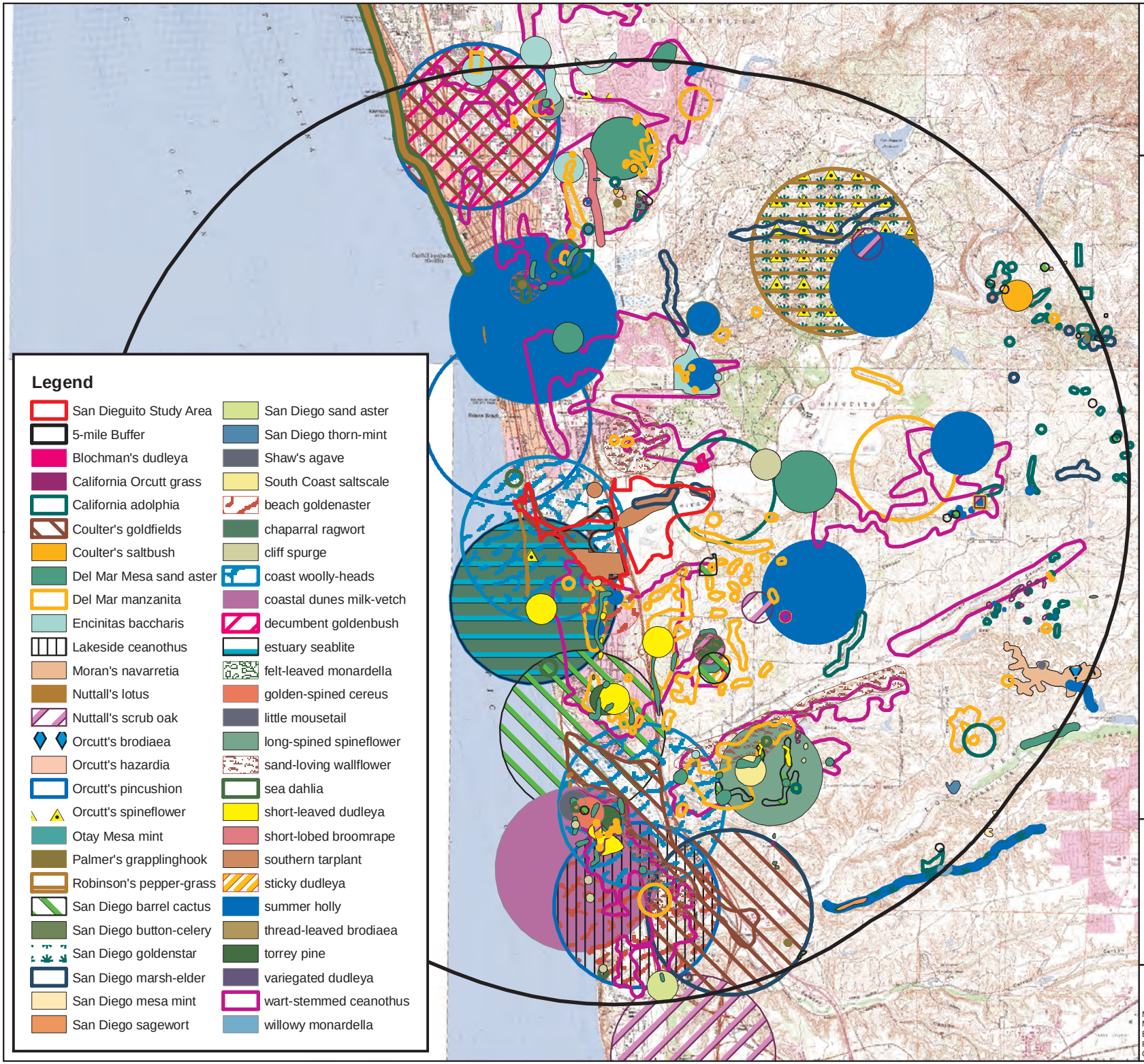

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Figure 6-7.
Special Status Plant Species within 5-mile Radius of the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\San Dieguito\CNDDBPlant.mxd

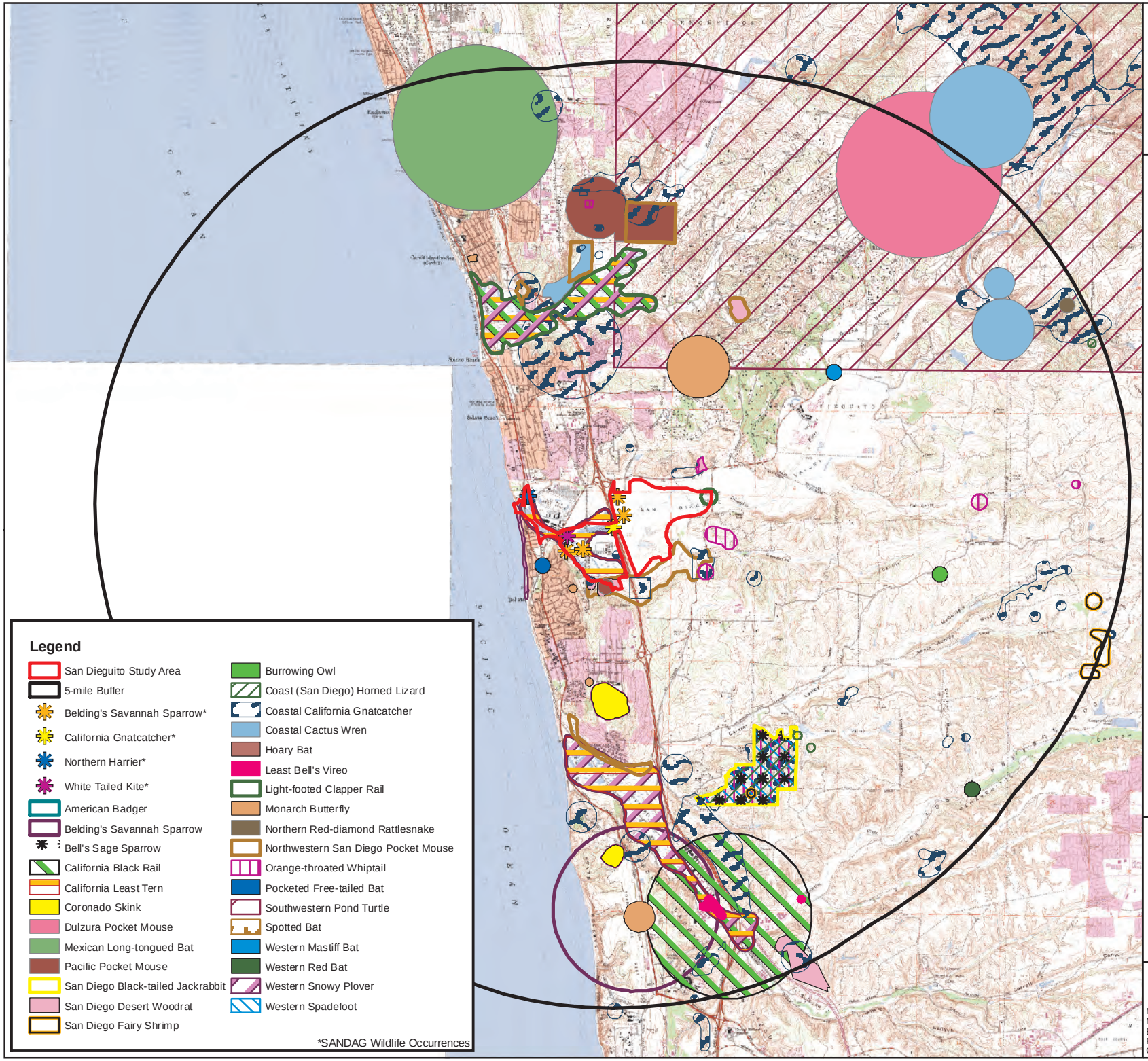

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Figure 6-8.
Special Status Animal Species within 5-mile Radius of the Study Area

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Miles

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: USGS Quad
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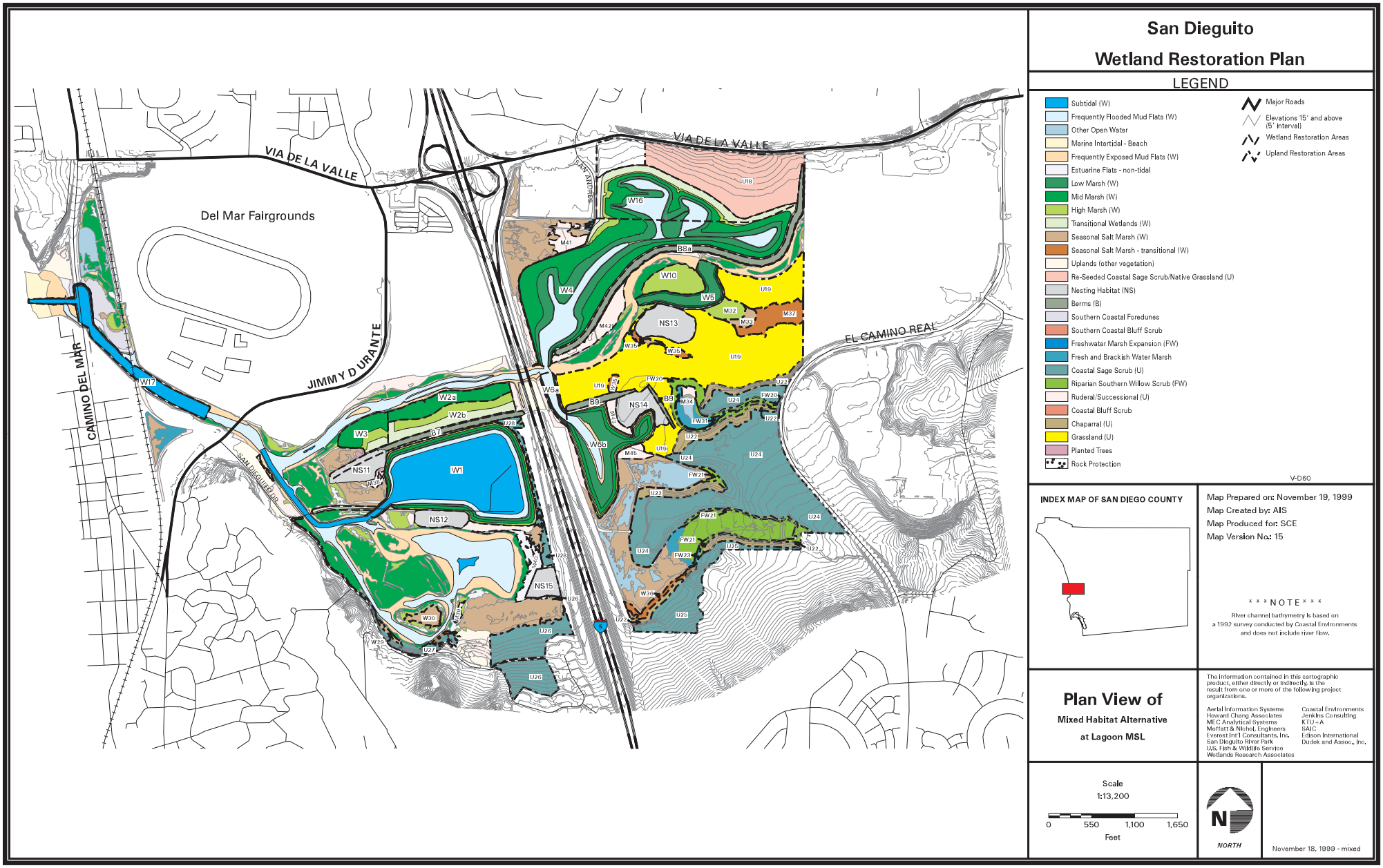

Figure 6-9. Plan View of Mixed Habitat Alternative

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Figure 6-10.
Potential Restoration Areas

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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7.0 LOS PEÑASQUITOS LAGOON

Los Peñasquitos Lagoon is located along the northwest border of the City of San Diego, just south of the City of Del Mar (Figure 7-1). The lagoon is located in the Los Peñasquitos watershed, which encompasses approximately 95 square miles. Carmel Creek and Los Peñasquitos Creek are the main tributaries to the lagoon. The Study Area encompasses approximately 463 acres of tidal wetlands within the lagoon and extends inland approximately 2.04 miles.

7.1 PHYSICAL SETTING

7.1.1 Historical Profile

The Los Peñasquitos Valley was formed approximately 10,000 to-20,000 years ago due to sea level rise as a result of melting polar ice caps (Hubbs et al. 2008). The valley was consequently filled to form a deep bay (Hubbs et al. 2008), and regular sedimentation has gradually formed the existing mudflats (Hubbs et al. 2008). It is presumed that more fresh water historically entered the lagoon based on historic accounts of the area (Hubbs et al. 2008). In addition, historically higher precipitation patterns, a larger lagoon, and less restricted tidal influence are assumed to have provided sufficient flow to keep a channel open to the beach (Hubbs et al. 2008). Marine fossil assemblages suggest that historically the lagoon mouth remained permanently open (Hubbs et al. 2008) to tidal influence. Currently, the mouth does not naturally remain open, and estuarine marine life has been impacted (Hubbs et al. 2008). During exceptionally wet winters, adequate runoff may build up in the lagoon to break through the barrier bar naturally (Hubbs et al. 2008). If the bar is not breached in this way, however, the channel is often artificially opened (Hubbs et al. 2008).

The historic lagoon mouth is thought to have been located at the far southwest corner of the lagoon, near the present-day south parking lot (Hubbs et al. 2008). The first narrow gauge railroad was constructed in 1888 along the north side of the valley, and railroad maps began showing the inlet to be at the far northwest edge of the lagoon (Hubbs et al. 2008).

The construction of the Santa Fe Railroad in 1925 restricted natural drainage patterns within the lagoon (Hubbs et al. 2008). The railroad divided the lagoon into its current northeast and southwest sections, significantly altering tidal influence (Hubbs et al. 2008). This modification decreased the effective tidal flow to approximately one-quarter of its pre-1925 values, so that by 1928, photographs showed the entrance channel choked with sand as far as the old McGonigle Road Bridge (Hubbs et al. 2008). When the coast highway was extended in the 1930s, the low beach barrier was increased in elevation, further altering tidal influence. The lagoon entrance was then shifted southward one-quarter-mile to its present location near the old McGonigle Bridge (Hubbs et al. 2008). The majority of the historic bridge pilings have been removed to increase tidal flow (Hubbs et al. 2008).

Los Peñasquitos Lagoon once supported approximately 425 acres of low/salt marsh (SDRWQCB in CWIS, 1983). In addition to the discharge of treated sewage into the lagoon from 1962 to 1972 (Los Peñasquitos Lagoon Foundation & SCC in California Wetland Information System [CWIS] 1985), past land uses such as farming and cattle ranching impacted both the quality and type of habitat in the lagoon.

7.1.2 Surrounding Land Uses

Torrey Pines State Beach and Reserve border the western edge of the lagoon, Carmel Valley Road borders the lagoon's northern edge, and I-5 forms the eastern boundary. Residences and

small businesses occupy land along and north of Carmel Valley Road. Land south of the lagoon is part of the Torrey Pines State Reserve.

7.1.3 Topography and Bathymetry

The project Study Area, which extends from the I-5 bridge west to the Pacific Ocean, consists of a broad, relatively flat floodplain that is dominated by salt marsh habitat in the western end transitioning to brackish and riparian habitat in the eastern portion. There are several tidal channels that transverse the lagoon. The Lagoon is bordered by relatively steep coastal terraces and bluffs. The most prominent landforms within and adjoining the project site include the following:

- Primarily low-lying salt marsh habitat;
- Braided tidal channels in the northern portion of the lagoon;
- A relic sand dune south of the lagoon mouth;
- Several salt pans and a larger salt flat east of the railroad bridge;
- A mud flat west of the railroad bridge in the southern portion of the lagoon; and
- Public beach areas located north and south of the lagoon mouth.

7.1.4 Surrounding Transportation Systems

The transportation systems in the vicinity of the lagoon consist of the following:

- The NCTD railroad (formerly the Santa Fe Railway), which traverses the center of the lagoon, separating the lagoon into halves;
- I-5, which forms the lagoon's eastern periphery;
- Carmel Valley Road, which borders the lagoon's northern edge;
- North Torrey Pines Road, which runs along the western perimeter; and
- Pacific Coast Highway (Highway 101), which crosses over the ocean inlet/outlet and forms the western edge of the lagoon.

7.1.5 Utilities

Electricity lines run along the eastern boundary of the Study Area, just off of Sorrento Valley Road.

In 1970 plans were formalized for the discharge of wastes through the Metropolitan Sewage System and water in the form of treated sewage effluent now enters the southeast portion of the Study Area from two nearby sewage treatment plants.

7.1.6 Storm water Discharges

The average annual precipitation for the coastal area is usually around 10 inches per year and 18 inches per year in the mountains of the coastal range (AMEC 2005). Intense storms occur between November and March with a majority of the annual precipitation falling during a few storms in close proximity to one another. Rainfall patterns for the area are subject to extreme variations from year to year and have longer term wet and dry cycles.

Storm water discharge enters the Study Area as runoff from the surrounding roadways, which are outlined in section 7.1.4. This input comes in the form of sheeting surface runoff and through roadside storm drains. Additional runoff enters the lagoon through the upper watershed and as treated wastewater from two wastewater treatment facilities located in the watershed (CSCC 2001).

7.2 OWNERSHIP

Land ownership as recorded by SANGIS is shown in Figure 7-2.

7.2.1 Private Properties within Study Area

There are no private landholdings within the Study Area.

7.2.2 Public Properties Adjacent to the Study Area

Public property owners in the Study Area include the City of San Diego, SDG&E, San Diego Metropolitan Transit Development Board, and the State of California, which is operated by the California State Parks system. Interstate 5 and the associated right-of-way are owned by Caltrans.

7.2.3 Land Use within Study Area

The land within the Study Area is within the designated City of San Diego as Open Space, Sensitive Coastal Resource Zone (CWIS 1985). Onsite uses include utility corridors, municipal infrastructure such as storm water outfalls and sewer lines, and small-scale restoration sites. Beaches north and south of the lagoon mouth are State Parks recreation areas. The area is closed to all boats and hiking except for the Flintkote Trail (Hubbs et al. 2008).

7.3 HYDROLOGY

7.3.1 Flood and River Data

Los Peñasquitos, Carroll Canyon and Carmel Valley creeks drain three sub watersheds that combined, are approximately 60,000 acres. Historically, the only perennial (year-round) flow came from Peñasquitos Creek, with Carroll Canyon and Carmel Valley creeks serving as ephemeral drainages, flowing only during the winter months. However, beginning in the late 1980's, coincident with increasing development in the watershed, Carroll Canyon and Carmel Valley creeks also began flowing year-round (Pacific Estuarine Research Laboratory [PERL] 2004).

The Los Peñasquitos Creek flow is partly regulated by several conservation reservoirs. A 1982 estimate of the 100-year peak at a point near the mouth of the creek was 16,300 cfs. Carroll Creek, which has its headwaters near Miramar Reservoir, has an estimated 10-year storm and 100-year storm event that would produce a runoff rate of 1,200 cfs and 6,000 cfs, respectively. For Carmel Creek, the 1985 estimated 100-year peak at a point near the mouth was 9,600 cfs (CSCC 2001).

The Study Area is located within the FEMA 100-year flood zone as shown in Figure 7-3. Due to the increased urbanization of the upper watershed, the Study Area is more prone to flooding and has seen a dramatic increase in the peak flow and volume during a storm event (AMEC 2005).

7.3.2 Tidal Data

The general characteristics of the tide at Los Peñasquitos Lagoon can be represented by tide conditions recorded at the Scripps Pier, located in northern La Jolla, California. Tide measurements are recorded from Tide Gauge No. 9410230, and began in 1925. The mean tide range in the Pacific Ocean for this location is about 3.7 feet, with the lowest annual tide at about -2.0 feet MLLW datum and the highest annual tide about 7.8 feet MLLW. MLLW is 2.75 feet

below mean sea level. The diurnal range is 5.4 feet, while the extreme range is near 10 feet. A table showing the mean tide levels at the La Jolla tide station is included in Appendix B.

Under present conditions, a permanent inlet to the Pacific Ocean cannot be naturally maintained; consequently, the marine life has diminished and, at times, has been almost eliminated. During exceptionally wet winters, sufficient runoff may accumulate in the lagoon to break through the barrier bar naturally. If the bar is not breached in this manner the channel is often bulldozed open to alleviate the danger of flooding and to improve the health of the lagoon.

7.4 BIOLOGICAL INFORMATION

Extensive biological data has been collected on the Los Peñasquitos Lagoon over the years and is beyond the scope of this brief synopsis to provide in detail. The Physical, Chemical and Biological Monitoring of Los Peñasquitos Lagoon (2004) and the Los Peñasquitos Watershed Management Plan (2005) provide the most recent data available for the Study Area. This section is based on existing biological survey data; no new surveys were conducted as part of this study. Overall vegetation maps, soil maps, national wetlands inventory, sensitive species occurrences, and critical habitat for the vicinity of the Study Area are provided in Figures 7-4, 7-5, 7-6, 7-7, 7-8, and 7-9. Existing information used to create these figures includes SANGIS and the CNDDB.

Observed flora and fauna recorded during the September 2, 2009 site visit are presented in Appendix C. Additionally, special-status species that are documented to occur within 5 miles of the Study Area and that utilize similar habitats to those found within the Los Peñasquitos Lagoon are listed in Appendix D.

7.4.1 Regional Habitat and Species Conservation Planning

The Study Area is located within the jurisdiction of the City of San Diego Multiple Species Conservation Program (MSCP). About two-thirds of the Los Peñasquitos Lagoon/Canyon Del Mar Mesa core area is included in the City of San Diego MSCP Subarea Plan. The remaining third falls within the City of Del Mar subarea. However, a draft of the City of Del Mar MSCP Subarea Plan has not been completed. Thus, jurisdiction is deferred to the City of San Diego MSCP.

The Study Area is also governed by a Local Coastal Program (LCP) presided over by the City of Del Mar. Pursuant to the California Coastal Act, LCPs are required to be prepared by all local coastal jurisdictions to implement policies in the Coastal Act.

7.4.2 Biological Communities

According to SANGIS, there are nine habitat types within the Study Area, as well as urban/developed areas. The majority of the project area is mapped as southern coastal salt marsh. In addition, the following habitat types occur within the Study Area:

- Beach
- Diegan coastal sage scrub
- Southern maritime chaparral
- Valley and foothill grassland
- Coastal and valley freshwater marsh
- Estuarine
- Southern riparian scrub

Diegan coastal sage scrub is a low, soft-woody sub-shrub community usually dominated by California sagebrush (*Artemisia californica*) and California buckwheat (*Eriogonum fasciculatum*)

(Holland 1986). Other species present include laurel sumac (*Malosma laurina*) and white sage (*Salvia apiana*). Estuarine habitat may be comprised of various tidally-influenced vegetation communities such as coastal salt marsh, coastal brackish marsh, mudflats, and open water. Southern maritime chaparral is a low, fairly open chaparral community usually dominated by wart-stemmed ceanothus (*Ceanothus verricosus*) and thick-leaved manzanita (*Arctostaphylos glandulosa*). Valley and foothill grassland within the Study Area is dominated by non-native, invasive grasses such as Italian ryegrass (*Lolium multiflorum*).

7.4.3 Special-Status Species

7.4.3.1 Wildlife

Extensive biological monitoring of fauna has been conducted in accordance with the Los Peñasquitos Enhancement Plan. Several special-status species utilize the area for various aspects of their life history. The northwestern portion of the lagoon has been designated critical habitat for the snowy plover (see Fig. 7-9). Appendix D provides a list of special-status species that are documented to occur within a 5-mile radius of the Study Area, and utilize similar habitat types as those found within the lagoon. State and federally listed threatened or endangered species that utilize the lagoon for critical portions of their life history (such as breeding) are mentioned below.

Belding's Savannah Sparrow, has been observed at Los Peñasquitos Lagoon as breeding pairs and as year-round residents. Based off the CNDDB records, surveys for Belding's savannah sparrow estimated that 129 pairs were fairly evenly distributed throughout the lagoon in 2001. Any additional salt marsh creation and enhancement or increase in the tidal prism would serve to benefit the required habitat for this species.

The light-footed clapper rail has been well documented to occur in Los Peñasquitos Lagoon as a small breeding population since at least the early 1990s. Prior to this, individuals were sporadically documented. Based on a 2007 survey, a record high 12 breeding pairs were detected within the lagoon (CDFG 2009). This population would stand to benefit from an increase in the tidal prism.

The Western snowy plover is a federally threatened species that has designated critical habitat in the northwest portion of the Study Area. This species requires sandy, gravelly, or friable soils for nesting sites. Nesting sites have been documented around the northwest portion of the Study Area (CDFG 2009).

7.4.3.2 Plants

According to the CNDDB, six special-status plant species are documented to occur within or immediately adjacent to the Study Area and are presumed extant: Coulter's goldfields (*Lasthenia glabrata* ssp*. coulteri*), San Diego barrel cactus (*Ferocactus viridescens*), beach goldenaster (*Heterotheca sessiliflora*), Orcutt's pincushion (*Chaenactis glabriuscula* var. *orcuttiana*), Del Mar Mesa sandaster (*Corethrogyne flaginaflora* var. *liniflora*), and coast woolly-heads (*Nemacaulis denudata*) (CDFG 2009). CNDDB records indicate occurrences of 52 additional special-status species within 5 miles of the Study Area (CDFG 2009). A list of all special-status plant species documented in the vicinity of the Study Area can be found in Appendix D, and a figure depicting the approximate location of those occurrences is included as Figure 7-7.

7.4.4 Invasive Plants

An influx of freshwater due to tidal restrictions and impervious layers upstream, adjacent ornamental landscaping, and disturbance due to the construction of treatment ponds and the railroad have contributed to invasion by nonnative plant species. More than 130 nonnative plant species have been recorded within the lagoon, including the following species of concern: Monterey cypress (*Cupressus macrocarpa*), Coulter pine (*Pinus coulteri*), Canary Island date palm (*Phoenix canariensis*), Mexican fan palm (*Washingtonia robusta*), freesia (*Freesia refracta*), asphodel (*Asphodelus fistulosus*), Bermuda grass (*Cynodon dactylon*), Italian ryegrass (*Lolium multiflorum*), veldt grass (*Ehrharta* sp.), and pampas grass (*Cortaderia jubata*).

7.5 RESTORATION ACTIONS IN STUDY AREA

7.5.1 Past Restoration Activities in Study Area

Little traditional restoration activity has taken place for the Los Peñasquitos Lagoon. Larger steps to preservation occurred when the State Division of Parks and Recreation raised the status of Los Peñasquitos Lagoon from "State Park" (with free public access and recreational use) to that of "State Reserve" (with restricted access and usage) and now to "State Preserve" (the most restricted usage). Limiting the amount of public use and designating this area within its boundaries to be preserved in a natural state has helped to protect one of the few natural tidal estuaries remaining along the Southern California coast.

One of the major issues facing the lagoon is the rate of increased sedimentation from the alteration of the existing tidal prism (with the construction of the railroad bridge) and the urbanization of the watershed. Additionally, due to the increase in freshwater runoff from landscaping, wastewater treatment and hardpan (cement lining), far more freshwater enters the lagoon year-round then it did historically. Because of these issues, the lagoon mouth began to close seasonally. This reduces the health of an estuary by limiting the amount of sediment it can remove from the system and causes significant changes in salinity levels. Evaporation reduces the amount of water within the closed lagoon and increases the concentration of salt, which can rise to lethal levels for many of the organisms that live within the water and mudflats of the lagoon, and thereby impact the entire area's food web. In an effort to mitigate for this, the Los Peñasquitos Lagoon Enhancement Plan was developed in 1985 by CCC. Adaptive management included monitoring of the lagoon water quality and of the mechanical opening of the mouth of the lagoon before water quality became poor enough to kill organisms (PERL 2004). PERL, based at San Diego State University, has conducted the water quality monitoring portion of this management plan since 1987 and have sampled benthic invertebrates, fish, and saltmarsh vegetation since 1988.

Additional efforts to help maintain the opening of the mouth of the lagoon were implemented during construction of the Highway 101 bridge, which spans the mouth of the lagoon. The bridge, which was completed in 2005, was designed to reduce its impact on the tidal prism (Flatiron 2009). The structure now includes only four bridge supports, all of which are located outside the tidal channel. Future Restoration in Study Area

Future restoration activity for the Los Peñasquitos Lagoon has focused on the reduction of sediment to the system, curtailing freshwater input, and maintaining the opening of the lagoon mouth. An additional area of need for restoration is the control and removal of invasive plant species (AMEC 2005). The input of excess freshwater to the system, through urban and landscape runoff, has enabled some invasive freshwater species, such as ditchgrass (*Ruppia maritima*, an invasive seagrass), to thrive in portions of the lagoon. The treatment and removal

of such invasive species has been identified as a high priority in the PERL annual monitoring summaries.

Continued studies to determine how to best manage and preserve the Los Peñasquitos Lagoon are ongoing, and an updated lagoon enhancement plan is currently being prepared by the lagoon foundation.

7.6 RESTORATION OPPORTUNITIES

Following the preliminary inspection and discussions with interested parties, two potential restoration areas were identified within Los Peñasquitos Lagoon (Figure 7-10). These areas were visited by the field teams to conduct more specific investigations and to determine the potential for restoration. Details on the methodologies employed have been described in Section 1.3 of this report.

7.6.1 Conventional Restoration

7.6.1.1 Opportunities and Constraints

The primary opportunities for conventional tidal marsh restoration are the removal of existing berms and the conversion of low-quality upland or ruderal habitat in areas along the southern portion of the Study Area. Because the Study Area is within a State Preserve, any restoration activity would encounter minimal direct anthropogenic interference upon completion.

Currently, the Los Peñasquitos Lagoon is dominated by salt marsh and wetland habitat. There is very limited opportunity for wetland creation within the Study Area, and those areas identified are far outside the existing tidal influence. Additionally, access to these areas is very limited, and access trails would likely have to be cut, which would require mitigation for their temporary impact. Enhancement opportunities through the removal of invasive plant species may serve as more beneficial for the lagoon system; however, this approach will not generate any wetland creation credits.

A summary of the wetland restoration potential for each of the sites evaluated within the Los Peñasquitos Study Area is provided in Table 7-1 and photographs included in Appendix E. The detailed scores, as well as preliminary restoration acreages of each potential restoration site, are provided in the Appendix A.

Table 7-1. Mitigation Potential in the Los Peñasquitos Study Area

Assessment Site	Mitigation Potential8	Site Condition Score	Comments
LP-1	4	57.1	Site is subject to sedimentation, restricted tidal flows and has freshwater influx due to a significant impervious surface upstream. Restoration opportunities would require management of both freshwater and tidal flows. Site would be very difficult to access with either hand crews or machinery.
LP-2	4	42.9	These areas are small elevated areas along Carmel Valley Road that are colonized by invasive plants.

*Note: Mitigation potential scores range from 1 (highest potential with least constraints) to 5 (lowest potential due to on-site constraints).

7.6.1.2 Potential Mitigation Acreage

The potential wetland restoration acreage under conventional restoration methods for those sites ranked as 1 or 2 is 0 total acres. A breakdown of acreage per study site is listed in Appendix A.

7.6.1.3 Next Steps

Los Peñasquitos Lagoon does not offer many opportunities for wetland creation or enhancement that would qualify as mitigation credits for Caltrans. While there are a few areas identified that have fill material that could be removed and converted into wetland habitat, access is limited and any restoration would likely result in temporary impacts to existing wetland habitat that would then require mitigation. Because the Study Area is completely under the ownership of the state, any restoration actions taken would serve the vision of preservation the ecological preserve seeks to maintain.

7.6.2 Hydrodynamic Restoration

7.6.2.1 Opportunities and Constraints

The Los Peñasquitos Lagoon is dominated by salt marsh habitat. The major structure that impairs the tidal prism is the railroad bridge which essentially bisects the lagoon diagonally. The I-5 bridge structure is located in the north east corner of the lagoon, well outside the existing tidal influence. The Highway 101 bridge, which is located above the mouth of the lagoon, was designed specifically to reduce the structural impact to tidal prism muting by using only four well-spaced pillars as the structural support.

The most likely approach to hydrodynamic restoration through the modification of existing structures would focus on modifying the existing railroad trestle bridge. An improvement in this structure could serve to greatly benefit the tidal prism within the lagoon because the bridge spans so much of the lagoon. Any restoration of the tidal prism through this method would serve to increase the health of the existing salt marsh habitat, but would not result in increased wetland habitat.

One of the advantages for restoration within the Los Peñasquitos Lagoon Study Area is increasing the amount of healthy functional wetland will help to increase water quality, which is vital to not only the natural community but also beneficial to the public, who have contact with it along a popular recreational beach near the outlet of the lagoon.

7.6.2.2 Potential Mitigation Acreage

The primary change that would be associated with increased tidal action would be conversion from brackish to tidal marsh habitat within the LP-1 area. There would not be any significant increase in wetland acreage.

7.6.2.3 Next Steps

Further determination needs to be made by SANDAG as to whether further analysis should be conducted on Los Peñasquitos Lagoon based on existing mitigation requirements and restrictions.

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LOS PEÑASQUITOS STUDY AREA FIGURES

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Figure 5-1.
Aerial Site Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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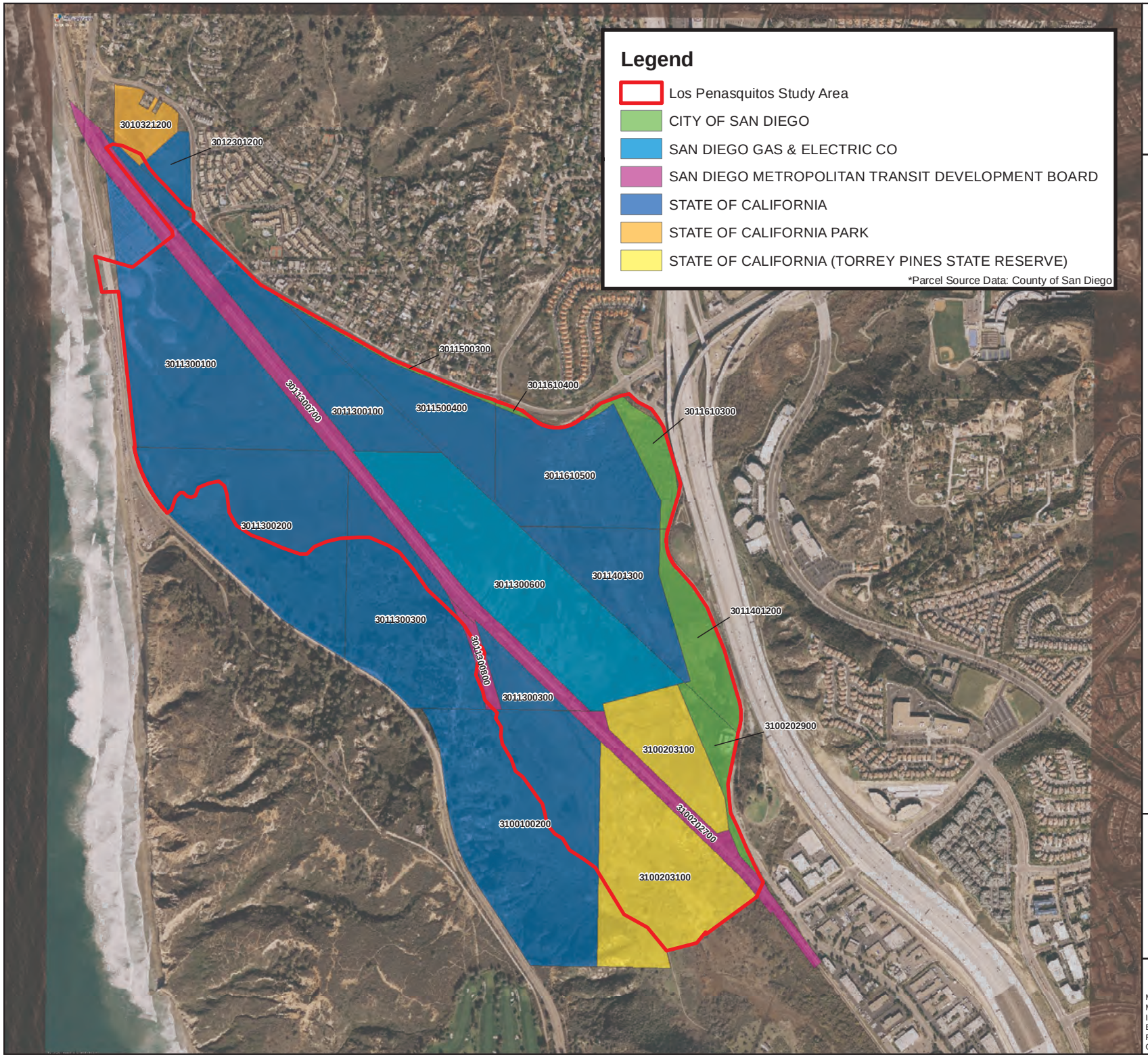

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Figure 7-2.
Parcel Owners within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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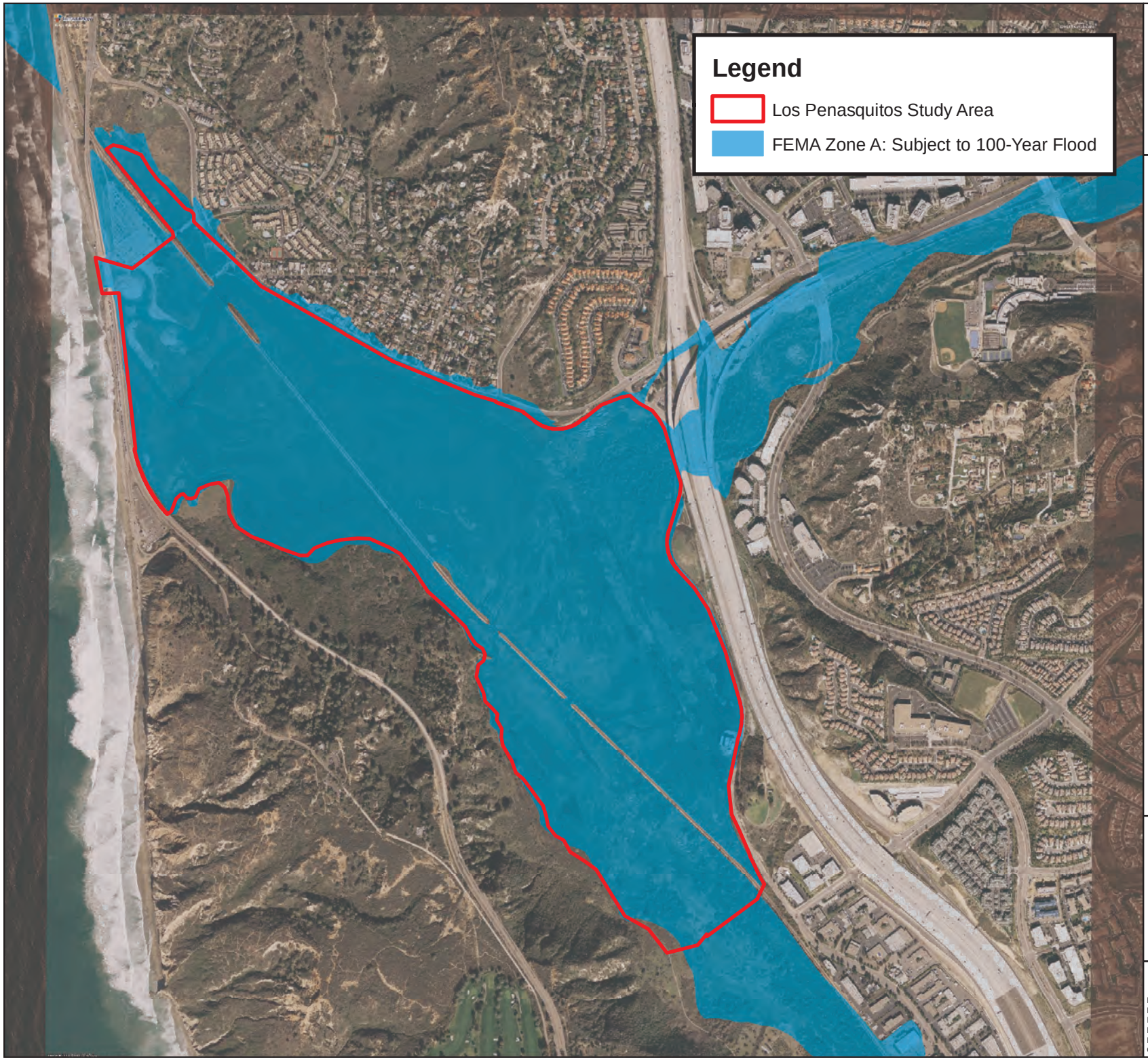

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**Figure 7-3.
FEMA Zones
within the
Study Area**

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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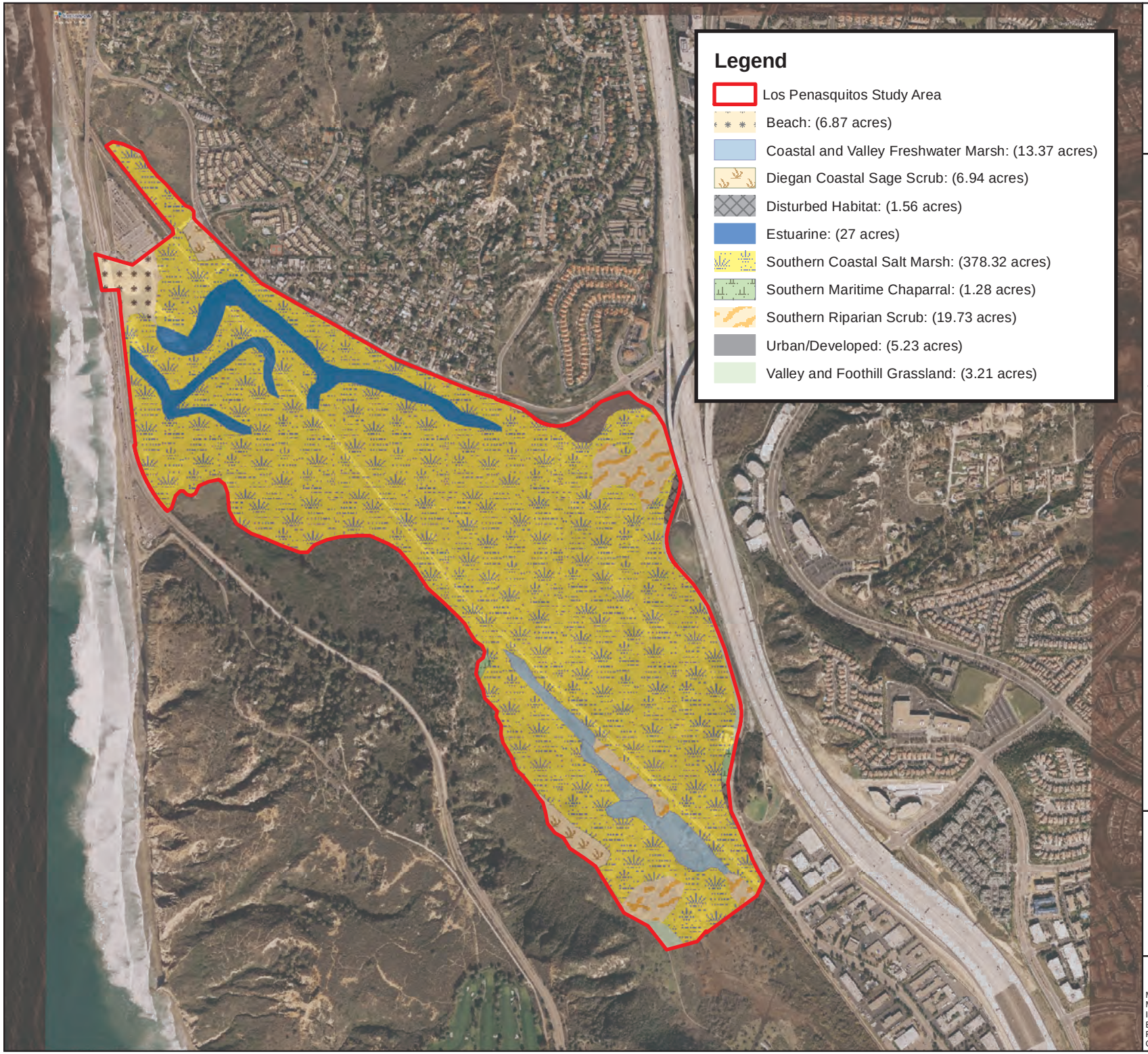

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Figure 7-4.
Vegetation Communities within the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
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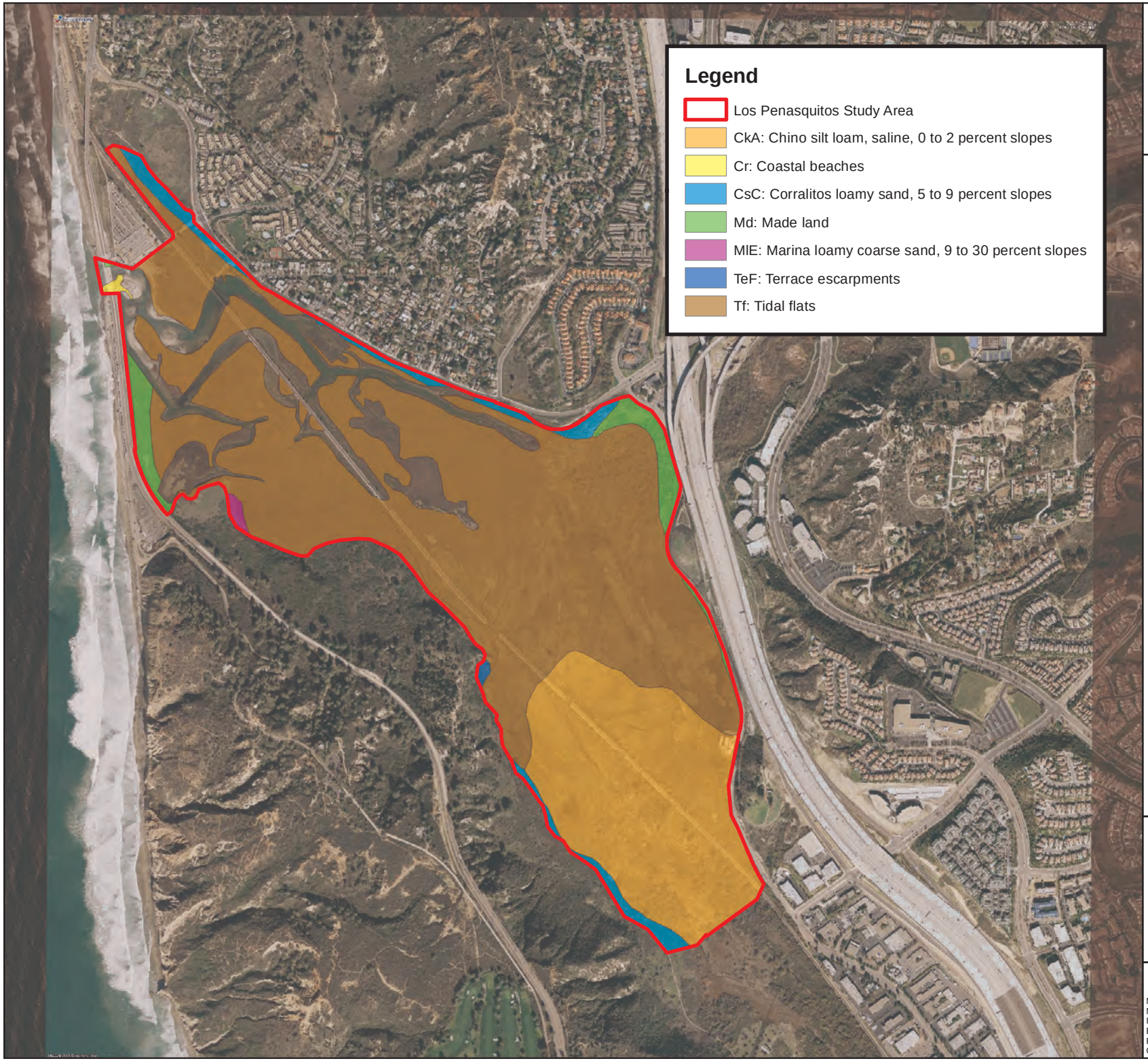

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Figure 7-5.
Soils Map

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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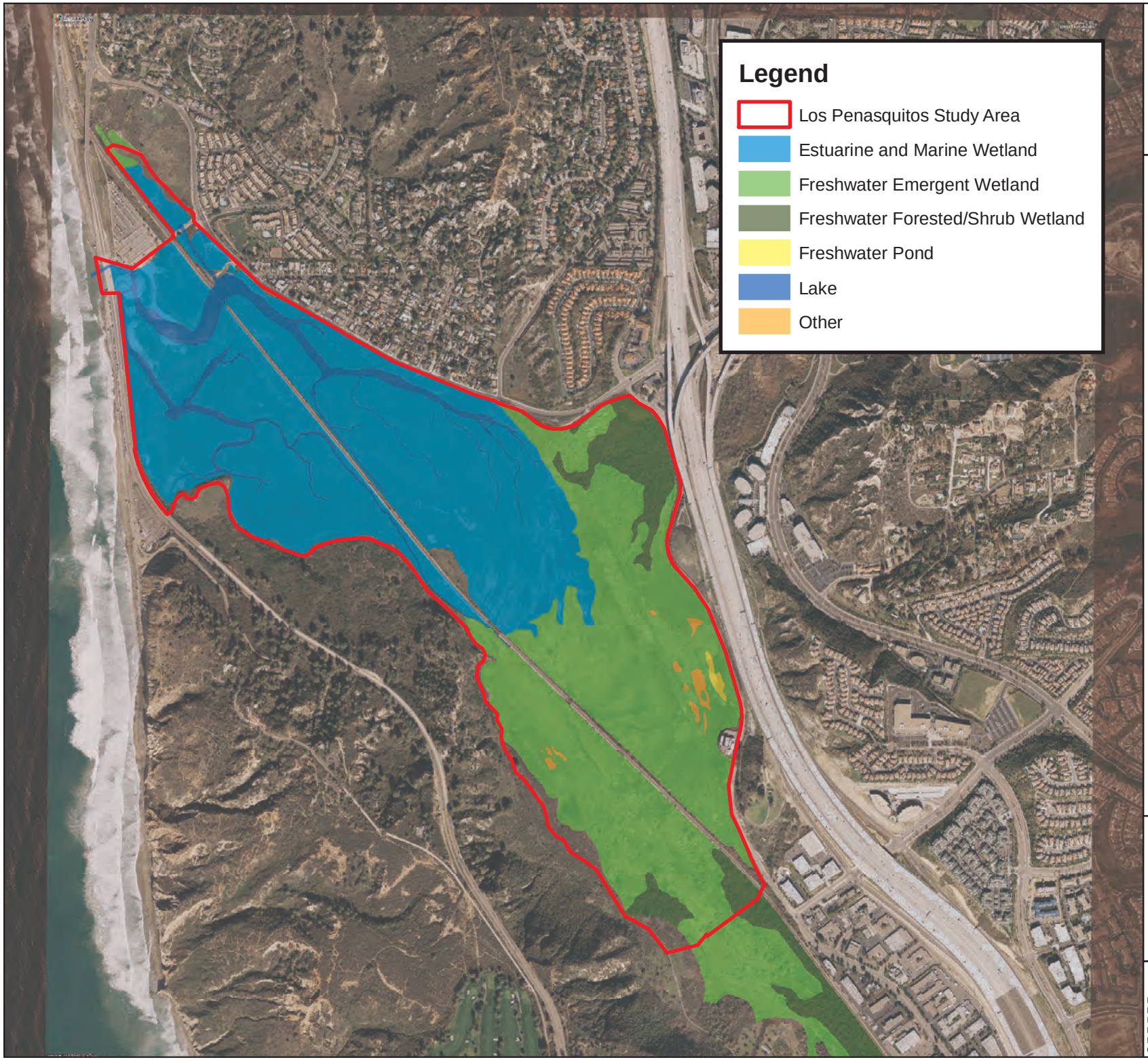

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Figure 7-6.
NWI Data (May 2002)
within the
Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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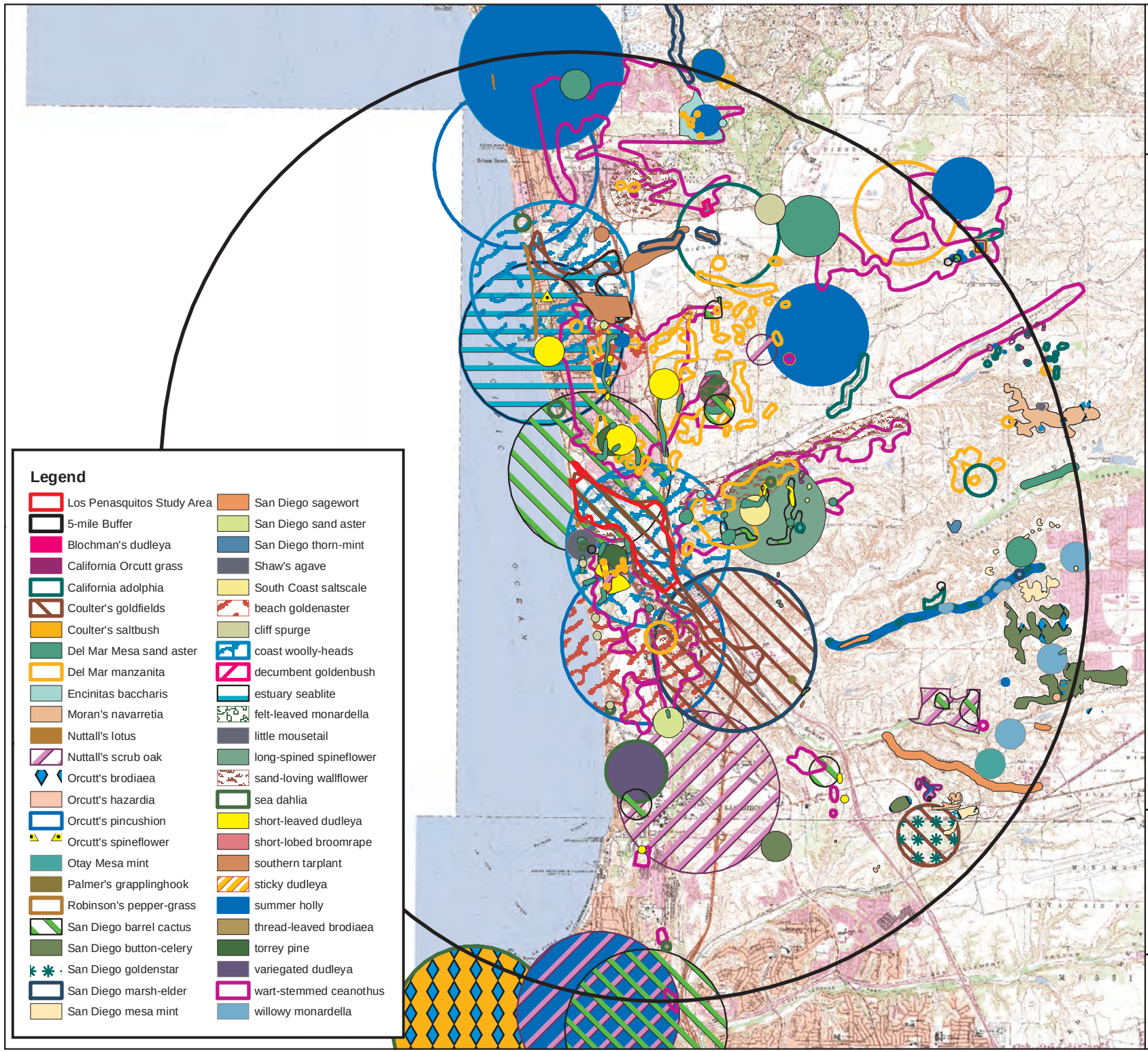

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Figure 7-7.
Special Status Plant Species within 5-mile Radius of the Study Area

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Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Los Penasquitos\CNDDBPlant.mxd

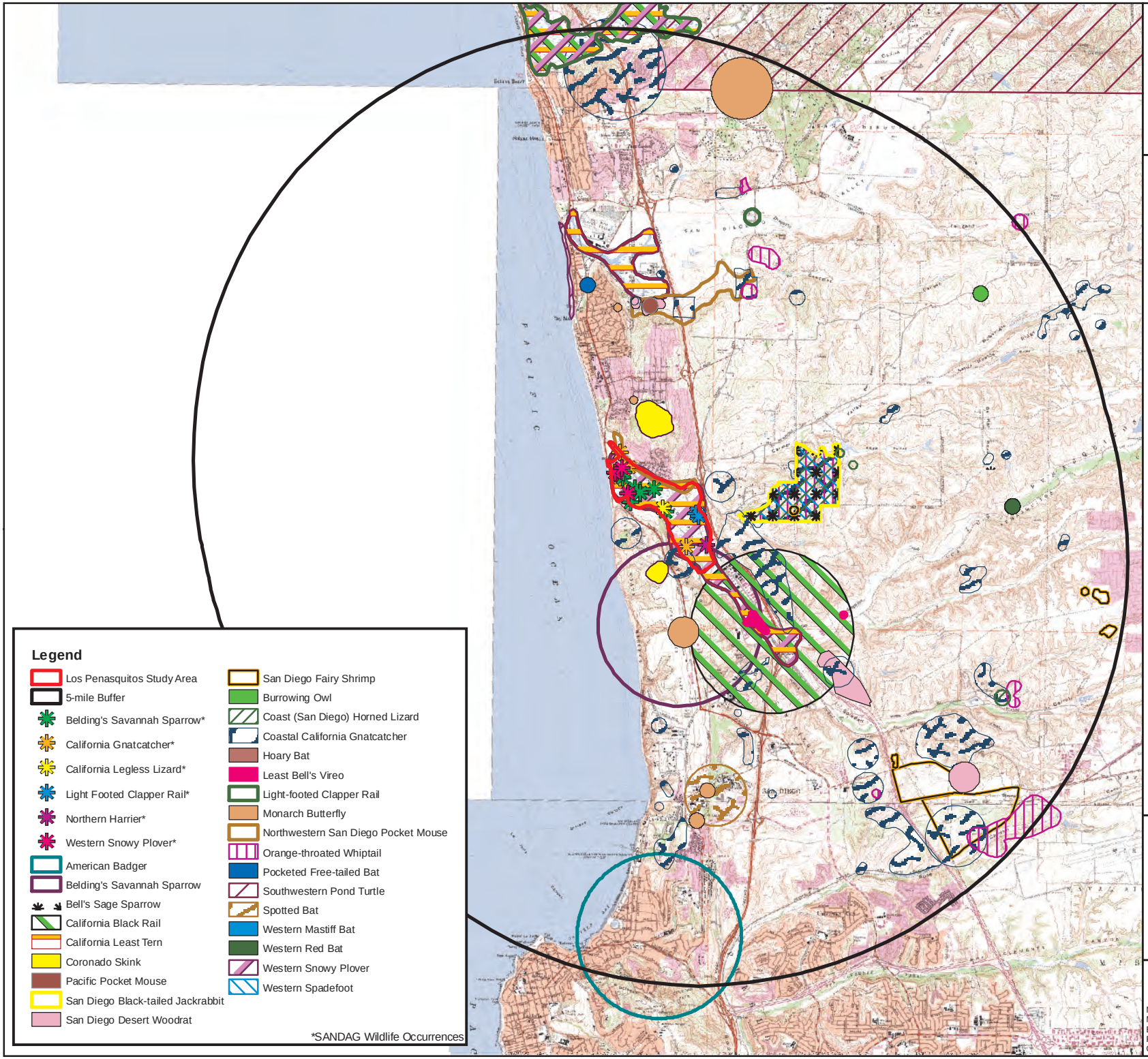

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Figure 7-8.
Special Status Animal Species within 5-mile Radius of the Study Area

Map Date: Sept 09
Map By: Sundaran Gillespie
Base Source: NAIP
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Buena Vista\CNDDBAnimal.mxd

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Figure 7-9.
Western Snowy Plover Critical Habitat

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Feet

Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
Filepath: I:\ACAD2000\16000\16165\GIS\ArcMap\Los Penasquitos\Plover.mxd

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SANDAG

Los Penasquitos Lagoon
San Diego County,
California

Figure 7-10.
Potential Restoration Areas

N
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0 500 1,000
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Map Date: Sept 09
Map By: Sundaran Gillespie
Image Date: Jan 08
Base Source: Terraserver
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8.0 SUMMARY

After examining historic and existing conditions as well as past, ongoing, and planned restoration and enhancement activities in the six lagoons, it was determined that there were a number of opportunities for both conventional and hydrodynamic restoration and/or enhancement. These opportunities were evaluated for both their mitigation potential and site constraints and then ranked using a quantitative scoring methodology.

8.1 CONVENTIONAL RESTORATION OPPORTUNITIES

San Dieguito Lagoon has the greatest potential for conventional restoration (Figure 8-1). This is due to the large area of the floodplain east of I-5 that has been degraded and altered over the years due to agricultural activities. While the floodplain has the potential for restoration, the area to be used for creation of additional tidal wetland is restricted due to potential issues of sediment trapping within the immediate vicinity of the San Dieguito River. Basins that are created within the floodplain in a region referred to as the "effective flow area" can trap sediments, creating the potential for downstream erosion. Such erosion may have adverse impacts on existing resources and infrastructure. Therefore, conventional restoration opportunities at San Dieguito need to be carefully evaluated to assure that they do not exacerbate downstream flooding or erosion. A benefit to expanded tidal restoration within the lagoon would be the increase in tidal velocities through the inlet channel which could reduce the amount of maintenance required to keep the inlet open. Additional areas for potential restoration at San Dieguito Lagoon include some fill areas within and along the entrance channel to the CDFG area. Figure 8-1 provides a summary of the potential restoration acres identified during this study, and is grouped by mitigation score.

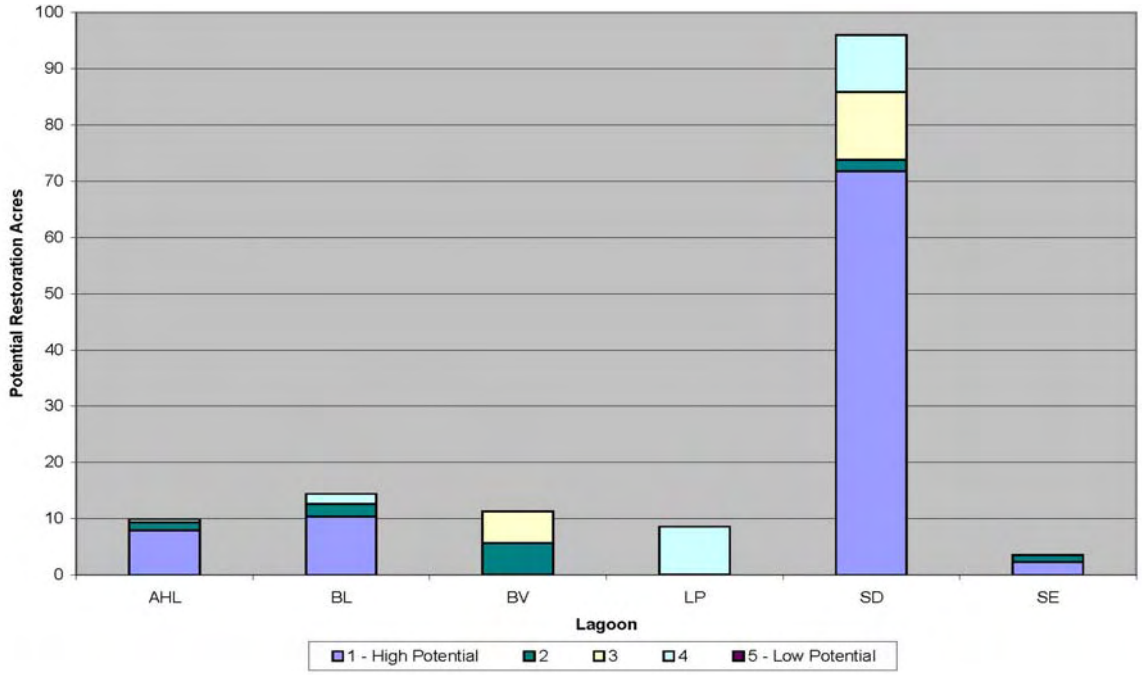

Figure 8-1 Potential Conventional Restoration Acres grouped by Mitigation Potential Score

Other lagoons have more modest opportunities for restoration; however, they still may offer good opportunities for meeting the Caltrans mitigation requirements. Aqua Hedionda and

Batiquitos Lagoons have a number of sites of high mitigation potential around the fringes of the lagoons (Figures 3-10 and 5-11). Most of these projects would involve excavation of filled areas and/or improved tidal inundation to create salt marsh habitat. There are a number of areas in the eastern end of Buena Vista Lagoon that could be restored (Figure 2-9); however, the type of habitat to be created is dependent upon the eventual preferred restoration plan for the lagoon. This uncertainty makes it difficult to plan for either emergent marsh (under current conditions) or tidal saline marsh should tidal action be restored. San Elijo Lagoon has a few areas where conventional restoration actions could result in increased tidal marsh habitat, whereas Los Peñasquitos Lagoon has the least based on this analysis (Figures 4-10 and 7-10).

Another way to evaluate the potential for conventional restoration at each of the lagoons is to rank each site based on its site condition score and its mitigation potential score. A description of site assessment scoring methods is included in Appendix A. Figure 8-2 provides a means to compare restoration potential of the various conventional restoration sites investigated.

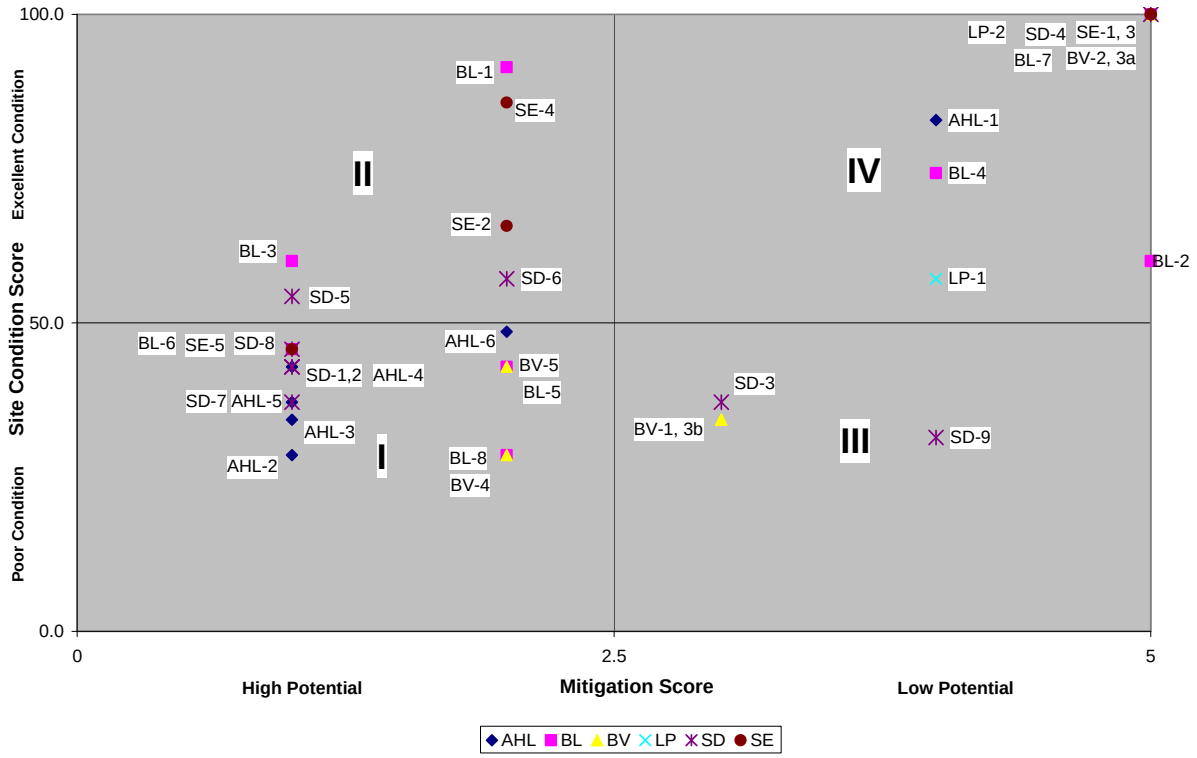

Figure 8-2. Phase I Mitigation Potential for all Study Sites

Sites with a mitigation potential score of 1 or 2 and with a site condition score below 50, fall into Quadrant I. These sites generally support upland habitat that is not likely considered wetland under federal or state resource agency jurisdiction and do not have sensitive biological resources that would be impacted by mitigation work or by accessing the site for mitigation activities. The sites in Quadrant I do not have significant constraints for mitigation use and may be the best candidates for wetland creation credit. These sites merit more detailed investigations into their suitability for mitigation, and are summarized in Table 8-1.

Table 8-2. Summary of Assessment Sites Ranking in Quadrant I

	Mitigation Potential[1]	**Site Condition Score**	**Ownership[2]**	**Potential Restoration Acreage[3]**
Buena Vista Lagoon				
BV-4	2	28.6	Public	1.20
BV-5	2	42.9	Private	4.50
			Subtotal Potential Acreage Available	*5.70*
Agua Hedionda Lagoon				
AH-2	1	28.6	Public	1.80
AH-3	1	34.3	Public	4.30
AH-4	1	42.9	Both	1.70
AH-5	1	37.1	Private	0.10
AH-6	2	48.6	Public	1.40
			Subtotal Potential Acreage Available	*9.30*
Batiquitos Lagoon				
BL-5	2	42.9	Public	0.10
BL-6	1	45.7	Public	1.40
BL-8	2	28.6	Public	0.70
			Subtotal Potential Acreage Available	*2.20*
San Elijo Lagoon				
SE-5	1	45.7	Public	2.30
			Subtotal Potential Acreage Available	*2.30*
San Dieguito				
SD-1	1	42.9	Public	21.10
SD-2	1	42.9	Public	46.50
SD-7	1	37.1	Public	1.80
SD-8	1	45.7	Public	1.60
			Subtotal Potential Acreage Available	*71.00*
Los Peñasquitos				
No site ranked in Quadrant I				
			Total Potential Acreage Available	**90.50**

Sites within Quadrant II have a mitigation potential score of 1 or 2 and a site condition score above 50. This grouping corresponds to sites that are likely not existing wetlands, but may have higher quality upland habitat or some access limitations for mitigation activity. These sites merit further investigation, although the sites appear to have some constraints for use in mitigation.

[1] Determination of overall mitigation rank is detailed in Table A-1. Mitigation Potential Summary
[2] Ownership listed as parcels owned by Public entities, Private parties, or Both (Study Area incorporates parcels owned by both Public and Private owners)
[3] The approximate acreage available for mitigation is based on preliminary site visits, is approximate, and is subject to further site analysis.

Sites within Quadrant III are those with a mitigation potential score of 3 or 4 and a site condition score below 50. These sites are likely within agency jurisdiction, but the sites low habitat quality may make them good candidates to gain habitat enhancement credits. In some cases, mitigation work may be implemented with few impacts to biological resources due to the absence of site access constraints. In other cases, mitigation may be required to offset impacts to existing biological resources. In general, these sites have moderate constraints for use in mitigation.

Sites within Quadrant IV were found to have the most constraints for use in mitigation. These sites were given a mitigation potential score of 4 or 5 and a site condition score higher than 50. The sites are likely wetlands under federal and state jurisdiction and generally have high-quality habitat. Mitigation work would likely cause impacts to biological resources, and additional mitigation would be required. In some cases, such as with AH-1, there are small areas of poor-quality upland habitat surrounded by high-quality wetland habitat. Mitigation credit could be gained through restoration of this low-quality upland area, but impacts to jurisdictional features would be necessary to access this site. The BL-2 site is located on a least tern upland breeding island that is part of the Batiquitos Lagoon Restoration Project, but is dominated by weedy species and therefore may be a candidate for enhancement or creation. However, any mitigation work conducted at this site would require additional mitigation to offset impacts to this protected area.

8.2 HYDRODYNAMIC APPROACH

A determination of the potential for enhancement of tidal flows is part of the Phase II portion of this Study. However, it is apparent from the topography and geomorphology of the lagoons and the location of the I-5 bridge that hydrodynamic enhancement through reduction of tidal muting can best be achieved at Batiquitos and Aqua Hedionda lagoons. This is because there are substantial areas around the eastern periphery of these lagoons that could be inundated under improved tidal flows. Similarly, San Dieguito Lagoon offers some potential for hydrodynamic enhancement, especially in areas that have been restored east of I-5 as part of the SCE project. On the other hand, areas within the eastern portion of the floodplain of San Dieguito Lagoon are too high and the banks are too steep to benefit from any substantial expansion of habitat should tidal muting be reduced. Excavation would have to be undertaken to bring these areas under tidal influence.

The San Elijo Lagoon Restoration project is being undertaken by the SELC and is funded by SCC and SANDAG. A portion of that work involves modeling to determine means by which to increase the tidal prism within the lagoon. This work will evaluate a number of factors that may affect tidal circulation including the inlet, Highway 101, the railroad bridge, the existing tidal channel system within the lagoon, and the I-5 Bridge. As noted in Section 5.5, San Elijo Lagoon represents a rare opportunity for comprehensive restoration of a lagoon system. Not only the existing habitat can be manipulated, but existing hard structures traversing the lagoon are proposed for replacement or rehabilitation and can also be considered in the project. The proposed restoration project work will assist in developing an overall restoration plan for the lagoon that will achieve a number of objectives, including improved tidal circulation. As this study proceeds and the environmental documentation is prepared, there may be recommendations to bridge design at the I-5 corridor, the NCTD railroad corridor and Highway 101. Because this work is currently underway, it is not included in the subsequent Phase II work being undertaken under this contract.

Los Peñasquitos Lagoon does not have the potential for hydrodynamic enhancement at the I-5 bridge crossing. The bridges span the creeks entering that lagoon and are too far east to have an influence on tidal muting or dampening. Most tidal muting is related to either the inlet dynamics or the configuration and geomorphology of the tidal channels in the marsh system. Not further investigation related to hydrodynamic restoration is proposed under Phase II.

Buena Vista Lagoon is presently a freshwater system and water levels are controlled by a weir at its entrance. Under current conditions, tidal muting is not an issue that can be resolved through changes at the I-5 overcrossing. If the opportunity arises to convert this lagoon to a more saline environment, it may also offer an opportunity to plan changes to the I-5 bridge at this location.

8.3 PHASE II ANALYSIS

Prior to initiating Phase II analyses, meetings with Caltrans, SANDAG, and interested resource agencies will be held to further refine the selection of sites to be studied and the type of restoration mechanisms to be used. Finalizing an approach to the feasibility of either conventional or hydrodynamic mitigation to meet Caltrans' needs will involve a number of steps. The first step is a determination of the likelihood that the landowners of the affected parcels would allow restoration to proceed on their properties and the type of restoration that they would allow. For private property owners, this would involve a determination that they are "willing sellers" and/or that the property as appraised by the state can be acquired. For public owners, it necessitates a determination that their general or master plans will allow for such uses as proposed herein and that they are willing to accommodate the specific mitigation requirements that must be met by Caltrans. In some cases, such as nonfunctional nesting islands within ecological reserves that may be converted to wetlands, it may involve replacement of these habitats elsewhere in the reserve. Similarly, any work proposed on property owned by CDFG or State Parks requires that Caltrans supply other desirable lands in exchange for the opportunity to perform mitigation on these lands. Under the hydrodynamic approach, flooding of additional lands by an expanded tidal regime will have to be evaluated to determine if this would result in damage to property or public utilities around the periphery of the affected lagoons and how such damage can be mitigated.

Once it is determined that it is feasible to proceed with further evaluation of a particular site, the following steps should be undertaken:

- Further refinement of the extent and area for the creation or restoration activity;
- Specific habitat mapping for each area to determine vegetative communities and habitat potential for sensitive species;
- Delineation of USACE and CCC jurisdictional areas to determine the potential for a net increase in wetland habitat;
- Topographic information to determine relative elevation and potential costs for excavation and habitat creation;
- Determination of any physical constraints to restoration including presence of public utilities, proximity to existing high-use areas requiring buffers, and/or plans that would result in future disturbance of the areas following restoration;
- Conceptual plans for the restoration activity that show areas of habitat improvement, creation, and general topographic and landscape conditions that will result; and

- Initial evaluation to determine what further studies may be needed prior to conducting more detailed studies.

The modeling that is proposed under Phase II of this work will involve both tidal dynamics and stream flow. The work for the hydrodynamic restoration alternatives will be conducted by Dr. Scott Jenkins of the Scripps Institute of Oceanography and Dr. Howard Chang, Professor Emeritus of San Diego State University. The tidal dynamic work to be completed by Dr. Jenkins will investigate current conditions within the lagoons of interest and evaluate the occurrence and magnitude of tidal muting related to both the ocean and inlet conditions. Mathematical models that have been verified for coastal lagoon systems will be used to make these determinations and calibrated for the lagoon studied. If tidal muting is occurring as a result of restrictions at the bridge crossing, potential actions or design changes to the I-5 bridges will be evaluated using the model. The change in tidal regime can then be related to tidal inundation curves that predict the occurrence of various tidal marsh communities along the shoreline and within areas where conventional restoration methods will be used. With increased tidal range, it is expected that both the extent and quality of tidal marsh communities will increase and such increases can then be mapped and additional habitat benefits quantified.

Because these lagoons are also located on streams that flow to the ocean, the dynamics of flood flows need to be taken into account. Floods can cause erosion through increased velocity and increase sedimentation as a result of increased carrying capacity of the flowing water. Erosion can affect infrastructure while sedimentation can fill tidal channels and basins. Therefore, it is important to undertake restoration designs that accommodate flood events without exacerbating sediment erosion and deposition. Dr. Chang's modeling work using fluvial flood models will assist in making these evaluations. It is expected that the outcome will be an evaluation of bridge designs or channel configurations at the bridges that will improve tidal circulation without adverse effects from flood conditions.

APPENDICES

Appendix A – Site Assessment Methods and Results

Appendix A – Site Assessment Methods and Results

Mitigation Potential Scoring

Field investigations were conducted at six lagoons along the I-5 corridor in San Diego County by WRA and AECOM in August and September 2009 as part of a comprehensive study to assess the mitigation potential offered by each of these lagoons for the Caltrans I-5 North Coast Corridor Project. Areas within Agua Hedionda, Batiquitos, Buena Vista, Los Peñasquitos, San Dieguito and San Elijo Lagoons were evaluated in the field for their mitigation potential based on a rapid assessment of habitat condition, access, and state resource agency jurisdiction. Assessment areas, or sites, with high mitigation potential were generally those that have degraded natural habitat and thus would benefit from restoration or enhancement, those that were easily accessed without creating additional impacts to protected or sensitive habitat, and those that would not be under the jurisdiction of resource agencies if there were proposed modifications to the site.

Methods

Methods for assessing habitat condition were based on the United States Environmental Protection Agency (EPA) Level 1 and Level 2 assessments for wetlands (USEPA 2006) and the California Rapid Assessment Method for Wetlands (CRAM, Collins et al 2008); these methods incorporate a landscape-scale survey (Level 1) and a field-based rapid habitat condition evaluation (Level 2 and CRAM) to identify potential mitigation sites in the lagoons. Each lagoon was first investigated at the landscape scale using aerial imagery, national and state databases, brief site visits and information from previous studies to determine areas within each lagoon that are likely to support degraded and/or non-wetland habitat and thus would be suitable for more focused field surveys.

Qualitative data collected during field surveys included an inventory of biological resources, the resource agency that may have jurisdiction over these resources, location and type of utilities within or adjacent to the site, and off-site stressors that likely affect the condition of the habitat. Each site was also given a score ranging from poor (score = 1) to excellent (score = 5) for the condition of its vegetation, hydrology, topography, soils, wildlife habitat, and level of disturbance relative to “natural” or “least impacted” conditions for each of these habitat features (EPA 2006). The site was then evaluated for ease of access during mitigation activity using the scoring listed in Table 1.

Table A-1 Site Access Scoring

1	Site can be accessed easily by hand crew or machinery; no improvements are necessary to access site for mitigation.
2	Site can be easily accessed by hand crew only; no improvements are necessary and no addition habitat impacts would occur.
3	Site can be accessed by hand crew or machinery with minimal associated habitat impacts.
4	Site can be accessed with hand crew or machinery with moderate associated habitat impacts.
5	Site cannot be accessed by hand crew or machinery OR access is possible with

	associated habitat impacts.

A mitigation rank was also given for each site, which was based on an evaluation of the likelihood of a site's biological resources to be under the jurisdiction of one or more local, state or federal agencies if mitigation activities were proposed as listed in Table 2.

Table A-2. Mitigation Ranking

1	Mitigation activity would not require compensation for impacts to this habitat feature. Mitigation would likely be credited as 1:1 habitat creation.
2	Site contains high quality upland/transition habitat. Mitigation would provide some habitat creation credit (<1:1).
3	Site is within CCC but not Corps jurisdiction. Mitigation would provide some habitat creation credit (<1:1).
4	Mitigation activity at this site could only be credited as enhancement.
5	Mitigation activity would be considered an impact to this site and would require additional mitigation. No credits would be gained from assessment area.

Data Analysis

To distill the habitat condition and the site access score into one site mitigation potential score, these field data were combined to yield the site's mitigation potential percentage score: a site's actual condition and access scores were added together and then divided by 35 (the total possible points in this scenario), and this number was multiplied by 100%. The equation for this score is as follows:

$$\text{Mitigation Potential} = \frac{\text{(vegetation condition score + hydrology condition score + topography condition score + soils condition score + wildlife habitat condition score + level of disturbance score)}}{35} \times 100\%$$

This percentage, along with the mitigation rank, gives a snapshot view of the site's opportunities and constraints for mitigation. In general, those sites with a mitigation rank of 1 or 2 and site condition percentage of 20-49% offer the best potential for mitigation. Section 6.6 of each lagoon's analysis section provides the scores for each site, as well as a brief description of site characteristics.

Results

Table A-3, shown on the following page, presents the raw scores given to each site, as well as the total acreage within the site that may have the potential to be used in mitigation.

Table A-3. Mitigation Potential Summary
San Diego Regional Lagoon Overview Study Phase I

Site	OVERALL MITIGATION RANK	STUDY AREA HABITAT FEATURES							MITIGATION POTENTIAL PERCENTAGE	POTENTIAL RESTORATION ACREAGE
		VEGETATION	HYDROLOGY	TOPOGRAPHY	SOILS	WILDLIFE	DISTURBANCE	ACCESS		
AH-1	4	4	4	4	5	4	4	4	82.9	0.6
AH-2	1	1	1	2	1	3	1	1	28.6	1.8
AH-3	1	2	2	1	2	2	1	2	34.3	4.3
AH-4	1	2	2	3	2	3	2	1	42.9	1.7
AH-5	1	1	1	1	2	3	1	4	37.1	0.1
AH-6	2	4	3	2	2	3	2	1	48.6	1.4
BL-1	2	5	5	4	5	5	4	4	91.4	1.4
BL-2	5								0.0	0
BL-3	1	2	4	5	5	2	2	1	60.0	9
BL-4	4	4	4	4	4	4	4	2	74.3	1.8
BL-5	2	2	3	1	3	3	2	1	42.9	0.1
BL-6	1	3	3	1	3	3	2	1	45.7	1.4
BL-7	5								0.0	0
BL-8	2	2	2	2	1	1	1	1	28.6	0.7
BV-1	3	1	2	2	2	2	2	1	34.3	5.6
BV-2	5								0.0	0
BV-3a	5								0.0	0
BV-3b	3	3	2	1	2	1	2	1	34.3	0.9
BV-4	2	2	1	1	1	2	2	1	28.6	1.2
BV-5	2	2	2	2	3	3	2	1	42.9	4.5
LP-1	4	2	2	2	3	3	3	5	57.1	8.6
LP-2	5								0.0	0
SD-1	1	1	2	4	3	3	1	1	42.9	21.1
SD-2	1	1	2	4	3	3	1	1	42.9	46.5
SD-3	3	3	2	1	1	2	3	1	37.1	12.1
SD-4	5								0.0	0
SD-5	1	2	4	2	3	2	2	4	54.3	0.8
SD-6	2	2	4	2	3	2	2	5	57.1	2
SD-7	1	2	1	2	3	2	2	1	37.1	1.8
SD-8	1	2	4	2	3	2	2	1	45.7	1.6
SD-9	4	1	3	1	1	2	2	1	31.4	10.1
SE-1	5								0.0	0
SE-2	2	4	3	3	4	4	3	2	65.7	0.9
SE-3	5								0.0	0
SE-4	2	5	5	5	4	4	3	4	85.7	0.3
SE-5	1	2	2	2	2	3	2	3	45.7	2.3
									TOTAL	144.6

References

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U.S. Environmental Protection Agency (USEPA). 2006. Application of elements of a state water monitoring and assessment program for wetlands. Wetlands Division, Office of Wetlands, Oceans and Watersheds, U.S. EPA, Washington, D.C

Appendix B – Mean Tide Levels at La Jolla, California Tide Station

Appendix B – Mean Tide Levels at La Jolla, Ca Tide Station

	Datum MLLW (ft)
Highest Observed Water Level (Nov 13, 1997)	7.94
Mean Higher High Water (MHHW)	5.37
Mean High Water (MHW)	4.62
Mean Sea Level (MSL)	2.75
National Geodetic Vertical Datum (NGVD)	2.56
Mean Low Water (MLW)	0.93
Mean Lower Low Water (MLLW)	0.00
Lowest Observed Water Level(Dec 11, 1933)	-2.6

Appendix C – Wildlife and Plant Species Observed in the Phase I Lagoon Study Areas

Appenidx C – Wildlife and Plant Species Observed in the Phase I Lagoon Study Areas

Table C-1. Buena Vista Lagoon Site Visit Observed Species List August 31, 2009	
Common Name	**Scientific Name**
Wildlife	
Black-tailed jackrabbit	*Lepus californicus*
Brown pelican	*Pelecanus occidentalis*
Great blue heron	*Ardea Herodias*
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
Virginia rail	*Rallus limicola*
American coot	*Fulica Americana*
Least tern	*Sternula antillarum*
Caspian tern	*Hydroprogne caspia*
Rock pigeon	*Columba livia*
Mourning dove	*Zenaida macroura*
Anna's hummingbird	*Calypte anna*
Black phoebe	*Sayornis nigricans*
American crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
Marsh wren	*Cistothorus palustris*
Common yellowthroat	*Geothlypis trichas*
Savannah sparrow	*Passerculus sandwichensis*
Red-winged blackbird	*Agelaius phoeniceus*
Western fence lizard	*Sceloporus occidentalis*
Raccoon	*Procyon lotor*
Plants	
Big saltbush	*Atriplex lentiformis*
Coyote brush	*Baccharis pilularis*
Mulefat	*Baccharis salicifolia*
Black mustard	*Brassica nigra*
Iceplant	*Carpobrotus edulis*
Pigweed	*Chenopodium californicum*
Fennel	*Foeniculum vulgare*
Alkali heliotrope	*Heliotropium currassavicum*
Toyon	*Heteromeles arbutifolia*
Menzies' goldenbush	*Isocoma menziesii*
Marsh jaumea	*Jaumea carnosa*
Crystalline iceplant	*Mesembranthymum* sp.
Pricklypear	*Opuntia* sp.
Bristly ox tounge	*Picris echioides*
Mockorange	*Pittosporum tobira*
Narrowleaf plantain	*plantago lanceolata*
Wild radish	*Raphanus sativus*
Pickleweed	*Salicornia* spp.

Table C-1. Buena Vista Lagoon Site Visit Observed Species List August 31, 2009	
Common Name	**Scientific Name**
Tamarisk	*Tamarix* sp.

Table C-2. Agua Hedionda Lagoon Site Visit Observed Species List September 1, 2009	
Common Name	**Scientific Name**
Wildlife	
Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
California ground squirrel	*Spermophilus beecheyi*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Osprey	*Pandion haliaetus*
White-tailed kite	*Elanus leucurus*
Red-tailed hawk	*Buteo jamaicensis*
Black-bellied plover	*Pluvialis squatarola*
Killdeer	*Charadrius vociferus*
Willet	*Tringa semipalmata*
Western sandpiper	*Calidris mauri*
Mourning dove	*Zenaida macroura*
Black phoebe	*Sayornis nigricans*
Western scrub-jay	*Aphelocoma californica*
American crow	*Corvus brachyrhynchos*
Northern Rough-winged swallow	*Stelgidopteryx serripennis*
Barn swallow	*Hirundo rustica*
Marsh wren	*Cistothorus palustris*
California coastal gnatcatcher	*Polioptila californica*
Common yellowthroat	*Geothlypis trichas*
Savannah sparrow	*Passerculus sandwichensis*
Song sparrow	*Melospiza melodia*
Brewer's blackbird	*Euphagus cyanocephalus*
House finch	*Carpodacus mexicanus*
Lesser goldfinch	*Carduelis psaltria*
Western fence lizard	*Sceloporus occidentalis*
Longjaw mudsucker	*Gillichthys mirabilis*
Western mosquitofish	*Gambusia affinis*
Purple shore crab	*Hemigrapsus nudus*
Plants	
California sagebrush	*Artemesia californica*
Annual water aster	*Aster subulatus* var. *ligulatus*
Big saltbush	*Atriplex lentiformis*
Wild oat	*Avena* sp.
Coyote brush	*Baccharis pilularis*
Black mustard	*Brassica nigra*
Red brome	*Bromus madritensis* ssp. *rubens*
Iceplant	*Carpobrotus edulis*
Coulter's conyza	*Conyza coulteri*

Table C-2. Agua Hedionda Lagoon Site Visit Observed Species List September 1, 2009	
Common Name	**Scientific Name**
Alkali weed	*Cressa truxilensis*
Tarplant	*Deinandra* sp.
Saltgrass	*Distchlis spicata*
Willowherb	*Epilobium* sp.
California buckwheat	*Eriogonum fasciculatum*
Cudweed	*Gnaphalium* sp.
Alkali heliotrope	*Heliotropium currassavicum*
Menzies' goldenbush	*Isocoma menziesii*
Wild lettuce	*Lactuca* sp.
Perez's sealavander	*Limonium perezii*
Chaparral mallow	*Malacothamnus fasciculatus*
Crystalline iceplant	*Mesembranthymum* sp.
Pricklypear	*Opuntia* sp.
Salt marsh fleabane	*Pluchea odorata*
Rabbit's foot grass	*Polypogon monspeliensis*
Lemonade berry	*Rhus integrifolia*
Pickleweed	*Salicornia* spp
Mojave yucca	*Yucca schidigera*

Table C-3. Batiquitos Lagoon Site Visit Observed Species List September 2, 2009	
Common Name	**Scientific Name**
Wildlife	
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Western gull	*Larus occidentalis*
Anna's hummingbird	*Calypte anna*
Marsh wren	*Cistothorus palustris*
Wrentit	*Chamaea fasciata*
California towhee	*Pipilo crissalis*
Song sparrow	*Melospiza melodia*
House finch	*Carpodacus mexicanus*
Western fence lizard	*Sceloporus occidentalis*
Plants	
California sagebrush	*Artemesia californica*
Annual water aster	*Aster subulatus* var. *ligulatus*
Big saltbush	*Atriplex lentiformis*
Wild oat	*Avena* sp.
Coyote brush	*Baccharis pilularis*
Black mustard	*Brassica nigra*
Ripgut brome	*Bromus diandrus*
Red brome	*Bromus madritensis* ssp. *rubens*
Iceplant	*Carpobrotus edulis*
Pigweed	*Chenopodium californicum*
Alkali weed	*Cressa truxilensis*
Saltgrass	*Distchlis spicata*
Willowherb	*Epilobium* sp.
Eucalyptus	*Eucalyptus globulus*
Fennel	*Foeniculum vulgare*
Cudweed	*Gnaphalium* sp.
Telegraphweed	*Heterotheca grandiflora*
Menzies' goldenbush	*Isocoma menziesii*
Wild lettuce	*Lactuca* sp.
Chaparral mallow	*Malacothamnus fasciculatus*
Crystalline iceplant	*Mesembranthymum* sp.
Date palm	*Phoenix canariensis*
Salt marsh fleabane	*Pluchea odorata*
Rabbit's foot grass	*Polypogon monspeliensis*
Wild radish	*Raphanus sativus*
Lemonade berry	*Rhus integrifolia*
Pickleweed	*Salicornia* spp
Willow	*Salix sp.*
Cattail	*Typha spp.*

Table C-4. San Elijo Lagoon Site Visit Observed Species List September 1, 2009	
Common Name	**Scientific Name**
Wildlife	
Great egret	*Ardea alba*
Red-tailed Hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
Clapper rail	*Rallus longirostris*
Mourning dove	*Zenaida macroura*
California coastal gnatcatcher	*Polioptila californica*
California thrasher	*Toxostoma redivivum*
Western meadowlark	*Sturnella neglecta*
Swallowtail butterfly	*Papilio* sp.
Plants	
California sagebrush	*Artemesia californica*
Coyote brush	*Baccharis pilularis*
Mulefat	*Baccharis salicifolia*
Black mustard	*Brassica nigra*
Ripgut brome	*Bromus diandrus*
Iceplant	*Carpobrotus edulis*
Saltgrass	*Distchlis spicata*
Alkali heath	*Frankenia salina*
Tarplant	*Hemizonia* sp.
Menzies' goldenbush	*Isocoma menziesii*
Rush	*Juncus* sp.
Pricklypear	*Opuntia* sp.
Lemonade berry	*Rhus integrifolia*
Pickleweed	*Salicornia* spp.
Bulrush	*Schoenoplectus americanus*

Table C-5. San Dieguito Lagoon Site Visit Observed Species List September 2, 2009	
Common Name	**Scientific Name**
Wildlife	
Coyote	*Canis latrans*
Black-tailed jackrabbit	*Lepus Californicus*
Great egret	*Ardea alba*
Osprey	*Pandion haliaetus*
Red-tailed Hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
Willet	*Tringa semipalmata*
Western sandpiper	*Calidris mauri*
Western gull	*Larus occidentalis*
Anna's hummingbird	*Calypte anna*
Western scrub-jay	*Aphelocoma californica*
Wrentit	*Chamaea fasciata*
Fiddler crab	*Uca sp.*
Plants	
Coyote brush	*Baccharis pilularis*
Fivehook bassia	*Bassia hyssopifolia*
Black mustard	*Brassica nigra*
Ripgut brome	*Bromus diandrus*
Iceplant	*Carpobrotus edulis*
Pigweed	*Chenopodium californicum*
Alkali weed	*Cressa truxilensis*
Bermuda grass	*Cynodon dactylon*
Saltgrass	*Distchlis spicata*
Willowherb	*Epilobium* sp.
Fennel	*Foeniculum vulgare*
Alkali heath	*frankenia salina*
Menzies' goldenbush	*Isocoma menziesii*
Marsh jaumea	*Jaumea carnosa*
Wild lettuce	*Lactuca* sp.
Crystalline iceplant	*Mesembranthymum* sp.
Tobacco tree	*Nicotina glauca*
Rabbit's foot grass	*Polypogon monspeliensis*
Wild radish	*Raphanus sativus*
Lemonade berry	*Rhus integrifolia*
Curly dock	*Rumex crispus*
Pickleweed	*Salicornia* spp
Willow	*Salix sp.*

Prickly Russian thistle	*Salsola tragus*
Seablite	*Suaeda sp.*

Table C-6. Los Pensaquitos Lagoon Site Visit Observed Species List September 2, 2009	
Common Name	**Scientific Name**
Wildlife	
Song sparrow	*Melospiza melodia*
Plants	
Coyote brush	*Baccharis pilularis*
Alkali weed	*Cressa truxilensis*
Saltgrass	*Distchlis spicata*
Wheatgrass	*Elytrigia pontica*
Fennel	*Foeniculum vulgare*
Alkali heath	*frankenia salina*
Menzies' goldenbush	*Isocoma menziesii*
Creeping wildrye	*Leymus triticoides*
Italian ryegrass	*Lolium multiflorum*
Rabbit's foot grass	*Polypogon monspeliensis*
Curly dock	*Rumex crispus*
Pickleweed	*Salicornia* spp
Cattail	*Typha spp.*

Appendix D – Special-Status Species Potentially Occurring in the Phase I Lagoon Study Areas

Appendix D – Special Status Species Potentially Occurring in the Phase I Lagoon Study Areas

Table D-1. Special-Status Species Potentially Occurring Within the Buena Vista Study Area

List compiled from 2009 searches of the California Department of Fish and Game (CDFG) Natural Diversity Database for the San Luis Rey, Morro Hill, Oceanside, and Encinitas USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-1. Special-Status Species Potentially Occurring Within the Buena Vista Study Area		
Common Name	**Scientific Name**	**Status***
Wildlife		
Pallid bat	*Antrozous pallidus*	SSC
Western yellow bat	*Lasiurus xanthinus*	SSC
Western mastiff bat	*Eumops perotis californicus*	SSC
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	SSC
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' kangaroo rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego Black-tailed Jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
Least bittern	*Ixobrychus exilis*	SSC
Northern harrier	*Circus cyaneus*	SSC
White-tailed Kite	*Elanus leucurus*	CFP
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
Light-footed Clapper Rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
Black skimmer	*Rynchops niger*	BCC, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Marbled murrelet	*Brachyramphus marmoratus*	FT, SE
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	FC, SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE
Bank swallow	*Riparia riparia*	ST
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC, BCC
Coastal california gnatcatcher	*Polioptila californica californica*	FT, SSC
Yellow warbler	*Dendroica petechia*	SSC
Yellow-breasted Chat	*Icteria virens*	SSC
Bell's sage sparrow	*Amphispiza belli belli*	BCC

Table D-1. Special-Status Species Potentially Occurring Within the Buena Vista Study Area		
Common Name	**Scientific Name**	**Status***
San Clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC
Coast (San Diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC
Orange-throated whiptail	*Aspidoscelis hyperythra*	SSC
Two-striped garter snake	*Thamnophis hammondii*	SSC
South coast garter snake	*Thamnophis sirtalis* ssp.	SSC
Northern red-diamond rattlesnake	*Crotalus ruber ruber*	SSC
Southern steelhead - southern California ESU	*Oncorhynchus mykiss irideus*	FE, SSC
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	Roost sites protected by CDFG
Plants		
San Diego thorn mint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
Peirson's milkvetch	*Astragalus magdalenae* var. *peirsonii*	FT, SE, List 1B.1
Coastal dunes milk vetch	*Astragalus tener* var. *titi*	FE, SE, List 1B.1
Davidson's saltscale	*Atriplex serenana* var. *davidsonii*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Smooth tarplant	*Centromadia pungens* ssp. *laevis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1
Sea dahlia	*Coreopsis maritima*	List 2.2
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*	List 1B.1
Sticky dudleya	*Dudleya viscida*	List 1B.2
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1

Table D-1. Special-Status Species Potentially Occurring Within the Buena Vista Study Area

Common Name	Scientific Name	Status*
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Decumbent goldenbush	*Isocoma menziesii* var. *decumbens*	List 1B.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Willowy monardella	*Monardella linoides* ssp. *viminea*	FE, SE
Mud nama	*Nama stenocarpum*	List 2.2
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
Slender cottonheads	*Nemacaulis denudata var. gracilis*	List 2.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

Table D-2. Special-Status Species Potentially Occurring Within the Agua Hedionda Study Area.

List compiled from 2009 searches of the CDFG Natural Diversity Database for the San Luis Rey, San Marcos, Rancho Santa Fe and Encinitas USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-2. Special-Status Species Potentially Occurring Within the Agua Hedionda Study Area		
Common Name	**Scientific Name**	**Status***
Wildlife		
Western yellow bat	*Lasiurus xanthinus*	SSC
Pocketed free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	SSC
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' Kangaroo Rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
White-tailed Kite	*Elanus leucurus*	CFP
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
Light-footed Clapper Rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Marbled murrelet	*Brachyramphus marmoratus*	FT, SE
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC, SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell’s vireo	*Vireo bellii pusillus*	FE, SE
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC, BCC
Coastal california gnatcatcher	*Polioptila californica californica*	FT, SSC
Yellow warbler	*Dendroica petechia*	SSC
Yellow-breasted Chat	*Icteria virens*	SSC
San clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding’s savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC
Coast (San Diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC
Orange-throated whiptail	*Aspidoscelis hyperythra*	SSC
Two-striped garter snake	*Thamnophis hammondii*	SSC
Northern red-diamond	*Crotalus ruber ruber*	SSC

Table D-2. Special-Status Species Potentially Occurring Within the Agua Hedionda Study Area		
Common Name	**Scientific Name**	**Status***
Rattlesnake		
Southern steelhead – southern California ESU	*Oncorhynchus mykiss irideus*	FE, SSC
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	Roost sites rotected by CDFG
Plants		
San Diego thornmint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
Peirson's milkvetch	*Astragalus magdalenae var peirsonii*	FT, SE, List 1B.1
Coastal dunes milkvetch	*Astragalus tener* var. *titi*	FE, SE, List 1B.1
South coast saltscale	*Atriplex pacifica*	List 1B.2
Davidson's saltscale	*Atriplex serenana* var. *davidsonii*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Orcutt's brodiaea	*Brodiaea orcuttii*	List 1B.1
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Smooth tarplant	*Centromadia pungens ssp. laevis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1
Sea dahlia	*Coreopsis maritima*	List 2.2
Del Mar Mesa sand aster	*Corethrogyne filaginifolia var. linifolia*	List 1B.1
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*	List 1B.1
Sticky dudleya	*Dudleya viscida*	List 1B.2
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Orcutt's hazardia	*Hazardia orcuttii*	List 1B.1
Decumbent goldenbush	*Isocoma menziesii var. decumbens*	List 1B.2
San Diego marsh elder	*Iva hayesiana*	List 2.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Willowy monardella	*Monardella linoides ssp. viminea*	FE, SE
Mud nama	*Nama stenocarpum*	List 2.2

Table D-2. Special-Status Species Potentially Occurring Within the Agua Hedionda Study Area		
Common Name	**Scientific Name**	**Status***
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
Star phacelia	*Phacelia stellaris*	List 1B.1
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

Table D-3. Special-Status Species Documented to Occur within a 5-Mile Radius of the Batiquitos Lagoon Study Area.

List compiled from 2009 searches of the California DFGNatural Diversity Database for the San Luis Rey, San Marcos, Rancho Santa Fe and Encinitas USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-3. Special-Status Species Documented to Occur within a 5-Mile Radius of the Batiquitos Lagoon Study Area.

Common Name	Scientific Name	Status*
Wildlife		
Mexican long-tongued Bat	*Choeronycteris mexicana*	SSC
Western yellow bat	*Lasiurus xanthinus*	SSC
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	SSC
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' kangaroo rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
White-tailed Kite	*Elanus leucurus*	CFP
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
California black rail	*Laterallus jamaicensis coturniculus*	ST, CFP, BCC
Light-footed clapper rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
Black skimmer	*Rynchops niger*	BCC, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Marbled murrelet	*Brachyramphus marmoratus*	FT, SE
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC, SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC, BCC
Coastal California gnatcatcher	*Polioptila californica californica*	FT, SSC
Yellow warbler	*Dendroica petechia*	SSC
Yellow-breasted chat	*Icteria virens*	SSC
Bell's sage sparrow	*Amphispiza belli belli*	BCC
San Clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC

Table D-3. Special-Status Species Documented to Occur within a 5-Mile Radius of the Batiquitos Lagoon Study Area.		
Common Name	**Scientific Name**	**Status***
Wildlife		
Coast (San Diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC
Orange-throated whiptail	*Aspidoscelis hyperythra*	SSC
Two-striped garter snake	*Thamnophis hammondii*	SSC
Northern red-diamond rattlesnake	*Crotalus ruber ruber*	SSC
Southern Steelhead - southern California ESU	*Oncorhynchus mykiss irideus*	FE, SSC
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	Roost sites protected by CDFG
Plants		
San Diego thorn mint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
San Diego sagewort	*Artemisia palmeri*	
Peirson's milkvetch	*Astragalus magdalenae* var *peirsonii*	FT, SE, List 1B.1
Coastal dunes milk vetch	*Astragalus tener var. titi*	FE, SE, List 1B.1
Coulter's saltbush	*Atriplex coulteri*	List 1B.2
South coast saltscale	*Atriplex pacifica*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
San Diego goldenaster	*Bloomeria clevelandii*	List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Orcutt's brodiaea	*Brodiaea orcuttii*	List 1B.1
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Southern tarplant	*Centromadia parryi ssp. australis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Long-spined spineflower	*Chorizanthe polygonoides var. longispina*	List 1B.2
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1
Sea dahlia	*Coreopsis maritima*	List 2.2
Del Mar Mesa sand aster	*Corethrogyne filaginifolia* var. *linifolia*	List 1B.1
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*	List 1B.1
Sticky dudleya	*Dudleya viscida*	List 1B.2

Table D-3. Special-Status Species Documented to Occur within a 5-Mile Radius of the Batiquitos Lagoon Study Area.

Common Name	Scientific Name	Status*
Wildlife		
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
San Diego barrel cactus	*Ferocactus viridescens*	List 2.1
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Orcutt's hazardia	*Hazardia orcuttii*	List 1B.1
Beach goldenaster	*Heterotheca sessiliflora*	List 1B.1
Decumbent goldenbush	*Isocoma menziesii* var. *decumbens*	List 1B.2
San Diego marsh elder	*Iva hayesiana*	List 2.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Robinson's peppergrass	*Lepidium virginicum var. robinsonii*	List 1B.2
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Felt-leaved monardella	*Monardella hypoleuca ssp. lanata*	List 1B.2
Willowy monardella	*Monardella linoides ssp. viminea*	FE, SE
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
Short-lobed broomrape	*Orobanche parishii ssp. brachyloba*	List 4.2
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

Table D-4. Special Status Species Potentially Occurring Within the San Elijo Study Area.

List compiled from 2009 searches of the CDFG Natural Diversity Database for the Del Mar, Rancho Santa Fe and Encinitas USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-4. Special-Status Species Potentially Occurring Within the San Elijo Study Area.		
Common Name	**Scientific Name**	**Status***
Wildlife		
Mexican long-tongued bat	*Choeronycteris mexicana*	SSC
Spotted bat	*Euderma maculatum*	SSC
Western red bat	*Lasiurus blossevillii*	SSC
Western mastiff bat	*Eumops perotis californicus*	SSC
Pocketed free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	SSC
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' kangaroo rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
Black rail	*Laterallus jamaicensis*	ST, BCC
Light-footed clapper rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Burrowing owl	*Athene cunicularia*	SSC, BCC
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell’s vireo	*Vireo bellii pusillus*	FE, SE
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC, BCC
Coastal california gnatcatcher	*Polioptila californica californica*	FT, SSC
Bell’s sage sparrow	*Amphispiza belli belli*	BCC
San clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding’s savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC
Coast (San Diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC

Table D-4. Special-Status Species Potentially Occurring Within the San Elijo Study Area.		
Common Name	**Scientific Name**	**Status***
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC
Orange-throated whiptail	*Aspidoscelis hyperythra*	SSC
Northern red-diamond Rattlesnake	*Crotalus ruber ruber*	SSC
Southern steelhead - southern California ESU	*Oncorhynchus mykiss irideus*	FE, SSC
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	FE, SSC
Plants		
San Diego thorn mint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
Shaw's agave	*Agave shawii*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
San Diego sagewort	*Artemisia palmeri*	List 4.2
Peirson's milkvetch	*Astragalus magdalenae* var *peirsonii*	FT, SE, List 1B.1
Coastal dunes milk vetch	*Astragalus tener* var. *titi*	FE, SE, List 1B.1
Coulter's saltbush	*Atriplex coulteri*	List 1B.2
South coast saltscale	*Atriplex pacifica*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
Golden-spined cereus	*Bergerocactus emoryi*	List 2.2
San Diego goldenaster	*Bloomeria clevelandii*	List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Orcutt's brodiaea	*Brodiaea orcuttii*	List 1B.1
Lakeside ceanothus	*Ceanothus cyaneus*	List 1B.2
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Southern tarplant	*Centromadia parryi* ssp. *australis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Long-spined spineflower	*Chorizanthe polygonoides* var. *longispina*	List 1B.2
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1

Table D-4. Special-Status Species Potentially Occurring Within the San Elijo Study Area.

Common Name	Scientific Name	Status*
Sea dahlia	*Coreopsis maritima*	List 2.2
San Diego sand aster	*Corethrogyne filaginifolia* var. *incana*	List 1B.1
Del Mar Mesa sandaster	*Corethrogyne filaginifolia* var. *linifolia*	List 1B.1
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*	List 1B.1
Short-leaved dudleya	*Dudleya brevifolia*	SE, List 1B.1
Varigated dudleya	*Dudleya variegata*	List 1B.2
Sticky dudleya	*Dudleya viscida*	List 1B.2
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
San Diego barrel cactus	*Ferocactus viridescens*	List 2.1
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Orcutt's hazardia	*Hazardia orcuttii*	List 1B.1
Beach goldenaster	*Heterotheca sessiliflora*	List 1B.1
Decumbent goldenbush	*Isocoma menziesii* var. *decumbens*	List 1B.2
San Diego marsh elder	*Iva hayesiana*	List 2.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Robinson's peppergrass	*Lepidium virginicum* var. *robinsonii*	List 1B.2
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Felt-leaved monardella	*Monardella hypoleuca* ssp. *lanata*	List 1B.2
Willowy monardella	*Monardella linoides* ssp. *viminea*	FE, SE
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
Short-lobed broomrape	*Orobanche parishii* ssp. *brachyloba*	List 4.2
Torrey pine	*Pinus torreyana* ssp. *torreyana*	List 1B.2
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Purple stemodia	*Stemodia durantifolia*	List 2.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

Table D-5. Special-Status Species Documented to Occur within a 5-Mile Radius of the San Dieguito Lagoon Study Area.

List compiled from 2009 searches of the CDFG Natural Diversity Database for the Del Mar, Rancho Santa Fe and Encinitas USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-5. Special-Status Species Documented to Occur within a 5-Mile Radius of the San Deguito Lagoon Study Area.

Common Name	Scientific Name	Status*
Wildlife		
Mexican long-tongued bat	*Choeronycteris mexicana*	SSC
Spotted bat	*Euderma maculatum*	SSC
Western red bat	*Lasiurus blossevillii*	SSC
Western mastiff bat	*Eumops perotis californicus*	SSC
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	SSC
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' kangaroo rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
Northern harrier	*Circus cyaneus*	SSC
White-tailed kite	*Elanus leucurus*	CFP
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
Black rail	*Laterallus jamaicensis*	ST, BCC
Light-footed clapper rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Burrowing owl	*Athene cunicularia*	SSC, BCC
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC, BCC
Coastal California gnatcatcher	*Polioptila californica californica*	FT, SSC
Bell’s sage sparrow	*Amphispiza belli belli*	BCC
San Clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding’s savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC
Coast (San Diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC

Table D-5. Special-Status Species Documented to Occur within a 5-Mile Radius of the San Deguito Lagoon Study Area.		
Common Name	**Scientific Name**	**Status***
Orange-throated whiptail	*Aspidoscelis hyperythra*	SSC
Northern red-diamond rattlesnake	*Crotalus ruber ruber*	SSC
Southern Steelhead - southern California ESU	*Oncorhynchus mykiss irideus*	FE, SSC
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	Roost sites protected by CDFG
Plants		
San Diego thorn mint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
Shaw's agave	*Agave shawii*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
San Diego sagewort	*Artemisia palmeri*	
Peirson's milkvetch	*Astragalus magdalenae* var *peirsonii*	FT, SE, List 1B.1
Coastal dunes milk vetch	*Astragalus tener var. titi*	FE, SE, List 1B.1
Coulter's saltbush	*Atriplex coulteri*	List 1B.2
South coast saltscale	*Atriplex pacifica*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
Golden-spined cereus	*Bergerocactus emoryi*	List 2.2
San Diego goldenaster	*Bloomeria clevelandii*	List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Orcutt's brodiaea	*Brodiaea orcuttii*	List 1B.1
Lakeside ceanothus	*Ceanothus cyaneus*	List 1B.2
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Southern tarplant	*Centromadia parryi ssp. australis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Long-spined spineflower	*Chorizanthe polygonoides var. longispina*	List 1B.2
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1
Sea dahlia	*Coreopsis maritima*	List 2.2
San Diego sand aster	*Corethrogyne filaginifolia var. incana*	List 1B.1
Del Mar Mesa sand aster	*Corethrogyne filaginifolia* var. *linifolia*	List 1B.1
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*	List 1B.1
Short-leaved dudleya	*Dudleya brevifolia*	SE, List 1B.1
Varigated dudleya	*Dudleya variegata*	List 1B.2
Sticky dudleya	*Dudleya viscida*	List 1B.2
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1

Table D-5. Special-Status Species Documented to Occur within a 5-Mile Radius of the San Deguito Lagoon Study Area.

Common Name	Scientific Name	Status*
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
San Diego barrel cactus	*Ferocactus viridescens*	List 2.1
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Orcutt's hazardia	*Hazardia orcuttii*	List 1B.1
Beach goldenaster	*Heterotheca sessiliflora*	List 1B.1
Decumbent goldenbush	*Isocoma menziesii* var. *decumbens*	List 1B.2
San Diego marsh elder	*Iva hayesiana*	List 2.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Robinson's peppergrass	*Lepidium virginicum var. robinsonii*	List 1B.2
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Felt-leaved monardella	*Monardella hypoleuca ssp. lanata*	List 1B.2
Willowy monardella	*Monardella linoides ssp. viminea*	FE, SE
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
Short-lobed broomrape	*Orobanche parishii ssp. brachyloba*	List 4.2
Torrey pine	*Pinus torreyana ssp. torreyana*	List 1B.2
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

Table D-6. Special-Status Species Documented to Occur within a 5-Mile Radius of the Los Pensaquitos Lagoon Study Area.

List compiled from 2009 searches of the CDFG Natural Diversity Database for the Del Mar and La Jolla USGS 7.5' quadrangles and U.S. Fish and Wildlife Service (USFWS) Species Lists for San Diego County.

Table D-6. Special-Status Species Documented to Occur within a 5-Mile Radius of the Los Pensaquitos Lagoon Study Area		
Common Name	**Scientific Name**	**Status***
Wildlife		
Spotted bat	*Euderma maculatum*	SSC
Western red bat	*Lasiurus blossevillii*	SSC
Western mastiff bat	*Eumops perotis californicus*	SSC
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	SSC
Southern sea otter	*Enhydra lutris nereis*	FT, CFP
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	SSC
Stephens' kangaroo rat	*Dipodomys stephensi*	FE, ST
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE, SSC
San Diego desert woodrat	*Neotoma lepida intermedia*	SSC
San Diego Black-tailed Jackrabbit	*Lepus californicus bennettii*	SSC
Brown pelican	*Pelecanus occidentalis*	FE
Northern harrier	*Circus cyaneus*	SSC
Bald eagle	*Haliaeetus leucocephalus*	SE, CFP
Black rail	*Laterallus jamaicensis*	ST, BCC
Light-footed Clapper Rail	*Rallus longirostris levipes*	FE, SE, CFP
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC
California least tern	*Sternula antillarum browni*	FE, SE, CFP
Burrowing owl	*Athene cunicularia*	SSC, BCC
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Least Bell’s vireo	*Vireo bellii pusillus*	FE, SE
Coastal california gnatcatcher	*Polioptila californica californica*	FT, SSC
Bell’s sage sparrow	*Amphispiza belli belli*	BCC
San clemente sage sparrow	*Amphispiza belli clementeae*	FT, SSC
Belding’s savannah sparrow	*Passerculus sandwichensis beldingi*	SE
Southwestern pond turtle	*Actinemys marmorata pallida*	SSC
Coast (san diego) horned lizard	*Phrynosoma coronatum (blainvillii population)*	SSC
Coronado skink	*Eumeces skiltonianus interparietalis*	SSC
Orange-throated Whiptail	*Aspidoscelis hyperythra*	SSC
California legless lizard	*Anniella pulchra*	SSC
Southern Steelhead - southern	*Oncorhynchus mykiss irideus*	FE, SSC

Table D-6. Special-Status Species Documented to Occur within a 5-Mile Radius of the Los Pensaquitos Lagoon Study Area		
Common Name	**Scientific Name**	**Status***
California ESU		
Tidewater goby	*Eucyclogobius newberryi*	FE, SSC
Monarch butterfly	*Danaus plexippus*	Roost sites protected by CDFG
Plants		
San Diego thorn mint	*Acanthomintha ilicifolia*	FT, SE, List 1B.1
California adolphia	*Adolphia californica*	List 2.1
Shaw's agave	*Agave shawii*	List 2.1
San Diego ambrosia	*Ambrosia pumila*	FE proposed, List 1B.1
Del Mar manzanita	*Arctostaphylos glandulosa* ssp. *crassifolia*	FE, List 1B.1
San Diego sagewort	*Artemisia palmeri*	
Peirson's milkvetch	*Astragalus magdalenae* var *peirsonii*	FT, SE, List 1B.1
Coastal dunes milk vetch	*Astragalus tener var. titi*	FE, SE, List 1B.1
Coulter's saltbush	*Atriplex coulteri*	List 1B.2
South coast saltscale	*Atriplex pacifica*	List 1B.2
Encinitas baccharis	*Baccharis vanessae*	FT, SE, List 1B.1
San Diego goldenaster	*Bloomeria clevelandii*	List 1B.1
Threadleaf brodiaea	*Brodiaea filifolia*	FT, SE, List 1B.1
Orcutt's brodiaea	*Brodiaea orcuttii*	List 1B.1
Wart-stemmed ceonothus	*Ceanothus verrucosus*	List 2.2
Southern tarplant	*Centromadia parryi ssp. australis*	List 1B.1
Orcutt's pincushion	*Chaenactis glabriuscula* var. *orcuttiana*	List 1B.1
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE, SE, List 1B.1
Long-spined spineflower	*Chorizanthe polygonoides var. longispina*	List 1B.2
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*	List 1B.2
Salt marsh bird's beak	*Cordylandthus maritimus* ssp. *maritimus*	FE, SE, List 1B.1
Sea dahlia	*Coreopsis maritima*	List 2.2
San Diego sand aster	*Corethrogyne filaginifolia var. incana*	List 1B.1
Del Mar Mesa sand aster	*Corethrogyne filaginifolia* var. *linifolia*	List 1B.1
Otay tarplant	*Deinandra conjugens*	FT, SE, List 1B.1
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*	List 1B.1
Short-leaved dudleya	*Dudleya brevifolia*	SE, List 1B.1
Varigated dudleya	*Dudleya variegata*	List 1B.2
Sticky dudleya	*Dudleya viscida*	List 1B.2
San Diego button celery	*Eryngium aristulatum* var. *parishii*	FE, SE, List 1B.1
Sand-loving wallflower	*Erysimum ammophilum*	List 1B.2
Cliff spurge	*Euphorbia misera*	List 2.2
San Diego barrel cactus	*Ferocactus viridescens*	List 2.1

Table D-6. Special-Status Species Documented to Occur within a 5-Mile Radius of the Los Pensaquitos Lagoon Study Area

Common Name	Scientific Name	Status*
Mexican flannelbush	*Fremontodendron mexicanum*	FE, SR, List 1B.1
Palmer's grapplinghook	*Harpagonella palmeri*	List 4
Orcutt's hazardia	*Hazardia orcuttii*	List 1B.1
Beach goldenaster	*Heterotheca sessiliflora*	List 1B.1
Decumbent goldenbush	*Isocoma menziesii* var. *decumbens*	List 1B.2
San Diego marsh elder	*Iva hayesiana*	List 2.2
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	List 1B.1
Robinson's peppergrass	*Lepidium virginicum var. robinsonii*	List 1B.2
Nutall's lotus	*Lotus nuttallianus*	List 1B.1
Felt-leaved monardella	*Monardella hypoleuca ssp. lanata*	List 1B.2
Willowy monardella	*Monardella linoides ssp. viminea*	FE, SE
Moran's navarretia	*Navarretia fossalis*	FT, List 1B.1
Coast woolly-heads	*Nemacaulis denudata* var. *denudata*	List 1B.2
California Orcutt grass	*Orcuttia californica*	FE, SE, List 1B.1
Short-lobed broomrape	*Orobanche parishii ssp. brachyloba*	List 4.2
Torrey pine	*Pinus torreyana ssp. torreyana*	List 1B.2
San Bernadino bluegrass	*Poa atropurpurea*	FE, List 1B.1
San Diego mesa mint	*Pogogyne abramsii*	FE, SE, List 1B.1
Otay mesa mint	*Pogogyne nudiuscula*	FE, SE, List 1B.1
Nutall's scrub oak	*Quercus dumosa*	List 1B.1
Estuary seablite	*Suaeda esteroa*	List 1B.2

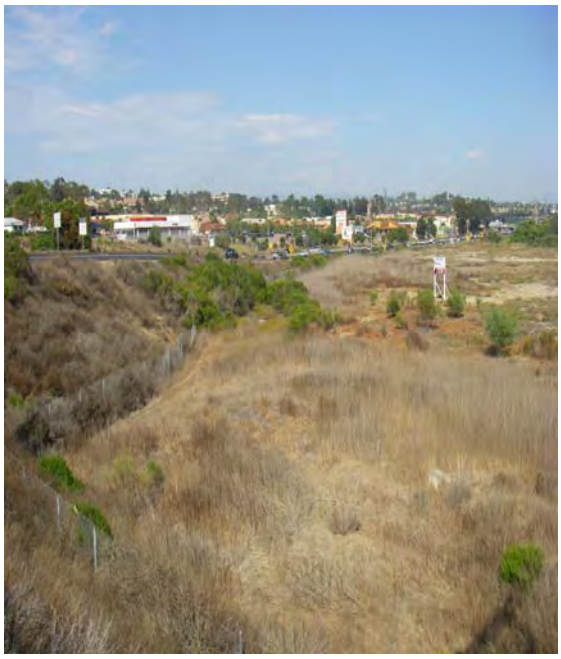
Appendix D – Special Status Species Potentially Occurring in the Phase I Lagoon Study Areas

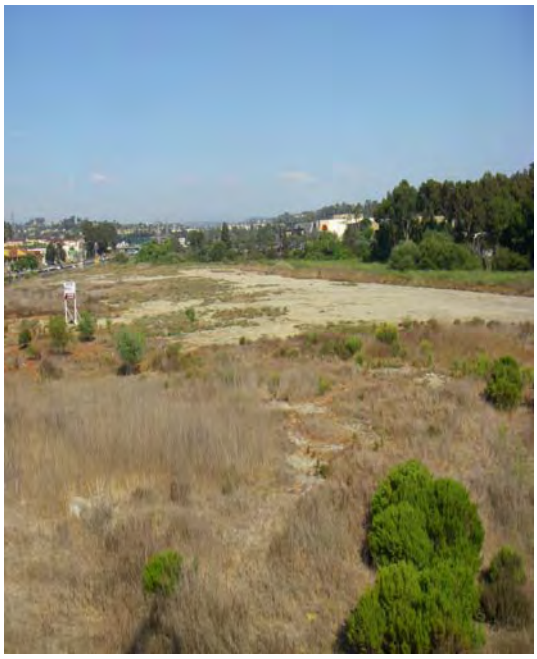
* Key to status codes:

FE	Federal Endangered
FT	Federal Threatened
FC	Federal Candidate
BCC	USFWS Birds of Conservation Concern
SE	State Endangered
ST	State Threatened
SR	State Rare
SSC	CDFG Species of Special Concern
CFP	CDFG Fully Protected Animal
List 1A	CNPS List 1A: Plants presumed extinct in California
List 1B	CNPS List 1B: Plants rare, threatened or endangered in California and elsewhere
List 2	CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere
List 3	CNPS List 3: Plants about which CNPS needs more information (a review list)
List 4	CNPS List 4: Plants with limited distribution (Watch List)

Appendix E – Representative Phase I Lagoon Study Area Photographs

Buena Vista Study Area





Study Area BV-1 view to the north side of site; upland habitat visible.	Study Area BV-1 view to the southeast portion of the site. Upland and patches of pickleweed visible in photo.

Study Area BV-2 view to the west. Pickleweed and salt flat visible.	Study Area BV-2 view to the northeast. Large patch of pickleweed visible.

Buena Vista Study Area

Study Area BV-3a view to the southwest side of the site. Salt flat visible with salt marsh.	Study Area BV-3a view of the north side of the site. Salt marsh and patches of upland habitat visible in the background.

Study Area BV-3b view to the west. Unvegetated sand flat with upland habitat in the background visible.	Study Area BV-3b view of the northeast portion of the site. Small patches of pickleweed surrounded by sand flat and some upland habitat visible.

Buena Vista Study Area

Study Area BV-4 view to the northeast side of the site. Upland habitat dominates the photo.	Study Area BV-4 view to the north. Upland habitat and bank slope visible.

Study Area BV-5 view to the northeast. Upland habitat with large patches of iceplant and trail visible.	Study Area BV-5 view to the south; iceplant visible in the foreground and wetland in the background.

Agua Hedionda Study Area

Study Area AH-1 view to the west. Berm visible mid-picture, power plant stack in the background.	Study Area AH-1 view to the southeast. Tidal slough and berm visible in foreground.

Study Area AH-2 view to the west. Upland and ruderal habitat visible.	Study Area AH-2 view to the southeast. Upland vegetation visible in foreground.

Agua Hedionda Study Area

Study Area AH-3 view to the south. Berms and ruderal salt flat visible with health tidal salt marsh in the background.	Study Area AH-3 view to the north. Ruderal habitat visible in the foreground and upland habitat in the background.

Study Area AH-4 view to the west. Upland habitat and exposed sand flat visible.	Study Area AH-4 view of channel with pickleweed vegetation.

Agua Hedionda Study Area

Study Area AH-5 view to the west. Entire study site visible in photo.	Study Area AH-5 view the bank of the small point. Small patches of pickleweed visible in foreground.

Study Area AH-6 view to the west. Upland scrub habitat and trail visible, sewer main access visible in background.	Study Area AH-6 view to the east, along trail with upland habitat visible.

San Elijo Study Area

Study Area SE-2 view to the north side of site; upland native vegetation habitat visible.	Study Area SE-2 view to the northeast. Steep slopes leading to draw visible.

Study Area SE-3 from north end of Study Area looking to south. High plateau of site visible in background.

San Elijo Study Area

Study Area SE-4 view to the east. Native upland vegetation slopes gently to a narrow band of transitional habitat and then to the main tidal channel.

Study Area SE-5 view to the north. Site is consists of bare ground and basins in photo background. Unvegetated flat areas at slightly higher elevation than wetlands visible.

Batiquitos Study Area

Study Area BL-5 view to the south side of site; eucalyptus stand and upland habitat in foreground, salt marsh in the background.	Study Area BL-5 view to the south east portion of the site. Upland and patches, eucalyptus and southern portion of the trail visible.

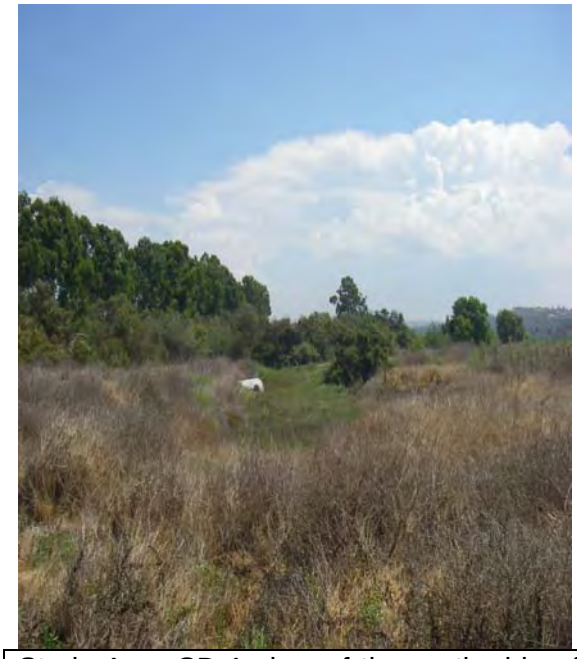
Study Area BL-6 view to the north east. Pickleweed and wetland visible in the	Study Area BL-6 view to the east. Eucalyptus stand and trail visible in picture. Patches of

Batiquitos Study Area

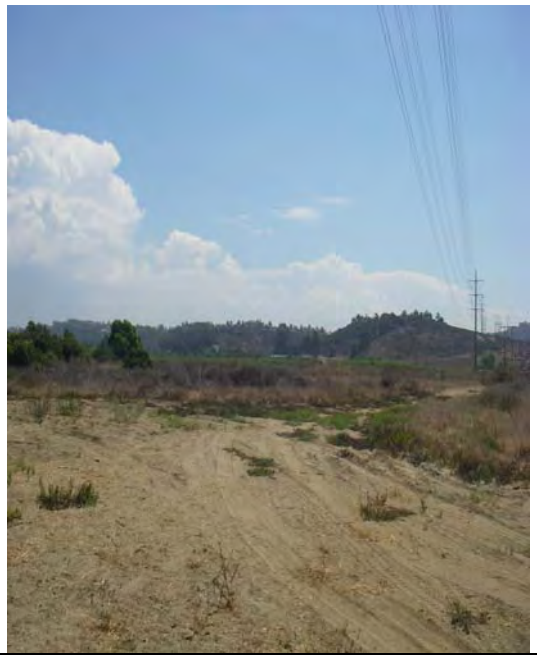
foreground, eucalyptus stand in the background.	pickleweed comprise the understory.

Study Area BL-8 view to the north east. Salt marsh borders the broad trail, with a small patch of upland in the foreground.	Study Area BL-8 view of the south east. Patches of upland scrub in the middle of the trail, with salt marsh visible behind.

San Dieguito Study Area



Study Area SD-1 view of the north side of the site. Ruderal upland in foreground, wetland in background with concrete pipe in it.



Study Area SD-1 view to the east. Large expanse of sandy exposed soil, ruderal upland and scrub habitat. Transmission lines overhead.

Study Area SD-2 view of the north side of study site. Current restoration tidal area visible, with bank and patches of ruderal upland habitat.

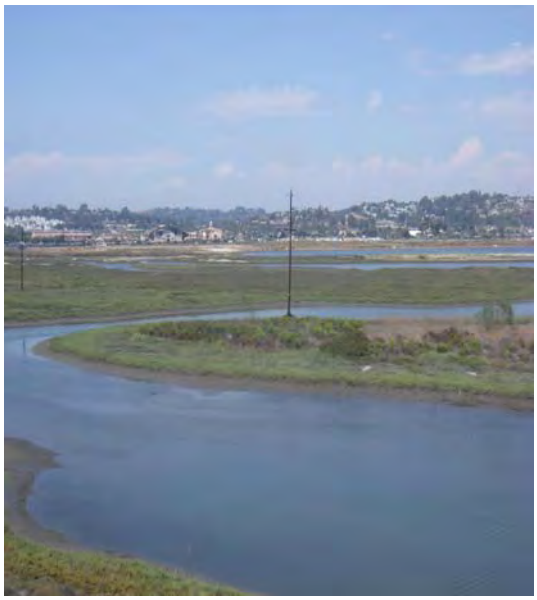
Study Area SD-2 view to the east. Expansive ruderal upland and scrub habitat.

San Dieguito Study Area

Study Area SD-3 view to the south. Upland habitat and patches of invasive iceplant in the foreground.	Study Area SD-3 view to the north, taken from near the south end of the study site. Ruderal habitat and invasive plants visible in the foreground.

Study Area SD-5 view of the entire study site in the background with the eastern portion of SD-6 in the foreground.	Study Area SD-5 view of the south east side of the site. Fill and ruderal habitat visible.

San Dieguito Study Area



Study Area SD-6 view of the eastern portion of the site. Site designated as a Least Tern breeding island.	Study Area SD-6 view of the western portion of the site. Site designated as a Least Tern breeding island.

Study Area SD-7 view to the west. Tidal slough and bank of study site visible.	Study Area SD-7 view of the south west portion of the site. Ruderal upland and invasive iceplant visible in picture.

San Dieguito Study Area

Study Area SD-8 view to the west. Wetland in center of photo and upland fringing the edges.	Study Area SD-8 view of the south west portion of the site. Pickleweed visible in the foreground.

Study Area SD-9 view to the north. Small channel and pickleweed visible in foreground with unvegetated dirt lot in the background.	Study Area SD-9 view of the south west portion of the site. Pickleweed visible in the background with the unvegetated dirt parking lot in the foreground.