APPENDIX A

LOS PEÑASQUITOS LAGOON ENHANCEMENT PLAN

Final

LOS PEÑASQUITOS LAGOON ENHANCEMENT PLAN

Torrey Pines, CA

Prepared for
Los Peñasquitos Lagoon
Foundation

August 2018

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CHAPTER 1
Introduction

Los Peñasquitos Lagoon (the Lagoon) is a State Marsh Natural Preserve and is part of the Torrey Pines State Natural Reserve (TPSNR) located in coastal north county San Diego, which is owned and managed by California State Parks (CSP). Los Peñasquitos Lagoon is a 565-acre coastal estuary that receives drainage from an approximately 59,212-acre watershed comprising three primary sub-drainages: Carmel Valley, Los Peñasquitos Canyon, and Carroll Canyon (**Figure 1-1**). The Lagoon and its associated uplands provide important habitat for five listed bird species and 35 sensitive plant species endemic to the region. Los Peñasquitos Lagoon also serves as an important refuge for migratory birds using the Pacific Flyway and is the closest coastal estuary to the La Jolla State Marine Conservation Area (ASBS #29) and San Diego-Scripps State Marine Conservation Area (ASBS #31) (**Figure 1-1**).

Once a pristine coastal salt marsh, the Lagoon now must exist within the context of an urban environment that, for the most part, will not be changed. Human activities and urban development have become a permanent part of the Lagoon's ecology. Beginning with large-scale cattle ranching in Los Peñasquitos Canyon that began in the 1800s to modern day urban development, land use change within the watershed has altered native landscapes, degraded water quality, and modified hydrology and geomorphology. As a result, Los Peñasquitos Lagoon has been placed on the Clean Water Act Section 303(d) list of impaired water bodies. The Lagoon is also considered a breeding hotspot in coastal San Diego for *Culex tarsalis*, the mosquito species known to transmit West Nile virus (WNV) to avian, equine, and human hosts.

Backed by the strong support of the local community and groups active in TPSNR, several efforts were made to improve and protect Los Peñasquitos Lagoon. In 1983, the Los Peñasquitos Lagoon Foundation (LPLF) was formed from representatives of key stakeholder groups, including landowners, the development community, local municipalities, local residents, and the members of the environmental community. The premise of forming LPLF in this manner was to facilitate planning and implementation of action items designed to improve and protect the Lagoon, as well as to mitigate impacts related to watershed development planned for areas such as Carmel Valley. LPLF also successfully "bridged the gap" that often exists between state agencies and local stakeholder groups, providing avenues of dialogue and opportunities for consensus building.

Los Peñasquitos Lagoon. D130136

Figure 1-1
Los Penasquitos Location Map

1.1 Previous Lagoon Enhancement Plan (1985)

With help from the California State Coastal Conservancy (SCC), LPLF worked with local residents and other key stakeholder groups to develop and certify the Los Peñasquitos Lagoon Enhancement Plan and Program (Lagoon Enhancement Plan) in 1985. The Lagoon Enhancement Plan was instrumental in implementing an adaptive approach to managing the Lagoon that included restoring tidal circulation using mechanized equipment to excavate the inlet area, identifying key land parcels to acquire in the near-term, and establishing the longest continual biological monitoring program for coastal wetlands in the region. Chapter 2 summarizes these efforts.

Since the Lagoon Enhancement Plan was certified in 1985, conditions within the Lagoon and its watershed have been modified because of land use changes, including the expansion of urban and industrial areas. As a result, management of the Lagoon and future restoration requires adaptive measures and new strategies, which necessitate updating the 1985 Lagoon Enhancement Plan. Since 2012, LPLF has worked closely with CSP and other key stakeholder groups to develop comprehensive strategies to improve the Lagoon through a watershed-based approach.

Successful long-term restoration of Los Peñasquitos Lagoon requires a comprehensive, watershed-based approach emphasizing sound science, adaptive management strategies, and stakeholder input to foster coastal stewardship. Biology, hydrology, geomorphology, finance, and resource policy will need to be integrated with intrinsic and extrinsic values placed on the Lagoon by primary stakeholder groups, including the public. Building upon their experience in developing the 1985 Lagoon Enhancement Plan, the LPLF developed a draft vision and set of goals and objectives needed to update the 1985 Plan. This effort was performed in collaboration with experts from CSP, City of San Diego, Torrey Pines Association, Tijuana River National Estuarine Research Reserve (TRNERR), and the SCC. Draft goals considered: (1) native habitats and species; (2) hydrology and geomorphology; (3) water quality; (4) public health and safety; (5) global climate change; (6) public outreach, education, and access; (7) long-term maintenance; (8) regional value of Los Peñasquitos Lagoon; and (9) coastal stewardship as it applies to both the Lagoon and its watershed. This draft version of the goals and objectives provides the foundation for the next step in this process, which is the update to the Lagoon Enhancement Plan. The update to the Lagoon Enhancement Plan was initiated through a stakeholder-driven process that refined these goals and objectives, identified opportunities and constraints, and developed a phased approached to implementing the enhancements to meet these goals, as is further discussed in the next subsection.

1.2 The Lagoon Enhancement Plan Update Process

Working collaboratively with CSP, the City of San Diego, and other key stakeholder groups, LPLF has been successful in aligning watershed improvements to the restoration and enhancement priorities for the Lagoon, as well as long-term management needs. LPLF participated in several watershed-based planning efforts for the Los Peñasquitos Watershed that included the third-party Los Peñasquitos Lagoon Sediment Total Maximum Daily Load (Lagoon Sediment TMDL) and the revised Regional Storm Water Permit recently released by the San

Diego Water Board. During these planning efforts, it was determined that restoration of the Lagoon's historic habitats (e.g., salt marsh) and ecosystem services (e.g., beneficial uses identified in the San Diego Basin Plan) would serve a primary compliance target, in conjunction with load reductions of sediment and other constituents of concern. It was also determined that the updated Lagoon Enhancement Plan would serve as a key guidance document for improvements in the Lagoon and its watershed, required under the Lagoon Sediment TMDL and Regional Storm Water Permit.

Building on the tradition of bringing together sound science and coastal stewardship through stakeholder involvement in the development of the original Lagoon Enhancement Plan, the LPLF held six public workshops from October 20, 2012 to April 20, 2013. Participants in these workshops included local community members, land owners, local municipalities, partner non-profits (e.g. Torrey Pines Association and Torrey Pines Docents) and regional planning authorities. The workshops were designed to facilitate stakeholder involvement through a progressive series of steps, beginning with review and refinement of Lagoon Enhancement Plan goals and objectives. This refined set of goals and objectives was then used in subsequent workshops as the basis for participants to identify, assess, and evaluate opportunities and constraints to meet these goals. Workgroups were formed to focus around habitat, public access, and sustainability oriented goals. Participants were free to move independently between each of these workgroups to provide input. Based on the stakeholder discussions of the constraints and opportunities, a phased approach to meeting the goals and objectives was identified and further developed.

An implementation approach was broken down into three phases, or timelines: Phase 1 (0–5 years), Phase 2 (5–25 years), and Phase 3 (25–50 years). The identified opportunities were then assigned to one of the three phases based on anticipated timelines to plan, design, and implement these opportunities; existing physical constraints (e.g., railroad berm); and regulatory driven goals (e.g., Lagoon Sediment TMDL). The opportunities were also defined by management zones that each has a unique set of characteristics (e.g., inlet – Zone 1 compared to intact salt marsh – Zone 2). The workshops concluded with a defined set of activities and projects (opportunities) to be considered for implementation during each of the three phases.

The outcomes of this stakeholder process were used to develop and assess the Project Concepts presented in Chapter 7 – Chapter 9 of this Lagoon Enhancement Plan. Presented in Chapter 10, performance metrics were developed to allow comparison between the Project Concepts as they relate to meeting the refined goals and objectives of the updated Lagoon Enhancement Plan and within the context of biological assessments of historical and current lagoon habitats. This stakeholder-driven process continued with a final workshop held on March 25, 2017 to present the results of the Lagoon Enhancement Plan update and provide an opportunity for stakeholder input on the Lagoon Improvement (or Project) Concepts for Phases I and II.

1.3 The Updated Lagoon Enhancement Plan (2013)

The updated Lagoon Enhancement Plan provides a new road map for restoring the Los Peñasquitos Lagoon's habitats and protecting listed species, along with reducing threats to public health and empowering stakeholder groups with regard to the stewardship of coastal resources. A brief summary of the updated Lagoon Enhancement Plan's chapters is provided below:

Chapter 2: Success of Past Efforts

Chapter 2 provides a summarized assessment of efforts made to pursue and complete action items developed under the 1985 Lagoon Enhancement Plan, including the following:

- Monitoring
- Lagoon Mouth Maintenance
- Land Acquisition
- Improving Circulation
- Restoring Habitat
- Providing Public Access
- Controlling Sedimentation

Chapter 3: History of the Lagoon & Watershed

Chapter 3 explores some of the key factors that helped shape the Lagoon settings and baseline conditions, including:

- Cattle ranching in Los Peñasquitos Canyon (1823–1962)
- Transportation infrastructure (e.g., railway, roads and highways, parking lots)
- Sewage discharges into the Lagoon
- Urban development in the Los Peñasquitos Watershed

Chapter 3 also provides a discussion regarding impacts to Los Peñasquitos Lagoon caused by these activities that include:

- Extended closures of the Lagoon inlet
- Water quality impairment
- Hydromodification within the Lagoon's drainages
- Increased sedimentation
- Increased freshwater inputs during dry weather
- Habitat conversion

Chapter 4: Lagoon Setting & Baseline Conditions

Chapter 4 establishes the setting and baseline conditions for the Lagoon and its watershed to establish context for both management and future restoration/enhancement efforts. The chapter begins with a discussion regarding the Lagoon's three sub-watersheds that includes drainage area and land use. Topography and bathymetry are then discussed, followed by hydrologic conditions within the Los Peñasquitos Lagoon and the role that the inlet and coastal processes play. Drainage and flooding from the Lagoon's three tributaries are also highlighted along with water quality, soil conditions, and sedimentation (fluvial and tidal). The Lagoon's biologic and cultural resources are also described in Chapter 4, as well as public access and vectors.

Chapter 5: Vector Management

Chapter 5 is dedicated to addressing management concerns for airborne vectors and begins with a brief summary of the historic and contemporary presence of mosquitos in the Lagoon, focusing on those species that present the greatest risk to human populations—such as through the transmission of viruses that can cause brain encephalitis in human hosts. Next, the chapter explores some of the key anthropogenic drivers that contribute to the presence, species type, and magnitude of mosquito population in the Lagoon. Recorded incidents of WNV within the vicinity of Los Peñasquitos Lagoon and vulnerabilities of surrounding communities are then discussed briefly, followed by a brief description of obstacles that complicate effective vector management. Chapter 5 concludes with summarizing the nexus between effective vector management and restoration/enhancement of the Lagoon with regard to the County's Vector Habitat Remediation Program, County Department of Environmental Health's Wetland Design Guidelines for Vector Control, and Project Concepts developed in the updated Lagoon Enhancement Plan.

Chapter 6: Stakeholder Participation through Public Workshops

Chapter 6 describes the stakeholder-driven process for developing this updated Lagoon Enhancement Plan. Elements of Chapter 6 include justification for the strategy of improving and preserving the Lagoon through a public approach. The chapter also provides details about the progression of the workshops that began with the refinement of goals and objectives and concluded with a phased approach to improving the Lagoon using stakeholder-vetted criteria specific to habitat, community access and public safety, and sustainability.

Chapter 7: Lagoon Restoration and Enhancement Concepts

Chapter 7 through Chapter 9 present the different Improvement (or Project) Concepts for native habitat restoration and enhancement; public access, safety, and education; and public health through vector habitat remediation. Chapter 7 presents the evolution of the final set of Lagoon Restoration and Enhancement Concepts (Lagoon Concepts) developed through technical analysis and input from wetland experts and resource agency representatives. The development of Lagoon Concepts includes modeling efforts to assess baseline conditions within Los Peñasquitos Lagoon and potential trajectories of habitat evolution with the goal of establishing a coastal wetland that is a dynamic system capable of being resilient, self-sustaining, and as close to native/natural as possible with the understanding that the Lagoon will most likely remain a managed system in perpetuity.

Chapter 8: Public Access, Safety, and Education Concepts

Chapter 8 describes the existing pathways and trails around the Lagoon and the proposed improvements discussed during the public workshops. Chapter 8 explores phased improvements for public access that begin with initial efforts to repair and enhance existing segments, followed by potential realignment of pathways and trail segments to improve public safety and sustainability, and concluding with a connected trail system around the entire Lagoon. Efforts were also made to examine opportunities to create linkages to public transit centers and regional trail systems that include the California Coastal Trail, Sea to Sea Trail, TPSNR, and Los Peñasquitos Canyon Preserve. Finally, Chapter 8 concludes with the presentation of concept designs for selected improvements to public access and safety with a discussion of how they complement the Trail Management Plan for the TPSNR currently being updated by CSP.

Chapter 9: Community Health – Vector Habitat Remediation Concepts

Chapter 9 presents Vector Habitat Remediation Concepts (Vector Concepts) developed to improve vector management at Los Peñasquitos Lagoon with emphasis on reducing breeding habitat favored by *C. tarsalis*, the mosquito species linked to the transmission of WNV and other forms of brain encephalitis to human hosts. A key aspect of these concepts is reducing areas of ponded, stagnated fresh and brackish waters either through enhanced tidal circulation and/or dewatering areas of frequent and prolonged inundation. While these concepts can be considered as "stand-alone" projects, efforts will be made to integrate them with Lagoon improvements that include large-scale restoration of salt marsh habitat.

Chapter 10: Evaluation, Ranking and Selection of Improvement Concepts for Los Peñasquitos Lagoon

Chapter 10 provides an assessment and evaluation of the Improvement (or Project) Concepts presented in Chapters 7 through 9 to arrive at the preferred concepts using criteria developed during the stakeholder process discussed in Chapter 6.

Chapter 11: Next Steps

Chapter 11 provides the next steps to be taken toward implementing the updated Lagoon Enhancement Plan. Elements of this chapter include:

- Design and feasibility study for the preferred Lagoon Concept, which includes a Phase 1 Pilot Restoration Project.
- Ongoing coordination with planning and improvement efforts for the Los Peñasquitos Watershed under programs that include the Lagoon Sediment TMDL, County-wide Bacteria

TMDL, and the Water Quality Improvement Plans prepared under the Regional Storm Water Permit.

- Adaptive management.
- Opportunities to implement Public Access, Safety and Education Concepts developed under the updated Lagoon Enhancement Plan.
- Improving and expanding the capacity for LPLF as a management entity within Los Peñasquitos Lagoon and its watershed, as well as within the region.

1.4 Consistency of the Updated Lagoon Enhancement Plan with Other Plans

The updated Lagoon Enhancement Plan is consistent with numerous local, regional, and State/National plans and programs, which acknowledge the value of Los Peñasquitos Lagoon as a State Preserve with coastal salt marsh and estuarine habitats, the importance of connectivity between the watershed and the Lagoon, the value of improved public access to promote and sustain stewardship of coastal resources, and the need to protect public health. The updated Lagoon Enhancement Plan is consistent with the following plans and programs:

Local Level

- Wildlife Management Plan for TPSNR
- Torrey Pines State Natural Reserve Vegetation Management Statement (2009)
- Los Peñasquitos Lagoon Sediment TMDL
- Comprehensive Load Reduction Plan for the Los Peñasquitos Watershed
- Water Quality Improvement Plan for the Los Peñasquitos Watershed
- City of San Diego Multi-Habitat Planning Area (MHPA)
- City of San Diego Multiple Species Conservation Program (MSCP)
- City of San Diego Watershed Urban Runoff Management Program (WURMP)
- City of San Diego Standard Urban Storm Water Mitigation Plan (SUSMP)
- City of San Diego Strategic Plan for Watershed Implementation
- Community Plans that include Torrey Pines, Carmel Valley, Del Mar Mesa, and Sorrento Hills

Regional Level

- San Diego County Bacteria TMDL
- San Diego Basin Plan
- Integrated Regional Water Management Plan (IRWMP)
- Southern California Wetlands Recovery Project's Work Plan

- Vector Habitat Remediation Program (VHRP) Implementation Plan
- San Diego Coastal State Park System General Plan
- North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (NCC PWP/TREP)
- San Diego Gas & Electric Sub-Regional Natural Community Conservation Plan

State and National Level

- Governor's Executive Orders –
  - Executive Order S-13-08. Consideration of sea level rise in state funded/directed construction plans.
  - Executive Order B-30-15. Reduce greenhouse gas emissions and climate preparedness = priority action.
- California Water Action Plan (Objective 2 – restoration of species and habitat)
- California Wildlife Action Plan
- California Aquatic Invasive Species Management Plan
- California Essential Habitat Connectivity Strategy for Conserving a Connected California
- Proposition 1– Water Quality, Supply, and Infrastructure Improvement Act of 2014
- California State Coastal Conservancy (SCC) Strategic Plan (2013-2018) – Division 21 of Public Resource Code (SCC's statutory programs and purposes)
- U.S. Fish & Wildlife Service Recovery Plans for least Bell's vireo, light-footed Ridgeway's rail, and western snowy plover

CHAPTER 2

Success of Past Efforts

The 1985 Los Peñasquitos Lagoon Enhancement Plan and Program (Lagoon Enhancement Plan) developed a set of action items to guide Los Peñasquitos Lagoon (the Lagoon) enhancement in the following areas:

- Monitoring
- Lagoon Mouth Maintenance
- Land Acquisition
- Improving Circulation
- Restoring Habitat
- Providing Public Access
- Controlling Sedimentation

Although not all of the action items from the 1985 Lagoon Enhancement Plan were implemented, Los Peñasquitos Lagoon has been greatly improved due to the efforts highlighted in this Chapter. Monitoring programs established under the 1985 Lagoon Enhancement Plan have greatly expanded our understanding the Lagoon and the processes that affect it health with much of this information provided by Biological and Physical Monitoring Program that has collected data continuously since 1987. Other monitoring programs include a Sediment Monitoring Program, a Storm Water Runoff and Sedimentation Monitoring Program, and a Vegetation Association and Mapping Pilot Study (Section 2.1). Ongoing adaptive management of the lagoon inlet has identified and refined effective approaches and methods for mechanical openings needed to restore and maintain tidal connectivity with the ocean while reducing both the frequency and duration of extended closures that degrade water quality within lagoon channels and exacerbate vector breeding (Section 2.2). Acquisition of lands within and adjacent to Los Peñasquitos Lagoon that include the 226-acre San Diego Gas & Electric Company parcel and the 20-acre Sorrento Associates Property have greatly expanded the boundaries of the Lagoon and helped to reduce habitat fragmentation through the protection of wildlife corridors (Section 2.3). Focused restoration and enhancement efforts, including trash cleanups and removal of invasive plant species, have improved the quality of habitats (Section 2.5). The Carmel Valley Restoration and Enhancement Project (CVREP), the Los Peñasquitos Sediment Basin and other structural abatement projects have reduced, in part, the amount of sediment entering the Lagoon from the watershed following storm events. The recently approved Los Peñasquitos Lagoon Sediment Total Maximum Daily Load (Lagoon Sediment TMDL) and the County-wide Bacteria TMDL look to further protect the health and ecosystem services provided by the Lagoon that include

Beneficial Uses identified in the San Diego Basin Plan. Both TMDLs will examine opportunities for watershed improvements to generate comprehensive load reductions through efforts that include source control, structural facilities, and channel restoration.

2.1 Monitoring

Coastal estuaries in Southern California are highly complex systems that can be difficult to understand because they are subjected to numerous natural and anthropogenic drivers that affect their processes (e.g. hydrology), generate impacts, determine how habitats evolve over time, and affect populations of sensitive species. While some of these drivers are constant in nature, others vary in magnitude over temporal scales. Furthermore, coastal estuaries like Los Peñasquitos Lagoon are often shaped by episodic events that can occur during shifts in climate that are possible during the El Niño – Southern Oscillation (ENSO). Establishing an effective monitoring program is a critical to understanding these systems and guide adaptive management required for coastal estuaries constrained by urban encroachment.

Understanding the importance of collecting quality data, the Los Peñasquitos Lagoon Foundation (LPLF) helped to establish the longest-running continuous monitoring program within the Southern California Region through the 1985 Lagoon Enhancement Plan. Designed by the Pacific Estuarine Research Lab (PERL) with guidance from Joy Zedler (PERL director), the monitoring program was implemented in 1987. Since that time, it has been funded through an ongoing grant with the California State Coastal Conservancy (SCC) that was derived from mitigation payments generated through the development of Carmel Valley and surrounding areas through a fee collection program set up by LPLF, the City of San Diego, SCC, and the California State Coastal Commission.

The monitoring program is guided by a set of objectives and action items designed to better inform management efforts within Los Peñasquitos Lagoon and its watershed in order to achieve the goal of restoring and protecting the Lagoon as well as to help document regional shifts in habitat type and distribution in Southern California coastal estuaries.

The following objectives were developed by PERL in coordination with LPLF for the monitoring plan:

- Assess the health and ecological value of Los Peñasquitos Lagoon and its systems.
- Document changes in the functional values of the lagoon system, especially in terms of the habitat value for birds and fish.
- Evaluate the success of the various elements of the 1985 Lagoon Enhancement Plan.
- Help determine the timing of implementation for other elements of the 1985 Lagoon Enhancement Plan.

The 1985 Lagoon Enhancement Plan also identified the following action items, developed to help achieve monitoring objectives:

1. Periodically measure the physical and chemical parameters of the lagoon waters, such as water level, salinity, temperature, and dissolved oxygen.
2. Measure the biological parameters, including surveys of benthic invertebrates, fish, birds, and vegetation.
3. Measure the amount of runoff and sedimentation originating from the major lagoon tributaries, and relate this information to the amount of rainfall.
4. Observe and document each enhancement activity, record the duration and location of each lagoon mouth opening and the conditions under which it closes, and periodically measure channel depths.

Using an adaptive approach since 1985, actions items for monitoring were pursued through the development of three specific monitoring programs. Conducted separately, the monitoring programs were designed so that they could be integrated together as needed. These programs were:

- Biological and Physical Monitoring Program for Los Peñasquitos Lagoon
- Sediment Monitoring Program for Los Peñasquitos Lagoon
- Storm Runoff and Sedimentation Monitoring Program for the Los Peñasquitos Watershed

Implementation of the 1985 Lagoon Enhancement Plan has resulted in a far more stable system with the inlet opened on an as-needed basis to avoid die-off of channel organisms, which has been documented during previous extended inlet closures. Accordingly, fish and invertebrate populations have rebounded and are more diverse than those that had existed in the Lagoon prior to 1985.

The background and evolution of each monitoring program is briefly described in the following sub-sections. Additional information for each program is provided, including an assessment of success, within the context of the action item(s) it supports in Appendix B.

2.1.1 Biological and Physical Monitoring Program

Listed as a key component in the 1985 Lagoon Enhancement Plan, the Biological and Physical Monitoring Program began in 1987. Under the guidance of Joy Zedler, a baseline study was conducted in 1986–1987, which involved the sampling of adult and juvenile fishes, benthic invertebrates, and vegetation and physiochemical parameters within the Lagoon (Nordby and Covin 1988). Recommendations, monitoring sites, and protocols established in this baseline study were used to ongoing monitoring efforts in the Lagoon and to allow comparisons between historic and contemporary data sets. Subsequent changes have been made to the protocols and station locations based on an adaptive approach. This has allowed some level of consistency across time, while also permitting better assessment of changing conditions and management needs with regard to annual funding.

From 1987 to 2004, the monitoring program at Los Peñasquitos Lagoon was conducted by PERL, which was located at San Diego State University. In 2004, PERL was discontinued and their core staff relocated to the Tijuana River National Estuarine Research Reserve (TRNERR). During the transition, LPLF worked closely with the Southwest Wetland Interpretive Association (SWIA) who coordinates monitoring efforts and project management in TRNERR. Currently funded through a grant from the SCC, sampling methods were developed for Los Peñasquitos Lagoon to make results more comparable to ongoing monitoring at TRNERR, whose monitoring is part of a nationwide National Oceanic and Atmospheric Administration (NOAA) effort. TRNERR makes an excellent reference location, as the mouth of the reserve is rarely as restricted as at Los Peñasquitos Lagoon and is not bisected by a railway berm, allowing for comparisons between tidally restricted and unrestricted systems. Coordinating monitoring programs also provides comparative analysis between two coastal estuaries in Southern California that vary in size with TRNERR being a larger system.

The Biological and Physical Monitoring Program is further described and assessed in Appendix B under Action Items #1–3.

2.1.2 Sedimentation Monitoring Program

In 1995, a monitoring program was developed for Los Peñasquitos Lagoon by Coastal Environments (CE) to assess sediment accretion and erosion rates and trends within the Lagoon's terrestrial and aquatic environs. The program established survey transects and benchmarks across lagoon channels and within the marsh plain located in the eastern portion of Los Peñasquitos Lagoon based on recommendations from previous studies and communication with LPLF board members and the technical advisory committee. A baseline study was conducted by CE in 1995 to establish survey transects and benchmarks to be used in subsequent years to provide consistency with regard to data collection and review. Surveys were conducted annually, often occurring in winter months. The Sediment Monitoring Program is further described in Appendix B under Action Item #3.

2.1.3 Storm Runoff and Suspended Sediment Monitoring Program

Measuring runoff and suspended sediment originating from Los Peñasquitos Lagoon's three tributaries was included in the 1985 Lagoon Enhancement Plan pursuant to recommendations provided in the 1982 San Diego Association of Governments (SANDAG) Watershed Management Plan for Los Peñasquitos. Flow rates from the Lagoon's major tributaries (Carmel Creek, Los Peñasquitos Creek, and Carroll Canyon Creek) were monitored at three stations to assess freshwater input and sediment transport to Los Peñasquitos Lagoon from the watershed with emphasis placed on storm runoff and its ability to carry sediment to Lagoon. Monitoring of sediment loads within each tributary was also performed, looking at suspended sediment, bed load sediment, and total sediment. Monitoring of flow rates and sediment loads within each tributary was then integrated with monitoring of sediment deposition within the Lagoon conducted in a separate effort. The Storm Runoff and Sedimentation Monitoring Program is described further in Appendix B under Action Item #3.

2.1.4 Vegetation Association and Mapping Pilot Study

In coordination with California State Parks (CSP) and TRNERR, LPLF worked with the City of San Diego in 2011 to develop the Vegetation Association and Mapping Pilot Study to better define opportunities to restore salt marsh habitats within Los Peñasquitos Lagoon. The need for this pilot study was based primarily on the fact that vegetation associations used to determine habitat classifications within the Lagoon had not been adequately surveyed and mapped to the level of scale that would facilitate lagoon restoration. Previous classification and mapping efforts in Los Peñasquitos Lagoon used a more generalized approach that delineated the Lagoon using three main habitat types: salt marsh, brackish/transitional, and riparian. However, field investigations revealed that habitat within the Lagoon was not as clear-cut, nor homogenous within each habitat area. For example, approximately 170 acres in the middle of Los Peñasquitos Lagoon consists of a mosaic of vegetation associations that are characteristic of tidal salt marsh, non-tidal alkali marsh, brackish marsh, invasive grass, upland transition and areas dominated by invasive species (e.g., *Festuca perennis*). The Vegetation Association and Mapping Pilot Study is described in more detail in Section 4.6 of Chapter 4.

2.2 Lagoon Mouth Maintenance

Restoring tidal mixing and increasing the tidal prism within Los Peñasquitos Lagoon was a key measure and priority for the 1985 Lagoon Enhancement Plan, as it was seen as the most important factor in restoring lagoon health and reducing populations of mosquitoes and midges that thrived during past extended inlet closures. Prior to the 1985 Lagoon Enhancement Plan, mouth closures at the Lagoon not only occurred frequently, but also often extended for several months to a year, with some cases of inlet closures extending beyond a year (see Section 4.4.3). Compounding the impacts that generally occurred during extended inlet closures (e.g., dissolved oxygen depleted to levels toxic to aquatic animals) were the daily discharges of primary-treated sewage into Los Peñasquitos Lagoon from three separate sewage treatment plans (see Section 3.1.6) from 1950 to the early 1970s. Planned discharges of treated effluent were eventually discontinued by the City of San Diego and redirected away from the Lagoon to the City's main sewage infrastructure through two pump stations (Pump Station 64 and Pump Station 65). However, numerous sewage spills from Pump Station 64 continued to impact water quality within Los Peñasquitos Lagoon, and contributed to legacy pollutants entrained in the Lagoon's sediments from decades of effluent discharges and spills that still affect water quality during extended inlet closures.

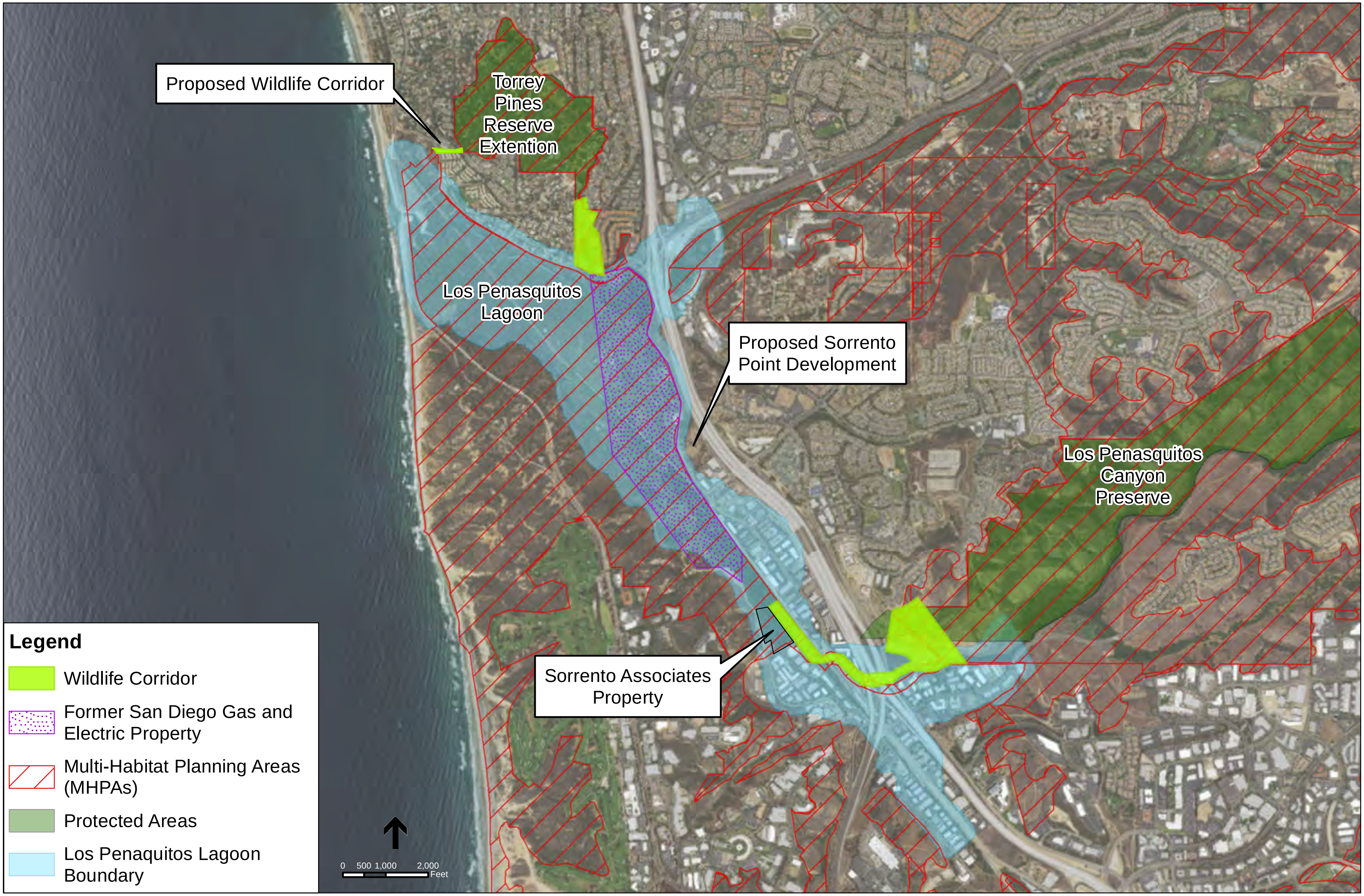
Restoring the tidal prism at Los Peñasquitos Lagoon using heavy equipment was initially the responsibility of CSP with efforts dating back to the mid-1960s. However, these efforts generated mixed results and selecting the appropriate method through adaptive management was a focus of the 1985 Lagoon Enhancement Plan. During the development of the 1985 Lagoon Enhancement Plan, "alternatives that would massively increase the tidal prism were considered and rejected because of the desire to preserve existing quality marsh habitats, and because initial analyses indicated that even with a much larger tidal prism the Lagoon mouth would close frequently." Instead, it was determined that the 1985 Lagoon Enhancement Plan should take a more conservative approach that considered the least damaging techniques for restoring tidal actions before considering techniques that were “more costly and environmentally disruptive.” Acknowledging that periodic maintenance would be required as a tradeoff for lower capital costs, the 1985 Lagoon Enhancement Plan included two techniques for restoring the Lagoon’s tidal prism using heavy equipment along with a set of criteria for evaluating success. Both techniques and the set criteria are described in Appendix C.

Since the 1985 Lagoon Enhancement Plan, LPLF has continued the adaptive management approach to maintain the Lagoon’s inlet and restore its tidal prism. The program was reviewed and modified in two separate efforts in 1997 and 2006, which examined previous efforts, results, and lessons learned (Appendix C). Programmatic-level changes occurred during both of these efforts, focusing on key elements during the progression of maintenance efforts. Furthermore, the dynamic nature of the inlet coupled with additional factors (e.g., nesting season for listed bird species, regional beach nourishment efforts) necessitated that annual efforts also take an adaptive approach (e.g., use of equipment) to maximize efficiency and benefits, while minimizing project impacts and adhering to annual budgets. Project needs, priorities, and constraints have been assessed prior to implementing annual maintenance efforts, as well as throughout the duration of each inlet maintenance effort.

2.3 Land Acquisition

The 1985 Lagoon Enhancement Plan cited the need to acquire additional important habitat areas, including wetlands, and surrounding buffers that were not part of the Torrey Pines State Natural Reserve (TPSNR). This measure was supported by planning documents from communities adjacent to the Lagoon, the General Plan for the TPSNR, and recovery plans for listed bird species (e.g., light-footed clapper rail and California least tern). The 1985 Lagoon Enhancement Plan provided the following six priority actions to be pursued under this measure (**Figure 2-1**):

1. Transfer portions of or all of the SDG&E property west of Sorrento Valley Road (226 acres) to the State of California as additions to the TPSNR. Explore with the owners possibilities of fee title acquisition, transfer of development to other properties under the same ownership, donations, or purchase as mitigation for major development proposals that will affect the Lagoon. [Completed in 1987.]
2. Transfer the Sorrento Associates Property (20 acres) to the State of California as a second addition to the TPSNR. Also explore with the landowners alternative ways of accomplishing the transfer. [Completed in 1986.]
3. Transfer the Wyer Property (6 acres) to public ownership to preserve open space upland areas related to the lagoon system. Alternatively, private development should be clustered on the upper portions of the site to buffer the adjacent potential marsh restoration site. [Status unknown as this property has not been identified through record searches performed in 2011]
4. Arrange Protection for the Wildlife Link between the Los Peñasquitos Canyon Preserve and the Lagoon Area. Explore with Cal Sorrento the possibilities of fee title acquisition, transfer of development to other properties, donations, partial development and dedication, or land swaps for other property. [Completed through inclusion in the City of San Diego Multiple Species Conservation Program (MSCP).]
5. Provide an open space corridor between the TPSNR Extension and the Lagoon area. [Completed through inclusion in the MSCP.]



Source: MHPAs and Los Penasquitos Canyon Preserve (City of San Diego); Imagery (Microsoft 2015)

Figure 2-1
Sorrento Property and Habitat Areas

6. Accept and enforce open space easements over prominent bluffs and hillsides that form a visual backdrop to Los Peñasquitos Lagoon. The managing agency or group should arrange funding to cover the costs of monitoring and enforcing these easements if it accepts this responsibility. In instances where the City does not accept an easement or requirements for monitoring and enforcement exceed those ordinarily undertaken by the City, the LPLF may assume these responsibilities. [Not completed.]

A brief description of each action item identified in the 1985 Lagoon Enhancement Plan, along with an assessment of success, is provided in Appendix D.

2.4 Improving Circulation

The preferred approach in the 1985 Lagoon Enhancement Plan to improve tidal mixing within lagoon channels was to increase the tidal prism through inlet maintenance and modification to existing channels and restoration of those cut off by the railway berm. It was thought that this component would help mitigate the adverse impacts caused by past filling of wetland areas, such as the blocking of historic tidal channels by the railway berm constructed in 1925. This element involved the four following actions:

1. Prepare topographic map of the tidal channels with 1-foot contours. Also prepare bid documents and specifications for proposed alterations.
2. Jack culverts through the railroad embankment to increase both tide and flood flows in the lagoon channels on the west side of the embankment, thereby better approximating the historical circulation and flushing characteristics.
3. Reconnect and design existing historical channels west of the railroad berm. This would increase the Lagoon tidal prism and improve flushing through the culverts under the railroad embankment. Connecting isolated ponds and the tidal channels with small drainage ditches would help control mosquitoes by reducing favorable breeding conditions.
4. Install culverts under the North Beach parking lot access road to increase tidal flushing along the east side of the railroad embankment. Expand the width of the channel in this area to increase the tidal prism and return tidal flushing to the area north of the road. This may involve redesign of the roadway.

This component never made it to the design phase and, therefore, was never implemented. However, the potential benefits of this component were later restated in a 2003 study conducted by CE, which recommended reconnecting historic Los Peñasquitos Lagoon's historic channels currently blocked by the railway berm and excavating both restored and existing primary Lagoon channels to -2-foot National Geodetic Vertical Datum (NGVD). Restoring, or at least improving, lagoon hydrology will most likely be an important step in restoring native salt marsh habitat in Los Peñasquitos Lagoon. Channel restoration would reduce impacts caused by freshwater impoundment behind the railway berm during flood events, which has facilitated sediment deposition and habitat conversion in the eastern portion of the Lagoon and occlusion and closures of the lagoon mouth through the reduction in velocity of outflows caused by storm runoff. Additionally, impoundment of freshwater from daily dry weather flows of water in the eastern areas of Los Peñasquitos Lagoon has presented threats to public health in the form of West Nile virus (WNV) through the establishment of breeding habitat for *Culex tarsalis*, the freshwater mosquito species known to transmit brain encephalitis in San Diego County to avian, equine, and human hosts. Improving drawdown times of impounded freshwater in the upper lagoon and facilitating tidal mixing will help reduce the breeding habitat for *C. tarsalis*, reduce vulnerability of nearby urban infrastructure to flooding and abate habitat conversion from salt marsh to brackish and freshwater marsh.

2.5 Restoring Habitat

Aside from lagoon mouth openings to restore tidal action and improve circulation of lagoon waters, the 1985 Lagoon Enhancement Plan acknowledged the need to perform additional habitat restoration efforts that should be guided by "what occurs naturally on the site, emphasizing and enhancing current vegetation features." The 1985 Lagoon Enhancement Plan also mentioned the need to consult recovery plans for endangered species to provide guidance on restoration efforts and to avoid conflicts associated with managing these sensitive species. Large-scale restoration measures or restoration alternatives were not included in the 1985 Lagoon Enhancement Plan, most likely because half of the existing lagoon was still owned by SDG&E at the time and hydrology impairment limited options. The 1985 Lagoon Enhancement Plan did provide five "minor" habitat improvements for consideration:

1. Restore sand dune environment adjacent to the North Beach parking lot. [Partially completed.]
2. Remove encroaching vegetation from historic least tern nesting sites along the sewer berm. Also consider covering the site with a layer of sand. [Not completed because of access restrictions; also because the sewer berm was removed in 1997/1998.]
3. Reestablish cordgrass on an experimental basis in tidal channels once tidal action is restored. [Not completed.]
4. Remove ice plant and other exotic species and establish tidal channels and salt marsh habitat in the areas bounded by Carmel Valley Road, the railroad embankment, and the North Beach parking lot access road. [Ice plant removed from 3 acres in 2009; tidal channels were not established; habitat was restored naturally along the North Beach parking lot starting in 2004/2005.]
5. Periodically remove illegal dumps and clean up litter around the perimeter of Los Peñasquitos Lagoon and within its inlet area. [Illegal dumping has declined in most areas along the Lagoon and litter is often cleaned up regularly by CSP and volunteers. However, there has been an ongoing issue with illegal dumps occurring within the upland areas adjacent to Sorrento Valley and where Portofino Drive intersects Carmel Valley Road.]

Small- and medium-scaled habitat restoration efforts have occurred within Los Peñasquitos Lagoon on both an intermittent and ongoing basis, and are performed primarily by CSP and the City of San Diego. Some of these efforts included habitat improvements provided by the 1985 Lagoon Enhancement Plan (e.g., trash pickup, ice plant removal), while others were performed as mitigation for activities that included the construction of the City of San Diego's Pump Station 65. These improvements are described and assessed in Appendix E.

2.6 Providing Public Access

Designated as a State Marsh Natural Preserve, public access into Los Peñasquitos Lagoon is restricted to protect the Lagoon's sensitive species and the habitats that support them. Access to the Lagoon is provided by CSP through Right of Entry and/or Science Collection Permits for activities that do not conflict with management guidelines of a State Preserve. Providing some degree of public access to Los Peñasquitos Lagoon will improve resource protection and management by facilitating educational opportunities and overall appreciation of the Lagoon's environs and species. In conjunction with the TPSNR General Plan, the 1985 Lagoon Enhancement Plan identified nine public access improvements for consideration, with the intent to improve public access and education while protecting areas of sensitive resources. These improvements were:

1. Build a Visitor Center in the North Beach parking lot with interpretive displays about the marsh and lagoon ecosystem.
2. Build a boardwalk extending south from the North Beach parking lot into the restored sand dunes and marsh areas for interpretive purposes.
3. Build a pedestrian link between the North Beach parking lot and sidewalk of North Torrey Pines Road bridge to provide pedestrian access to the south beach when the lagoon mouth is open.
4. Build a boardwalk from the lagoon mouth along the eastern shoulder of North Torrey Pines Road.
5. Build a trail from Flintkote Avenue to North Torrey Pines Road, bypassing the sensitive transitional areas between wetland and upland vegetation. Construct linking trails to North Torrey Pines Road.
6. Expand and improve the parking lot at the end of Flintkote Avenue and include interpretive facilities.
7. Construct and maintain fences and gates at either end of the sewer berm to prevent illegal vehicular entry to the wetland.
8. Develop interpretive displays about sedimentation, freshwater and salt marshes, and riparian habitat in conjunction with the park and ride facility at the intersection of Carmel Valley Road and Sorrento Valley Road. Include a trail or boardwalk skirting the wetland to Portofino Drive to improve pedestrian access.
9. Develop a viewpoint on Sorrento Valley Road at the crest of the hill overlooking the lagoon, if traffic safety considerations can be met. This may be accomplished in conjunction with road improvements or adjacent private development.

For the most part, recommendations provided in the 1985 Lagoon Enhancement Plan for improving public access in Los Peñasquitos Lagoon were not implemented, although some were satisfied indirectly. Educational components (e.g., interpretive displays and informational panel) were implemented to a certain degree around the inlet area, informing the public about the Lagoon's sensitive species, typical bird species observed within the inlet area, and the need to conduct inlet maintenance to restore and maintain tidal connectivity. A description and assessment of success for each of the nine recommended access improvements is provided in Appendix F.

2.7 Controlling Sedimentation

Sedimentation is one of the most pressing problems affecting the continued health of the Los Peñasquitos Lagoon and its ecosystem services. This point was expressed in the 1985 Lagoon Enhancement Plan and is still valid today, as evidenced by the development of the Lagoon Sediment TMDL, which was adopted in June 2012. During the development of the 1985 Lagoon Enhancement Plan, sediment control measures focused in part on the pending development of North City West that would later become Carmel Valley because of the potential sediment-related impacts (Prestegaard 1975). However, many of the sediment management measures identified and evaluated in the 1985 Lagoon Enhancement Plan were rejected as too environmentally damaging, and not strictly required in the wetland. Sedimentation control recommendations presented in the Prestegaard study and the SANDAG Watershed Management Plan for Los Peñasquitos have been partially implemented in the watershed. Three action items were identified in the 1985 Lagoon Enhancement Plan to address sediment input from the watershed:

1. Implement recommendations in the SANDAG Watershed Management Plan for Los Peñasquitos for improvements to erosion control ordinances and enforcement and for public education. Publish standards for erosion control and the use of best management practices.
2. Preserve sediment storage areas identified by Prestegaard (1975) in their natural state. Only development that retains the current natural capacity and function of these areas to hold sediment from upstream, or properly mitigates any disruption should be allowed.
3. Design in-stream improvements that would decrease erosion and slow downstream sedimentation. Estimate the cost of conserving, restoring, and maintaining stream channels, and identify sediment sources. Re-evaluate the desirability of a facility to remove sediment at the lower end of Carmel Valley. Also re-evaluate the costs, possible financing mechanisms, locations, and environmental effects of sedimentation basins in Carroll Canyon and Los Peñasquitos Canyon.

Several of the action items identified in the 1985 Lagoon Enhancement Plan were pursued directly, while others were attained indirectly through programs such as the Lagoon Sediment TMDL and the CVREP. Appendix G provides a brief description and assessment of activities pursued under each of the action items identified in the 1985 Lagoon Enhancement Plan.

CHAPTER 3

History of the Lagoon & Watershed

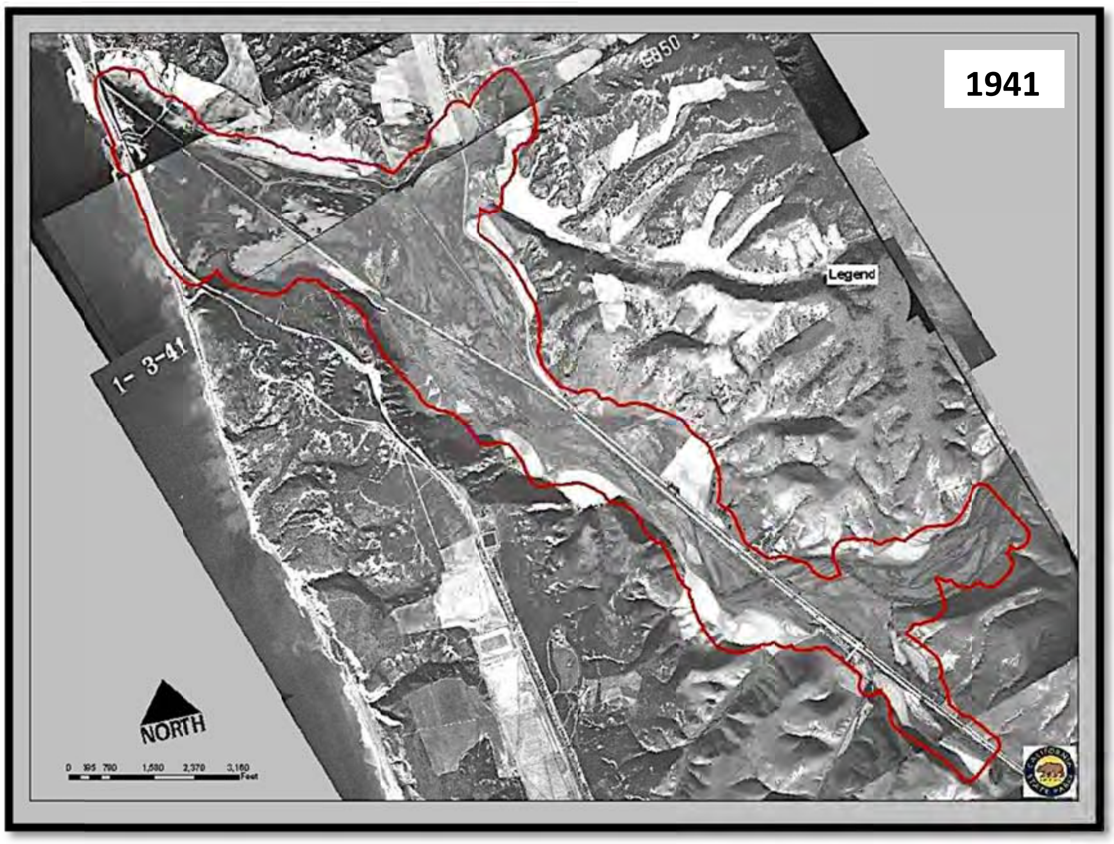
In the late 1800s, Los Peñasquitos Lagoon (the Lagoon) was mostly salt marsh with an extensive salt flat in the middle, which fluctuated in size from year to year (SFEI 2014). Land use changes within Los Peñasquitos Canyon began in 1823 with the advent of cattle ranching in the upper watershed. In 1834, Rancho Los Peñasquitos was expanded to include the lower watershed and over the subsequent decades, land within the Canyon was cleared for cattle grazing. Removing established chaparral through controlled burns exposed large areas of earth that were more vulnerable to sediment erosion during storm events (Cole and Wahl 2000). The construction of two different railway alignments in 1888 and 1925 changed the hydrology of the Lagoon by cutting off tidal channels and limiting flow during storm events. The construction of Highway 101 in 1932 and the North Beach parking lot in 1968 relocated and confined the Lagoon's inlet to its current position and constricted flow, which caused more frequent mouth closures. Urban development, including the construction of Interstates 5 and 805 (I-5 and I-805, respectively), increased rapidly from 1966 through 1999 and undeveloped land decreased from 87% to 57% of the watershed area (White and Greer 2006). As of 2000, 54% of the watershed was urbanized with 46% classified as impervious (Tetra Tech 2010). Prior to this development, flood plains located at the bottom of each of the Los Peñasquitos Lagoon's sub-watersheds served as natural sediment deposition and flood abatement zones during storm events. As flood waters spread out horizontally through a branching network of channels within the floodplain, sediment transport was greatly reduced before reaching the Lagoon. Development within the floodplain altered this natural process as the branching system of channels was replaced by urban hardscapes and channelization of all three tributaries through the lower portions of the watershed. As a result, peak flows and sediment transport greatly increased through the lower watershed because of the lack of a floodplain and sediment deposition increased in Los Peñasquitos Lagoon, sometimes in the form of large sediment plumes that raised elevations in these areas above tidal influence. Additionally, between 1950 and 1972, primary-treated sewage effluent was discharged into the Lagoon, impacting water and sediment quality through nutrient loading, as well as increasing freshwater flows. Since 1996, Los Peñasquitos Lagoon has received year-round freshwater inputs as all three tributaries became perennial as a byproduct of urbanization of the watershed. Increased sediment deposition within the Lagoon coupled with year-round freshwater intrusion has converted salt marsh, salt flat and salt panne habitat in the upper lagoon to a mix of brackish marsh, freshwater marsh, and riparian habitats.

3.1 History of the Lagoon

Once a pristine salt marsh, the Los Peñasquitos Lagoon has evolved into an urbanized coastal estuary that requires ongoing management to protect its historic habitats and sensitive species, value as a refuge for migratory birds using the Pacific Flyway, and ecosystem services for local residents and visitors. Aerial photographs of the Lagoon from 1941, 1973, and 2010 illustrate many of the changes that the Lagoon and surrounding watershed have gone through in the past 50 years. **Figure 3-1** presents these images, which are described in more detail below.

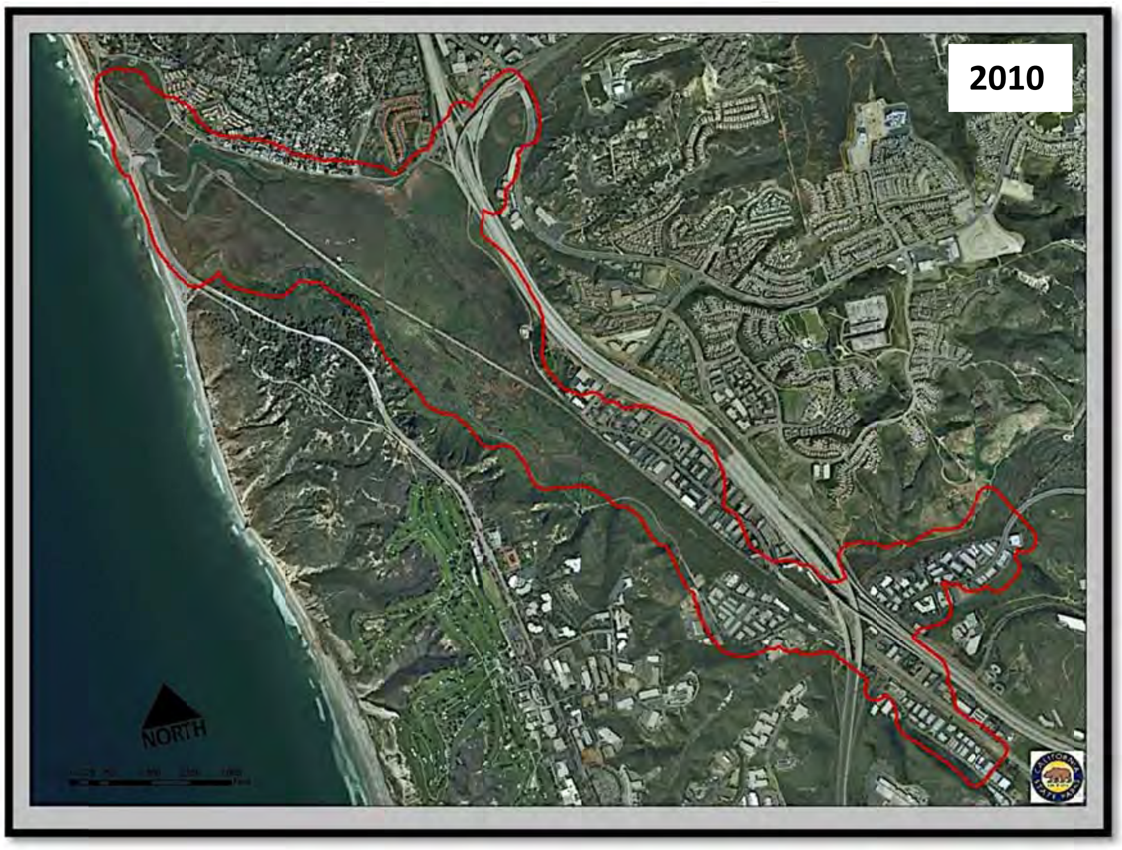
By 1941, development within Los Peñasquitos Lagoon had already occurred in the form of Highway 101 along the barrier beach and two railway alignments through the Lagoon that were completed in 1888 and 1925. The mesa tops surrounding Los Peñasquitos Lagoon were still undeveloped, aside from Camp Callan, which covered portions of what is now the Torrey Pines State Natural Reserve (TPSNR). As shown in **Figure 3-1a**, the floodplain was also relatively undeveloped at this point, with the terminus of each of the Lagoon's main three tributaries showing branching stream networks stretching across a relatively wide flood plain. Large salt pannes are visible within the mid and upper reaches of Los Peñasquitos Lagoon, most likely as a result of evaporation of impounded waters during extended inlet closures and/or storm runoff. Areas disked for dry-farming beans are also visible along the southern edges of the Lagoon adjacent to what is now the Marsh Trail.

Figure 3-1b provides an overview of Los Peñasquitos Lagoon in 1973. While the watershed was still relatively undeveloped, the Lagoon's borders and floodplains as well as portions of the Lagoon itself had been altered by development. The community of Torrey Pines is now visible along the northern border of Los Peñasquitos Lagoon along with the Torrey Pines Golf Course along coastal bluffs to the south of the Lagoon in an area that was formerly occupied by Camp Callan between 1941-1945. The detention ponds of the Sorrento Wastewater Plant are visible along the southern edge of the Lagoon, adjacent to the Marsh Trail. The North Beach parking lot is also visible near the lagoon inlet, relocated to the lower bridge span with the completion of Highway 101 in 1932. Floodplains in the southeastern portion of Los Peñasquitos Lagoon and the lower reaches of Los Peñasquitos Canyon and Carroll Canyon have been developed for industrial and commercial land use. As a result, the meandering, branching system that was present for both Los Peñasquitos Creek and Carroll Canyon Creek prior to development has been replaced by more linear and narrowed single channels. A 1-mile section of Carroll Canyon Creek has been replaced with a concrete-lined channel through Sorrento Valley in an attempt to protect nearby structures from flooding. Habitats within Los Peñasquitos Lagoon still seem to be predominantly salt marsh, although areas of expansive mud flats are now more visible than in the 1941 aerial.



3-1a

3-1b



3-1c

Source: CA State Parks 2011

Figure 3-1
Los Peñasquitos Lagoon from 1941 to 2010
Red line denotes study area for the updated plan

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Figure 3-1c presents a recent aerial graphic of Los Peñasquitos Lagoon depicting the Lagoon and surrounding areas in 2010. The watershed just east of the Lagoon has been built-out, as well as the community of Torrey Pines and the science parks just east of the Torrey Pines Golf Course. Development and riparian corridors have replaced sandy washes present within the floodplain and western portions of the watershed. Habitat conversion is now more visible within Los Peñasquitos Lagoon. Areas of historic salt marsh in the eastern portion of the Lagoon and within the floodplain have been converted to upland habitat types that include brackish marsh and riparian species. Once held behind the 1888 railway/sewer berm, brackish marsh and riparian habitats within Carmel Valley extended further into Los Peñasquitos Lagoon after the berm was removed in the late 1990s. Expansive mud flats readily visible throughout the Lagoon in the 1941 and 1973 aerials (**Figures 3-1a** and **b**) are now vegetated and difficult to see.

As shown in the previous figures, Los Peñasquitos Lagoon has evolved from an expansive salt marsh into a coastal estuary with mixed habitats that range from coastal salt marsh in the west to transitional brackish and upland habitats in the east with riparian corridors that extend from the Lagoon up into the three sub-watersheds. Salt marsh acreage within Los Peñasquitos Lagoon has been reduced from approximately 430 acres in 1973 to approximately 262 acres in 2010, primarily as a result of sedimentation and perennial freshwater inputs from the watershed and drainages that border the Lagoon. The following sections provide further detail on the historic developments that have occurred at Los Peñasquitos Lagoon with Section 3.2 summarizing the impacts these changes have had on the health of the Lagoon.

3.1.1 Geologic History of Los Peñasquitos Lagoon and Watershed

Los Peñasquitos Lagoon originated as a stream-cut valley 15,000 to18,000 years ago during the Late Pleistocene and last glacial period when sea levels were 350 to 400 feet below their current elevation. With the warming climates of the Holocene, a rapid post-glacial rise in sea level inundated coastal areas and formed the Los Peñasquitos Drainage Basin. By 6,000 years ago, an open bay had formed with rocky beaches consisting of cobbles (Inman 1983). Rising sea levels accelerated by glacial melt slowed down 4,000 years ago, allowing sandy beaches to blanket (build along) the rocky shoreline (Masters and Gallegos 1997). Littoral drift and wave action helped to form what is now the Torrey Pines State Beach, a barrier beach that grew across the narrow mouth of the bay. Sand transport from the beach as well as alluvial sediments from the watershed began catching up with the rate of sea-level rise, slowly transforming the embayment into a lagoon.

3.1.2 Native American History

(Portions of the Native American History section are taken from Mealey and Ruston 2010.)

The earliest well-documented prehistoric sites in the San Diego region show evidence of human presence dating back over 9,000 years ago. Groups from the Early Prehistoric period or Paleoindian period have been referred to locally as the San Dieguito Complex or Tradition, and date to the early Holocene Epoch (Rogers 1966, Pignolio 2010). People of the San Dieguito complex were previously thought to have been almost exclusively "big game hunters" and highly mobile to follow large mammals (Pourade 1966). However, more recent evidence suggests that they were also gatherers, and, along the coast, exploiters of marine resources (Gallegos 1992).

During the Early Archaic Period it is believed that the Native Americans had a generalized economy that focused on hunting and gathering (Pignolio 2010) with coastal Southern California economies remaining largely based on wild resource use until European contact (Willey and Phillips 1958). Around 6,000 years BP, the lagoons of northern San Diego County supported large populations (Gallegos and Kyle 1988; Pignolio et al. 1993). However, there appears to be a decline in the numbers of sites in northern San Diego County from around 3,000 to 1,500 years BP, which has been attributed to the siltation of the lagoons and the depletion of lagoon resources, including shellfish (Gallegos 1992:206, 213; Gallegos and Kyle 1988).

The Late Prehistoric period (also known as the Late Archaic or Yuman period) saw the migration of peoples from the eastern deserts to the western portion of San Diego County, possibly due to the drying up of the large inland lakes (Lake Cahuilla and others) (e.g., Pourade 1966:8). Torrey Pines State Natural Reserve, including Los Peñasquitos Lagoon, is within the ethnographic territory of the Kumeyaay, who are direct descendants of the early Yuman hunter-gatherers. The Kumeyaay were mainly hunters and gatherers, making seasonal rounds to take advantage of various resources. However, they had also developed horticultural/agricultural techniques, including burning, seed broadcasting, transplanting, and planting (Bean and Lawton 1973; Gee 1972; Luomala 1978; Shipek 1982). More information about the Kumeyaay is presented in Appendix H.

European contact with the Kumeyaay in coastal San Diego began on September 28, 1542, when Spanish explorers entered San Diego Harbor. Kumeyaay culture and society remained stable until the advent of the mission system and displacement by Hispanic populations during the eighteenth century (Pignolio 2010). While many of the Kumeyaay initially resisted missionization, the introduction of European diseases greatly reduced the native population during this period and contributed to the breakdown of cultural institutions.

3.1.3 Ranching in Los Peñasquitos Canyon (1823–1962)

Ranching in Los Peñasquitos Canyon began in 1823 when Captain Francisco Maria Ruiz established Rancho Los Peñasquitos in the upper watershed following the separation of Mexico from Spain in 1821. Ranching in the region expanded with the Secularization Act of 1833, which eliminated mission-owned lands and allowed private ranchers to begin to settle within San Diego. Driven initially by the foreign demand for hides and tallow, cattle ranching flourished during this time at the rancheros of San Diego County, including Rancho Peñasquitos which expanded in 1834 to include the lower portion of Los Peñasquitos Canyon.

The cattle industry in San Diego once again became lucrative in the mid-1800s as a result of the Mexican–American War and the discovery of gold in the Sierra Nevada Mountains. With populations in central and northern California growing rapidly, beef was now in high demand and San Diego rancheros prospered. However, prosperity was short-lived and cattle ranching declined after the 1850s as a result of several factors, including drought, disease, and changing land use priorities (farming and homesteads over large ranches) (Wade et al. 2009).

Cattle ranching reemerged in San Diego County in the early 1900s as a result of advancements in bovine vaccines and modern pumping equipment that improved irrigation within pastures and enabled the development of wells for water supplies. However, cattle ranching declined again after the end of World War II, due in part to the pressure from housing development along the coast as a result of the post-war population boom that occurred in Southern California.

Burning thick stands of chaparral was a common practice in the ranchos of San Diego, as it allowed grass to grow and also improved access for both cattle and cattlemen (Wade et al. 2009). Prior to the establishment of Rancho Los Peñasquitos, thick chaparral and a forested riparian zone along the creek made up the dominant vegetation communities within Los Peñasquitos Canyon. Large expanses of chaparral within Los Peñasquitos Canyon were cleared using fire to improve grazing opportunities for cattle. Sediment cores taken within Los Peñasquitos Lagoon, as part of a paleo-ecological study, show high charcoal values occurring in the mid-1820s that indicate man-made fires, as opposed to charcoal signatures characteristic of naturally occurring fires. After these prescribed burns, areas of chaparral were replaced by large areas of native grasses that could be used for grazing areas for cattle, as evidenced in pollen counts taken in sediment cores from Los Peñasquitos Lagoon (Cole and Wahl 2000).

Box 3-1. Rancho Los Peñasquitos

In 1823, Rancho Los Peñasquitos was created when Captain Francisco Maria Ruiz, the Commandant of the San Diego Presidio, was awarded 4,243 acres of land in the upper portion of Los Peñasquitos Canyon. Ruiz was later granted an additional 4,243 acres of land that comprised the lower portion of Los Peñasquitos Canyon in 1834, following the Secularization Act.

Historic reports mention that the United States Army collected over 100 head of cattle from Rancho Los Peñasquitos in 1846 when General Stephan Watts Kearny chose the rancho as resting place for his Army of West after the Battle of San Pasqual (Cole and Wahl 2000). In 1848 the Mexican–American War ended with the Treaty of Guadalupe Hildago and California was ceded to the United States.

Throughout the 1930s and 1940s, beef production was one of the most important industries in San Diego County (Wade et al. 2009). Big ranches with large herds dominated the industry and Rancho Los Peñasquitos was considered one of the largest cattle ranches in San Diego (Wade et al. 2009).

Persisting until the early 1960s, the ranching era in Los Peñaquitos Canyon sharply declined in 1962 when J. Irvin Kahn, a major developer, purchased the area with plans to develop it into golf courses and residences. Evidence of ranching activities in Los Peñasquitos Canyon and within the Lagoon persist in the form of fence posts that can still be seen today from viewpoints around the Lagoon and along trails within Los Peñasquitos Canyon Preserve.

3.1.4 Transportation Infrastructure

Railroad

Aside from the Tijuana River National Estuarine Research Reserve (TRNERR), all of the coastal estuaries within San Diego County have been impacted by coastal railway alignments. In Los Peñasquitos Lagoon, two separate railway alignments were constructed across the Lagoon upon elevated berms of compacted fill that greatly altered lagoon hydrology. The first railway alignment was constructed in Los Peñasquitos Lagoon in 1888 just west of the current alignment of Sorrento Valley Road (**Figure 3-2**). The 1888 railway was abandoned in 1925 due to the realignment of the railway to the west. The elevated berm from the 1888 alignment was later converted into a sewer berm and vehicle access road for SDGE before it was removed in 1998.

The 1925 railway alignment was moved to the center of Los Peñasquitos Lagoon on top of an elevated berm of compacted fill and remains in use today for both passenger and freight use. During construction, the inlet was moved south from its historic location to allow the railway line to exit the Lagoon at its northwest corner and proceed along the coastal bluffs to Del Mar. The upper bridge constructed as part of Highway 101 in 1932 spans this section of the railway and the historic lagoon mouth location (**Figure 3-2**). The berm used for the 1925 alignment cut off several historic tidal channels and divided the Lagoon into an eastern basin and a western basin, resulting in the loss of tidal prism. The new railway alignment incorporated only three bridge spans within Los Peñasquitos Lagoon to convey flows from the watershed toward the ocean. Storm flows can proceed through the bridge spans and toward the Lagoon mouth during small flood events and dry-season flows. Moderate to large flood events result in storm water being impounded within the eastern basin for prolonged periods of time until waters can effectively drain, causing increased sedimentation and habitat conversion east of the railway berm due the lack of hydrologic connectivity to the western basin.

Regional efforts to expand and improve the service capability of the railway have been considered through the Los Angeles to San Diego Rail Improvement Program (LOSSAN). Key components of this program include double tracking and retrofitting of existing railway bridges between 2015 and 2017, including the three that occur within Los Peñasquitos Lagoon. Selection of the preferred alignment through the Lagoon will most likely occur during the remaining phases of LOSSAN and implementation is projected to occur in 2030. Currently, several railway alignments are proposed since the current one may not be feasible in the long-term because of its location along erosive coastal bluffs just north of the Los Peñasquitos Lagoon as well as community pressure from Del Mar. Regardless of which alternative is selected, it appears that the railway alignment will remain within Los Peñasquitos Lagoon rather than relocating outside of the Lagoon (e.g., along the median of I-5).

SOURCE: Imagery (Microsoft 2015)

ESA

Figure 3-2
Site Map of Historic Impacts

Highway 101

The first incarnation of the coast highway in San Diego County was completed in 1915 and was composed of a 15-foot strip of concrete that hugged the coast. While this road passed through Los Peñasquitos Lagoon, it did so using a different alignment than what is currently used today. Heading south, the road cut inland from the coast on the Lagoon's northern border along what is now Carmel Valley Road and rejoined the coast near the current location of the South Beach parking lot at TPSNR by way of a bridge that crossed Los Peñasquitos Lagoon's western-most channel (**Figure 3-3a**). This alignment preserved the coastal strand and dunes of Torrey Pines State Beach as well as the Lagoon's meandering inlet.

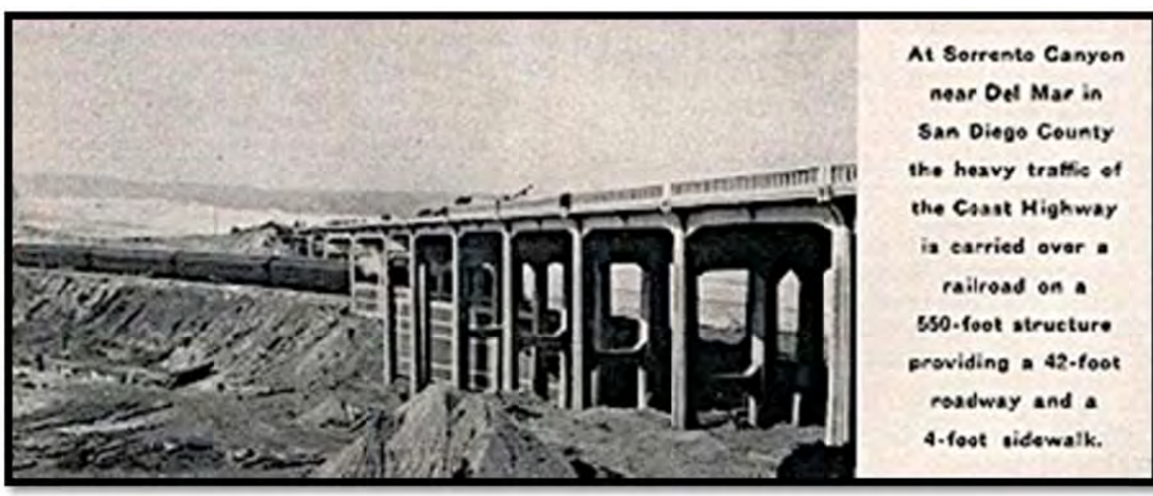
In 1932, the original coastal road at Los Peñasquitos Lagoon was rerouted with the construction of Highway 101with the section passing the Lagoon referred to as North Torrey Pines Road. Elevated on a berm of compacted fill, Highway 101 ran the entire length of Los Peñasquitos Lagoon's western boundary along Torrey Pines State Beach, effectively separating the Lagoon from its barrier beach. The Lagoon inlet was "preserved" under the lower bridge (Coppock 1985) since the Lagoon's historic inlet location to the north had been obstructed by the construction of the railway alignment in 1925 followed by the construction of the upper bridge for Highway 101 (**Figure 3-3b**).

Box 3-2. The Beach Shingle Railroad

Part of the 1888 railway alignment, the "Beach Shingle Railroad," also referred to as the "Sea Wall Spur," was a railroad spur off the main alignment that headed directly toward the beach. This section of track, was used to help access and transport beach cobbles that were used to build the streets of San Diego during the 19th century (Beller et al. 2014). It is believed that the western section of Beach Shingle Railroad alignment was later used as part of the original coastal road, allowing vehicles to cross Los Peñasquitos Lagoon before reconnecting to the coastline where the TPSNR southern parking lot is currently located. Sections of the1915 coastal road are still used today for pedestrian and vehicular access to trailheads located along the coastal bluffs within the Reserve.

In 2004–2005, the original lower bridge, constructed in 1932, was replaced by the City of San Diego. The design of the new bridge included features to improve tidal flushing within Los Peñasquitos Lagoon and Lagoon outflows during flood events in an attempt to reduce the frequency and duration of inlet closures. This was achieved by reducing the total number of support columns from 74 used by the original bridge to 4 used by the new bridge, along with a slightly wider bridge span across the inlet (**Figure 3-4**).

3-3a Driving to Los Peñasquitos Lagoon in a Ford Model A - Early 1920s.



3-3b Historic Highway 101 Upper Bridge and 1925 Railway Alignment.

Source: U.S. 101 Photo Gallery

ESA

Los Peñasquitos Lagoon. D130136

Figure 3-3

Historic Photos of Highway 101

North Beach Parking Lot

Built in 1968 near the Lagoon inlet, the North Beach parking lot was developed to generate revenue for California State Parks (CSP) and to provide improved access to Los Peñasquitos Lagoon, the northern stretch of Torrey Pines State Beach, and the Torrey Pines State Natural Reserve Extension (**Figure 3-2**). The parking lot is triangular in shape and is accessed via Carmel Valley Road at McGonigle Road/Del Mar Scenic Parkway. The lot contains public amenities, including bathrooms, showers, and an access ramp to Torrey Pines State Beach, which was greatly improved in 2004-2005 as a feature of the new lower bridge at North Torrey Pines Road. The parking lot also provides great viewpoints for Los Peñasquitos Lagoon, along with informational panels describing management efforts at the inlet and bird species visible within the Lagoon. Public access to Los Peñasquitos Lagoon is not provided from the North Beach parking lot, although it does serve as staging area for biological monitoring and other scientific efforts within the Lagoon.

Interstates 5 & 805

I-5 is the main north/south interstate highway on the west coast of the United States and was constructed to replace Highway 101 as the major public transportation corridor along the coast. I-5 was extended south to San Diego and opened in 1964. The demand for a highway to service inland areas in San Diego resulted in the construction of I-805, which merges with I-5 at its northern extent just east of Los Peñasquitos Lagoon. I-805 was opened in 1975. The I-5/805 merge was expanded in 2007 to include 22 lanes at the widest point (**Figure 3-2**). Additional improvements to this section of freeway are being considered under the San Diego Association of Governments (SANDAG) North Coast Corridor Public Works Plan and may include a flyover lane to improve connectivity with State Route 56 that provides vehicular access between the coast and Interstate 15 to the east.

3.1.5 Water Infrastructure

Numerous urban infrastructure pipelines run along the edges of Los Peñasquitos Lagoon and, in some cases, across it. While sewer lines breaks have not occurred within the Lagoon, several water main breaks have. In 2004, two waterline breaks occurred along Carmel Valley Road near Portofino Drive that resulted in direct impacts to 0.09 acres of coastal sage scrub and riparian habitats (RECON 2011). It was estimated that between 180 and 560 acre-feet of potable water was discharged directly into Los Peñasquitos Lagoon before the water was turned off (Smith 2004). It was also estimated that approximately 505 cubic yards (cy) of rock, gravel, and soil was deposited within the Lagoon as a result of both breaks. In March 2009, a separate 24-inch waterline that serves Sorrento Valley ruptured within Los Peñasquitos Lagoon near the eastern section of the Marsh Trail and approximately 2,000 feet north of the public terminus of Flintkote Avenue.

3-4a

3-4b

Source: Photos by Mike Hastings

Figure 3-4
Original and New Lower Bridge Spanning the Inlet
at Los Peñasquitos Lagoon

Approximately 0.26 acres of coastal sage scrub and 0.20 acres of salt marsh were directly impacted during the repair of the pipe (Balo 2009). Estimates of total volume of water and sediment discharged directly into Los Peñasquitos Lagoon during this break were not available, though photos indicate that it was much bigger than what occurred along Carmel Valley Road in 2004. Aside from these documented water main breaks, numerous instances of leaking water main valves that contribute to freshwater inputs to the Lagoon have been observed by CSP staff.

3.1.6 Sewage Discharges into the Lagoon

Over the years, Los Peñasquitos Lagoon has received direct discharges of primary-treated sewage effluent from at least three wastewater treatment plants and pump stations operating within Sorrento Valley. The first known discharges of treated effluent occurred from the Callan Treatment Facility, located above Los Peñasquitos Lagoon on Torrey Mesa (Figure 3-2). The Callan Treatment Plant had previously served Camp Callan, a U.S. Army Anti-Aircraft Artillery Training Center operational during World War II. Although the Callan Treatment Plant was offline shortly after WWII when Camp Callan closed, it was reopened in 1950 and began discharging up to 50,000 gallons a day of primary-treated effluent into Los Peñasquitos Lagoon. From 1962 to 1972, the Sorrento Treatment Plant discharged approximately 500,000–1,000,000 gallons per day of treated effluent into the Lagoon, increasing nitrate and phosphate loads and reducing water salinity (Nordby and Zedler 1991). Remnants of the oxidation ponds used by the Sorrento Treatment Plant are still visible within the Lagoon near the Marsh Trail. Located in the upper Los Peñasquitos Sub-Watershed, the Pomerado Waste Water Treatment Plant discharged primary-treated sewage effluent directly into Los Peñasquitos Creek between 1962 and 1972 (White and Greer 2002).

Planned discharges of treated effluent into Los Peñasquitos Lagoon were eliminated when the City of San Diego built Pump Station 64 and Pump Station 65 in Sorrento Valley. Pump Station 65 was relocated in 1996 to the edge of the Lagoon at the southern end of the closed portion of Sorrento Valley Road that borders Los Peñasquitos Lagoon on the east. While the pump stations helped to end daily discharges of treated effluent into Los Peñasquitos Lagoon, frequent spills from Pump Station 64 have led to discharges of untreated sewage into the Lagoon. For example, millions of gallons of untreated sewage were discharged from Pump 64 during 60 spills between 1977 and 1987, including a spill in 1987 that released approximately 20,000,000 gallons into the Lagoon (Nordby and Zedler 1991). Although several upgrades were carried out on Pump Station 64, a massive spill occurred on September 9, 2011, during a region-wide power failure that resulted in an estimated 2.3 million gallons of raw sewage discharged just upstream of Los Peñasquitos Lagoon. Water quality was severely impacted by the spill and resulted in fish kills within the Lagoon and contaminated water along the coastline that extended south to La Jolla Shores. Long-term impacts related to eutrophication within the Lagoon still occur to this day due to legacy nutrients in channel sediments that cause dissolved oxygen levels to crash precipitously during extended inlet closures, especially during periods of warm weather. Maintaining tidal connectivity has been essential in preserving healthy water quality parameters in the Lagoon, as evidenced by 30 years of water quality data collected in lagoon channels.

3.1.7 Urban Development in the Watershed

Driven in part by a steady increase in population within San Diego County, development of the Los Peñasquitos Watershed began to accelerate in the 1970s. From 1966 to 1999, the total acreage of urbanized land within the upper Los Peñasquitos Creek Watershed increased by 290% (White and Greer 2002). Urban land use dominated the watershed by 2000, primarily in the form of residential, industrial/commercial, and transportation (City of San Diego 2005). Between 1965 and 1972, the Lagoon's watershed was less than 15% urbanized, becoming 15–25% developed by 1987 and exceeding 25% by 2000 (Tetra Tech 2010). Between 1970 and 2010, the population of San Diego Region doubled, increasing from approximately 1.4 million in 1970 to 3.1 million in 2010, with an estimated 254,000 residents living in the Los Peñasquitos Watershed (SANDAG 2010; Weston 2009). By 2010, the Los Peñasquitos Watershed was relatively built out **(Figure 3-5)**, with land use data indicating 54% of the watershed is developed and 46% of that area is impervious (Tetra Tech 2010).

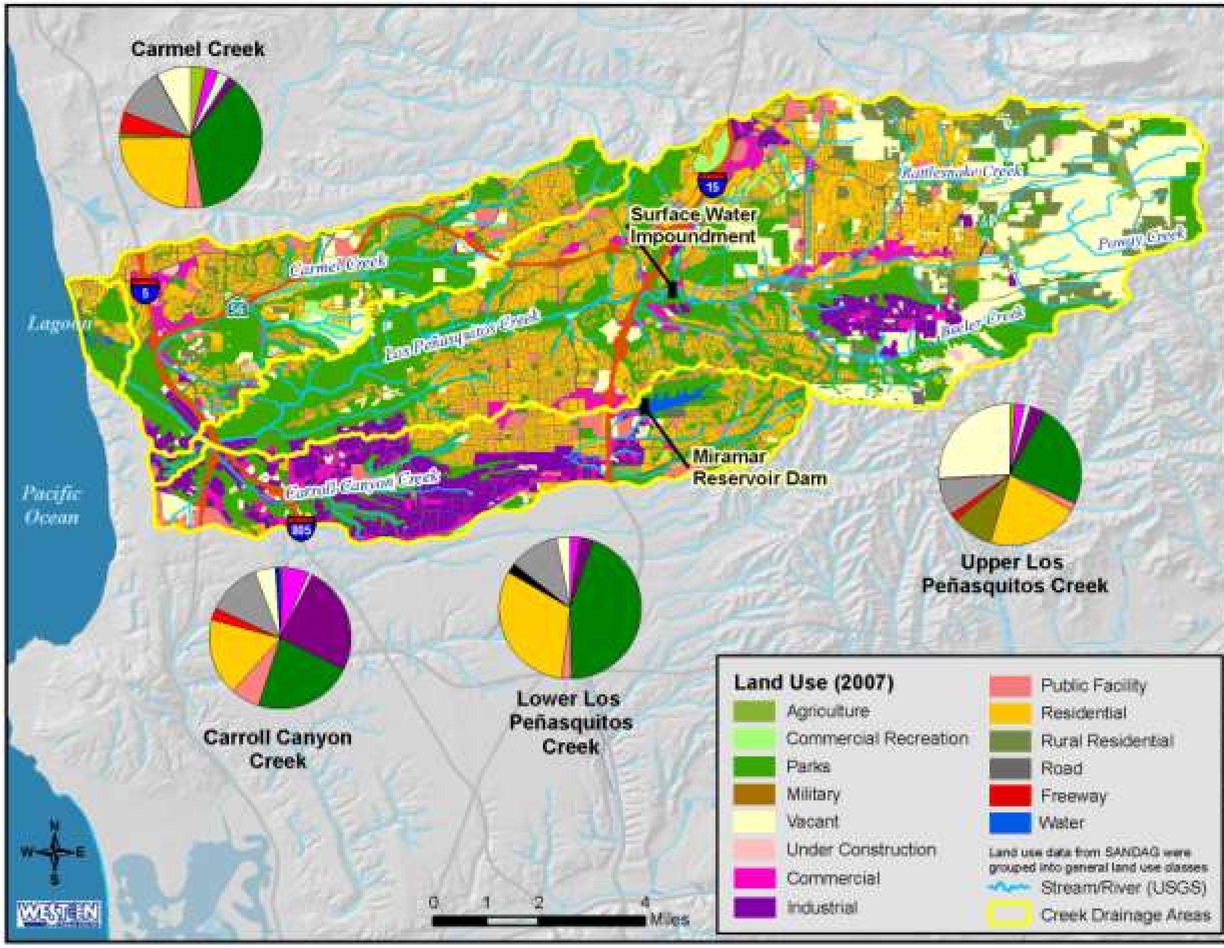
3.1.8 Regional Beach Nourishment

Since 2000, two large beach-nourishment projects have occurred within coastal north county San Diego. Part of SANDAG's shoreline management program, the Regional Beach Sand Project (RBSP) was implemented in an attempt to preserve San Diego's eroding coastline by placing large volumes of sand on local beaches in 2001 and 2012. In 2001, over 2.1 million cubic yards (cy) of sand was placed on 12 beaches between Oceanside and Torrey Pines State Beach under RBSP I (Coastal Frontiers 2001). Torrey Pines State Beach received 245,000 cy of sand in April 2001 at a location south of the Lagoon's inlet. Most of this additional sand was eroded from this nourishment site following a single storm event in the following winter and beach profiles altered in the subsequent years.

In 2012, RBSP II was implemented with approximately 1.0 million cy of sand placed on seven beaches between Oceanside and Solana Beach from September to December. Several lines of evidence indicate that both RBSP I and II had contributed to a substantial increase in total volume of sand within the inlet area and raised beach elevations along Torrey Pines State Beach by +3 to +6 feet. As a result, tidal circulation and flushing was greatly reduced and, at times, completely cut off. (See Section 3.2.1 for more information).

3.2 Impacts to the Lagoon

Section 3.1 presented the history of Los Peñasquitos Lagoon and the human developments within the watershed. This section will examine the impacts these developments have had on the health of the Lagoon.



Source: Weston Solutions, from 2009 TMDL Monitoring Report

ESA

Los Peñasquitos Lagoon. D130136

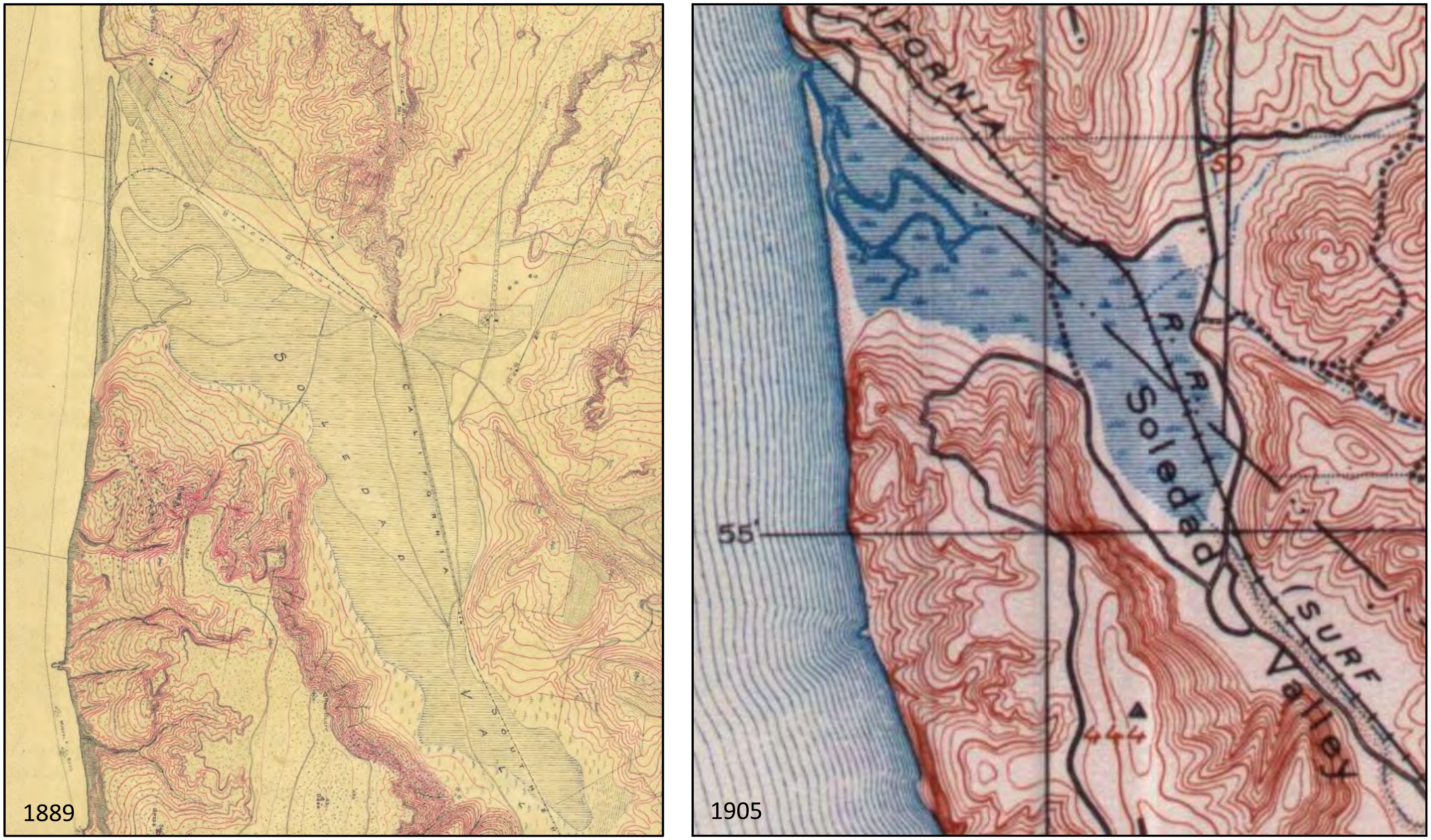
Figure 3-5
Land Use in the Los Peñasquitos Watershed

3.2.1 Lagoon Inlet

Tidal circulation is one of the key drivers for the health of Los Peñasquitos Lagoon. Incoming tides replenish dissolved oxygen, salinity, and temperature levels within Lagoon channels, which are required for aquatic organism health. Outgoing tides flush out impounded waters that are often depleted of dissolved oxygen, as a result of respiration and other factors that include legacy pollutants such as nitrate and phosphate in Lagoon soils. Tidal circulation within a coastal lagoon or estuary is often quantified as tidal prism, which is the volume of oceanic water that resides within a coastal lagoon or estuary between mean high tide and mean low tide. Tidal prism plays a key role in keeping inlets open and, if large enough, can produce sufficient inlet channel flow during tidal cycles to prevent deposition of sand that causes inlet closures or occlusion. Since large rainfall amounts in Southern California tend to occur episodically and not seasonally as in other parts of the State's coastline, tidal prism, as opposed to storm runoff, appears to be the main forcing mechanism needed to keep the inlet open in coastal estuaries such as Los Peñasquitos Lagoon.

Prior to the construction of the railways across the Lagoon, the inlet at Los Peñasquitos Lagoon likely remained opened most of the year with occasional but infrequent closures (Section 4.4.2). It is estimated that by 1925 the tidal prism within Los Peñasquitos Lagoon had been reduced by 50–75% because of the construction of the two railway alignments through the Lagoon. Construction of Highway 101 further contributed to loss of tidal prism when the meandering inlet was permanently relocated and constrained under the lower bridge. Several studies have linked the loss of tidal prism at Los Peñasquitos Lagoon with the higher frequency and duration of inlet closures in a system that appears to have been tidally connected year-round prior to 1888 (Hubbs and Whittaker 1972, Mudie et al. 1974, Cole and Wahl 2000). The first recorded inlet closure at Los Peñasquitos Lagoon occurred shortly after the construction of the 1888 railway alignment. This railway alignment completely cut off tidal circulation in the upper lagoon and prevented storm flows from Carmel Creek from reaching lagoon channels due to the lack of culverts nor bridge span in the elevated berm of compacted fill. Both reduced tidal prism and lack of scour following major storm events from Carmel Creek likely contributed to inlet closures. Sediment cores taken within Los Peñasquitos Lagoon also indicate a shift toward finer-grained sediments from 1910 to 1925 (Cole and Wahl 2000). Since fine-grained sediments are normally flushed out to the ocean by storm flows, the increase in silts and clays on the marsh plain indicate the likelihood of more frequent and prolonged inlet closures, which prevent the export of this material. While annual sediment deposition rates increased dramatically between 1820 and 1840 because of ranching practices within the watershed (Section 3.1.3), they did not surpass 4.0 mm/year until the 1888 railway alignment and later surpassed 5.0 mm/year after the 1925 alignment (Cole and Wahl 2000).

Prior to the construction of Highway 101 in 1932 and the North Beach parking lot in 1968, the inlet at Los Peñasquitos Lagoon was likely able to meander along Torrey Pines Beach and breach the barrier beach at multiple locations (Inman 1983). The T-Sheets prepared for Los Peñasquitos Lagoon in the late 1800s show the mouth of the Lagoon located to the north with a narrow barrier beach just to the south that indicate the potential for a secondary opening (**Figure 3-6**).



Source: 1889 (NOAA); 1905 (CA State Parks)

Los Peñasquitos Lagoon. D130136

Figure 3-6

T-Sheets of Los Penasquitos Lagoon, 1889 and 1905

Box 3-3. Los Peñasquitos Lagoon: A Managed System
Extended inlet closures have had devastating effects on aquatic organisms within Los Peñasquitos Lagoon. While overtopping of waves and high tides can temporarily maintain water quality parameters within the Lagoon during closures, these benefits tend to be short-lived and seldom persist past one week if not days. When tidal circulation is cut off, water quality parameters (e.g., dissolved oxygen) within lagoon channels can reach levels that are toxic for aquatic organisms. Dissolved oxygen levels can drop precipitously when inlet closures occur during periods of warm temperatures, reaching stressful levels (i.e., below 5 milligrams/liter) within days and toxic levels (i.e., 0 milligrams/liter) within a week. Fish kills and loss of invertebrate populations within Los Peñasquitos Lagoon occur when dissolved oxygen levels reach 0 milligrams/liter, removing a key food source for local and migratory bird species that reside in the Lagoon. Perhaps the most dramatic example of inlet closures devastating aquatic species in the Lagoon occurred between 1965 and 1966 when the inlet remained open for a total of just 16 weeks (LeeGrange 1985). Fish and invertebrate surveys conducted after this prolonged closure indicated that only five "hardy" species of fish inhabited Los Peñasquitos Lagoon and no shellfish were present by the end of this time (Miller 1966, Mudie et al. 1974). Within a year of restoring tidal exchange, surveys recorded 20 species of shellfish and six additional fish species (Mudie et al. 1974). Loss of invertebrate populations during extended inlet closures have also been recorded following a series of extended inlet closures between 1983 and 1989 (Gibson et al. 1994).

When the Lagoon's tributaries were seasonal, impounded waters during inlet closures would become hypersaline during periods of dry weather as evaporation and transpiration were the dominant processes. However, after 1995, continual freshwater inputs from the watershed began to dilute impounded waters during inlet closures, turning the Lagoon into a hyposaline regime. Furthermore, continual inputs of freshwater from the watershed cause water levels in Los Peñasquitos Lagoon to rise continuously, inundating terrestrial habitats if the inlet is not able to reopen naturally or by mechanical means. When this occurs, halophytic plants lose the soil salinity levels needed to outcompete non-natives and freshwater species, which is exceptionally critical in areas of non-tidal salt marsh (see Section 3.2.6 for further discussion of habitat conversion and loss of salt marsh in the Lagoon). Sensitive bird species are also impacted when water levels rise within the Lagoon and inundate areas used for foraging and nesting habitats. A direct association between the inlet status at the Lagoon (open or closed) and breeding pairs of Belding's savannah sparrow (State listed, endangered) has been established, showing minimal pairs (e.g., 60) during period of frequent or prolonged closures and up to 200 nesting pairs when the inlet remains open for the year (Zembal 2010). Vector problems are also an issue during extended inlet closures, as the entire Lagoon becomes potential breeding grounds for mosquitoes, with hyposaline conditions favoring *Culex tarsalis*, a species known to transmit brain encephalitis to humans, horses, and other mammals (see Subsection 3.2.5 and Chapter 5 for more information related to vectors in Los Peñasquitos Lagoon).

Based on the impacts related to extended inlet closures, maintaining tidal circulation is a management priority. Dating back to the 1960s, efforts to keep the inlet open were performed primarily by California State Parks (CSP) with support from local community members such as Lee LeGrange. Since then, the Los Peñasquitos Lagoon Foundation has worked with CSP to adaptively manage the inlet at the Lagoon. Efforts have been made to improve and refine mechanical excavation of the inlet to generate multiple benefits, such as beach nourishment, and keep the cost relatively low.

The ability to meander allows the inlet to reopen during intermittent closures by forcing a breach in the barrier beach when the previous location of the inlet is too occluded with sediments, including cobbles. Constraining the ocean inlet at Los Peñasquitos Lagoon to the width of the lower bridge span of Highway 101 has greatly impacted lagoon health, which depends largely on unrestricted tidal exchange between the Lagoon and the Pacific Ocean. Stabilizing the inlet location, in combination with the reduced storm flow scour caused by the railway berms, has made Los Peñasquitos Lagoon more vulnerable to extended inlet closures due to increased occlusion by marine sediments. This problem was exacerbated by the design of the original lower bridge, which incorporated 74 support columns that served to trap a majority of marine sediments below the bridge span. This has contributed to frequent and extended mouth closures, with some closures lasting over a year at a time (Coppock 1985; Coastal Environments 2003e; Hastings 2012) (see Section 4.4.2).

While the design of the new lower bridge has been successful in reducing the frequency of extended inlet closures, it has, at times, resulted in a higher rate of marine sediment deposition east of the bridge. Storm surges and waves can now carry sediment past the bridge and into the Lagoon as sediment transport rates are not decreased by hardened structures (i.e., 74 cement support columns). Though the Lagoon inlet at Los Peñasquitos Lagoon tends to remain open for longer periods of time with the modified design of the lower bridge, it appears that sand and cobbles are now deposited further east within the inlet area due to unimpeded storm surge and wave energy that now enters the Lagoon. As a result, inlet maintenance now requires the removal of a larger volume of sand and cobbles to maintain tidal connectivity.

As mentioned before, beach nourishment efforts under both RBSP I and RBSP II contributed to more frequent inlet closures at Los Peñasquitos Lagoon and higher costs associated with inlet maintenance due to the larger volumes of sand within the inlet and along Torrey Pines State Beach. While Torrey Pines State Beach did not receive sand under RBSP II, the inlet still became heavily occluded with sand following the winter of 2012-2013. The massive amount of sand within the Lagoon inlet required three separate efforts in both 2013 and 2014 to mechanically remove over 90,000 cy of sand from the Lagoon's inlet area to restore and maintain tidal circulation. This reflects an almost 100% increase in sand volume removed from the Lagoon annually during the years prior to RBSP II. Several lines of evidence indicate that the additional sand within the inlet area of the Lagoon in 2013 and 2014 was from RBSP II receiver sites and was delivered to the Lagoon by the predominate longshore current within the Oceanside Littoral Cell (see Section 4.4.3 for more information regarding coastal processes). Results from grain size analysis performed in May 2013 were not typical of sand typically found in the Lagoon's inlet area in years prior to RBSP II. Rather, it reflected a larger proportion of moderate to coarse material that was selected for beach nourishment efforts under RBSP II. Furthermore, beach elevations at TPSB north of the Lagoon inlet were approximately 3 to 6 feet higher than in the previous 10 years. Photos taken at the Lagoon in May 2013 and June 2013, as well as beach profile elevations using light, detection, and radar (LiDAR), are provided in Appendix B.

Given that beach nourishment will most likely be the preferred response to accelerated coastal erosion due to sea level rise, great care should be taken to accurately document unintended impacts to Los Peñasquitos Lagoon from downcoast movement of sand so that adaptive management and mitigation of impacts can occur. Current beach monitoring efforts on the regional scale do not provide quality data needed to demonstrate impacts to Los Peñasquitos Lagoon from beach nourishment efforts. This is due in most part to the fact that all beach survey transects used in regional monitoring efforts at Torrey Pines State Beach are located south of the inlet and, therefore, do not account for sand deposited within the Lagoon during winter months when wave energy and nearshore currents move sand north to south within the Oceanside Littoral Cell.

3.2.2 Water Quality

As discussed in Section 3.1.6, Los Peñasquitos Lagoon has a history of impairment caused by direct discharges of primary-treated effluent from wastewater treatment plants and accidental spills of raw sewage from the city of San Diego pump stations located near the Lagoon. From 1950 to the early 1970s, Los Peñasquitos Lagoon received daily discharges of primary-treated sewage from three separate treatment plants. Impacts generated by these discharges included:

- Eutrophication caused by high levels of nitrate and phosphate in effluent that depleted dissolved oxygen levels within Lagoon channels, causing fish and invertebrates die offs and algae blooms.
- Prolonged periods of decreased salinity levels that contributed to the loss of aquatic species native to Los Peñasquitos Lagoon.
- Concentrations of nitrate and phosphate in the lagoons sediments that contribute to eutrophic conditions within the Lagoon, especially during extended inlet closures.
- Facilitation of the presence of airborne vectors that use the stagnated waters within Los Peñasquitos Lagoon to breed.
- Threats to public health with regard to water contact.
- Closures of local beaches, including Torrey Pines State Beach and, at times, beaches in Del Mar and La Jolla Shores.
- Discharges of nutrient-rich waters near Areas of Special Biological Significance, located just south of Los Peñasquitos Lagoon's inlet.

Eventually these planned discharges ceased with the construction of pump stations that diverted sewage to treatment plants, but sediment quality in the Lagoon remains impacted by legacy nutrients within soils and channel substrates comprised of clays and silt.

Storm runoff has also contributed to impairment of water quality within Los Peñasquitos Lagoon, with pollutants including total suspended solids (e.g., sediment), total dissolved solids, bacteria, metals, nutrients, grease/oil, trash and pesticides. Most of the storm water that enters the Lagoon is from the Municipal Separate Storm Sewer System (MS4) located along the Lagoon's borders and within its watershed. Additionally, outfalls located within the Caltrans easements along I-5 and I-805 embankments discharge runoff along the boundaries of Los Peñasquitos Lagoon and into drainages that empty into the Lagoon. As a result, sediment, road debris, trash, and dissolved metals (e.g., copper) are discharged directly or indirectly into Los Peñasquitos Lagoon during rain events. Cole and Wahl documented the impacts of pollutant loads associated with autos through the detection of increased concentrations of lead and zinc in lagoon soils shortly after the opening of I-5 in 1964 (Cole and Wahl 2000). Similarly, the North Beach parking lot has increased pollutant loading to the Lagoon as well.

3.2.3 Hydromodification

With the increase of impervious surfaces in the watershed (Section 3.1.7), less storm water can infiltrate into the ground, and more is instead directed to natural waterways or the MS4, where flows are consolidated and released through storm outfalls. As a result, MS4 discharges scour drainages and exposed cliffs and reach the creeks more rapidly. This means that the peak (and total) flow in the creeks is greater and occurs more rapidly than under undeveloped conditions (with fewer impervious surfaces). This modification to the creeks' hydrographs is referred to as hydromodification (hydromod). Hydromod can cause significant erosion in the natural drainages and canyon walls, which receive these discharges, as well as within creek beds, banks, and floodways, as the geomorphology shifts to transport the larger flow. The higher peak flows possess greater energy, which can mobilize greater amounts and sizes of sediment most of which is characterized as moderate to highly erosive in the Los Peñasquitos Watershed.

All three creeks in the Los Peñasquitos Watershed have experienced some level of hydromod. In particular, Carroll Canyon has been shown to be contributing significant sediment to Los Peñasquitos Lagoon due to hydromod (ESA PWA 2011), while the other two canyons have been found to be more stable under present day conditions (Weston 2009 and ESA PWA 2011). A monitoring study conducted for the Lagoon Sediment TMDL showed that flow during a storm event peaked faster and at higher flow rates within Carroll Canyon Creek than at Carmel Creek or Los Peñasquitos Creek. The study also showed the highest levels of total suspended solids, an indicator of sediment transport, occurred in Carroll Canyon Creek.

3.2.4 Increased Sedimentation

Sedimentation rates in Los Peñasquitos Lagoon likely increased by an order of magnitude from 0.27 mm/year pre-settlement to 3.5 mm/year post-settlement because of hydromod affects associated with land use changes (Cole and Wahl 2000) and the two railway alignments. By the 1900s, the sedimentation rate reached 4.3 mm/year (Cole and Wahl 2000). While expanding grazing areas within Los Peñasquitos Canyon using brush burns improved the ability to raise cattle at Rancho Los Peñasquitos, it affected the geomorphology of Los Peñasquitos Canyon by removing areas of thick chaparral that helped to secure the Canyon's moderate to highly erodible soils during rain events and subsequent floods. After these burns, exposed soils and areas repopulated by grass experienced more erosion and provided sediment to Los Peñasquitos Lagoon during flood events. Furthermore, overgrazing created large areas denuded of vegetation, which also became potential sources of sediment within the watersheds.

Prior to the construction of the railway berms in 1888 and 1925, floodwaters from the watershed were able to pass through Los Peñasquitos Lagoon unimpeded as they made their way out of the Lagoon's inlet, which remained open year-round. As a result, finer sediments (e.g., clay and silt) were generally carried out to the ocean as suspended sediment. Sediment deposited within the Lagoon was spread across a wide marsh plain, resulting in only slight increases in elevation, even under the modified geomorphic conditions caused by cattle ranching. However, the construction of the two railway alignments across Los Peñasquitos Lagoon greatly exacerbated the problem of increased sedimentation in the Lagoon. The railway berms greatly modified Lagoon's hydrology and sedimentation trends within the Lagoon, primarily through their role in facilitating lagoon mouth closures that prevented sediment export to the ocean during flood events and focusing sediment deposition in areas east of the 1925 railway alignment. Before its removal, the 1888 railway alignment detained storm runoff and sediment flows originating in Carmel Valley behind the berm. Unable to spread out across the Lagoon marsh plain, sediment deposition became concentrated behind the berm (**Figure 3-7a**), burying alkaline-rich soils and raising elevations east of the railway berm rapidly to 4.0 to 6.0 feet National Geodetic Vertical Datum in some areas (Coastal Environments 2010, Coppock 1985). In 1998, the berm from the 1888 railway alignment was removed to promote habitat and hydrologic connectivity within Los Peñasquitos Lagoon. However, decreased soil salinity and lack of tidal inundation due to elevation changes resulted in continued habitat conversion from salt marsh to brackish marsh (**Figure 3-7b**). Subsequent periods of impounded freshwater facilitated the conversion of this area to brackish marsh and riparian habitats (**Figure 3-7c**).

While the 1925 railway alignment through the middle of Los Peñasquitos Lagoon incorporated three bridge spans within the berm to allow small flood events and dry-season flows to pass through, larger flows typical of moderate to large flood events tend to be impounded east of the railway berm (**Figure 3-8**). Unable to pass through a small bottleneck caused by the berm's proximity to the canyon wall along the southern edge of the Lagoon, flows from Los Peñasquitos Creek and Carroll Canyon Creek backflow into the eastern basin through spans of the middle bridge (Bridge 246.9) and eastern bridge (Bridge 247.1), where they merge with flows from Carmel Creek (**Figure 3-2**). As the water becomes impounded and slows or stops moving through the system, sediment drops out onto the marsh plain, further increasing accretion rates.

Additionally, the extensive urban development, starting in the 1960s, dramatically increased hydromod and sediment loading to Los Peñasquitos Lagoon. Between 1968 and 1985, approximately 6.1 feet of sediment accumulated at the mouth of Carmel Creek, according to survey data (Coppock 1985).

3.2.5 Increased Freshwater Inputs

Increased freshwater inputs from urban sources have greatly impacted the health of Los Peñasquitos Lagoon, impairing water quality, facilitating vector breeding habitat, and contributing to the loss of native salt marsh through habitat conversion. Following the build out of the watershed, all three tributaries to Los Peñasquitos Lagoon became perennial, with year-round input to the Lagoon occurring from 1995 to the present day. Often related to the irrigation of urbanized landscapes, these flows enter the watershed directly by way of the MS4 or through seepages often located along the bottom of canyon walls. Water main breaks and leaking water main valves have contributed freshwater to Los Peñasquitos Lagoon as well. Continued freshwater inputs have generated significant impacts to the Lagoon by lowering salinity in soils and waters, contributing to vector problems that threaten public safety, and inundating sensitive bird species' nesting and foraging habitats during inlet closures.

As halophytes, salt marsh plants have evolved to survive in hypersaline conditions where they can out-compete other species that require persistent freshwater regimes and have adapted to thrive in seasonal pulses of freshwater that are typical during the wet season. However, year-round freshwater flows from the watershed have altered these conditions by leaching salt from lagoon soils during prolonged periods of inundation that frequently occurs in the upper reaches of Los Peñasquitos Lagoon even when the inlet is open. Between 1966 and 2000, the area of riparian vegetation in the Lagoon doubled (White and Greer 2006, see Section 3.2.6).

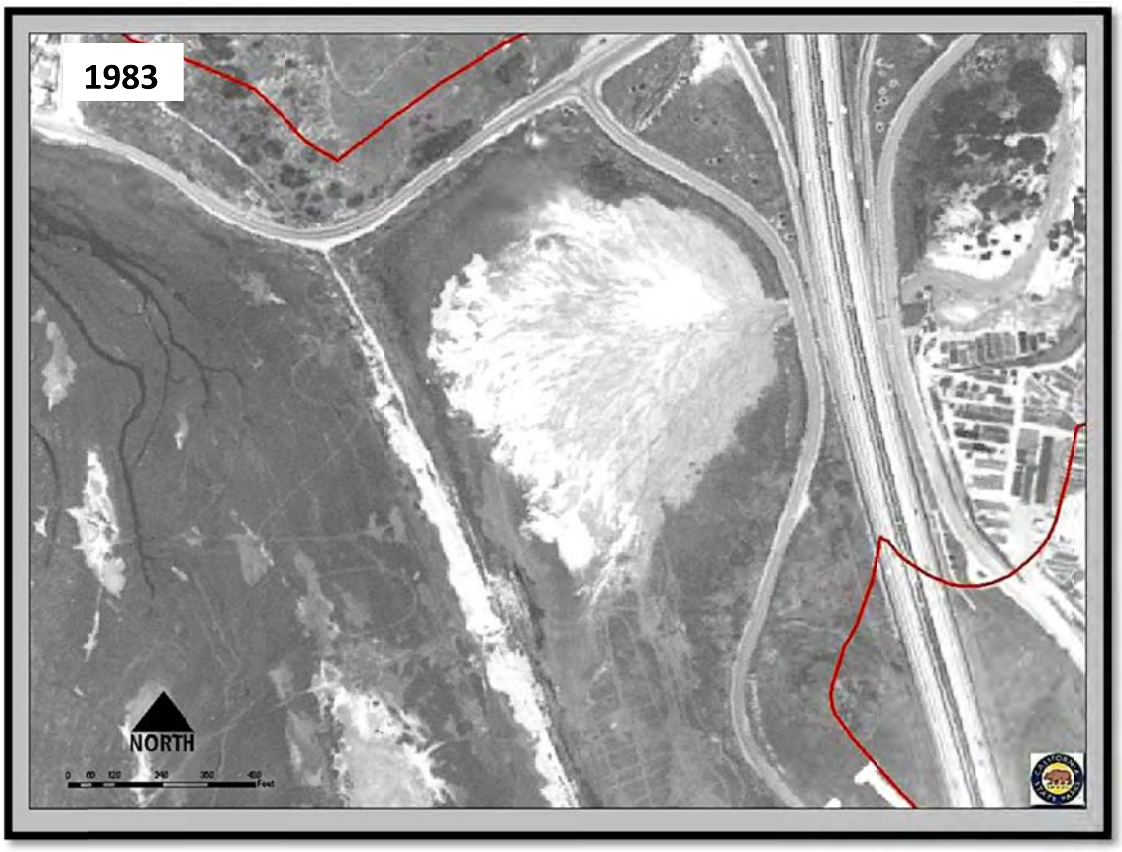
Continuous freshwater inputs to Los Peñasquitos Lagoon from the watershed have also greatly contributed to vector problems at the Lagoon and to surrounding communities. Inundated with freshwater even during extended periods without rainfall, portions of the Los Peñasquitos Lagoon's eastern basin provide ideal breeding habitat for *Culex tarsalsis*, the freshwater mosquito known to transmit brain encephalitis to humans, horses, and other mammals. During extended inlet closures, the entire Lagoon can become a breeding area for *C. tarsalsis* as impounded waters become hyposaline as a result of continual freshwater inputs to from the watershed (see Chapter 5 for further discussion of vector-related issues in the Lagoon).

Finally, continual inputs of freshwater from the watershed have also impacted sensitive bird species within the Los Peñasquitos Lagoon during prolonged inlet closures, as important habitats are inundated by the rising waters within the Lagoon. Areas used for foraging are reduced or completely lost. Once wet, nests are usually abandoned for the rest of the season and recruitment for the year is greatly impaired.

3.2.6 Habitat Conversion

The composition of vegetation communities in Los Peñasquitos Lagoon has been influenced by numerous factors, including increased freshwater input, sedimentation, and wastewater. Historically, Los Peñasquitos Lagoon was tidally influenced and received freshwater primarily during the rainy season in late winter and spring. Recently, however, perennial freshwater inflows have resulted in conversion of regionally rare salt marsh habitat to more common fresh and brackish habitats, as shown in **Figure 3-9**. Furthermore, with continued increase in freshwater input, invasive weed species have become established in this habitat, as well as in coastal salt marsh and coastal freshwater marsh habitat.

Los Peñasquitos Lagoon has also has been negatively affected by increased residential development in the watershed. Over time, the development has led to increased sedimentation, which has resulted in raising the elevation of the marsh plain within the Lagoon (Section 3.2.4). Higher elevations combined with freshwater flows have facilitated colonization by exotic plant species in many areas that once supported only salt marsh plant species and salt panne. Historically, riparian habitats were confined to freshwater riparian areas upstream of Los Peñasquitos Lagoon. Recent sedimentation and daily freshwater flows have greatly increased the range of riparian habitat that now extends into the Lagoon.



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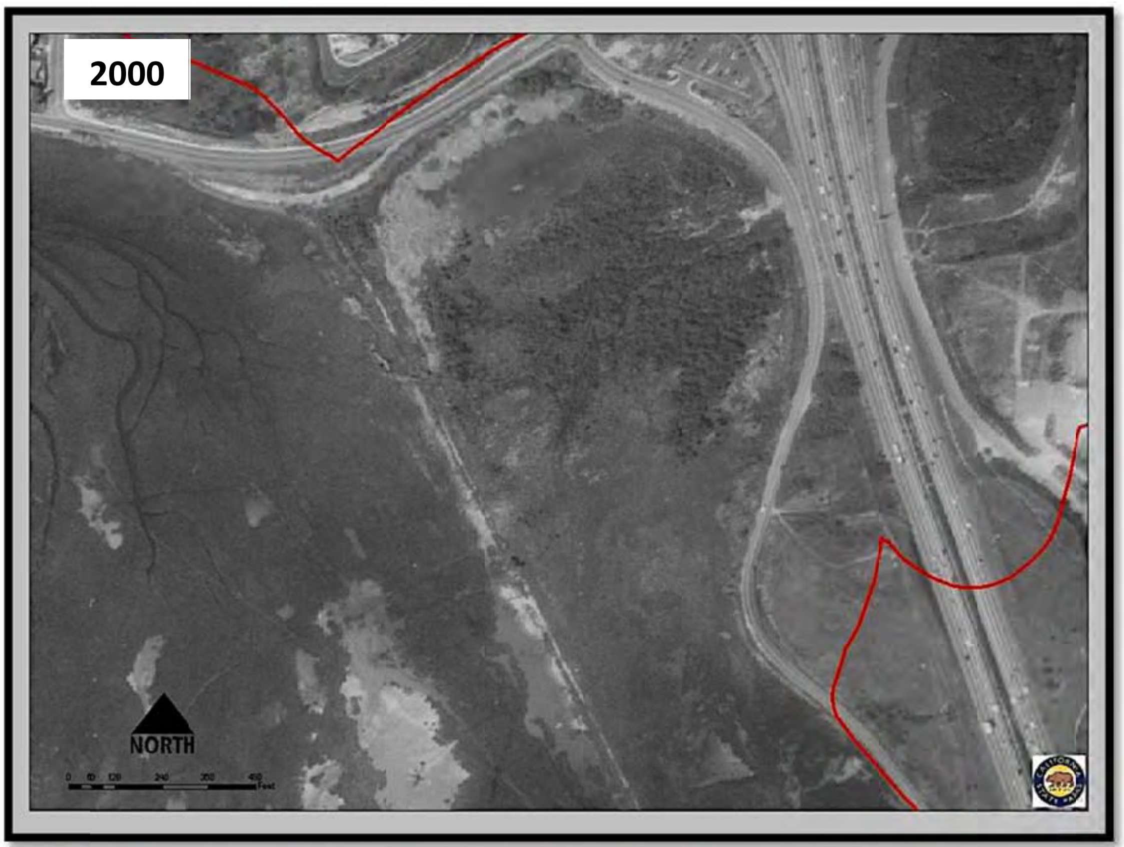

3-7b

3-7c

Source: CA State Parks 2011

Los Peñasquitos Lagoon. D130136

Figure 3-7

Sediment plume from Carmel Creek evolving into established riparian habitat

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Source: City of San Diego (2003)

Los Peñasquitos Lagoon. D130136

Figure 3-8

Railway Bridge Impounded Storm Flows, Los Peñasquitos Lagoon 2003

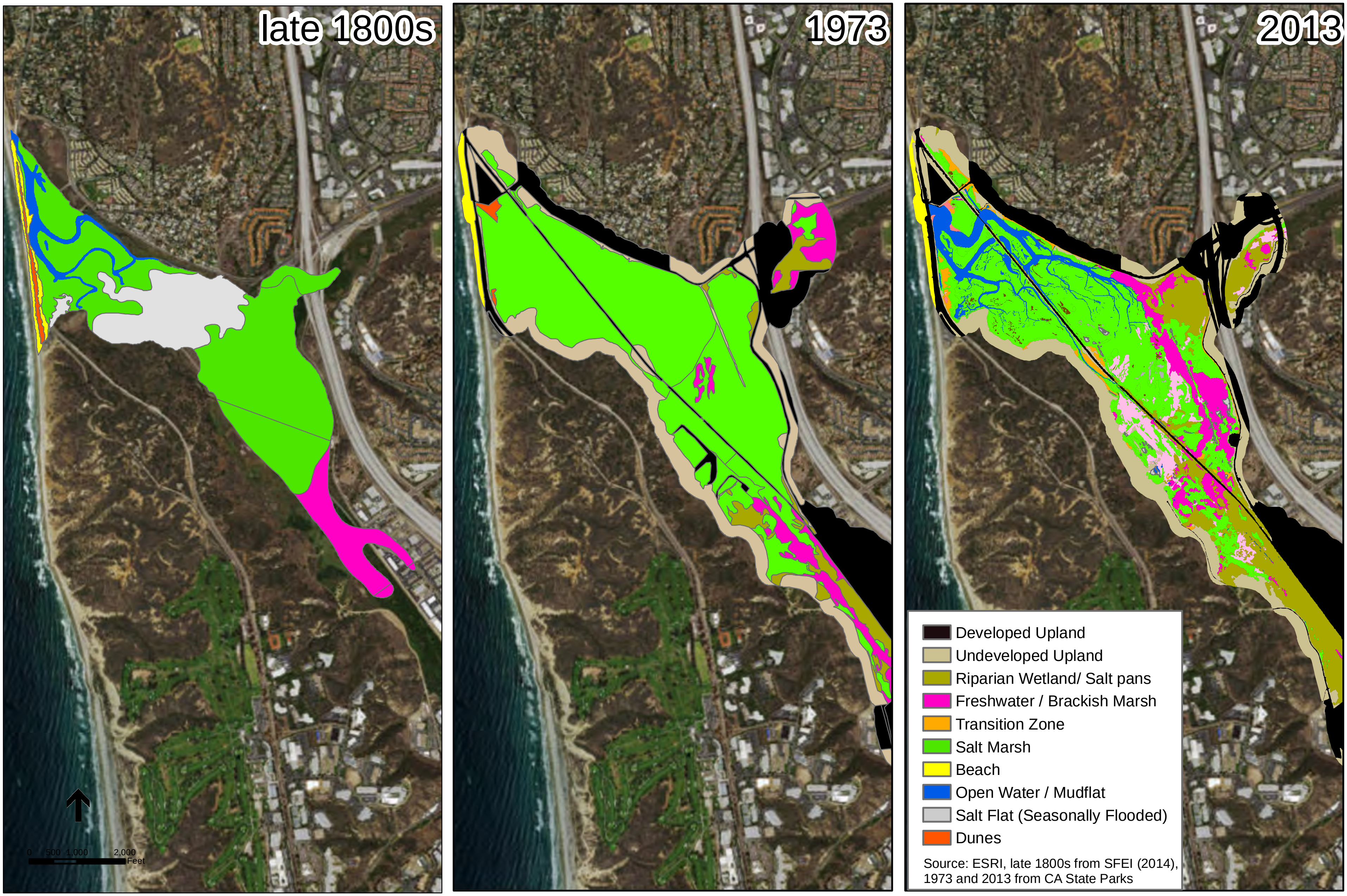


Figure 3-9

Historic and Current Vegetation Maps

CHAPTER 4
Lagoon Setting & Baseline Conditions

The Los Peñasquitos Lagoon (the Lagoon) is part of the Torrey Pines State Natural Reserve (TPSNR) located in northern San Diego County (**Figure 1-1**). The Lagoon is fed by three creeks, Carmel Creek, Los Peñasquitos Creek, and Carroll Canyon Creek, which drain urban watersheds. Urban land use in the Los Peñasquitos Watershed includes residential, commercial/industrial, and transportation corridors. The Lagoon itself has been impacted by this infrastructure since 1888, including the construction of two railway alignments, Highway 101, commercial development within the floodplain, the North Beach parking lot, and Interstates 5 (I-5) and 805 (I-805). Additionally, three wastewater treatment plants discharged primary-treated sewage on a daily basis into the Lagoon between 1950 and 1972. These flows were later diverted away from the Lagoon by two pump stations, one of which (Pump 65) was built in the upper lagoon by Sorrento Valley Road.

The San Diego coast experiences mixed semidiurnal tides, with two high and two low tides of unequal heights each day. When Los Peñasquitos Lagoon is open to the ocean, tides propagate through the lagoon mouth and continue eastward through a network of tidal channels. However, the total volume (tidal prism) and spatial extent of tidal waters within Los Peñasquitos Lagoon can be diminished when the lagoon inlet and its tidal channels are occluded by marine sediments comprised primarily of sand and cobbles. Tidal circulation within the Lagoon is usually constricted by flow through the Lagoon inlet and the inlet dimensions. Coastal processes deliver sand into the mouth of Los Peñasquitos Lagoon, and the current inlet configuration limits flushing capacity. As a result, the Los Peñasquitos Lagoon Foundation (LPLF), California State Parks (CSP), and other key stakeholders have had to excavate the inlet area using heavy equipment in order to maintain the Lagoon’s tidal prism continually since 1985.

Hydrologic modification of Los Peñasquitos Creek and Carroll Canyon Creek has resulted in encroachment of fresh and brackish marsh into what was formerly salt marsh in the southern portion of the Los Peñasquitos Lagoon. Similar modification of Carmel Creek has resulted in increased freshwater flows and sediment deposition in the eastern end of the Lagoon and rapid conversion of salt marsh and salt panne to riparian habitats. Despite the impacts of Lagoon closure, sedimentation, and increased freshwater inflows, faunal resources of Los Peñasquitos Lagoon are relatively rich and productive. Although many studies of the Lagoon focus on birds, numerous species of mammal, reptiles, amphibians, and invertebrates inhabit the Lagoon as well, including many sensitive species.

4.1 Site Location and Land Uses

The Los Peñasquitos Lagoon is a coastal estuary within northern San Diego County (**Figure 1-1**). The Lagoon is part of TPSNR and represents one of the few remaining coastal salt marsh habitats in Southern California. Los Peñasquitos Lagoon is home to several state and federally listed species and the important habitats needed to support them. The Lagoon also serves as an important refuge for migratory birds following the Pacific Flyway and the Lagoon provides Essential Fish Habitat (EFH) for several coastal fish species and is the closest coastal estuary to the only Areas of Special Biological Significance (ASBSs) located within San Diego County: La Jolla State Marine Conservation Area and the San Diego-Scripps State Marine Conservation Area (**Figure 1-1**). Based on its importance in providing California Coastal Commission designated Environmentally Sensitive Habitat Areas (ESHAs), the Lagoon has been afforded the highest level of protection by the State of California through its designations as a Marsh Natural Preserve and Critical Coastal Area #77. Locally, the Lagoon is also designated as a core area with high to moderate habitat values within the City of San Diego's Multiple Species Conservation Program (MSCP) Sub-Area Plan.

4.1.1 Los Peñasquitos Watershed

Los Peñasquitos Lagoon receives drainage from the Los Peñasquitos Watershed (approximately 59,212 acres). This watershed includes portions of the city of San Diego, city of Poway, city of Del Mar, and county of San Diego (**Figure 1-1**). The San Diego Basin Plan divides the watershed into two hydrologic areas (HAs): Miramar Reservoir (HA 906.10) and Poway (HA 906.20). The Miramar Reservoir HA comprises the western portion and contains the drainage areas of Carmel Creek and Carroll Canyon Creek as well as the lower portion of Los Peñasquitos Creek. The Poway HA, located to the east, is covered entirely by the upper Los Peñasquitos Creek Watershed (Figure 3-5). The drainage areas for the three major creeks are shown in **Table 4-1**.

TABLE 4-1
DRAINAGE AREA FOR THE MAIN TRIBUTARIES TO LOS PEÑASQUITOS LAGOON

Drainage Area	Hydrologic Area	Acres
Carmel Creek	906.10	11,180
Los Peñasquitos Creek	906.10 and 906.20	37,028
Carroll Canyon Creek	906.10	11,004

SOURCE: Weston Solutions Inc. 2009.

4.1.2 Land Use

Urban land use in Los Peñasquitos Watershed is dominated by residential, commercial/industrial, and transportation. The primary land uses within the Los Peñasquitos Watershed are open space park/preserve (30%), residential (27%, excludes spaced rural residential), vacant/undeveloped (15%), freeway (2%), and other roads and utilities (10%) (Weston 2009). Other groupings of land use classes within the watershed include agriculture, commercial recreation, industrial, public facility, water, and areas under constructio**n (Figure 3-5, Table 4-2**).

Several notable differences in land use composition and topography among the three creek drainage areas warrant an individual assessment of each sub-watershed. Carmel Valley, Los Peñasquitos, and Carroll Canyon sub-watersheds are discussed in the following pages.

TABLE 4-2
LAND USE PERCENTAGES BY SUB-WATERSHED. ADAPTED FROM WESTON SOLUTIONS, INC. 2009

Land Use Class	Percent (%) of Drainage Area Los Peñasquitos – Upper Watershed (Poway HA)	Los Peñasquitos – Lower Watershed (Miramar Reservoir HA)	Los Peñasquitos Sub-Watershed Total	Carroll Canyon Sub-Watershed	Carmel Valley Sub-Watershed
Agriculture	1.1	0	0.8	0.4	3.7
Commercial	2.4	2.2	2.3	6.3	2.8
Commercial recreation	1.2	0.3	0.9	0.7	2.5
Industrial	3.4	2.7	3.2	24.9	2.0
Parks	23.6	44.5	29.2	22.7	36.2
Public facility	2.0	2.1	2.1	6.6	4.1
Residential	20.8	31.6	23.7	17.6	23.4
Rural residential	9.6	0.0	7.0	0.0	1.4
Freeway	1.46	2.2	1.66	2.72	4.69
Other roads and utilities	8.29	11.48	9.15	12.18	11.15
Under construction	0.5	0.0	0.4	0.1	0.2
Vacant	25.7	2.9	19.6	4.6	7.9
Water	0.0	0.0	0.0	1.2	0.0
Total (%)	100	100	100	100	100

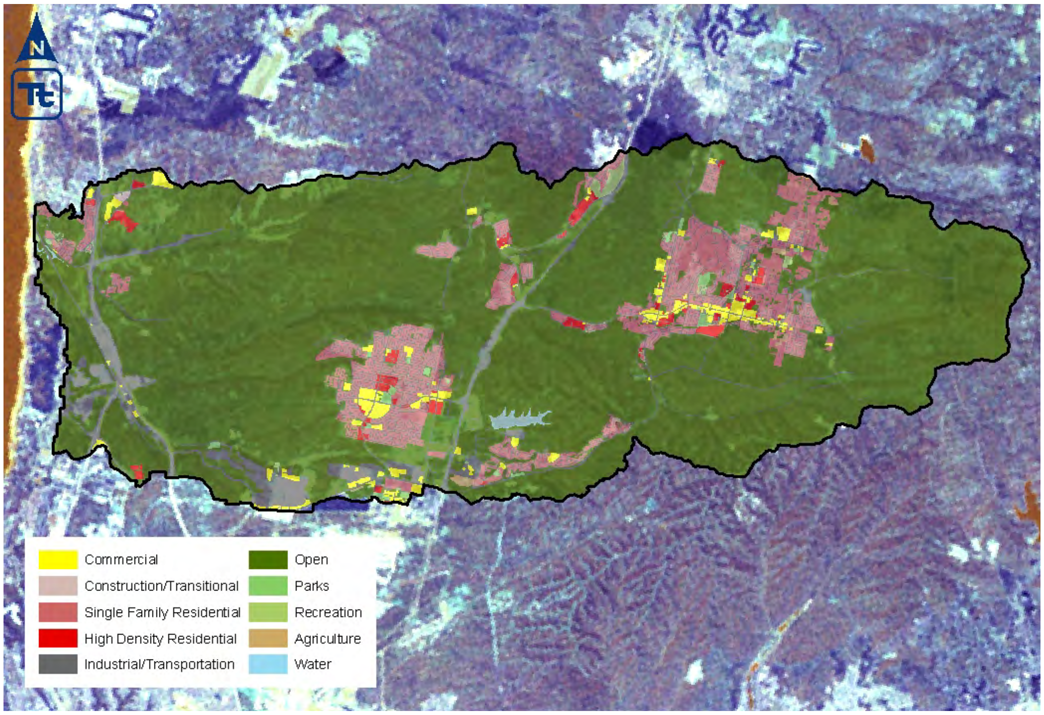
Carmel Valley Sub-Watershed

Carmel Valley was the most recently developed of the three sub-watersheds, beginning in the 1990s, with most development in the western portion of this sub-watershed occurring between 2001 and 2002. The watershed shifted from expansive open spaces to more residential and transportation land uses (**Table 4-2**; **Figure 4-1**). Parks are still the dominant land use type at 36%, followed by residential (23%) and transportation (16%), including both freeway and other roads and utilities. Impervious surfaces in Carmel Valley comprise approximately 36% of this drainage area (Weston 2009). The watershed extends from Black Mountain in the east, under I-5, and into the Lagoon through three 12-foot by 10-foot reinforced concrete box culverts, north of the Los Peñasquitos Creek watershed. The watershed has well vegetated slopes and a gentle gradient, which results in a low sediment yield.

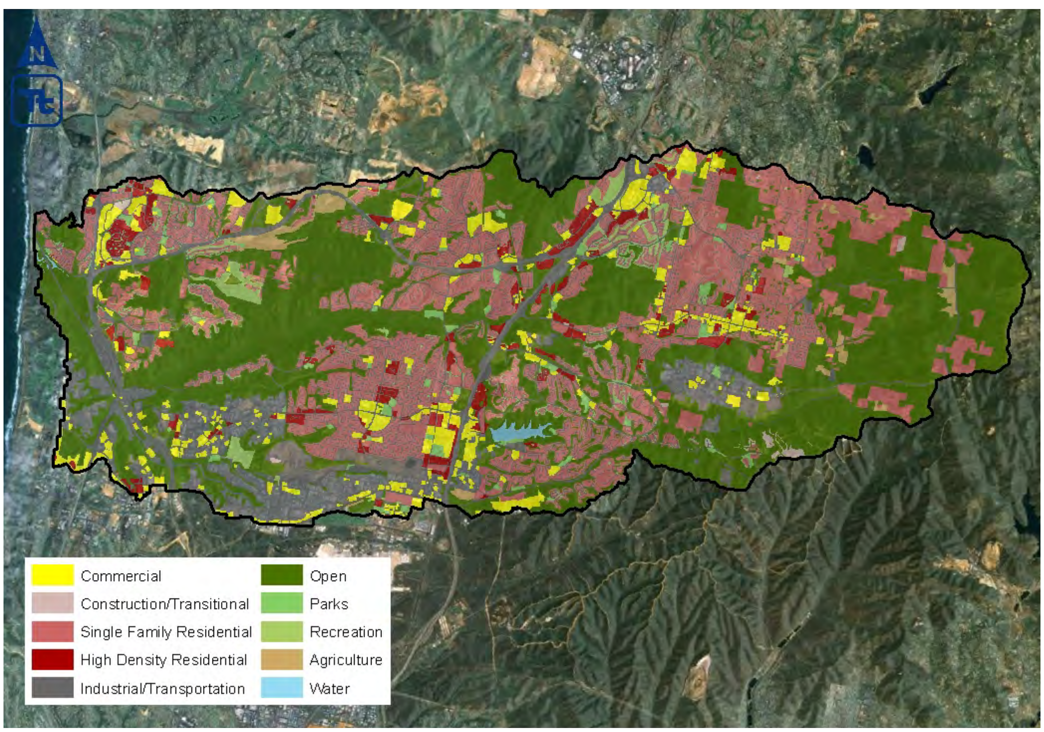
The Carmel Valley Restoration and Enhancement Project (CVREP), implemented in the early 2000s by the City of San Diego as part of the construction of State Route (SR) 56, helps to abate sediment flows from this sub-watershed. Designed to preserve an open space corridor along Carmel Creek, CVREP implemented structural Best Management Practices (BMPs) both within and along Carmel Creek that appear to have successfully reduced annual sediment loads delivered to Los Peñasquitos Lagoon. Thick stands of vegetation (e.g. willows) within the creek most likely also help to abate sediment loads from entering the Lagoon from this tributary. However, increased freshwater input from residential areas and golf courses within this drainage has remained a management issue.

Los Peñasquitos Sub-Watershed

Los Peñasquitos Canyon is the largest of the three sub-watersheds, representing approximately 61% of the total watershed area (Weston 2009). Land use in the upper watershed is primarily undeveloped land (26%) and parks (24%; **Table 4-2**). However, with the growth and development of Poway over the last 20 years, residential land use has grown to 21% in the upper portion of the sub-watershed (**Figure 4-1**). Impervious surfaces in the upper watershed comprise approximately 29% of this drainage area (Weston 2009). In the lower watershed, parks are the dominant land use type, comprising 44.5% of total land use because of the presence of Los Peñasquitos Canyon Preserve. Residential is the second most prominent land use type in the lower watershed at 32% of total land use, followed by transportation (i.e., freeways, roads, and utilities) at 14%. Industrial and commercial land use types are present along the southern edge of Los Peñasquitos Canyon, although at a relatively small percentage of overall land use. Impervious surfaces in the lower watershed comprise approximately 37% of this drainage area (Weston 2009).



1970



2000

SOURCE: Tetra Tech, 2010

ESA

Figure 4-1
Los Peñasquitos Watershed
Land Uses Over Time

Unlike the other two sub-watersheds, a wide alluvial plane characterizes the lower portion of Los Peñasquitos Canyon. While this creates a larger source of sediment and exotic plant species, it also serves to slow transport rates to the Lagoon and delay response times in Los Peñasquitos Creek to rain events. The lower reach of Los Peñasquitos Creek is channelized just before it confluence with Carroll Creek to protect adjacent business parks and access road within the Preserve from flooding. Channelization of this creek may also have been performed to protect grazing land for cattle in the lower portion of Los Peñasquitos Canyon.

Carroll Canyon

Characterized by steep, incised canyons and drainages, Carroll Canyon has the greatest concentration of industrial (24.9%) and commercial (6.3%) land uses within the entire Los Peñasquitos Watershed (**Table 4-2**). Impervious surfaces in Carroll Canyon comprise approximately 54% of this drainage area (Weston 2009). The presence of two large sand mining facilities located within the flood plain of this sub-watershed and a cement channel that accelerates flows from Carroll Canyon Creek through Sorrento Valley increases storm flows and sediment transport to the Lagoon.

4.2 Urban Infrastructure

Los Peñasquitos Lagoon has been impacted by urban infrastructure since 1888, including construction of two railway alignments, Highway 101, commercial development within the floodplain, the North Beach parking lot, I-5, and I-805 (**Figure 3-2**). Additionally, three wastewater treatment plants and pump stations have operated within the Lagoon or along its boundaries since the 1950s. Currently, sewage lines run along the perimeter of Los Peñasquitos Lagoon and within nearby drainages, connecting adjacent communities and business parks to Pump Station 65, located in the southeast corner of the Lagoon, and Pump Station 64, located within Sorrento Valley. Storm water conveyance systems are also located along the boundaries of Los Peñasquitos Lagoon, including outfalls that discharge directly into the Lagoon. San Diego Gas & Electric operates underground gas lines along the Lagoon boundaries and aerial power lines that cross Los Peñasquitos Lagoon on support poles, though a decommissioned power line alignment was removed in 2004. The City of San Diego manages an underground water main that crosses the Lagoon (**Figure 4-2**) and has been problematic in the past, with the most recent break occurring in 2008. Chapter 3 discusses these facilities in greater detail in Sections 3.1.4 through 3.1.6.

SOURCE: City of San Diego, ESRI

ESA

Los Penasquitos Lagoon. D130136

Figure 4-2
Infrastructure

4.3 Site Topography

Elevation ranges within Los Peñasquitos Lagoon have been consistently monitored since 1995, when transects were established to provide a coarse measure of baseline topography and sediment accretion within Los Peñasquitos Lagoon (Appendix B). A more precise approach to measuring topography within the Lagoon was implemented during vegetation association surveys and development of the Lagoon's baseline model, which occurred between 2012 and 2014. Existing topography at Los Peñasquitos Lagoon was compiled from multiple sources. **Figure 4-3** presents the topography of the Lagoon and the four sources that were used to build it. Off the coast, the U.S. Army Corps of Engineers (USACE) Southern California Bathy LiDAR (2009) was used for bathymetric data, while the Scripps Southern California LiDAR (2009) provided more detailed data along the shore and into the lagoon mouth. The rest of Los Peñasquitos Lagoon was covered with the California State Coastal Conservancy Coastal LiDAR Project Digital Elevation Model (DEM) 2009–2011). The remaining area within the site boundary was covered with the California IFSAR DEM (2002–2003), which is lower resolution than the other data sets.

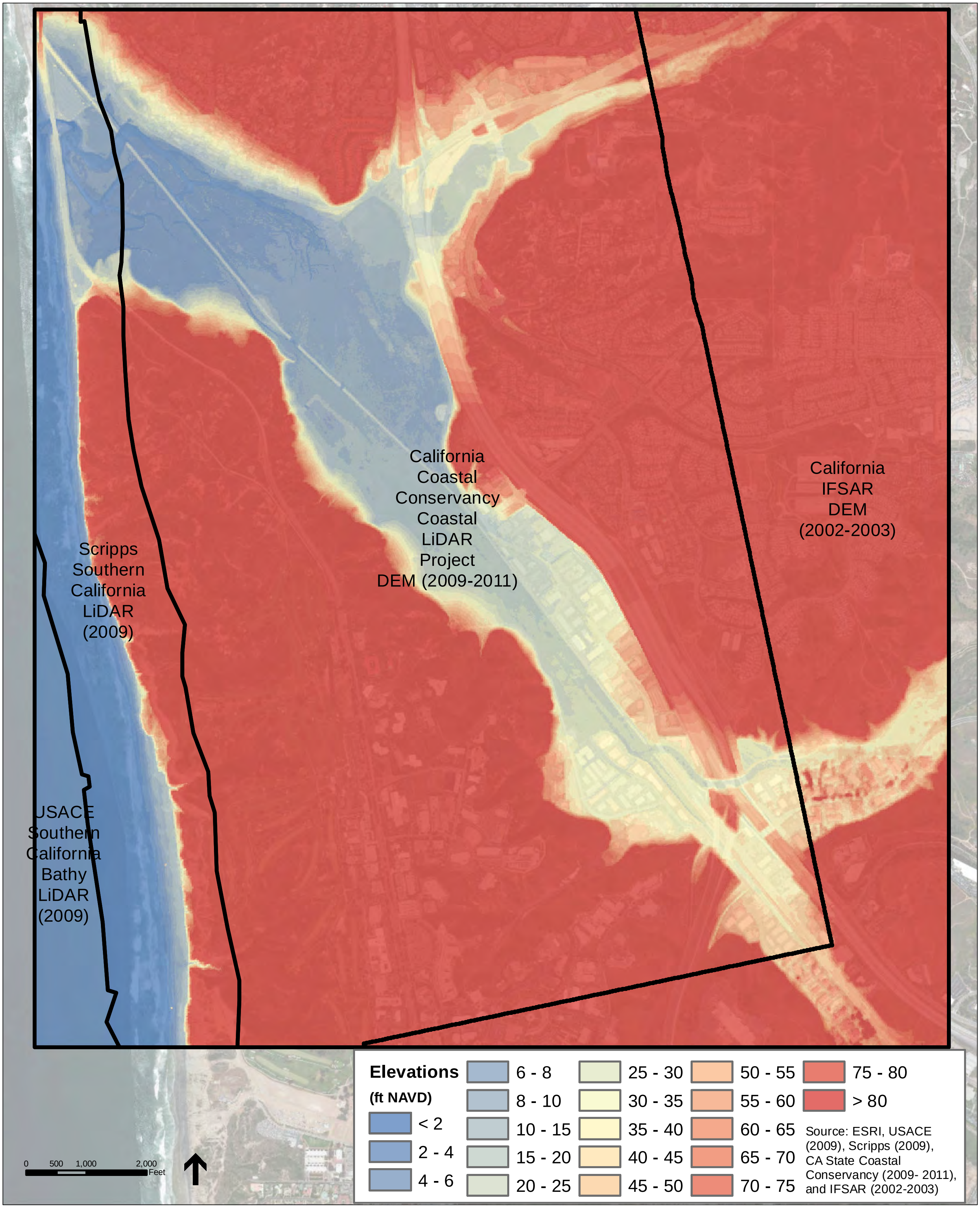
The topography data was checked in the field on May 7, 2014, using Leica Geosystems system1200 real-time kinematic global positioning systems (RTK-GPS) rovers receiving position corrections via Leica's SmartNet base station network. The field survey confirmed the accuracy of the LiDAR data.

4.4 Hydrologic Conditions

Hydrology is a key factor in understanding the processes in coastal estuaries in Southern California. At Los Peñasquitos Lagoon, the ocean tides replenish water quality parameters (e.g., salinity, temperature, and dissolved oxygen) within the Lagoon channels required for the health of flora and faunal species endemic to coastal estuaries (Sections 4.4.1 through 4.4.3). Conversely, undesirable inputs from the watershed and peripheral drainages affect ecology by delivering daily freshwater inputs during dry weather, and pollutants (e.g., sediment, nutrients) entrained in storm runoff during wet weather (Section 4.4.4 through 4.4.7).

4.4.1 Coastal Processes

Coastal areas are often divided into natural compartments referred to as littoral cells. Each cell serves as a bounded system composed of a complete cycle of sedimentation that includes sources, transport paths, and sinks (Flick et al. 2011). Los Peñasquitos Lagoon is part of the Oceanside Littoral Cell. The Oceanside Littoral Cell is located within the Southern California Bight, bounded on the north by Dana Point and on the south by the Scripps/La Jolla Submarine Canyon System. Sediment in the cell travels south from Dana Point past the six San Diego County Lagoons to the Scripps Submarine Canyon, which acts as a sink. Sediment stops along the way along fringe reefs, offshore sand bars, beaches and within the lagoons, which act as temporary sinks, until freshwater flows can flush out the mouths.



ESA

Los Peñasquitos Lagoon. D130136

Figure 4-3
Los Penasquitos Lagoon
Topography and Bathymetry

Historically, the major sources of sediment (e.g., sand and cobbles) for this cell have been ephemeral rivers and drainages, as well as erosion from coastal bluffs (Flick 2006). However, many of these sediment sources have been reduced and, in some cases, eliminated due to alterations of coastal tributaries by anthropogenic structures (e.g., dams), armoring of coastal bluffs, and gravel-mining facilities. Movement of marine sediment within the Oceanside Littoral Cell is driven primarily by waves generated in the North Pacific Ocean during the winter months and the predominant longshore current that moves in a southerly direction (Flick et al. 2011). While seasonal shifts in transport direction during summer months occurs to a degree in beaches within the northern reach of the Oceanside Littoral Cell, this does not occur at Torrey Pines State Beach under most circumstances due to shadowing effect of the La Jolla headland and refraction of wave energy by offshore marine canyons located south of the Lagoon.

At Los Peñasquitos Lagoon, the fixed inlet (see Section 3.2.1), increased sedimentation (see Section 3.2.4), and changed hydrology (see Section 3.2.3) have decreased the ability of the lagoon mouth to flush sediment that had built up over time from coastal processes. As a result, cobbles transported along the coast tend to remain in the Lagoon's inlet area, creating a hardened structure, or sill, that facilitates further accretion by marine-originated sand (Coppock 1985; Boland 1993). As discussed in Section 4.4.3, the inlet is now dredged to be kept open.

4.4.2 Tidal Characteristics

The San Diego coast experiences mixed semidiurnal tides, with two high and two low tides of unequal heights each day. In addition, the tides exhibit strong spring-neap tide variability; spring tides exhibit the greatest difference between high and low tides, while neap tides show a smaller-than-average range. The spring-neap tides also vary on an annual cycle, with the highest spring tides occurring in June–July and December–January and the weakest neap tides occurring in March–April and September–October.

Tidal Datums

The National Oceanic and Atmospheric Administration (NOAA) tidal datums for the 1983–2001 epoch for the La Jolla tide gage are summarized in **Table 4-3**. This table also provides a conversion from the older National Geodetic Vertical Datum of 1929 (NGVD) to the current North American Vertical Datum (NAVD). The mean tide range, defined as mean high water (MHW) minus mean low water (MLW) is 3.69 feet (ft), and the diurnal tidal range, defined as mean higher high water (MHHW) minus mean lower low water (MLLW) is 5.33 feet.

When Los Peñasquitos Lagoon is open to the ocean, tidal flows propagate through the mouth of the Lagoon back through the tidal channels. However, tidal volume and extent within Los Peñasquitos Lagoon can be constricted when the inlet is occluded with marine sediments (cobbles and sand) that modify inlet dimensions. After inlet maintenance occurs (see **Box 3-3**) and sand is removed to enlarge the inlet, low tides can drain to below mean sea level (MSL), but as sand fills in the mouth, water cannot drain out on low tide and only high tides enter the Lagoon.

Tide data within the Los Peñasquitos Lagoon was collected by the Tijuana River National Estuarine Research Reserve (TRNERR) from September 2013 through May 2014. The location of the bridge sensor is shown in **Figure 4-4**, as well as the tides within the Lagoon while the mouth is open and during a closure event. Comparisons of the La Jolla gage and bridge gage show that the MHHW and mean MHW datums are similar during the period analyzed (September 2013–May 2014) when the inlet at Los Peñasquitos Lagoon is open and not very constrained.

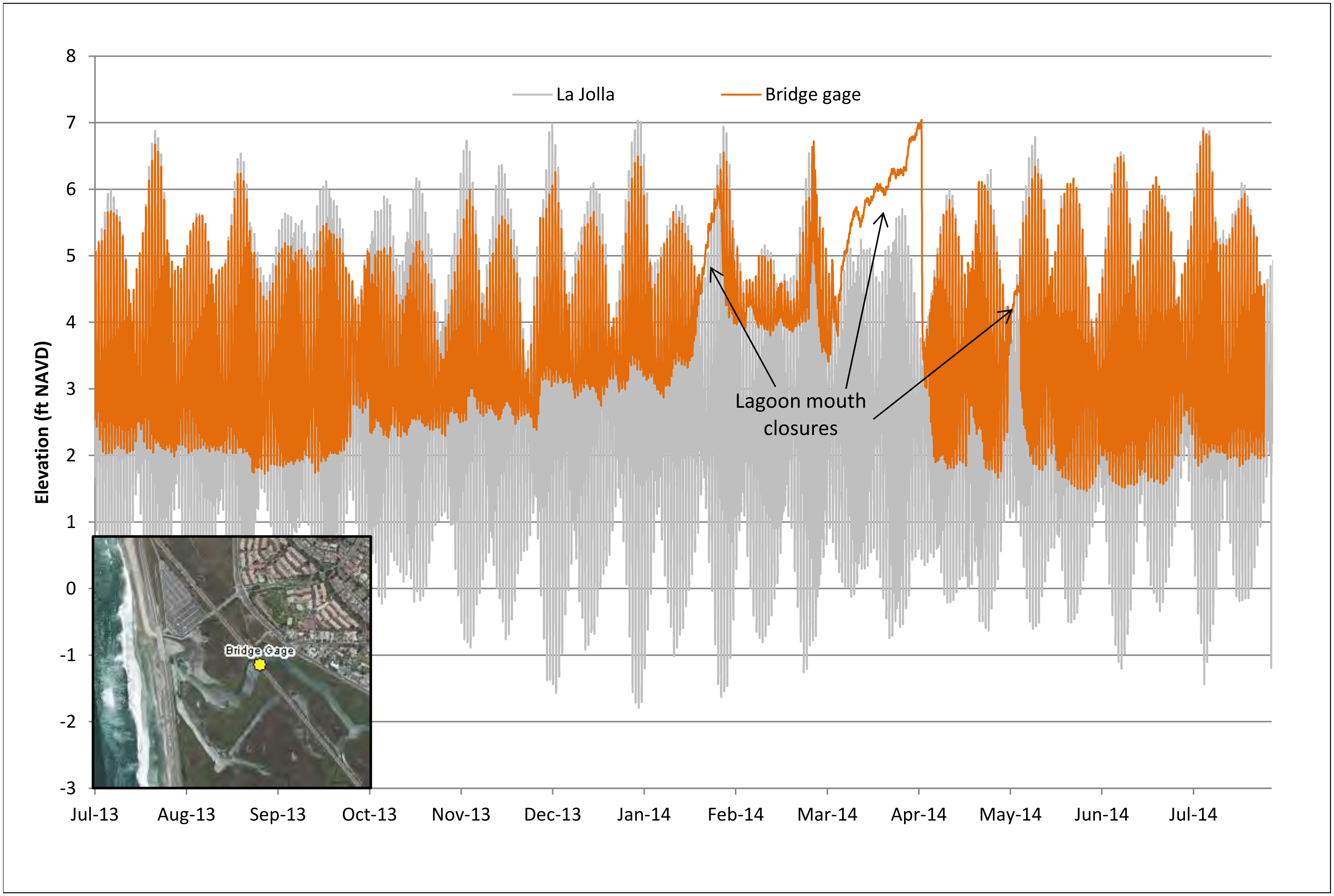
TABLE 4-3
TIDAL DATUMS AT LOS PEÑASQUITOS LAGOON

	La Jolla Tide Gage[1]				Bridge Gage[2]
	1924-present			Jun 2013 – Aug 2014	
Tidal Datum	ft MLLW	ft NGVD	ft NAVD	ft NAVD	ft NAVD
Highest Astronomical Tide (HAT)	7.14	4.84	6.95		
Mean Higher High Water (MHHW)	5.33	3.03	5.14	5.39	5.27
Mean High Water (MHW)	4.60	2.30	4.41	4.69	4.67
Mean Tide Level (MTL)	2.75	0.45	2.56	2.80	3.60
Mean Sea Level (MSL)	2.73	0.43	2.54	2.80	3.73
National Geodetic Vertical Datum of 1929 (NGVD)	2.30	0	2.11	2.11	2.11
Mean Low Water (MLW)	0.91	-1.39	0.71	0.91	2.53
North American Vertical Datum of 1988 (NAVD)	0.19	-2.11	0	0	0
Mean Lower Low Water (MLLW)	0	-2.30	-0.19	0.08	2.39

1. NOAA Tides and Currents, 1924–present
2. TRNERR, June 2013-present

Sea-Level Rise

Historical trends in relative sea level are measured at tide gages, which capture relative vertical movements of land as well as changes in the global, or eustatic, sea level. These records measure the local rates of sea-level rise relative to the coast. NOAA estimates that relative sea levels have been rising at a rate of 2.07 mm/year at the La Jolla tide gage (1924–2006).



Source: TRNERR

Los Peñasquitos. D130136

Figure 4-4

Tide Time Series
July 2013 to July 2014

The State of California Sea-Level Rise Guidance Document (CO-CAT 2013) provides guidance for California projects on how to use predictions of global sea-level rise for long-term planning purposes. The document recommends using the estimates provided by the National Research Council's (NRC's) report on *Sea-Level Rise for the Coasts of California, Oregon, and Washington* (2012) as a starting place to select values. These predictions are:

- 1.6 to 16 inches of sea-level rise by 2030
- 5 to 24 inches of sea-level rise by 2050
- 17 to 66 inches of sea-level rise by 2100

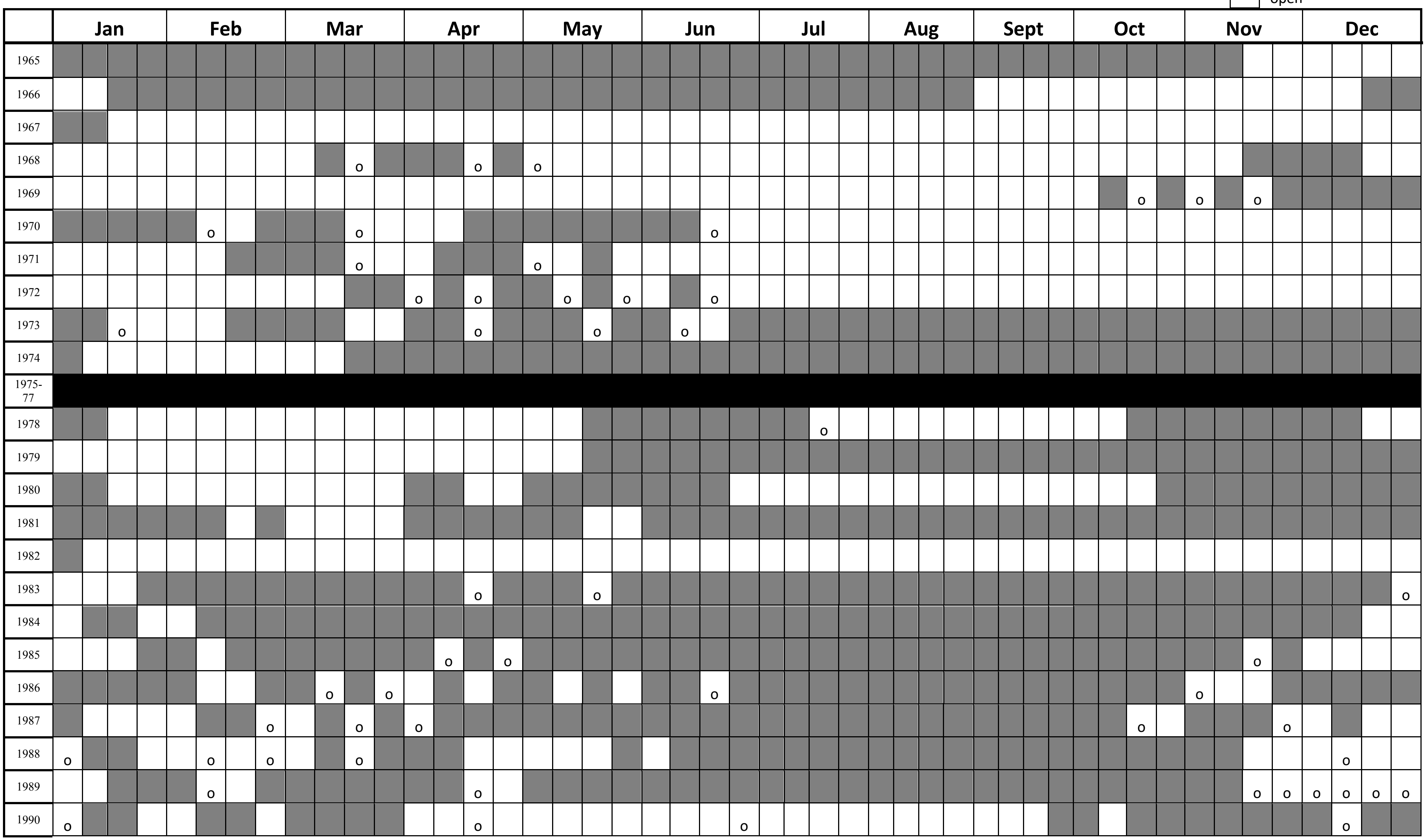
Extreme high water levels may change more than MSLs as a result of alterations in the occurrence of strong winds and low pressures. However, this has not been extensively studied for the project area.

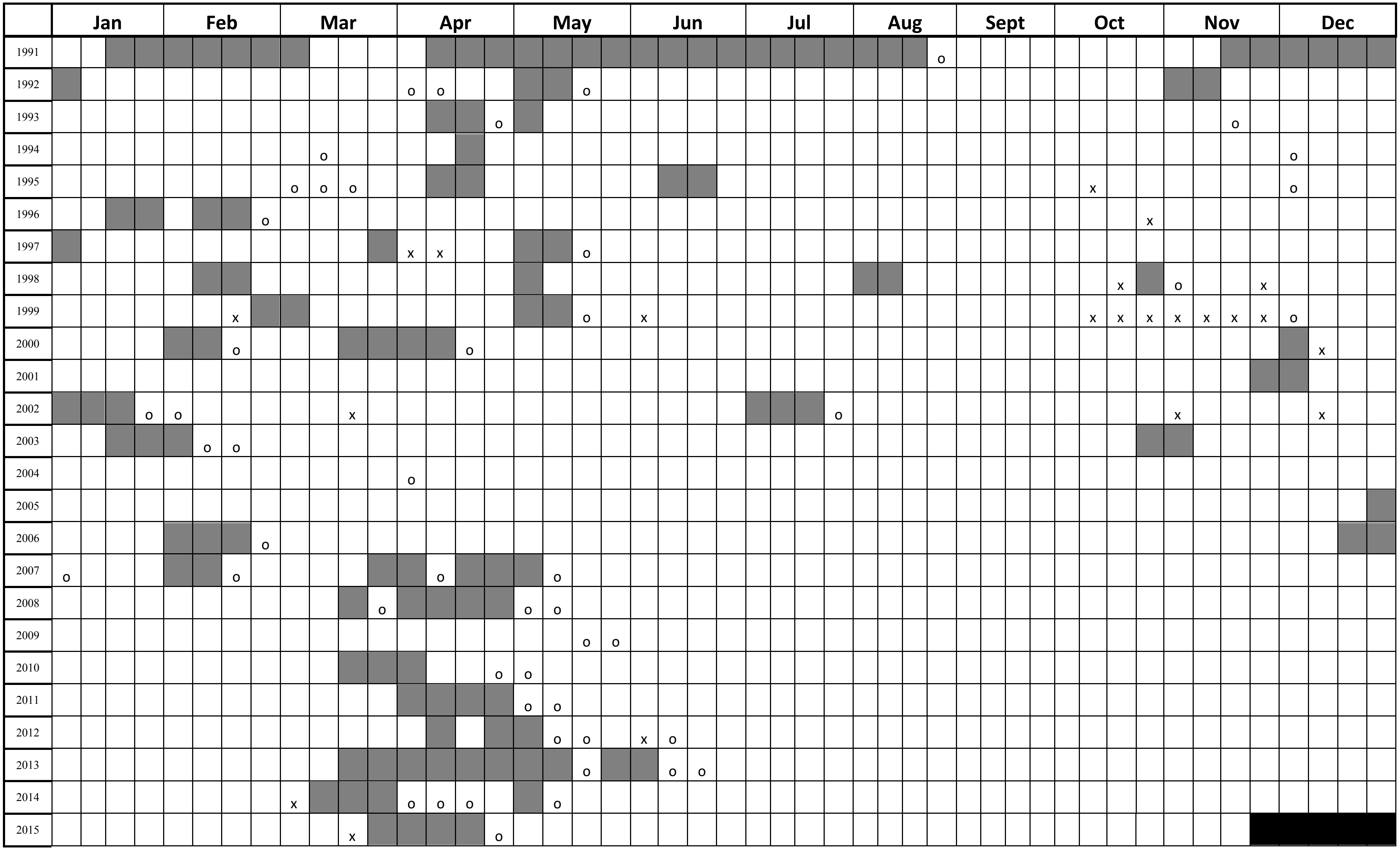
4.4.3 Mouth Inlet

Historic evidence that includes mollusk middens left by indigenous people, railroad maps from 1888, notes by Spanish explorers, sediment cores and photographs, indicate that the inlet most likely had once remained open relatively consistently throughout the year (Beller et al 2014, Crooks et al. 2014, Cole and Wahl 2000). However, it is likely there were periods of mouth restriction and temporary closures (Beller et al 2014, Crooks et al. 2014). With the current inlet location fixed under the lower bridge span and unable to meander, it is vulnerable to occlusion by marine sediments resulting in more frequent closures and for longer durations. Compounding this issue, lagoon outflows have been substantially muted by other structures within Los Peñasquitos Lagoon (e.g. railway berms and the North Beach parking lot) that limit the ability to remove these sediments even following moderate to large storm events (see Section 3.2.1). As a result, efforts to excavate the inlet area using heavy equipment to maintain the Lagoon's tidal prism have occurred since 1965. Identified as a key priority for lagoon health, inlet maintenance was formalized in the 1985 Lagoon Enhancement Plan and adaptive approaches using heavy equipment (e.g. equipment type, timing, methods) have implemented and refined up to the current approach typically implemented on an annual basis. **Table 4-4** presents the history of mouth closures and openings since 1965, while Appendix C summarizes the techniques used over time.

TABLE 4-4
MOUTH CLOSURES AND OPENINGS AT LOS PEÑASQUITOS LAGOON (1965–2015)

Key:
- no data
- closed
- x partially closed
- o artificially opened
- open





Adapted from records kept by Lee LeGrange, Mike Wells, and Mike Hastings.

4.4.4 Creek Input and Flooding

Creek Input

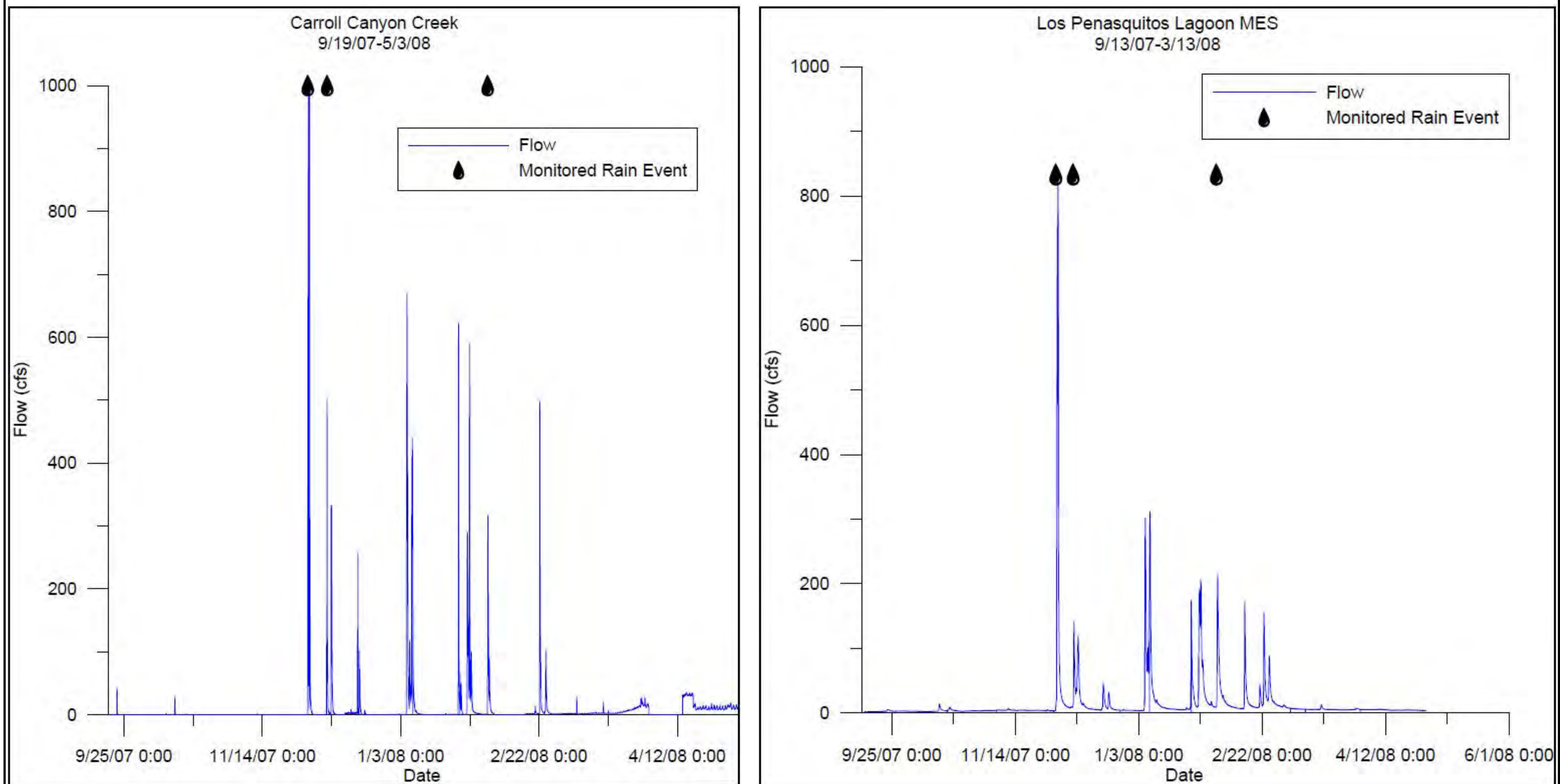
Inflow to wetlands has a major influence on the type of vegetation present and helps establish the internal channel network. The potential amount of water contributed, frequency of contributions, and type of water contributed (e.g., saline, fresh, polluted) are important in the consideration of the hydrologic functions of the wetlands. The hydrology of the three creeks that feed into the Lagoon—Los Peñasquitos Creek, Carmel Creek, and Carroll Canyon Creek—is discussed below and in the following pages.

Los Peñasquitos Creek

Los Peñasquitos Creek receives drainage from the largest of Los Peñasquitos Lagoon's three sub-watersheds and enters the Lagoon from the southeast after it joins Carroll Canyon Creek in Sorrento Valley. The creek bed has become heavily vegetated with riparian species over the last decade, most likely as a result of continuous freshwater flows from urban sources (White and Greer 2002). The average base flow for Los Peñasquitos Creek is estimated to be between 1.0 and 2.17 cubic feet per second (cfs) (Crooks and Uyeda 2010, Weston 2009, Coastal Environments 2003). During storms, the creek's response to rainfall is delayed when compared to the other two creeks, likely a result of dense vegetation, a dam upstream that may restrict flow, and the wide floodplain that characterizes the lower section of the canyon (**Figure 4-5**). The estimated annual wet-weather load for Los Peñasquitos Creek is 419,219 lb/season, which results in a sediment volume of 155 cubic yards (cy) during a typical year (Weston 2009).

The U.S. Geological Survey (USGS) maintains a long-term flow gage (Station #11023340) in the upper Los Peñasquitos Creek watershed, the only long-term and continuous gage within the entire watershed. Daily discharge rates from this gage are available for 1964 through present and have successfully captured an episodic flood event that occurred in December 2010 that was estimated to be a 50-year event. Return rates for flow at this gage were calculated and are presented in **Table 4-5**. It should be noted that daily discharge rates recorded at this USGS gage are not representative of discharge rates in the lower Los Peñasquitos Creek watershed. A mass loading station near the base of Los Peñasquitos Creek used for monitoring discharge rates during storm events has been operated by the City of San Diego, but only during select years and not during dry weather.

Additional streamflow data were collected at the base of the Los Peñasquitos Creek between 2007 and 2008 as part of the Los Peñasquitos Sediment Total Maximum Daily Load (Lagoon Sediment TMDL) monitoring study (Weston 2009). Weston created transformations to calculate flows based on the USGS gage data (**Table 4-5**). Under base flow conditions, the downstream gage showed slightly large flows than the USGS gage. However, under storm events, the downstream gage showed noticeably smaller flows (even smaller than would be expected with infiltration upstream), which may indicate that the stream flows are underestimated. The Weston transformations were applied to the return rates from the USGS gage to calculate approximate returns for the three creeks (**Table 4-5**).



Source: Weston 2009

Figure 4-5
Carroll Canyon Creek and Los Peñasquitos Lagoon Hydrographs

TABLE 4-5
USGS AND WESTON-CALCULATED RUNOFF FLOW CONDITIONS

Return Period (year)	Upper Los Peñasquitos Streamflow[1] (cfs)	Lower Los Peñasquitos Streamflow[2] (cfs)	Carmel Creek Streamflow[2] (cfs)	Carroll Canyon Creek Streamflow[2] (cfs)
50	7,233	5,240	1,703	8,075
10	503	364	118	562
5	260	188	61	290
1	49	36	12	55

1. Calculated from USGS gage #11023340.
2. Calculated using Weston 2009 transformations.

The Federal Emergency Management Agency (FEMA) (2012) also modeled flow return rates in a 1976 Hydrology for FIS, Soledad Canyon, and Tributaries study. These flows are presented in **Table 4-6** and are an order of magnitude larger than those calculated using the transformations. Although the Weston study is more site specific and current than the FEMA analysis, any future flood modeling that goes through FEMA would be required to use the FEMA values as a starting point, so these values are included as well.

TABLE 4-6
FEMA RUNOFF FLOW CONDITIONS

Return Period (year)	Lower Los Peñasquitos Streamflow (cfs)	Carmel Creek Streamflow (cfs)	Carroll Canyon Creek Streamflow (cfs)
500	37,600	21,300	18,700
100	16,800	9,800	6,700
50	11,300	6,500	4,500
10	3,700	2,100	1,500

SOURCE: FEMA (2012).

Carmel Creek

Carmel Creek enters Los Peñasquitos Lagoon from the northeast corner. The creek is heavily vegetated with riparian species up to I-5 with its major tributary streams including Deer Canyon, Shaw Valley, El Camino Canyon, and Bell Valley. Average base flow in Carmel Creek is estimated to between 0.47 cfs and 0.78 cfs (Crooks and Uyeda 2010, Coastal Environments 2003).

The USGS maintained a streamflow gage on Carmel Creek between 1985 and 1986 (Station #11023450). Greer and Stow (2003) took streamflow measurements at the same location between 1999 and 2000 and observed an order of magnitude increase in dry-season flows. **Table 4-5** shows the return period flows as calculated from the USGS gage with the Weston transformation, while **Table 4-6** shows the much larger FEMA values. Flow at all three creeks has also been measured monthly since 1995 for the Los Peñasquitos Lagoon Monitoring (TRNERR 2012; see Section 2.1.1). As urbanization of the watershed has continued, the once perennial freshwater flows have increased and become year-round, and have led to an increase in brackish vegetation species where Carmel Creek enters Los Peñasquitos Lagoon.

The estimated annual wet-weather load for Carmel Creek is 193,701 lb/season, which is about half as much as Los Peñasquitos Creek and represents the smallest load to the Lagoon. The sediment volume contributed by the creek in a typical year is 72 cy. Photographic evidence from CSP in the 1980s shows that Carmel Creek was once a major contributor of sediment to the Lagoon. However, it is believed that sediment transport from the creek has dropped greatly since the implementation of the CVREP in the early 1990s (Kimley-Horn 2003). Designed to mitigate impacts generated by the development of Carmel Valley and SR 56, CVREP incorporated several best management practices (BMPs) within the creek to reduce sediment transport to the Lagoon.

Carroll Canyon Creek

Carroll Canyon Creek enters Los Peñasquitos Lagoon from the southeast after its confluence with Los Peñasquitos Creek. The creek bed is heavily vegetated with riparian species in some areas and bare in others, showing exposed cobbles and sand. The lower section of Carroll Canyon Creek comprises a cement channel that runs for just under 0.5 miles through Sorrento Valley. Carroll Canyon Creek also is the only tributary with two active aggregate mining facilities operated by Vulcan Materials Company and Hanson Aggregates. While the Vulcan site is currently scheduled for decommission, the Hanson facility continues to operate in the bed of Carroll Canyon Creek.

Table 4-5 provides the return event flows for Carroll Canyon Creek based on the Weston transformations, while **Table 4-6** presents the FEMA values. Monthly streamflow measurements have also been taken since 1995 for the Los Peñasquitos Lagoon Monitoring (TRNERR 2012). While having a smaller drainage area than both Los Peñasquitos Creek and Carmel Creek, Carroll Canyon Creek appears to yield the highest peak flows during storm events, according to Weston, as shown in **Table 4-5**. This is due to several factors that are unique to the Carroll Canyon sub-watershed, including larger areas of impervious surfaces along the mesa tops, steep incised canyons and drainages that receive Municipal Separate Storm Sewer System (MS4) discharges, and a cement channel that expedites storm runoff through Sorrento Valley. Because the watershed has become so urbanized, flows are quick to respond to rainfall events and result in larger peak flow rates, as water runs directly off the impervious surfaces and into the channel. These larger flows have incised the channel upstream and now contribute to the increased sedimentation downstream. While it is the smallest drainage, Carroll Canyon Creek provides 36 times the amount of sediment to Los Peñasquitos Lagoon than Carmel Creek and 18 times the amount as Los Peñasquitos Creek (7,486,267 lb/wet season and 2,733 cy sediment volume/typical year; Weston 2009). Field surveys conducted in 2009 indicated that the primary sources of sediment within Carroll Canyon include canyon walls and drainages that receive direct discharges from MS4 outfalls as well as creek channel bed and banks (Weston 2009). Field mapping and sediment transport modeling performed by ESA PWA[1] in 2011 support these findings. In addition to increased peak flows from MS4 discharges, the cement channel located within Sorrento Valley also contributes to elevated rates of sediment transport to the Lagoon from Carroll Canyon. During a preliminary monitoring program for the Lagoon's Sediment TMDL, hydrographs generated for Carroll Canyon Creek showed the flashy nature of this sub-watershed, as opposed to hydrographs that showed gradual increases and a decline in discharge rates for Los Peñasquitos Creek (Weston 2009).

Flooding

Flooding within Los Peñasquitos Lagoon and adjacent areas may result from extreme water levels caused by storm surges occurring at high tides, high outflows from creeks, or the joint occurrence of these processes. Flooding within the Lagoon is greatly exacerbated by structural impediments within the Lagoon and occlusion of the inlet by marine sediments that reduce drawdown times of impounded waters (see Section 3.2.1 for more information).

FEMA (2012) mapped the lagoon within the 100-year floodplain, with a base flood elevation of 14 feet NAVD back to the southern-most railroad bridge (**Figure 4-6**). Beyond the railroad bridge, flood levels rapidly increase to 37 feet NAVD at the mouth of Los Peñasquitos Creek, likely because of the backflow caused by the bottleneck between the toe of the canyon wall and the railroad berm (see Section 3.2.4). The FEMA 100-year floodplain extends up all three creeks. The FEMA 100-year coastal wave runup elevation is 10.9 feet NAVD.

4.4.5 Marsh Sedimentation

Storm water runoff and tidal flushing are the primary sources of sediment input into Los Peñasquitos Lagoon. Although these forces are technically independent, both can interact to contribute to sediment deposition within Lagoon channels and terrestrial habitats. Sediment from marine origins can occlude and sometimes completely block the inlet area of Los Peñasquitos Lagoon, resulting in a diminished or lost tidal prism (Section 4.4.3). When this occurs, suspended fluvial sediments can settle within the Lagoon's tidal channels, over the marsh plain, and/or in transitional areas located behind the railway berm. Conversely, runoff during large storm events can overtop and erode an inlet berm, rapidly scouring marine sediments that may have accumulated in the Lagoon inlet and channels. However, this tends to not occur with frequency at Los Peñasquitos Lagoon due to the 1925 railway alignment that abates outflow velocities. Or high tides can overtop the inlet berm, causing water levels within the Lagoon to rise enough to erode the inlet berm but without the scouring of lagoon channels that can occur from runoff during large storm events.

[1] Environmental Science Associates (ESA) and Philip Williams and Associates Ltd. (PWA) merged in 2010. PWA is now part of ESA.

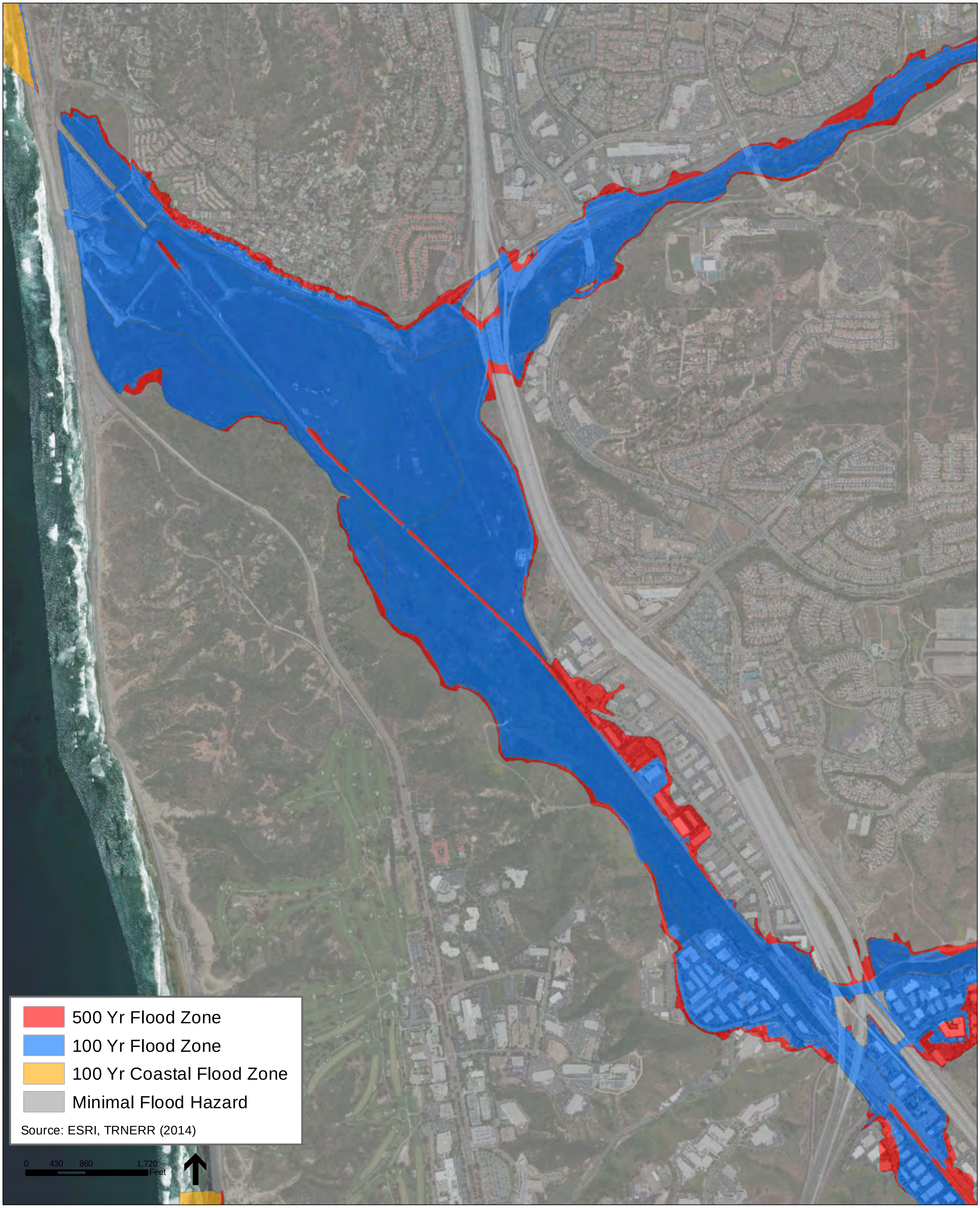


Figure 4-6
FEMA Flood Map

Fluvial Accretion

In 1996, Los Peñasquitos Lagoon was placed on the Section 303(d) of the Clean Water Act's list of impaired waterbodies because of increased sediment and siltation resulting from the urbanization of its watershed. In 2009, the Environmental Protection Agency and State Water Resources Control Board initiated monitoring efforts to support the development of a third-party TMDL for sediment loading in the Lagoon through collaboration between key stakeholders (MS4 operators, CSP, and LPLF) (Weston 2009). Since much of the sediment-related impairment to Los Peñasquitos Lagoon had already occurred, it was determined that a lagoon restoration compliance target was needed in conjunction with sediment load reduction.

The watershed sediment load was estimated for the TMDL by modeling the current and historic sediment loads using data on catchments, streams, soil characteristics, irrigation, land use, and meteorological conditions. Current (2000) and historic (mid-1970s) land uses were modeled using the same meteorological conditions from a critical wet period to determine the change over time. **Table 4-7** presents these values.

TABLE 4-7
SEDIMENT LOADS BASED ON TMDL

	Current Load (2000) (cy/yr)	Historic Load (mid-1970s) (cy/yr)	Required Load Reduction
TMDL	7,620	2,550	67% or 2,520 cy/yr

SOURCE: Tetra Tech 2010.

The pattern and volume of fluvial sediment deposition in Los Peñasquitos Lagoon are due to the sediment load that enters the Lagoon from the creeks, which includes deposition of coarser- and finer-grained sediment as storm flows spread out over the Lagoon, and the amount of sediment that is deposited versus exported to the ocean (i.e., sediment trapping efficiency). The pattern and volume of deposition observed in the topography provides empirical information on the net deposition. The existing topography of Los Peñasquitos Lagoon indicates two sloping fans of sediment: one extending from Carmel Creek and another extending from the confluence of Los Peñasquitos Creek and Carroll Canyon Creek. It should be noted that the sediment fan from Los Peñasquitos Creek and Carroll Canyon Creek extends into the Lagoon in a northward trajectory facilitated by two railway bridges that create gaps in the earthen railway berm rather than a northwest trajectory that would most likely occur if the railway berm were not present.

Tidal Accretion

Suspended sediment from storm flows or resuspension of sediment by tidal flows is deposited across the marsh plain and intertidal habitats when they are inundated by sediment-laden tidal water. As the tidal waters rise and fall, areas that are low with respect to the tidal range are covered with sediment-laden water for a longer period of time and accrete at a faster rate than higher elevations. At the higher end of the tidal range, the frequency and duration of flooding by high tides is diminished so that the rate of sediment accumulation is less. This provides an inverse relationship between sediment accretion and elevation. The maximum accretion rate occurs at low elevations (below MLLW) and little to no tidal accretion occurs above MHHW.

4.4.6 Salinity

Salinity in Los Peñasquitos Lagoon's tidal channels and soils plays a key role in the health and survival of its historic habitats and halophytic plant species. Historically, when the lagoon inlet was open during dry weather, water in the marsh was near ocean salinity. During rain events, the salinity would lower as freshwater entered the Lagoon from the watershed, and then rise as the tidal waters reentered during incoming tides. Prior to the urbanization of the watershed and the perennial nature of the Los Peñasquitos Lagoon's tributaries, water trapped within the Lagoon during mouth closures would often become hypersaline and most likely contributed to the expansive salt flat that was believed to have characterized the middle portion of the Lagoon's habitats since the late 1800s. However, year-round freshwater input from the watershed since 1995 precludes hypersaline conditions for the most part, even during summer months with no precipitation. As a result, salinity in Los Peñasquitos Lagoon's waters ranges from <5 to 35 parts per thousand (ppt) depending on the tides and freshwater flow.

Reduction of soil salinity is a key precursor to major shifts in species compositions in coastal salt marshes (Zedler and Magdych 1984, Zedler 1983, Bertness 1991). This is due in most part to prolonged inundation of freshwater that makes conditions favorable for glycophytes (salt-intolerant species), including *Typha* (cattail) and *Salix* (willow) (Greer and Stow 2003). Daily discharges of dry-weather flows from urbanized areas within the watershed have caused Los Peñasquitos Lagoon's terrestrial habitats to change rapidly, with areas of salt marsh, salt flat, and salt panne converting to riparian and brackish marsh (Greer and Stow 2003, Section 3.2.5).

4.4.7 Water Quality

As discussed in Section 3.2.2, water quality is one of the most important factors affecting the health of Los Peñasquitos Lagoon, with tidal exchange playing the key role. Tidal exchange promotes flushing of lagoon channels, which restores water quality parameters (e.g., salinity, temperature, dissolved oxygen (DO), pH) to levels required for native aquatic species and facilitates drawdown times of freshwater inputs from the watershed. During optimal conditions, tidal exchange is unrestricted. Restricted tidal exchange (e.g., when the inlet area is occluded with sand) or complete loss of tidal exchange (i.e., during a lagoon mouth closure), causes water within lagoon channels to stagnate. When stagnation occurs, DO levels can drop to lethal levels for fish and invertebrates, sometimes within a few days during summer months since DO is sensitive to temperature and the influence of legacy nutrients in channel sediments.

DO is perhaps one of the most important water quality parameters for aquatic species residing in Los Peñasquitos Lagoon's channels and is the most used parameter for triggering opening of the Lagoon inlet during closures. During inlet closures, DO can drop to levels considered stressful to most marine organisms (5mg/L). During extended inlet closures, DO levels can continue to drop, toward anoxic conditions (0 mg/L) resulting in fish kills.

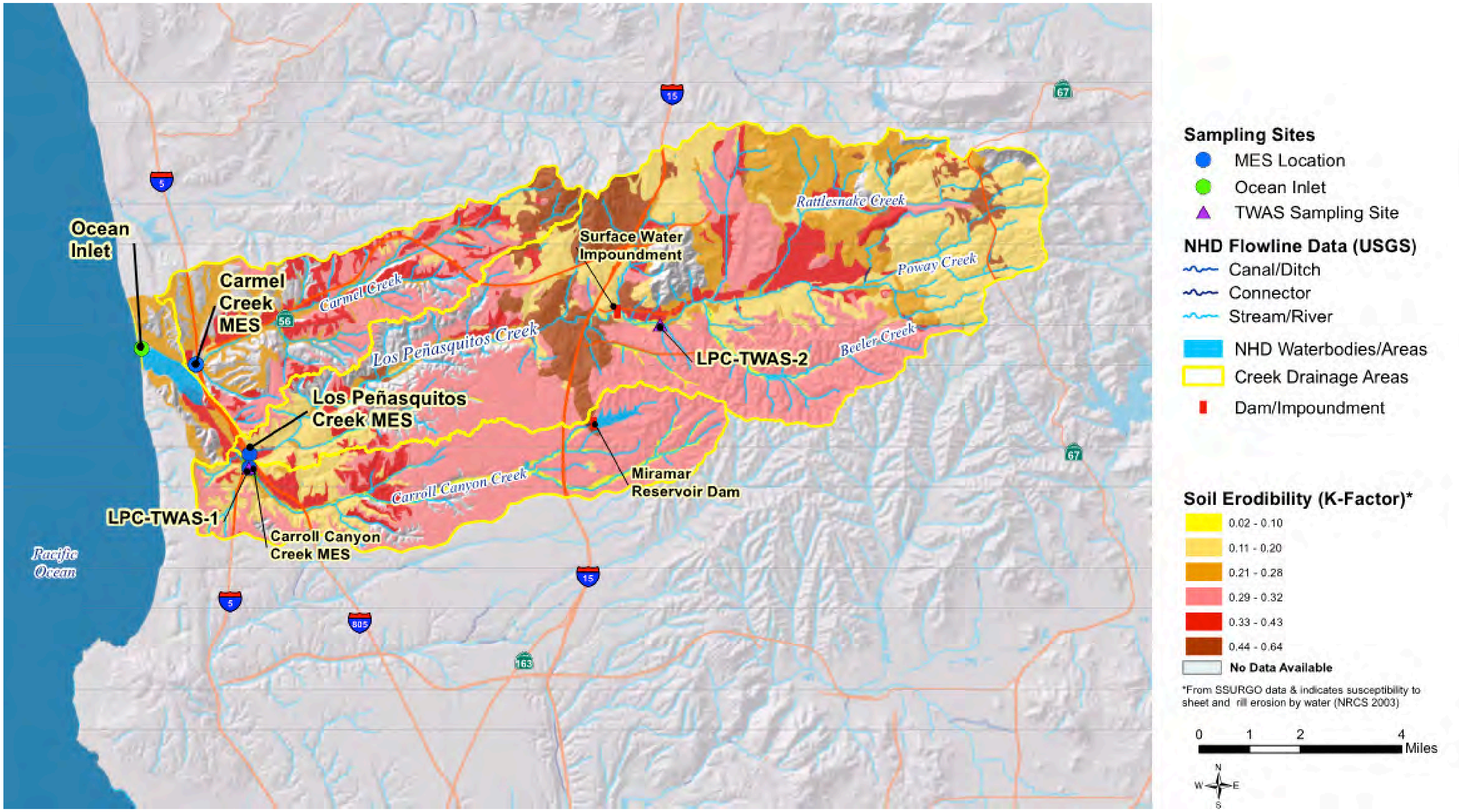
As described in Section 3.1.6, daily discharges of primary-treated wastewater has also impacted the Los Peñasquitos Lagoon. From 1950 to 1972, three sewage treatment plants discharged into the Lagoon with the Sorrento Treatment Plant alone discharging 0.5 to 1.0 million gallons per day (MGD). As a result, nutrient loading and reduced salinity levels within the Lagoon occurred on a frequent basis and was compounded during inlet closures (Nordby and Zedler 1991). While this practice was discontinued in 1972 through the use of pump stations connected to the metropolitan sewage system, legacy contaminants of nitrate and phosphate loads still greatly impact water quality and contribute to the eutrophic conditions within Los Peñasquitos Lagoon during inlet closures. Numerous sewage spills from Pump Station 64 between 1972 and 2011 have compounded the issue of legacy nutrients in channel sediments in Los Peñasquitos Lagoon, including a spill in 1987 that released 20 million gallons of untreated sewage directly into the Lagoon.

4.5 Geology and Soil Conditions

The geology of Los Peñasquitos Lagoon and its western drainages are characterized by thick non-marine sedimentary rocks, which are clearly exposed in the steep cliffs of TPSNR. The oldest formation in the area is the Delmar Formation, which is exposed in the lower part of the bluffs near the lagoon mouth, and characterized by greenish siltstones and deposits of fossil oysters. Above the Delmar Formation is the Torrey Sandstone, a white, beach-type deposit that weathers into distinctive caverns and hollows. This formation accounts for the spectacularly eroded cliffs bounding the Lagoon. The formation is especially susceptible to landslides and slope failures. The Linda Vista Formations are relatively thin layers of striking red rock that overlie the older Torrey Sandstone deposits on the flat ridge tops. They form a cap which, when removed by grading, exposed the highly erodible and porous rocks below. The eastern portion of the watershed in the vicinity of Poway is underlain by uplifting granite, the Santiago Peak volcanic rocks, and some non-marine conglomerates. The volcanic rocks are more resistant to erosion, appearing in outcrops, waterfalls, and stone-mantled hilltops.

The basin of Los Peñasquitos Lagoon itself is underlain by marine or river sand to a depth of more than 50 feet, covered in most areas by approximately 6 feet of fine silts and clays. Four types of soils occur within the Lagoon, with each derived from a different type of sediment washed into the Lagoon from its watershed. Silts and clay are the predominant soils types within the Los Peñasquitos Lagoon's eastern channels, while sand from coastal sources is the predominant sediment type within the inlet area. Terrestrial soils within the Lagoon tend to be a mix of sandy substrate, loamy soil (a mixture of sand, silt, and clay), and areas of clay that help to create the Lagoon's salt pannes.

The Soil Conservation Service's index of erodibility identifies virtually all of the soils outside Los Peñasquitos Lagoon's floodplains as having "severe" erosion potential. **Figure 4-7** shows the soil erodibility factor (K-factor) from the Soil Survey Geographic Databases (USDA 1973). Soils with low K values (<0.2) have low soil erodibility, while light-textured soils have the highest K values (>0.4) and produce high rates of runoff (Weston 2009, Institute of Water Research 2002).



SOURCE: Weston Solutions Inc., 2009

Los Peñasquitos Lagoon . D130136

Figure 4-7
Soil Erodibility

4.6 Biological Resources

Biological resources within Los Peñasquitos Lagoon include a large number of wetland and transitional vegetation communities and a large number of important and special status plant and animal species. Both regional and local drivers have impacted many of the Lagoon's native species due to factors such as sedimentation, hydromodification, and invasive species (see Section 3.2.6 for additional details on habitat conversion). Much of Los Peñasquitos Lagoon's native vegetation and its inhabitants have changed over time, while some historic species remain. The following section describes the Lagoon's biological resources in terms of historic occurrence and contemporary presence.

4.6.1 Vegetation Communities

Although it has been subject to much disturbance in the recent past, Los Peñasquitos Lagoon supports a variety of native vegetation communities that support a large number of plant and animal species. Vegetation observed in the Lagoon includes a mosaic of saline, brackish, freshwater, riparian and transitional habitats. Many of these communities have been greatly reduced in Southern California. As a result, a number of the plant and wildlife species that rely on them for survival are now threatened with extinction. Coastal salt marsh associated with Southern California lagoons and estuaries is considered to be particularly valuable as approximately 91 percent of coastal wetlands in the state of California have been lost to development (California Department of Fish and Game, 2001).

In 2013–2014, CSP developed a detailed map of the vegetation communities of Los Peñasquitos Lagoon. Vegetation assemblages and associations were mapped in the field using a modified version the methodology of the Western San Diego County Vegetation Manual (AECOM 2011). This methodology results in a very fine-grained vegetation map that is difficult to interpret. These fine-grained types were consolidated according to Holland (1986) to better communicate more broad vegetation patterns and habitat delineations within the Lagoon. The following discussion is based on the cross-walked, modified Holland categories. The detailed Western San Diego County Vegetation Manual mapping is also presented in Appendix I.

Using the modified Holland approach, there are nine vegetation communities/land forms in Los Peñasquitos Lagoon, including:

- Southern foredunes
- Southern coastal salt marsh
- Salt panne
- Coastal brackish marsh
- Riparian habitats (Southern willow scrub and mule-fat scrub)
- Coastal freshwater marsh
- Transitional habitat
- Non-native grassland
- Disturbed upland habitat

The 2014 distribution of the vegetation communities observed in the Lagoon and transitional areas is illustrated in **Figure 4-8**. This 2014 condition is compared to the 2010 and 1973 vegetation communities. The 1973 vegetation communities existed prior to major sediment deposition events beginning in the late 1980s. Although mapped in varying degrees of detail, the comparison of the changes incurred after 1973 demonstrates the impacts of these events with the greatest impacts occurring in the eastern and southern portions of the Lagoon.

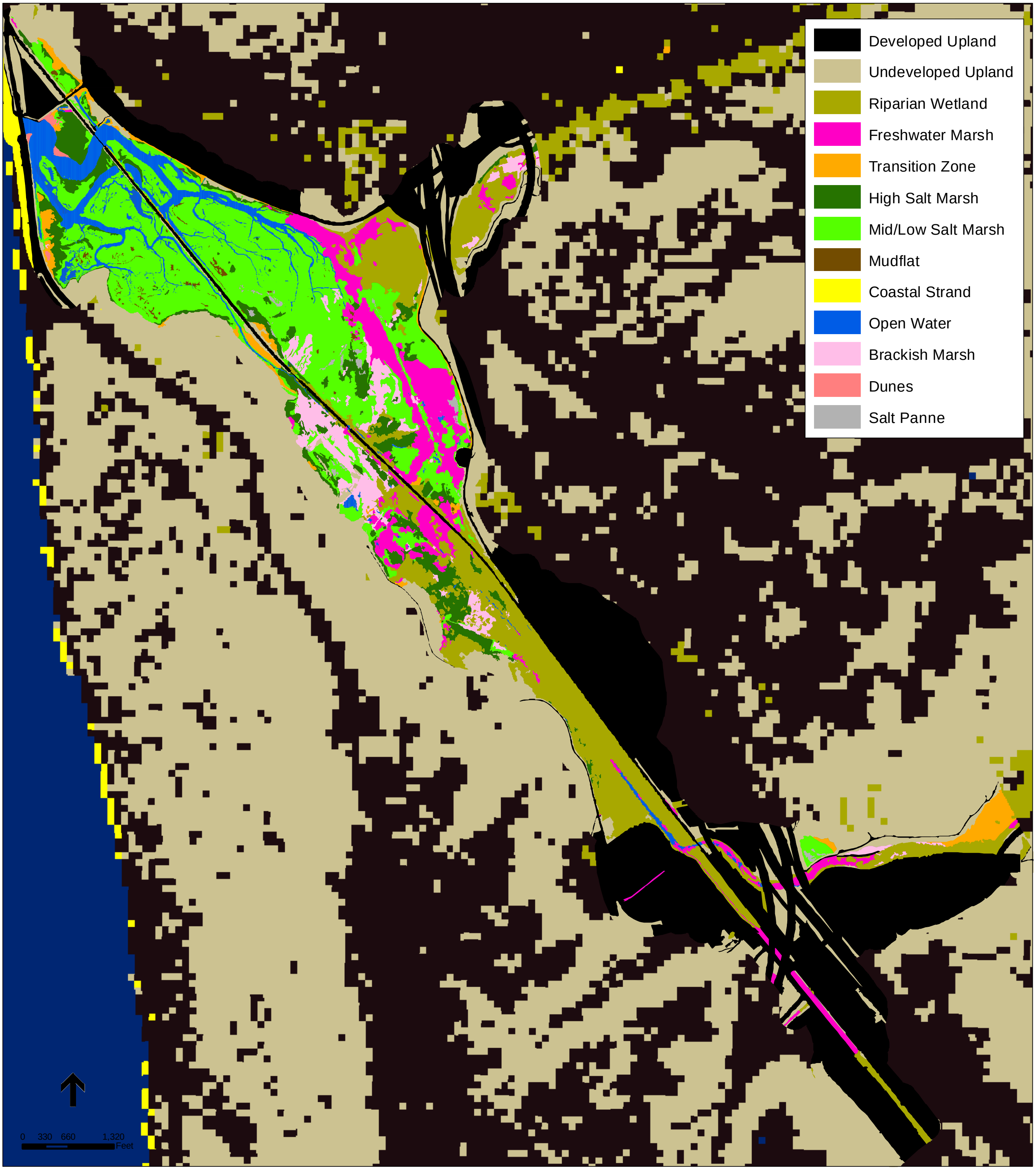
Within each habitat type, the proportion of native and exotic plant species varies greatly, from relatively undisturbed native communities to habitats that support a high percentage of exotic species. Generally, there is a sharp gradient of invasive species increasing from tidal to non-tidally influenced habitats. This situation is further compounded by freshwater inflows and sediment deposition. A complete list of plant species observed in the project area is presented in Appendix J.

Southern Foredune

Southern foredune is a sparsely vegetated community that is dominated by plants that are suffrutescent (i.e., having a base that is somewhat woody and does not die down each year) (Holland 1986). Plant species that are characteristic of this habitat include beach evening primrose (*Camissoniopsis cheiranthifolia*), red sand-verbena (*Abronia maritima*), beach sand-verbena (*Abronia umbulata*), and beach-bur (*Ambrosia chamissonis*). Within Los Peñasquitos Lagoon, this vegetation community also supports some cover of high salt marsh species, such as saltgrass (*Distichlis spicata*) and Pacific pickleweed (*Salicornia pacifica*), as well as invasive non-native species, such as sea fig (*Carpobrotus edulis*), crystalline iceplant (*Mesembryanthemum crystallinum*) and annual yeldy grass (*Ehrharta longiflora*). This vegetation supports several special status plants including, Nuttall's acmispon (*Acmispon prostratus*) and coast woolly heads (*Nemacaulis denudata* var. *denudata*).

Southern Coastal Salt Marsh

Pristine coastal salt marsh can be described as a highly productive habitat, dominated by herbaceous and suffrutescent, salt-tolerant hydrophytes that form moderate to dense cover and grow up to 1 meter in height (Holland 1986). This vegetation community is usually segregated by elevation, with California cordgrass (*Spartina foliosa*) occurring at lower elevations, Pacific pickleweed and other halophytic succulents occurring at mid-littoral elevations, and an assemblage of species occurring at the upper littoral elevations. California cordgrass is not present at Los Peñasquitos Lagoon, though it appears to have been present in the past (Cole and Wahl 2000). Reasons for its absence are likely related to a loss of intermediate elevation substrates between mudflats and areas dominated by Pacific pickleweed. Southern coastal salt marsh habitat supports an intricate food web that is rich in both invertebrate and vertebrate species. In addition, this vegetation community provides habitat for the federally listed endangered light-footed clapper rail (*Rallus longirostris levipes*) currently referred to as the light-footed Ridgway's rail [*Rallus obsoletus levipes*]) and stated-listed endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*).



Source: Lagoon vegetation mapping by State Parks 2015. Upland mapping from NOAA 2006.

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Los Penaquitos. D130136

Figure 4-8
Los Penasquitos Lagoon Vegetation Map

Plant species typical of coastal salt marsh include pickleweed, alkali heath (*Frankenia salina*), fleshy jaumea (*Jaumea carnosa*), western marsh rosemary (*Limonium californicum*), and California cordgrass (Holland 1986). Most species are active during the summer months and dormant during the winter months. A total of 10 vascular plant species and 1 parasitic species were observed in the salt marsh of Los Peñasquitos Lagoon during annual monitoring of the vegetation communities (Crooks et al. 2014). All are native to the region. Dominant species included Pacific pickleweed, salt marsh daisy (*Jaumea carnosa*), alkali heath (*Frankenia salina*), and saltgrass (Appendix J). Because of the frequency of inlet closures and lack of intermediate elevations between mudflat and mid-high salt marsh, California cordgrass does not occur at the Lagoon. Instead, elevations suitable for low marsh are either unvegetetated or are dominated by salt marsh daisy.

There are approximately 390 acres of coastal salt marsh within the Los Peñasquitos Lagoon, with 180 acres considered impaired (Smith 2009). The more pristine southern coastal salt marsh occurs primarily within the tidally influenced areas of the northwest portion of the Lagoon, while remnant, impaired patches persist in the southern portion in association with a number of more freshwater-influenced habitats. Historically, this vegetation community extended over a greater area than it does today and supported very few invasive species. Today, much of the coastal salt marsh habitat is a remnant of the time before sedimentation impacted the area. In the southern portion of Los Peñasquitos Lagoon, much of this remnant habitat is non-tidal, persisting on rainfall and run-off, and has been invaded by weedy, non-native species such as Italian ryegrass (*Festuca perennis*), Turkish wheatgrass (*Elytrigia pontica*), annual beardgrass (*Polypogon monspeliensis*), and bristly ox-tongue (*Helminthotheca echioides*). As such, the function of this typically productive habitat has been compromised.

Salt Panne

Salt panne habitat can be described as a basin or small depression that traps saline waters during the highest spring tides and rainfall during wet periods. During the summer months, the water in these basins rapidly evaporates, resulting in hypersaline soils devoid of vegetation. During the winter, the pannes hold water and support algae and aquatic insects (Zedler et al. 1992). Typically, salt pannes hold water only for a short period each year. Consequently, the productivity and complexity of the communities associated with this habitat are not well understood (Zedler et al. 1992). Salt panne habitat in the Lagoon was historically most prevalent in the eastern portion of the Lagoon (**Figure 3-9**). Today, portions of the former salt panne habitat have been elevated above tidal influence by sediment deposition associated with Carmel Creek and no longer impounds seasonal rainfall. The area has been invaded by freshwater marsh and riparian species and has succeeded primarily to cattail (*Typha* sp.) dominated freshwater marsh and southern willow scrub habitat.

Coastal Brackish Marsh

Coastal brackish marsh is a vegetation community dominated by perennial, emergent herbaceous monocots approximately 2 meters in height (Holland 1986). Vegetative ground cover is often complete and dense. This vegetation community is intermediate between to coastal salt marsh and freshwater marsh with some plants characteristic of each.

Historically, much of the area in the Lagoon currently designated as brackish marsh was coastal salt marsh (Section 3.2.6). However, increased freshwater inflows have created brackish conditions in these areas, allowing for the colonization of freshwater marsh plants and invasive weed species. Plant species observed in the project area included Pacific pickleweed, Parish's pickleweed (*Arthrocnemum. subterminale*), Olney's bulrush (*Schoenoplectus americanus*), narrow-leaved cattail (*Typha angustifolia*), cocklebur (*Xanthium strumarium*), curly dock (*Rumex crispex*), annual beard grass, and yerba manza (*Anemopsis californica*).

Riparian Habitats

Much of the acreage of riparian habitats is fairly new to Los Peñasquitos Lagoon resulting from recent (since the 1970s) anthropogenic inputs of freshwater and sediment. These habitats occur in areas that formerly supported non-tidal salt marsh, brackish marsh, and salt panne habitats.

Southern Willow Scrub

Most of the tree-dominated riparian vegetation is best described as southern willow scrub or southern arroyo willow riparian forest. This vegetation is mainly composed of arroyo willow (*Salix lasiolepis*) but also supports smaller patches of taller-statured species including red willow (*Salix laevigata*), black willow (*Salix goodingii*), and western sycamore (*Platanus racemosa*). The understory of this vegetation is variable based on exposure to sedimentation and freshwater storm flows. Understory areas subject to sedimentation and scouring are heavily infested with non-native invasive plants including giant reed (*Arundo donax*), Cape Ivy (*Delairea odorata*), pampas grass (*Cortedaria selloana*), Castor bean (*Ricinus comunis*), hoary cress (*Lepidium draba*), periwinkle (*Vinca major*), and others.

Mule-fat Scrub

Mule-fat scrub is a depauperate (not well developed), tall herbaceous riparian scrub strongly dominated by mule-fat (*Baccharis salicifolia*; Holland 1986). This early seral community is maintained by frequent flooding and is rapidly colonizing brackish marsh habitats within the Lagoon below the confluence of Los Peñasquitos Creek and Carroll Canyon Creek. Alkalai heath and San Diego marsh elder (*Iva hayesiana*) are common within the understories of new colonies of mule-fat scrub.

There are currently approximately 110 acres of these riparian habitats within the Lagoon (Smith 2009). Other species typically observed in this vegetation community include arrow weed (*Pluchea sericea)*, coyote bush (*Bacharris pilularis*), Canadian horseweed (*Erigeron canadensis*), and cattail (*Typha* sp.).

Coastal Freshwater Marsh

Coastal freshwater marsh is dominated by perennial, emergent monocots 4 to 5 meters tall, often forming completely closed canopies (Holland 1986). Plant species characteristic of this community include cattails and viscid bulrush (*Scirpus acutus = Schoenoplectus acutus*). Like southern willow scrub, freshwater marsh was historically confined to freshwater riparian areas upstream of Los Peñasquitos Lagoon. This vegetation community, however, has also been affected by freshwater inflows and is no longer confined to the river channels but occurs where the freshwater sheet flows in the southern and eastern portions of the Lagoon. In the Lagoon, coastal freshwater marsh is dominated by cattail (or bulrushes (for example, viscid bulrush, California bulrush (*Schoenoplectus californicus*), and Olney's bulrush (*Schoenoplectus americanus*). In addition to extending the range of this vegetation community within the Lagoon, freshwater inflows, sedimentation, and other disturbances have resulted in the colonization of exotic plant species with Italian rye grass being prevalent. As a result, coastal freshwater marsh can be currently described as disturbed. Exotic plant species observed in this habitat type also include water iris (*Iris pseudacorus*), annual sweet clover (*Melilotus indicus*), and curly dock.

Transitional Habitat

Although not a Holland category, the term transitional habitat has been used by numerous wetland biologists to describe areas that support high elevation coastal salt marsh elements and upland plant species. Typically, this habitat type occurs as a narrow band where upland habitats and wetland habitats overlap (Zedler et al. 1992).

At Los Peñasquitos Lagoon, transitional habitat occurs primarily in fragment patches in the extreme northwestern portion. Additional transition zone habitat occurs in the south-central part of the Lagoon in association with man-made structures such as berms and dikes. Eleven taxa were recorded in transition zone habitats during annual vegetation monitoring of the Lagoon, ten to species and one to genus (Crooks et al. 2014). All plants identified to species level were native. Dominants included coast goldenbush (*Isocoma menziesii*) and grannies hairnet (*Pterostegia drymarioides*).

Non-Native Grassland

Non-native grassland is described as a dense to sparse cover of annual grasses with flowering culms 0.2-0.5 meters high. Germination occurs with the onset of the late fall rains; growth, flowering, and seed-set occur from winter through spring (Holland 1986). In Los Peñasquitos Lagoon, non-native grassland is used to describe areas that once supported high elevation salt marsh habitat that, as a result of sedimentation and freshwater flows, are now dominated by non-native grasses. Sparsely distributed salt marsh elements, such as Pacific pickleweed and alkali heath, were also observed; however, non-native grasses were the dominant species. Plant species observed in this vegetation community included mainly Italian rye grass. In transition zones or areas subject to former disturbance or heavy sedimentation, ripgut grass (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), foxtail chess (*Bromus madritensis* ssp. *rubens*), are also present. Some of the areas dominated by Italian ryegrass also support low abundances of Parish's pickleweed, alkali heath, and other salt marsh species.

Disturbed Upland Habitat

Disturbed upland habitat is described as areas that are recovering from agricultural practices, fire, or other disturbances. These areas are dominated by ruderal, non-native forbs, or sparse native shrub species, including spreading goldenbush and coyote bush (*Baccharis pilularis*). The disturbed uplands occur mostly upstream of the tidal areas, mostly within Sorrento Valley in between developments, highway overpasses, and the adjacent Flintkote Avenue.

4.6.2 Wildlife

Despite the impacts of extended inlet closures at the Lagoon, sedimentation, and increased freshwater inflows, faunal resources of Los Peñasquitos Lagoon are both diverse and abundant. Although many studies of the Lagoon focus on birds, numerous species of mammal, reptiles, amphibians, and invertebrates inhabit the Lagoon, as presented and in the following pages.

Mammals

The presence of medium to large mammal species in Los Peñasquitos Lagoon was documented during a 2-year period of focused surveys conducted by K. Crooks (Crooks 2002). In addition, observations by Hubbs et al. (1991) were consulted for a number of faunal taxa.

Crooks used four standard sampling techniques to estimate the distribution, relative abundance, movement patterns, and potential wildlife corridors used by medium to large mammals visiting the lagoon. These included: (1) scat transect surveys; (2) track counts of animals attracted to scent lures, also along transects; (3) remotely triggered cameras located at track stations; and (4) questionnaires distributed to residents in the area. Five areas were surveyed, including the main reserve, the Torrey Pines Natural Reserve Extension, Los Peñasquitos Lagoon, Crest Canyon, and the Sorrento Valley corridor.

Track and scat surveys revealed similar trends and correlated well to questionnaires. Scat evidence of coyote (*Canis latrans*) visitation was by far the most abundant, followed by bobcat (*Lynx rufus*) and fox (*Urocyron* sp.). Evidence of mesopredator visitation was also abundant with striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginianus*), raccoon (*Procyon lotor*), domestic dog (*Canis familiaris*), and domestic cat (*Felis catus*) common.

Hubbs et al. (1991) adds observations of mule deer (*Odocoileus hemionus*) tracks in the southern part of the Lagoon as an additional large mammal and notes numerous small mammals typical of regional coastal wetlands. These include ornate shrew (*Sorex ornatus*), western harvest mouse (*Reithrodontomys raviventris*), deer mouse (*Peromyscus maniculatus*), California vole (*Microtus californicus*), San Diego pocket mouse (*Chaetodipus fallax fallax*), house mouse (*Mus musculus*), California ground squirrel (*Spermophilus beecheyi)*, and desert cottontail (*Sylvilagus audubonii*), among others. California vole, ornate shrew, and gray shrew (*Notiosorex crawfordi*) were among the numerically dominant species inadvertently captured in pitfall trap arrays during herpetofaunal surveys of the Lagoon (see the subsection on Reptiles and Amphibians on page 4-32).

The presence of feral cats and dogs in the project vicinity has had a negative effect on native fauna. Feral cats are known to hunt reptiles, small mammals, and bird species. Although efforts to remove these species from the area continue year-round, feral cats and dogs remain a problem.

Avifauna

The avifauna of Los Peñasquitos Lagoon is diverse, exhibiting temporal and spatial variation in their abundance, distribution, and activity. Crooks (2002) summarized 17 avifauna surveys between 1969 and 1997, including TPSNR monthly bird counts conducted between 1983 and 1994. More than 164 bird species were documented in the Lagoon in a 1984 study conducted for the Los Peñasquitos Lagoon Management Plan (Copper and Webster 1984, as cited in Crooks 2002). This diversity in bird species can be attributed to the availability of a variety of habitats, including salt marsh, brackish marsh, intertidal mudflats, coastal scrub, dunes, and riparian habitats. Weedy areas that are of lower biological value than native communities also provide foraging grounds for several species of raptor.

Los Peñasquitos Lagoon is an important stop along the Pacific Flyway, a migratory route used by birds traveling between breeding sites in Arctic and sub-Arctic regions and southern wintering sites. Along this flyway, the Lagoon serves as a foraging and resting area. Although many birds continue to travel south during the late summer and fall months, many shorebird, water fowl, passerines, and raptor species winter at Los Peñasquitos Lagoon and other regional lagoons and estuaries.

Currently there are five listed bird species that inhabit Los Peñasquitos Lagoon and adjacent uplands. These include the federally- and state-listed endangered light-footed Ridgway's rail (*Rallus obsoletus levipes*), and least Bell's vireo (*Vireo bellii pusillus*); the federally-listed threatened western snowy plover (*Charadrius alexandrinus nivosus*) and coastal California gnatcatcher (*Polioptila californica californica*); and the state-listed endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). With the exception of the gnatcatcher, which nests in upland habitats, including southern maritime chaparral and coastal sage scrub, the remaining species feed and nest within the Lagoon habitats. The status of each of these species is presented in Section 4.6.3 Sensitive Species and **Table 4-10**.

Historically, Los Peñasquitos Lagoon provided nesting habitat for federally listed endangered California least tern (*Sterna antillarum browni*) in the western reaches of the Lagoon near the North Beach parking lot and along the western edge of the 1888 railway berm (Copper and Webster 1984). However, this species has not been observed nesting in the Lagoon since the 1980s because of human disturbance, predation of fledglings, and encroachment of vegetation over open areas that served as viable nesting sites (Coppock 1985, Copper and Webster 1984). California brown pelican (*Pelecanus occidentalis*) is a frequent visitor to Los Peñasquitos Lagoon, using exposed sand bars and beach within the Lagoon's inlet area to rest between feedings offshore of Torrey Pines State Beach. While this species was previously federally-listed as threatened, it was delisted by the U.S. Fish and Wildlife Service in 2009 and, therefore, is not included as listed species in this section.

Reptiles and Amphibians

Focused surveys for reptiles and amphibians were conducted in 1995–1997 to collect baseline data for management of the TPSNR (Fisher and Case 1997, as cited in Crooks 2002). The Reserve was divided into three areas for sampling: Broken Hills, Lagoon/Guy Fleming Trail/Parry Grove, and the Extension. Thirty-five sites were sampled for the presence of reptiles and amphibians using arrays of seven 5-gallon buckets as pitfall traps connected by drift fencing to funnel the organisms into the pitfall traps. Trapping was conducted for 10 consecutive days every 6 weeks for a total of 50 to 60 days/year distributed evenly across all seasons.

Twenty-one species and over 1,500 specimens representing 10 families were collected over the 2-year period. The majority of these were collected in upland habitats adjacent to Los Peñasquitos Lagoon; however, three species were collected at the Lagoon that were not collected elsewhere. These included western toad (*Bufo boreas),* western yellow-bellied racer (*Colubur constrictor*), and two-striped garter snake (*Thamnophis hammondii*). Other species that were collected at the Lagoon station included orange-throated whiptail (*Cnemidophorus hyperythrus*), Coronado skink (*Eumeces skiltonianus interparietalis),* California legless lizard (*Anniella pulchra*), San Diego ring-necked snake (*Diadophis punctatus*), and coastal western whiptail (*Cnemidophorus tigris multiscutatus*). Although not captured in pitfall traps, the red diamond rattlesnake (*Crotalus ruber*) was observed in the Lagoon near the Marsh Trail and in cattail stands near the base of Carmel Creek.

Data on reptiles and amphibians associated with freshwater habitats in the eastern end of Los Peñasquitos Lagoon were not recorded as no pitfall arrays were located there. The authors speculated that two additional species could occur there: Pacific pond turtle (*Clemmys marmorata*) and western spadefoot toad (*Scaphiopus hammondii*).

As the surveys focused on pitfall trapping and not on vocalizations, it is likely that some common amphibian species were missed. It is likely that California tree frog (*Pseudacris* (*Hyla*) *cadaverina*) and Pacific chorus frog (*Pseudacris* (*Hyla*) *regilla*) occur in the freshwater marshes of the Lagoon.

Sensitive reptile species observed within the Lagoon include Federal Species of Concern and California Special Concern Species California legless lizard, and California Special Concern Species Coronado skink, orange-throated whiptail, two-striped garter snake, and red diamond rattlesnake. The status of each of these species is presented in Section 4.6.3, Sensitive Species.

Fish

Fish are an essential part of the wetland food chain because of their role in nutrient cycling and because, as prey items, they have the potential to transfer energy from a marine environment to a terrestrial environment. This is especially important at Los Peñasquitos Lagoon, where fish are prey to endangered birds such as the California least tern and the light-footed Ridgway's rail.

Because of its history of periodic inlet closures and sewage spills, the fish assemblage at the Lagoon fluctuated in terms of diversity and relative abundance. Inlet closure during warm periods led to rapid deterioration of water quality and resulted in mortality of fishes, sometimes on a massive scale. Once the inlet opened naturally or was opened mechanically, fish eggs, larvae, juveniles, and adults recruited from the shallow nearshore habitat and prospered in the Lagoon until the inlet closed again. With inlet management by LPLF, fish populations have become more stabilized. Sewage spills in the Lagoon have also contributed to periodic large-scale fish kills as DO quickly dropped to toxic levels. The most recent occurrence happened on September 9, 2011, during a region-wide power failure that resulted in an estimated 2.3 million gallons of raw sewage discharged just upstream of the Lagoon; widespread fish kills were documented by CSP and the San Diego Coastkeeper.

Shortly after the completion of the 1985 Lagoon Enhancement Plan and inlet maintenance by LPLF, a 2-year study of the Lagoon's fish and invertebrate populations was undertaken by scientists at the Pacific Estuarine Research Laboratory (PERL). From June 1987 to March 1989, quarterly surveys were conducted at three stations representing a spatial continuum from the tidal inlet to the tidal creeks in the eastern end of Los Peñasquitos Lagoon. These stations were sampled using beach seines and blocking nets (Nordby and Zedler 1991). During this period, sewage spills on the order of 20 million gallons occurred as pump stations failed to convey sewage to the Point Loma treatment facility. In addition, there were floods during the wet seasons of 1986, 1987, and 1988 that impacted the Lagoon in many ways, including the diversity and densities of channel organisms. Nordby and Zedler (1991) addressed the impacts of these disturbances on the channel biota.

During the 2-year period (1987–1989), 13 species of fish from 10 families were collected from Los Peñasquitos Lagoon (**Table 4-8**). Numerically dominant species included topsmelt (*Atherinops affinis*; 36% of total), mosquitofish (*Gambusia affinis*; 18%); longjaw mudsucker (*Gillichthys mirabilis*; 17%) and arrow goby (*Clevelandia ios*; 16%). Other noteworthy species included California halibut (*Paralichthys californicus*), although numbers were low (n = 12). The high numbers of mosquitofish collected are indicative of the degree of freshwater intrusion into the Lagoon and were most likely introduced to the Lagoon to control mosquito populations. Over the 2-year period, fish densities peaked in spring and summer and crashed each year to near zero each winter as a result of floods.

Irregular sampling of the fishes of Los Peñasquitos Lagoon has been conducted since 1990 by scientists at PERL and later by TRNERR using similar methods. Despite the variation inherent in such sampling, species composition for the most part remained similar to that encountered during the period reported by Nordby and Zedler. Occasionally, a new species will appear during one year and then quickly disappear. The most recent survey was completed in September 2013 and collected 11 species. The numerically dominant species included topsmelt (70%), deepbody anchovy (13.5%), and opaleye (*Girella nigricans*; 9%), taken at the station closest to the ocean. Yellowfin goby (*Acanthogobius flavimanus*), an invasive, non-native species, was collected for the first time in 1993 and was present during most subsequent surveys. It was not collected in September 2013.

Between the years 1986 and 2006, 28 species of fish were recorded at Los Peñasquitos Lagoon based on regular sampling (Crooks et al. 2006). Ten of those occurred in only one year.

TABLE 4-8
FISH COLLECTED AT LOS PEÑASQUITOS LAGOON, 1987 -1989

Family	Scientific Name	Common Name	Number Collected
Atherinidae	*Atherinops affinis*	topsmelt	1,875
Bothidae	*Paralichthys californicus*	California halibut	12
Cottidae	*Leptocottus armatus*	staghorn sculpin	346
Cyprinodontidae	*Fundulus pavipinnis*	California killifish	107
Engraulidae	*Anchoa compressa*	deepbody anchovy	67
Gobiidae	*Clevelandia ios*	arrow goby	816
Gobiidae	*Gillichthys mirabilis*	longjaw mudsucker	877
Gobiidae	*Ilypnus gilberti*	cheekspot goby	22
Gobiidae	*Lepidogobius lepidus*	bay goby	9
Mugilidae	*Mugil cephalus*	striped mullet	3
Pleuronectidae	*Hypsopsetta guttulata*	diamond turbot	14
Poeciliidae	*Gambusia affinis*	mosquitofish	937
Syngnathidae	*Syngnathus leptorhynchus*	bay pipefish	2
Total			**5,087**

Benthic Invertebrates

Much like fish, benthic invertebrates are essential to wetlands because of their role in nutrient cycling and because, as prey items, they also have the potential to transfer energy from a marine environment to a terrestrial environment. They are especially important prey items for migratory and resident shorebirds.

Nordby and Zedler (1991) collected macrobenthic invertebrates quarterly from three stations in Los Peñasquitos Lagoon between 1987 and 1989. Invertebrates were collected using a 15-cm-diameter coring device pressed into the sediment to a depth of 20 cm and sieved through a 1-mm mesh screen. Polychaetes were the numerically dominant taxa with 1,207 individuals collected representing 11 families and 20 species. Polychaetes of the species *Baccardia* and *Polydura* made up the majority of those collected.

Twelve species of bivalve molluscs were collected at low numbers. Only 95 individuals were collected. The numerically dominant was the California jackknife clam (*Tagelus californianus*; 42%), followed by an unidentified species of surf clam (*Spisula* sp; 18%).

The authors concluded that the macrobenthic assemblage at the Lagoon was dominated by species that can survive salinity shock and very low levels of DO, are easily reintroduced during brief periods of inlet opening, or are introduced from freshwater inflows.

The most recent survey of benthic invertebrates was conducted by TRNERR in 2014. Only one station was sampled by corer and it was dominated by California jackknife clam. Additional invertebrate taxa were collected during fish collecting activities, including seines and enclosure nets. Invertebrates collected included yellow shore crab (*Hemigrapsus oregonensis),* striped shore crab (*Pachygrapsus crassipes*), Xantus' swimming crab (*Portunus xantusii*), California green shrimp (*Hyppolyte californiensis*), western mud snail (*Nassarius tegula*), and bubble snail (*Bulla gouldiana*). Invasive species detected in the Lagoon include include *Palaemon macrodactylus* (oriental shrimp), *Musculista senhousei* (Asian mussel), and, more recently, *Crassostrea gigas* (Pacific oysters), whose presence has grown rapidly within the last few years.

Insects and Arthropods

Insects serve as an important source of prey, pollinators to plants, and predators that aid in the management of potentially detrimental species (Atkins 1971; Daly 1978). They can also transmit disease and be a nuisance to humans and other animals. Los Peñasquitos Lagoon has been a chronic source of potentially disease-transmitting populations of mosquitoes, including populations of *Culex tarsalis*, *C. pipiens*, and *C. peus*, among others (See Chapter 5). These species are known vectors for equine encephalitis and are potential vectors for West Nile Virus (WNV). In addition, large populations of day-biting mosquitoes of the genus *Aedes* intermittently hatch from the Lagoon and become a serious nuisance (Los Peñasquitos Lagoon Enhancement Plan and Program 1985). Historically, biting midges have emerged from Los Peñasquitos Lagoon in association with poor water quality as a result of inlet closure and these also become a serious nuisance for people living in the area.

One taxa of insect wandering skipper (*Panoquina errans*)) that occurs in the Lagoon is considered threatened by the International Union for Conservation of Nature (IUCN) and occurs on that organization's red list of globally threatened species. The status of this species is discussed in further detail in the next subsection, Sensitive Species.

4.6.3 Sensitive Species

Sensitive species are those that have been listed as such by federal or state resource agencies, or by special interest groups such as the California Native Plant Society (CNPS). At least 49 sensitive species are known to occur within Los Peñasquitos Lagoon and adjacent uplands. These include 35 plants, 1 insect, 6 reptiles, and 5 birds.

Sensitive Plant Species

Sensitive plant species that have been observed in the Lagoon and adjacent uplands are summarized in **Table 4-9**. The majority of these occur in upland habitats or at the wetland/upland transition. Most are considered rare, threatened, or endangered by the CNPS; however, three upland species are federally listed as endangered.

Sensitive Wildlife

Listed animal species currently present in Los Peñasquitos Lagoon are provided in **Table 4-10**. All of the reptile species are listed as California Species of Special Concern. Bird species are either federally listed threatened and endangered, or state-listed endangered and California Species of Special Concern.

TABLE 4-9
SENSITIVE PLANT SPECIES IN LOS PEÑASQUITOS LAGOON AND ADJACENT UPLANDS

U = Wet/Upland Transition. L = Lagoon/Dunes	**Species Name** RE = Rare & Endangered Classification 1B = Plants Rare, Threatened or Endangered in CA and elsewhere 2 = Plants Rare, Threatened or Endangered in CA but more common elsewhere 4 = Plants of Limited Distribution – a Watch List	**Common Name**
1U	*Chaenactis glabriuscula* var. *orcuttiana* (RE–1B)	Orcutt's Pincushion
2U	*Coreopsis maritima* (RE-2)	Sea Dahlia
3U	*Erysimum suffrutescens*	Island Wallflower
4U	*Lepidium virginicum* var. *robinsonii* (RE-1B)	Robinson's Peppergrass
5U	*Ferocactus viridescens* (RE-2)	Coast Barrel Cactus
6U	*Atriplex pacifica* (RE-1B)	South Coast Saltscale
7U	*Dichondra occidentalis* (RE-4)	Ponyfoot, Western Dichondra
8U	*Quercus dumosa* (RE-1B)	Nuttall's Scrub Oak
9U	*Pinus torreyana* (RE-1B)	Torrey Pine
10U	*Chorizanthe procumbens* (RE-4)	Spine-Flower
11U	*Mucronea californica* (*Chorizanthe californica*) (RE-4)	California Spine-Flower
12U	*Calandrinia maritima* (RE-4)	Seaside Red Maids
13U	*Ceanothus verrucosus* (RE-2)	Wart-stemmed Ceanothus
14L	*Artemisia palmeri* (RE-2)	Palmer Sagewort
15L	*Iva hayesiana* (RE-2)	San Diego Marsh-Elder
16L	*Lasthenia glabrata* ssp. *coulteri* (RE-1B)	Coulter's Salt Marsh Daisy
17L	*Suaeda esteroa* (S. californica) (RE-1B)	California Sea-Blite
18L	*Suaeda taxifolia* (RE-4)	Woolly Sea-Blite
19L	*Acmispon prostratus* (formerly *Lotus nuttallianus*) (RE-1B)	Nuttal's Acmispon (formerly Nuttall's Lotus)
20L *	*Phacelia stellaris* (RE-1B)	Brand's Phacelia
21L	*Abronia maritima* (RE-4)	Red Sand-Verbena
22L	*Nemacaulis denudata* var. *denudata* (RE-1B)	Coast Wooly-Heads
23U**	*Berberis nevinii* (RE-1B)	Nevin's Barberry
24U	*Bergerocactus emoryi* (RE-2)	Golden-Club Cactus
25U	*Aphanisma blitoides* (RE-1B)	Aphanisma
26U	*Dudleya blochmaniae* ssp. *brevifolia* (RE-1B)	Short-Leaved Dudlyea
27U	*Dudleya variegata* (RE-1B)	Variegated Dudlyea
28U **	*Arctostaphylos glandulosa* ssp. *crassifolia* (RE-1B)	Del Mar Manzanita
29U	*Comarostaphylis diversifolia* ssp. *diversifolia* (RE-1B)	Summer-Holly
30U	*Agave shawii* (RE-2)	Shaw's Agave
31U	*Muilla clevelandii* (RE-1B)	San Diego Goldenstar
32U	*Orobanche parishii* ssp. *brachyloba* (RE-4)	Short-Lobed Broomrape
33U **	*Chorizanthe orcuttiana* (RE-1B)	Orcutt's Spineflower
34U	*Chorizanthe polygonoides* ssp. *longispina* (RE-1B)	Long-Spined Spineflower
35U	*Myosurus minimus* ssp. *apus* (RE-3)	Little Mousetail

* Candidate for Federal Listing
** Federally Endangered

TABLE 4-10
SENSITIVE WILDLIFE SPECIES IN LOS PEÑASQUITOS LAGOON AND ADJACENT UPLANDS

Species	Status	Habitat	Distribution at Los Peñasquitos Lagoon
Reptiles			
Orangethroat whiptail (*Aspidoscelis hyperythra*)	Federal Status: None State Status: Species of Special Concern	Coastal scrub, chaparral, sandy areas with brush and rocks for cover.	Observed in lagoon and adjacent uplands.
Northern red diamond rattlesnake (*Crotalus ruber ruber*)	Federal Status: Threatened State Status: Species of Special Concern	Chaparral, woodland, grassland, desert areas with rocky areas and dense vegetation.	Observed in lagoon. Probable in adjacent uplands.
Coronado Island skink (*Plestiodon skiltonianus interpareitalis*)	Federal Status: None State Status: Species of Special Concern	Grassland, chaparral, pinyon-juniper woodland, juniper sage woodland, pine-oak and pine forests.	Observed in lagoon and adjacent uplands.
Coast horned lizard (*Phrynosom blainvillii)*	Federal Status: Endangered State Status: Species of Special Concern	Lowlands along sandy washes with scattered bushes.	Observed in uplands; appropriate habitat does not occur on the project site.
Two-striped garter snake (*Thamnophis hammondii*)	Federal Status: None State Status: Species of Special Concern	In or near permanent freshwater; streams courses.	Not observed; appropriate habitat does not occur on the project site.
California legless lizard (*Anniella pulchra*),	Federal Status: None State Status: Species of Special Concern	In loose, sandy soils or leaf litter, typically in sand dunes along the coast.	Observed in lagoon.
Birds			
Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)	Federal Status: None State Status: Endangered	Nests in pickleweed in coastal salt marshes.	Observed in lagoon. Nests in lagoon.
Coastal cactus wren (*Campylorhynchus brunneicapillus sandiegensis*)	Federal Status: None State Status: Species of Special Concern	Coastal sage scrub.	One individual observed in adjacent uplands in 1984.
Coastal California gnatcatcher (*Polioptila californica californica*)	Federal Status: Threatened State Status: Species of Special Concern	Coastal sage scrub.	Observed and nests in adjacent uplands.
Light-footed Ridgway's rail (*Rallus onsoletus brevipes*) formerly referred to as Light-footed Clapper Rail (*Rallus longirostris levipes*)	Federal Status: Endangered State Status: Endangered	Coastal salt marshes and brackish marshes.	Observed in lagoon. Nests in lagoon.
California least tern (*Sturnula antillarum browni*)	Federal Status: Endangered State Status: Endangered	Sandy beaches, alkali flats, land fills, paved areas.	Observed in lagoon in 1980s. Does not nest in lagoon.
Western Snowy plover (*Charadrius alexandrinus nivosus*),	Federal status: Threatened State status: Species of Special Concern	Sandy dunes, salt pannes, mudflats.	Infrequent visitor to lagoon. Does not nest in lagoon.
Least Bell's vireo (*Viroe bellii pusillus)*	Federal Status: Endangered State Status: Endangered	Summer resident of riparian habitats near water.	Observed in lagoon. Does not nest in lagoon.
Insects			
Wandering skipper (*Panoquina errans*)	Federal Status: None State Status; None ICUN Status: Red List	High salt marsh with saltgrass as larval host plant.	Observed and breeds in lagoon.

Although observed in various habitats at Los Peñasquito Lagoon, coastal cactus wren, western snowy plover, California least tern, and least Bell's vireo do not currently nest there. Suitable breeding habitat exists for each of these species; however, human use of the beach and predation have discouraged nesting by terns and plovers and the salt panne habitat formerly used by terns as a nesting site has been elevated and converted to riparian habitats. The expansion of riparian habitats in the eastern and southern portions of the Lagoon have created habitat that appears suitable to nesting by least Bell's vireo. However, it is hypothesized that this habitat lacks the dense, low cover preferred by this species (R. Patton, pers. comm.), and that possible predation by crow that proliferate the area may be limiting the species presence in this area.

Crooks (2002) cite the western snowy plover as a once common visitor and infrequent nester in the mudflats/salt pannes and coastal sand dunes in and around Los Peñasquitos Lagoon. Nesting was documented in 1981 on the beach north of the Lagoon mouth (Copper and Webster 1984, as cited in Crooks et al. 1984). Unitt (2004) cites no record of nesting by this species at the Lagoon from 1997 to 2003. Ongoing surveys performed by CSP indicates that western snowy plover still frequent the Lagoon's inlet area for foraging, but nesting activities remain near the Lagoon's historic inlet location under the upper bridge along Highway 101.

Belding's savannah sparrow and light-footed Ridgway's rail are year-round residents of Los Peñasquitos Lagoon and breed within the wetland habitats. Both species are surveyed periodically, Ridgway's rails every year and savannah sparrows every 5 years. Thus, the population trends at the Lagoon are known and are reflective of the efforts to manage the Lagoon for these and other sensitive species with annual recruitment success of Belding's savannah sparrow being directly associated with an open inlet at the Lagoon (Zembal 2010).

Belding's savannah sparrow

- Federal Status: None
- State Status: Endangered

The Belding's savannah sparrow (*Passercullus sandwichensis beldingi*) is a member of the Emberizidae family. This small dark-brown songbird is heavily streaked, with distinctive black streaks on a white breast, back color tinged with olive green, and a yellow wash to the lores and face (Unitt 2004). A year-round resident of Southern California, the Belding's savannah sparrow nests and forages almost exclusively in the coastal salt marsh environment dominated by Pacific pickleweed. Nests are usually built in natural depressions in the ground and are concealed by overhanging vegetation. The decline of the Belding's savannah sparrow can be attributed to habitat loss resulting from the development of the Southern California coastline, competition with song sparrows (*Melospiza melodia*), and prolonged inlet closures during which nesting areas are inundated by rising water levels within the Lagoon due to continuous freshwater inputs from the watershed. Appropriate habitat for this species occurs throughout much of the Lagoon.

In a 2010 census of Southern California lagoons and estuaries (Zembal and Hoffman 2010), 101 territories representing breeding pairs were recorded at Los Peñasquitos Lagoon, down from

203 in 2006. The authors speculated that this decline was the result of inlet closure at the time of the survey and subsequent flooding of pickleweed-dominated marsh that provides nesting habitat.

Light-footed Ridgway's rail

- Federal status: Endangered
- State status: Endangered

Light-footed Ridgway's rails are known to nest in cordgrass-dominated low marsh habitat and forage at the edge of the salt marsh, mudflats, and tidal channels. The loss of cord grass and salt marsh habitat in Southern California has threatened this species with extinction. Despite management practices, the status of this species remains critical. It is believed that there are fewer than 600 individuals left in the wild.

The light-footed Ridgway's rail population of Los Peñasquitos Lagoon has been monitored annually since 1980. No rails were observed until 1988, when a single pair was documented (Zembal and Hoffman 2014). From 2006 through 2013, the number of breeding pairs varied from 7 to 12. In 2014, five pairs were recorded. The Lagoon has been the recipient of captive-bred Ridgway's rails during this time frame. It is assumed that most of the rails surveyed between 2006 and 2014 were either transplanted captive-bred birds or their offspring.

Many salt marsh restoration projects target creation of cordgrass-dominated marsh, the preferred breeding habitat of the light-footed Ridgeway's rail. A glimpse of successful salt marsh creation is provided by the Model Marsh. The Model Marsh was part of the first phase of the Tijuana Estuary Tidal Restoration Project (Entrix et al. 1991) and was constructed during the winter of 1999-2000. Five pairs of breeding Ridgeway's rails were detected in the 20-acre Model Marsh in fall 2004.

Wandering skipper

- Federal status: None
- State status: None

IUCN Red List

The wandering skipper (*Panoquina errans*) is a small butterfly that is under consideration as an IUCN-listed endangered species resulting from loss of coastal salt marsh habitat. It is found only along the coast of Southern California, Baja California, and northwestern mainland Mexico. The larval host plant for this species, saltgrass (*Distichlis spicata*) is found in the transitional habitats along the edge of the high marsh. Nectar sources include wild heliotrope (*Heliotropium* spp.), Pacific pickleweed, sea lavender, and alkali heath.

Thirty-nine individual wandering skippers were observed in a focused survey of Los Peñasquitos Lagoon in August 2010 (Greer and Roeland 2010). Two methods were used to estimate the population of wandering skipper at the Lagoon in 2013. These included the "distance method" and mark-recapture method (Greer and McCutcheon 2013). The distance method indicated that population in the 3.86-acre study area located east of the North Beach parking lot was 451 individuals with a 95% confidence interval of 419 to 485 individuals. The mark-recapture method indicated an average population of 658 individuals.

4.7 Public Access

Public access within and around Los Peñasquitos Lagoon is primarily managed by CSP as part of the TPSNR, with additional access along Lagoon boundaries provided by Caltrans and the cities of Del Mar and San Diego.

Vehicular access to Los Peñasquitos Lagoon is provided via I-5, SR-56 or Highway 101 (North Torrey Pines Road), and then along Carmel Valley Road, Sorrento Valley Road, or Roselle Street. Vehicular parking is provided for a fee within TPSNR at the North Beach and South Beach parking lots, with overlooking views of the Lagoon provided by a lot adjacent to the visitor center at the terminus of Torrey Pines Park Road. Additional free parking is provided along the western shoulder of Highway 101, at the Caltrans Park & Ride lot off Carmel Valley Road, at identified locations along both shoulders of Carmel Valley Road, at the end of Sorrento Valley Road, and along Roselle Street and Flintkote Avenue.

Bicycle access is provided as bike lanes along Highway 101, most of Carmel Valley Road, and most of Sorrento Valley Road. The portion of Sorrento Valley Road between Carmel Mountain Road and Carmel Valley Road is closed to vehicular traffic and used as a multi-use path. No bicycle access is allowed on any unpaved roads or trails within TPSNR.

Pedestrian access is provided along the western shoulder of Highway 101, along the beach frontage (Torrey Pines State Beach), along the shoulder of Carmel Valley Road, along the Sorrento Valley multi-use path, and along Flintkote Avenue, which provides access to the eastern portion of Los Peñasquitos Lagoon, CSP staff residence, and the Marsh Trail.

4.7.1 Highway 101

Constructed in 1932, Highway 101 runs north-south along the western edge of Los Peñasquitos Lagoon where it is referred to as North Torrey Pines Road. There are no pedestrian facilities along the eastern edge of the roadway and the undeveloped shoulder is too narrow before it drops off to the Lagoon to make any improvements, short of an elevated walkway. The bike lane provided along the eastern edge (north bound) provides an appropriate level of access. Along the western edge, the current configuration often places bicyclists and pedestrians in conflict with vehicles entering or leaving parking spaces, especially during peak days (e.g., the weekends, holidays). The bike lane runs within a few feet of the back of the parking stalls, giving very little warning to a cyclist when a vehicle backs out of a parking space. Pedestrians have to choose to walk either behind the parked cars or along the unimproved shoulder in front of the parked cars. Some pedestrians elect to walk along Torrey Pines State Beach, though access from Highway 101 can be difficult because of rip rap located along the edge of the eroded coastal bluff. The shoulder varies in width as a result of active erosion of the slope at the back of the beach and bluff failures, evidenced by broken pavement. Compounding the issue of public safety, vehicles often stop within the bike lane to wait for potential parking spots to open up or dart in from the right lane of

Highway 101. During peak use, vehicles attempting to enter the south lot often back up into the bike lane.

4.7.2 Carmel Valley Road

Carmel Valley Road runs along the northeastern edge of Los Peñasquitos Lagoon. Bike lanes are provided along both sides for most of the length, except for the stretch between Portofino Drive and Sorrento Valley Road in the southeast. A pedestrian sidewalk runs along the northeastern edge of Carmel Valley Road from Sorrento Valley Road, past McGonigle Road (with access to the North Beach parking lot), up to Via Mar Valle where it stops. There is no fully improved pedestrian access along the Lagoon edge of Carmel Valley Road. From Via Borga to Via Mar Valle (where free parallel parking is offered) a narrow (less than 4 feet) dirt path has been improved immediately adjacent to the curb. Outside of this area, only narrow user-created trails exist along the shoulder which is located within the City of San Diego's easement. It should be noted that this dirt path is not a dedicated trail within TPSNR and would most likely need to be included within the updated Trail Management Plan for TPSNR before additional trail improvements (e.g., fencing) could be implemented.

The northern portion of Los Peñasquitos Lagoon includes a 22.5-acre triangle of open space situated between the railroad, Carmel Valley Road, and the North Beach parking lot. This portion of the park slopes downward from Carmel Valley Road to the north and east and flattens out to the Lagoon along the rail line and entryway. There are currently no official paths through this portion of the park; however, user-generated trails originating at various points along Carmel Valley Road cross the area (**Figure 4-9**). These trails all converge at the Highway 101 bridge over the railroad tracks and are used as alternative access to the beach under the northern bridge span. A 1,600-foot portion of the trail extending from the North Beach parking lot to the railroad under-crossing appears to have been used as a vehicular access in the past. Exclusionary signs are posted at many of these trails, telling hikers to stay out of the wildlife area. The trails are frequently used as a shortcut to the beach for visitors who park for free along Carmel Valley Road or within the adjacent neighborhood rather than paying a fee in the North Beach parking lot. It should be noted that these dirt paths are not dedicated trails within TPSNR and would most likely need to be included within the updated Trail Management Plan for TPSNR before trail improvements could be implemented. However, CSP staff has indicated their preference to close these defacto trails and reroute pedestrian traffic to protect existing habitat.

Figure 4-9
Carmel Valley Road Improvement and Natural Restoration

4.7.3 Sorrento Valley Road

Sorrento Valley Road runs along the eastern edge of the Lagoon and is managed by the City of San Diego with a Caltrans easement where it borders I-5. Approximately one mile of the road is closed to vehicular traffic between the Caltrans Park and Ride lot near Carmel Valley Road and City of San Diego Pump Station 65 located just north of Carmel Mountain Road. This closure occurred in the 1990s, when Caltrans built an interchange between SR 56 and I-5. While the City of San Diego attempted to reopen it for vehicular traffic, this effort was abandoned due to pressure from the environmental community. In 1998, the closed section of Sorrento Valley Road was reopened for pedestrian and bike use only and in 2001 it was dedicated by the City as a Class I Multi-Use Path. South of Carmel Mountain Road, bike lanes and sidewalks are provided on both sides. Free parking is provided at the Caltrans Park & Ride lot and along Sorrento Valley Road, just north of the Carmel Mountain Road. The closed section of Sorrento Valley Road is currently under consideration for improvements by Caltrans as part of their Public Works Plan/Transportation Resource Enhancement Plan for the North Coast Corridor that extends from La Jolla to Oceanside.

4.7.4 Roselle Street / Flintkote Avenue

Roselle Street and Flintkote Avenue run north-south near the southeastern edge of Los Peñasquitos Lagoon and are connected by Estuary Way, which borders open space areas adjacent to TPSNR that includes a large parcel owned by the State Coastal Conservancy and managed by CSP. Because of the low volume of vehicular traffic on these streets, no formal bicycle facilities exist. Sidewalks exist on both sides of Roselle Street and then along the western edge of Flintkote Avenue. Free parking is provided along Roselle Street and Flintkote Avenue. Access for authorized vehicles into TPSNR from Flintkote Avenue is provided through a locked gate operated by CSP that can be circumvented by pedestrian and bike traffic. Access to the gate can be problematic following rain events, as it can be occluded by sediment deposition from natural drainages located just north of the General Atomics property. Flintkote Avenue is the primary access point to two CSP residences that are used by ranger and operations/maintenance staff. In 2015 a section of Flintkote Avenue was realigned upslope of its original location in a joint project between the San Diego Association of Governments, Caltrans, and CSP. This road also provides access to the southeastern trailhead for the Marsh Trail through a second gate located just northwest of the CSP residences.

4.7.5 Marsh Trail

The Marsh Trail is the only dedicated trail within Los Peñasquitos Lagoon and only pedestrian use is permitted. It currently runs a northwest-southeast route along the base of the hillside, immediately adjacent to and even with the intertidal marsh in areas. There is a quarter-mile loop at the northern end that is situated on a flat clearing that sits approximately 10 feet below road grade, which is reached by descending a steep embankment. The area sits 14 to 20 feet above the marsh plain and provides an excellent viewing location. At the eastern edge of the loop, the trail descends to the edge of the marsh as it proceeds to the southeast. Once along the marsh edge, the trail continues three quarters of a mile to the point at which it becomes pinched between a tidal channel and the railroad berm and a hillside spur. Continuing south from this point the trail gradually gains elevation and distance from the Lagoon's edge.

The Marsh Trail provides some unique views of Los Peñasquitos Lagoon and the cliffs of TPSNR. However, it does present some challenges with regard to protecting the Lagoon's habitats. This is especially true in the first mile south of the loop near Highway 101, where the trail follows the edge of salt marsh habitat. Along this segment, the trail drops below the current high tide line for the first thousand feet of trail. As result, sections of trail along this segment are often submerged during high tide and pedestrian traffic is diverted off-trail to upslope areas to circumvent areas of inundation or mud. Projected sea-level rise will only exacerbate this issue in future years.

Existing Trail Access

The north end of the Marsh Trail terminates on the east side of Highway 101 about 600 feet south of Torrey Pines Park Road (**Figure 4-10**), which provides access to the South Beach parking lot and continues on to the State Reserve Visitor Center and trailheads at the top of the bluffs. The South Beach parking lot is intended to be the primary departure point for users of the Marsh Trail. The entrance to the Marsh Trail is only a little over 100 feet from the South Beach parking lot; however, Highway 101 creates a wall of earth rising from 6 to over 20 feet high (Photo 2 on **Figure 4-10**), is four to six travel lanes wide with no pedestrian facilities to cross or walk along, and carries high-speed vehicular and bicycle traffic. On the east side of Highway 101, the trail immediately drops 12 feet from the road edge, down a steep embankment, to the loop trail (**Photo 1** on **Figure 4-10**). A trail marker is mounted toward the bottom of the embankment, concealing it from view for most visitors. Even with a map, the trail location is difficult to detect, let alone unsafe to access.

The south end of the Marsh Trail terminates at the CSP residences. While there are no signage or informational kiosks, a couple interpretive panels were installed at this location to inform trail users about the Lagoon's unique species. From there, public access is along the park road to the gate near Flintkote Avenue and Estuary Way.

Source: KTUA 2015

ESA

Los Peñasquitos Lagoon. D130136

Figure 4-10

Current Marsh Trail Access

4.7.6 Other Public Access Planning Efforts

There are a number of public access planning efforts that are proposed to traverse some portion of the Los Peñasquitos Lagoon study area, including:

- Trans-County Trail: The County of San Diego is leading an effort to create a 110-mile trail traversing San Diego County from the desert, over the mountains, and down valleys to the coastal bluffs.
- Sea to Sea Trail: The San Diego Sea to Sea Trail Foundation, in conjunction with nine government agencies, is creating a 140-mile walking, cycling, and horse riding trail, running from the Salton Sea to the Pacific Ocean.
- California Coastal Trail: In 1975 the California Coastal Plan, Policy 145, specifically called for the establishment of a Coastal Trail System: "A hiking, bicycle, and equestrian trails system shall be established along or near the coast… Ideally, the trails system should be continuous and located near the shoreline, but it may be necessary for some trail segments to be away from the oceanfront area to meet the objective of a continuous system."
- Coastal Rail Trail: The six coastal cities in San Diego County (Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar, and San Diego) along with the North San Diego County Transit Development Board, the Metropolitan Transit Development Board, the San Diego Association of Governments, and Caltrans are partnering to create a multi-use pathway within the San Diego Northern Railway right-of-way.

4.8 Cultural Resources

(Portions of the Cultural Resources section are taken from Mealey and Ruston 2010)

The Sorrento Valley and Los Peñasquitos Lagoon area is the site of the Kumeyaay Village of Ystagua (see Section 3.1.2 and Appendix H). The area is considered a Multiple Resource Area by the National Register of Historic Places Guidelines because of archaeological remnants that were found from Ystagua. The site has extensive middens and artifacts, and has burial sites with cremation remains that are of special concern to local Native Americans. Archaeological excavations conducted at Ystagua have yielded extensive grinding technology and faunal collections, which include 19 fish species (Noah 1998). Other pelagic fish found at this site indicate that residents of Ystagua ventured offshore to kelp beds off of Del Mar and, potentially, further out into open coastal waters.

4.9 Vectors

Los Peñasquitos Lagoon is a known location of mosquito breeding habitat within San Diego County (County) with documented cases of WNV in both avian and human populations. Human-caused impacts to the Lagoon (see Chapter 3) have resulted in increased mosquito breeding habitat, which have been a nuisance to nearby communities for several decades.

The County's Department of Environmental Health has attempted to control mosquito populations and breeding habitat within the Lagoon through methods that include aerial spraying of larvicide over 70 acres in 2011 (SD County 2011). In 2012, LPLF submitted a grant application to the County of San Diego Vector Habitat Remediation Program (VHRP) to conduct a combined study and project that would address both the cause and manifestation of these impacts in accordance with the goal of the County's VHRP. This is discussed in more detail in Chapter 5.

CHAPTER 5
Vector Management

Vector management has been an ongoing issue at Los Peñasquitos Lagoon (the Lagoon) dating back to the 1985 Lagoon Enhancement Plan, with mosquitoes being the primary species of concern. This chapter begins with a brief summary of the historic and contemporary presence of mosquitoes in the Lagoon, focusing on those species that present the greatest risk to human populations with regard to transmission of viruses that can cause brain encephalitis in human hosts. Next, the chapter explores some of the key anthropogenic drivers that contribute to the presence, species type, and magnitude of the mosquito populations in the Lagoon. Recorded incidents of West Nile virus (WNV) within Los Peñasquitos Lagoon and vulnerabilities of surrounding communities are then discussed briefly, followed by a brief description of obstacles that complicate effective vector management within the Lagoon. Chapter 5 concludes with summarizing the nexus between effective vector management within Los Peñasquitos Lagoon and restoration/enhancement of the Lagoon with regard to the San Diego County Vector Habitat Remediation Program, San Diego County Department of Environmental Health's Wetland Design Guidelines for Vector Control, and Project Concepts developed in the updated Lagoon Enhancement Plan.

5.1 Background

5.1.1 Mosquito Populations in Los Peñasquitos Lagoon and Brain Encephalitis

Los Peñasquitos Lagoon is a known location of mosquitoes within San Diego County resulting from areas of stagnant, ponded water that provide ideal breeding habitat. During extended inlet closures, the populations of mosquitoes can explode exponentially as the entire Lagoon becomes viable for breeding in the absence of tidal circulation. While a nuisance to nearby communities and park visitors, several of the mosquito species found in Los Peñasquitos Lagoon also pose a threat to public health and safety because of their disease-transmitting capabilities. The 1985 Lagoon Enhancement plan identified populations of *Culex tarsalis* (*C. tarsalis*), *C. pipiens*, and *C. peus* as being common to the Lagoon, with large populations of day-biting mosquitoes of the genus *Aedes* occurring intermittently emerging from the Lagoon (Coppock 1985). Culex species were known vectors capable of transmitting Western Equine Encephalitis and St. Louis Encephalitis to both human and equine hosts. Attempts to control mosquitoes at Los Peñasquitos Lagoon included inlet maintenance to keep water conveyance and tidal mixing active in lagoon channels, as well as eliminating daily discharges of treated effluent that occurred on a daily basis between 1950 and 1972.

Currently, the San Diego County Department of Environmental Health (DEH) operates a vector management program with it primary species of concern being *C. tarsalis* due to its ability to spread Western Equine Encephalitis and WNV within a 2-mile radius of its preferred habitat. Originating in Uganda, WNV is a form of brain encephalitis that is relatively new to the San Diego region, making its first appearance in California in 2003 (DEH website http://www.sandiegocounty.gov/deh/pests/wnv.html). DEH has identified numerous, ongoing instances of WNV infections in avian populations within Los Peñasquitos Lagoon and currently maintains a population of sentinel chickens within the Lagoon. While not fatal to avian species, WNV can be transmitted to *C. tarsalis* and then transferred to human hosts. In 2008, two human cases of WNV occurring near Los Peñasquitos Lagoon were recorded by DEH staff, making management of this species at the Lagoon a priority within the County. While often misdiagnosed as the flu, WNV can be fatal to both the young and elderly in human populations, which DEH refers to as “sensitive receptors.” Even when not fatal, brain encephalitis can lead to lifelong neurologic disorders that can vary in symptomology and severity. More information related to brain encephalitis can be found at encephalitisglobal.org or through short video: Fighting Encephalitis (https://www.youtube.com/watch?v=g1oFPdzjyl8).

5.1.2 Anthropogenic Drivers for Vector Presence in Los Peñasquitos Lagoon

While Los Peñasquitos Lagoon’s natural environs provide habitat for mosquitoes, the presence, species type, and magnitude of the mosquito populations have been greatly influenced by human activities and development that have altered hydrologic processes and native habitats within both the watershed and the Lagoon. Daily inputs of freshwater from the watershed since 1995 have caused rapid expansion of brackish and freshwater habitats into the Lagoon, as discussed in Section 3.2.6 and Section 4.4.6. Rapid sedimentation within Los Peñasquitos Lagoon caused by development within the watershed has increased elevations within the marsh plain and transitional zones, precluding these areas from tidal inundation and creating additional areas for freshwater ponding. Sedimentation has also altered freshwater conveyance away from tidal channels at the base of Carmel Creek, resulting in an expanding area of constant freshwater inundation along old Sorrento Valley Road that extends southward to Pump Station 65. As described in Section 3.2, structural impediments (e.g., railway berm, Highway 101) also have greatly affected freshwater conveyance within the Lagoon’s channels, increasing drawdown times of flood waters impounded within the lagoon channels, greatly diminishing tidal circulation, and impairing the ability of the Lagoon to maintain an open inlet. As a result, *C. tarsalis* and other freshwater mosquitoes have become further established in Los Peñasquitos Lagoon and at greater concentrations due to the expansion of preferred breeding habitat and complications associated with on-site vector management.

5.1.3 Sensitive Receptors

As mentioned previously, *C. tarsalis* can infect human and other mammal hosts for up to a 2-mile radius from its core habitat areas. This exposes large human populations located within urban areas and that spend time in open space areas that border the Lagoon, such as the Torrey Pines State Natural Reserve (TPSNR), to the possibility of contracting WNV. Numerous sensitive receptors (elderly and children) can be present within 2 miles of Los Peñasquitos Lagoon in local communities and at other locations. In 2012 a survey performed by LPLF identified the following areas within 2 miles of the Lagoon that present a strong likelihood for ongoing or frequent presence of sensitive receptors:

- Bright Horizons Preschool and Kindergarten
- San Diego Jewish Academy
- San Raphael Daycare
- A Brighter Future Daycare
- After School Learning Trees
- Torrey Pines Montessori School
- Carmel Valley Creek Bike Path and Park
- Torrey Pines State Natural Reserve and Extension
- Carmel Del Mar Park

5.2 Vector Management & Lagoon Improvements

5.2.1 Vector Habitat Remediation Program

San Diego's DEH currently operates an integrated vector management program that combines public education/outreach, surveillance, control (e.g., larvicide applications) and the County of San Diego Vector Habitat Remediation Program (VHRP). VHRP looks to implement alternative approaches to manage vector species, with emphasis on *C. tarsalis*, to protect public health and safety from WNV. Activities funded under VHRP include direct and competitive grant programs to fund efforts such as improved water management and source control, vegetation removal to improve the effectiveness of larvicide applications, and restoration of native habitats that support vector management needs.

Between 2012 and 2013, the Los Peñasquitos Lagoon Foundation (LPLF) received funding for three separate projects through VHRP to integrate vector management needs specific to *C. tarsalis* at the Lagoon with the restoration and enhancement of Los Peñasquitos Lagoon's native salt marsh and improvement to hydrology. Components of the VHRP funded projects included the following:

- Baseline vegetation surveys and mapping of habitat delineations within the Lagoon to determine the extent of freshwater and brackish and salt marsh habitats.
- Improved monitoring to better characterize freshwater inputs, tidal mixing, and water quality parameters within the lagoon channels.
- Improved understanding of how inlet status (open, occluded, and closed) affects water quality parameters (e.g., dissolved oxygen, salinity) within the lagoon channels.
- Modeling of Los Peñasquitos Lagoon's baseline conditions and potential habitat trajectories while accounting for projected sea-level rise scenarios and watershed inputs to facilitate the

development, assessment, and evaluation of lagoon improvement concepts that include large-scale restoration of historical salt marsh.

- Development, assessment, evaluation, and selection of restoration concepts for the Lagoon that consider vector management needs at Los Peñasquitos Lagoon through the long-term.
- Completion of the updated Lagoon Enhancement Plan.

5.2.2 Nexus between Vector Management and Lagoon Improvements

The main nexus between improving vector management in Los Peñasquitos Lagoon and restoring its historic habitats is to modify hydrologic processes already impaired by urbanization and transportation infrastructure. Lagoon improvement concepts developed in Chapter 7 and evaluated in Chapter 11 of the updated Lagoon Enhancement Plan include measures and approaches to improve hydrology within the watershed and the Lagoon, while incorporating coastal processes that affect lagoon hydrodynamics through elements such as tidal range, shoaling, thermodynamics, and sea-level rise. Some of these measures and approaches are provided below.

Measures Considered

- Comprehensive management of freshwater and storm water inputs from the watershed through the integration of the updated Lagoon Enhancement Plan with the City of San Diego's Water Quality Improvement Plan for the watershed.
- Reducing areas of prolonged inundation and ponding of fresh and brackish water within Los Peñasquitos Lagoon's eastern basin.
- Facilitating drawdown times during flood events in a manner complementary to protecting and sustaining lagoon improvements (e.g., salt marsh restoration).
- Improved tidal circulation within Los Peñasquitos Lagoon's channels and inundation on the marsh plain.
- Avoidance of prolonged inlet closures with emphasis on summer months, when warmer temperatures make water quality more vulnerable to degradation and the potential for vector-borne brain encephalitis within Los Peñasquitos Lagoon is greater.

Approaches Considered

- Source identification and phased reduction of freshwater inputs during dry weather from the watershed and along lagoon boundaries through structural and non-structural Best Management Practices.
- Large-scale grading within Los Peñasquitos Lagoon's historic marsh plain to obtain elevation profiles conducive to tidal inundation in areas currently above tidal influence because of rapid sediment deposition from land use changes within the watershed.
- Channel modification with minor grading to improve connectivity between the watershed, the Lagoon, and the ocean needed to support improved tidal circulation and drawdown times of freshwater inputs during dry weather and following storm events.

- Channel modification to facilitate dewatering of ponded areas of brackish water along Old Sorrento Valley Road and at the base of Los Peñasquitos Lagoon's tributaries.
- Maintenance of the Lagoon's inlet area and tidal channels to restore and enhance circulation of tidal waters within lagoon channels and increase tidal prism.

5.2.3 Vector Management and the Updated Lagoon Enhancement Plan

Goals & Objectives

Vetted and refined through a public process, the goals and objectives of the updated Lagoon Enhancement Plan support key ecosystem services provided by Los Peñasquitos Lagoon within the context of habitat, public access, sustainability, and public safety. Public safety with regard to vector-borne illness is supported under Goal 4: *Consider public health when implementing the updated Enhancement Plan* and explicitly stated under Objective 3: *Reduce and, where possible, eliminate breeding and refuge habitat used by Culex tarsalis, the mosquito species identified as a transmitter of the West Nile Virus in San Diego County*.

Lagoon Improvement Concepts and Targeted Projects

The updated Lagoon Enhancement Plan integrates vector management improvements through both large-scale restoration of salt marsh habitat and projects targeted for specific areas of potential breeding habitat for *C. tarsalis* in Los Peñasquitos Lagoon identified by the County of San Diego's DEH. Large-scale restoration efforts will focus on the Lagoon's historic marsh plain (Zone 3) and will complement vector management by converting areas dominated by invasive, fresh, and brackish species to salt marsh and transitional habitats. The preferred restoration concept presented in Chapter 10 will also help abate the further advance of freshwater and brackish habitats by directing freshwater flows into the Lagoon's network of tidal channels. Targeted projects aim to reduce favorable breeding habitat for the *C. tarsalis* in areas outside of the large-scale restoration footprint, where freshwater ponds for extended periods or is stagnant due to muted tidal exchange. Targeted projects identified in Chapter 9 include dewatering of ponded water near Pump Station 65 (e.g., VCP Site 577) that is outside of tidal influence and enhancing tidal connectivity in areas where tidal circulation has been muted or cut off as a result of structural failures (e.g., VCP Site 626). Lagoon improvement concepts for large-scale restoration (Chapter 7) and projects that directly target vector habitat remediation (Chapter 9) are evaluated in Chapter 10 with regard to their ability to support Goal 4 and Objective 3 of the updated Lagoon Enhancement Plan.

Consistency with San Diego County Wetland Design Guidelines for Vector Control

Restoration and Public Health-Vector Habitat Remediation Concepts presented in Chapter 7 and Chapter 9 are consistent with the DEH's Wetland Design Guidelines for Vector Control with regard to managing natural wetlands, including wetland design, water management, and vegetation manipulation.

These concepts meet these guidelines through:

- Improvement in public health and safety with regard to reducing vulnerability to mosquitoes-borne encephalitis, which includes WNV, by reducing or eliminating standing freshwater within Los Peñasquitos Lagoon.
- Improving tidal mixing to facilitate diurnal flushing in the Lagoon's network of channels.
- Expediting outflows of freshwater from the watershed to the ocean and dewatering of areas of persistent inundation through channel improvements within Los Peñasquitos Lagoon.
- Restoration of salt marsh habitat in areas converted to freshwater and brackish habitats, which currently facilitate mosquito breeding, in the eastern portion of the Lagoon.
- Providing a watershed approach to wetland restoration that aims at reducing freshwater input through source control and diversion.
- Restoring the salt marsh ecology of Los Peñasquitos Lagoon in an efficient and cost-effective manner that is consistent with and complementary to the vector management efforts of the County's DEH.

CHAPTER 6

Stakeholder Participation through Public Workshops

Stakeholder participation played a key role in the development of the original Los Peñasquitos Lagoon Enhancement Plan and Program (Lagoon Enhancement Plan) certified in 1985, with Los Peñasquitos Lagoon Foundation (LPLF) leading several workshops that were open to the public. Conducted early in the planning process, these workshops provided an opportunity for interested groups, local residents, and other members of the public to express their concerns about the deteriorating health of Los Peñasquitos Lagoon (the Lagoon) to wetland scientists and decision makers from local municipalities and state agencies, including California State Parks (CSP) and State Coastal Conservancy (SCC) during the development of the 1985 Lagoon Enhancement Plan. The workshops also provided a forum where these stakeholder groups could work collaboratively to identify priority goals and objectives, as well as the management actions needed to support and sustain improvements to the Lagoon. This blueprint for success was used by LPLF for the Lagoon Enhancement Plan update that commenced in 2012.

Chapter 6 further describes the stakeholder-driven process highlighted Sub-Section 1.2 and includes justification for the strategy of improving and preserving Los Peñasquitos Lagoon through a public approach. Chapter 6 also provides more detail about the progression of the workshops that began in October 2012 with refinement of goals and objectives and concluded in March 2013 with a phased approach to improving the Lagoon using stakeholder-vetted criteria specific to habitat, public access and safety, and sustainability. An additional public workshop was held in April 2013 to explore potential funding opportunities for improvements to the Lagoon's habitats and public access in conjunction with regional transportation improvements planned by San Diego Association of Governments (SANDAG) North County Coastal Public Works Plan/Transportation Resource Enhancement Program. Participant input generated in all of the workshops was captured on flip charts, transcribed, and made available to the public on the Torrey Pines Association website at http://torreypines.org. A final workshop was held in March 2017 to present the draft Lagoon Enhancement Plan update and to provide an opportunity for stakeholder input on the Project Concepts for Phases I and II.

6.1 Improving and Preserving Los Peñasquitos Lagoon – A Public Approach

Understanding the importance of having a nexus between sound science and coastal stewardship, LPLF held six preliminary public workshops from October 20, 2012, to April 20, 2013, to invite stakeholder involvement and input early in the planning process for the Lagoon Enhancement

Plan update and to facilitate consensus building needed to support its future implementation in a sustainable manner. The workshops were designed to capture perspectives and priorities with regard to improvements to the Lagoon's habitats, public access, sustainability, and public safety issues related to vector-borne disease. Attendance to the workshops was open to the public, rather than just select individuals and representatives of key stakeholder groups. This was done in an attempt to capture the potentially broad range of perspectives and concerns of individuals and stakeholder groups with regard to the ecosystem services provided by Los Peñasquitos Lagoon based on how they interact with the Lagoon (e.g., passive recreation, wetland science, land management, public outreach, watershed planning, enforcement of public resource code, and management of transportation infrastructure and storm water conveyance systems). Ultimately, the workshops were successful in drawing input from various stakeholder groups, including local community members, interested individuals and groups (e.g., Torrey Pines Association, Torrey Pines Docents) active in the Torrey Pines State Natural Reserve (TPSNR), land owners, local municipalities, and regional planning authorities.

The workshops began through a progressive series of steps that began with a plenary session designed to set the context and justify the need for a Lagoon Enhancement Plan update using a watershed-based approach. Presentations were designed to inform workshop attendees about the current state of Los Peñasquitos Lagoon and how it evolved from a pristine coastal salt marsh to a managed system in an urban setting. Opportunities to integrate the Lagoon Enhancement Plan update with improvements planned for the watershed and along transportation corridors were also explored during the plenary session to allow workshop attendees to consider the need for a comprehensive approach to implement and sustain Lagoon improvements through the long-term and in a feasible manner. Following the plenary session, workshop participants were allowed to review and refine draft goals and objectives developed for the updated Lagoon Enhancement Plan as they worked collaboratively in breakout groups. Subsequent workshops allowed participants to identify, assess, and evaluate opportunities and constraints to meet these goals and objectives while considering the driving forces of environmental, economic, and social factors. Based on the stakeholder discussions and input, a phased approach to meeting the goals and objectives of the updated Lagoon Enhancement Plan was identified and further developed. Three phases were selected, with each phase corresponding to the timelines needed to plan, design, and implement opportunities juxtaposed against identified constraints and regulatory-driven goals. The workshops concluded with a defined set of activities and projects to be considered for implementation during each of the three phases that were used to develop and assess the Project Concepts presented in the updated Lagoon Enhancement Plan. The following sections provide a brief overview of each workshop and the outcomes of this stakeholder-driven process.

6.2 Progression of Public Workshops

6.2.1 Goals and Objectives – A Refinement through Public Input

Held on October 20, 2012, Workshop 1 began with a plenary session and poster presentation to establish the background, context, and need for the updated Lagoon Enhancement Plan using a watershed-based approach. Presentations were given by representatives from LPLF and the City of San Diego and included the following topics:

- The Marsh Preserve – Historical and Current Conditions
- In Context – Comprehensive Approach to Watershed Management
- Moving Forward – (Draft) Goals and Objectives for Los Peñasquitos Lagoon.

Following the plenary session, a poster presentation was provided to allow workshop participants to understand the Lagoon within the context of current vegetation associations and habitat delineations. Generated from contemporary, high-resolution aerial imagery and field investigations, vegetation association maps were provided for viewing. Participants were able to ask questions and have them answered by the Natural Resource Manager for the CSP South Coast District, who led the mapping effort.

Breakout groups were formed after the poster session to allow workshop participants a chance to review and critique proposed goals and objectives of the updated Lagoon Enhancement Plan. Breakout group participants were asked to provide comments regarding the comprehensive nature of the goals and objectives as well as whether the goals and objectives met their values and expectations regarding what the Los Peñasquitos Lagoon represents currently and what it could be in the future. Additional comments were also recorded to ensure that all of the participants' input was captured, including additional goals and objectives not previously considered.

To focus conversations, the breakout groups were organized by the three main themes present within the draft goals for the updated Lagoon Enhancement Plan. Participants were allowed to move freely between breakout groups based on their interest and preference. The three themes selected were:

- Habitat
- Public Access, Safety & Education/Cultural Resources
- Sustainability

The Habitat Workgroup focused on reviewing and critiquing the following set of goals drafted for the Lagoon Enhancement Plan update:

> **Goal 1.** Protect, restore, and enhance habitats and species native to Los Peñasquitos Lagoon and its uplands.
>
> **Goal 2.** Restore and maintain hydrologic and geomorphologic processes that support lagoon health, resiliency, and functionality as a coastal salt marsh.
>
> **Goal 3.** Ensure that water quality in the Lagoon and its tributaries supports natural resources, native habitats, and species endemic to Los Peñasquitos Lagoon and its associated uplands.
>
> **Goal 5.** Identify opportunities and constraints related to global climate change.
>
> **Goal 9.** Protect and promote the regional value of Los Peñasquitos Lagoon and its watershed.

The Public Access, Safety & Education/Cultural Resources Workgroup focused on reviewing and critiquing the following set of goals:

Goal 4. Consider public health and safety when implementing the updated plan.

Goal 6. Provide public education and outreach efforts, as well as improved coastal stewardship of lagoon and watershed resources.

Goal 7. Manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of California State Parks.

Goal 10. Protect biological, cultural, and paleontological resources found within Los Peñasquitos Lagoon and its uplands.

The Sustainability Workgroup focused on reviewing and critiquing the following set of goals:

Goal 5. Identify opportunities and constraints related to global climate change.

Goal 8. Identify potential funding sources for lagoon restoration, enhancement, and long-term maintenance while considering approaches that minimize long-term maintenance costs.

Goal 9. Protect and promote the regional value of Los Peñasquitos Lagoon and its watershed.

Goal 11. Strengthen the Los Peñasquitos Lagoon Foundation's capacity as a management entity and steward of coastal resources.

Box 6-1 provides the refined set of goals and objectives for the Lagoon Enhancement Plan update based on the input from each of the three breakout groups in Workshop 1. The new set of goals and objectives were then used in subsequent workshops to identify opportunities and constraints within the context of management zones and phased implementation of Lagoon improvements. Finally, the technical review and evaluation of Project Concepts presented in Chapter 10 were based in part on the ability to meet goals and objectives for Habitat; Public Access, Safety & Education/Cultural Resources; and Sustainability.

Box 6-1. Refined Goals and Objectives

VISION STATEMENT: To develop an updated Plan that helps to establish a coastal wetland that is a dynamic system capable of being resilient, self-sustaining, and as close to native/natural as possible while maintaining a relatively high degree of functionality.

Goal 1. Protect, preserve, restore, and enhance habitats and species native to Los Peñasquitos Lagoon and its watershed.

OBJECTIVES FOR GOAL 1

1. Identify, analyze, quantify, and qualify opportunities and constraints.
2. Protect core areas of prime and/or critical salt marsh habitats for species native to the Lagoon, including both sensitive and listed species.
3. Restore areas of historical tidal and non-tidal salt marsh habitats.
4. Enhance areas of existing or fragmented salt marsh habitats to establish additional core areas or expand existing ones.
5. Improve habitat connectivity and native wildlife movement between the ocean, lagoon and associated uplands, as well as between core areas.
6. Maximize the functional habitat and food chain values of Los Peñasquitos Lagoon.
7. Identify opportunities:
    a. to create buffer zones around existing lagoon habitats.
    b. for long-term funding for maintenance of buffer zones around existing lagoon habitats.
    c. to acquire lands adjacent to the Lagoon.
    d. for long-term funding for maintenance of lands acquired adjacent to the Lagoon.

Goal 2. Improve and maintain hydrologic and geomorphologic processes that support lagoon health, resiliency and functionality as a coastal salt marsh.

OBJECTIVES FOR GOAL 2

1. Improve freshwater and sediment input from the watershed and along lagoon boundaries to levels and frequencies that support native habitats and healthy and functional hydrology.
2. Improve hydrology within lagoon channels to support native habitats and species, maximize tidal mixing and facilitate drainage within lagoon channels.
3. Maintain an open inlet to protect and enhance the health and ecological value of the Lagoon, including habitats critical to rare and/or listed species.
4. *(New Objective) Expand and/or improve monitoring within lagoon tributaries and channels to better characterize flow, water quality and loading.*
5. *(New Objective) Develop and implement a monitoring program to assess historic and annual sediment accretion at the base of lagoon tributaries and within the floodplain.*

Goal 3. Ensure that water quality in the Lagoon and its tributaries supports natural resources, native habitats, and species native to Los Peñasquitos Lagoon and its watershed.

OBJECTIVES FOR GOAL 3

1. Establish and maintain water quality parameters conducive primarily to native salt marsh species and habitats, as well as other species of value.
2. Protect the Lagoon's beneficial uses identified under the San Diego Basin Plan.
3. Reduce pollutant loading from both point-source and non-point sources.
4. Protect the functional value of the Lagoon with respect to water quality for coastal salt marshes (e.g., sediment trapping, retention, and removal of nutrients).

Goal 4. Consider public health when implementing the updated plan.

OBJECTIVES FOR GOAL 4

1. Implement measures to protect public health and safety whenever possible and feasible, giving priority to approaches that improve and/or protect the Lagoon's ecosystem.
2. Coordinate efforts with other agencies and entities dedicated to protecting public health and safety whenever possible and feasible.
3. Reduce and, where possible, eliminate breeding and refuge habitat used by *Culex tarsalis*, the mosquito species identified as a transmitter of the West Nile Virus in San Diego County.
4. Identify opportunities and constraints related to global climate change.

5. Address public health at beaches from impact from storm flows.

Goal 5. Identify opportunities and constraints within the timeframe of the Plan using established global climate change projections.

OBJECTIVES FOR GOAL 5

1. Identify opportunities and constraints related to sea level rise within the timeframe of the Plan using established global climate change projections.
2. Identify opportunities and constraints related to modified storm events (increased intensity, duration, etc.).
3. Identify opportunities and constraints related to changing landscapes on plant communities, habitats, and wildlife.
4. Identify opportunities and constraints related to modified temperatures trends.
5. Identify opportunities and constraints related to increased risk of drought, fire, and floods.
6. Identify opportunities and constraints related to potential vulnerability and risks to public health and safety.
7. Identify opportunities and constraints related to potential vulnerability and risks for economic loss and damage.

Goal 6. Provide public education and outreach efforts, as well as improved coastal stewardship of Lagoon and watershed resources.

OBJECTIVES FOR GOAL 6

1. Develop or facilitate the development of curriculum consistent with resource protection and coastal stewardship.
2. Provide or facilitate the implementation of education and outreach opportunities consistent with resource protection.
3. Facilitate watershed-based education and outreach efforts and activities that help achieve the vision and goals of the updated enhancement plan.
4. Facilitate improvements to policy and regulations that affect lagoon health and management, as well as restoration and enhancement opportunities.
5. Communicate social benefits of the Lagoon and watershed through local schools, outreach efforts to HOAs and neighborhoods, and interpretive signs.
6. Build community support for restoration.
7. Preserve current status of the Preserve and keep environmental protection at the forefront with a balance to limited access and strengthening stewardship.

Goal 7. Manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of California State Parks.

OBJECTIVES FOR GOAL 7

1. Develop a comprehensive management plan for public access along the Lagoon that includes viewpoints, view corridors, and trails.
2. Improve Safety of Existing Access (Sorrento Valley Bike Trail, New Parking Lot at Flintkote Avenue, and Access to Beach/Lagoon over Hwy 101).
3. Where possible and practical, integrate the management plan developed in Objective 1 with similar plans developed for public access within the Torrey Pines State Natural Reserve.
4. Coordinate with Caltrans and SANDAG on Public Works Plan to develop better connectivity with public transit and bike trails.
5. Manage access to build community support.
6. Facilitate the permitting and implementation of the management plan developed in Objective 1.
7. Identify and pursue opportunities to acquire funding to support costs associated with implementation and long-term maintenance.

Goal 8. Identify potential funding sources for lagoon restoration, enhancement, and long-term maintenance. Consider approaches that minimize long-term maintenance costs.

OBJECTIVES FOR GOAL 8

1. Identify potential funding sources and mechanisms for lagoon restoration and enhancement needs, as well as long-term maintenance.
2. Prioritize restoration and enhancement needs over mitigation needs.
3. Implement adaptive management and related metrics to assess program and project success in relation to costs associated with construction and/or maintenance.
4. Coordinate efforts with stakeholder groups operating in the watershed and Torrey Pines State Natural Reserve to identify complementary needs and facilitate the development of comprehensive and integrated strategies.
5. Develop a phased approach for Lagoon restoration that incorporates needed “fixes” in the watershed, along lagoon boundaries, and within the Lagoon itself to minimize capital costs and annual maintenance costs.

6. Identify opportunities and constraints related to global climate change.

Goal 9. Protect and promote the regional value of Los Peñasquitos Lagoon and its watershed.

OBJECTIVES FOR GOAL 9

1. Protect regionally sensitive and listed species and their critical habitats with emphasis on those native to Los Peñasquitos Lagoon (sensitive and listed species).
2. Protect the Lagoon's role, contribution, and regional value with regard to the Pacific Flyway (Migratory Birds).
3. Protect the Lagoon's role, contribution, and regional value with regard to native plant species and assemblages with emphasis on those listed as sensitive, rare, threatened, or endangered by the California Native Plant Society (Plants – Herbs, Shrubs, and Trees).
4. Protect the Lagoon's role, contribution, and regional value to marine environs and related species that include Areas of Special Biological Significance and the Southern California Bight (Fisheries and Coastal Water Quality).

5. (New Objective) Protect and preserve the Lagoon's role, contribution, and value with regard to the Torrey Pines State Natural Reserve.

6. (New Objective) Protect and preserve the economic, social, and recreational values of the Lagoon.

7. (New Objective) Consider the implications of lagoon improvements and management with regard to nearby Marine Protected Areas and Areas of Special Biological Significance.

Goal 10. Protect biological, cultural, and paleontological resources found within Los Peñasquitos Lagoon and its uplands.

OBJECTIVES FOR GOAL 10

1. Identify and map areas and/or locations of biological, cultural, and/or paleontological resources within Los Peñasquitos Lagoon and its associated uplands.
2. When possible and practicable, avoid or reduce impacts to biological, cultural, and/or paleontological resources, particularly at lagoon margins.
3. Coordinate efforts with California State Parks during planning, design, and implementation phases for projects or programs that may impact biological, cultural, and/or paleontological resources.
4. Coordinate efforts with third-party groups (e.g., Native American, San Diego Natural History Museum, California Native Plant Society) during planning, design, and implementation phases for projects or programs that may impact biological, cultural, and/or paleontological resources.
5. Support Goal 10 within the context of the California Public Resource Code and management plans and policies of California State Parks.

Goal 11. Strengthen the Los Peñasquitos Lagoon Foundation's capacity as a management entity and steward of coastal resources.

OBJECTIVES FOR GOAL 11

1. Identify and explore opportunities to expand the Los Peñasquitos Lagoon Foundation's presence and role in Los Peñasquitos Lagoon, watershed, and region.
2. Identify and explore opportunities to increase the Los Peñasquitos Lagoon Foundation's staff, either through volunteer or paid positions.
3. Identify funding mechanisms and/or coordinate efforts with other stakeholder groups to support Objective 1 and Objective 2.
4. Implement strategies and actions identified in Objectives 1-3 upon approval by the Los Peñasquitos Lagoon's Board of Directors.

New Goal 12. Achieve a sustainable restoration project using the triple-bottom-line approach that includes environmental, social/community, and economic goals.

OBJECTIVES FOR NEW GOAL 12

1. Environmental Sustainability Objectives:
    a. Consider climate change to achieve long-term project sustainability.
    b. Improve saltwater exchange to achieve long-term project sustainability.
    c. Reduce freshwater impacts/intrusion to achieve long-term project sustainability.
    d. Ensure project considers the connection and linkage to the watershed water quality.

   e. Ensure project considers the connection and linkage to protecting the water quality of the ocean and marine resources that could be impacted by the Lagoon.
   f. Consider the influence of the Lagoon on the adjacent marine habitat.
   g. Identify and consider oceanographic systems (currents, sand movements, water quality) that affect the Lagoon in the restoration design.
   h. Consider the regional importance of the restoration and protection of lagoon habitats.
   i. Restore and preserve the “natural systems” of the Lagoon.
2. Social/Community Sustainability Objectives:
   a. Identify and quantify the social and community values with regard to the Lagoon.
   b. Consider identified social/community values in conjunction with environmental and economic sustainability objectives during development and assessment of restoration alternatives.
3. Economical Sustainability Objectives:
   a. Identify and quantify the value of the Lagoon and beaches.
      i. Economic value of beaches to local tourism
      ii. Protection of communities and urban infrastructure from flood events (watershed) and storm surges (ocean) under both current and projected climate change scenarios
      iii. Carbon sequestration for carbon credits
   b. Ensure both short-term funding to complete the project and long-term funding for maintenance.

New Goal 13: Remove, relocate, or modify existing infrastructure located along or within the Lagoon to reduce or eliminate both direct and indirect impacts to lagoon resources and processes.

<u>OBJECTIVES FOR GOAL 13</u>
1. Reduce impacts from existing infrastructure to ensure long-term environmental sustainability and address community and economic sustainability of the restoration.
2. Ensure the project identifies and considers the potential impact on the restoration project from future infrastructure (road, railroad, utilities) projects and development.

6.2.2 Identifying Opportunities and Constraints

Once refinement of Lagoon Enhancement Plan goals and objectives was completed, the next three workshops focused on identifying opportunities and constraints of achieving them within the context of the breakout group themes: Habitat (Workshop 2); Public Access, Safety & Education/Cultural Resources (Workshop 3); and Sustainability (Workshop 4). Workshop attendees were invited to review and discuss potential activities and opportunities presented by LPLF and were encouraged to provide additional ideas. Activities and opportunities were then juxtaposed against identified constraints that included:

- <u>Timing Constraints</u>. Anticipated timelines to plan, design, and implement each activity or to pursue each opportunity.
- <u>Land Use Constraints</u>. These included residential areas, commercial development, and transportation infrastructure that physically occupy areas within and around Los Peñasquitos Lagoon.
- <u>Financial Constraints</u>. Understanding that funding is limited and would need to be allocated over time instead of as one lump sum. Maintenance costs were also considered under this constraint.
- <u>Environmental Constraints</u>. Impairment of Los Peñasquitos Lagoon is also driven by environmental constraints, including climate change, modified hydrology, and altered geomorphology.
- <u>Regulatory Constraints</u>. Consideration of whether the proposed activity will pass regulatory review and/or be subjected to mitigation requirements that make opportunity infeasible.

Understanding that opportunities and constraints will vary across Los Peñasquitos Lagoon's habitats and on either side of the railway berm; LPLF divided the Lagoon into the following four management zones (see **Figure 6-1**):

- Zone 1 – Coastal/Beach
- Zone 2 – Tidal Salt Marsh
- Zone 3 – Transitional (Mixed)
- Zone 4 – Transitional (Brackish/Riparian)

Separating Los Peñasquitos Lagoon into zones greatly facilitated discussions between workshop attendees since some opportunities and constraints are specific to an individual zone (e.g., inlet maintenance in Zone 1), while others may be present in multiple zones (e.g., invasive plant management in Zones 2–4).

Habitat (Workshop 2)

Workshop 2 was held on November 14, 2012, to present the results from Workshop 1 as they pertain to the refinement of goals and objectives specific to the Habitat breakout group. An overview of the conceptual exercise of determining opportunities and constraints for achieving the goals and objectives of the updated Lagoon Enhancement Plan was presented to workshop attendees. Next, workshop attendees were presented the concept of dividing Los Peñasquitos Lagoon into the four management zones. A group discussion ensued regarding opportunities and constraints as they apply to habitat-themed goals and objectives for each zone; how to improve hydrologic connectivity between zones; and how to support habitat improvements, preservation, and long-term protection throughout the Lagoon. Stakeholder ideas and comments were captured on a flip chart and later transcribed and provided online to interested parties. The outcome of Workshop 2 was the lists of opportunities and constraints provided in **Table 6-1**. Workshop 2 time limitations precluded discussion regarding the results from goal and objective refinement for the Public Access, Safety & Education/Cultural Resources and Sustainability done by Workshop 1 breakout groups. Therefore, it was collectively decided that the review opportunities and constraints related to goals and objectives for these categories would occur during subsequent workshops.

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Figure 6-1
Management Zones in Los Peñasquitos Lagoon

TABLE 6-1
SUMMARY OF THE OUTCOMES FROM WORKSHOP 2: OPPORTUNITIES AND CONSTRAINTS FOR HABITAT

Opportunities	Constraints
• Promote/augment greater tidal flow from Zone 2 to Zone 3 • Make Zone 3 lower in elevation to get tidal zone higher (into the lagoon) and capture dry-weather flows from watershed. Example = San Elijo Lagoon Restoration Plan • Removal of invasive (plant species) that trap sediment • Excavate channels to deepen – increase tidal flow	• Available area • Cost of sediment removal • Permitting - impacts to existing species (e.g., bird nesting)
• Increase number of crossings/openings along railway berm to improve tidal circulation • Work with transit to increase spans/culverts as part of double tracking	• Cost to increase/widen openings (in railway berm) • Permitting • Need to coordinate with Transnet timeframe for double-tracking – may not correspond with restoration schedule
• Preserve Salt Marsh in Zone 2	• Costs to acquire buffer zones • Buffer zones may be outside of Reserve jurisdiction
• Establish new habitat in Zone 3 – Salt Marsh	• Continual impact from freshwater input
• Use buffer zones in Zone 4 to filter storm water	• Very difficult to control/manage • Limited space and buffer zones may be outside of the Reserve
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads	• Need to address sediment load from the watershed
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4	• Exotic species • Maintaining salinity in soils • Freshwater ponding
• Increase size of box culvert at Carmel Creek to allow for greater connectivity between Zones 3 & 4 for birds (e.g., road runners, Ridgeway's rail) and mammals (bobcats, mountain lions, deer) • Potential opportunity = Connecting SR 56 onramp from I-5 • Notes – look at study on wildlife corridors/access (TPA – currently doing, CSP-old report from late 1990s) • Salt marsh expansion	• Concern with agencies • Extensive permitting • Cost • Existing infrastructure: I-5, Sorrento Valley Development
• Increase functional food web in salt marsh • Shift in habitats	• Losing upland habitat • Space/Area
• Increase inlet opening/increase sub-tidal habitat to increase food web • Increase channel opening and depth	• Existing infrastructure – Highway 101 (a.k.a. North Torrey Pines Rd): berm and bridge • Shoaling
• Converting degraded habitat to improved habitat as part of buffers • Use buffer zones for water quality, protecting sensitive species, provide for sea level rise changes • Maximize potential buffers zones (existing and new) • Use buffer zones for trails – manage pet waste/trash • Acquisition of new lands for buffer zones • Old Sorrento Valley Road Buffer Zone • Expanding buffer to protect sensitive habitat from trash, dog waste, trails	• Areas are limited • Urban areas – no buffer • Cost to acquire buffer zones • Buffer zones may be outside Reserve jurisdiction

Public Access, Safety & Education/Cultural Resources (Workshop 3)

Workshop 3 was held on January 9, 2013, to present the results from Workshop 1 as they pertain to the refinement of goals and objectives specific to the Public Access, Safety & Education/Cultural Resources that were not addressed in Workshop 2. Working together in a group, participants discussed and evaluated potential opportunities and constraints to the enhancement of existing hiking trails, dedicated bike lanes, and other existing public access routes, as shown in **Figure 6-2**, to meet the refined public access goals and objectives. Also discussed were potential enhancements to provide improved wildlife corridors (e.g., to Los Peñasquitos Canyon Preserve), transportation hubs (e.g., Sorrento Valley Coaster Station) and regional trails networks (e.g., Sea to Sea Trail, CA Coastal Trail). As presented in **Table 6-2**, the outcome of Workshop 3 was a list of opportunities and constraints for the each of the primary access routes and trails to and around the Lagoon. These key access routes and trails include:

- Carmel Valley Road
- Sorrento Valley Road
- Marsh Trail
- Highway 101

The opportunities summarized in **Table 6-2** are also highlighted in **Figure 6-3**, which presents the long-term goal of a Los Peñasquitos Lagoon loop trail that connects existing routes and trails around the Lagoon and with transit hubs, with the Carmel Valley State Route (SR) 56 Bikeway Regional Corridor, and Los Peñasquitos Canyon Preserve. Comments provided by workshop participants were recorded on a flip chart and later provided online, along with results/comments from previous workshops prior to Workshop 4, held on February 9. Comments from Workshop 3 were also submitted to SANDAG for consideration under their North Coast Corridor Public Works Plan that will allocate funding over the next 50 years for improvements to wetland habitat, wildlife corridors, and public access along the Interstate 5 (I-5) and the railway alignment through the North Coast Corridor.

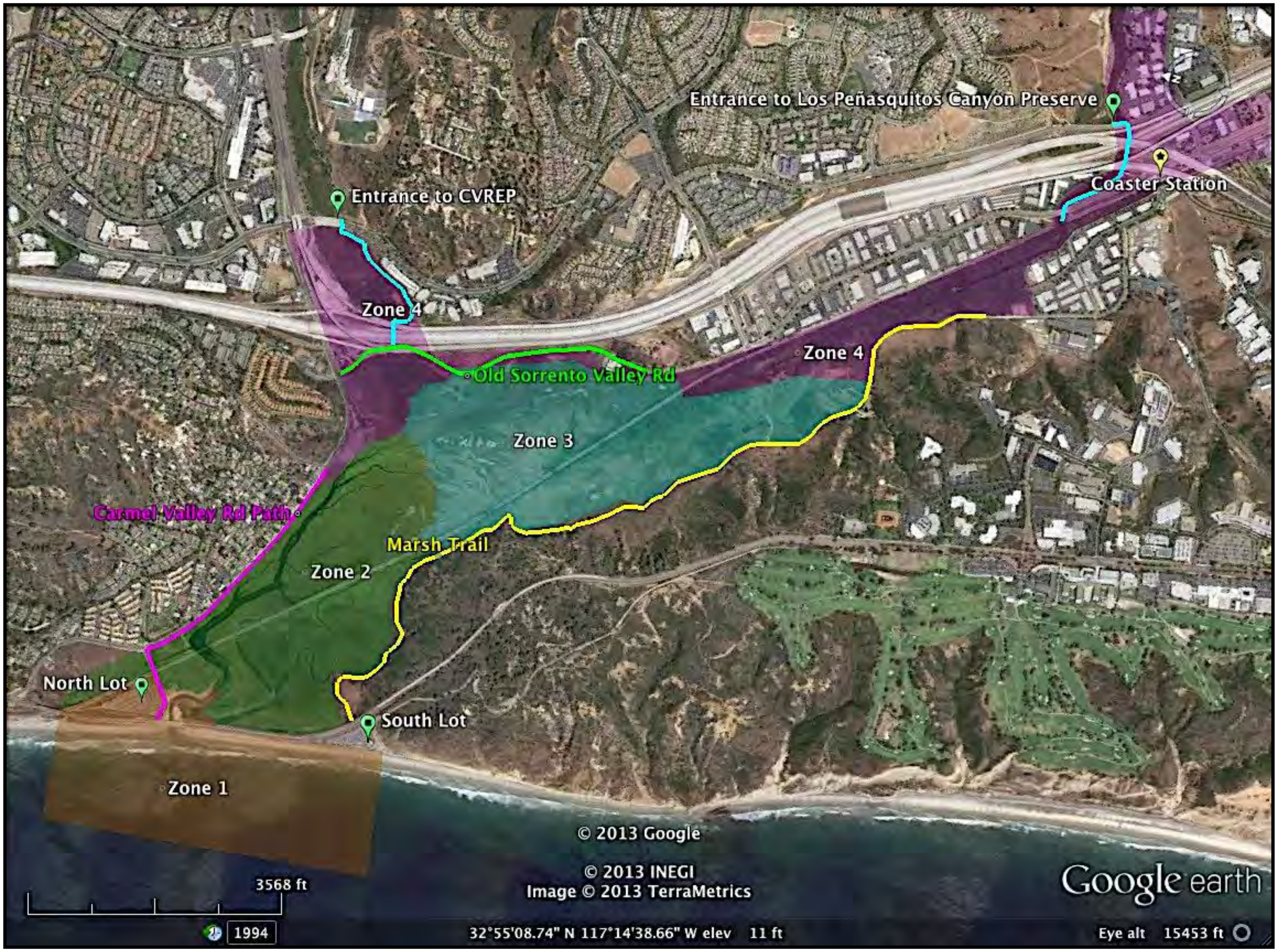

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Figure 6-2
Existing Trails and Paths

Figure 6-3
Highlights of Workshop 3 Outcomes:
Potential Enhancements of Existing Trails and Paths

TABLE 6-2
SUMMARY OF THE OUTCOMES FROM WORKSHOP 3: OPPORTUNITIES AND CONSTRAINTS FOR PUBLIC ACCESS, SAFETY, AND EDUCATION/CULTURAL RESOURCES

Opportunities	Constraints
Carmel Valley Road	
• Invasive Species Removal ○ Carmel Valley Road and Sorrento Valley Road Pampas Grass Removal	• Permits • Coordination with invasive species removal on adjacent non-reserve lands

• Integration of Trail Enhancements and New Features with near-term and longer-term Transportation Projects
  ○ Use City right-of-way to improve bike lane and potential walking trail on lagoon side
  ○ Reduce sidewalk on north side to create more space for bike and walking lanes on south side
	• Coordination with City on use of right-of-way and maintenance obligations
	• Coordination with Caltrans on the SR 56 and I-5 ramps and future projects
	• Limited space for additional expansion of shoulder usage along lagoon.
	• City standards and codes for right-of-way
	• Funding

• Improve management of storm water ○ Control sediment migration to the marsh by runoff from State Park property on north side of Carmel Valley Road.	• Coordination with City • Funding • Potential storm water Impacts as a result of greater access/opening of preserve – potential impact to sensitive species

• Improve trails for pedestrian access and safety, while avoiding impacts to native plants
  ○ West end of Carmel Valley Road– Create new access trail to improve current pedestrian trail that is narrow and steep, and runs from auto shop along steep bluff and goes under upper bridge to access the beach
  ○ Improve east side of Carmel Valley Rd to link to trails coming down Carmel Valley – connecting east and west sides of I-5 to Carmel Valley
  ○ Balance access improvements with potential impacts to resource preservation
  ○ Trail/boardwalk along south side of Carmel Valley Road from Sorrento Valley Road to North Beach parking lot
	• Coordination with City on use of right-of-way and maintenance obligations
	• Coordination with Caltrans on the SR 56 and I-5 ramps and future projects
	• Limited space for additional expansion of shoulder usage along lagoon.
	• City standards and codes for right-of-way
	• Funding
	• Limited right-of-way
	• Potential impacts to sensitive species

• Improve bike access and create a bike trail along Carmel Valley Road between the I-5 and Highway 101 – Remove sidewalk and on north side and create two bike lanes for two-way traffic – expand east bound lane for pedestrian traffic ○ Use, improve, and link City of San Diego service access road	• Coordination with City on use of right-of-way and maintenance obligations • Limited space for additional expansion of shoulder usage along lagoon. • City standards and codes for right-of-way • Funding • Limited right-of-way
• Improved buffer zones to help balance increased access with potential impact to sensitive biology • Use volunteer organizations to perform focused maintenance activities to reduce costs • Negotiate with Resource Agencies for development of mitigation credits for maintenance of buffer zones and restored areas to bring in additional funding	• Land acquisition or access agreements needed for buffer zones outside of current preserve boundaries • Increased maintenance due to extension of preserve responsibilities – limited state funding

Opportunities	Constraints
Sorrento Valley Road	

• Integration with Transportation Projects
  ○ Potential pedestrian bridge in Zone 4 as part of the rail road double tracking to connect Sorrento Valley Rd with the Marsh trail
  ○ Linkages to SR 56 trail via undercrossing or other means. Could be required as mitigation for I-5 Corridor improvements
	• Coordination with Transnet on double tracking
	• Impact to sensitive species from construction and increased access
	• Funding
	• Permitting

• Establish a visitor center near the existing City Pump Station to provide for trail education and outreach on the preserve. • Interpretive site and/or wildlife viewing area at pond near Pump Station 65	• Coordination with the City on land use • Increased need for maintenance and security – added costs to State Parks with limited resources • Funding • Vector breeding habitat in areas of ponded water near Pump Station 65
• Expand parking and create trailhead education/outreach area next to Sorrento Valley Road ○ Include use of smartphone technology to provide information on the trails, the Preserve, lagoon restoration efforts, etc.	• Existing park and ride – Caltrans and City coordination on modifications and integration to current usage • Increased need for maintenance and security – added costs to State Parks with limited resource • Funding
• Removal of invasive plant species as part of establishing a “buffer zone” around the Preserve	• Access to non-park land • Land acquisition may be needed to conduct long-term invasive species management program • Permits
• Create “Green Street” multiple functions that provide maintenance vehicle access, hiking and biking trails, storm water management. ○ Remove gated fence at the north end of Sorrento Valley Road to increase/improve pedestrian access	• Coordination and approval by City • Funding
• Elevate roadway as part of Caltrans mitigations to allow for animal passage and connection to north side of the I-5	• Coordination and approval by Caltrans • Funding not covered under mitigation additional work
• Create connections for bikers, hikers and wildlife between Carmel Valley (CVREP) and Sorrento Valley Road by expanding box culverts ○ Linkages to SR 56 trail via undercrossings or other means. Could be required as mitigation for I-5 improvements	• No current access • Current conditions will likely change with proposed road changes • Coordination with Caltrans and proposed roadway project • Wildlife corridors are currently very limited • Multi-use access will limit wildlife access • Access needs to be restricted during storm events if culverts also convey storm water flows • Consistency with proposed Caltrans projects

Opportunities	Constraints
Marsh Trail	
• Establish a visitor's education area (improved trailhead) at the east end of the trail (Flintkote Road) to provide for trail education and outreach on the Preserve ○ Area that is used by the City for staging of equipment – Utilities Department	• Coordination with the City on land use – maintain ability for use as equipment staging area • Increased need for maintenance and security – added costs to State Parks with limited resources/state funding • Funding • Consistency with California State Park Plan and sub-plans specific to Torrey Pines State Natural Reserve
• Improve trail on the east end which is outside of the preserve– long-term potential ○ Provides additional benefit to address flooding and habitat enhancement	• Property acquisition • Funding
• Improve trailhead on the west side by providing a turn-out from Highway 101 and limited parking • Construct tunnel under Highway 101 to connect to the Marsh Trail to the South Beach parking lot at Torrey Pines State Natural Reserve • Install a traffic signal and create pedestrian crossing over Highway 101 • Restrict access at night of improved trailhead and trail • Potential linkage to Sea to Sea Trail • Potential ADA compliant viewing area on upland area at west end of the Marsh Trail – create access either from the south lot or turn-out/limited parking area	• Trailhead located at base of steep hill – high traffic speeds may result in significant safety issue for cars turning into to small parking area • Coordination and approval by Caltrans • Attraction of improper use of parking area and trail at night • Air and water quality issues due to breaking of automobiles (e.g., dissolved copper from brake pads) • Funding • Potential Cultural resource issues • ADA compliance
• Enhancement of existing trail to allow for bikes and access year round ○ Use new FEMA maps and sea level rise prediction models to determine near- and long-term flooding and design trail enhancement to reduce potential flooding	• Increased need for maintenance and security – added costs to State Parks with limited resources/state funding • Potential impact to sensitive species from greater public access • Loss of some of the "natural" elements and "peaceful" character of the existing trail (increased noise, etc.) • Difficulty in passage due to seasonal flooding of lower elevation areas both in the west and eastern portions of the trail • Increased flooding from sea level rise – new FEMA mapping • Competition between bikers and hikers – trail safety • Safety of users • ADA Requirements • Increased need for maintenance and security – added costs to State Parks with limited resources/state funding • Potential damage of trails due to flooding

Opportunities	Constraints
• Connect Marsh Trail with the transit center through designated pedestrian walkways, bike trail, and signage • Create a bike loop around the Lagoon	• Coordination with the City, Caltrans and SANDAG on improving sidewalks and signage to get bikers and hikers to and from the Marsh Trail and Coaster Station located in Sorrento Valley • Maintaining safety of trail users in heavy car traffic area • Increase in access leads to increased need for maintenance and security – added costs to State Parks with limited resources
• Raised post/pier boardwalk trail (similar to San Elijo or San Dieguito Lagoons) in marshy areas or realign trail segments in wet areas • Consider seasonal trails • Consider “black diamond: ski mountain approach to rate trail difficulty	
Highway 101	
• Improve access to Torrey Pines State Beach on the south-side of the lagoon inlet to reduce safety and habitat impacts from pedestrians walking down the unstable bluff	• Limited space to provide new pedestrian access and meet ADA requirements • Continued erosion of shoreline bluff • Coordination with Caltrans

• Modify existing parking along shoreline to create dedicated pedestrian and bike lanes
  ○ Separate lanes that are on the shoreline side and not in line of traffic and parking vehicles
  ○ Shift parking spots along Highway 101 eastward and locate pedestrian access buffer along the top of riprap on west side of diagonal parking
• Include curb cuts along bike land to allow sand to pass through and reduce maintenance requirements
	• Limited space to provide new pedestrian access and meet ADA requirements
	• Continued erosion of shoreline bluff
	• Coordination with Caltrans
	• Reduction of any parking spaces require California Coastal Commission approval and demonstration that greater access is achieved
	• High level of popularity of existing parking area

• Construct new foot path on east side lower bridge along Highway 101 that would connect to the Marsh Trail and Carmel Valley Trail to create a loop trail
  ○ Allow for safe bird watching along east side of Highway 101 that does not disturb wildlife
  ○ Footbridge or boardwalk would allow for co-installation of improved utilities
	• Support of Caltrans
	• Funding
	• Permitting
	• Extensive engineering/Structural analysis – does not impact existing bridge
	• Permitting

Sustainability (Workshop 4)

Conducted on February 9, 2013, Workshop 4 began with a plenary review of the results from previous workshops. Participants then engaged in a group discussion regarding the assessment and evaluation of opportunities and constraints related to implementing goals and objectives refined by the Sustainability breakout group during Workshop 1. Key to the group discussion was the role that climate change could play with regard to both opportunities and constraints for improvements to Los Peñasquitos Lagoon and surrounding areas over the long-term. Projected sea level rise scenarios established for the California coastline (see **Figure 6-4**) were presented and related to the Lagoon in terms of potential effects on current habitats, transportation infrastructure, and the endangered and threatened species that use these habitats. **Figure 6-5** presents possible low-tide conditions in Los Peñasquitos Lagoon for a 2-meter rise in sea level projected for 2100, and the potential conversion of habitat from increased frequency and extent of full tidal inundation. **Figure 6-6** depicts the potential for habitat conversion due to sea level rise and potential loss of current habitat important to keystone species at Los Peñasquitos Lagoon, such as the (state-listed) endangered Belding's savannah sparrow. The potential impacts to existing infrastructure around the Lagoon that is important to public access and to the beach are illustrated through potential rises in sea levels at the inlet (**Figure 6-7**), and at Torrey Pines State Beach (**Figure 6-8**). Additionally, the importance of transitional zones to allow for gradual migration of habitat as sea levels rise was discussed. This led to a discussion and presentation of different restoration approaches that provide for greater transitional zones between salt marsh and upland through gradual grading of slopes, as illustrated in **Figure 6-9**. As shown in these figures, a more gradual slope from tidal to non-tidal and then upland habitats allows for greater opportunity for adaptation to sea level rise since salt marsh habitat is confined to a limited range of vertical elevation. Restoration approaches that create and maintain these transitional zones provide greater long-term sustainability by providing for more gradual adaptation to these changes.

Workshop 4 also provided an opportunity for participants to engage in the preliminary development of Project Concepts to enhance Los Peñasquitos Lagoon. Working with CSP, LPLF generated 3-foot by 4-foot maps of the Lagoon and its management zones prepared during Workshop 2 to allow participants an additional chance to identify potential projects and activities, as well as their location within Los Peñasquitos Lagoon. Participants were asked to write down activities or projects on post-it notes and place them on the maps in the location(s) and zones where they would be implemented. Projects placed on the map included restoration of historical salt marsh in Zone 3, improvement to public access through extension of trails, reduction of sediment, and freshwater loading from the watershed. Participants were then asked to differentiate between those efforts that would have the least constraints and those that were more constrained by factors such as funding, timing (e.g., phasing with complimentary activities in the watershed and/or transportation corridor improvements), and permitting. This last activity helped to set the groundwork for Workshop 5 and the development of the phased approach to improve the Lagoon in a sustainable manner.

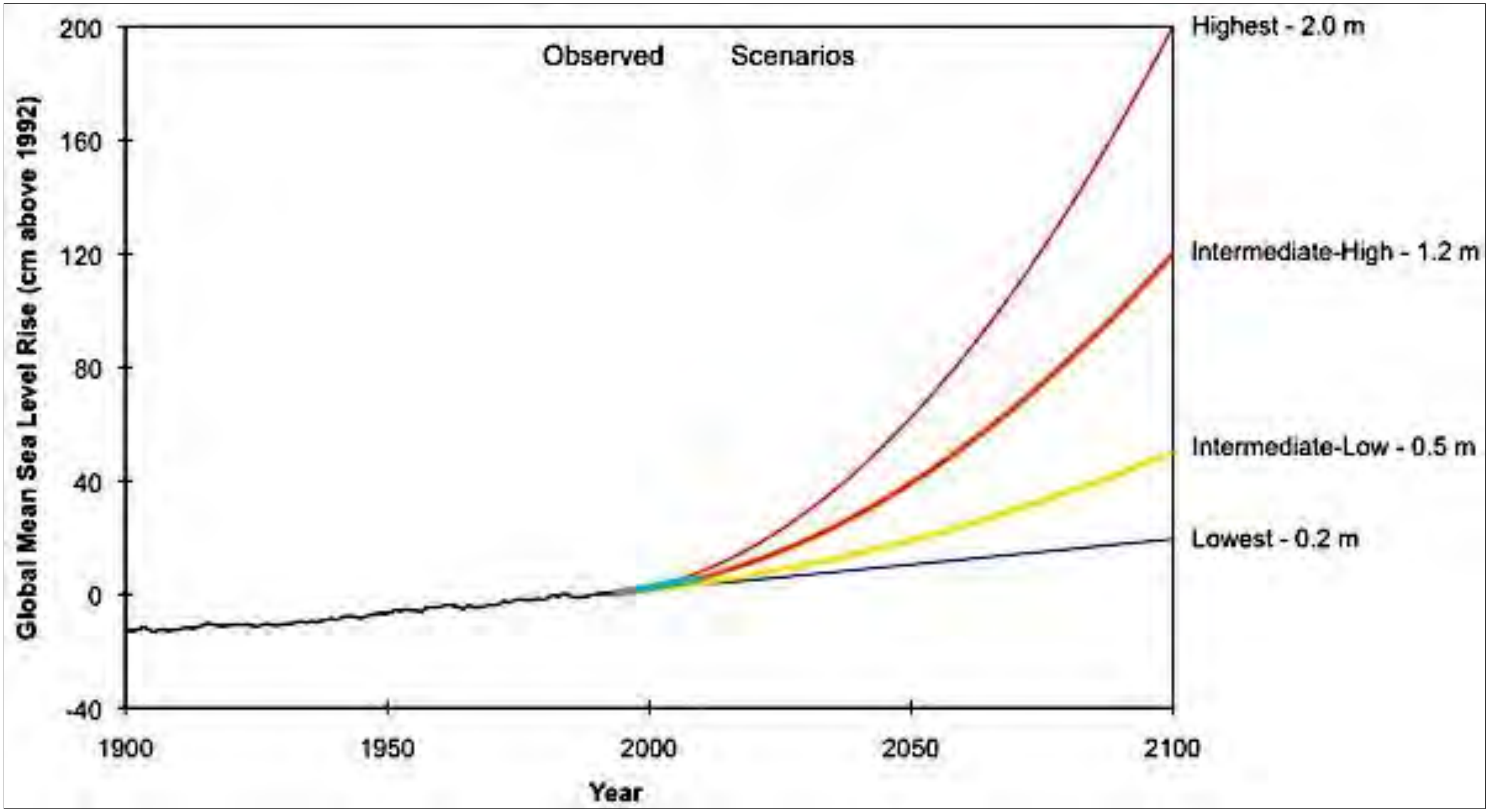

Figure 6-4
Projected Sea Level Rise Scenarios
Current - 2100

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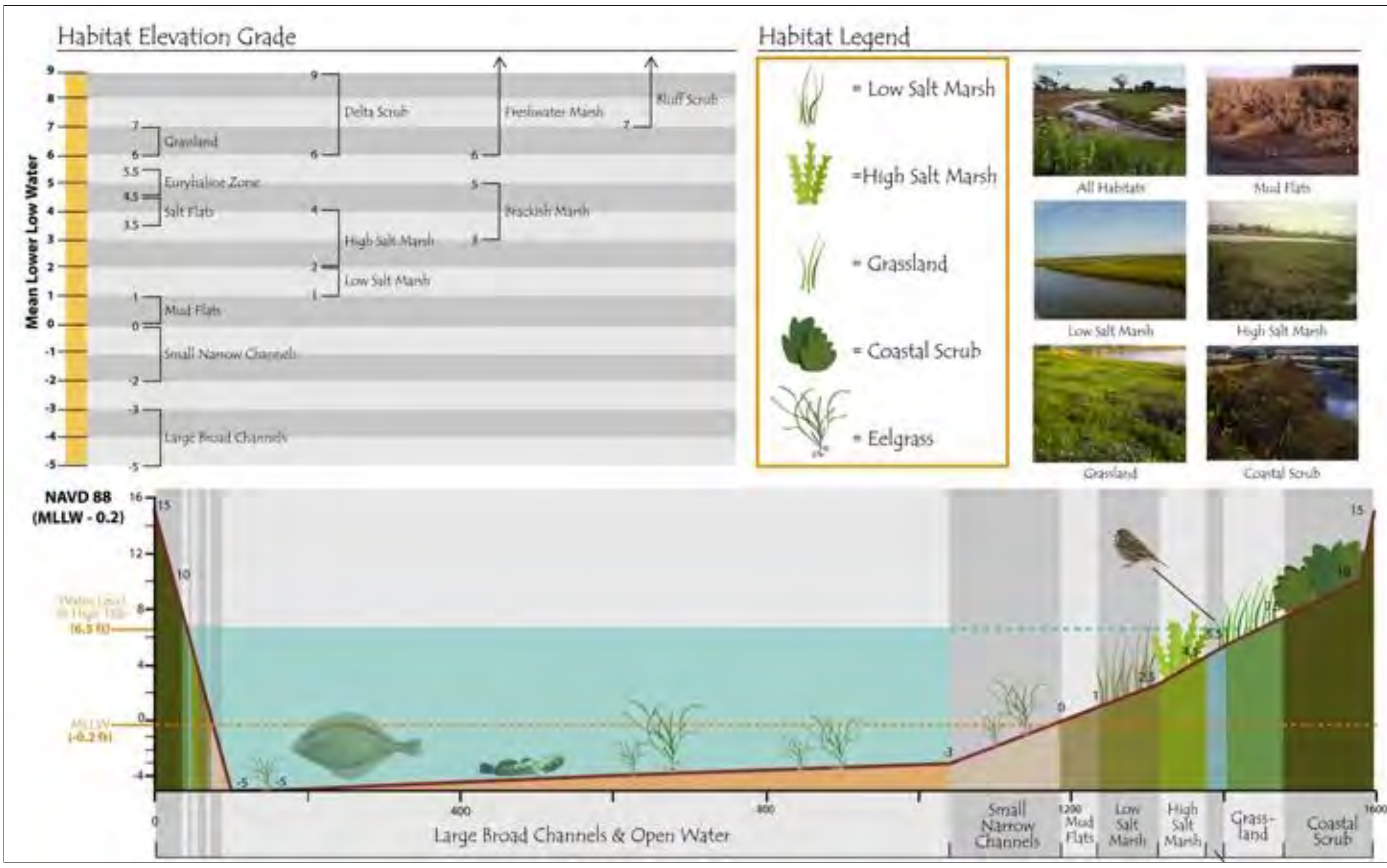
Figure 6-5

Depiction of Possible Lagoon Water Levels (Low Tide)
2100 with 2.0 meter Increase in Sea Level

Figure 6-6
Illustration of Potential Impacts to Endangered Species from Increased Inundation of Salt Marsh due to Sea Level Rise
Belding's Savannah Sparrow Nesting Habitat

Figure 6-7
Depiction of Potential Lagoon Water Level (Low Tide)
In 2100 at Inlet with 2.0-meter Increase in Sea Level

Figure 6-8
Illustration of Possible Conditions along Torrey Pines State Beach Mean Lower Low Tide (0 ft) in 2011 (Left) and Project Mean Lower Low Tide in 2100 (Right) Assuming 2 meters of Sea Level Rise



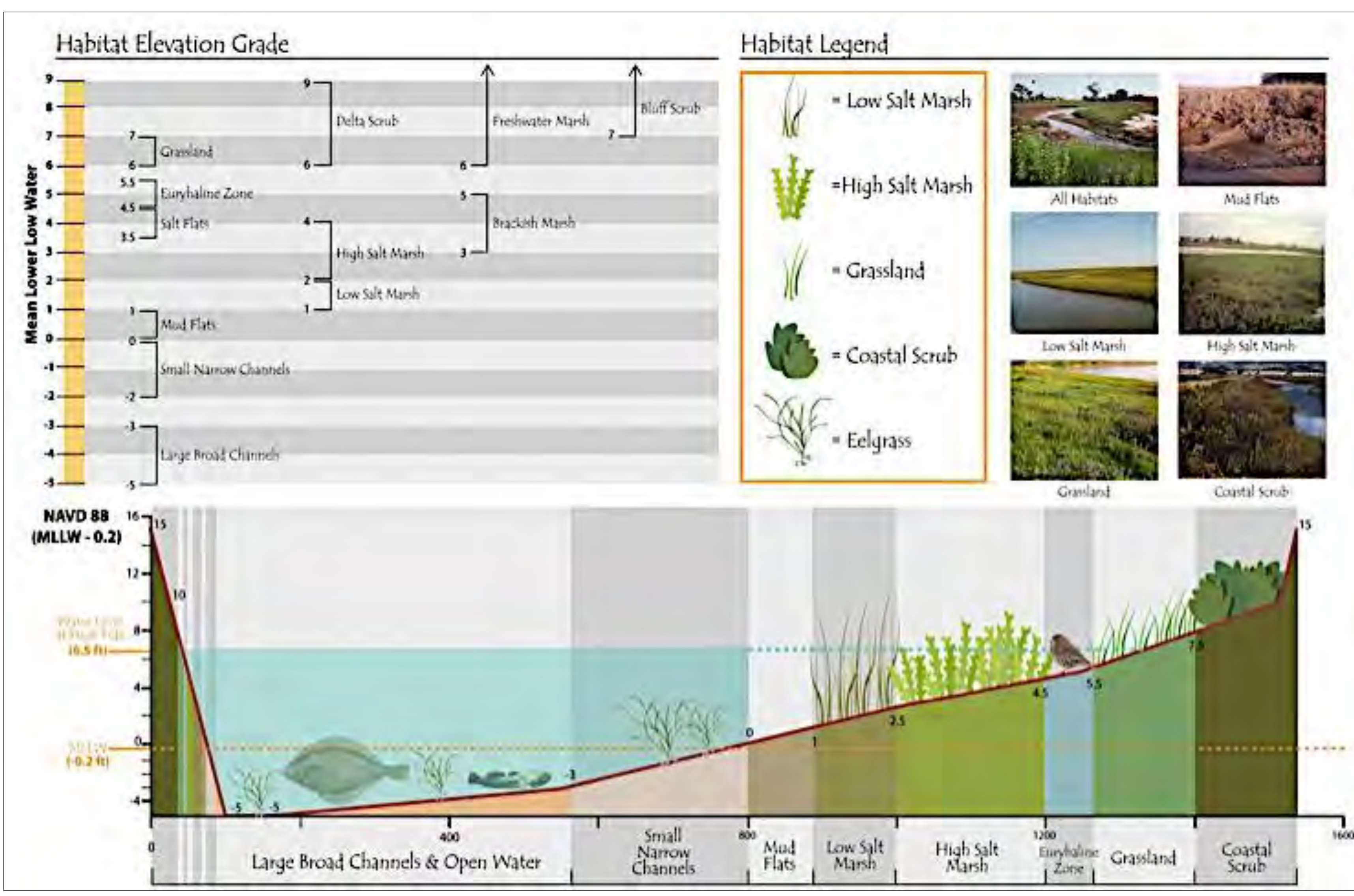


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Figure 6-9
Illustration of Different Restoration Approaches
Steep Slopes from Tidal Channels (Top)
And More Gentle Slopes (Bottom)

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6.2.3 A Phased Approach to Improving Los Peñasquitos Lagoon

Coastal estuaries are highly complex systems and are subject to numerous drivers (natural and anthropogenic) and feedback loops that can affect wetland ecology and overall understanding of the systems. An adaptive, phased approach is justified as it allows for variation within these systems and provides flexibility to respond to unforeseen changes while minimizing costs associated with errors. This approach also helps to account for potential discrepancies between projected and real climate change scenarios (e.g., sea level rise) that may vary in magnitude and/or timing in the near-, mid- and long-term. For example, sea level rise along the coast of Southern California most likely will not follow a linear increase over time as witnessed in other regions of the world because of coastal processes (e.g., prevailing winds and currents) operating in the nearshore. Rather, sea level rise may manifest with little to no change during the next 20 years, followed by quick increases in response to climate change. This could have significant repercussions for restoration efforts that account for assumed elevation increases in sea level to drive restoration of salt marsh habitats in areas currently outside of tidal influence.

An adaptive, phased approach will also facilitate coordination of the updated Lagoon Enhancement Plan with the Water Quality Improvement Plan (WQIP) recently developed for the Los Peñasquitos Watershed by the City of San Diego and other Phase 1 dischargers identified in the Regional Storm Water Permit. The WQIP was designed to address conditions and activities within the watershed that have led to the impairment of water quality of receiving water bodies that include tributaries to Los Peñasquitos Lagoon and the Lagoon itself. Folded into the WQIP are the Los Peñasquitos Lagoon Sediment Total Maximum Daily Load (Lagoon Sediment TMDL) and the county-wide TMDL for bacteria. While load reduction plays a key role in both TMDLs, the Lagoon Sediment TMDL also contains a Lagoon compliance target that requires the restoration of 84 acres of salt marsh within Los Peñasquitos Lagoon over a 20-year period (i.e. by 2035). Watershed improvements planned under the WQIP, including TMDL compliance, will most likely include integrating a combination of structural improvements (e.g., stream bank stabilization, detention basins, Low Impact Development (LID)) with nonstructural approaches that include different modalities of education and outreach, such as incentives to reduce irrigation in urban areas. However, addressing issues within the watershed will take time to account for factors such as funding, planning, permitting, implementation, and monitoring to assess success of watershed activities. Phasing lagoon improvements with watershed activities to be implemented under the WQIP will be necessary to make sure that conditions within the watershed support efforts to restore and maintain salt marsh habitat within Los Peñasquitos Lagoon in a sustainable manner. For example, improving management of freshwater inputs to the Lagoon during dry weather and sediment loads during storm events will need to occur before large-scale restoration of salt marsh habitat in the eastern can become feasible through the long-term.

Finally, phasing the implementation of the updated Lagoon Enhancement Plan will also improve opportunities to coordinate Lagoon restoration and enhancement with planned improvements to transportation infrastructure within the North County Coastal Corridor set to occur over the next 50 years. Perhaps the most important modification to the transportation infrastructure involves the railway alignment that currently bisects Los Peñasquitos Lagoon. Double tracking through the

Lagoon is estimated to occur within next 20–25 years, and both the selected railway alignment and structure (e.g., elevated berm or causeway) could dramatically affect improvements to the Lagoon that depend on enhanced hydrology. Examples of enhanced hydrology in Los Peñasquitos Lagoon include increased tidal prism to improve inlet management, extending tidal circulation into areas currently dominated by brackish waters, and improved drawdown times of waters impounded within the Lagoon's channels following high tides and/or storm events. Therefore, implementing large-scale restoration of salt marsh habitat will need to correspond or, at the very least, consider the timeframe estimated for double tracking.

Phasing (Workshop 5)

Workshop 5 was held on March 16, 2013, to present the concept of a phased approach for implementing Lagoon improvement opportunities using stakeholder input from the previous workshops. The workshop began with a review of key points and summarized the results from the previous four workshops to provide context and background for participants who may not have been able to attend all of the previous workshops. After the overview of previous workshops, a discussion of the overall approach to implement projects (opportunities) to meet the refined goals and objectives while considering the identified constraints led to the discussion of implementing a phased approach. **Box 6-2** provides a summary of the three phases and their timeframes selected to help strategize implementation of lagoon improvements identified in the previous workshops and guide efforts under the updated Lagoon Enhancement Plan. It should be noted that placement within a specific phase does not necessarily preclude a project from being implemented during a different phase. While some enhancement and improvements have defined timelines for implementation, such as restoration of 84 acres under the Lagoon Sediment TMDL, others may be moved to an early phase (e.g., moved from Phase 2 to Phase 1) if windows of opportunity present themselves and benefits generated by the project can be sustained to the extent required for feasibility. Conversely, improvements may be moved to later phases (e.g., Phase 1 to Phase 3) if feasibility studies determine the need for delayed implementation.

Box 6-2. Phased Approach to Los Peñasquitos Lagoon Enhancement Implementation

- **Phase 1 (0–5 years).** Opportunities to improve habitat and public access that are more readily implemented will be considered for the primary phase of Lagoon enhancement. These include invasive species management and readily implemented trail improvements.
- **Phase 2 (5–25 years).** Opportunities dependent on watershed improvements that include the restoration of 84 acres of additional salt marsh habitat required by the Lagoon Sediment TMDL, as well as opportunities/constraints defined by the railway alignment and related infrastructure. Improvements to public access that were dependent upon or affected by large-scale habitat restoration and/or improvements to transportation infrastructure were placed under Phase 2.
- **Phase 3 (25–50 years).** Opportunities to maximize salt marsh habitat acreage while maintaining long-term sustainability of wetland function. Phase 3 also includes completion of the trail loop around the Lagoon and connections to transportation hubs (e.g., Sorrento Valley Coaster Station) and watershed trailheads in Carmel Valley and Los Peñasquitos Canyon Preserve, assuming it cannot be achieved in Phase 2.

Following the identification of the three phases for implementation of lagoon improvements, Workshop 5 proceeded with a reexamination of activities and projects (opportunities) to meet lagoon habitat and public access goals that were identified in previous workshops. Three 3-foot by 4-foot maps of Los Peñasquitos Lagoon were provided for viewing with each map containing management zones and the assigned phase. Workshop participants were allowed to edit the maps and/or place additional ideas for improvement on the maps using post-it notes. Additional comments and edits were recorded and these inputs represented in **Figures 6-10** through **6-12**, for Phases 1, 2, and 3 respectively.

Input provided by attendees of Workshop 5 is presented in **Tables 6-3** through **6-6** for Phases 1, 2 and 3, respectively. These tables present the activities and projects (opportunities) and likely constraints identified by the stakeholders for each management zone within the Lagoon (see **Figure 6-1** for zone location) and phases (see **Box 6-2** for phase description). These stakeholder-developed tables provide the basis for the development of the Project Concepts presented in the updated Lagoon Enhancement Plan to meet habitat, public access, and sustainability goals.

North Coast Corridor Transportation Improvements (Workshop 6)

Workshop 6 was conducted on April 20, 2013 to present a summary of the draft Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) developed by SANDAG for the North Coast Corridor that was released for public review during April. A goal of the PWP/TREP was to encourage multi-modal transportation within the North Coast Corridor to reduce dependency on automobiles. An objective to support this goal was improving bicycle and pedestrian access and mobility throughout the region by connecting fragmented trails and path networks, while enhancing existing trail/path segments. A discussion followed that focused on determining opportunities to integrate habitat and public access improvements identified through previous workshops with the draft PWP/TREP. Workshop participants were then encouraged to submit comment letters to SANDAG requesting the integration of improvement concepts and projects from the updated Lagoon Enhancement Plan with the PWP/TREP for future consideration for funding and implementation through Transnet.

Presenting the Draft Lagoon Enhancement Plan Update (Workshop 7)

Workshop 7 was held on March 25, 2017 to present the results of the Lagoon Enhancement Plan update in draft form to allow workshop participants the chance to observe how their input was used to inform and guide the technical analysis for the development of the Lagoon Enhancement Plan's Project Concepts that consisted of: Lagoon Concepts, Public Access Concepts and Vector Concepts. The workshop began with a presentation that included information regarding CEQA certification of the draft Lagoon Enhancement Plan, followed by poster session where participants could review each of the Project Concepts and ask questions to experts involved in the technical analysis.

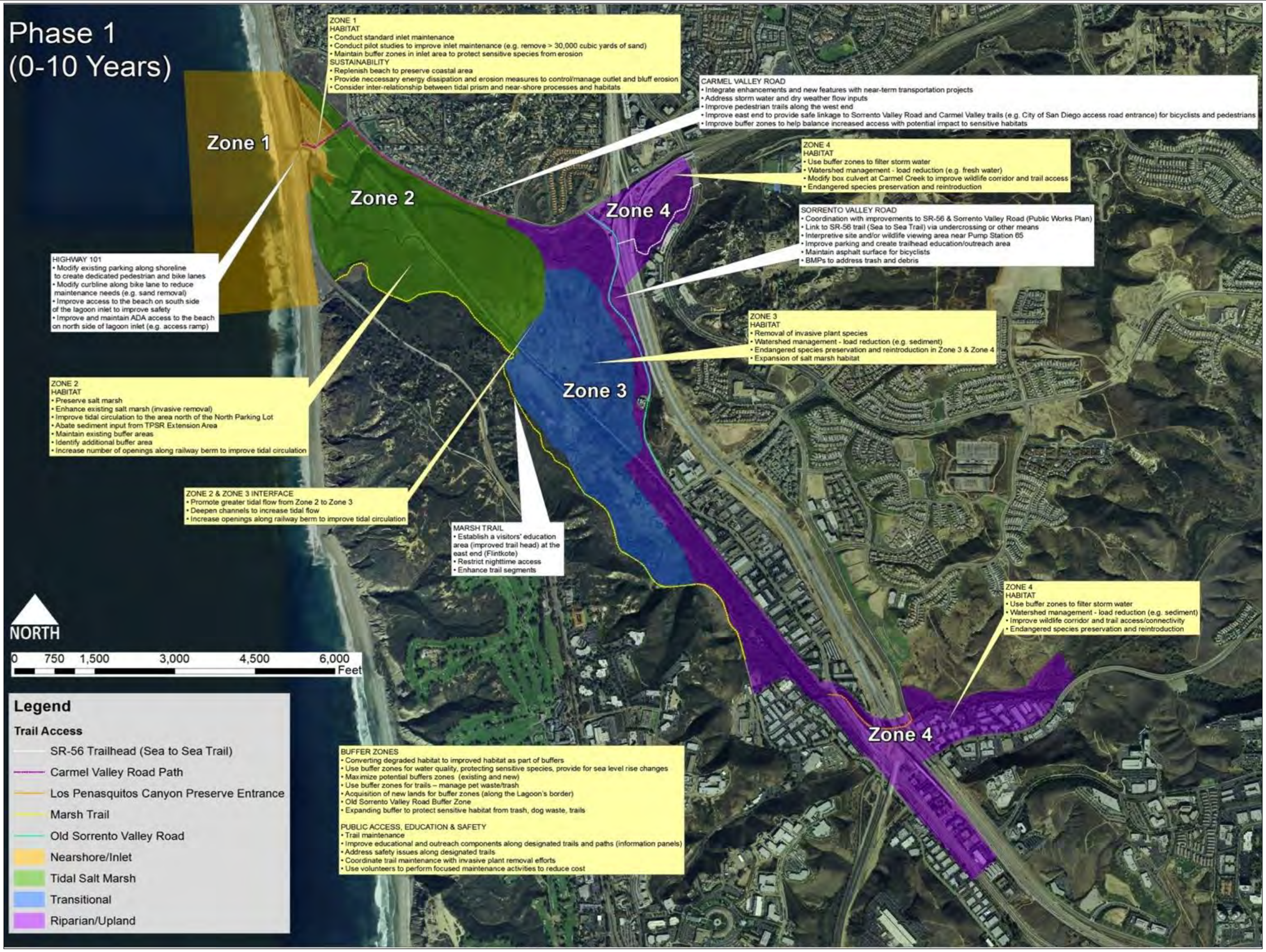

Figure 6-10
Phase 1 (0-5 Years)
Preserve Existing Habitat, Improve Trails
And Move Toward Restoration

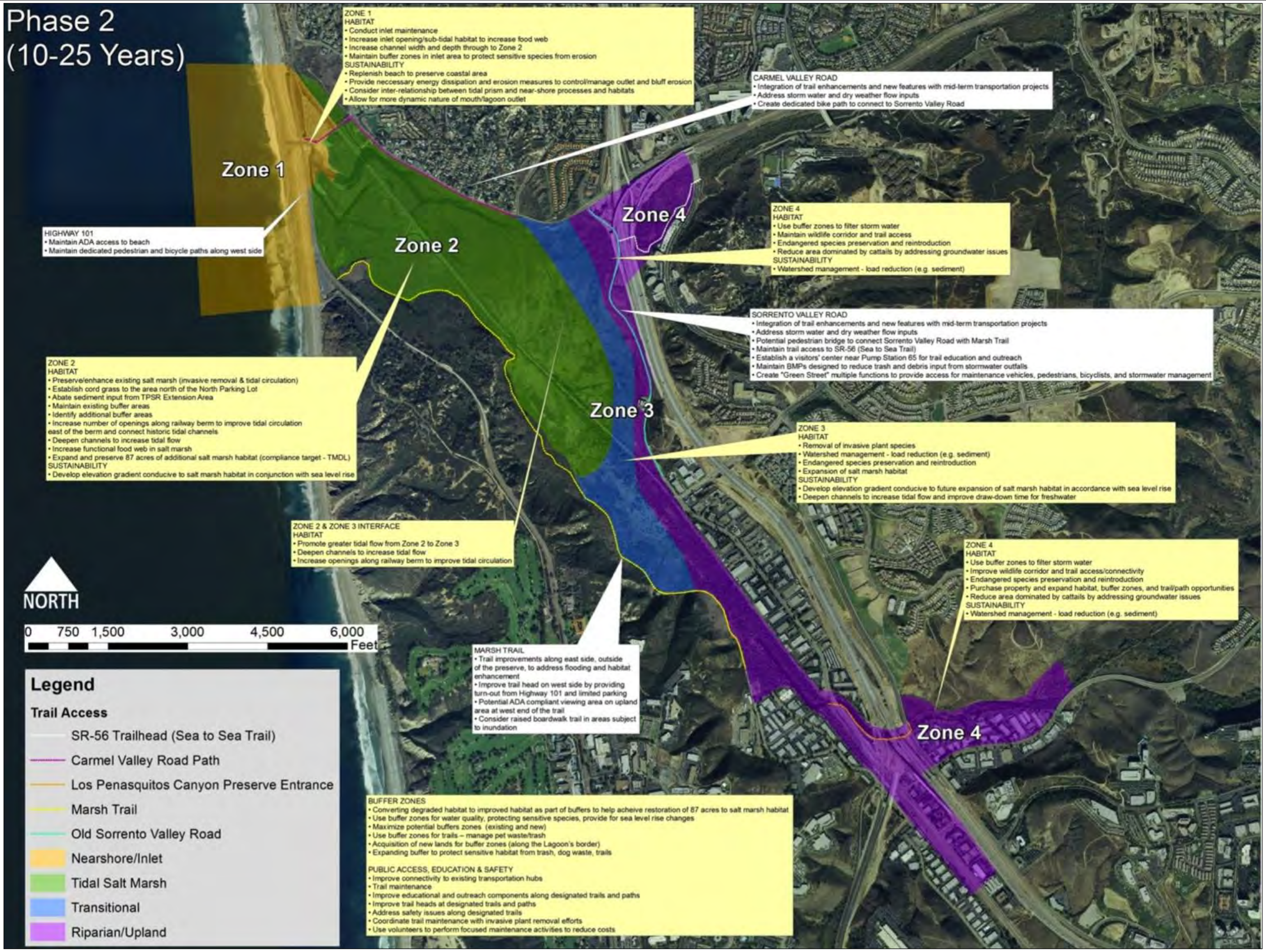

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Figure 6-11
Phase 2 (5-25 Years)
Restore 87 Acres of Salt Marsh
With other Wetland Improvements
And Enhance Trails

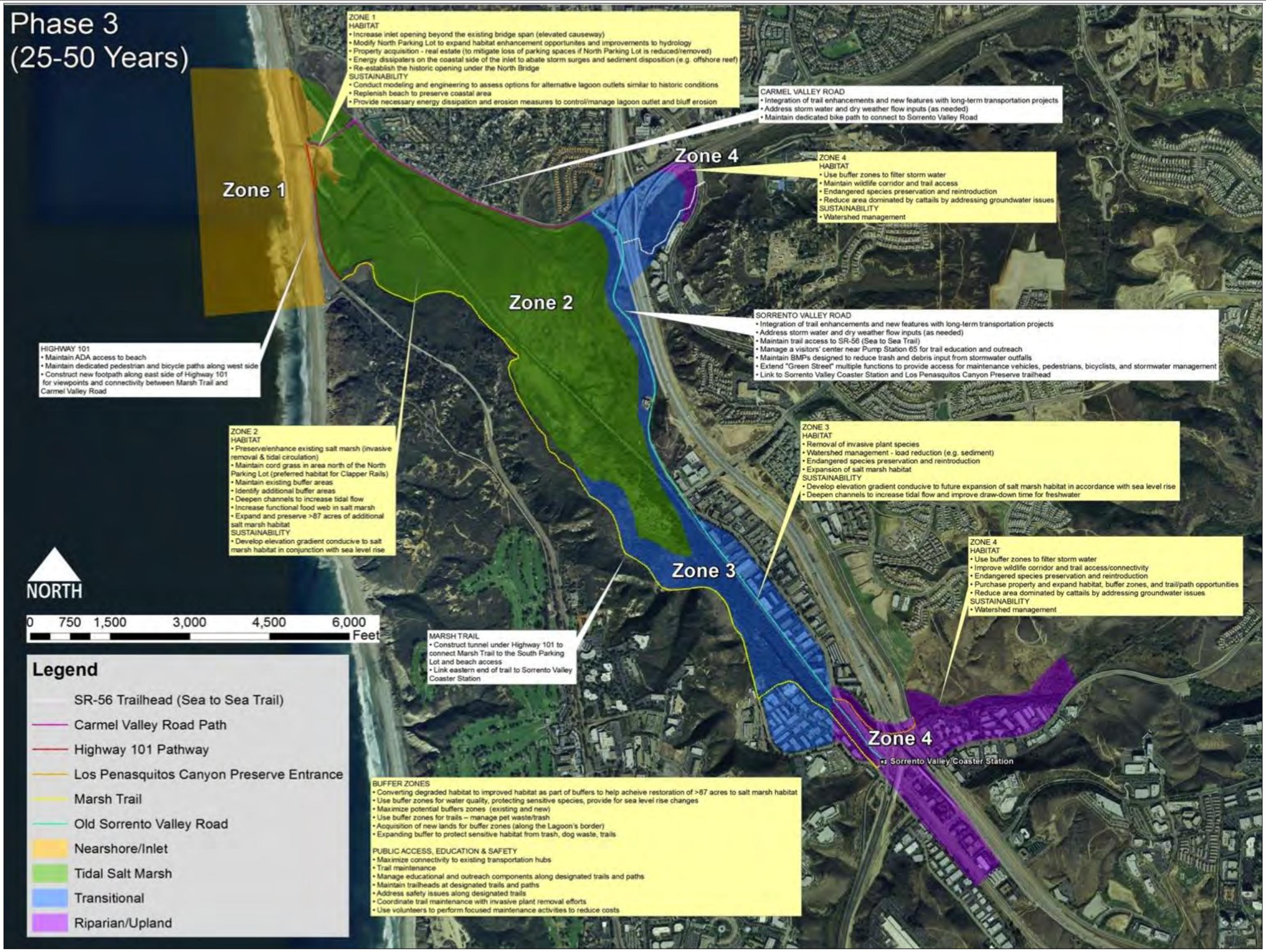

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Figure 6-12
Phase 3 (25-50 Years)
Maximize Salt Marsh Habitat Acreage
Maintain Long-Term Sustainability of Wetland Function
Complete Trail Loop

TABLE 6-3
PHASE 1: SHORT-TERM (0–5 YEARS)

Opportunities (Activities and Project)	Constraints
Zone 1 - Nearshore/Inlet	
• Conduct inlet maintenance using current methods refined since 1985 • Conduct pilot studies to assess the benefits of removing more sand from the inlet area (i.e., >30,000 cubic yards) • Maintain buffer zones in inlet area to protect sensitive species (Nuttall's acmispon and Belding's savannah sparrow) from erosion, undercutting of channel banks, etc.	• Existing infrastructure – Highway 101 (a.k.a. N. Torrey Pines Rd) berm and bridge • Shoaling • Funding • Permit requirements
Zone 2 - Tidal Salt Marsh	
• Preserve salt marsh in Zone 2 • Enhance existing salt marsh in Zone 2 (invasive removal) • Design and implement improvements to area north of the North Beach parking lot (e.g., tidal circulation) • Design & implement improvements to Torrey Pines State Natural Reserve Extension Area to abate sediment input • Maintain existing buffer areas • Identify additional buffer areas	• Costs to acquire buffer zones • Buffer zones may be outside of Reserve jurisdiction
Zone 2/Zone 3 - Transitional Area	
• Removal of invasive (plant species) that trap sediment	• Available area • Cost of Sediment Removal • Permitting – impacts to existing species (e.g., bird nesting)
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads as required compliance target	• Need to address sediment load from the watershed
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4 (Invasive Removal) • Salt marsh expansion	• Exotic species • Maintaining salinity in soils • Freshwater ponding
Zone 4 (Riparian/Upland)	
• Use buffer zones in Zone 4 to filter storm water	• Very difficult to control/manage • Limited space and buffer zones may be outside of the Reserve
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads	• Need to address sediment load from the watershed
• Increase size of box culvert at Carmel Creek to allow for greater connectivity between Zones 3 & 4 for birds (e.g., road runners, Ridgeway's rail) and mammals (bobcats, mountain lions, deer) ○ Potential opportunity = Connecting SR 56 onramp from I-5 • Notes – look at study on wildlife corridors/access (TPA – currently doing, CSP-old report from late 1990s)	• Concern with agencies • Extensive permitting • Cost • Existing infrastructure: I-5, Sorrento Valley Development
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4	• Exotic species • Maintaining salinity in soils • Freshwater ponding
• Increase functional food web in salt marsh • Shift in habitats	• Losing upland habitat • Space/Area

TABLE 6-4
PHASE 2: MID-TERM (5–25 YEARS)

Opportunities (Activities and Projects)	Constraints
Zone 1 - Nearshore/Inlet	
• Increase inlet opening/increase sub-tidal habitat to increase food web • Increase channel width and depth through Zone 2	• Existing infrastructure – N. Torrey Pines Rd berm and bridge • Shoaling • Funding • Permit requirements
Zone 2 - Tidal Salt Marsh	

• Enhance and preserve existing salt marsh in Zone 2
• Establish cord grass in area north of the North Beach parking lot (preferred habitat for Ridgeway's rail)
• Promote/augment greater tidal flow into Zone 2, east of railway berm
  o Excavate channels to -2 NGVD
  o Identify improvement opportunities to tidal channels currently blocked by the railway berm
  o Work with transit to increase spans/culverts as part of double tracking design through the Lagoon
• Expand and preserve 84 acres of additional salt marsh habitat in Zone 3 (Compliance target – TMDL)
	• Costs to acquire buffer zones
	• Buffer zones may be outside of Reserve jurisdiction
	• Available area
	• Cost of sediment removal
	• Permitting - impacts to existing species (e.g., bird nesting)
	• Cost to increase/widen openings in railway berm
	• Need to coordinate with SANDAG/Transnet timeframe for double-tracking – may not correspond with restoration schedule

Zone 3 - Transitional Area	
• Removal of invasive (plant species) that trap sediment • Excavate channels to deepen - increase tidal flow	• Available area • Cost of Sediment Removal • Permitting - impacts to existing species (e.g., bird nesting) • Continual impact from freshwater input
• Increase functional food web in salt marsh • Shift in habitats (grade to balance rise in sea level and "migration" of salt marsh habitat eastward)	• Losing upland habitat • Space/Area
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads and freshwater inputs	• Need to address sediment load and freshwater inputs from the watershed
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4 • Salt marsh expansion	• Exotic species • Maintaining salinity in soils • Freshwater ponding
Zone 4 (Riparian/Upland)	
• Use buffer zones in Zone 4 to filter storm water	• Very difficult to control/manage • Limited space and buffer zones may be outside of the Reserve
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads and freshwater inputs	• Need to address sediment load and freshwater inputs from the watershed
• Increase size of box culvert at Carmel Creek to allow for greater connectivity between Zones 3 & 4 for birds (e.g., road runners, Ridgeway's rail) and mammals (bobcats, deer) • Potential opportunity = Connecting SR 56 onramp from I-5 • Salt marsh expansion	• Concern with agencies • Extensive permitting • Cost • Existing infrastructure: I-5, Sorrento Valley Development
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4	• Exotic species • Maintaining salinity in soils • Freshwater ponding
• Increase functional food web in salt marsh • Purchase property and expand habitat, buffer zones and trail/path opportunities (e.g., non-developed areas) • Reduce area dominated by cattails by addressing ground water issues (e.g., freshwater wells)	• Losing upland habitat • Space/Area

TABLE 6-5
PHASE 3: LONG-TERM (25–50 YEARS)

Opportunities (Activities and Projects)	Constraints
Zone 1 - Nearshore/Inlet	
• Increase inlet opening beyond the existing bridge span (e.g., elevated causeway) • Modify North Beach parking lot to expand habitat enhancement opportunities and improvements to hydrology • Property acquisition - real estate (to mitigate loss of parking spaces if North Parking Lot is reduced/removed) • Energy dissipaters on the coastal side of the inlet to abate storm surges and sediment disposition (e.g., offshore reef) • Re-establish the historic opening under the North Bridge	• Existing infrastructure – Highway 101 (a.k.a. N. Torrey Pines Rd) berm and bridge • Shoaling
Zone 2 - Tidal Salt Marsh	
• Enhance salt marsh in Zone 2 (invasive removal, improved function, establish preferred plant associations) • Maintain cord grass in area north of the North Beach parking lot (preferred habitat for Ridgeway's rail)	• Costs to acquire buffer zones • Buffer zones may be outside of Reserve jurisdiction
• Promote greater tidal flow within Zone 2 and Zone 3 o Increase number of crossings/openings along railway berm to improve and sustain tidal circulation east of the railway berm.	• Cost to increase/widen openings in railway berm • Permitting • Need to coordinate with Transnet timeframe for double-tracking – may not correspond with restoration schedule
• Establish and preserve >84 acres of additional salt marsh habitat in Zone 3	• Continual impact from freshwater input
• Removal of invasive (plant species) that trap sediment • Excavate additional channels to deepen to increase tidal flow into areas of reduced or no tidal inundation	• Available area • Cost of Sediment Removal • Permitting - impacts to existing species (e.g., bird nesting)
• Increase functional food web in salt marsh • Shift in habitats (grading for transitional zones to balance rise in sea level and preservation of >87 acres of restored salt marsh habitat and required buffer zones)	• Losing upland habitat • Space/Area
• Salt marsh expansion beyond 346 acres (TMDL compliance target)	• Concern with agencies and Extensive permitting • Cost • Existing infrastructure: I-5, Sorrento Valley Development
Zone 3 - Transitional Area	
• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads and freshwater inputs	• Watershed Management • TMDL – work with the City (of SD) to reduce sediment loads and freshwater inputs
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4 • Salt marsh expansion	• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4 • Salt marsh expansion
Zone 4 (Riparian/Upland)	
• Use buffer zones in Zone 4 to filter storm water	• Use buffer zones in Zone 4 to filter storm water
• Watershed Management	• Watershed Management
• Salt marsh expansion beyond 346 acres (TMDL compliance target)	• Salt marsh expansion beyond 346 acres (TMDL compliance target)
• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4	• Non-tidal salt marsh areas – endangered species preservation and reintroduction in Zones 3 & 4

• Increase functional food web in salt marsh • Shift in habitats • Purchase property and expand habitat, buffer zones, and trail/path opportunities (e.g., developed areas in Sorrento Valley) • Reduce area dominated by cattails by addressing ground water issues (e.g., freshwater well at Carmel Valley near Caltrans staging area)	• Increase functional food web in salt marsh • Shift in habitats • Purchase property and expand habitat, buffer zones, and trail/path opportunities (e.g., developed areas in Sorrento Valley) • Reduce area dominated by cattails by addressing ground water issues (e.g., freshwater well at Carmel Valley near Caltrans staging area)

TABLE 6-6
BUFFER ZONES

Opportunities	Constraints
Phase 1: Short-Term (0–5 Years)	
• Converting degraded habitat to improved habitat as part of buffers (selected areas - small scale and/or mosaic) • Use buffer zones for water quality, protecting sensitive species, provide for sea level rise changes • Maximize potential buffers zones (existing and new) • Use buffer zones for trails – manage pet waste/trash • Acquisition of new lands for buffer zones (along the Lagoon's border) • Old Sorrento Valley Road Buffer Zone • Expanding buffer to protect sensitive habitat from trash, dog waste, trails	• Areas are limited • Urban areas – no buffer • Cost to acquire buffer zones • Buffer zones may be outside Reserve jurisdiction
Phase 2: Mid-Term (5–25 Years)	
• Converting degraded habitat to improved habitat as part of buffers to help achieve restoration of 84 acres to salt marsh habitat • Use buffer zones for water quality, protecting sensitive species, provide for sea level rise changes • Maximize potential buffers zones (existing and new) • Use buffer zones for trails – manage pet waste/trash • Acquisition of new lands for buffer zones (along the Lagoon's border) • Old Sorrento Valley Road Buffer Zone • Expanding buffer to protect sensitive habitat from trash, dog waste, trails	• Areas are limited • Urban areas – no buffer • Cost to acquire buffer zones • Buffer zones may be outside Reserve jurisdiction
Phase 3: Long-Term (25–50 Years)	
• Converting degraded habitat to improved habitat as part of buffers (>84 acres of salt marsh habitat) • Use buffer zones for water quality, protecting sensitive species, provide for sea-level rise changes • Maximize potential buffers zones (existing and new) • Use buffer zones for trails – manage pet waste/trash • Acquisition of new lands for buffer zones (purchase developed areas within the flood plain and convert to buffer zones) • Old Sorrento Valley Road Buffer Zone • Expanding buffer to protect sensitive habitat from trash, dog waste, trails	• Areas are limited • Urban areas – no buffer • Cost to acquire buffer zones • Buffer zones may be outside Reserve jurisdiction

CHAPTER 7

Lagoon Restoration and Enhancement Concepts

Chapter 7 presents the further development of Project Concepts generated through the stakeholder process explored in Chapter 6. Through technical analysis and evaluation using modeling and input from wetland experts and resource agency representatives, key Project Concepts were transformed into Lagoon Restoration and Enhancement Concepts (Lagoon Concepts). Section 7.1 provides a description of modeling baseline conditions and potential habitat trajectories for Los Peñasquitos Lagoon (the Lagoon) that take into account lagoon processes (e.g., tides, topography, habitat zones) with consideration of projected sea level rise and watershed inputs. Key uncertainties are identified along with hypotheses and data gaps prior to presenting the results of the baseline and habitat trajectory modeling efforts. In Section 7.2, Lagoon Concepts are then discussed within the context of management zones presented during the stakeholder process to identify "zone-specific" management priorities that include: inlet maintenance in Zone 1, protection and enhancement of salt marsh in Zone 2, large-scale salt marsh restoration in Zone 3, and enhancement of riparian habitats in Zone 4. Section 7.3 provides phasing of Lagoon Concepts and related efforts with focus on salt marsh restoration that includes a "pilot" project in Phase 1 used to inform a large-scale effort planned for Phase 2.

Further development of Project Concepts that address the public access, safety and education goals and objectives are presented in Chapter 8 and those that address community health with regard to improved vector management are presented in Chapter 9.

7.1 Modeling Baseline Conditions and Potential Habitat Trajectories

ESA developed a GIS-based marsh Habitat Evolution Model (HEM) for Los Peñasquitos Lagoon to estimate the change in acreages of salt marsh, brackish marsh, freshwater marsh, and transition zone habitats over time for future conditions, considering watershed inputs and projected sea level rise. This section discusses the modeling of baseline conditions, including development of the conceptual model used to inform the HEM (Section 7.1.1), a description of HEM and model inputs (Section 7.1.2), and results for habitat trajectory modeling using baseline conditions under HEM (Section 7.1.3). For more information related to the development and results of the HEM, please refer to the Baseline Conditions Habitat Projection Modeling Report in Appendix K.

7.1.1 Conceptual Model of Los Peñasquitos Lagoon

The habitat projection model is based on the conceptual model that Los Peñasquitos Lagoon habitats change over the long-term in response to multiple processes, including tides, sediment accretion, freshwater inputs from the watershed, ecology, and sea level rise. These processes are briefly summarized below (see Chapter 4 for existing conditions), along with the history of how they have changed over time at the Lagoon (see Chapter 3 for more history of the site). Together, these processes and history provide the conceptual basis or framework (conceptual model) for the habitat projection model.

7.1.1.1 Lagoon Processes

Tides

Salt marsh and intertidal habitats establish within zones corresponding to tidal inundation. Tidal inundation is an important process that affects terrestrial and aquatic habitats within Los Peñasquitos Lagoon. Ocean tides propagate through the Lagoon's inlet and up its channels. However, the height and duration of the tidal waters within Los Peñasquitos Lagoon can vary with regard to tidal data measured offshore. The existing tides within the Lagoon are described in detail in Section 4.4.1 of Chapter 4.

Topography and Accretion

The elevation of an area determines the frequency of tidal inundation, which in turn determines soil moisture and salinity. These factors affect the type of vegetation that can establish and persist. If the topography changes due to accretion (or restoration/grading), the habitat types change in response. The Lagoon receives sediment from its watershed and tributary creeks as described in Chapter 4 (Section 4.4.5). Typically, this sediment input results in accretion with resultant effects on tidal inundation (reduced) and salinity (reduced).

Freshwater Inputs

Riparian, freshwater marsh, and brackish marsh habitats form in areas influenced by freshwater inflows. These areas of freshwater influence are either inundated solely by freshwater or are characterized by tidal mixing of ocean water and freshwater inflows, creating brackish salinities. The influence of freshwater determines what type of vegetation can establish and persist in that area. If the extent of freshwater inundation increases, the extent of riparian, freshwater marsh, and brackish marsh habitats will increase at the expense of salt marsh and transitional areas. Conversely, if the area of freshwater influence is reduced, the extent of freshwater habitats will be reduced over time if soil salinity levels can be restored. The area or extent of freshwater influence can be inferred from the extent of existing freshwater habitats, correlated to freshwater inflows, and/or quantified through monitoring and modeling of freshwater inflows and salinity gradients. Sources of freshwater flows entering Los Peñasquitos Lagoon may consist of storm water, dry weather flows and groundwater.

Habitat Zones

Lagoon habitat zones can be defined for different areas based on the elevation of the area relative to tidal datums (i.e., as a surrogate for the frequency of tidal inundation) and whether the area is within the zone of freshwater influence (**Figure 7-1**). The model uses an additional datum called the "salt elevation," which is based on the extent of existing salt marsh (7.55 ft NAVD) and is just above the highest astronomical tide or HAT (6.95 ft NAVD). Remnant salt marsh exists in the Lagoon above the HAT elevation as a byproduct of lagoon mouth closures, which raise water levels above typical tide levels. However, most of these areas have been lost to habitat conversion. **Figure 7-1** shows the different elevation-based habitat zones for areas outside and within the area of freshwater influence used in the habitat projection model. When freshwater is absent, the upland species establish at the highest elevations, followed by transition, salt marsh, mudflat, and lastly, subtidal habitat. When a freshwater influence is present, riparian species establish at the highest elevations, followed by riparian transition zone, freshwater marsh, brackish marsh, low salt marsh, mudflat, and subtidal habitat. Below MHW, the tides have a strong enough influence that salt marsh can establish even in the presence of freshwater.

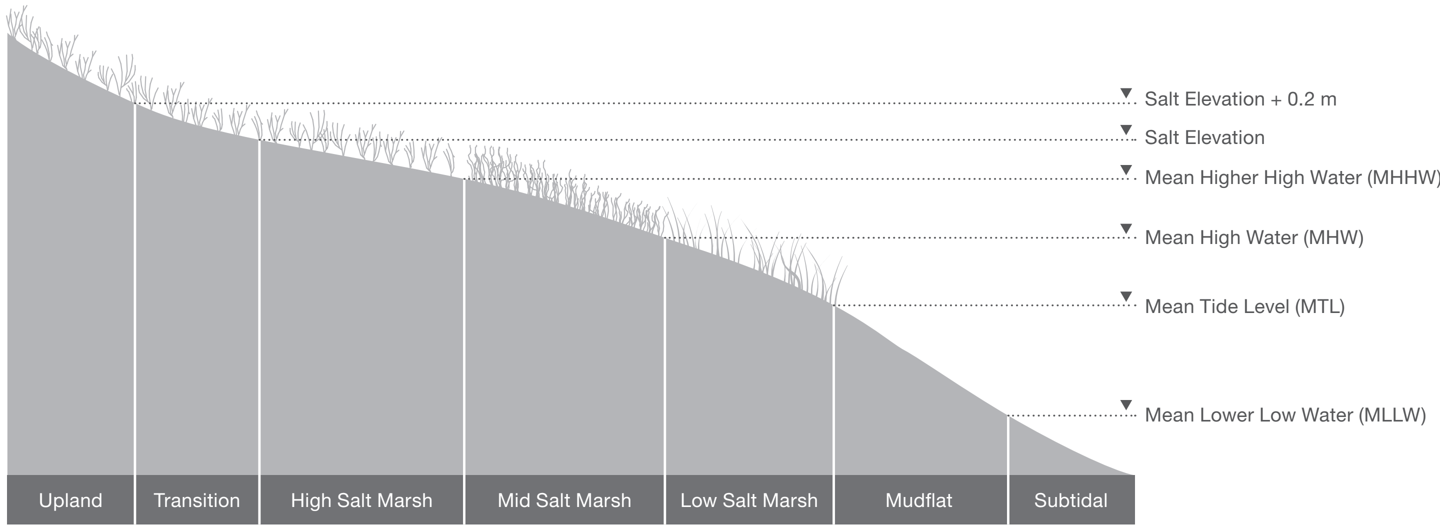
Sea Level Rise

Sea level rise is expected be a major driver of habitat evolution at Los Peñasquitos Lagoon. Since most vegetation establishes in areas based on the local tidal inundation and salinity, habitats will evolve when the tides rise. Section 4.4.2 in Chapter 4 describes the current sea level rise estimates for the California coast and how it may affect the Lagoon.

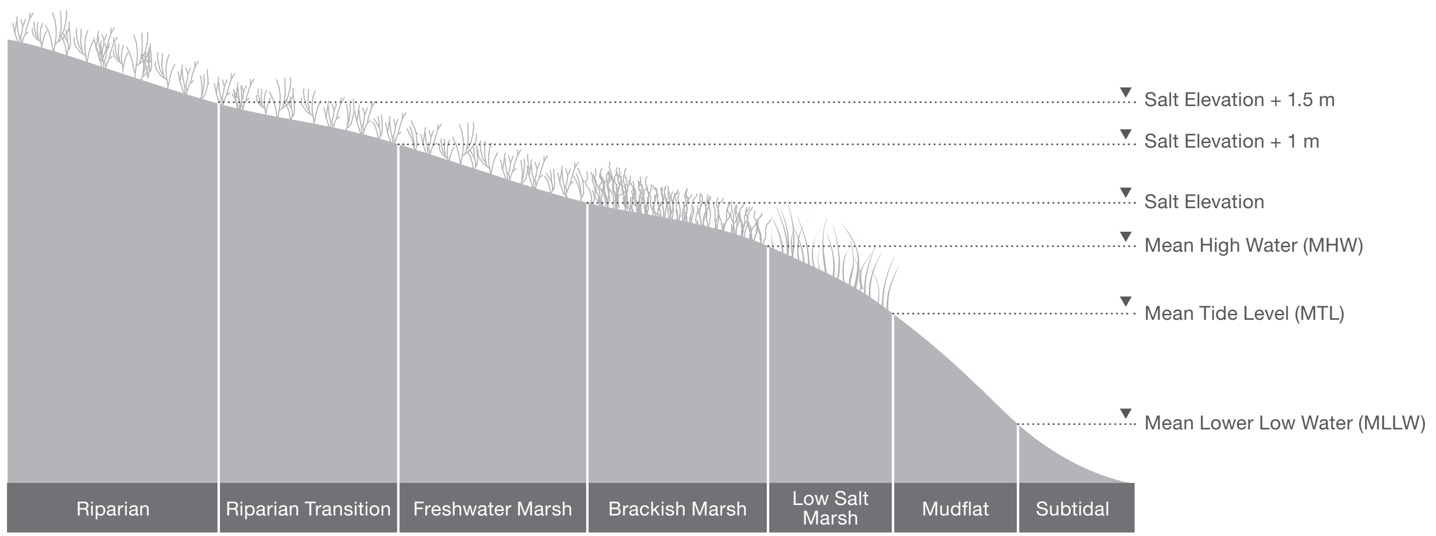
7.1.2 HEM Inputs

Inputs to the HEM include topography, vegetation mapping and habitat data, tidal water levels, projected future sea level rise, areas of freshwater influence, and watershed sediment loading. The model uses a habitat evolution decision tree to determine how habitats will evolve over time, and then produces maps of habitat types and habitat acreages on decade intervals (i.e., through 2100 for this analysis). Habitat zones within Los Peñasquitos Lagoon can be defined for different areas based on the elevation of the area relative to tidal datums (i.e., as a surrogate for the frequency of tidal inundation) and whether the area is within the zone of freshwater influence. Over time, tidal datums will increase due to sea level rise, sedimentation will continue to raise topography, and the area of freshwater influence may be reduced due to watershed management. All of these factors determine the path a specific area in the lagoon will follow within the habitat evolution decision tree, as shown in **Figure 7-2**.

Note that the habitat projection model is focused on long-term habitat changes and processes occurring over a multi-decade time frame. Certain shorter-term processes affect habitat evolution, but are accounted for by modeling long-term cumulative processes and habitat change rather than directly representing these shorter term processes. For example, lagoon inlet dynamics and mouth closure affects sediment deposition and freshwater influence on seasonal and interannual time scales. The long-term model captures the net cumulative effect of these processes by using average tides (tidal datums), habitat zonation based on tidal datums, and the sedimentation and freshwater influence modules.



Habitat Zones Outside of Freshwater Influence



Habitat Zones Within Area of Freshwater Influence

Figure 7-1
Conceptual Habitat Elevation Zone Model

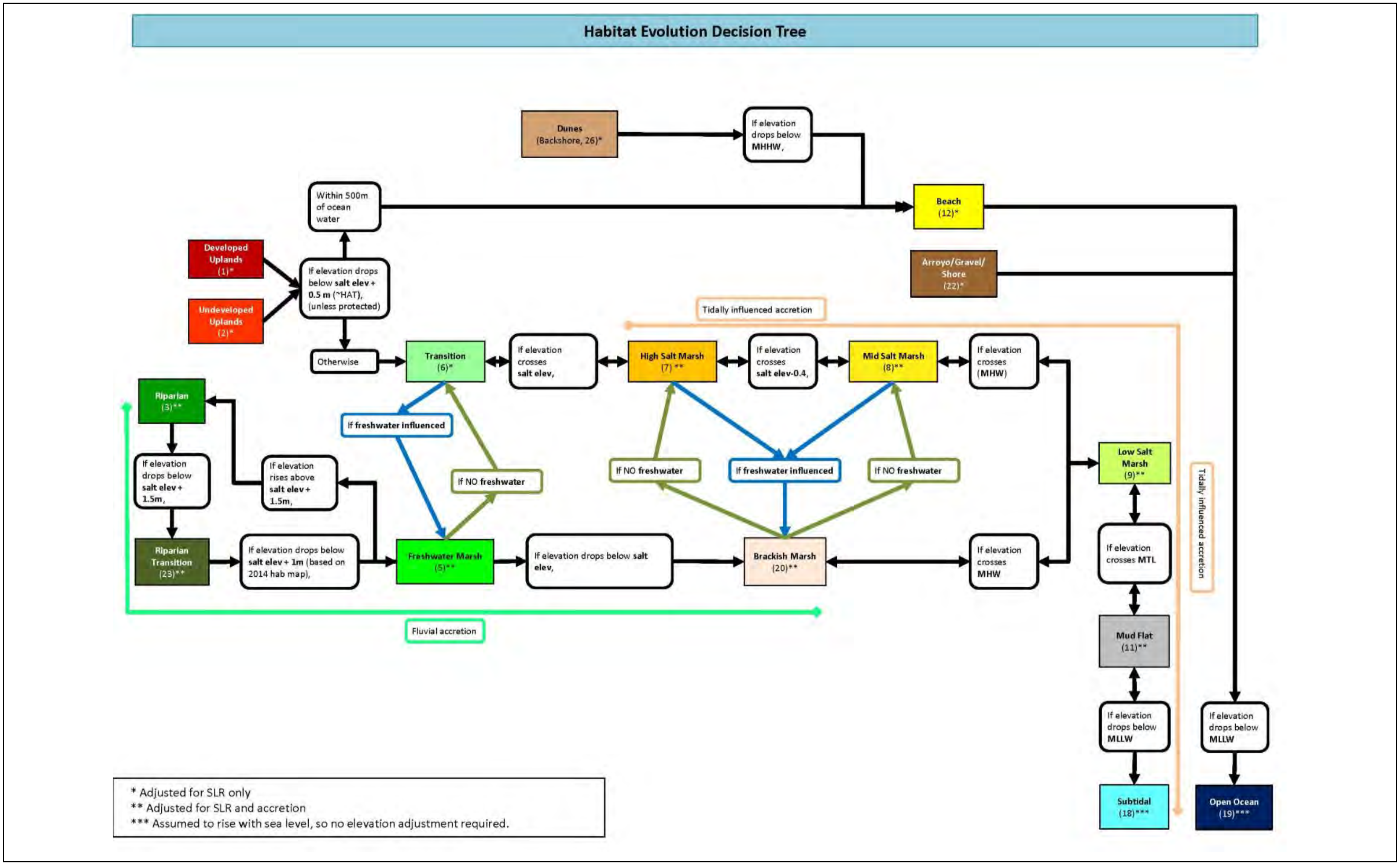


Figure 7-2
Habitat Evolution Decision Tree

The current modeling assumes that the inlet dynamics and ongoing maintenance program will not significantly change in the future and that longer term tidal and deposition processes will therefore not be affected due to changes in inlet processes and maintenance. Coastal sand transport and inlet dynamics are expected to change over time, in response to sea level rise and regional sand management; however, analyses of these processes is currently outside the scope of this effort. Coastal and inlet processes will be analyzed along with channel hydrology in subsequent efforts through a separate hydrodynamic study used to help better define feasibility of designing and implementing the preferred Lagoon Concept. These additional inputs to the HEM and potential effects on habitat evolution will be accounted for in the habitat projection model by refining the habitat decision tree or adding an inlet module.

Another example of a short-term process that the model analyzes on a longer time-scale, is the episodic sediment delivery from large storms events that Pacific Coast tidal lagoons typically experience. These events, which occur and vary on seasonal and interannual timescales, are not considered directly in the model. Rather, the model uses average decadal sediment loads to account for the overall cumulative amount of sediment that enters the Lagoon in the long-term. To evaluate baseline conditions (no restoration) at Los Peñasquitos Lagoon, the GIS model was run with the following inputs: topography and bathymetry; vegetation; tidal water levels; sedimentation; and freshwater.

7.1.2.1 Topography and Bathymetry

Topography is used in the model as input to the habitat evolution decision tree (**Figure 7-2**). **Figure 4-3** presents the existing topography of Los Peñasquitos Lagoon and the four sources that were used. Off the coast, the USACE Southern California Bathy LiDAR (2009) was used for bathymetric data, while the Scripps Southern California LiDAR (2009) provided more detailed data along the shore and into the lagoon mouth. The rest of the Lagoon topography was covered with the State Coastal Conservancy Coastal LiDAR Project Digital Elevation Model (DEM; 2009-2011). The remaining area within the model boundary was covered with the California IFSAR DEM (2002-2003), which is lower resolution than the other data sets.

The resulting topography/bathymetry was converted to 5 meter cells provide a spatial resolution that is consistent with the vegetation mapping and maintains reasonable model run times. Section 4.3 in Chapter 4 provides more information related to the existing topography in Los Peñasquitos Lagoon.

7.1.2.2 Vegetation Mapping

Vegetation mapping existing conditions is needed in the model to evaluate how habitats will evolve over time. California State Parks (CSP) delineated vegetation boundaries on an aerial image flown by Lenska in the winter of 2013 and vegetation polygons were delineated at a scale of 1:600. Additional data used to assist with the delineation of vegetation boundaries included:

- 2013 LiDAR vegetation height data from State Coastal Conservancy
- 2009-2011 California State Coastal Conservancy Coastal LiDAR DEM

- 2011 Bing Imagery
- Oblique Imagery from Google Maps and Bing Maps
- Images from ArcGIS.

Dominant species cover was estimated in the field and categorized using the Vegetation Classification Manual for Western San Diego County, which was modified to account for the presence of invasive species (VCMWSD) (AECOM/CDFG 2011). Vegetation was categorized into habitat types according to a habitat cross-walk (see Appendix K). The cross-walk was developed based on inundation frequency, salinity preferences, and expected evolution under sea level rise for each vegetation type. The habitat evolution decision tree is presented in **Figure 7-2**. Salt pannes were not included in the initial runs of the HEM but could be added as a post-processing step if needed.

7.1.2.3 Tidal Water Levels

Tidal Datums

Tidal datums are used within the model as an input to the habitat evolution decision tree (**Figure 7-2**). For example, mean lower low water (MLLW) is the boundary between open water and mudflat or beach, because it indicates the elevation at which land is always inundated (during an average day). If land is below MLLW, it is assumed to be open water; if land is just above, it is either mudflat or beach.

Tide data collected by the Tijuana River National Estuarine Research Reserve (TRNERR) from September 2013 through May 2014 was used to calculate tidal datums in Los Peñasquitos Lagoon (**Table 7-1**). As previously mentioned, an additional "salt elevation" datum is used to set the limit between high salt marsh and transition zone, and brackish marsh and freshwater marsh. The salt elevation is set to 7.55 feet (ft) NAVD (2.3 m NAVD) at Los Peñasquitos Lagoon, based on the existing transition between habitats.

TABLE 7-1
TIDAL DATUMS USED IN THE MODEL
(VALUES IN FEET NAVD)

Tidal Datum	Bridge Gage[1]
Salt Elevation	7.55 (2.3 m)
MHHW	5.27
MHW	4.67
MTL	3.60
MSL	3.73
MLW	2.53
MLLW	2.39

1. Data from TRNERR

Sea Level Rise

In the model, sea level rise is added to each datum by decade. The NRC (2012) sea level rise projection was used in the baseline model run. Appendix K provides a sensitivity analysis to different rates of sea level rise. **Table 7-2** provides the projected sea level rise scenario by decade.

TABLE 7-2
SEA LEVEL RISE SCENARIO
(VALUES IN INCHES FROM 2000)

Year	Projected Scenario
2010	1.3
2020	3.1
2030	5.3
2040	8.2
2050	11.6
2060	15.5
2070	20.0
2080	25.1
2090	30.7
2100	36.9

7.1.2.4 Sedimentation

Fluvial Accretion

The HEM uses a decadal sediment load to build alluvial fans or partial cones of sediment that advance out from the creek mouths to raise the topography. A sediment loading curve was developed based on the loads estimated in the Lagoon Sediment TMDL (**Table 7-3**). The curve was derived from the current, historic, and required loads from the Lagoon Sediment TMDL in cubic yards (cy) per year (yr) and interpolated in between (**Figure 7-3**). Appendix K provides a sensitivity analysis to different sedimentation curves.

TABLE 7-3
SEDIMENT LOADS BASED ON TMDL

	Current Load (2000) (cy/yr)	Historic Load (mid-1970s) (cy/yr)	Required Load Reduction
TMDL	7,620	2,550	67% or 2,520 cy/yr

SOURCE: Tetra Tech 2010.

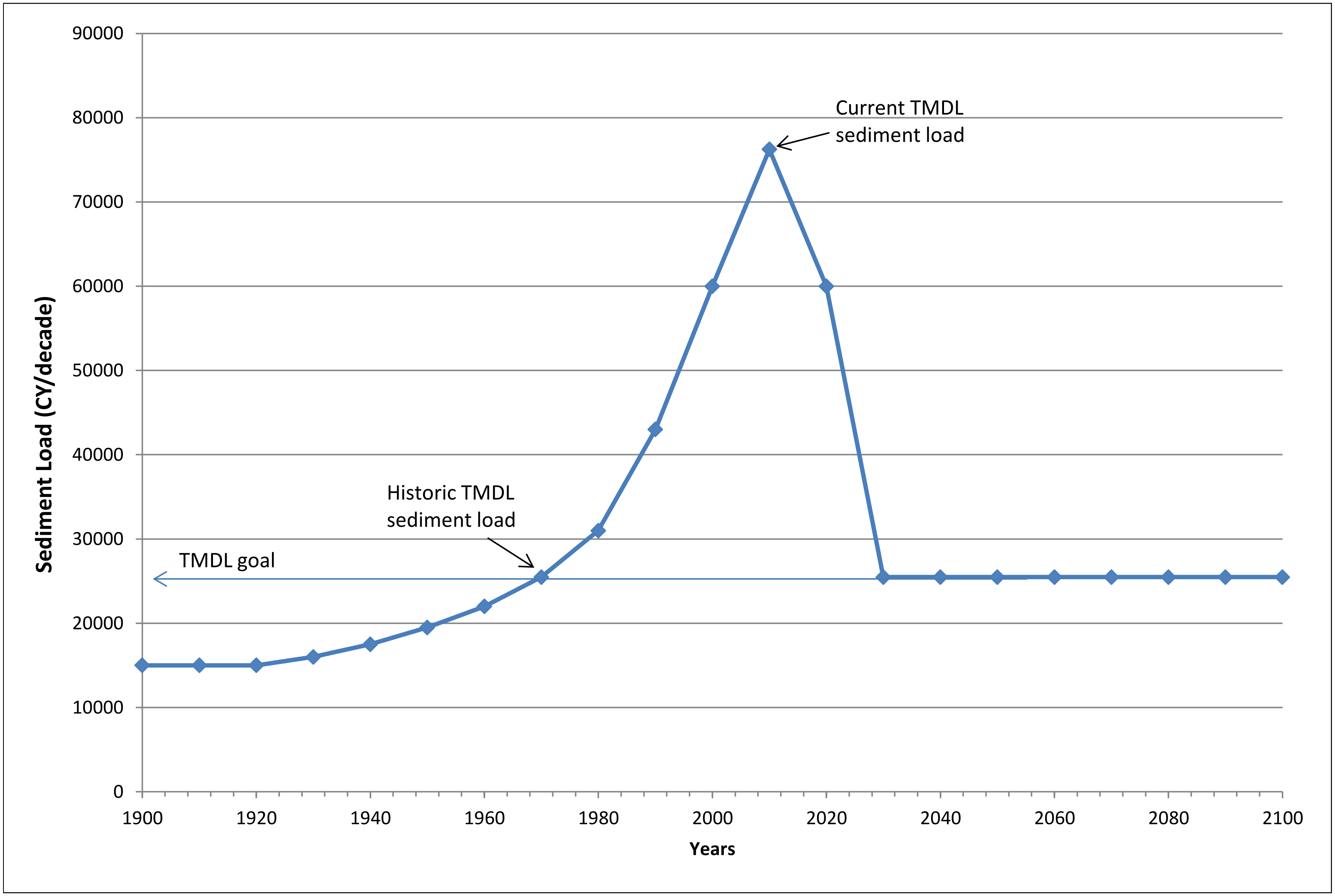


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Figure 7-3
Conceptual Sediment Loading Curve

Tidal Accretion

In the model, tidal accretion is applied to all areas below mean higher high water (MHHW) as described in the conceptual model in Appendix K. The maximum rate of tidal accretion was set to 4.6 mm/yr based on the current estimated rate found by Cole and Wahl from a sediment core taken within Los Peñasquitos Lagoon as part of a study conducted to recreate the Lagoon's historic ecology (Cole and Wahl 2000).

7.1.2.5 Freshwater Inputs

The model defines the area of year-round freshwater influences based on a freshwater influence polygon. For existing conditions, this polygon was defined by the extent of brackish and freshwater marsh in Los Peñasquitos Lagoon (**Figure 7-4**). The model assumes freshwater extends to the limits of the existing brackish marsh, and that the addition of channels could flush freshwater through the system. Appendix K presents a sensitivity analysis to changing the area of freshwater influence.

7.1.3 Habitat Trajectory Baseline Conditions Model Results

As shown in Appendix L, baseline condition maps (baseline conditions are the habitat trajectory without the project) prepared for Los Peñasquitos Lagoon over decadal intervals from 2010 through 2100 indicate that habitat conversion and overall loss of salt marsh in the Lagoon will most likely continue into the future if no action is taken. Under existing conditions, salt marsh habitat is substantially reduced within the Lagoon as sea level rises. If freshwater inputs to the Lagoon are not reduced, the model results show salt marsh establishment in Zone 3 will be delayed until 2070 – 2090, since the model assumes brackish marsh will not convert to salt marsh until elevations are below MHW. In 2100, only 20 acres of mid/high salt marsh remain, representing a loss of 120 acres from 2010 (**Table 7-4**).

Over time, the freshwater marsh moves upslope onto the sediment fans and is replaced by brackish marsh at the lower elevations. Riparian habitat decreases as well, as the freshwater marsh encroaches.

Figure 7-4
Area of Freshwater Influence

TABLE 7-4
MODELED HABITAT ACREAGES FOR BASELINE (NO PROJECT) CONDITIONS

Habitat	2010	2030	2050	2070	2100	Change between 2010 and 2100
Developed Upland	2551	2551	2551	2551	2551	0
Undeveloped Upland	2355	2354	2352	2350	2344	-11
Riparian Wetland	193	190	185	177	167	-26
Riparian Transition Zone	19	19	18	17	12	-7
Freshwater Marsh	47	50	52	43	37	-10
Brackish Marsh	148	149	153	170	159	11
Transition Zone	38	35	32	31	28	-10
High Salt Marsh	39	28	15	9	6	-33
Mid Salt Marsh	113	125	127	52	14	-99
Low Salt Marsh	6	9	21	100	62	57
Mudflat	0	1	2	10	115	115
Subtidal	40	40	40	40	53	13
Dunes	1	1	1	1	1	0
Beach	18	16	14	11	8	-10
Arroyo/Gravel/Shore	3	3	3	3	3	0
Open Ocean	422	424	427	429	433	10

7.2 Lagoon Concepts by Management Zone

7.2.1 Zone 1 Lagoon Concepts – Inlet Maintenance and Tidal Prism

Zone 1 restoration and enhancement may include modifying the inlet to increase tidal prism and sub-tidal habitat, to improve tidal circulation and overall functionality of the Lagoon, and to reduce the long-term inlet maintenance efforts. Inlet modification concepts and the effects of the concepts and sea level rise on inlet dynamics will be developed and evaluated to help inform adaptive management of Los Peñasquitos Lagoon's resources and design of Lagoon Concepts identified for Zone 2 through Zone 4 that include salt marsh restoration and enhancement of riparian corridors. Currently, a Design and Feasibility Study is underway for these Lagoon Concepts and will include modeling of coastal processes in order to assess the extent and frequency of inlet closures and to create maximum tidal exchange and circulation in Los Peñasquitos Lagoon with cost effective long-term maintenance.

7.2.2 Zone 2 Lagoon Concepts – Preservation of Salt Marsh and Restoration of Marsh Habitat North of the North Beach Parking Lot

Restoration and enhancement for Zone 2 includes continuing ongoing preservation activities, such as removal of invasive plants, coupled with lagoon improvements designated for later phasing. These improvements may include potential channel modifications to increase both volume and extent of tidal circulation to improve overall functionality of the Lagoon. Channel modification and other restoration will be further evaluated under the Design and Feasibility Study mentioned in Section 7.2.1 that will include hydraulic and geomorphologic analysis. In addition, Zone 2 enhancement concepts include improving tidal flow and exchange into the area north of the North Beach parking lot. This area receives tidal flows through a culvert under the North Beach parking lot access road which is undersized and may have been compromised due to heavy traffic loads. The restriction of flows to this area has degraded the salt marsh habitat and increased favorable conditions for mosquito breeding habitat. This concept is further discussed and evaluated in Chapter 9 as a potential Phase 1 community health-vector habitat remediation concept.

7.2.3 Zone 3 Lagoon Concepts – Salt Marsh Restoration

Lagoon Concepts for Zone 3 were developed to meet the refined project habitat and sustainability goals and objectives using the opportunities identified through the stakeholder process. The Project Concepts presented in this section focus on the opportunities identified for Phase 1 (0-5 years) for a "pilot" restoration project followed by a larger-scaled effort for Phase 2 (5-25 years) to meet the minimum salt marsh habitat restoration objective of 84 acres in Zone 3. Phase 1 of lagoon restoration will focus on the area within Zone 3 located southwest of the railroad berm as discussed in Section 7.3. Phase 2 will then address large-scale salt marsh restoration opportunities north of the railway berm in Zone 3. The Lagoon Concepts will also consider restoration goals that extend into Phase 3 and beyond through analysis of long-term factors such as sea level rise and reductions of sediment and freshwater loading from the watershed. The Lagoon Concepts represent different methods for re-establishing salt marsh habitat over time (including consideration of future sea level rise) in areas that have converted to non-native and native brackish and freshwater habitat. The Lagoon Concepts are:

Lagoon Concept 1 – No Action (**Figure 7-5**);

Lagoon Concept 2 – Freshwater Management through Channel Improvements focuses on freshwater management measures that include modifications to the tidal channels in order to dewater areas of historical salt marsh that have been converted to brackish system from both surface freshwater and groundwater inputs (**Figure 7-6**). Creating tidal channels would also provide channel features in areas where salt marsh is expected to develop over time in response to sea level rise. Freshwater management measures also include reductions of freshwater inputs through watershed runoff reduction measures and potential diversion and beneficial use of these flows where feasible. There would be only limited grading in this concept (approximately 51,000 cy) and minimal habitat impacts (7 acres).

Lagoon Concept 3 – Elevation Reduction through Sediment Removal uses elevation reduction to achieve salt marsh restoration through the removal of accumulated sediment in Zone 3 (**Figure 7-7**) to lower the current grades down to marsh plain elevation (~7.5 ft NAVD). Grading would impact 90 acres of habitat and require 196,000 cy of excavation.

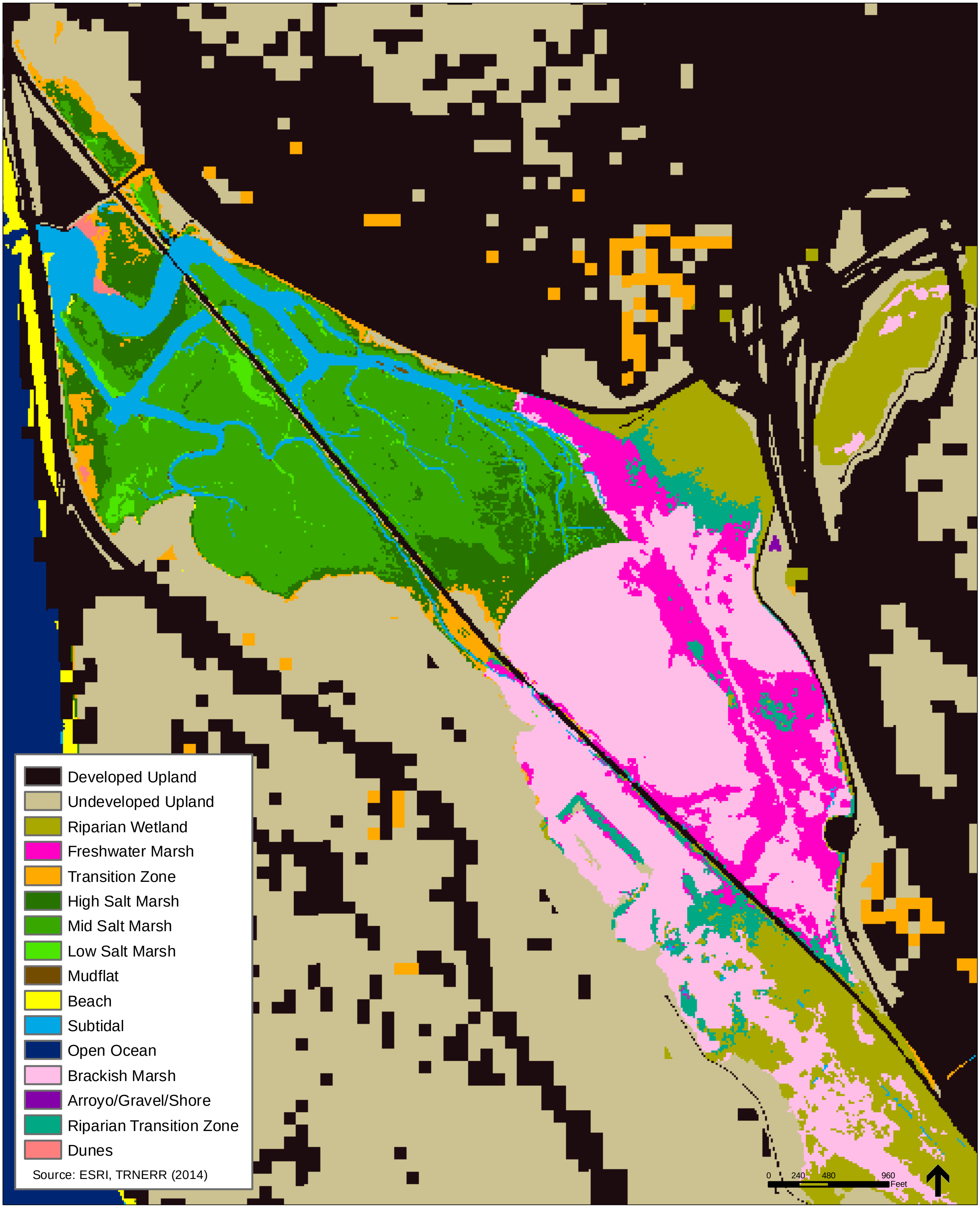

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Figure 7-5
Lagoon Concept1, No Action

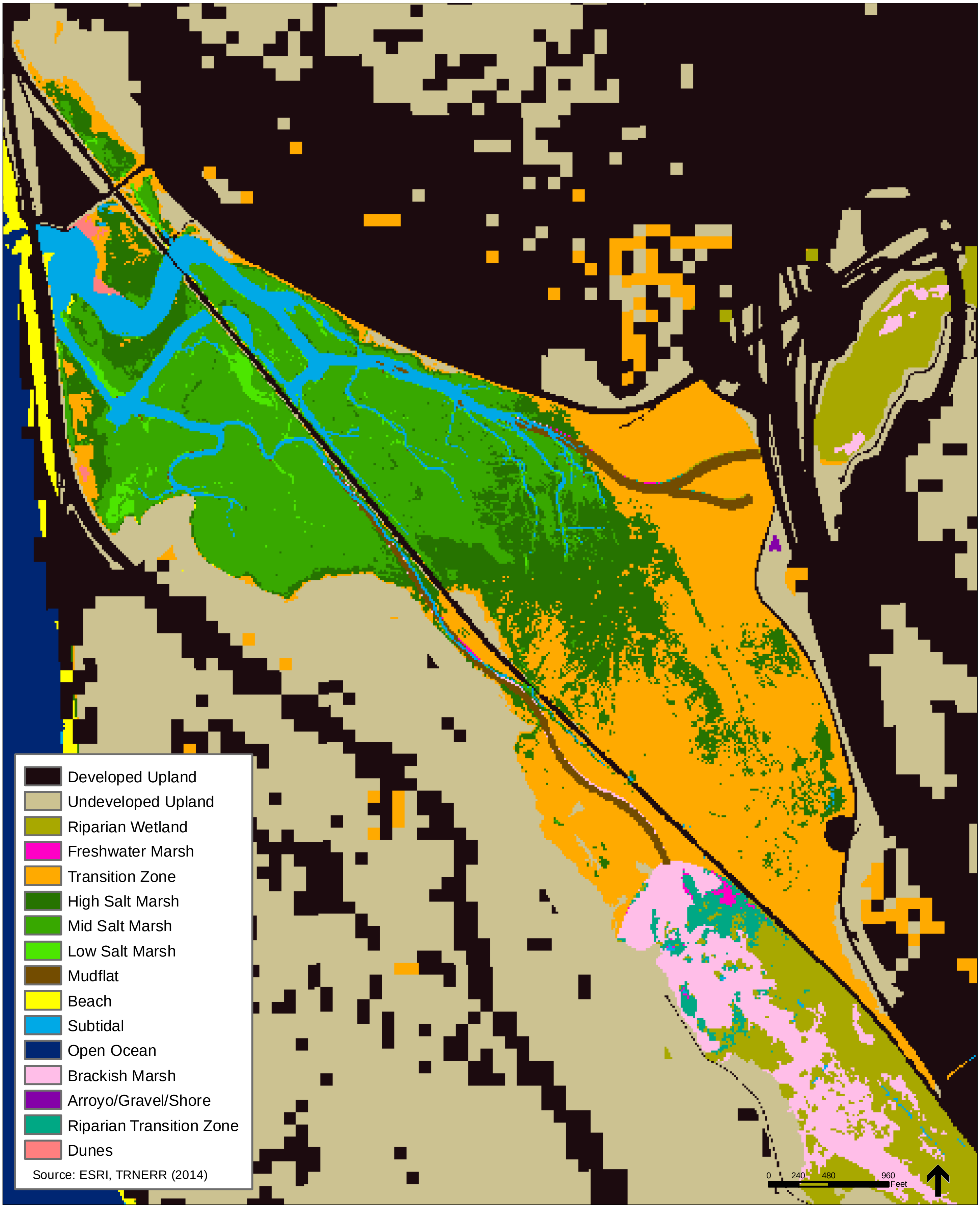

Figure 7-6
Lagoon Concept 2,Channel Improvements

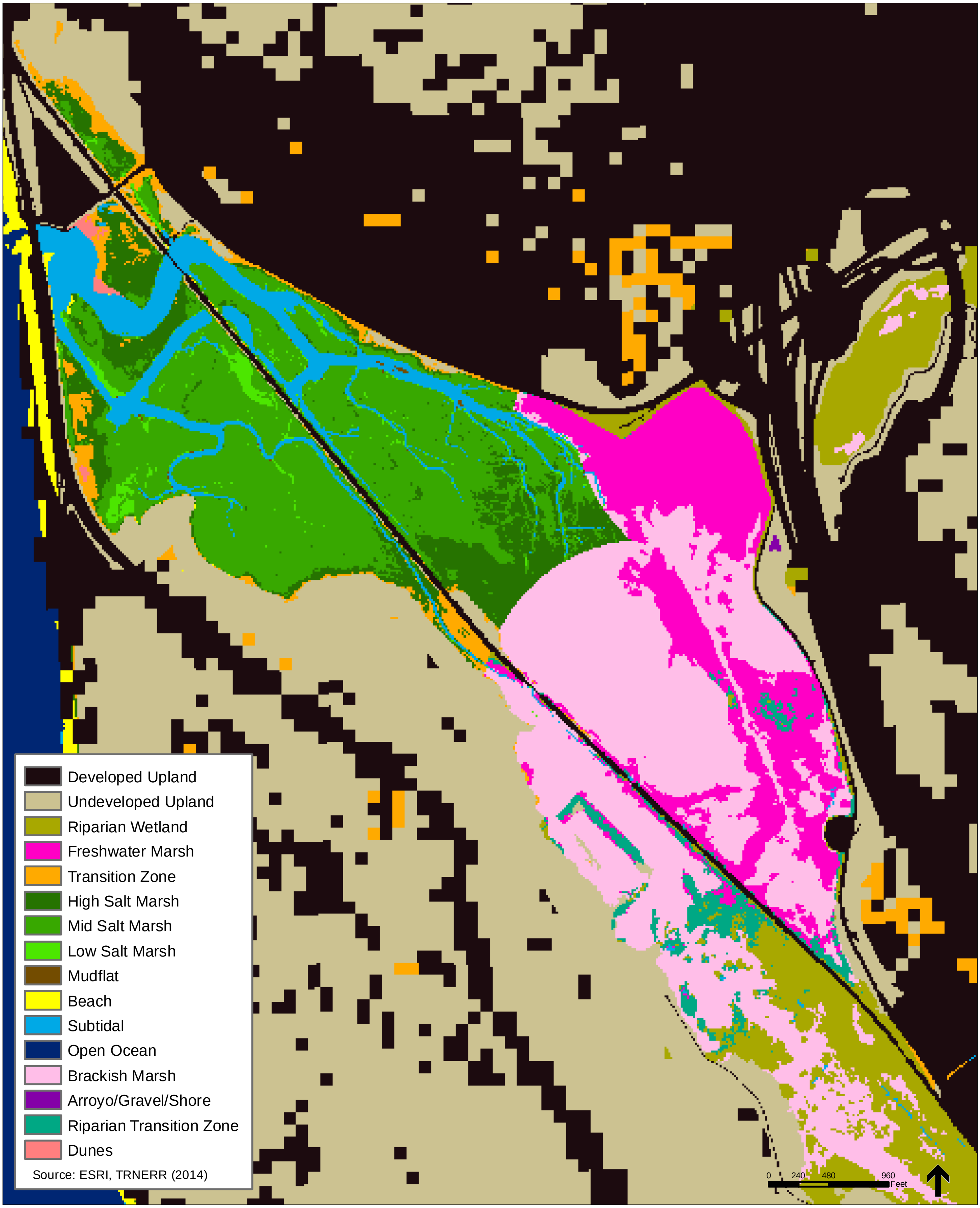

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Figure 7-7
Lagoon Concept 3, Grading

Lagoon Concept 4 – Elevation Reduction and Freshwater Management combines freshwater management with elevation reduction (**Figure 7-8**). The channels would be modified as in Lagoon Concept 2, and the middle of the Lagoon (Zone 3) would also be graded to marsh plain elevation as in Lagoon Concept 3. This concept would require the most grading (247,000 cy) and the largest impacts (95 ac).

The design features for each Lagoon Concept are presented in the following section along with the modeled habitat trajectories for each concept and the adaptive management that would be needed for each concept. Phasing of Lagoon Concepts developed for Zone 3 is provided in Section 7.3. Chapter 10 provides a comparison of Lagoon Concepts along with justification for selecting the preferred Lagoon Concept.

7.2.3.1 Description of Lagoon Concepts

Lagoon Concept 1 – No Action

Lagoon Concept 1 is the no-action option. Under this concept, Los Peñasquitos Lagoon would continue to evolve under baseline conditions with no mechanized efforts conducted (e.g. grading, channel modification) to facilitate salt marsh recovery in Zone 3. Instead, efforts would be focused on small-scale control of invasive plant species and planting and seeding of native species. The No Action Lagoon Concept is included as a necessary component for NEPA/CEQA compliance.

Lagoon Concept 2 – Freshwater Management through Channel Improvements

Under Lagoon Concept 2, channels would be excavated to help transport year-round, non-storm freshwater flows to the ocean and to bring tidal waters further back into the eastern reaches of Los Peñasquitos Lagoon. Lagoon Concept 2 would create additional subtidal habitat in the channels, and transition zone habitat would replace the existing brackish and freshwater habitat. Over time with sea level rise, the channels would provide tidal flow and drainage to the marsh plain, which would convert to salt marsh. Additionally, freshwater flows from the watershed would be reduced and/or diverted.

Habitat and Design Features

As shown in **Figure 7-9**, one channel would be cut to extend east to Carmel Creek, while the other would be extended southeast along the railroad berm, towards the confluence of Carroll Canyon and Los Peñasquitos Creeks. Additional channels may be added following further hydrodynamic modeling performed as part of the Design and Feasibility Study that will help determine channel design and associated features needed to capture non-storm flows and eliminate or reduce freshwater input and inundation across the marsh plain. It is expected that the reduction of freshwater inputs and the increase in tidal flows would convert the existing riparian, freshwater, and brackish marsh in Zone 3 to salt marsh and transition habitat (**Figure 7-6**).

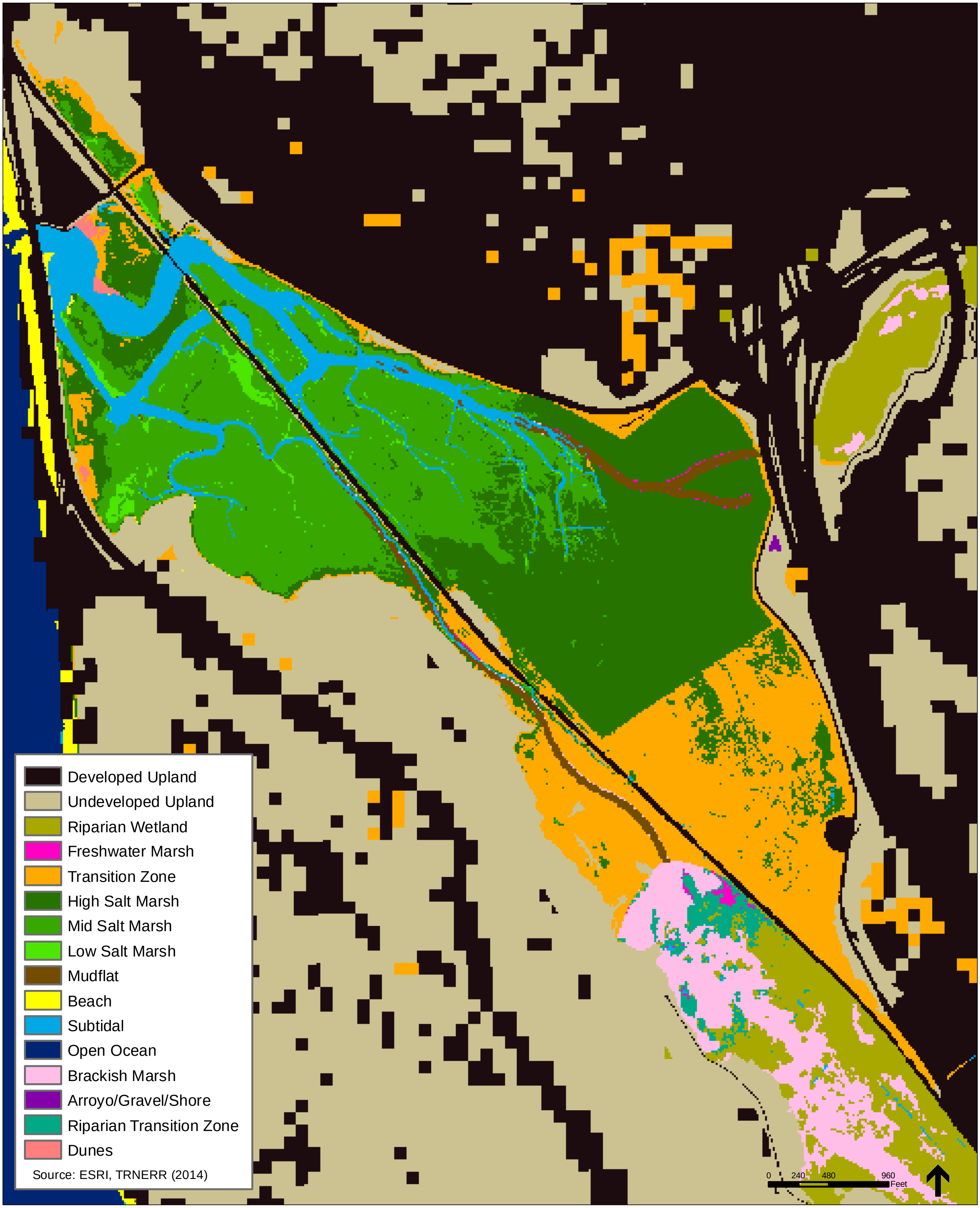

Figure 7-8

Lagoon Concept 4, Grading and Channel Improvements

Additionally, benches could be excavated along the channel to provide additional salt marsh habitat at lower elevations. Benching is a term used to describe lowering the channel bank and focused grading to increase total surface area exposed to tidal inundation while creating a transitional gradient that promotes upslope migration of tidal salt marsh in response to sea level rise. Depending on the bench elevation, revegetation may be necessary to avoid colonization by invasive vegetation. Other minor grading would likely be incorporated into the design to achieve the requirements of the Lagoon Sediment TMDL if determined to be beneficial to the overall goals and objectives of salt marsh restoration.

Excavators and track-mounted trucks would be used to remove the material in the channels. Material disposal options include placement within Los Peñasquitos Lagoon, in the near vicinity of the Lagoon (e.g. raising the parking lot), or offsite disposal.

It is expected that Lagoon Concept 2 would be implemented using a phased approach to observe how the lagoon hydrology and habitats will respond over time to channel modifications, watershed inputs (e.g. successful reduction of freshwater and/or sediment) and actual sea level rise versus predicted rates.

Channels

The northern channel would extend 2,100 ft from the most northern existing channel toward the mouth of Carmel Creek (**Figure 7-9**). The existing channel that runs south along the railroad berm would be extended 3,800 ft toward Sorrento Valley. It is expected that the southern channel will also need to be widened and deepened due to its relatively constrained dimensions. Additional channels may be added to further drain the marsh plain and promote tidal inundation.

There are numerous ways of estimating natural channel cross-section dimensions, ranging from mimicking historic or nearby reference channels, using regional empirical relationships, or employing sediment transport analyses. At Los Peñasquitos Lagoon, the modified northern and southern channels would be at the intersection of the fluvial and tidal regimes, and would likely be shaped by both. Since dry-weather flows are relatively smaller in volume than tidal waters, preliminary channel dimensions to be created and analyzed under Lagoon Concept 2 will be sized based on tidal flows.

Tidal channel dimensions can be related to marsh area through the empirical hydraulic geometry relationships of Williams et al (2002). These relationships are based on data from tidal channels in mature natural marshes located throughout San Francisco Bay and Southern California. The marsh area for each proposed channel was estimated in GIS. The channel depth, width, and cross-sectional area was calculated using the relationships and is shown in **Figure 7-9** and provided in **Table 7-5**.

The channel dimensions calculated with the hydraulic geometry relationships may be oversized for post-restoration conditions, since the lagoon elevations are above typical marsh plain elevations. Under current conditions, water would not overtop the banks of the channels and inundate the marsh plain regularly, because the marsh plain is above MHHW. This means that the channels would be oversized for the actual amount of marsh area they would support. Initially, the channels may fill in, since the tidal scour would be smaller than if the marsh plain was inundated daily, but a marsh plain bench could be excavated along the channel to increase the tidal prism to some extent. Additionally, the channel dimensions would be appropriate to support full conveyance of tidal waters to the marsh plain over time, as a result of projected sea level rise.

TABLE 7-5
PROPOSED CHANNEL DIMENSIONS FOR LAGOON CONCEPT 2 – FRESHWATER MANAGEMENT

	Marsh Area (ac)	Channel Depth (ft)	Channel Width (ft)	Channel Cross-Sectional Area (ft^2)
Northern Channel towards Carmel Creek	50	7.9	60	260
Southern Channel toward Carroll Canyon and Los Peñasquitos Creeks	40	7.5	50	220

SOURCE: Williams et al (2002).

Potential Habitat Impacts

Excavating the channels would potentially impact just under 7 acres of lagoon habitat. **Table 7-6** provides a preliminary estimate of the potential impact acreage by habitat type.

TABLE 7-6
POTENTIAL HABITAT IMPACTS FOR LAGOON CONCEPT 2 – FRESHWATER MANAGEMENT

Habitat	Area (ac)
Upland	0.03
Riparian Wetland	1.74
Freshwater Marsh	0.55
Brackish Marsh	1.58
Transition Zone	0.34
Salt Marsh	2.65
Total	**6.89**

Earthwork Quantities and Cost Estimate

For planning purposes, order of magnitude estimates of possible construction quantities and costs are provided to allow cost comparison of alternatives. The preliminary quantity and cost estimates for the proposed work items for Lagoon Concept 2 are summarized in **Table 7-7** and **Table 7-8**. Cost estimates are intended to provide an approximation of total project costs appropriate for the conceptual level of design. These cost estimates are considered to be approximately -30% to +50% accurate, and include a 20% contingency to account for project uncertainties (such as final design refinements, permitting restrictions, and bidding climate). These estimates are subject to refinement and revisions as the design is developed in future stages, which is outside of the scope of the Lagoon Enhancement Plan update.

Each Lagoon Concept includes excavation and grading to a certain extent within the Lagoon, which presents several implementation challenges. Key factors considered for cost estimating and to be further explored during future phases include:

Soil placement locations. The final placement of excavated soils will significantly influence costs. Material disposal options include placement within Los Peñasquitos Lagoon, in the near vicinity of the Lagoon (e.g. raising the parking lot), or offsite disposal. At this stage it is assumed that placement within the Lagoon would not be compatible with ecological objectives, and may also not be permitted by regulatory agencies. For cost estimating purposes, it is assumed that soil could be disposed in the near vicinity of the Lagoon. It is further assumed that material is transported (e.g. in off-road and/or track-mounted trucks) from the Lagoon to disposal site. If near-site disposal is not feasible, costs would increase further, requiring material to be loaded and transported in highway-rated trucks.

Working in soft, saturated soils. At this stage, it is assumed that soils within Los Peñasquitos Lagoon are saturated and loosely consolidated, and would likely not be able to support heavy construction equipment. For cost estimating purposes, it is assumed that temporary construction access would be needed for excavation equipment (e.g. excavator and track-mounted trucks). Options for access, to be refined based on future soils investigation, would include placing wooden marsh mats or constructing a temporary road (e.g. crushed rock and geotextile fabric). All temporary road materials would require complete removal and offsite disposal following construction.

Sensitive wildlife area. The work must be performed in a manner that minimizes impacts to various wildlife and aquatic species that inhabit Los Peñasquitos Lagoon. It is assumed that several precautions and mitigation measures would need to be implemented during construction, including avoiding or minimizing potential impacts to endangered species, working within restricted construction windows, and turbidity reduction measures.

These assumptions were used to generate conceptual-level costs. For channel excavation under Lagoon Concept 2, it was assumed that temporary construction access would be installed along the channel alignment, and then removed concurrently with channel excavation.

TABLE 7-7
EARTHWORK QUANTITIES FOR LAGOON CONCEPT 2 – FRESHWATER MANAGEMENT

	Channel Cross-Sectional Area (ft^2)	Channel Length (ft)	Excavation Volume (cy)
Northern Channel towards Carmel Creek	260	2,100	20,200
Southern Channel toward Carroll Canyon and Los Peñasquitos Creeks	220	3,800	31,000[1]
Total			**51,200**

1. There is an existing channel in this area which would be deepened and extended, so this is a conservative estimate of volume.

TABLE 7-8
CONCEPTUAL COST ESTIMATE FOR LAGOON CONCEPT 2 – FRESHWATER MANAGEMENT

Description	Quantity	Unit	Unit Price Range		Cost Range	
			Low	High	Low	High
Mobilization	1	LS	5%	10%	$81,000	$438,000
Mitigation Measures (SWPPP, etc.)	1	LS	$25,000	$100,000	$25,000	$100,000
Temporary Access	5900	LF	$100	$300	$590,000	$1,770,000
Channel Excavation & Transport	51,200	CY	$15	$40	$768,000	$2,048,000
Fill Placement & Grading	46,080	CY	$5	$10	$230,400	$460,800
Revegetation	0	AC			-	-
Subtotal					**$1,694,400**	**$4,816,800**
Contingency	**20%**				**$338,900**	**$963,400**
Total					**$2,033,300**	**$5,780,200**

1. These estimates are subject to refinement and revisions as the design is developed in future stages of the project.
2. This table does not include estimated project costs for permitting, monitoring, and/or ongoing maintenance.
3. Estimated costs are presented in 2015 dollars, and would need to be adjusted to account for price escalation for implementation in future years.
4. This opinion of probably construction costs is based on ESA's previous experience and bid prices from similar projects.

To reduce costs and/or the uncertainty of the cost estimate, the following steps should be taken in the future phases of the design:

- Identification of soil disposal locations
- Collection of soils data and input of bearing capacity by a geotechnical analysis to inform equipment access constraints
- Consultation with local contractors experienced with working in soft soils and sensitive habitats on the feasibility of construction approach(es)
- Identification of permitting requirement that will affect construction (timing, methods, etc.) during permit process

Lagoon Concept 3 – Elevation Reduction through Sediment Removal

Under Lagoon Concept 3, the area of Zone 3 would be graded down to marsh plain elevation to increase tidal inundation and encourage salt marsh habitat.

Habitat and Design Features

As shown in **Figure 7-10**, approximately 90 acres in Zone 3 would be graded to salt marsh elevations to allow tidal inundation in the near-term. The area would be graded to an elevation of 7.5 ft NAVD, which is the upper elevation of high salt marsh under existing conditions. Revegetation would be necessary to ensure colonization by native species.

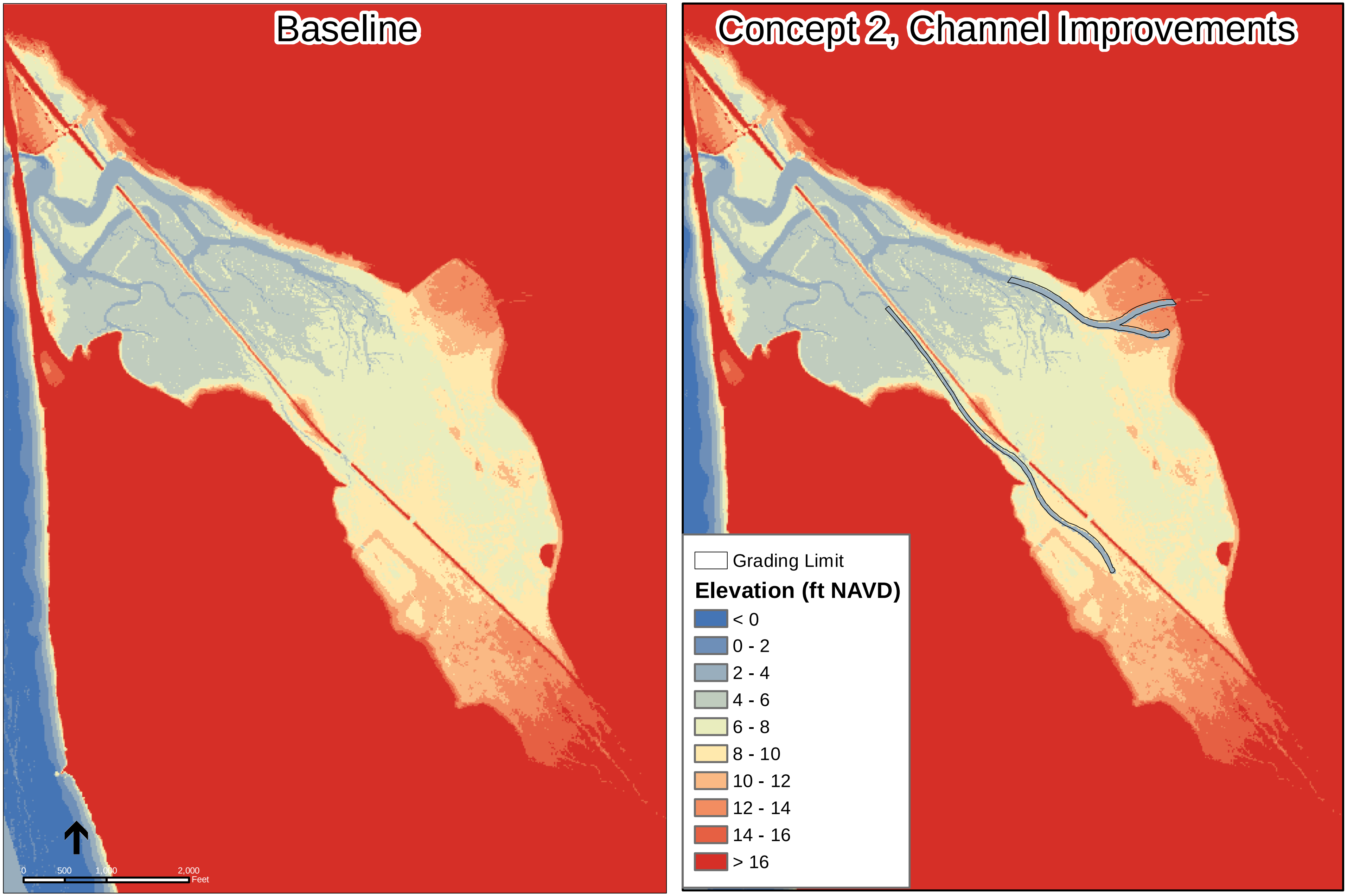

Figure 7-9
Lagoon Concept 2: Freshwater Management Through Channel Improvments

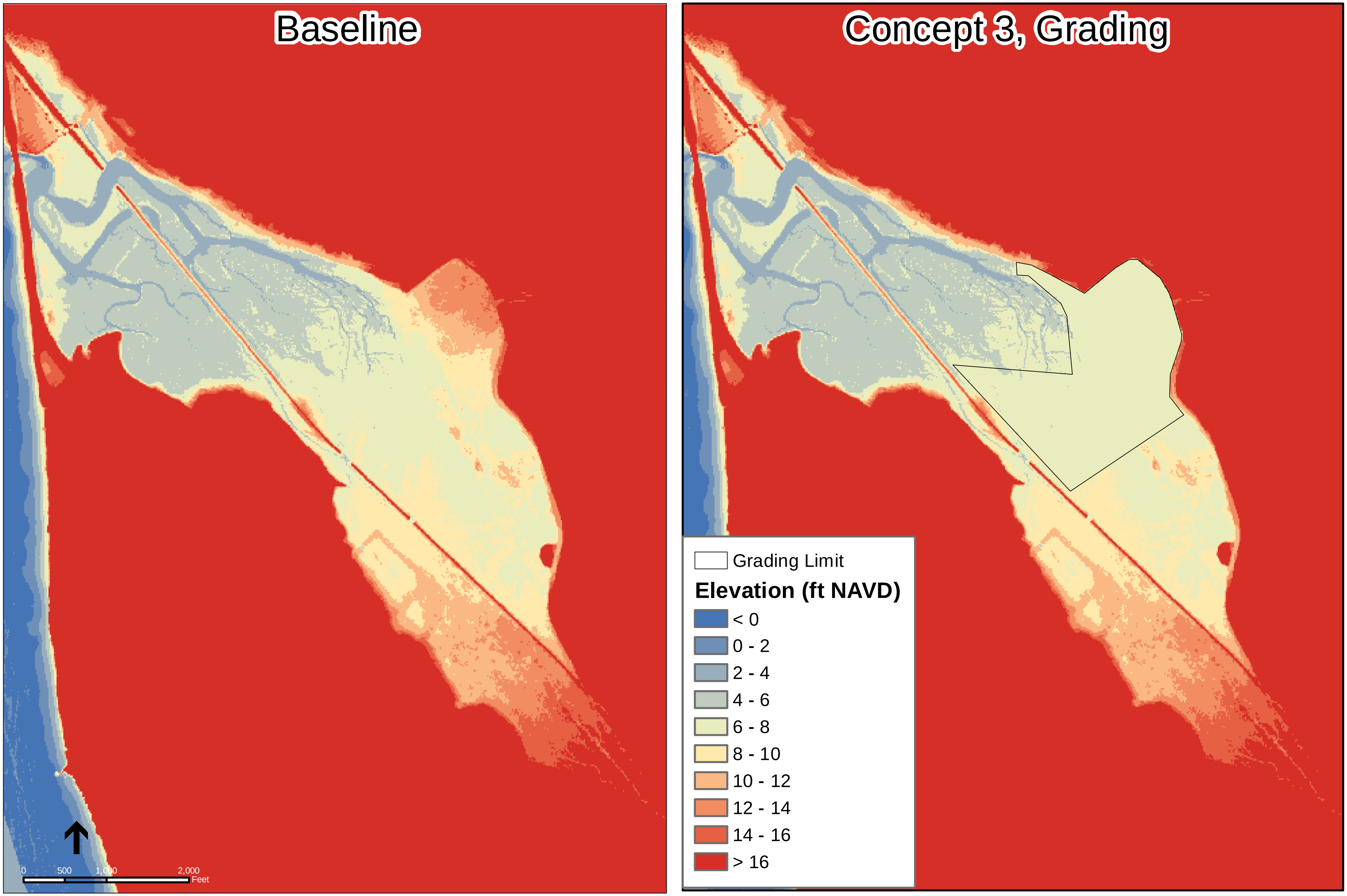

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Figure 7-10

Lagoon Concept 3: Elevation Reduction through Sediment Removal

Excavators and track-mounted trucks would be used to remove the material in the marsh. Material disposal options include placement within Los Peñasquitos Lagoon, in the near vicinity of the Lagoon (e.g. raising the parking lot), or offsite disposal.

Potential Habitat Impacts

Under Lagoon Concept 3, grading would potentially impact approximately 90 acres of habitat within Los Peñasquitos Lagoon. **Table 7-9** provides a preliminary estimate of the potential impact acreage by habitat type.

TABLE 7-9
POTENTIAL HABITAT IMPACTS FOR LAGOON CONCEPT 3, ELEVATION REDUCTION

Habitat	Area (ac)
Upland	0.15
Riparian Wetland	21.39
Freshwater Marsh	16.53
Brackish Marsh	20.42
Transition Zone	0.20
Salt Marsh	30.12
Subtidal/Mudflat	1.58
Total	**90.40**

Earthwork Quantities and Cost Estimate

For planning purposes, order of magnitude estimates of possible construction quantities and costs are provided to allow cost comparison of alternatives. The preliminary quantity and cost estimates for the proposed work items for Lagoon Concept 3 are summarized in **Table 7-10** and **Table 7-11**. This cost estimate is intended to provide an approximation of total project costs appropriate for the conceptual level of design. These cost estimates are considered to be approximately -30% to +50% accurate, and include a 20% contingency to account for project uncertainties (such as final design refinements, permitting restrictions and bidding climate). These estimates are subject to refinement and revisions as the design is developed in future stages, which is outside of the scope of the Lagoon Enhancement Plan update.

The assumptions discussed for Lagoon Concept 2 were used to generate conceptual-level costs for Lagoon Concept 3. Large-scale lowering of the marsh area under Lagoon Concept 3 is considered less efficient than channel excavation, since more extensive access road(s) would be required.

TABLE 7-10
EARTHWORK QUANTITIES FOR LAGOON CONCEPT 3, ELEVATION REDUCTION

	Excavation Volume (cy)
Grading	195,600
Total	**195,600**

TABLE 7-11
CONCEPTUAL COST ESTIMATE FOR LAGOON CONCEPT 3, ELEVATION REDUCTION

			Unit Cost		Total Cost	
Description	**Quantity**	**Unit**	**Low**	**High**	**Low**	**High**
Mobilization	1	LS	5%	10%	$318,000	$1,626,000
Mitigation Measures (SWPPP, etc.)	1	LS	$25,000	$100,000	$25,000	$100,000
Temporary Access	10,900	LF	$100	$300	$1,090,000	$3,270,000
Marsh Excavation	195,600	CY	$20	$50	$3,912,000	$9,780,000
Fill Placement & Grading	176,040	CY	$5	$10	$880,200	$1,760,400
Revegetation	90	AC	$5,000	$15,000	$450,000	$1,350,000
Subtotal					**$6,675,200**	**$17,886,400**
Contingency	**20%**				**$1,335,000**	**$3,577,300**
Total					**$8,010,200**	**$21,463,700**

1. These estimates are subject to refinement and revisions as the design is developed in future stages of the project.
2. This table does not include estimated project costs for permitting, monitoring, and/or ongoing maintenance.
3. Estimated costs are presented in 2015 dollars, and would need to be adjusted to account for price escalation for implementation in future years.
4. This opinion of probably construction costs is based on ESA's previous experience and bid prices from similar projects.

Lagoon Concept 4 – Elevation Reduction with Freshwater Management

Lagoon Concept 4 presents an approach that combines freshwater management identified for Lagoon Concept 2 with elevation reduction and improved tidal inundation identified for Lagoon Concept 3. Under Lagoon Concept 4, an area of Zone 3 would be graded down to marsh plain elevation to increase tidal inundation in the near-term and encourage salt marsh habitat recovery. As with Lagoon Concept 2, lagoon channels would be excavated to help transport year-round, non-storm freshwater flows to the ocean and to bring tidal waters further back into the Lagoon. Concept 4 would create additional subtidal habitat in the channels, and salt marsh habitat would replace the existing brackish and freshwater habitat. Over time with sea level rise, the channels would provide tidal flow and drainage to the marsh plain.

Habitat and Design Features

As shown in **Figure 7-11**, approximately 90 acres within Zone 3 would be restored by grading to an elevation of 7.5 ft NAVD, which is the upper elevation of high salt marsh under existing conditions within Los Peñasquitos Lagoon. In this area, revegetation would be necessary to ensure colonization by native species. In addition, the northern channel would be extended 2,100 ft eastward toward the mouth of Carmel Creek and the southern channel would be extended eastward for 3,800 ft toward Sorrento Valley. It is expected that the southern channel will also need to be widened and deepened due to its relatively constrained dimensions. Additional channels may also be added to further drain freshwater inundation within the middle portion of Zone 3 and expand tidal influence within this management zone.

Excavators and track-mounted trucks would be used to remove the material in the channels and marsh. Material disposal options include placement within the Los Peñasquitos Lagoon, in the near vicinity of the Lagoon (e.g. raising the parking lot), or offsite disposal.

Potential Habitat Impacts

Excavating the middle lagoon and channels would potentially impact approximately 95 acres of habitat within Los Peñasquitos Lagoon. **Table 7-12** provides a preliminary estimate of the potential impact acreage by habitat type.

TABLE 7-12
POTENTIAL HABITAT IMPACTS FOR LAGOON CONCEPT 4, ELEVATION REDUCTION WITH FRESHWATER MANAGEMENT

Habitat	Area (ac)
Upland	0.16
Riparian Wetland	21.55
Freshwater Marsh	16.59
Brackish Marsh	21.94
Transition Zone	0.54
Salt Marsh	32.71
Subtidal/Mudflat	1.58
Total	**95.07**

Earthwork Quantities and Cost Estimate

For planning purposes, order of magnitude estimates of possible construction quantities and costs are provided to allow cost comparison of alternatives. The preliminary quantity and cost estimates for the proposed work items for Lagoon Concept 4 are summarized in **Table 7-13** and **Table 7-14**. This cost estimate is intended to provide an approximation of total project costs appropriate for the conceptual level of design. These cost estimates are considered to be approximately -30% to +50% accurate, and include a 20% contingency to account for project uncertainties (such as final design refinements, permitting restrictions and bidding climate). These estimates are subject to refinement and revisions as the design is developed in future stages, which is outside of the scope of the Lagoon Enhancement Plan update.

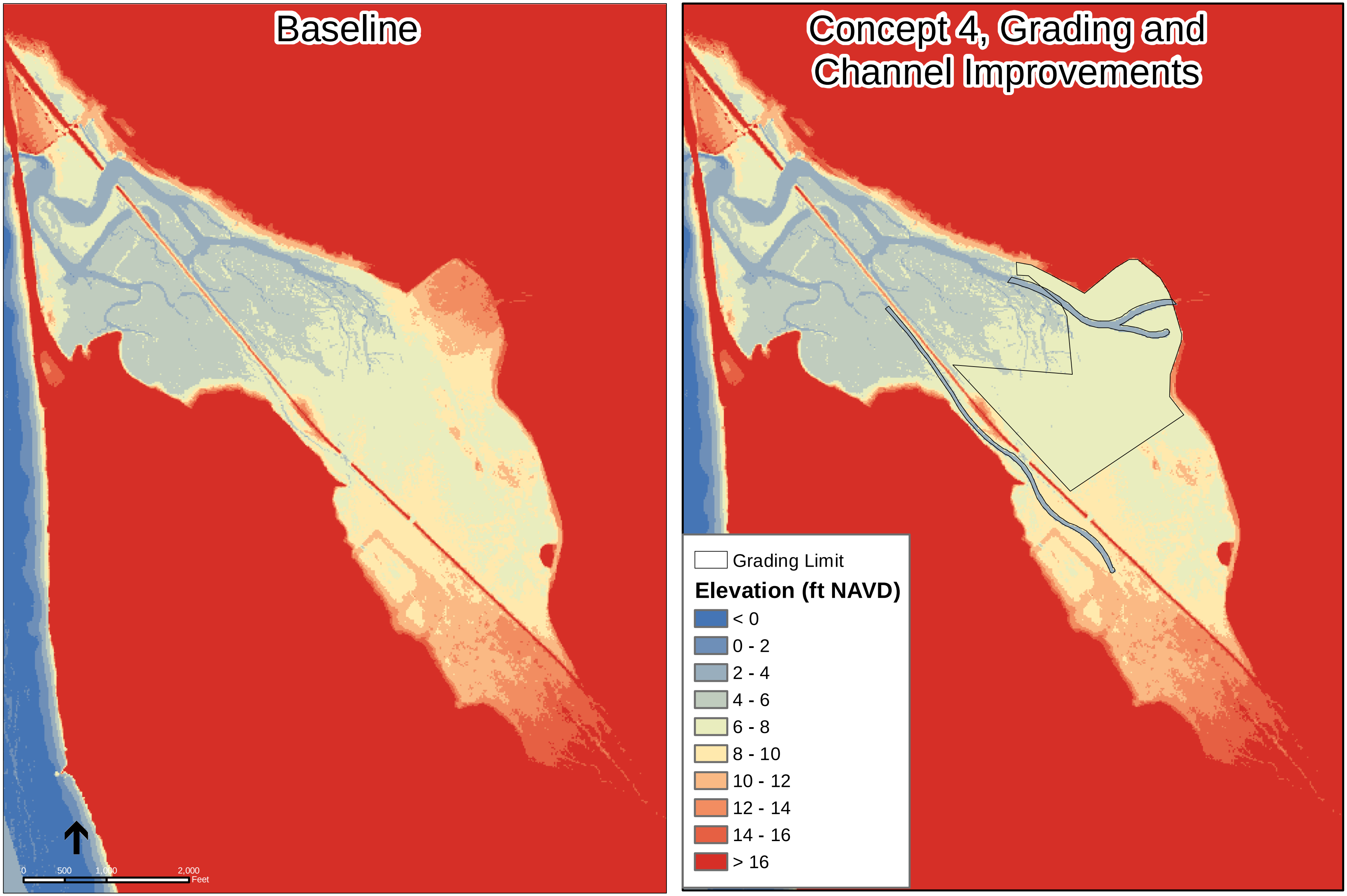

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Figure 7-11
Lagoon Concept 4: Elevation Reduction with Freshwater Management

TABLE 7-13
EARTHWORK QUANTITIES FOR LAGOON CONCEPT 4, ELEVATION REDUCTION WITH FRESHWATER MANAGEMENT

	Channel Cross-Sectional Area (ft^2)	Channel Length (ft)	Excavation Volume (cy)
Northern Channel towards Carmel Creek	260	2,100	20,200
Southern Channel toward Carroll Canyon and Los Peñasquitos Creeks	220	3,800	31,000[1]
Grading			195,600[2]
Total			**246,800**

1. There is an existing channel in this area which would be deepened and extended, so this is a conservative estimate of volume.
2. The northern channel would overlap with the grading in some places, so this is a conservative estimate of volume.

TABLE 7-14
CONCEPTUAL COST ESTIMATE FOR LAGOON CONCEPT 4, ELEVATION REDUCTION WITH FRESHWATER MANAGEMENT

Description	Quantity	Unit	Unit Cost		Total Cost	
			Low	High	Low	High
Mobilization	1	LS	5%	10%	$356,000	$1,831,000
Mitigation Measures (SWPPP, etc.)	1	LS	$25,000	$100,000	$25,000	$100,000
Temporary Access	10,900	LF	$100	$300	$1,090,000	$3,270,000
Channel Excavation & Transport	51,200	CY	$15	$40	$768,000	$2,048,000
Marsh Excavation	195,600	CY	$20	$50	$3,912,000	$9,780,000
Fill Placement & Grading	176,040	CY	$5	$10	$880,200	$1,760,400
Revegetation	90	AC	$5,000	$15,000	$450,000	$1,350,000
Subtotal					**$7,481,200**	**$20,139,400**
Contingency	**20%**				**$1,496,200**	**$4,027,900**
Total					**$8,977,400**	**$24,167,300**

1. These estimates are subject to refinement and revisions as the design is developed in future stages of the project.
2. This table does not include estimated project costs for permitting, monitoring, and/or ongoing maintenance.
3. Estimated costs are presented in 2015 dollars, and would need to be adjusted to account for price escalation for implementation in future years.
4. This opinion of probably construction costs is based on ESA's previous experience and bid prices from similar projects.

The assumptions discussed for Lagoon Concept 2 and Lagoon Concept 3 were used to generate conceptual-level costs. Similar to Lagoon Concept 3, large-scale lowering of the marsh area under Lagoon Concept 4 is considered less efficient than just performing channel excavation, since more extensive access road(s) would be required.

7.2.3.2 Lagoon Concept Habitat Trajectories and Sustainability Analysis

Model Setup

The Lagoon Concepts (aside from Lagoon Concept 1, "No Action") were evaluated against the baseline conditions using the HEM. The Lagoon Concepts were run in the model using the same inputs as described for the baseline condition model in Section 7.1 with the following exceptions:

- Lagoon Concept 2 – Freshwater Management through Channel Improvements
  - The topography was modified to include channels (**Figure7-9**).
  - The area of freshwater influence was modified to stay within the channels (**Figure 7-12**). This assumes that the freshwater no longer flows over the marsh, but completely drains through the channels. A hydrodynamic model will be needed to evaluate the feasibility of this assumption and to inform the channel design and help to address Uncertainty 2.
- Lagoon Concept 3 – Elevation Reduction through Sediment Removal
  - The topography was modified to lower approximately 90 acres in the middle of the Lagoon down to tidal elevations (**Figure 7-10**).
- Lagoon Concept 4 – Elevation Reduction with Freshwater Management
  - The topography was modified to include channels, as well as to lower approximately 90 acres in Zone 3 down to tidal elevations (**Figure 7-11**).
  - The area of freshwater influence was modified to stay within the channels (**Figure 7-12**).

Model Results and Discussion

With the inputs described in Section 7.1, the HEM was run to determine potential habitats directly after restoration (assuming instant vegetation establishment) and habitat trajectories for each of the Lagoon Concepts. Maps of the restored habitats by decade for each of the concepts are presented in Appendix L. Changes in habitat acreages for each Lagoon Concept are provided in **Table 7-15** through **Table 7-17**. 2010 is used as the reference point for baseline conditions to coincide with the Lagoon Compliance Target established through the Lagoon Sediment TMDL.

Lagoon Concept 2 – Freshwater Management through Channel Modifications

In Lagoon Concept 2 immediately after restoration, the middle of Los Peñasquitos Lagoon converts to high salt marsh and transition habitat, due to the removal of the freshwater influence (**Figure 7-13**). The HEM results show that management of freshwater supports successful recovery of salt marsh in Zone 3. Results for 2030 show increases for both salt marsh and transition habitat within the Lagoon (**Figure 7-14**). Salt marsh increases from 158 acres of existing salt marsh to 232 acres for a net increase of 74 acres by 2030 (See **Table 7-15**). Transitional habitat under Lagoon Concept 2 increases from 38 acres in 2010 to 141 acres in 2030 (See **Table 7-15**), a 370% increase from baseline conditions.

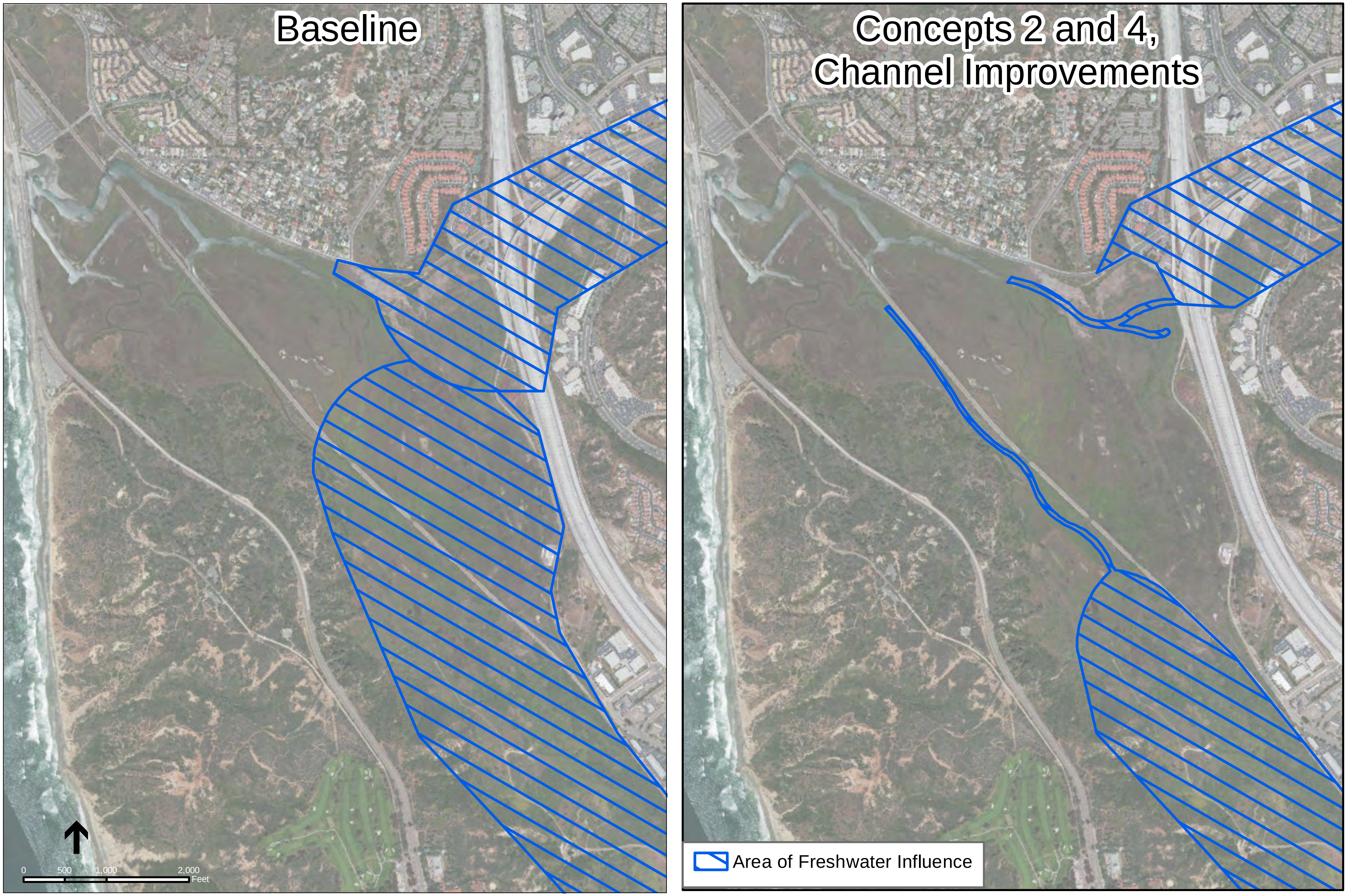

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Figure 7-12

Lagoon Concepts 2 and 4: Area of Freshwater Influence

While 74 acres does not directly meet the Lagoon Sediment TMDL compliance target of +84 acres of additional salt marsh, it is assumed that the remaining 10 acres will be generated as salt marsh migrates upslope into transitional habitats with sea level rise and/or through additional grading around the channels in further iterations of the design. With the reduction of the freshwater, brackish marsh decreases by 106 acres, from 148 acres under baseline conditions to 42 acres in 2030 according to the model results (See **Table 7-15**). The HEM also predicts that the extent of freshwater marsh will be reduced by 45 acres, from 47 acres under baseline conditions to 2 acres by 2030 (See **Table 7-15**).

By 2050, the majority of the middle lagoon is high marsh and the site reaches a peak of 250 acres of high/mid salt marsh as shown in **Figure 7-15** as compared to 150 ac in 2010 under baseline conditions in **Figure 7-13**. As the salt marsh moves upslope due to the rising sea level, transition habitat decreases, dropping from 141 acres in 2030 to 102 acres in 2050, though still showing an overall net increase of 64 acres from baseline conditions.

By 2070, the HEM shows in **Figure 7-16** that total salt marsh increases to 293 acres, although there is a loss in high/mid salt marsh from 2050 (-57 acres), which has converted to low marsh (+78 acres, **Figure 7-15**). This corresponds to a loss of 27-acres of transition habitat in the Lagoon from 2050 to 2070 that occurs primarily within Zone 3 as salt marsh pushes up against brackish habitats in Zone 3 and portions of Zone 4.

In 2100, the HEM shows that although the northern part of Los Peñasquitos Lagoon has converted to mudflat, the middle of the Lagoon still supports mid marsh (117 ac) and low marsh (61 ac; **Figure 7-17**). The HEM shows an overall decrease in salt marsh acreage from previous modeled years, falling to 202 acres total as most of Zone 2 and parts of Zone 3 convert to mudflat and the high marsh is compressed against transitional and upland areas (**Figure 7-17**). However, even with this decline, there still exists a net increase of 44 acres above baseline conditions for salt marsh acreage.

Lagoon Concept 3 – Elevation Reduction through Sediment Removal

Under Lagoon Concept 3, the middle of Los Peñasquitos Lagoon remains brackish marsh after restoration, since the extent of freshwater influence is unchanged (**Figure 7-13**). The removal of the fan of sediment at Carmel Creek converts riparian habitat to freshwater habitat since the area is still influenced by freshwater. Under Lagoon Concept 3, the HEM predicts only a slight increase from 158 acres of existing salt marsh to 163 acres by 2030 as a result of sea level rise, but this expansion occurs in Zone 2 (**Table 7-16**; **Figure 7-14)**. Although Lagoon Concept 3 expands tidal inundation into Zone 3 through large-scale excavation to lower existing elevations, the freshwater influence keeps the area from converting to salt marsh. The net increase of 5 acres of salt marsh falls well short of the Lagoon Sediment TMDL compliance target of +84 acres of additional salt marsh.

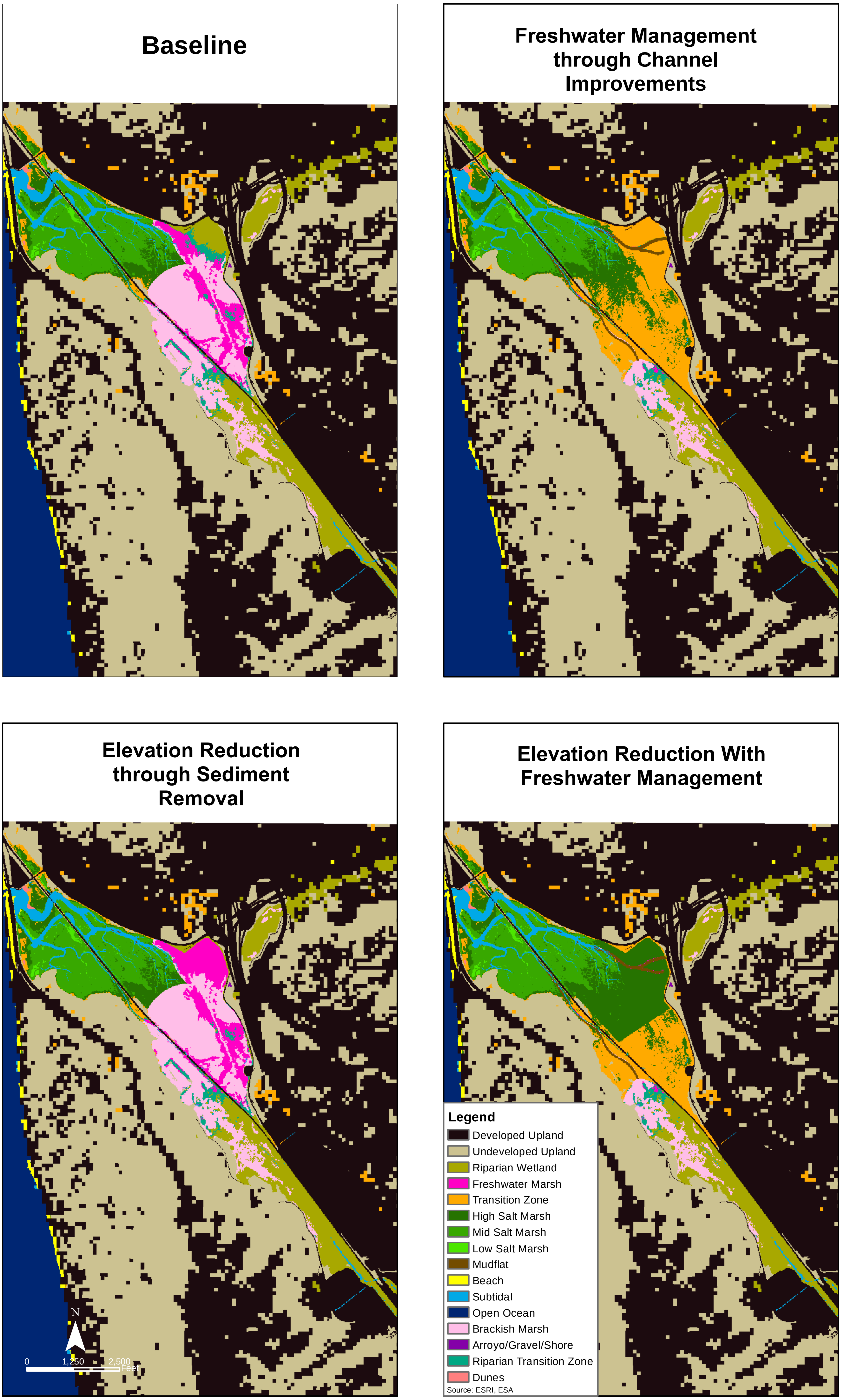

Figure 7-13
2010 Baseline vs Restored Habitats with Mid SLR

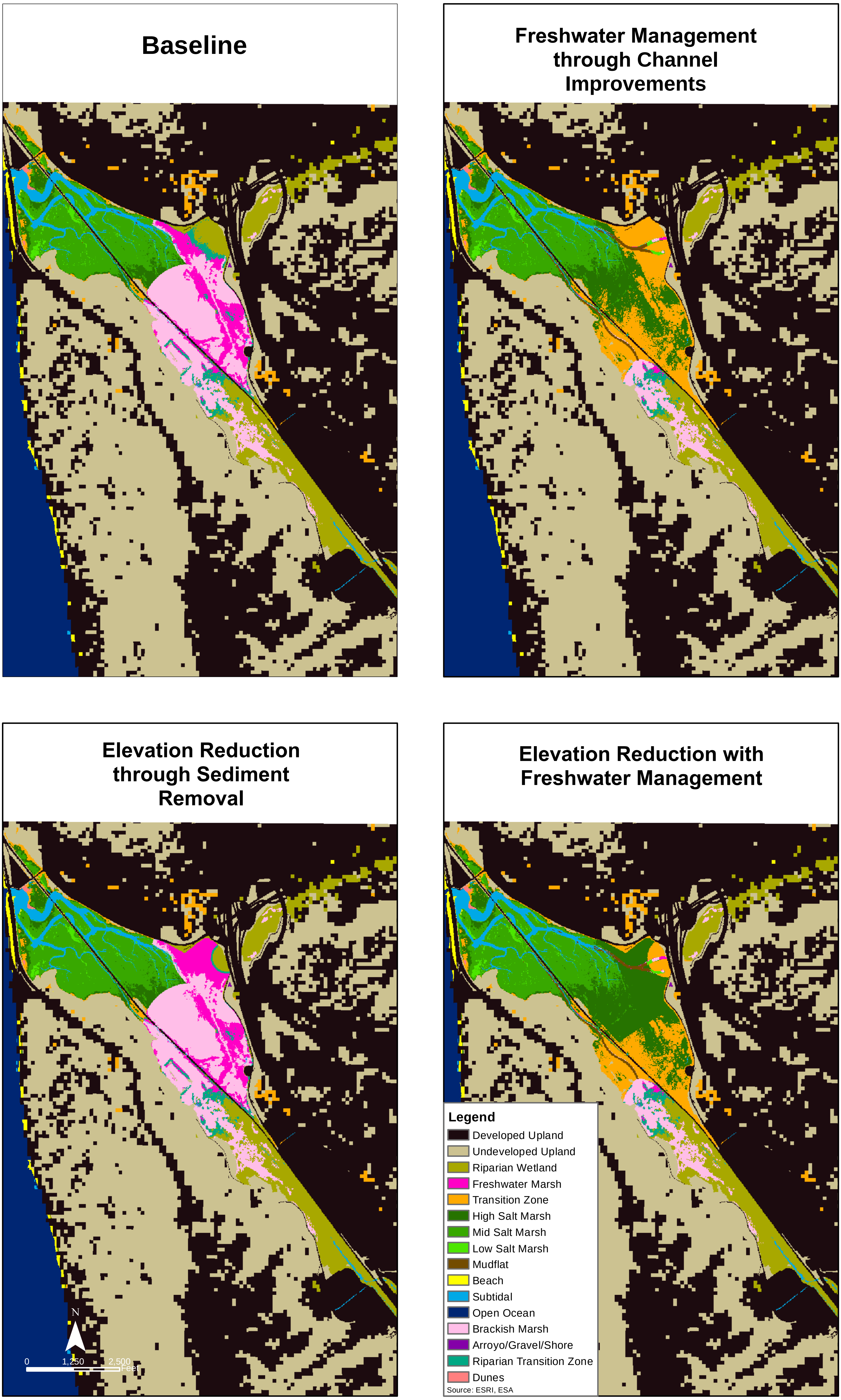

Figure 7-14
2030 Baseline vs Restored Habitats with Mid SLR

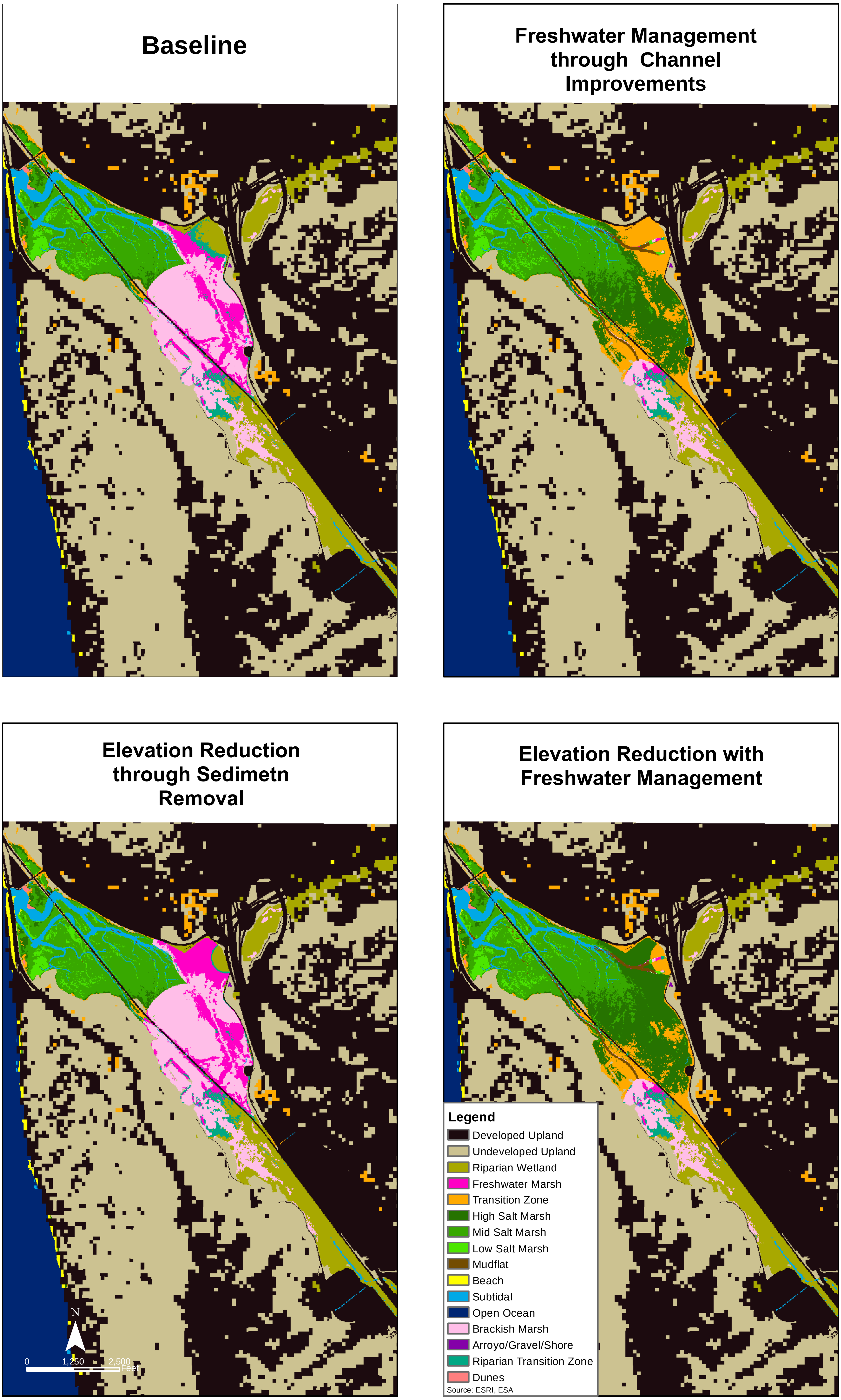

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Figure 7-15
2050 Baseline vs Restored Habitats
with Mid SLR

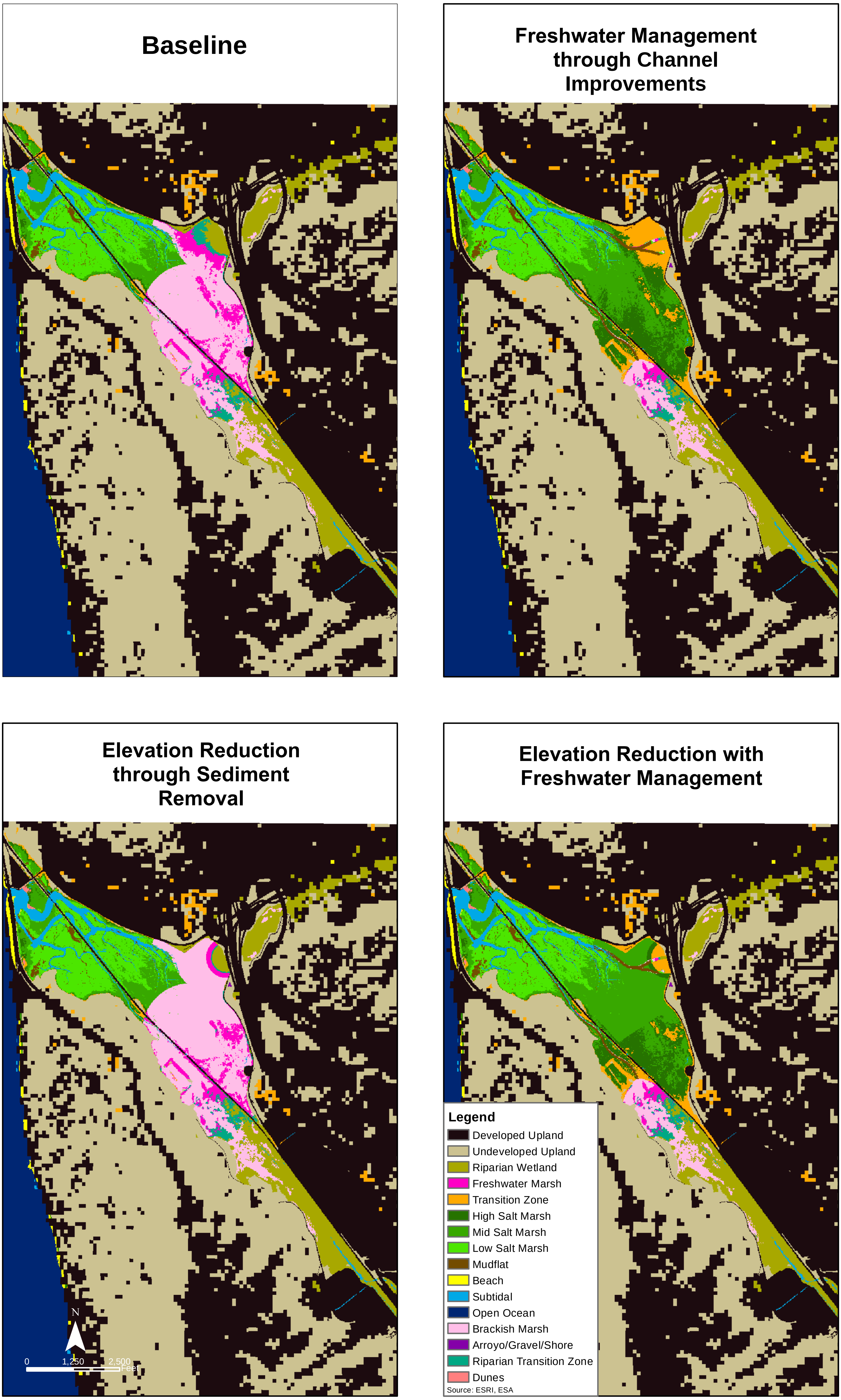

Figure 7-16
2070 Baseline vs Restored Habitats with Mid SLR

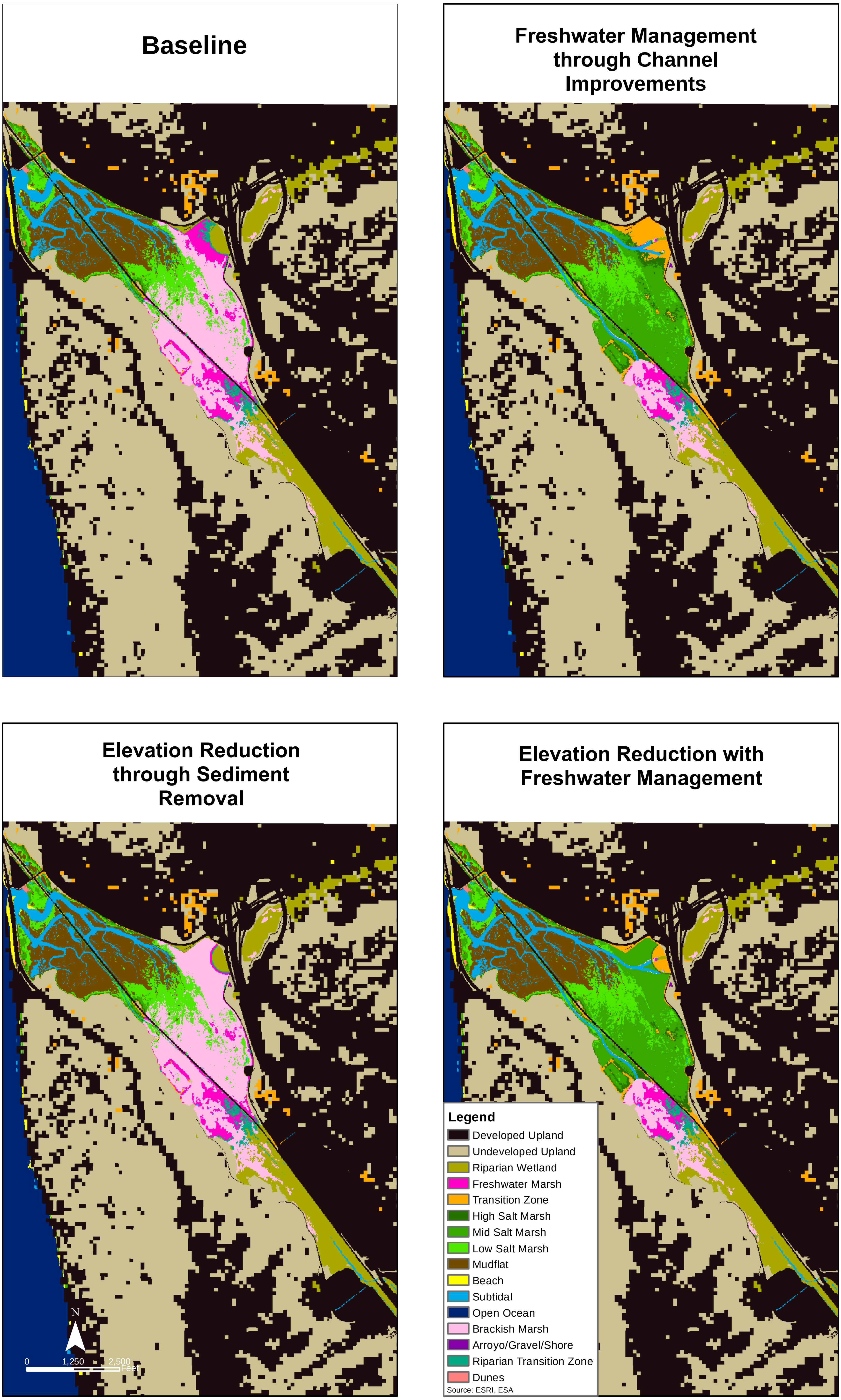

Figure 7-17
2100 Baseline vs Restored Habitats
with Mid SLR

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TABLE 7-15
MODELED HABITAT ACREAGES FOR LAGOON CONCEPT 2 – FRESHWATER MANAGEMENT

Habitat	2010 pre-restoration	2010 post-restoration	2030	2050	2070	2100	Change between 2010 and 2100, post-restoration
Developed Upland	2551	2551	2551	2551	2551	2551	0
Undeveloped Upland	2355	2355	2354	2352	2350	2344	-11
Riparian Wetland	193	173	171	168	164	158	-15
Riparian Transition Zone	19	7	8	10	10	8	1
Freshwater Marsh	47	1	2	4	7	15	14
Brackish Marsh	148	42	42	42	42	42	0
Transition Zone	38	176	141	102	75	54	-122
High Salt Marsh	39	77	96	111	80	24	-53
Mid Salt Marsh	113	113	127	139	113	117	4
Low Salt Marsh	6	6	9	22	100	61	56
Mudflat	0	9	8	10	18	115	105
Subtidal	40	40	40	40	40	61	21
Dunes	1	1	1	1	1	1	0
Beach	18	18	16	14	11	8	-10
Arroyo/Gravel/Shore	3	3	3	3	3	3	0
Open Ocean	422	422	424	427	429	433	10
Total Salt Marsh	158	196	232	272	293	202	6
Increase in Salt Marsh	-	38	74	114	135	44	-

The lowered elevation (due to grading) does not have an effect on the habitats in Zone 3 (relative to baseline conditions) until 2070 when some of the freshwater marsh begins to convert to brackish marsh (**Figure 7-16**). Brackish marsh acreage increases 37 acres from 2050 totals, which constitutes an increase of 42 acres from baseline conditions (**Table 7-16**). This occurs in conjunction with a loss of freshwater marsh from 64 acres in 2050 to 32 acres in 2070 (**Table 7-16**).

By 2100, the results of Lagoon Concept 3 are very similar to the baseline conditions, and salt marsh is largely "squeezed out" (**Figure 7-17**). The HEM projections for Lagoon Concept 3 show a sharp decline in salt marsh habitat, falling to 82 acres (**Table 7-16**). This constitutes a loss of 76 acres of salt marsh from baseline conditions in Los Peñasquitos Lagoon due in most part to wide-scale conversion to mudflat in Zone 2.

Lagoon Concept 4 – Elevation Reduction with Freshwater Management

In Lagoon Concept 4, as in Lagoon Concept 2, the middle of Los Peñasquitos Lagoon converts to high salt marsh and transition habitat, immediately after restoration, due to the removal of the freshwater influence (**Figure 7-13**). The HEM results show Lagoon Concept 4 would provide the quickest conversion of brackish marsh and freshwater marsh to salt marsh in Zone 3, when compared to Lagoon Concept 2 and Lagoon Concept 3. The combined benefits generated by freshwater management and lowering elevations to restore the marsh plain translate to rapid conversion to salt marsh by 2030 (**Figure 7-14**). Results from the HEM for 2030 show an increase from 158 acres of existing salt marsh to 264 acres within the Lagoon (**Table 7-17**). This net increase of 106 acres exceeds the Lagoon Sediment TMDL compliance target of +84 acres of additional salt marsh. Similar to Lagoon Concept 2, brackish marsh is greatly reduced under Lagoon Concept 4 from 148 acres under baseline conditions to 42 acres, for a net loss of 106 acres (**Table 7-17**).

TABLE 7-16
MODELED HABITAT ACREAGES FOR LAGOON CONCEPT 3 – ELEVATION REDUCTION

Habitat	2010 pre-restoration	2010 post-restoration	2030	2050	2070	2100	Change between 2010 and 2100, post-restoration
Developed Upland	2551	2551	2551	2551	2551	2551	0
Undeveloped Upland	2355	2355	2352	2352	2350	2344	-11
Riparian Wetland	193	180	181	178	173	166	-14
Riparian Transition Zone	19	12	14	13	12	9	-3
Freshwater Marsh	47	67	60	64	32	25	-41
Brackish Marsh	148	148	153	153	190	175	27
Transition Zone	38	38	36	32	30	28	-9
High Salt Marsh	39	40	28	16	9	6	-34
Mid Salt Marsh	113	113	128	131	53	14	-99
Low Salt Marsh	6	6	7	19	103	62	57
Mudflat	0	0	0	1	7	118	118
Subtidal	40	40	40	40	40	50	10
Dunes	1	1	1	1	1	1	0
Beach	18	18	14	14	11	8	-10
Arroyo/Gravel/Shore	3	3	3	3	3	3	0
Open Ocean	422	422	427	427	429	433	10
Total Salt Marsh	158	159	163	166	165	82	-77
Increase in Salt Marsh	-	1	5	8	7	-76	-

However, by 2050, the HEM results project that Lagoon Concept 4 would only have 20 acres more mid/high salt marsh than in Lagoon Concept 2 (**Figure 7-15**), and by 2070, Lagoon Concept 4 would have less high marsh than in Lagoon Concept 2 (**Figure 7-16**).

The HEM projects that salt marsh acreage would decline by 2100, dropping down to 213 total acres. This constitutes a reduction of 100 acres from 2070 amounts, as Zone 2 converts from salt marsh to mudflat (**Figure 7-17**; **Table 7-17**), but remains 55 acres above baseline conditions.

TABLE 7-17
MODELED HABITAT ACREAGES FOR LAGOON CONCEPT 4 – ELEVATION REDUCTION WITH FRESHWATER MANAGEMENT

Habitat	2010 pre-restoration	2010 post-restoration	2030	2050	2070	2100	Change between 2010 and 2100, post-restoration
Developed Upland	2551	2551	2551	2551	2551	2551	0
Undeveloped Upland	2355	2355	2354	2352	2350	2344	-11
Riparian Wetland	193	173	170	168	164	158	-15
Riparian Transition Zone	19	7	8	10	10	8	1
Freshwater Marsh	47	1	2	4	7	15	14
Brackish Marsh	148	42	42	42	42	42	0
Transition Zone	38	124	109	78	58	43	-81
High Salt Marsh	39	130	128	135	63	18	-111
Mid Salt Marsh	113	113	127	139	149	134	21
Low Salt Marsh	6	6	9	22	100	61	56
Mudflat	0	9	8	10	17	115	106
Subtidal	40	40	40	40	40	60	20
Dunes	1	1	1	1	1	1	0
Beach	18	18	16	14	11	8	-10
Arroyo/Gravel/Shore	3	3	3	3	3	3	0
Open Ocean	422	422	424	427	429	433	10
Total Salt Marsh	158	249	264	296	312	213	-36
Increase in Salt Marsh	-	91	106	138	154	55	-

7.2.3.3 Key Uncertainties & Adaptive Management

Coastal lagoons are highly complex systems where ocean, land, and atmospheric processes meet and interact. Below are key uncertainties identified during the technical analysis of baseline conditions and habitat trajectories of Lagoon Concepts over time.

Key Uncertainties, Hypotheses, and Data Gaps

The following key uncertainties have been identified for testing, modeling, and adaptive management during the next phases of restoration planning for Los Peñasquitos Lagoon. Key uncertainties are those that are considered most important (i.e., high potential to affect the outcome) and most uncertain.

- **Uncertainty 1, Relative contributions of freshwater from surface water and groundwater on vegetation conversion:** important to test because higher levels of groundwater may sustain freshwater and brackish marsh habitats if surface freshwater is removed or reduced. Extending the tidal channels will bring salt water further back in the Lagoon and increase surface water salinity to encourage re-establishment of salt marsh. It is hypothesized that groundwater levels will not maintain freshwater and brackish marsh, but would be replaced by other habitats with an increase in salt water and a reduction in freshwater surface flow.

- Uncertainty 2, Vegetation response to reduction in freshwater influence in existing transition/conversion zones prior to tidal inundation: important to test because reduction of freshwater without increases in tidal water may lead to invasion by weeds. It is hypothesized that salt marsh transition habitat would establish in this zone. Little data exists on the conversion of brackish/freshwater marsh to transition zone vegetation.

Adaptive Management

Findings from the proposed restoration will be applied to benefit similar efforts at other lagoon systems in Southern California through "adaptive learning" and may be used to adjust later phases of implementing the preferred Lagoon Concept.

Given the uncertainties of the relative contributions of freshwater and vegetation response to reduction in freshwater, an adaptive approach is the most appropriate. For this reason, the development of a freshwater conceptual model is proposed in Chapter 11(Next Steps) to assess alternative options and guide the overall design of the preferred Lagoon Concept selected in Chapter 10.

Lagoon Concept 2 – Future Studies and Adaptive Management

Under Lagoon Concept 2, both uncertainties described in Section 7.2.3.3 would need to be addressed. Uncertainty 1 (the interplay between groundwater and surface water within the lagoon) could be addressed prior to restoration through groundwater monitoring and hydrodynamic modeling. Uncertainty 2 (vegetation response to freshwater reduction) would require monitoring post-restoration to track the establishment of vegetation in this area. If invasive species were found to be establishing within the marsh, adaptive management measures could include removal, planting of natives, or continued monitoring.

Lagoon Concept 3 – Future Studies and Adaptive Management

Under Lagoon Concept 3, Uncertainty 1 (the interplay between groundwater and surface water within the Los Peñasquitos Lagoon) would need to be addressed. This could be addressed prior to restoration through groundwater monitoring and hydrodynamic modeling.

Lagoon Concept 4 – Future Studies and Adaptive Management

Under Lagoon Concept 4, both uncertainties described in Section 7.2.3.3 would need to be addressed. Uncertainty 1 (the interplay between groundwater and surface water within the lagoon) could be addressed prior to restoration through groundwater monitoring and hydrodynamic modeling. Uncertainty 2 (vegetation response to freshwater reduction) would require monitoring post-restoration to track the establishment of vegetation in this area. If invasive species were found to be establishing within the marsh, adaptive management measures could include removal, planting of natives, or continued monitoring.

7.2.4 Zone 4 Lagoon Concepts – Enhancement of Riparian Habitat

Zone 4 Lagoon Concepts include enhancement of disturbed riparian habitat where the confluence of Los Peñasquitos Creek and Carroll Canyon Creek enter Los Peñasquitos Lagoon from Sorrento Valley. Enhancement includes removal of invasive plant species that currently dominate the understory and improving conditions for native species re-establishment. These enhancement activities will be coordinated with channel restoration efforts to be conducted by the City of San Diego for Sorrento Valley planned as part of Phase 1. Habitat enhancement for this Lagoon Concept will continue into Phase 2 depending on the scope and success of the Phase 1 activities.

7.3 Restoration & Enhancement Phasing

As discussed in Chapter 6, a phased approach for implementing lagoon improvements was recommended from the public workshops and stakeholder input. Phase 1 priority projects (0 – 5 years) include "Study Projects" that support current management efforts (e.g. biological monitoring in the Lagoon) or that lead to design and implementation projects in Phase 2.

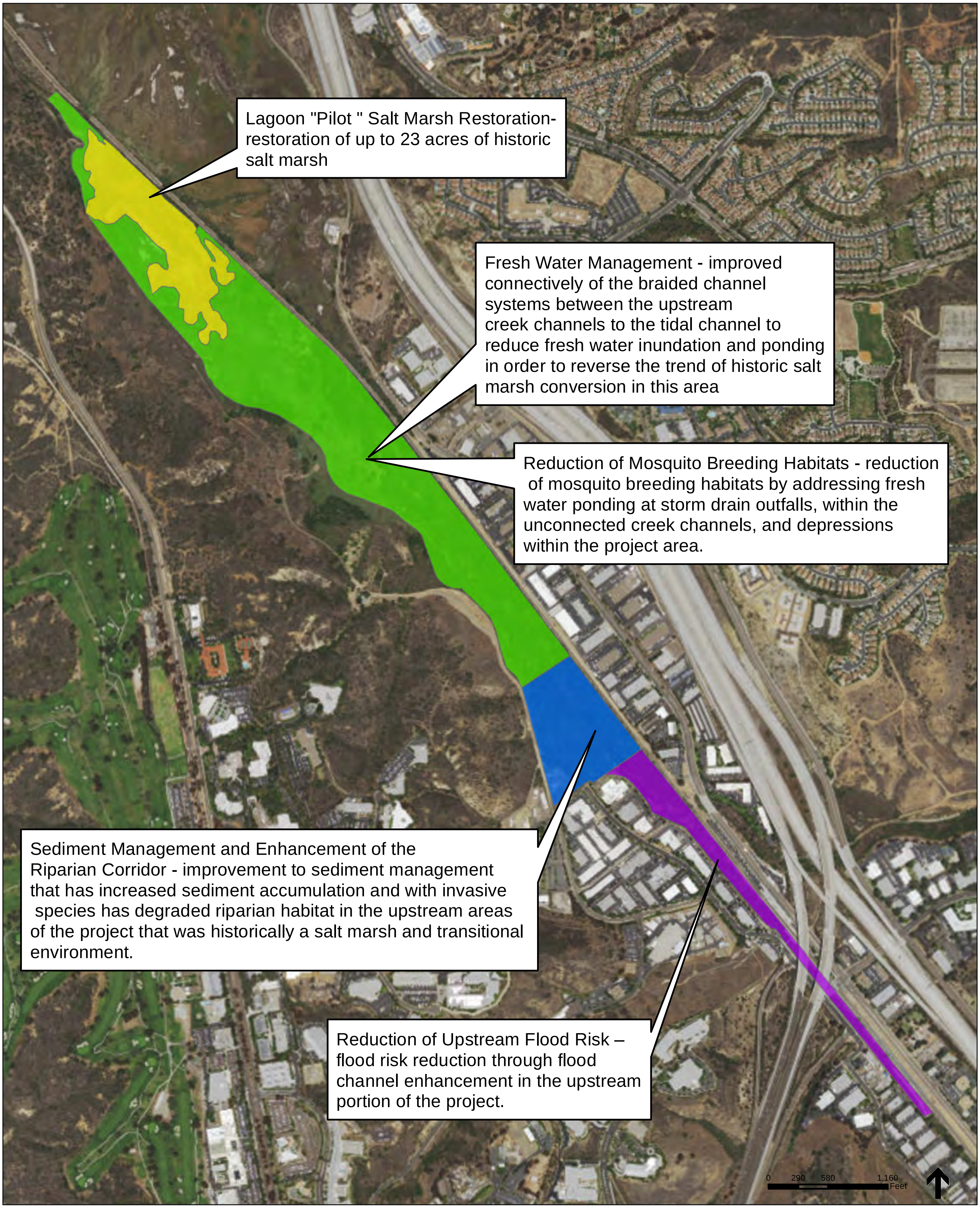
7.3.1 Phase 1 Restoration

Phase 1 priority projects can also include continuation of ongoing efforts within a specific management zone (e.g. inlet maintenance in Zone 1) or throughout all management zones (e.g. invasive plant identification and removal). Phase 1 projects also includes the planning, design, and implementation of "pilot" restoration projects that can be used to assess the effectiveness of restoration strategies outline in this section and for the preferred Lagoon Concept in Chapter 10.

7.3.1.1 Pilot Salt Marsh Restoration & Enhancement Project

The opportunity to move forward on the planning and design of a Phase 1 "pilot" salt marsh restoration has been realized in conjunction with a multi-benefit project in Sorrento Valley lead by the City of San Diego that includes enhancement of riparian corridor. **Figure 7-18** presents a conceptual view of this Phase 1 pilot restoration project.

The Phase 1 pilot restoration project (Project) will use similar restoration approaches and strategies of the alternatives presented in Section 7.2 and in Chapter 10. Focusing on the area southwest of the railroad berm within Zone 3, the Project will serve as the first step toward meeting the Lagoon Sediment TMDL compliance target of an additional 84 acres by 2035 and help fulfil ongoing load reduction targets. Aside from helping meet Lagoon Sediment TMDL targets, the Project will help inform large-scale restoration to occur within Los Peñasquitos Lagoon during Phase 2. Salt marsh restoration conducted under Phase 1 will be monitored to confirm successful conversion of the current degraded condition dominated by nonnative grass (Italian rye grass) to native salt marsh vegetation and transitional habitats. Future phases will therefore learn from the effectiveness of the management measures implemented in Phase 1 that are consistent with the approaches for the larger restoration planned for the upper Lagoon northeast of the railroad berm.



Source: ESRI, TRNERR (2014)

Los Peñasquitos Lagoon. D130136

Figure 7-18

Phase 1 - Project Elements

Phase 1 priority projects are not confined to Los Peñasquitos Lagoon and include watershed studies and concept design efforts that include a freshwater management program that aims to support lagoon health and salt marsh recovery by reducing freshwater inputs to Los Peñasquitos Lagoon during dry weather, a priority action identified in the Los Peñasquitos Water Quality Improvement Plan (WQIP). It is important that the updated Lagoon Enhancement Plan work with, and at times help guide, watershed efforts to ensure that recovery efforts in the Lagoon can be achieved and sustained in a feasible manner. The CEQA process, design, and permitting for this "pilot" restoration will continue with an estimated completion date of November 2022. Implementation of the project is planned over several construction seasons following approval of the permits. The implementation of these Phase 1 projects will depend on available funding and prioritization of available resources

7.3.2 Phase 2 Restoration

Projects identified for Phase 2 (5-25 years) include continued efforts carried over from Phase 1 (e.g. biological monitoring, invasive species management) as well as the large-scale salt marsh restoration for Zone 3. Delaying large-scale restoration until Phase 2 offers opportunities to improve the long-term success of salt marsh restoration, including design refinement through feedback generated by restoration projects implemented in Phase 1. Phase 2 also provides a timescale of 20 years to allow for adaptive management. In addition, Phase 2 implementation allows for more time to collect continued data on sea level rise, as well as time to design and implement the watershed improvements through the WQIP to reduce inputs of sediment and dry weather flows of freshwater to Los Peñasquitos Lagoon. Phase 2 also includes improvements to public access around the Lagoon (See Chapter 8), which consider sea level rise and the potential need to reroute existing trails (Marsh Trail), rather than investing in improvements in their current alignments.

7.3.3 Phase 3 Restoration

Projects identified for Phase 3 (25-50 years) will aim to maximize estuarine habitat acreage while maintaining long-term sustainability of wetland function in existing salt marsh. Phase 3 also includes completion of the trail loop around Los Peñasquitos Lagoon and connections to transportation hubs (e.g. Sorrento Valley Coaster Station) and watershed trailheads in Carmel Valley and Los Peñasquitos Canyon Preserve (see Chapter 8 for more details). Although the Lagoon Concepts described in Section 7.2.3.1 above are considered part of Phase 1 and Phase 2, they will be fully developed in consideration of long-term goals and objectives to ensure future Phase 3 projects can be implemented and integrated. Additionally, any adaptive management needed on Phase 2 projects would be completed in Phase 3.

Phase 3 projects may include modifications to the railroad berm, or other actions that are not feasible in the short-term or that fall just outside of the Phase 2 timeline. Additionally, any projects in Phase 3 will need to include a sea level rise and climate change adaptation plan component.

CHAPTER 8

Public Access, Safety, and Education Concepts

Improving public access, safety, and education was strongly supported during the public workshops held in 2012-2013 to update the Los Peñasquitos Lagoon Enhancement Plan (Lagoon Enhancement Plan). Since Los Peñasquitos Lagoon (the Lagoon) is a State Marsh Natural Preserve, access must be approved beforehand by California State Parks (CSP) and is usually limited to scientific work and management needs of the Lagoon. Several pathways and an established trail exist around the edges of Los Peñasquitos Lagoon, but they are in relatively poor condition and fragmented in nature. This chapter describes the proposed improvements to the pathways and trails around the Lagoon, based on discussions during the public workshops and further developed through technical analysis. A phased approach is briefly discussed to highlight opportunities and constraints for implementation, followed by a presentation of proposed improvements referred to as Public Access, Safety, and Education Concepts (Public Access Concepts). These concepts integrate elements of improved access with safety and educational opportunities and are organized into the following categories: Marsh Trail, Hilltop, Highway101, Carmel Valley Road, and Sorrento Valley Road. This chapter also explores opportunities to create linkages to regional trail networks that include the California Coastal Trail and the Sea to Sea Trail, as well as to public transit centers that include the Sorrento Valley Coaster Station.

8.1 Phased Approach

As discussed in Chapter 6, a phased approach was developed during the stakeholder process to allow consideration of identified opportunities and constraints for lagoon improvements that meet the refined goals and objectives of the updated Lagoon Enhancement Plan. The benefits associated with phasing the proposed Public Access Concepts include:

- Provides the ability to pursue opportunities where only partial funding is available.
- Presents opportunities to partner with other entities and/or groups working to improve and expand regional trail networks and bike paths.
- Informs design and implementation of planned improvements to transportation infrastructure along the north coast corridor to support enhanced public access (e.g., reduction of trash and debris, modifications to the railway alignment or berm).
- Considers sea level rise and planned responses (e.g., trail diversions).

Using the same timeframe described in Chapter 6, phasing can be applied to the Public Access Concepts with the understanding that improvements planned for later phases can be implemented sooner than anticipated should unforeseen opportunities arise (e.g., allocation of funding). Conversely, improvements may be moved to later phases (e.g., Phase 2 to Phase 3) if feasibility studies determine the need for delayed implementation to coordinate with larger park improvements or transportation projects. Based on this understanding, the following phased approach will be applied to the concepts:

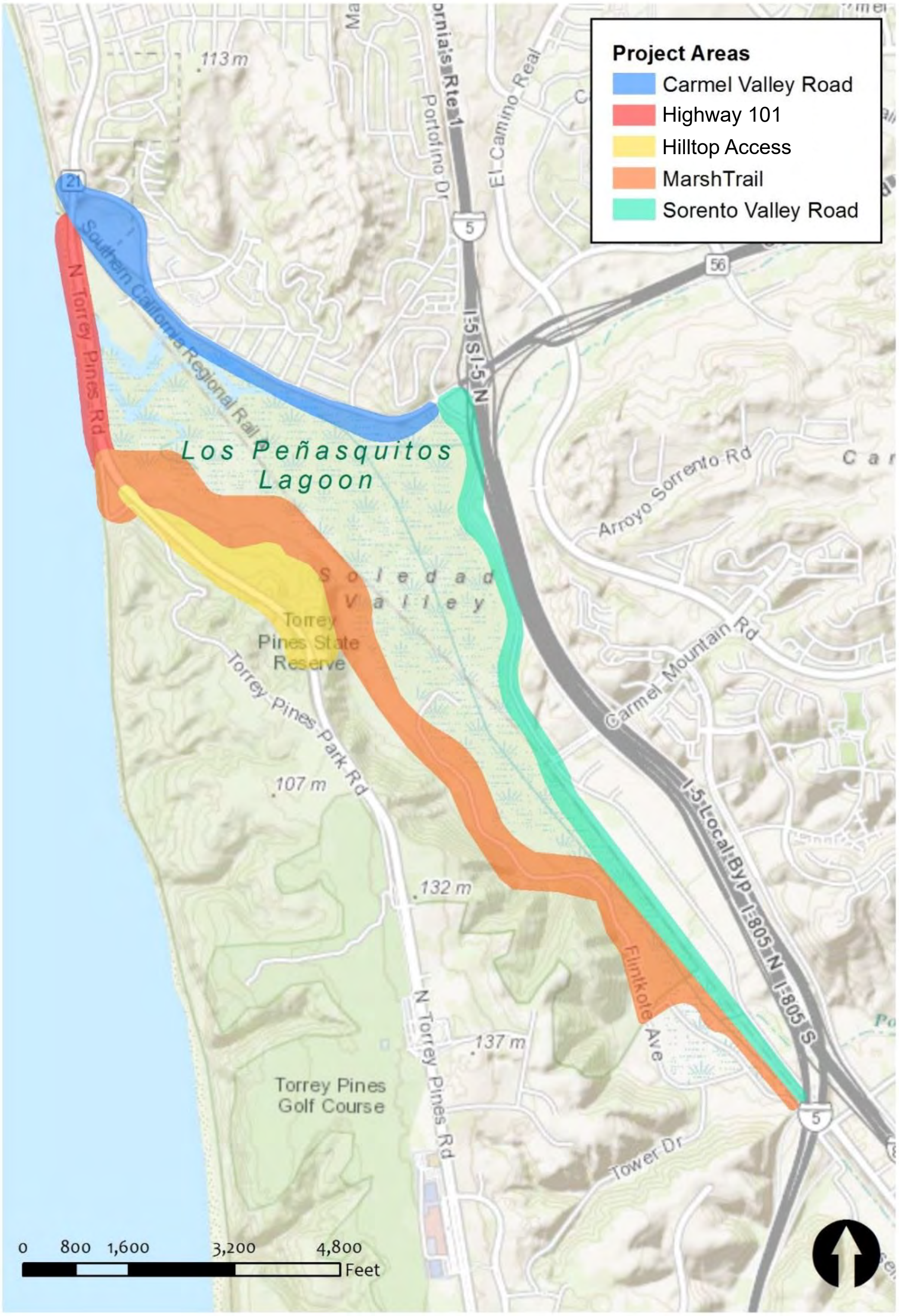
- **Phase 1 (0–5 years)** Phase 1 activities and projects to improve access that are more readily implemented will be considered for the primary phase. Key elements of this short-term phase include basic trail improvements and enhancements that may include information kiosks, improving trailheads (replacing chain link fencing with a gate), and closing off certain access points and revegetating user-created pathways.
- **Phase 2 (5–25 years)** Phase 2 activities and projects include improvements to trail connectivity around Los Peñasquitos Lagoon and with watershed trailheads in Carmel Valley (e.g., Sea to Sea Trail) and Los Peñasquitos Canyon Preserve. Where possible, these projects will be coordinated with planned transportation and transit projects, as well as related improvements to bike paths and pedestrian access. Phase 2 will also include improving safety along Highway 101, such as reducing conflicts of use between pedestrians, bicyclists, and vehicles along the western shoulder.
- **Phase 3 (25–50 years)** Phase 3 includes completion of the trail network that loops around Los Peñasquitos Lagoon as well as watershed trailheads that have not been completed in Phase 2. Providing improved connectivity to transportation hubs such as Sorrento Valley Coaster Station will be pursued in Phase 3 depending on the selected railway alignment that is expected to occur during Phase 2.

8.2 Proposed Public Access Concepts

Building on the stakeholder process presented in Chapter 6 and summarized in **Table 6-2**, a technical analysis was performed to further develop the Public Access Concepts for Los Peñasquitos Lagoon and adjacent trail networks. The analysis included the following:

- Assessment of current conditions (e.g., opportunities and constraints).
- Timing of planned improvements for transportation infrastructure and regional trail networks.
- Long-term sustainability with consideration to projected sea level rise.
- Potential conflict with resource management requirements within a State Marsh Natural Preserve and trail management within Torrey Pines State Natural Reserve (TPSNR).
- Funding for phased implementation.
- Long-term funding for operations and maintenance.

The results of the concept development are provided in the following section, with **Figure 8-1** providing an overview of the project areas for Carmel Valley Road, Highway 101, and the Marsh Trail. A Hilltop Education Overlook alternative is also included to provide additional viewpoints of Los Peñasquitos Lagoon with the potential to integrate it with the Marsh Trail realignment. The Public Access Concepts presented in this section contain elements and options that may be implemented as an isolated, single project or as a component of larger, regional projects.



Los Peñasquitos Lagoon. D130136

Figure 8-1
Project Areas Overview

The Public Access Concepts presented in this chapter will be evaluated in Chapter 10 using the assessment criteria developed during the stakeholder process discussed in Chapter 6.

8.2.1 Marsh Trail Opportunities

Response during the public workshops indicated that a majority of people prefer to keep the Marsh Trail in a similar condition without major improvements (e.g., paved walkways) aside from improved access at the western trailhead. However, results from the technical analysis indicated that northwest portions of the Marsh Trail will be lost to sea level rise due to low elevations that currently flood during higher high tides. Therefore, a trail realignment alternative is presented in this section as a means to avoid the loss of dedicated trail miles within TPNSR and to allow for trail use along this section of the Lagoon to continue despite the impacts of sea level rise. It is expected that the realignment would occur during Phase 2 given the current opportunities and constraints, as well as the need to solicit additional input from trail user groups, resource agencies, and TPSNR staff.

Trail Realignment

The area of highest concern occurs within the first mile of Marsh Trail from its northwestern trailhead because it begins just below the scenic loop located south of Highway 101. The current alignment of this section, highlighted in yellow in **Figure 8-2**, is problematic for multiple reasons. The lack of an adequate buffer zone along this segment between the trail and wetland vegetation creates a high potential for direct impacts (e.g., trampling) and indirect impacts (e.g., noise) to sensitive habitats. Portions of this section of the Marsh Trail are currently at elevations below the current high tide, which results in frequent periods of inundation. As a result, sections of the trail can become impassable and trail users are required to turn back, get wet, or move off trail to circumvent areas of flooding and/or mud. Looking forward in the context of predicted sea level changes, the entire three-quarter-mile segment will most likely fall below the predicted annual spring high tide line. In order to address the issues with the current alignment, and avoid the loss of dedicated trail miles within TPSNR, a new alignment for the northwest end of the Marsh Trail should be created. Ongoing use of the current alignment could still be allowed, though on a restricted basis (e.g., closed during higher high tides that include King Tides) to avoid impacts to lagoon habitats and sensitive species.

The proposed route (**Figure 8-3**) would continue to offer excellent views of Los Peñasquitos Lagoon while reducing the impact of visitors to the ecosystem. The existing loop at the northwest end of the trail would be replaced by a fork between a short northern spur to an observation point or viewing blind and the Marsh Trail heading southeast. The observation point would be located at the easternmost point of the elevated area with a 270-degree panorama of the Lagoon. The observation point trail would generally follow the northern portion of the existing loop, while the southern half of the loop would be allowed to revegetate. Additionally, if a crossing of Highway 101 is made, consideration should be given to making the observation point spur fully accessible.

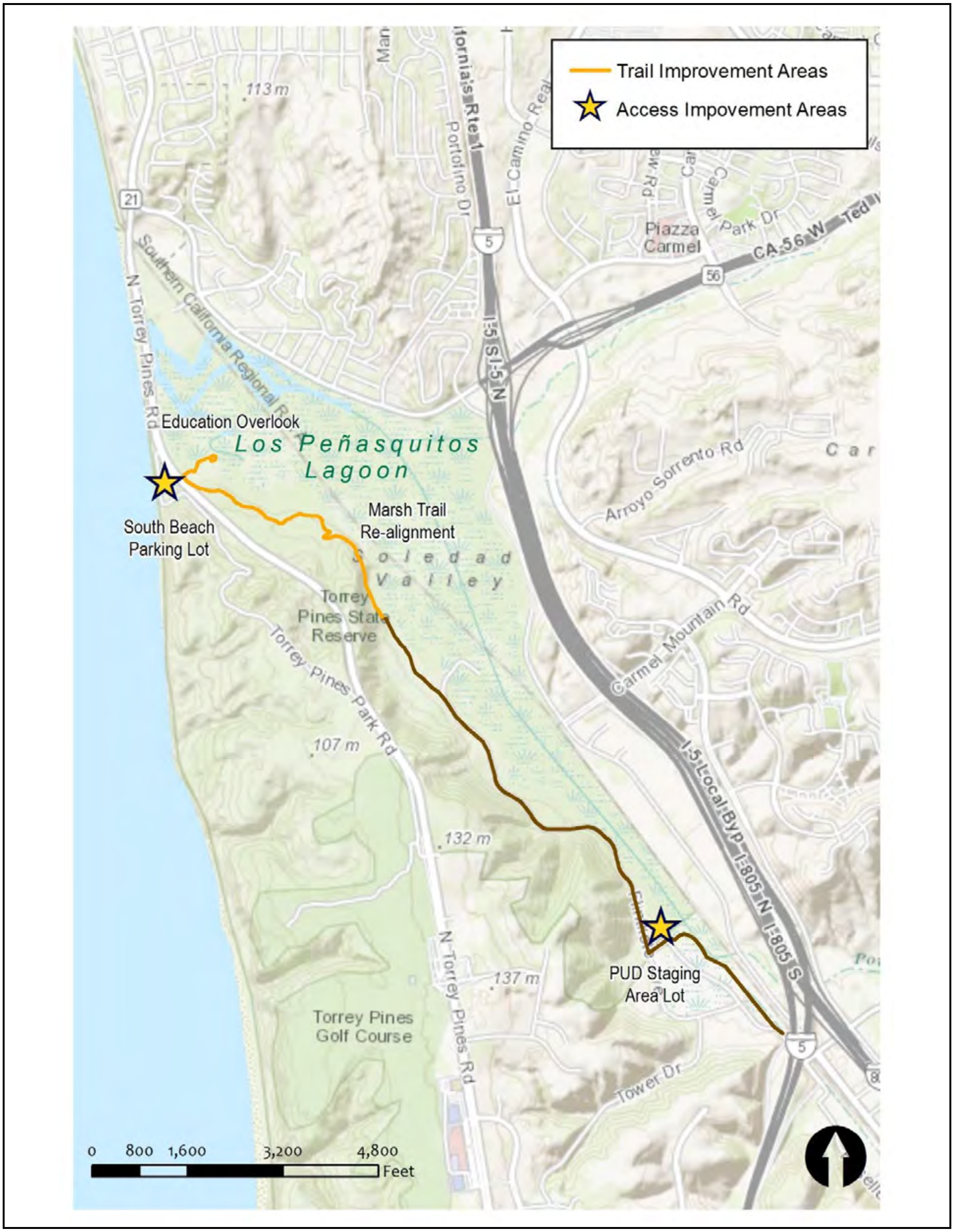


Figure 8-2
Marsh Trail Projects

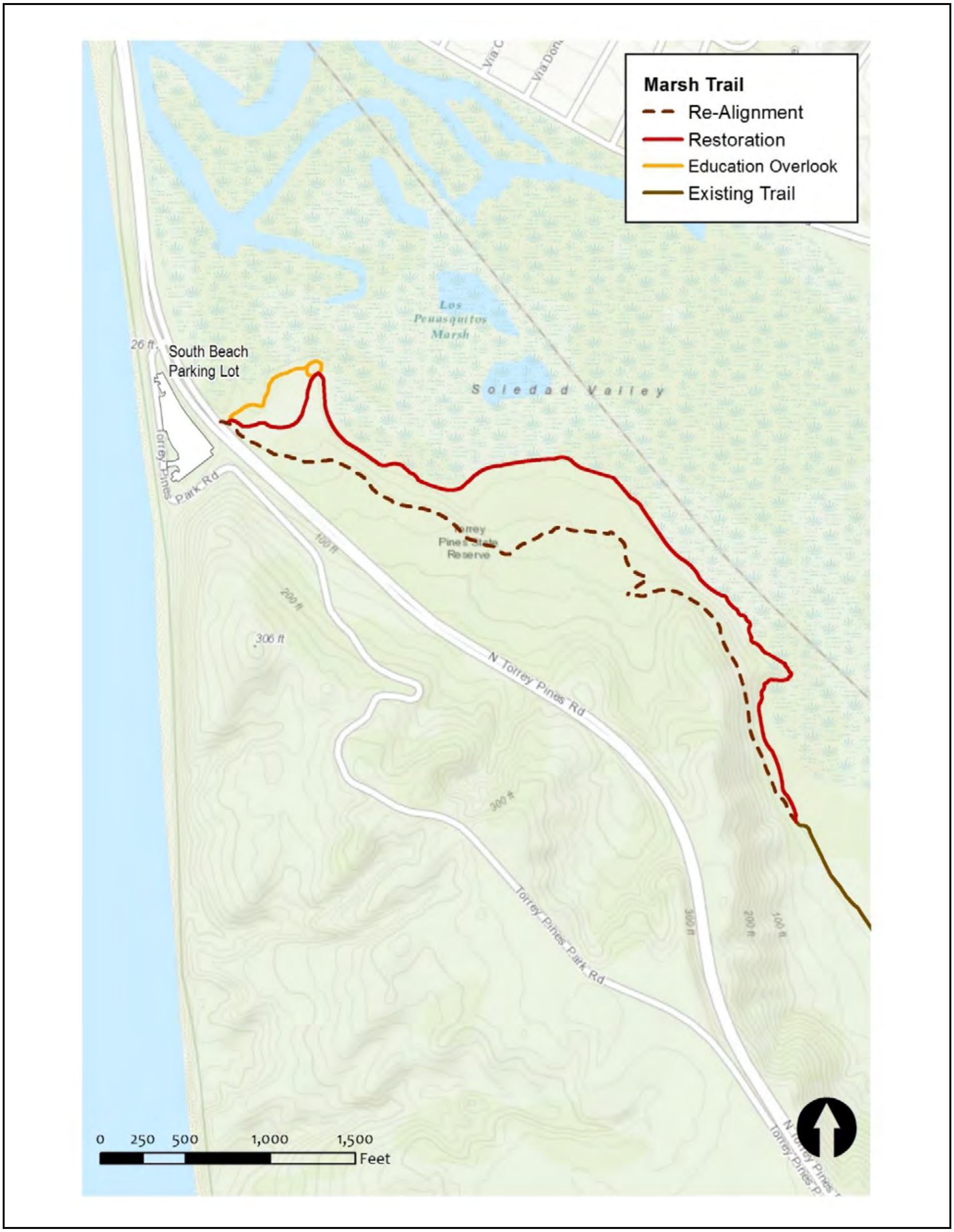


Figure 8-3
Marsh Trail Re-alignment and Education Overlook

The proposed Marsh Trail re-route would be designed to support only pedestrians and would follow an alignment that traverses the area further upslope from the lagoon edge at elevations ranging from 30 to 80 feet before reconnecting to the existing trail about one mile south. The first quarter mile of trail would gain nearly 50 feet of elevation while following the edge of a small bluff providing views to the east of the marsh plain and lagoon channels below. The new trail would then descend a short steep slope before angling east again. The trail would turn south once more where it would begin another climb to get above the escarpment at the edge of Los Peñasquitos Lagoon. Once above the top of the escarpment, the trail would flatten out and provide another opportunity for views overlooking the Lagoon below. From this point the trail would begin a gradual descent to the south, where it would rejoin the existing trail along at the base of the hillside. The remainder of the existing trail will need to have minor improvements made to it to allow for safe usage by pedestrians.

The new alignment would provide an elevated perspective for viewing the Lagoon and its wildlife while reducing direct adverse impacts on habitat and indirect impacts on wildlife. This trail would also be more sustainable and require less maintenance.

Phasing – Marsh Trail Realignment

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the Marsh Trail realignment in the updated TPSNR Trail Management Plan.
- Generate renderings to facilitate formal and informal reviews of realignment components and alternatives.
- Hold a series of public workshops and stakeholder meetings to gain consensus on the preferred approach and related aspects that are in compliance with the updated TPSNR Trail Management Plan.
- Initiate the Design & Feasibility Study.

Phase 2 (5–25 Years)

- Conduct and complete the Design & Feasibility Study.
- Conduct California Environmental Quality Act (CEQA) determination and acquire resource agency permits.
- Construct trail realignment portions with consideration to linkage trails to the Hilltop Education Overlook and other trail networks.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2, assuming feasibility.

Improved Marsh Trail Access

Access Improvements to Northwest End of Marsh Trail

Three options have been identified to improve access and safety to the northwest end of the Marsh Trail (**Figure 8-4**). The first is an at-grade crossing at the intersection of Highway 101 (North Torrey Pines Road) and Torrey Pines Park Road. The second is an underpass from the South Beach parking lot under Highway 101. The third is an overpass from Torrey Pines Park Road over Highway 101. All three options were discussed at the public workshops and in stakeholder meetings with CSP staff.

At-Grade Crossing

The first option to improve Marsh Trail access is an at-grade crossing (Option 1 in **Figure 8-5** and **Figure 8-6**). This option involves improvements to the intersection of Highway 101 and Torrey Pines Park Road located within TPSNR. This option also improves pedestrian facilities along the northbound lanes of Highway 101 from the intersection to Marsh Trail. Intersection improvements include a crosswalk and traffic-calming features at a minimum, and potentially a pedestrian-activated signal. On the eastside of Highway 101, a deck or small plaza is needed to keep congregating visitors safe before crossing. This could be similar to the bus stops found at the north beach access. Once across the North Torrey Pines section of Highway 101, approximately 600 feet of pedestrian improvements are required to reach the Marsh Trail. Based on the narrowness of the shoulder and steep embankment down to the Lagoon, a wood or steel boardwalk cantilevered out of the embankment may be more appropriate than a widening of the shoulder with a retaining wall and concrete sidewalk.

Underpass Crossing

The second, and most direct, option involves creating an underpass to connect the South Beach parking lot to the Marsh Trail (Option 2 in **Figure 8-5** and **Figure 8-6**). There is an elevation change of about 6 feet from the parking lot to the beginning of the Marsh Trail. If the underpass is cut at the south end of the parking lot, the existing elevation of Highway 101 will provide adequate vertical clearance for pedestrians. The most probable method for constructing the underpass would be to cut a wide trench and then bridge the road over, rather than bore a tunnel. The path would begin in the southeast corner of the parking lot and run approximately 150 feet to the northeast under Highway 101, where it would emerge onto the flat area above Los Peñasquitos Lagoon at the beginning of the Marsh Trail. The underpass option would also provide the best access for emergency vehicles needing access to the western reaches of the Marsh Trail.

Figure 8-4
Current Marsh Trail Access

Figure 8-5
Potential Marsh Trail Access Improvements

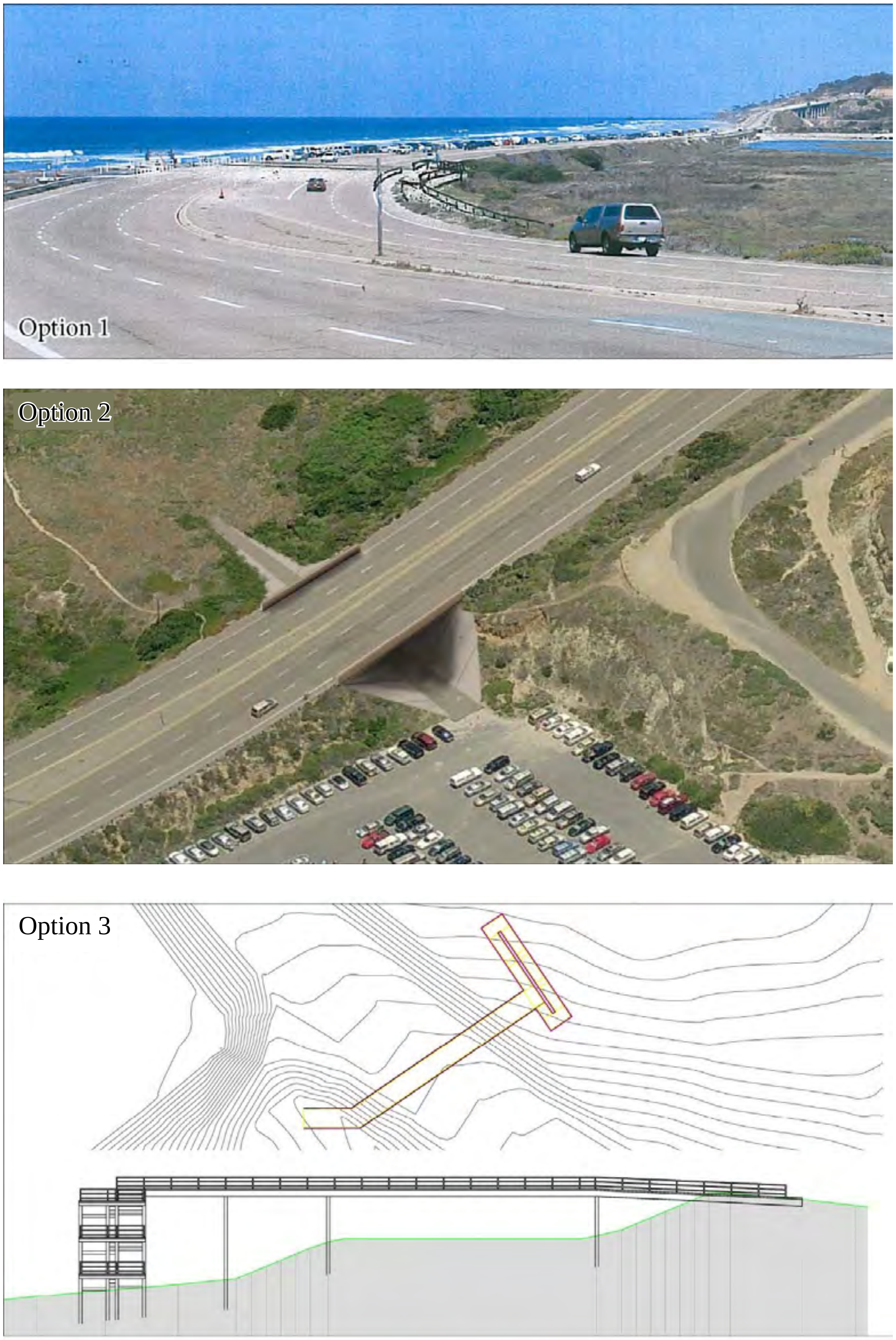


Figure 8-6
Marsh Trail Access Options

Overpass Crossing

The third option is a pedestrian overpass connecting Torrey Pines Park Road to the beginning of the Marsh Trail (Option 3 in **Figure 8-5** and **Figure 8-6**). The overpass, or bridge, would start at the turn in Torrey Pines Park Road just above the South Beach parking lot to take advantage of the existing elevation that is 8 to 10 feet above Highway 101. Additional ramping would be needed to gain adequate vertical clearance over Highway 101. Once the required elevation is gained, a bridge would span over Highway 101. Once over Highway 101, visitors would descend a series of ramps down to the beginning of the Marsh Trail some 35 feet below.

Phasing – Access Improvements to Northwest End of Marsh Trail

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the access improvements to the northwest end of the Marsh Trail in the updated TPSNR Trail Management Plan.
- Generate renderings to facilitate formal and informal reviews of access improvements.
- Hold a series of public workshops and stakeholder meetings to gain consensus on the preferred approach and related aspects that are in compliance with the updated TPSNR Trail Management Plan.
- Conduct the Design & Feasibility Study if funding is available.
- Initiate CEQA determination and permit applications if Design & Feasibility Study is completed.

Phase 2 (5–25 Years)

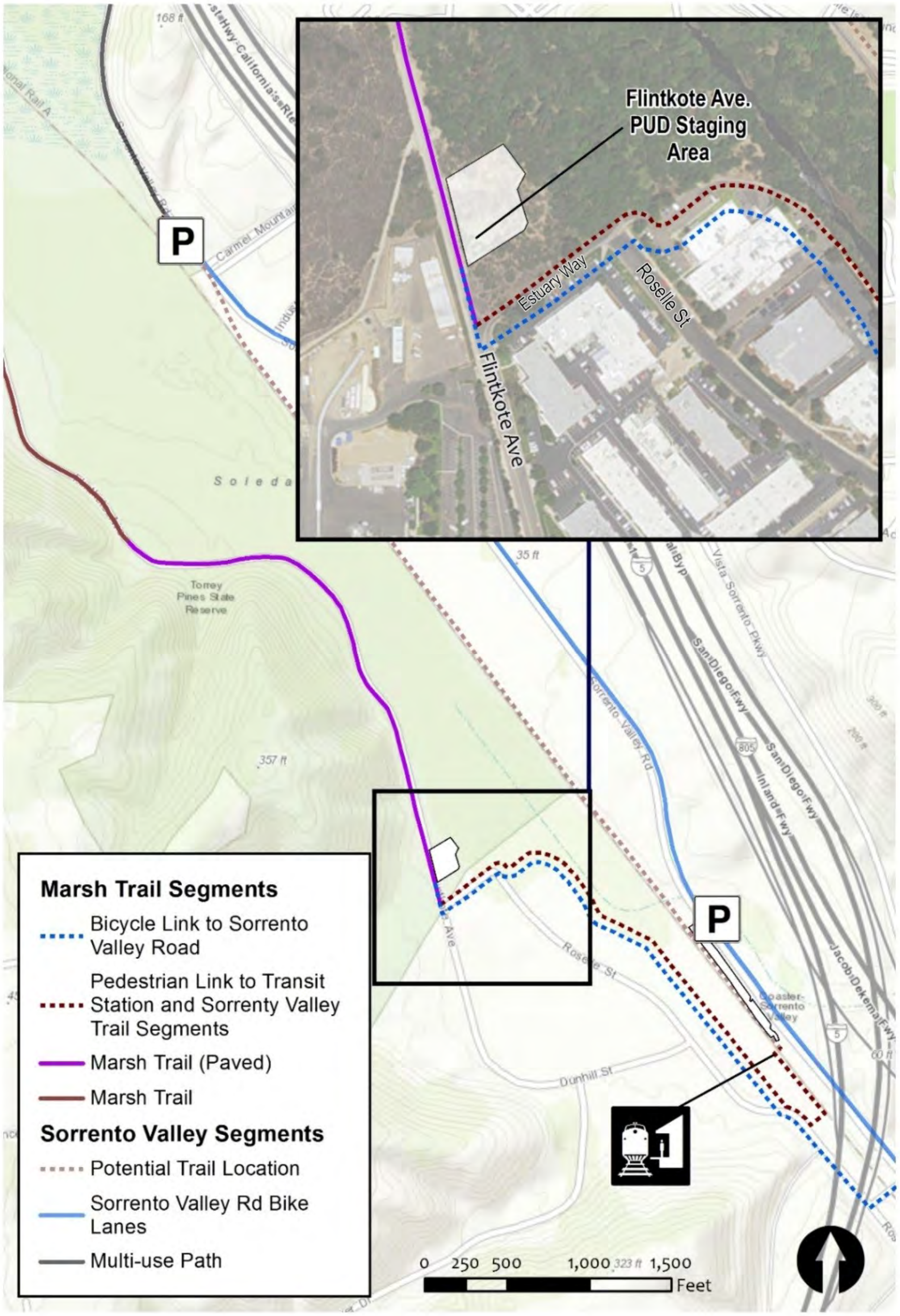
- Conduct the Design & Feasibility Study (if not performed or completed in Phase 1).
- Conduct and/or complete CEQA determination and acquire resource agency permits.
- Construct improved trail access feature and related components (e.g., educational panels).
- Connect with California Coastal Trail.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2 if still feasible.

Access Improvements to Southeast End of Marsh Trail

There is an unimproved parcel owned by the City of San Diego that is currently used infrequently as a construction staging area mainly by the Public Utilities Department (PUD)(**Figure 8-7**). Installing an entrance sign near the intersection of Flintkote Avenue and Estuary Way, and converting a portion of this area into a gated gravel parking lot with an informational kiosk, would provide significant benefit to the public accessing TPSNR. Public usage of the gravel lot could be suspended as required by the PUD as their project needs arise.



ESA

Figure 8-7
Flintkote Avenue Trail Access

In addition to these staging area improvements, a wayfinding program would be created to bring potential visitors from the Sorrento Valley Coaster Station that is approximately 0.75 miles away to the TPSNR. Trail improvements could still be designed and implemented for this section of the Marsh Trail even if the City's lot cannot be acquired for use. Examples include locating an informational kiosk and/or additional informational panels either near the gated entrance to TPSNR at Flintkote Avenue or at the trailhead near the CSP residences.

Phasing – Access Improvements to Southeast End of Marsh Trail

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the access improvements at the southeast end of the Marsh Trail in the updated TPSNR Trail Management Plan.
- Consult with the City of San Diego to determine opportunities and constraints for using the empty lot owned by the PUD.
- Generate renderings to facilitate formal and informal reviews of access improvements.
- Hold a series of public workshops and stakeholder meetings to gain consensus on the preferred approach and related aspects that are in compliance with the updated TPSNR Trail Management Plan.
- Conduct the Design & Feasibility Study (if needed).
- Initiate CEQA determination and permit applications if Design & Feasibility Study is completed (if needed).

Phase 2 (5–25 Years)

- Conduct the Design & Feasibility Study (if needed and not performed or completed in Phase 1).
- Conduct and/or complete CEQA determination and acquire resource agency permits.
- Construct improved trail access features and related components (e.g., educational panels).
- Coordinate with the San Diego Association of Governments (SANDAG) regarding potential linkages with the Sorrento Valley Coaster Station.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2, if still feasible.

8.2.2 Hilltop Opportunities

Hilltop Staging Area

The lack of appropriate staging and trail access leads to the Marsh Trail being underused relative to other trails within TPSNR. The poor access to the Marsh Trail area of the park has been noted as an issue dating back to the 1980s. The 1984 San Diego Coastal State Park System General Plan proposed developing a trailhead at East Grove off the northbound lane of North Torrey Pines Road (see **Figure 8-8**). The location is currently a relatively clear area, which at times gets used as an unofficial turn off that provides unofficial access to elevated viewing points looking over Los Peñasquitos Lagoon. The previously proposed trailhead was to include parking for 10 cars, a turnaround, an interpretive display, two portable restrooms, and a locking gate. The location suggested for the new trailhead in the 1985 Lagoon Enhancement Plan continues to be a viable location for new trailhead development. Coordination with TPSNR ranger staff should be initiated early in any planning process for this trail improvement to ensure that appropriate presence and response times could be considered and (if possible) enhanced and for inclusion in the updated TPSNR Trail Management Plan.

Hilltop Trail Connections

The 1984 Lagoon Enhancement Plan proposed an out-and-back trail along a ridgeline to an observation point that provides an elevated view 200 feet above Los Peñasquitos Lagoon. This trail is referred to as the Hilltop Education Overlook, as delineated in **Figure 8-8** with a yellow line. The 1985 Lagoon Enhancement Plan also proposed a second trail, shown in **Figure 8-8**, as the Hilltop Education Overlook to Marsh Trail Connection (brown line). This secondary trail would connect to the north access point along the top of the hillside paralleling Highway 101, including a fork that descended to the marsh trail below. A third trail alignment is also provided in **Figure 8-8** (red line) that would utilize the eastern shoulder of North Torrey Pines Road (Highway 101) to create a pedestrian linkage from the South Beach parking lot up to the new Hilltop Staging Area and recommended overlook trail. However, planning for this third potential trail alignment would need to consider safety issues related to high-speed bicycle and vehicle traffic that occurs along this downgrade of North Torrey Pines Road.

Phasing – Hilltop Opportunities

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the Hilltop Staging Area, Education Overlook, and Education Overlook to Marsh Trail connections in the updated TPSNR Trail Management Plan.
- Generate renderings to facilitate formal and informal reviews of access improvements.
- Hold a series of public workshops and stakeholder meetings to gain consensus on the preferred approach and related aspects that are in compliance with the updated TPSNR Trail Management Plan.
- Conduct the Design & Feasibility Study.
- Initiate CEQA determination and permit applications.

Phase 2 (5–25 Years)

- Conduct the Design & Feasibility Study (if not completed in Phase 1).
- Conduct/complete CEQA determination and acquire resource agency permits.
- Construct Hilltop Staging Area, Education Overlook, and Education Overlook to Marsh Trail connections, as well as related features (e.g., educational panels).

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2 if still feasible.

Figure 8-8
Hilltop Trail Access

8.2.3 Highway 101 Opportunities

Parking, Pedestrian, and Bicycle Improvements on the Western Edge of Highway 101

A number of conditions exist along the western edge of Highway 101 that are sub-optimal in terms of user experience and public safety. The current configuration places bicyclist and pedestrians potentially in conflict with vehicular traffic. If the Highway 101 right-of-way is considered as a whole, there is potential for various reconfigurations that would improve user safety and experience (**Figure 8-9**). However, these improvements may require the reduction of the number of available parking spaces.

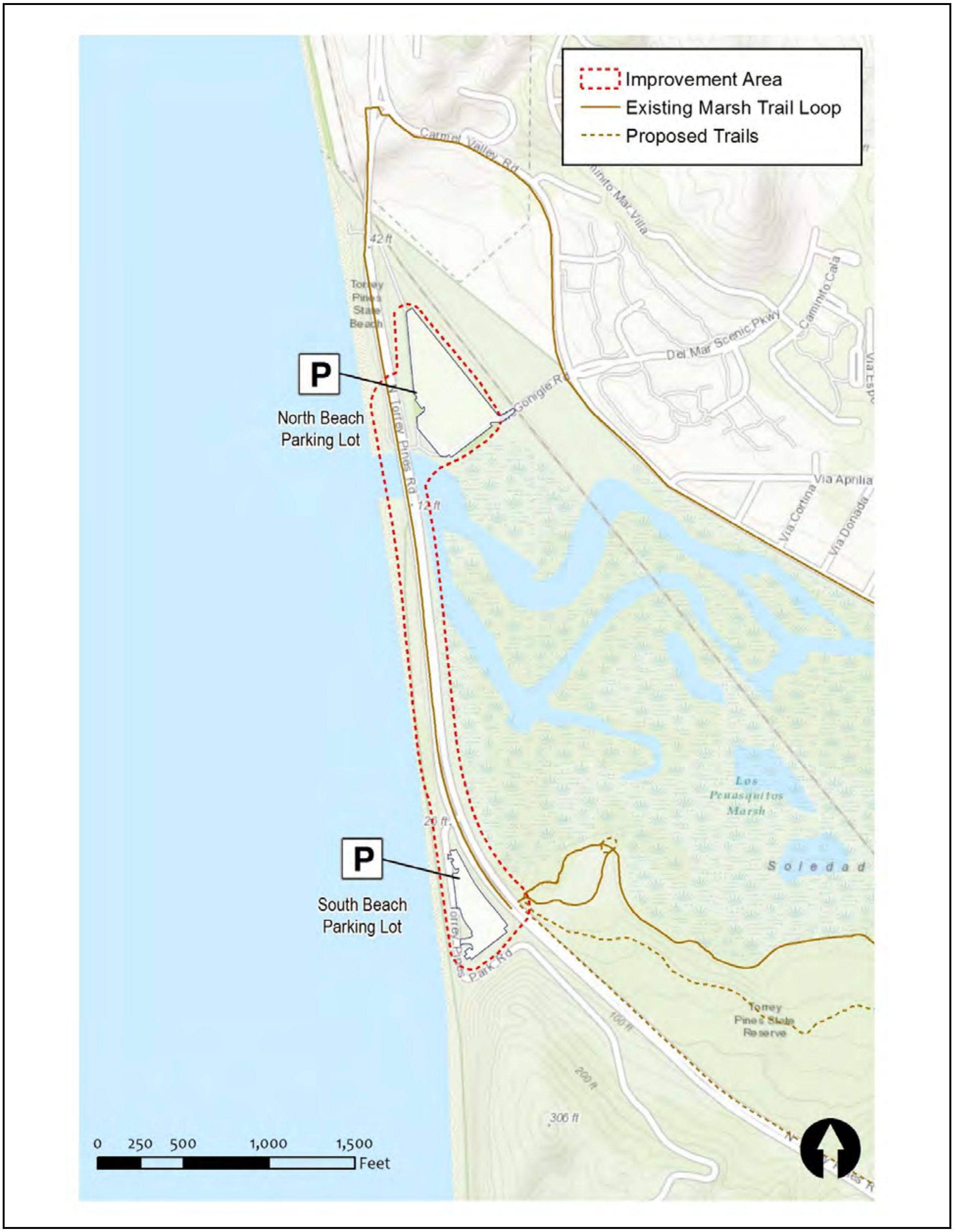
Travel Lane Configuration

Regardless of parking layout, the number of travel lanes between the bridge over the mouth of the Lagoon and the entrance to the South Beach parking lot would be reduced to one lane in each direction as a traffic-calming measure and to provide additional space for improvements to the pedestrian right-of-way. The bridge is already configured in this manner, so lane modifications would be more feasible than under different circumstances. Additional elements could include northbound U-turn capability just before the bridge over the mouth of Los Peñasquitos Lagoon and an additional entry lane to the South Beach parking lot to allow for queuing capacity for multiple vehicles without impeding lanes dedicated for southbound traffic.

There would also be benefit in reducing the number of lanes heading southbound after the South Beach parking lot entrance to provide an acceleration lane for vehicles leaving the lot. North of this point, only one travel lane exists, the only traffic being introduced originates from the South Beach parking lot, and the road decreases to two lanes at the top of the hill already. A reduction in lanes would also allow for buffered bicycle lanes along the grade and provide the opportunity for pedestrian facilities along the eastern edge of Highway 101. Proposed modifications to the travel lane configurations are shown in **Figure 8-10** to **Figure 8-12**.

Pedestrian Facilities

As discussed in Chapter 4, there currently are no dedicated pedestrian lanes along the western edge of Highway 101 south of the lower bridge and before the South Beach parking lot. Pedestrians must walk along active bike and vehicle lanes or along an eroded bluff with sections of broken pavement. The pedestrian facilities should be developed along the western edge of the right-of-way to provide a safer user experience in which pedestrians safely access the South Beach parking lot or Torrey Pines State Beach rather than dodging bicycles and vehicles backing out of parking spaces. The facility should have the characteristics generally associated with a public promenade, such as dedicated walkways separated from areas used by bicycle and vehicle traffic.



Los Peñasquitos Lagoon. D130136

Figure 8-9
Highway 101 Overview

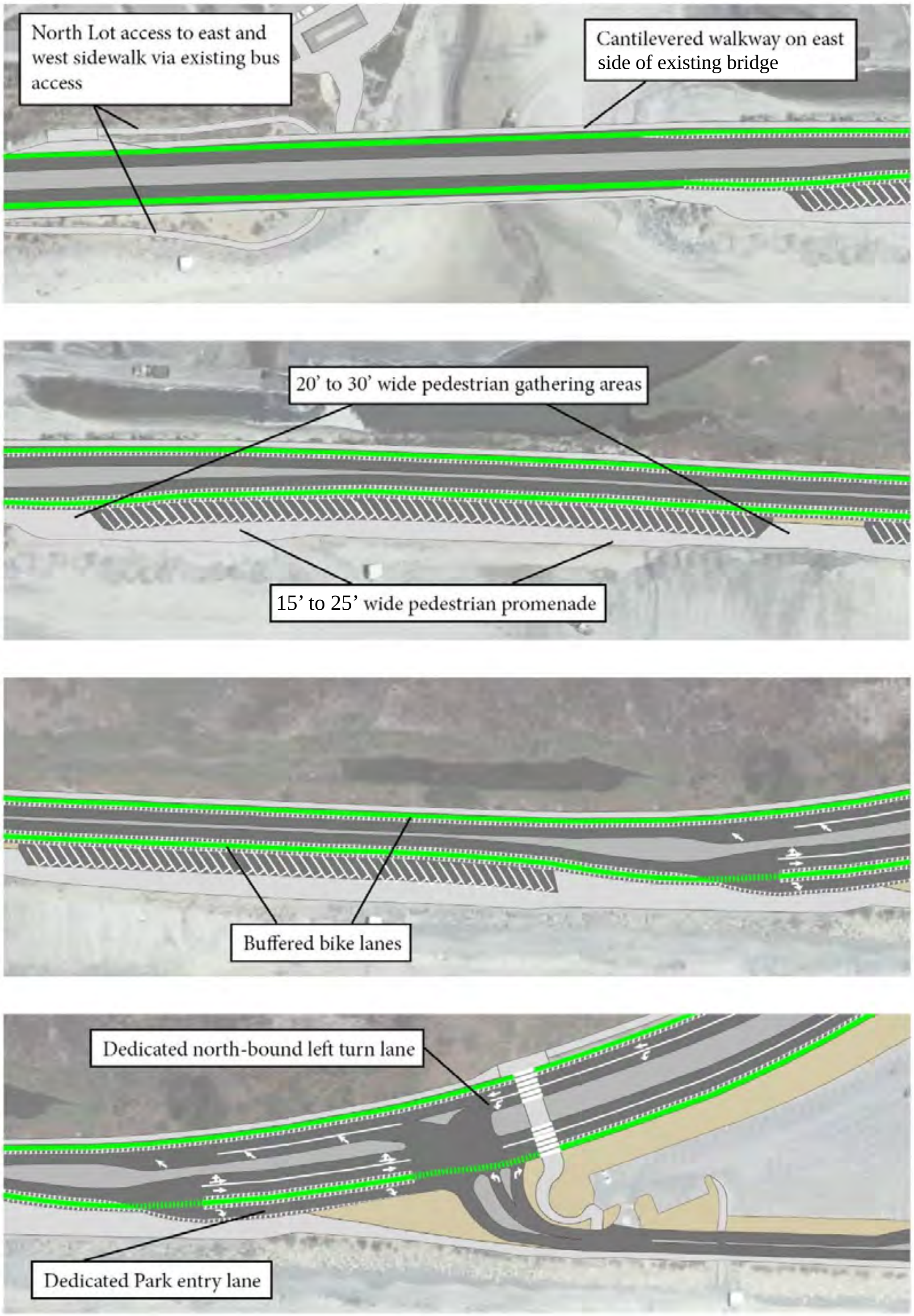


Figure 8-10
Head-In Parking Option

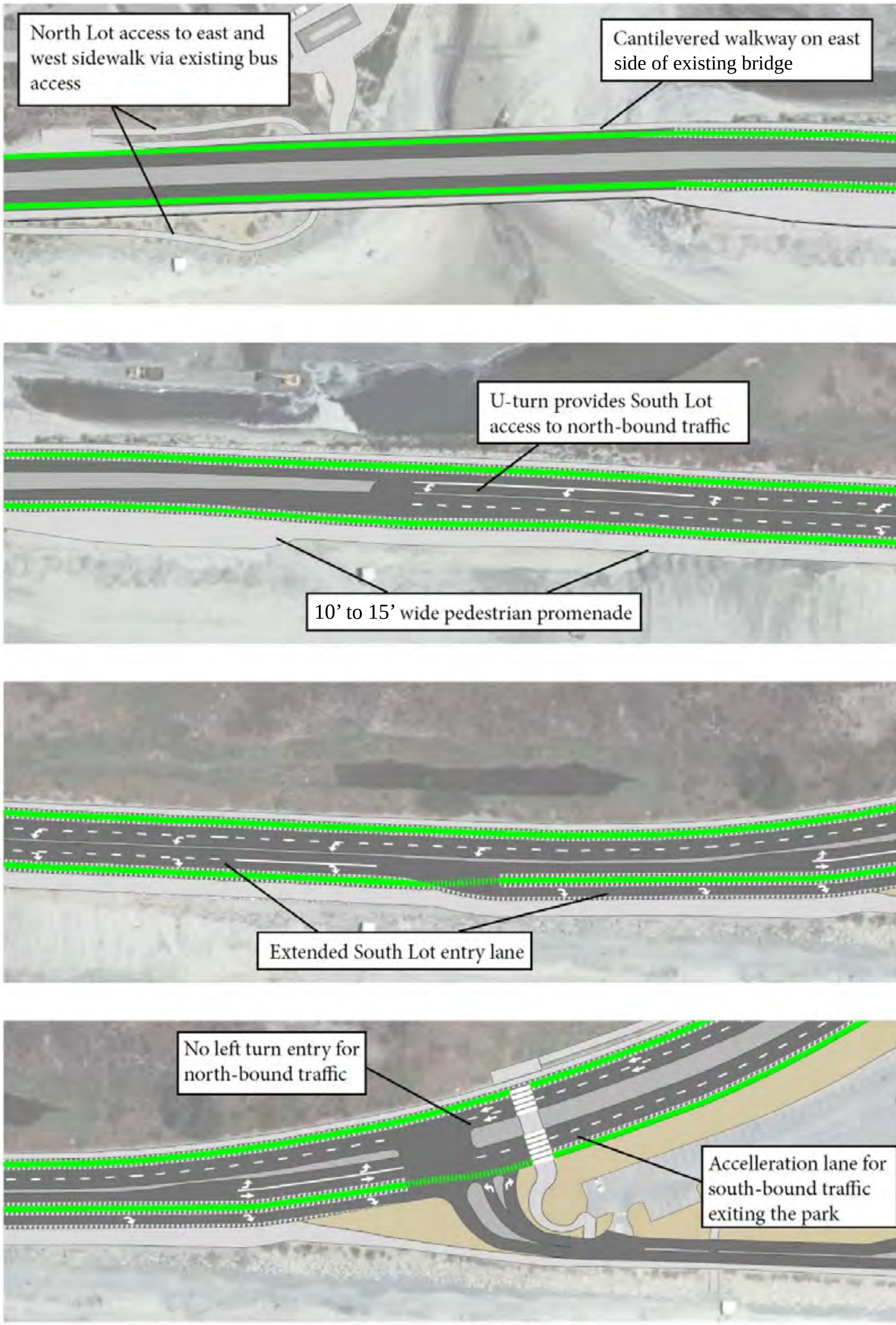


Figure 8-12
No Parking Option

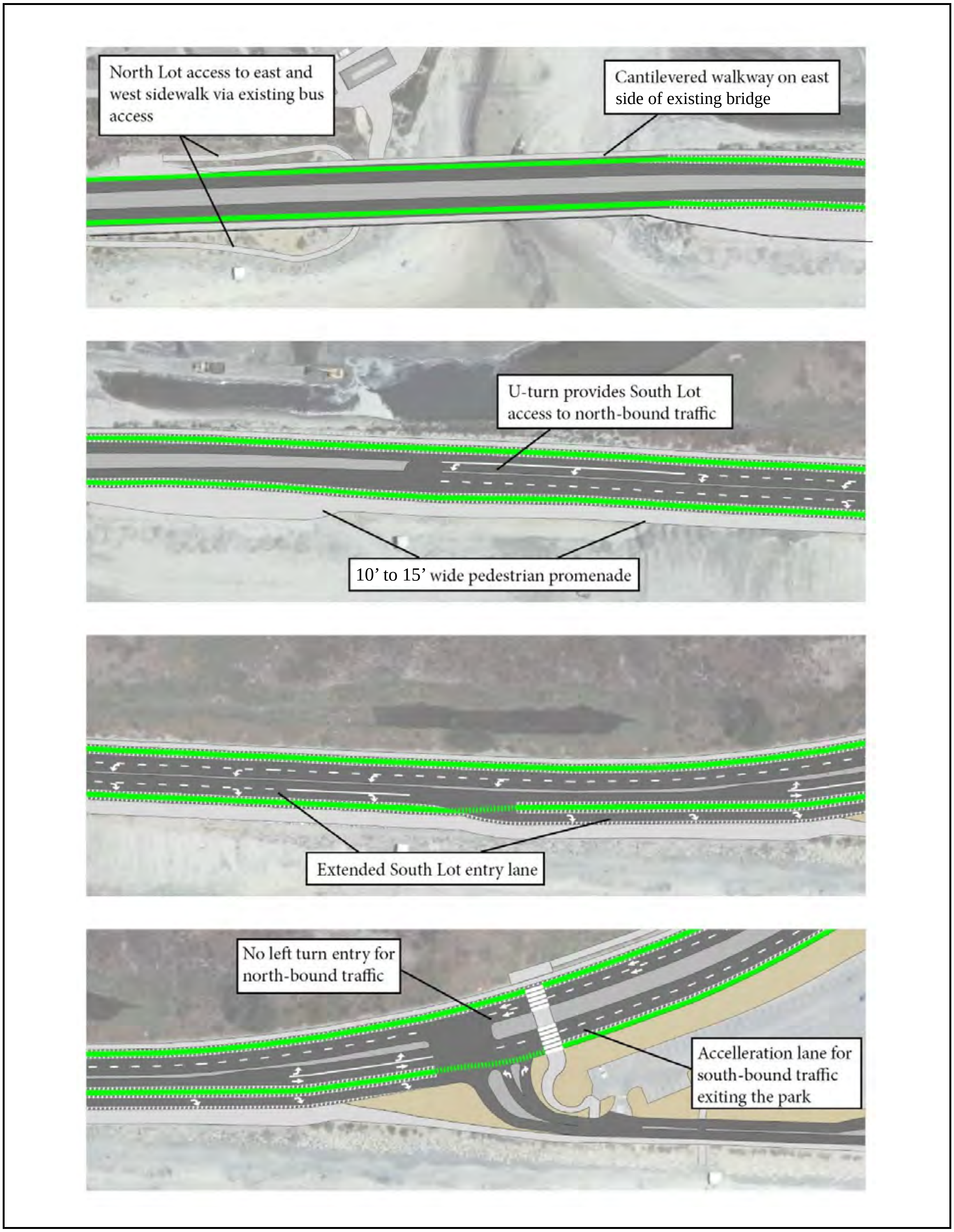


Figure 8-12
No Parking Option

Bicycle Facilities

Formal bicycle facilities (e.g., a delineated bike lane) should continue to be located between the travel lane and parking regardless of configuration with the addition of a buffer space for protection. Although casual riders may utilize the pedestrian facilities to pull off and experience the coast, bicycle through traffic in this area tends to occur at high speeds and would not be compatible with the promenade-type environment of the pedestrian facilities.

Parking Spaces

There are approximately 130 spaces currently situated along the western edge of Highway 101. Several of these spaces are located along sections of eroded bluff and some have already been lost as a result of bluff failures. Modifying the existing parking structure will most likely be needed to preserve public parking opportunities while balancing the need to improve the safety for pedestrians, bicyclists, and southbound vehicular traffic. A conversion to parallel parking would reduce parking capacity to 54 spaces. The head-in parking configuration could preserve as many as 100 spaces, depending on the final design of pedestrian congregation areas along promenade.

Pedestrian Improvements along the East Edge of Highway 101

Pedestrian facilities are currently non-existent along the eastern edge of Highway 101 despite opportunities for wonderful views of the marsh, birds, and the presence of the Marsh Trail at the southern end. The 1985 Lagoon Enhancement Plan identified the creation of a pedestrian connection from the North Beach parking lot south along the east edge of Highway 101 to the existing Marsh Trail. The east edge of the right-of-way on this stretch of Highway 101 currently consists of an approximately 6-foot-wide bike lane. There is no additional defined shoulder or curb to protect pedestrians along the roadway and the landform drops off steeply to the east down to the marsh. There is also no pedestrian access at all along the northbound side of the bridge; thus, access along this side of the road completely cut off.

To access the Marsh Trail from the North Beach parking lot, a visitor must pass under the lower bridge at Highway 101 and use the bus stop access ramp to reach the southbound side of the bridge over the mouth of the Lagoon. From here visitors can cross over to the south side of Los Peñasquitos Lagoon and continue south along the Highway 101 until they reach the South Beach parking lot entrance. As discussed in the previous section, no pedestrian facilities are currently provided between this point at the South Beach parking lot and the Marsh Trail, leaving visitors at risk when attempting to cross Highway 101 to access the trail.

In conjunction with a full right-of-way redesign of Highway 101 between the South Beach parking lot entrance and the bridge over the mouth of Los Peñasquitos Lagoon, there is potential to create pedestrian access from the North Beach parking lot to the Marsh Trail along the east edge of Highway 101. At the north end, a lightweight cantilevered walkway could be retrofitted to the east side of the bridge. From the bridge to the South Beach parking lot, options vary depending on the overall reconfiguration of Highway 101 and are described below.

Highway 101 Improvement Options

The following three design concepts have been developed at this stage of the project for Highway 101. Future design and implementation would require support from the City of San Diego who manages this roadway and related easements. Improvements would most likely be led by the City as part of a Capital Improvement Project.

Alternative A (Figure 8-10)

This alternative has the largest footprint, greatest potential environmental impacts, and likely highest construction costs. A promenade with widths ranging from 15 to 25 feet would be provided along the western edge for pedestrians and slow-moving cyclists, along with pedestrian gathering areas with widths that range from 20 to 30 feet. Head-in diagonal parking spaces would be provided along most of the length of the promenade. A buffered bicycle lane would be provided between the parking and southbound travel lane. The northbound travel lane would retain the standard bicycle lane and provide a pedestrian sidewalk or a cantilevered boardwalk along the Lagoon's edge. Dedicated entry and exit lanes to the South Beach parking lot for northbound and southbound traffic are included with this alternative to improve flow in and out of the parking lot to reduce vehicular congestion on Highway 101 that presents safety issues for pedestrian, bicycle and vehicles traffic.

Alternative B (Figure 8-11)

This alternative has a smaller footprint, less environmental impacts, and likely lower construction costs than Alternative A. A promenade with widths ranging from 15 to 25 feet would be provided along the western edge for pedestrians and slow-moving cyclists. Parallel parking spaces would be provided along most of the length of the promenade. A buffered bicycle lane would be provided between the parking and southbound travel lane. The northbound travel lane would include a standard bicycle lane and, finally, a pedestrian sidewalk along the edge of Los Peñasquitos Lagoon within the existing disturbed shoulder. Dedicated entry and exit lanes to the South Beach parking lot for northbound and southbound traffic are included with this alternative to improve flow in and out of the parking lot to reduce vehicular congestion on Highway 101 that presents safety issues for pedestrian, bicycle and vehicle traffic. Dedicated entry and exit lanes for the South Beach parking lot

Alternative C (Figure 8-12)

This alternative has the smallest footprint, least environmental impacts, and likely the lowest construction costs. A promenade with widths ranging from 10 to 15 feet would be provided along most of the western edge for pedestrians and slow-moving cyclists. No parking spaces would be provided to accommodate the space needed to improve safety for pedestrian and bicycle use. A standard bicycle lane would be provided adjacent to the southbound travel lane. The northbound travel lane would include the standard bicycle lane and, finally, a pedestrian sidewalk along the Lagoon's edge within the existing disturbed shoulder. Dedicated entry and exit lanes to the South Beach parking lot for southbound traffic are provided under this alternative. However, northbound traffic would need to access this parking lot by way of a U-turn rather than a dedicated left turn lane as provided in Alternative A and Alternative B. While this alternative reduces available parking along Highway 101 by 120 spaces, the adjacent North Beach parking lot provides 503 parking spaces and could accommodate parking needs as this parking lot is underutilized by more than 120 spaces on all but the busiest holidays.

Phasing – Highway 101 Improvement Options

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the Highway 101 Improvement Options in the updated TPSNR Trail Management Plan.
- Consult and coordinate with staff from SANDAG and the City of San Diego's Transportation and Storm Water Department to determine potential timeline for Highway 101 reconfiguration and assess opportunities and constraints to integrate one of the three alternatives (or components of) into the plans.
- Generate renderings to facilitate formal and informal reviews of access improvements.
- Hold a series of public workshops and stakeholder meetings to gain consensus on the preferred approach and related aspects that are in compliance with the updated TPSNR Trail Management Plan.
- Conduct the Design & Feasibility Study of the preferred alternative.

Phase 2 (5–25 Years)

- Conduct the Design & Feasibility Study (if not completed in Phase 1).
- Conduct/complete CEQA determination and acquire resource agency permits.
- Construct the preferred alternative and associated improvements.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2 if still feasible.

8.2.4 Carmel Valley Road Opportunities

Three improvement opportunities have been identified along Carmel Valley Road (**Figure 8-13**) between Highway 101 and Interstate 5 (I-5). These improvements can be implemented separately or as part of a larger project.

Closing User Created Trails

In total, there are over 4,000 feet of user-generated trails in the northern portion of TPSNR situated between the railroad, Carmel Valley Road, and the North Beach parking lot. Some of these trails may not be actively used today and just have not revegetated, but others show visible signs of frequent use. All may require more active means than just posting signage to close and restore these trails. This could include revegetation near the ends of the trails to obscure the remainder of the trail or more active enforcement of the policy already in place for a period of time necessary to allow the path to revegetate. In addition to more active closures/revegetation and increased enforcement, completing a sidewalk along the southwest side of Carmel Valley Road to the intersection with Highway 101 and a connector trail from Highway 101 down to the bluff on the west side of the railroad could help discourage the user perception that user-generated trails are acceptable in the absence of legitimate pedestrian facilities.

Pedestrian Improvements

Providing improved pedestrian access along the southern edge of Carmel Valley Road between McGonigle Road and Sorrento Valley Road (**Figure 8-13**) needs to be considered on both a short-term and long-term basis. In the short-term, replacing the narrow foot trails by extending the shoulder improvements that have been implemented between McGonigle Road and Via Borgia southeast to Sorrento Valley Road would improve user safety and provide an opportunity to define the edge of allowed public access along the Lagoon. In the long-term, reconfiguration of the street right-of-way to better accommodate pedestrian and bicycle activity should be incorporated into efforts to adjust the elevation of Carmel Valley Road to address sea level rise. It should be noted that this user-generated trail is not a dedicated trail within TPSNR and would need to be included in the updated TPSNR Trail Management Plan before any improvements could be implemented.

Bicyclist Improvements

Providing improved safety for bicyclists along Carmel Valley Road will need to be considered as well. Recent improvements along this street include implementing a dedicated bike lane. However, the eastbound bike lane terminates at Portofino Drive and does not reemerge until past the onramp for southbound I-5 traffic, providing a disconnect along this section and for access to Sorrento Valley Road. While westbound bike traffic can use a pedestrian sidewalk, the eastbound lane is delineated by a guardrail that forces bicyclists into the vehicular traffic. Complications associated with improving bicycle access along this segment of Carmel Valley Road include lack of space between the roadway and Los Peñasquitos Lagoon that would allow for the creation of an additional bike lane.

Regional Project Integration

The Carmel Valley Road corridor is included in three different regional trail program efforts: the Coastal Rail Trail, the Sea to Sea Trail, and the Trans-County Trail. The goals and objectives for improved public access and safety identified in the updated Lagoon Enhancement Plan should be integrated into these larger planning efforts as they move forward on their own timelines.

Phasing – Carmel Valley Road Improvements

Phase 1 (0–5 Years)

- Consult and coordinate with CSP staff to include the Carmel Valley trail closures and improvements in the updated TPSNR Trail Management Plan.
- Consult and coordinate with staff from SANDAG, Caltrans, and the City of San Diego's Transportation and Storm Water Department to determine potential timeline for Carmel Valley reconfiguration. Assess opportunities and constraints to integrate pedestrian and/or bicycle improvements into the plans.
- Coordinate with staff from SANDAG (Coastal Rail Trail), the State Coastal Conservancy (SCC) (California Coast Trail) and Sea to Sea Trail Foundation (Sea to Sea Trail) to include proposed trail and bike improvements from the updated Lagoon Enhancement Plan in their plans for expanding these trail networks while reducing fragmentation.

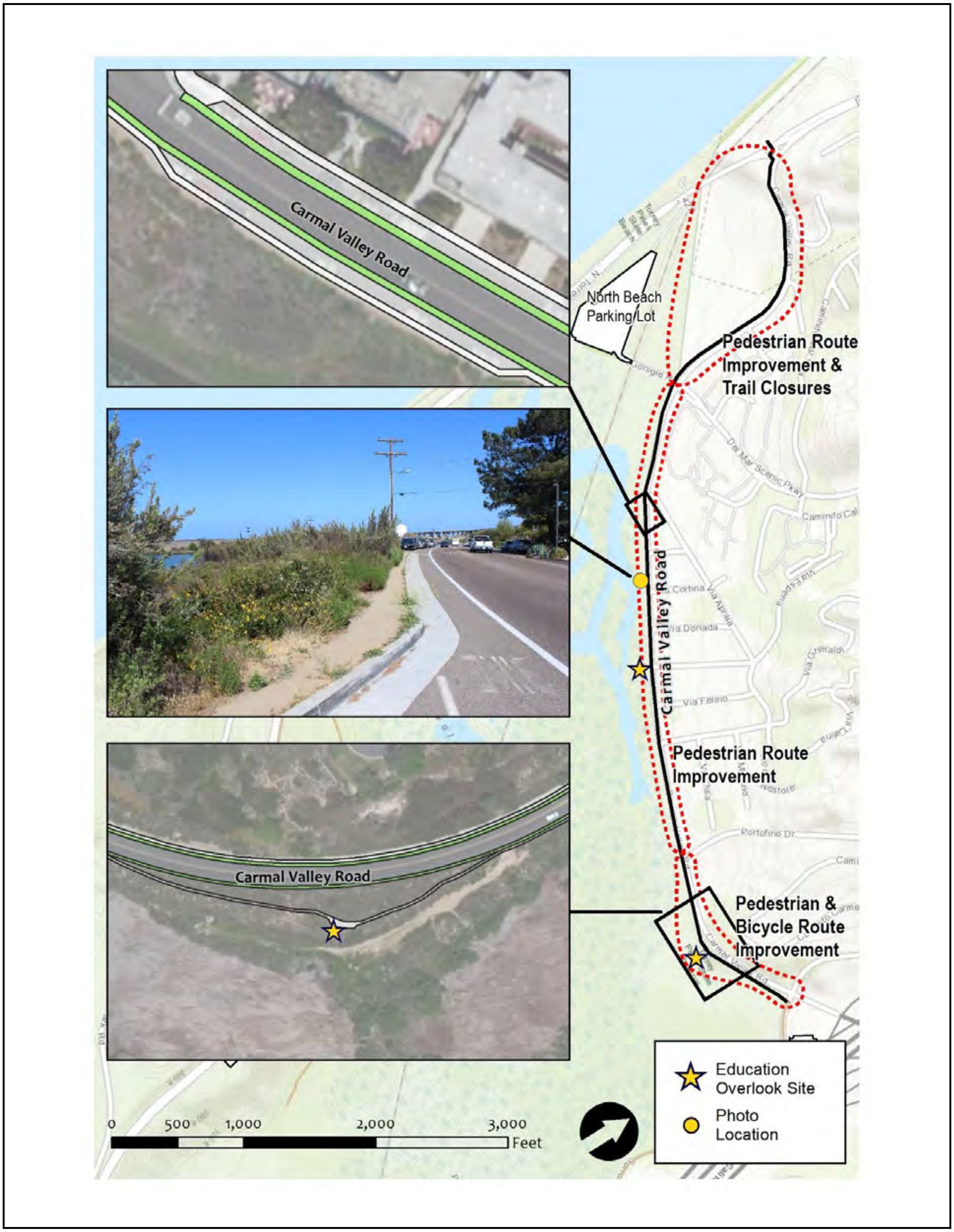


Figure 8-13
Carmel Valley Road Improvements Overview

- Determine, design, and implement short-term improvements (if any) for pedestrian access along Carmel Valley Road and implement them in accordance with TPSNR Trail Management Plan.

Phase 2 (5–25 Years)

- Coordinate efforts for the Design & Feasibility Study for modifications to Carmel Valley Road to avoid potential impacts related to sea level rise so that preferred alternative(s) selected for pedestrian and bicycle improvements (long-term) are included.
- Coordinate efforts to conduct/complete CEQA determination and acquire resource agency permits.
- Construct the preferred alternative(s) and associated improvements.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2, if still feasible.

8.2.5 Sorrento Valley Road Opportunities

Three improvement opportunities have been identified along Sorrento Valley Road, which include both the closed and open portions of this roadway (**Figure 8-14**). Near-term efforts (Phase 1) should focus on improvements to the closed portion since it is a dedicated Multi-Use Path and identified by SANDAG and Caltrans for potential enhancement in coordination with roadway improvements to I-5 and State Route (SR) 56. Improvements to the open portion of Sorrento Valley Road would most likely occur during Phase 2 or Phase 3 as they would probably need to coincide with roadway improvements and potential railway realignment that may result in the relocation of the Sorrento Valley Coaster Station.

Multi-Use Path Improvements

The existing multi-use path between the Caltrans Park & Ride lot in the north the City of San Diego's Pump Station 65 in the south is currently nothing more than a closed asphalt road. Opportunities exist along this section to create one or more educational and interpretive features about TPSNR. The existing pavement is also much wider than required to function as a Class I Multi-Use Path and maintenance access road for most of its length. As such, the segment could be reconfigured to provide a separate soft surface trail that parallels the paved path and provide opportunities to improve existing storm water BMPs, which currently discharge debris and mud onto the existing roadway. The improvements previously recommended by the City of San Diego Task Force for the reuse of the closed portion of Sorrento Valley Road should be considered (**Figure 8-15**). Current efforts to coordinate and collaborate with senior staff from Caltrans and SANDAG should be continued as needed, since these entities have identified the closed portion of Sorrento Valley Road for improvements to be funded through the PWP/TREP for the North Coast Corridor. Comments from the stakeholder workshops have already been submitted to SANDAG for consideration.

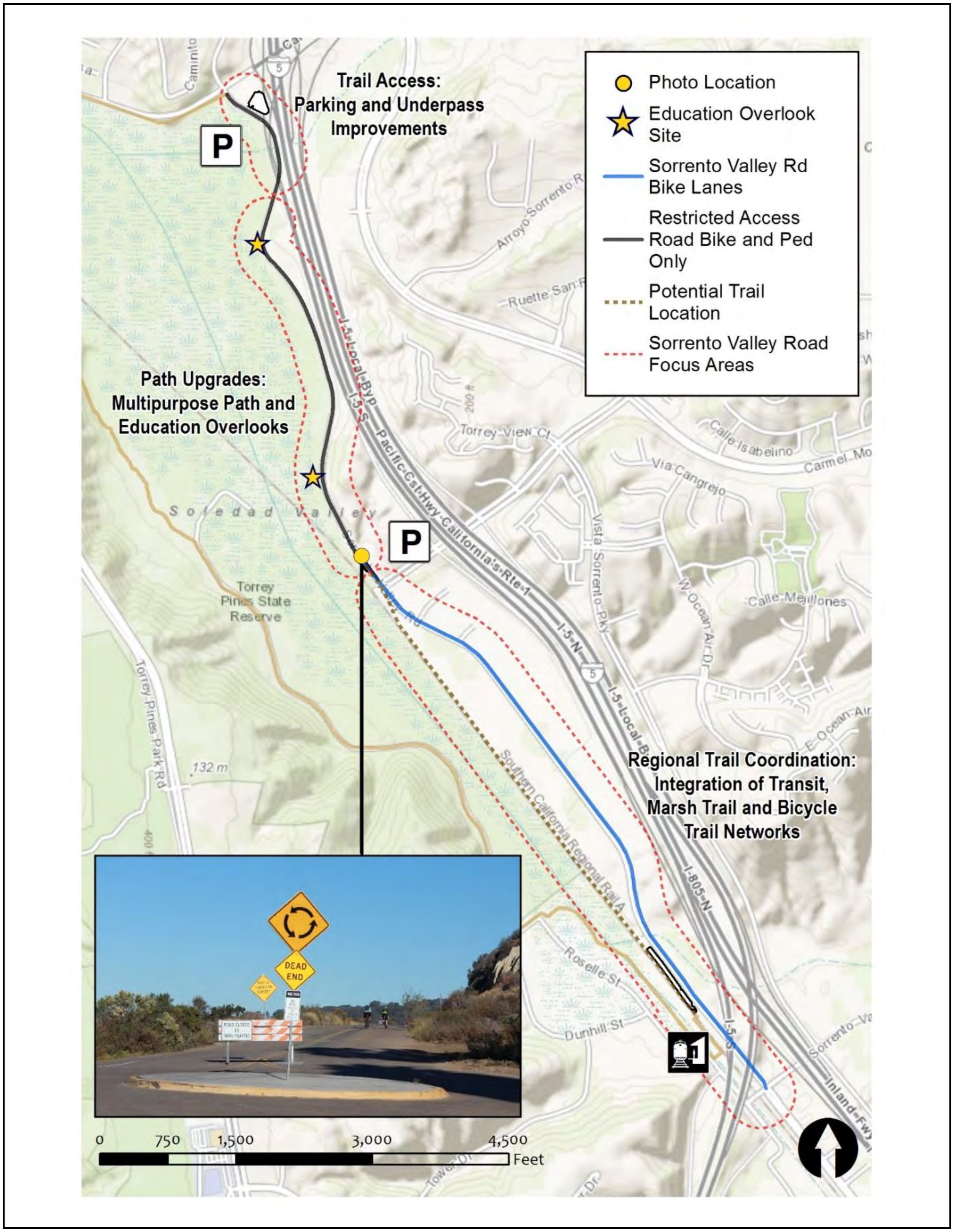


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Figure 8-14
Sorrento Valley Road Segment Overview

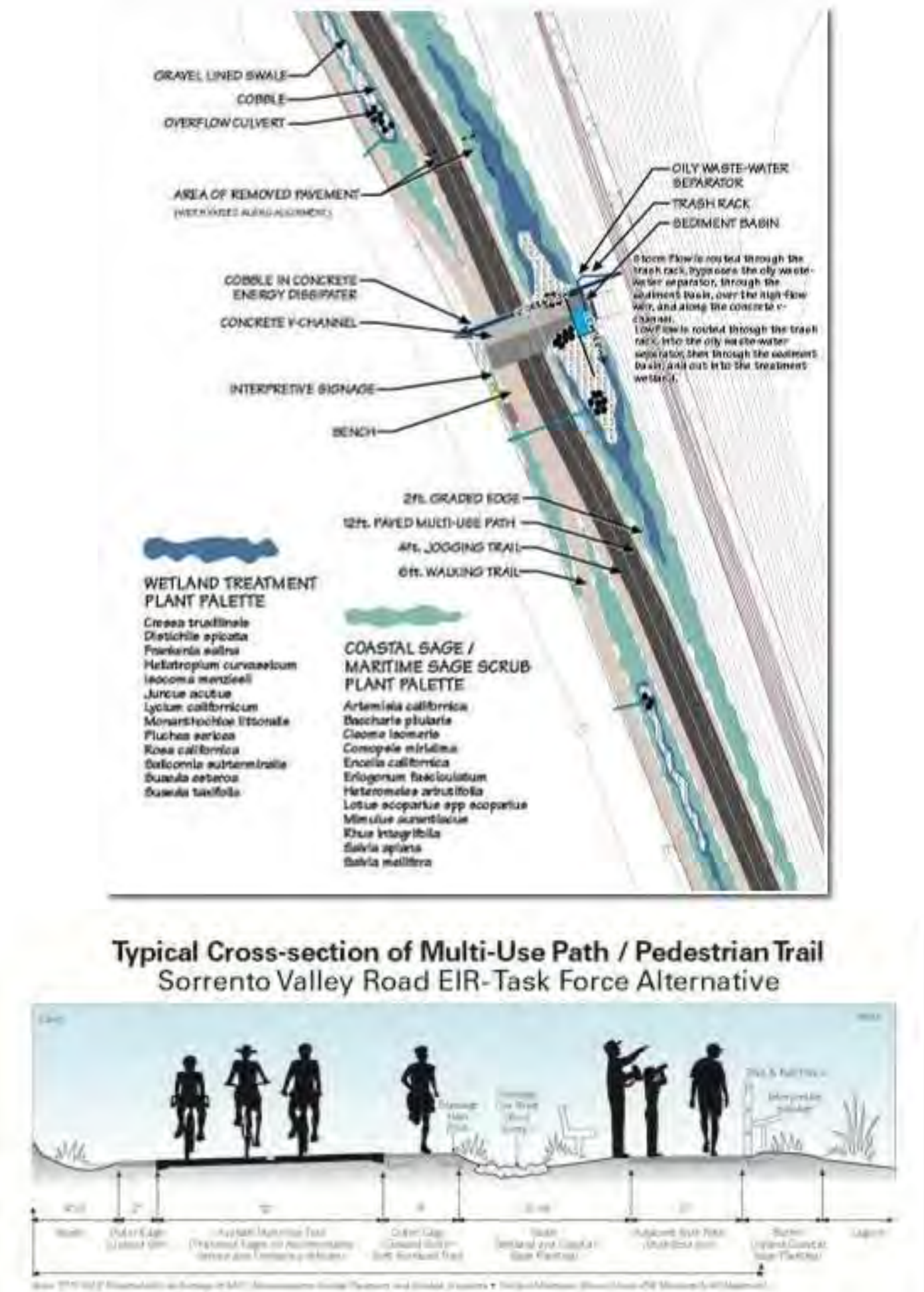


Figure 8-15
Sorrento Valley Road Multi-purpose Path

Connectivity Improvements (Trail Networks and Transportation Hub)

Providing connectivity to the bike path within Carmel Valley Restoration Enhancement Project (CVREP) is a crucial long-term goal for improved public access and regional recreation. This connectivity will require improving a portion of one of the box culverts under I-5 to provide recreational access during dry weather. The connection would need to be closed during storm events for public safety.

Caltrans and SANDAG have identified this area for potential improvements as part of the PWP/TREP for the North Coast Corridor that may include retrofitting the box culverts under I-5 or replacing them with a short bridge span, so efforts should be made to coordinate and collaborate with the appropriate staff. It has not been determined at this point if improvements to Sorrento Valley Road at this location and connectivity to CVREP/Sea to Sea Trail are dependent upon improvements to I-5/SR-56 that include a flyover lane to connect southbound traffic on I-5 to eastbound traffic on SR-56.

Coastal Rail Trail

The Sorrento Valley Road corridor is included as part of the Coastal Rail Trail that SANDAG is moving forward. SANDAG and the North Coast Transit District (NCTD) are also moving forward with improvement plans for the railroad within this area. Improved connectivity between the multi-use trail segment of Sorrento Valley Road and transportation hubs such as the Sorrento Valley Coaster Station would most likely be considered through the context of the Coastal Rail Trail. The goals of the updated Lagoon Enhancement Plan should be integrated into these larger planning efforts as they move forward on their own timelines to see whether additional public access improvements can be integrated into these projects to better reflect the views and needs of both existing and potential trail users.

Phasing – Sorrento Valley Road Improvements

Phase 1 (0–5 Years)

- Consult and coordinate with the City of San Diego and CSP staff to include proposed improvements to the closed portion of Sorrento Valley Road in the updated TPSNR Trail Management Plan and associated City planning documents.
- Consult and coordinate with staff from SANDAG and Caltrans and the City of San Diego's Transportation and Storm Water Department to determine potential timeline for improvements to the closed portion of Sorrento Valley Road and ensure that elements for improving bike and pedestrian use captured during public workshops for the updated Lagoon Enhancement Plan are included.
- Coordinate with staff from SANDAG (Coastal Rail Trail), SCC (California Coast Trail) and Sea to Sea Trail Foundation (Sea to Sea Trail) to include proposed trail and bike improvements from the updated Lagoon Enhancement Plan in their plans for expanding these trail networks while reducing fragmentation.

- Determine, design, and implement short-term improvements for pedestrian access along the closed portion of Sorrento Valley Road and implement them in accordance with TPSNR Trail Management Plan and related City of San Diego planning documents.
  - Examples include replacing gate and chain link fence at northern trailhead and providing informational kiosks at the trailhead and panels at select view corridors.
- Coordinate efforts for the Design & Feasibility Study for modifications to Sorrento Valley Road so that preferred alternative(s) selected for pedestrian and bicycle improvements (long-term) are included.

Phase 2 (5–25 Years)

- Coordinate efforts for the Design & Feasibility Study for modifications to Sorrento Valley Road so that preferred alternative(s) selected for pedestrian and bicycle improvements (long-term) are included (if not completed during Phase 1).
- Coordinate efforts to conduct/complete CEQA determination and acquire resource agency permits.
- Construct preferred alternative(s) and associated improvements.

Phase 3 (25–50 Years)

- Complete improvements not implemented in Phase 2, if still feasible.

CHAPTER 9

Community Health – Vector Habitat Remediation Vector Concepts

Chapter 9 presents Vector Habitat Remediation Concepts (Vector Concepts) developed to improve vector management at Los Peñasquitos Lagoon (Lagoon) and its upland habitats through the reduction of ponded and/or stagnate water that facilitate mosquito breeding within the Lagoon, its floodplain, and adjacent urban areas. Emphasis is given to reducing breeding habitat favored by *Culex tarsalis*, since this freshwater mosquito species has been linked to the transmission of West Nile virus (WNV) and other forms of brain encephalitis to human hosts within San Diego County. Measures considered to support Vector Concepts include:

- Structural improvements to facilitate the reduction of ponded water within storm drain systems, including drainage channels and outfalls located around Los Peñasquitos Lagoon and the lower portions of its watershed. These improvements may include: replacement of damaged culverts; removal of accumulated sediment and debris that occlude conveyance channels and/or outfalls; and stabilization of outfalls to reduce creation of scour ponds
- Channel modification (e.g., deepening of channel segments) to increase hydraulic capacity needed to improve tidal circulation and/or drawdown times of impounded waters
- Channel creation to connect areas of inundation to existing lagoon channels for dewatering purposes

Vector Concepts can be considered as “stand-alone” projects to be implemented in the near-term to protect public health, requiring in most cases a two-step turnkey approach that includes an initial study, design, and permitting (Step 1), followed by an implementation (Step 2). Vector Concepts can also be implemented using a phased approach to generate additional benefits such as improved performance and/or reduced costs. Using freshwater management as a nexus, Vector Concepts can be integrated into the phased restoration of salt marsh habitat within Los Peñasquitos Lagoon. Presented in Chapter 10, the preferred Lagoon Vector Concept (Vector Concept 2 in Chapter 7) aims to dewater areas of brackish water in the eastern portion of the Lagoon through a number of dewatering measures that include channel modifications. These measures will be supported by freshwater reduction efforts planned for the watershed to reduce dry-weather flows, a priority action under the Water Quality Improvement Plan (WQIP). Freshwater sources to Los Peñasquitos Lagoon include surface flows from the creeks, groundwater, and surface flows from storm drains that discharge directly to the Lagoon. Though implementation of channel modification and larger freshwater dewatering and diversion measures are expected to occur in Phase II (5–25 years), design elements that support Vector Concepts may be included to improve the success of reducing breeding habitat for *C. tarsalis* within Zone 3 and Zone 4. For example, creation of additional channels may be included in the final design for the preferred Lagoon Concept to expedite the dewatering of areas of stagnate water within Zone 3 and Zone 4 that have been identified as high priority for vector management by the County of San Diego.

Based on field surveys and review of available data, several Vector Concepts have been developed for potential implementation during Phase 1 and Phase 2 of the updated Lagoon Enhancement Plan.

Vector Concepts proposed for Phase 1 implementation include:

- Vector Concept 1 – Improved Flow through McGonigle Road Culvert (Vector Control Program (VCP) Site 626), Part 1 (Culvert Replacement)
- Vector Concept 2 – Storm Outfall Modification to Reduce Impoundment of Discharged Waters Near VCP Site 626
- Vector Concept 4 – Modification to Storm Drain Outfalls at Tripp Court and Sorrento Valley Road

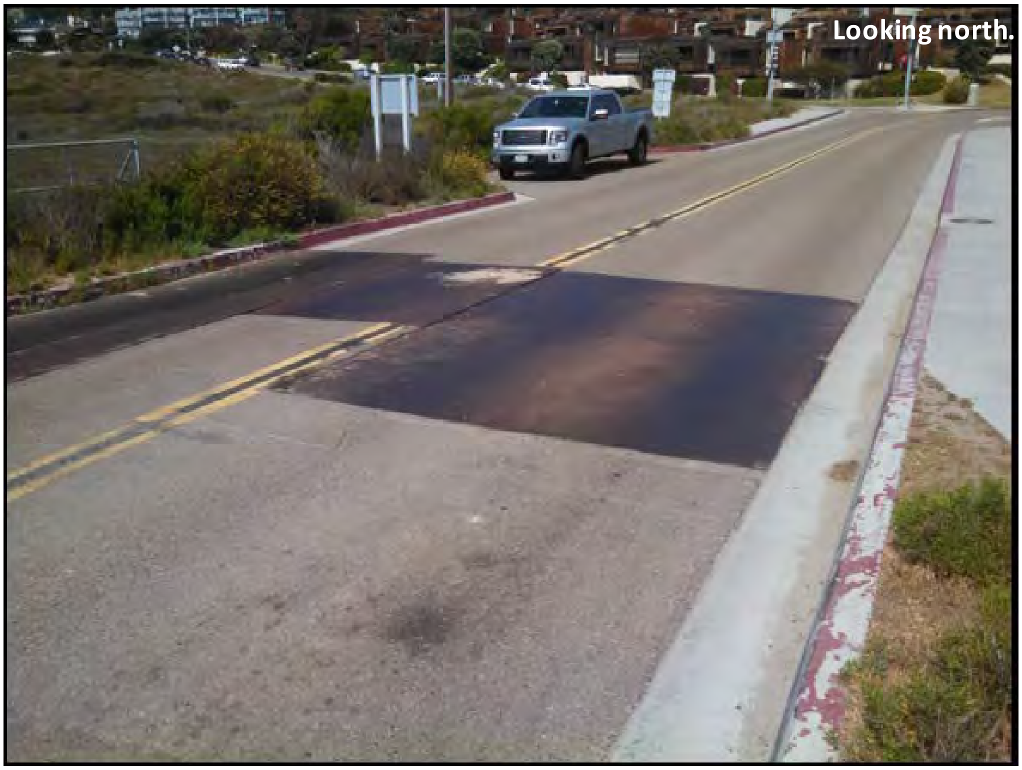
Vector Concepts proposed for Phase 2 include:

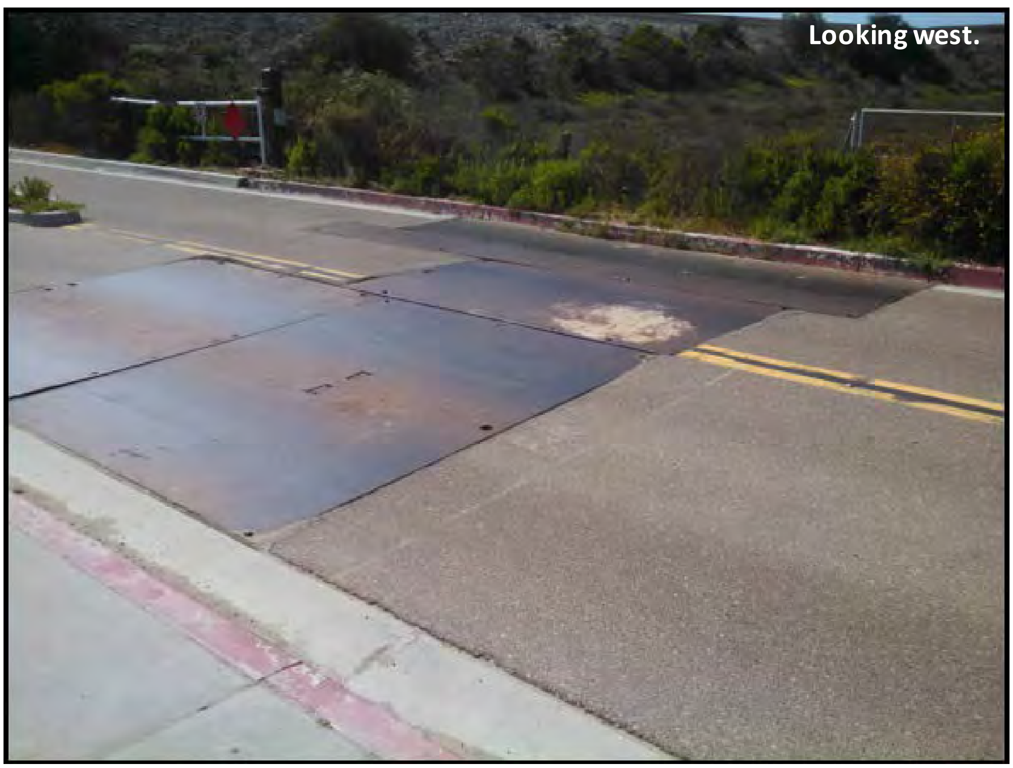
- Vector Concept 1 – Improved Flow through McGonigle Road Culvert (VCP Site 626), Part 2 (Channel improvements if feasible)
- Vector Concept 3 – Dewatering of VCP Site 577

9.1 Vector Concept 1. Improving Flow through McGonigle Road Culvert (Zone 2)

Description of Existing Conditions

During the late 1960s, the North Beach parking lot near Los Peñasquitos Lagoon's inlet was built to provide access to Torrey Pines State Beach. At that time, McGonigle Road was elevated onto an earthen berm and paved to protect this access point from flooding during high tides or storm events. A culvert was installed under the roadway to allow tidal and flood waters to flow along a historic tidal channel that had been previously cut off by the railway berm built in 1925. In 2008 the culvert began to fail at its northern section and by 2012 the failure began to spread eastward along the length of the culvert. By 2014 steel plates were placed across the roadway above the culvert to prevent this section of road from collapsing (see **Figure 9-1**).





Source: Mike Hastings 4/2/15

Figure 9-1
Photos of Steel Plates over Culvert Alignment at McGonigle Road

While the steel plates have preserved vehicular access along McGonigle Road, the culvert has become heavily occluded and is no longer structurally sound. As a result, water no longer drains effectively from the area north of the road after high tides (see **Figure 9-2**) or following flooding events from winter storms. Diminished flow and ponding of water north of McGonigle Road has been documented by monitoring efforts conducted as part of the Los Peñasquitos Lagoon Tidal Enhancement Pilot Study (DEH 13-0006), which placed tidal gauges throughout Los Peñasquitos Lagoon's channel network to measure surface elevations of channel waters in response to tidal cycles and freshwater input. Data collected north of McGonigle Road demonstrates that peak high tides are able to enter the area through the culvert, but low tides are unable to effectively drain in accordance with low-tide surface elevations.

Water impounded north of the McGonigle Road creates an ideal habitat for mosquito breeding, making this location (VCP Site 626) a potential area of concern for the County's Department of Environmental Health (DEH) Vector Habitat Remediation Program (VHRP), especially after summer high tides and winter flood events. Furthermore, this location is adjacent to the community of Torrey Pines that includes both residential homes and local businesses, and serves as the only means of access from Carmel Valley Road to the North Beach parking lot and Torrey Pines State Beach.

Project Description – McGonigle Road Culvert Replacement.

Vector Concept 1 is part one of a two-step turnkey project to combine roadway improvements with vector management and lagoon restoration. Step 1 includes the design and permitting of a roadway improvement at McGonigle Road to reduce the potential for mosquito breeding habitat that has been previously documented by DEH at VCP Site 626. The roadway improvement will consider replacing the damaged culvert with either a new culvert that is more structurally sound or a short bridge span over the tidal channel to allow improved circulation of tidal flows and drawdown times after flood events.

Step 2 of the proposed Vector Concept involves the construction of the roadway/culvert improvement designed and permitted during the initial step along with as-needed modification of the tidal channels that would occur during channel modifications identified for restoration in Phase 2 under the preferred Lagoon Concept. Channel modifications specific to Vector Concept 1 would be evaluated using a hydrodynamic model that would examine the benefits of deepening and/or extending the channels on both sides of the McGonigle Road to improve water movement through the roadway improvement with respect to improved tidal circulation and dewatering of the area after flood events to reduce impoundment of both freshwater and saltwater. Improved circulation and dewatering of impounded storm and tidal flows will reduce favorable mosquito breeding habitat in an area adjacent to local residences, businesses, and park facilities located along Carmel Valley Road.

Source: Mike Hastings 4/2/15

Note: Impounded water should have drained during the low tide that occurred just before this photo was taken

ESA

Figure 9-2

Photos of Headwall at the North End of Culvert Under McGonigle Road

Benefits Generated by the Proposed Project

Vector Concept 1 will provide multiple benefits, including:

- Reduction of potential breeding habitat for mosquitoes through improved tidal connectivity and drawdown times for flood waters.
- Cost reductions associated with less frequent vector management efforts that include hand and aerial application of larvicide.
- Improved protection from vector-borne illness (e.g., WNV) to sensitive receptors that live within the communities of Torrey Pines, Del Mar, and Carmel Valley, frequent local businesses along Carmel Valley Road, or visit the Torrey Pines State Natural Reserve (TPSNR) and Torrey Pines State Beach.
- Reduction in complaints by local community members regarding mosquito populations by treating an area adjacent to the communities of Del Mar and Torrey Pines.
- Preservation and protection of salt marsh habitat.
- Improved wildlife access to the area north of McGonigle Road.

Habitat Management & Consistency with Wetland Design Criteria for Vector Control

Vector Concept 1 is consistent with the County DEH's Wetland Design Guidelines for Vector Control with regard to managing natural wetlands that include Wetland Design, Water Management, and Vegetation Manipulation. The project will contribute to:

- Improving tidal mixing in the lagoon channel bisected by McGonigle Road with emphasis on the segment west of the road.
- Improving drawdown times for storm water that currently gets impounded west of McGonigle Road as a result of the failed culvert following winter storms and flood events.
- Deepening of tidal channels to improve tidal mixing and reduce areas of shallow, ponded water.
- Protecting areas of salt marsh habitat from conversion to freshwater and brackish water habitats north of McGonigle Road that can facilitate mosquito breeding.
- Implementation of mosquito habitat abatement within Los Peñasquitos Lagoon and adjacent to the communities of Del Mar and Torrey Pines.
- Improved effectiveness of vector management through system modification with potential reduction in costs associated with larvicide application in the Lagoon by the County DEH.

Consistency with Current VHRP Projects in Los Peñasquitos Lagoon

Vector Concept 1 is consistent with and complementary to both the Los Peñasquitos Lagoon Pilot Restoration Project (#DEH12-0004) and the Los Peñasquitos Lagoon Tidal Enhancement Study (#DEH13-0006) funded through the VHRP's Competitive Grants. The Los Peñasquitos Lagoon Pilot Restoration Project has identified approaches to restoring Los Peñasquitos Lagoon's natural hydrology to reduce areas of impounded water that lend to favorable breeding habitat for mosquitoes that include *C. tarsalis* while supporting efforts to restore, preserve, and protect the Lagoon's native salt marsh habitat. The Los Peñasquitos Lagoon Tidal Enhancement Study improves monitoring of lagoon environs and the ability to design improvements associated with restoring and enhancing tidal circulation throughout Los Peñasquitos Lagoon. Results from this study have already demonstrated the lack of adequate tidal mixing west of McGonigle Road and will be used to evaluate project success of the designed roadway improvement.

9.2 Vector Concept 2. Storm Outfall Modification to Reduce Impoundment of Discharged Waters Near VCP Site 626 (Zone 2)

Description of Existing Conditions

Several storm drain outfalls discharge directly into Los Peñasquitos Lagoon along Carmel Valley Road. One of the larger storm drain outfalls located between Via Aprilia and McGonigle Road on Carmel Valley Road discharges into a stilling basin that is separated by the tidal channels by a concrete weir, as shown in **Figure 9-3**. Storm discharges enter the stilling basin and do not flow into the tidal channel until they reach the elevation of the weir. Freshwater then remains ponded behind the weir and creates favorable mosquito breeding habitat due to lack of circulation. The outfall is located adjacent to VCP Site 626 and could potentially be linked to improvements associated with Vector Concept 1.

Project Description – Storm Water Outfall Improvement

Vector Concept 2 represents a two-step design/turnkey project that aims at first identifying the most effective approach to modify the existing storm drain outfall near McGonigle Road and Carmel Valley Road in order to significantly reduce favorable mosquito breeding habitat. Step 1 will consist of conducting a focused engineering study to identify and evaluate options to modify the outfall, stilling basin, and concrete weir to allow for greater tidal exchange and to significantly reduce the ponding of freshwater behind the current concrete weir that creates favorable mosquito breeding habitat for *C. tarsalis*. Design alternatives will be coordinated with the City of San Diego to ensure system capacity is maintained for flood management and to minimize long-term maintenance of the storm sewer system, as well as to consider opportunities and constraints to divert storm flows to a different section of the municipal storm water conveyance system. The selected design will address prevention of tidal backflows into the storm drain while maintaining storm flow capacity of the system, improving water quality entering Los Peñasquitos Lagoon, and significantly reducing favorable mosquito breeding habitat. The second step is implementation of modifications to the outfall, stilling basin, and weir per the selected design and permits.

Source: Google Earth, Mike Hastings 4/2/2015

Note: Water ponds behind weir

Figure 9-3
Storm Drain Outfall along Carmel Valley Road, VPR Site 626

Benefits Generated by the Proposed Project

Vector Concept 2 will provide multiple benefits, including:

- Reduction of potential breeding habitat for mosquitoes adjacent to VCP Site 626 through prevention of ponding of freshwater in the stilling basin located between the existing storm drain outfall and concrete weir
- Cost reductions associated with less frequent vector management efforts adjacent to VCP Site 626 that include hand and aerial application of larvicide.
- Improved protection from vector-borne illness (e.g., WNV) to sensitive receptors that live within the communities of Torrey Pines, Carmel Valley, and Del Mar, local businesses along Carmel Valley Road, and visitors to the TPSNR and Torrey Pines State Beach.
- Reduction in complaints by local community members regarding mosquito populations by treating an area along an established bike and pedestrian pathway, as well as adjacent to the communities of Torrey Pines and Del Mar.
- Facilitating the preservation and protection of restored and existing salt marsh habitat while abating the spread of fresh and brackish marsh habitats favored by mosquito species.
- Cost reductions associated with collaboration with California State Parks (CSP), City of San Diego, and the Los Peñasquitos Lagoon Foundation (LPLF) to integrate storm water management, vector management and management of the Lagoon.

Habitat Management & Consistency with Wetland Design Criteria for Vector Control

Vector Concept 2 is consistent with the County DEH Wetland Design Guidelines for Vector Control with regard to managing natural wetlands that include Wetland Design, Water Management, and Vegetation Manipulation. The project will contribute to:

- Improving tidal mixing in the lagoon channel by removing a physical barrier that impounds water below the storm water outfall identified in Vector Concept 2.
- Improving drawdown times for storm water that currently gets impounded below the storm water outfall identified in Vector Concept 2.
- Implementation of mosquito habitat abatement within the Lagoon and adjacent to the communities of Torrey Pines and Del Mar.
- Improved effectiveness of vector management through system modification with potential reduction in costs associated with larvicide application in Los Peñasquitos Lagoon by the County's DEH.

Consistency with Current VHRP Projects in Los Peñasquitos Lagoon

Vector Concept 2 is consistent with and complementary to both the Los Peñasquitos Lagoon Pilot Restoration Project (#DEH12-0004) and the Los Peñasquitos Lagoon Tidal Enhancement Study (#DEH13-0006) funded through the VHRP's Competitive Grants. The Los Peñasquitos Lagoon Pilot Restoration Project has identified approaches to restoring Los Peñasquitos Lagoon's natural hydrology to reduce areas of impounded water that lend to favorable breeding habitat for mosquitoes that include *C. tarsalis* while supporting efforts to restore, preserve, and protect the Lagoon's native salt marsh habitat. The Los Peñasquitos Lagoon Tidal Enhancement Study improves monitoring of lagoon environs and the ability to design improvements associated with restoring and enhancing tidal circulation throughout Los Peñasquitos Lagoon's channel network.

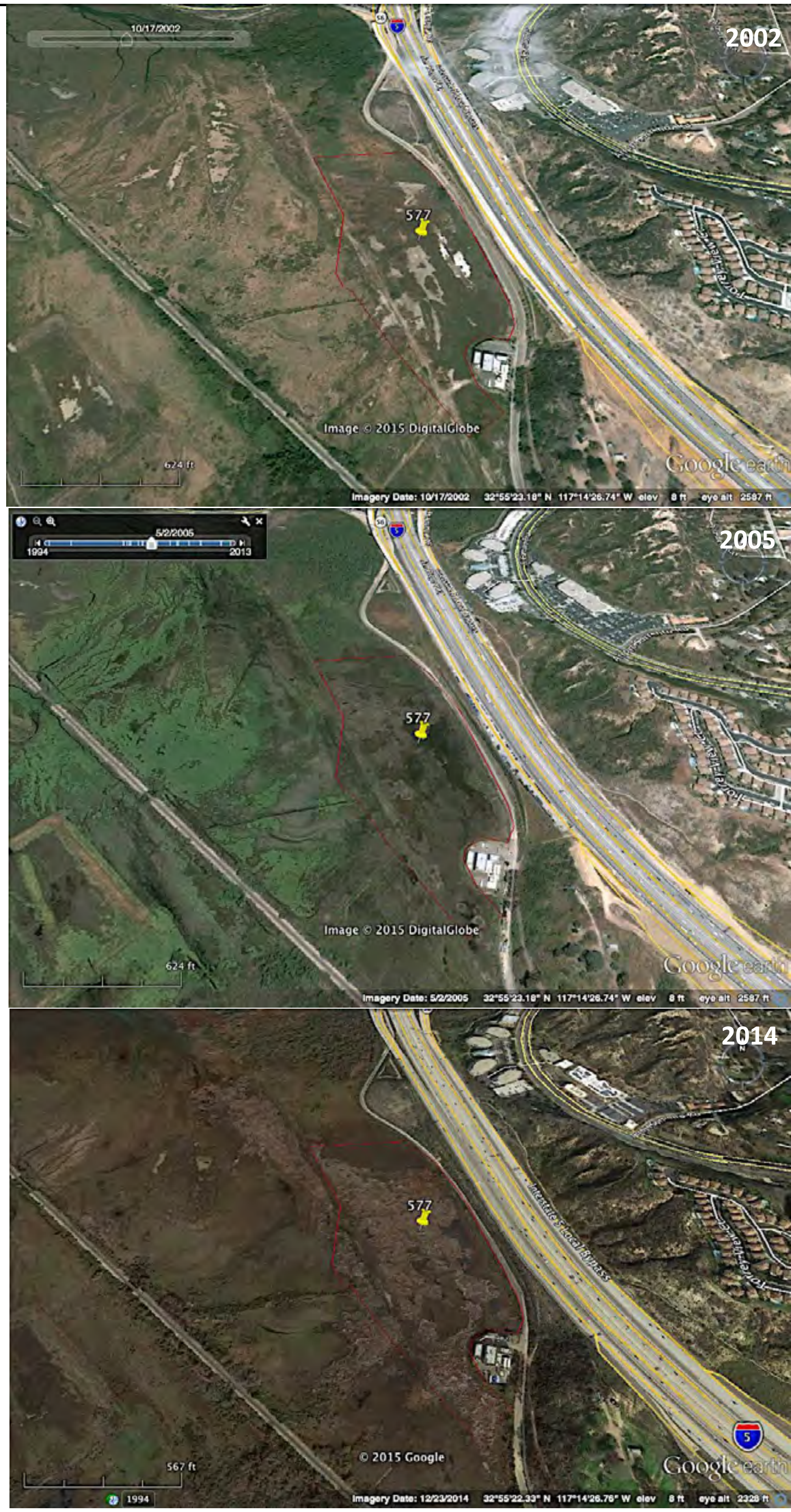
9.3 Vector Concept 3. Dewatering of VCP Site 577

Description of Existing Conditions

Los Peñasquitos Lagoon has experienced rapid habitat conversion as native salt marsh within the eastern portion of the Lagoon has been replaced by brackish and freshwater species. Vegetation transects established in the eastern region of Los Peñasquitos Lagoon in 1987 and used to monitor the health of salt marsh habitat were quickly overrun with cattails (*Typha*) and bulrush (*Schoenoplectus*) as tidal circulation was muted and salt leached out of lagoon soils by year-round flows of freshwater from Carmel Creek. Aside from displacing salt marsh, the newly formed brackish and freshwater habitats within the Lagoon and the lower reaches of Carmel Creek have created ideal breeding habitat for *C. tarsalis*. Tree and plant canopies within this area provide shelter for areas of ponded freshwater preferred by this freshwater mosquito and limit the success of the County of San Diego's attempts to distribute larvicide through aerial and hand application.

Habitat conversion is due primarily to freshwater inputs to Los Peñasquitos Lagoon from surface flows from the its tributaries and dry-weather flows from storm drains that discharge directly into the Lagoon. Groundwater contributions to dry-weather water flows into Los Peñasquitos Lagoon are also believed to contribute to habitat conversion in the Lagoon. While evidence of groundwater inputs has been observed near Pump Station 65 and in areas of Sorrento Valley adjacent to I-5 improvements (e.g., retaining wall along the southbound bypass), their contributions have not been quantified. Anecdotal evidence dating back to 2000 indicates that increased irrigation in the watershed has likely raised groundwater levels and increased seepage to the creeks and directly into Los Peñasquitos Lagoon at the base of the watershed. The increase in freshwater inputs from Carmel Creek is most likely attributed to the recent build out of the western reaches of this sub-watershed just before the turn of the century. Groundwater discharges from seepage pipes that dewater retaining wall structures along merge between Interstate 5 (I-5) and Interstate 805 (I-805) have also been observed and are addressed in Tripp Court outfall project discussed later in this chapter.

One of the most profound examples of habitat conversion within Los Peñasquitos Lagoon has occurred along the length of Old Sorrento Valley Road in the area identified by the County's DEH VHRP as VCP Site 577. Located north of Pump Station 65, the Lagoon's historic salt pannes and (historic and restored) salt marsh habitat have rapidly converted to fresh and brackish marsh habitats with areas of open water and perennial inundation. **Figure 9-4** show this dramatic and recent shift in habitat type from 2002 to 2014 and **Figure 9-5** shows areas of open water at VCP Site 577 surrounded by areas of cattails. The bottom photo in **Figure 9-5** was taken just north of VCP Site 577 in an area currently vegetated by cattails (*Typha*) and alkali heath (*Frankenia salina*), a salt marsh plant species that is tolerant of freshwater.



Source: Google Earth, LPLF

Note: VCP Site 577 shows salt pannes (white areas) and mudflats (brown areas) surrounded by salt marsh in 2002. By 2005, this habitat had begun toconvert to freshwater and brackish vegetation and open water. As of 2014, the areas is now dominated by Typha (Cattails) and open water.

Figure 9-4
VCP Site 577 (delineated in red)

Source: Mike Hastings 4/2/2015

Figure 9-5
Photos of Ponding at VCP Site 577

This area is almost completely inundated by brackish water and will most likely convert to being entirely cattails. It is believed that both surface and subsurface flows of freshwater from Carmel Valley are the primary sources of freshwater inputs to VCP Site 577 and surrounding areas due to elevation changes that direct flows southerly along Old Sorrento Valley Road instead of westward toward Los Peñasquitos Lagoon's channels. The retaining wall constructed as part of I-5 and I-805 improvements is believed to contribute to the role that groundwater plays in this area.

Project Description – Dewatering VCP Site 577

Vector Concept 3 represents the first step of a two-step project that aims at exploring the best method to dewater the area along Old Sorrento Valley Road that is currently identified by the County DEH VHRP as a priority area for managing mosquito breeding within Los Peñasquitos Lagoon (VCP 577). Step 1 will consist of investigating the source and characteristics of freshwater inputs that have converted this area of historic salt marsh into an area of perennial inundation that consists of open water areas and thick stands of emerging and established cattails. Results from this freshwater investigation will be used to inform the development of design alternatives to dewater this area in order to promote reduction of breeding habitat for *C. tarsalis* and facilitate restoration of salt marsh habitat while maintaining aesthetic value associated with open water areas that appeal to the public (e.g., duck ponds). Design alternatives generated for Vector Concept 3 under Step 1 will then be integrated into the Design and Feasibility Study for the preferred Lagoon Concept to be conducted for large-scale salt marsh restoration within Zone 3 of the Lagoon that will examine potential channel modifications and minor grading to establish hydrologic conditions that lend to both vector management and sustained salt marsh habitat restoration.

Benefits Generated by the Proposed Project

Vector Concept 3 will provide multiple benefits that include:

- Reduction of potential breeding habitat for mosquitoes at VCP Site 577 by dewatering areas inundated from dry-weather flows and flood waters during winter storm events.
- Cost reductions associated with less frequent vector management efforts at VCP Site 577 that include hand and aerial application of larvicide.
- Improved protection from vector-borne illness (e.g., WNV) to sensitive receptors that live within the communities of Del Mar, Torrey Pines, and Carmel Valley, people at local businesses along Carmel Valley Road and within Sorrento Valley, and visitors to the TPSNR and Torrey Pines State Beach.
- Reduction in complaints from local community members regarding mosquito populations by treating an area along an established bike and pedestrian pathway, as well as adjacent to the communities of Torrey Pines and Carmel Valley and commercial areas of Sorrento Valley.
- Facilitating the preservation and protection of restored and existing salt marsh habitat while abating the spread of fresh and brackish marsh habitats favored by mosquito species.
- Cost reductions associated with collaboration with CSP, City of San Diego, and LPLF.

Habitat Management & Consistency with Wetland Design Criteria for Vector Control

Vector Concept 3 is consistent with the County Department of Environmental Health's Wetland Design Guidelines for Vector Control with regard to managing natural wetlands that include Wetland Design, Water Management and Vegetation Manipulation. The project will contribute to:

- Facilitating future reductions of dry-weather inputs of water to VCP Site 577 from Carmel Valley to improve public health and safety with regard to reducing vulnerability to mosquitoes-borne encephalitis that includes WNV through source identification and characterization.
- Approaches to restore and protect salt marsh habitat in areas converted to freshwater and brackish water habitats that facilitate mosquito breeding in the eastern portion of Los Peñasquitos Lagoon.
- Eliminating areas of standing freshwater within the project area surrounding VCP Site 577 while preserving areas of historic and restored salt marsh and public value (e.g., duck ponds) in compliance with VHRP's guidelines for vector management.
- Improved effectiveness and potential reduction in costs associated with larvicide application in Los Peñasquitos Lagoon by the County DEH.
- Success of efforts to restore and protect 84 acres of additional salt marsh within the Lagoon in areas currently dominated by fresh and brackish marsh species.

Consistency with Current VHRP Projects in Los Peñasquitos Lagoon

Vector Concept 3 is consistent with and complementary to both the Los Peñasquitos Lagoon Pilot Restoration Project (#DEH12-0004) and the Los Peñasquitos Lagoon Tidal Enhancement Study (#DEH13-0006) funded through the VHRP's Competitive Grants. The Los Peñasquitos Lagoon Pilot Restoration Project has identified approaches to restoring the Lagoon's natural hydrology to reduce areas of impounded water that lend to favorable breeding habitat for mosquitoes that include *C. tarsalis* while supporting efforts to restore, preserve, and protect Los Peñasquitos Lagoon's native salt marsh habitat. Large-scale restoration of salt marsh habitat is currently being planned for areas just west of VCP Site 577, making Vector Concept 3 viable for integration into this effort by extending existing channels to the restoration site or constructing new ones where feasible. The Los Peñasquitos Lagoon Tidal Enhancement Study improves monitoring of lagoon environs and the ability to design improvements associated with restoring and enhancing tidal circulation throughout the Lagoon that include VCP Site 577.

9.4 Vector Concept 4. Modification to Storm Drain Outfalls at Tripp Court and Sorrento Valley Road (Zone 4)

Description of Existing Conditions

Several storm drain outfalls discharge directly into Los Peñasquitos Lagoon along the railroad right-of-way from industrial and commercial areas along Sorrento Valley Road. One of the larger storm drain outfalls that drains to the lagoon is identified as the Tripp Court drain as shown in **Figure 9-6**. The storm drain outfall collects storm water from areas along Sorrento Valley Road, I-5, and drainage areas to the east of I-5. Portions of the storm drain system that drains to this outfall are open channels and also receive groundwater seepage flows from the retaining wall along I-5. Sediment has built up at the outfall location, which is below grade and intercepts an open drainage channel that runs parallel to the railroad along edge of the right-of-way adjacent to Los Peñasquitos Lagoon. The outfall is an approximate 10-foot by 12-foot stilling basin that is filled with ponded freshwater. The stilling basin connects with the open drainage channel, but is deeper than the channel and does not drain fully or allow for circulation and positive drainage, which creates favorable mosquito breeding habitat. In addition, because the storm drain outfalls are blocked by sediment, the two 57-inch-diameter reinforced concrete storm culverts do not drain effectively, resulting in the backup of both dry-weather and storm flows upstream of the outfalls. Standing water is observed in the open channel sections of the storm drain system on the east side of Sorrento Valley Road, as shown in **Figure 9-6**, as a result of this blockage at the outfalls. This ponded water creates favorable mosquito breeding habitat, impacts water quality, and adds to the freshwater inputs to Los Peñasquitos Lagoon.

Project Description – Modification to Storm Drain Outfalls at Tripp Court and Sorrento Valley Road

Vector Concept 4 represents a two-step design/turnkey project that includes working with the City of San Diego's Transportation & Storm Water Department to develop a storm drain outfall and channel maintenance plan and permit applications for the removal of the sediment at the outfall and within the culvert and channel associated with the Tripp Court Outfall. Because of the location of the outfall within the Lagoon, the LPLF and CSP will also coordinate on this project to develop a plan that provides a cost-effective approach to sediment removal and considers long-term maintenance to keep this outfall open while minimizing impacts to sensitive habitats and species of concern. Access to this outfall is currently available along the railway right-of-way or through the Lagoon's riparian corridor. Access through Los Peñasquitos Lagoon would need to be coordinated, most likely, with habitat restoration efforts to be implemented either through the City of San Diego's channel maintenance program for Sorrento Valley, set to occur in Phase 1 of the updated Lagoon Enhancement Plan, or through Phase 2 implementation of large-scale restoration of salt marsh habitat, planned to occur downstream of the project area of Vector Concept 4.

Location of Tripp Court Storm Drain Outfall

Storm drain channel that drains to Tripp Ct. Outfall. The channel receives continual groundwater seepage from retaining wall along I-5.

Storm drain channel that drains to Tripp Ct. Outfall. The blocked outfall creates standing water in the channel.

Source: Google Earth, Mike Hastings 4/2/2015

ESA

Figure 9-6
Storm Drain Channel Draining to Tripp Ct. Outfall

The removal of the sediment buildup at the outfall at Trip Court and within the culvert and channel addresses the existing conditions to generate immediate improvements to hydrologic capacity. However, for long-term benefits to be generated, additional measures are needed to address the sources of sediment and dry-weather flows that results in ponding within the storm sewer system that in turn provides vector breeding opportunities and downstream impacts to the Lagoon. Therefore, Vector Concept 4 considers potential design elements that include collecting and diverting groundwater from the retaining wall drainage system to landscaped areas along Sorrento Valley Road or other beneficial uses. Sources of freshwater along the drainage ditch that runs along the railroad right-of-way will also be investigated, and measures will be developed to reduce or eliminate these flows and will be included in the freshwater management measures that will be undertaken as part of large-scale restoration to be implemented in Phase 2 for the preferred Lagoon Concept. Other design elements for consideration under Vector Concept 4 include measures to address sediment loading that has built up and blocked the outfall that may include a sediment removal and storm water treatment system that will be installed upstream of the outfall. This system will most likely include a trash-separation device to address potential blockages caused by litter and minor debris and then will undergo a clean-out of existing trash and sediment as part the maintenance plan. In addition, improvements to the Tripp Court outfall will consider improved connectivity to the concrete channel that runs adjacent to the basin to improve drainage and significantly reduce the ponding of water and the favorable mosquito breeding habitat.

Benefits Generated by the Proposed Project

Vector Concept 4 will provide multiple benefits that include:

- Reduction of potential breeding habitat for mosquitoes at the Tripp Court outfall, open sections of the storm drain, and along the open drainage ditch that runs along the railroad right-of-way and into the upper portions of Los Peñasquitos Lagoon through both maintenance and source control measures.
- Cost reductions associated with less frequent vector management efforts that include hand and aerial application of larvicide.
- Improved protection from vector-borne illness (e.g., WNV) to sensitive receptors that live within the communities of Del Mar, Torrey Pines and Carmel Valley, as well as local businesses along Sorrento Valley Road.
- Facilitating the preservation and protection of restored and existing salt marsh habitat while abating the spread of fresh and brackish marsh habitats favored by mosquito species.
- Cost reductions associated with collaboration with CSP, City of San Diego and the LPLF.

Habitat Management & Consistency with Wetland Design Criteria for Vector Control

Vector Concept 4 is consistent with the County DEH's Wetland Design Guidelines for Vector Control with regard to managing natural wetlands that include Wetland Design, Water Management, and Vegetation Manipulation. The project will contribute to:

- Facilitating future reductions of dry-weather inputs to Los Peñasquitos Lagoon and its upland areas to improve public health and safety with regard to reducing vulnerability to mosquito-borne encephalitis that includes WNV through source identification and characterization.

- Integrating approaches to restore and protect salt marsh habitat with vector management by reducing conditions that facilitate mosquito breeding and habitat conversion in the eastern portion of Los Peñasquitos Lagoon.
- Eliminating areas of standing freshwater in compliance with VHRP's guidelines for vector management.
- Improved effectiveness and potential reduction in costs associated with larvicide application in the Lagoon by the County DEH.

Consistency with Current VHRP Projects in Los Peñasquitos Lagoon

The Project is consistent with and complementary to both the Los Peñasquitos Lagoon Pilot Restoration Project (#DEH12-0004) and the Los Peñasquitos Lagoon Tidal Enhancement Study (#DEH13-0006) funded through the VHRP's Competitive Grants. The Los Peñasquitos Lagoon Pilot Restoration Project has identified approaches to restoring the Lagoon's natural hydrology to reduce areas of impounded water that lend to favorable breeding habitat for mosquitoes that include *C. tarsalis* while supporting efforts to restore, preserve, and protect Los Peñasquitos Lagoon's native salt marsh habitat. The Los Peñasquitos Lagoon Tidal Enhancement Study improves monitoring of the lagoon environs and the ability to design improvements associated with restoring and enhancing tidal circulation throughout Los Peñasquitos Lagoon.

CHAPTER 10

Evaluation, Ranking, and Selection of Improvement Concepts for Los Peñasquitos Lagoon

Chapter 10 provides an evaluation and assessment of improvement concepts developed during the Los Peñasquitos Lagoon Enhancement Plan (Lagoon Enhancement Plan) update. The chapter begins with a description of the assessment criteria used to evaluate these concepts based on the goals and objectives refined during the stakeholder process discussed in Chapter 6. Chapter 10 then explores how concept assessment criteria were applied in conjunction with performance metrics to support assessment, selection, and ranking of Lagoon Restoration and Enhancement Concepts (Chapter 7); Public Access, Safety, and Education Concepts (Chapter 8); and Vector Habitat Remediation Concepts (Chapter 9). Preferred alternatives are also presented for each concept category and briefly discussed.

10.1 Assessment Criteria and Performance Metrics

Assessment criteria were developed to facilitate the evaluation of improvement concepts presented in Chapter 7 through Chapter 9 using the goals and objectives identified for the Lagoon Enhancement Plan update and refined through the stakeholder workshop process. Presented in Chapter 6, this process involved categorizing goals and objectives according to the three primary groups:

- Habitat
- Public Access, Safety & Education/Cultural Resources
- Sustainability.

10.1.1 Habitat Goals

Goal 1. Protect, preserve, restore and enhance habitats and species native to Los Peñasquitos Lagoon (the Lagoon) and its watershed.

Goal 2. Improve and maintain hydrologic and geomorphologic processes that support lagoon health, resiliency and functionality as a coastal salt marsh.

Goal 3. Ensure that water quality in the Lagoon and its tributaries supports natural resources, habitats and species native to Los Peñasquitos Lagoon and its watershed.

Goal 5. Identify opportunities and constraints within the timeframe of the updated Lagoon Enhancement Plan using established global climate change projections.

Goal 9. Protect and promote the regional value of Los Peñasquitos Lagoon and watershed.

Goal 13. Remove, relocate or modify existing infrastructure located along or within the Lagoon to reduce or eliminate both direct and indirect impacts to lagoon resources and processes.

10.1.2 Public Access, Safety & Education/Cultural Resources Goals

Goal 4. Consider public health when implementing the updated plan.

Goal 6. Provide public education and outreach efforts, as well as improved coastal stewardship of lagoon and watershed resources.

Goal 7. Manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of California State Parks (CSP).

Goal 10. Protect biological, cultural and paleontological resources found within Los Peñasquitos Lagoon and its uplands.

Goal 13. Remove, relocate or modify existing infrastructure located along or within the Lagoon to reduce or eliminate both direct and indirect impacts to lagoon resources and processes.

10.1.3 Sustainability Goals

Goal 5. Identify opportunities and constraints within the timeframe of the Lagoon Enhancement Plan using established global climate change projections.

Goal 8. Identify potential funding sources for lagoon restoration, enhancement and long-term maintenance. Consider approaches that minimize long-term maintenance costs.

Goal 9. Protect and promote the regional value of Los Peñasquitos Lagoon and watershed.

Goal 11. Strengthen the Los Peñasquitos Lagoon Foundation's capacity as a management entity and steward of coastal resources.

Goal 12. Achieve a sustainable restoration project using the triple-bottom line approach that includes environmental, social/community and economic goals.

Goal 13. Remove, relocate or modify existing infrastructure located along or within the Lagoon to reduce or eliminate both direct and indirect impacts to lagoon resources and processes.

Performance metrics where then developed to support assessment, selection, and ranking of Lagoon Restoration and Enhancement Concepts (Chapter 7); Public Access, Safety, and Education Concepts (Chapter 8); and Vector Habitat Remediation Concepts (Chapter 9). These metrics provide quantitative and qualitative measures to assess how each concept supported the final set of goals for the updated Lagoon Enhancement Plan and, in some cases, its ability to be implemented successfully. Assessment criteria and performance metrics are presented in the subsequent sections within the context of the concept categories.

10.2 Evaluation of Lagoon Restoration and Enhancement Concepts

The following section presents an evaluation of the Lagoon Restoration and Enhancement Concepts (Lagoon Concepts) presented in Chapter 7, using assessment criteria and performance metrics. The assessment criteria are discussed in Section 10.2.1 and presented in **Table 10-1** to show how they correspond to and support the final set of goals developed for the updated Lagoon Enhancement Plan. Performance metrics are then provided alongside related assessment criteria to facilitate the evaluation of the Lagoon Concepts and to provide measures of success moving forward with implementation (see **Table 10-2**). Finally, Lagoon Concepts developed for large-scale recovery and preservation of salt marsh in Zone 3 are evaluated against the assessment criteria and performance metrics to provide a ranking used to select the preferred Lagoon Concept to be further developed through a Design & Feasibility Study (see **Table 10-3**).

10.2.1 Assessment Criteria and Performance Metrics

The following section provides a brief description of the assessment criteria and performance metrics used to facilitate evaluation of the Lagoon Concepts developed during the Lagoon Enhancement Plan update. Assessment criteria were established to ensure that the refined goals and objectives of the updated Lagoon Enhancement Plan were considered during the evaluation of the concepts. **Table 10-1** provides a quick reference with regard to each of the assessment criteria and the goals they support followed by an explanation of assessment criteria.

Table 10-2 presents assessment criteria and performance metrics, and the goals addressed by each in tabular form. Please note that goals related to public access and education improvements are addressed in Section 10.3, which presents the assessment criteria developed for Public Access Concepts previously discussed in Chapter 8. Concepts that specifically address goals related to community health are addressed in Section 10.4, which presents the assessment criteria developed for the Vector Concepts.

TABLE 10-1
ASSESSMENT CRITERIA AND PERFORMANCE METRICS TO EVALUATE LAGOON CONCEPTS

Assessment Criteria	Metrics for Concept Evaluation	Metrics for Concept Performance (Implementation)	Goals Addressed
1. Salt Marsh Restoration (Zone 3) – A) Does the concept achieve 84 acres of salt marsh restoration per the TMDL? B) Does the concept maximize salt marsh restoration and resiliency?	**Acres of high salt marsh established** – measured by habitat projection modeling, which accounts for watershed inputs and sea level rise.	**Acres of high salt marsh established** – measured based on vegetation survey. May or may not be tidally inundated in short-term.	1, 2, 3, 5, 9
2. Expansion of Brackish Marsh (Zone 3) – Does the concept abate or prevent conversion of the historical salt marsh to brackish habitat?	**Areas of fresh and brackish water inundation reduced** – measured by habitat projection modeling.	**Area and depth of fresh and brackish water inundation reduced** – measured by depth of water in piezometers, salinity readings, and/or vegetation surveys.	1, 2, 3
3. Inlet Maintenance (Zone 1) – Does the concept have the potential to reduce inlet maintenance needs?	**Improved tidal exchange and reduced sediment built-up** – measured by inlet modeling.	**Improved tidal exchange and reduced sediment build-up** – based on decreased frequency of inlet maintenance, decreasing trends in cubic yardage removal required to reestablish and maintain tidal connectivity, and tide gage monitoring within lagoon channels.	1, 2, 3, 5, 9, 11
4. Protection and Enhancement of Existing Salt Marsh (Zone 2) – Does the concept address protection and enhancement of salt marsh in Zone 2?	**Acres of salt marsh protected/enhanced in Zone 2** – measured by restoration design.	**Acres of salt marsh protected/enhanced** – measured by vegetation surveys along established transects and vegetation association surveys.	1, 2, 3, 4, 5
5. Enhancement of Riparian Areas (Zone 4) – Does the concept address enhancement of riparian habitat in Zone 4?	**Acres of degraded riparian habitat enhanced** – measured by acres designated for habitat enhancement in design.	**Acres of degraded riparian habitat enhanced** – measured by vegetation surveys along established transects and vegetation association surveys.	1, 3, 5
6. Public Safety and Health – Does the concept reduce the risk of West Nile virus cases through the reduction of breeding habitat favorable to *Culex tarsalis*?	**Area of fresh and brackish water ponding reduced** – measured by habitat projection modeling and estimated improvement in circulation.	**Area of fresh and brackish water ponding reduced** – measured by site assessments and aerial imagery supported by depth of water in piezometers and salinity readings.	4
7. Impacts to Sensitive Species and Habitat – Does the concept generate impacts to sensitive species and habitat during implementation?	**Severity of Impacts to Sensitive Species and Habitat** – compared to other concepts.	**Significant Impact to Sensitive Species and Habitat** – Construction and post-construction monitoring.	10
8. Long-Term Adaptability and Sustainability – Does the concept create important transitional habitat to adapt to sea level rise?	**Acres of transitional zone established** – measured by habitat projection modeling.	**Acres of transitional zone established** – measured by vegetation surveys along established transects and vegetation association surveys.	1, 2, 5, 9

Assessment Criteria	Metrics for Concept Evaluation	Metrics for Concept Performance (Implementation)	Goals Addressed
9. Cost Effectiveness – Does the concept achieve restoration in a cost-effective manner?	**Cost per acre** – measured by engineering analysis**.**	**Cost per acre** – actual.	8
10. Long-Term Maintenance – Does the concept minimize long term operations and maintenance (O&M)?	**Annual cost of O&M** – compared to other concepts.	**Annual cost of O&M** – actual.	8, 12
11. Contribution to Climate Change – Does the concept provide net gains or loss to climate changing gas release into the atmosphere?	**Emissions during implementation** – estimated volume of emissions based on number of heavy equipment pieces needed during implementation. **Sequestration rates –** estimated salt marsh acreage established by 2050.	**Emissions during implementation** – estimated rates of emissions for heavy equipment actually used during implementation. **Sequestration rates** – sequestration rates estimated using the Air Resources Board's revised formula and guidance measures for wetland habitats.	12
12. Multiple Benefits to Identify Funding Sources – Does the concept provide multi-benefits that could induce funding?	**Multi-benefits** – measured by average of other metrics**.**	**Multi-benefits** – measured by average of other metrics.	8, 12

TABLE 10-2
GOALS ADDRESSED BY ASSESSMENT CRITERIA

Assessment Criteria	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12
1. Salt Marsh Restoration (Zone 3)	✓	✓	✓		✓				✓			
2. Expansion of Brackish Marsh (Zone 3)	✓	✓	✓									
3. Inlet Maintenance (Zone 1)	✓	✓	✓		✓				✓		✓	
4. Protection and Enhancement of Salt Marsh (Zone 2)	✓	✓	✓	✓	✓							
5. Enhancement of Riparian Areas (Zone 4)	✓		✓		✓							
6. Public Safety and Health due to West Nile virus				✓								
7. Impacts to Sensitive Species and Habitat										✓		
8. Long-Term Adaptability and Sustainability	✓	✓			✓				✓			
9. Cost Effectiveness								✓				
10. Long-Term Maintenance								✓				
11. Contribution to Climate Change												✓
12. Multiple Benefits to Identify Funding Sources								✓				

Salt Marsh Restoration (Zone 3)

As presented in Chapter 7, Lagoon Concepts will be implemented and maintained using a phased approach over a 25-year timeline that concludes in 2035. While it is expected that some form of maintenance and management will continue beyond this timeframe, 25 years was selected to correspond with the compliance target date set for salt marsh restoration under the Lagoon's Sediment Total Maximum Daily Load (Lagoon Sediment TMDL). Having an extended time period allows for adaptive management (e.g. providing opportunity for a pilot restoration) and time to assess the real effects of climate change. The additional time also allows for the design and implementation of watershed improvements needed to support long-term success of salt marsh recovery in Los Peñasquitos Lagoon through efforts that include the reduction of freshwater inputs during dry weather and sediment loading after storm events. As shown in **Table 10-1**, Salt Marsh Restoration includes: A) "progression towards" restoration of 84 acres of historical salt marsh and B) the ability of the Lagoon Concept to maximize salt marsh recovery in a manner that is resilient to climate change and urban stressors. Inclusion of these sub-criteria allows the success measures to be applied to achieving the Lagoon Sediment TMDL Lagoon Compliance Target as a milestone and not, necessarily, the final goal for salt marsh recovery in Los Peñasquitos Lagoon. Rather than using a hard target of 84 acres for Lagoon Sediment TMDL compliance, "progression toward" 84 acres has been accepted as a more realistic target due to the complexities inherent in large-scale salt marsh recovery.

Performance Metrics

Performance metrics established for Salt Marsh Restoration are based on acres of salt marsh recovered within the Lagoon and sustained through the long-term. Lagoon Concepts are evaluated based on the results from the HEM model (Chapter 7). Metrics for concept performance after implementation will rely on surveys of existing vegetation types along established transects within the project area and in adjacent "control" areas. Performance will also be measured during vegetation association surveys conducted within Los Peñasquitos Lagoon that are expected to occur every 5-years or earlier as needed.

Expansion of Brackish Marsh (Zone 3)

Preventing the expansion of brackish marsh in Los Peñasquitos Lagoon will be necessary for both initial success and sustaining recovered salt marsh acreage in Zone 3 through the long-term. Managing dry weather flows of freshwater that enter the Lagoon from daily discharges by its three tributaries will be required to some extent. Using results from the HEM, each Lagoon Concept will be assessed on its ability to control the expansion of brackish marsh either through channel modification (Lagoon Concept 2), lowering the marsh plain to within tidal inundation range (Lagoon Concept 3), or a combined approach (Lagoon Concept 4). It should be noted that the role that groundwater plays in the establishment and recent expansion of brackish and fresh marsh into Los Peñasquitos Lagoon is not currently known. While the HEM did not consider the groundwater component for this comparative analysis between Lagoon Concepts, the effects of surface flows will still be considered for ranking purposes. A groundwater study is currently underway within Zone 4 and Zone 3 to improve the understanding of role that groundwater plays with regard to habitat conversion and establishment. Therefore, ranking of Lagoon Concepts under the Expansion of Brackish Marsh criterion are considered preliminary and Table 10-1 may be revised based on the results of the groundwater study and the HEM's ability to use data from this study for additional model runs.

Performance Metrics

Performance metrics established for Expansion of Brackish Marsh include area of inundation by freshwater as used in the HEM. Post-implementation metrics for area and depth of inundation by freshwater will most likely be determined through aerial imagery supported by in-field measurements and observations. Data from groundwater surveys will be integrated into the performance metrics if sub-surface flows are determined to play a role in habitat type and distribution. Vegetation surveys will most likely be needed as well.

Inlet Maintenance

Inlet maintenance is required at Los Peñasquitos Lagoon to avoid extended closures that can greatly impact the Lagoon's native habitats, migratory fowl, and sensitive species. Extended inlet closures at Los Peñasquitos Lagoon also present threats to public health as mosquito populations increase exponentially due to the increase of ponded, stagnant water within the Lagoon exacerbated by constant freshwater inputs from the watershed. Using adaptive management, the Los Peñasquitos Lagoon Foundation (LPLF) has worked with stakeholders to improve the management of Lagoon's inlet area through mechanized excavation and redesign of the bridge that spans lagoon mouth. It is expected that inlet maintenance will continue to be a management priority at Los Peñasquitos Lagoon through Phase II. However, elements incorporated into the Lagoon Concepts may require a modification to this approach to support protection of existing salt marsh and recovery of additional salt marsh acreage. Conversely, a Lagoon Concept may reduce the frequency and/or magnitude of inlet excavation needed to restore and maintain tidal influence through increased tidal prism or improved connectivity within lagoon channels that improve the ability to flush marine sediments out of the inlet area. It should be noted that efforts are currently underway to better model the inlet area using a Quantified Conceptual Model that predicts seasonal and episodic changes in depth and channel morphology in conjunction with coastal processes (e.g. tidal inundation, wave energy, shoaling). Therefore, ranking of Lagoon Concepts under the Inlet Maintenance criterion are based on professional opinion and should be considered preliminary. Rankings under this criterion may be updated (e.g. **Table 10-1**) based on the results from the Quantified Conceptual Model.

Performance Metrics

Performance metrics established for Inlet Maintenance will include changes in depth and channel morphology based on a Quantified Conceptual Model, which will be developed in the next phase of the restoration planning. Post-implementation metrics will be comparable to existing data sets maintained by LPLF and will most likely include all or a combination of grain size analysis, channel surveys, inlet closure frequency, water quality data, and sediment volume removed during dredge events.

Protection and Enhancement of Existing Salt Marsh

Another key focus of the stakeholder process explored in Chapter 6 was the protection and enhancement of Los Peñasquitos Lagoon's existing salt marsh habitat, which occurs primarily in Zone 2 and portion of Zone 3. Since the Lagoon has lost more than half its native salt marsh, protecting the remaining areas of established salt marsh was considered paramount during the public workshops and additional stakeholder consultations. This assessment criterion also considers whether a Lagoon Concept provides enhancement opportunities for existing salt marsh through efforts that support invasive removal, recruitment of native salt marsh plants, and/or improved freshwater management through connectivity with the Lagoon's tidal channels or lowering of the marsh plain.

Performance Metrics

Performance measures for Protection and Enhancement of Existing Salt Marsh include those used for Salt Marsh Restoration (i.e. acreage of salt marsh), which will be based on the restoration design developed in the next phase of the project. Lagoon Concepts are ranked according to their ability to sustain and support salt marsh in Zone 2 and Zone 3 during preliminary runs of the baseline and habitat trajectory model performed as part of the Lagoon Enhancement Plan update. Post-implementation metrics will also include acreage of protected and/or enhanced salt marsh with additional metrics that may include presence/absence of invasive species, changes in vegetation, sustained or increased populations of sensitive species, and/or vegetation assemblages and associations. Efforts will be made to demonstrate and measure habitat function.

Enhancement of Riparian Areas

Field assessments indicate that riparian areas within Zone 4 are relatively degraded with regard to habitat function and biological integrity. While arroyo willows dominate the overstory in Zone 4, the understory is comprised almost entirely of invasive plant species that include giant reed (*Arundo donax*), Cape Ivy (*Delairea odorata*), pampas grass (*Cortedaria selloana*) (See Southern Willow Scrub in Section 4.6.1). Therefore, Enhancement of Riparian Areas was included as an assessment criterion to evaluate the Lagoon Concepts ability to improve the riparian corridor in Zone 4 (e.g. promote establishment of native riparian species in the understory). This criterion will also be used to evaluate flood management efforts conducted by the City of San Diego in Sorrento Valley that consider restoration and enhancement components for Zone 4 in conjunction with improved capacity in flood channels.

Performance Metrics

Performance measures for Enhancement of Riparian Areas are based primarily on the restoration design, which will be developed in the next phase of the project. While improving the existing riparian habitat is important, further expansion of riparian habitat into Los Peñasquitos Lagoon is not desired. Therefore, the ability of Lagoon Concept 3 to expand riparian wetland and freshwater marsh into the Lagoon over time as shown in model results in Chapter 7 is not considered preferable to reductions in these habitat types under Lagoon Concept 2 and Lagoon Concept 4. At this point, performance metrics favor Lagoon Concept 2 and Lagoon Concept 4 since channel modifications will extend into the riparian areas and most likely trigger mitigation that would require enhancement of the understory. Post-implementation metrics will also include acreage of enhanced riparian habitat (e.g., establishment of native species in understory, diversity in overstory species), reductions in invasive species (e.g. invasive plants), and/or increased populations of sensitive species.

Public Safety and Health

Minimizing potential impacts to public health and safety from mosquito-borne brain encephalitis is included as a criterion for Lagoon Concepts based on Goal 4 of the updated Lagoon Enhancement Plan – *Consider public health when implementing the updated Lagoon Enhancement Plan*. As such, Lagoon Concepts are ranked in their ability to reduce ponding of freshwater and limit the extent of brackish and freshwater marsh areas within Los Peñasquitos Lagoon that supports breeding habitat for *Culex tarsalis* due to this species ability to transmit West Nile virus to human hosts. While similar to the Expansion of Brackish Marsh criterion, performance metrics or Public Safety and Health will not be limited to Zone 3 and will include coordination with the San Diego County Department of Environmental Health to include areas of documented breeding habitats within Los Peñasquitos Lagoon (see Chapter 9) and/or those areas of high concern adjacent to the Lagoon.

Performance Metrics

The primary performance measure for this assessment criterion is reduced acreage of potential mosquito breeding habitat. For the conceptual level review of the concepts, freshwater and brackish marsh acreage as determined with the HEM were used to determine the extent and potential changes of areas of freshwater inundation and ponded water. Post-implementation metrics will also involve in-field measures that will most likely include all or a combination of water quality parameters, mosquito populations, frequency/magnitude of larvicide treatments, and West Nile virus occurrences.

Impacts to Sensitive Species and Habitat

Implementing Lagoon Concepts 2 – 4 will result in some measure of impacts to sensitive species and habitats. Impacts may occur that are indirect (noise related) or direct in terms of take and destruction of habitat through efforts that will include grading (wide-spread or focused), excavation, and equipment access. Consideration of impacts (type and magnitude) generated by the implementation each of the Lagoon Concepts will need to be considered to help determine the preferred approach for salt marsh restoration in a State Preserve and the cost/benefit associations that include potential mitigation requirements or avoidance measures by California Environmental Quality Act (CEQA) and/or resource agency permits and waivers.

Performance Metrics

Performance metrics established for this criterion for the conceptual-level evaluation of the Lagoon Concepts includes proximity to known sensitive habitats, locations of sensitive plant species, as well as documented areas used by sensitive species (e.g. nesting habitat, foraging habitat). Performance measures during and after implementation will include biological monitoring with (as needed) species-specific protocoled monitoring. Data generated by these surveys will be compared to existing data sets for Los Peñasquitos Lagoon and regional surveys to determine impacts.

Long-Term Adaptability and Sustainability

This assessment criterion was included to address the sustainability of benefits generated by the Lagoon Concepts in light of predicted climate change. Resiliency of restored and enhanced areas of salt marsh will require establishing sufficient transitional zones that allow habitats to adapt to sea level rise. Lagoon Concepts that create greater transitional zones between the salt marsh and upland habitats will provide greater sustainability as habitat elevations can equilibrate to sea level rise. In addition, Lagoon Concepts that address the effects of sea level rise by preserving the greatest area of historical salt marsh over the longest timelines are also favorable to best achieve long term sustainability goals.

Performance Metrics

Performance metrics developed for Long-Term Adaptability and Sustainability will include modeled acreage of transitional areas established to provide the best opportunity for upslope migration of salt marsh in response to sea level rise. Post-implementation performance measure for this criterion will most likely involve aerial imagery supported by in-field surveys along established transects and vegetation association surveys.

Cost Effectiveness

The cost effectiveness of each Lagoon Concept is assessed on a per acre basis of habitat restored or enhanced. Cost effectiveness analysis also provides a basis for comparison with other restoration projects within the region and/or of similar type.

Performance Metrics

Performance metrics established to determine Cost Effectiveness of the Lagoon Concepts are based on projected (conceptual-level based) cost per acre of high salt marsh for the engineering analysis.

Long-Term Maintenance

Maintenance needs and their associated costs are an important criterion for evaluating the "real cost" of implementing and sustaining benefits for restoring salt marsh and the preferred transitional areas within Los Peñasquitos Lagoon. The assessment criterion includes evaluating the long-term maintenance needs with preference for concepts that minimize these costs.

Performance Metrics

The performance metric used for this criterion is based on the estimated level of operation and maintenance (O&M) for each of the Lagoon Concepts following implementation. The level of O&M is understood to increase with the amount of grading and need for revegetation. The greater the amounts of grading and sediment disturbance, the greater the re-vegetation effort and long-term O&M required to assure that the desired native vegetation successfully establishes and invasive species are controlled. This is illustrated below:

	Relative Level of Operation and Maintenance Costs		
	Extensive Grading and Re-vegetation	Minor Grading and Adaptive Management	Focus on Targeted Invasive Removal
Tidal Marsh, Riparian or Upland Restoration	Highest	Medium	Lowest
DECREASED O&M COST			

Contribution to Climate Change

This criterion was included to assess and compare each Lagoon Concept's contribution to climate change during implementation primarily in the form of emissions from heavy equipment. Emissions will then need to be balanced to presumed sequestration rates for salt marsh and other habitats within Los Peñasquitos Lagoon to inform a cost-benefit analysis for each Lagoon Concept.

Performance Metrics

Performance metrics for Contribution to Climate Change will require balancing emission rates and volumes of climate-changing gas during implementation with expected sequestration rates over time for salt marsh and transition areas restored and enhancements to existing salt marsh and riparian habitats. For the purposes of the Lagoon Enhancement Plan update, an attempt was made to predict this balance using best professional opinion. Ranking of Lagoon Concepts using this criterion will most likely be updated once the appropriate sequestration formulas and related guidance for salt marsh and other lagoon habitats are provided the Air Resources Board.

Multiple Benefit to Identify Funding Sources

Lagoon Concepts that generate multiple benefits (e.g., reducing vector breeding habitat, improving flood management) will most likely create additional funding sources to support restoration. Multiple benefits also facilitate coordination and collaboration with watershed stakeholders and garner additional support from local communities and other members of the public that enjoy visiting the Lagoon and other parts of the Torrey Pines State Natural Reserve (TPSNR).

Multiple benefits and/or impacts generated by each Lagoon Concept will be evaluated using the Triple-Bottom-Line (TBL) approach. Coined by John Elkington in 1994[1], the TBL approach provides an accounting framework that considers costs and benefits within three core areas: environmental (or ecological), social, and financial. Consideration of cost and benefits within this broader context provides a better, more comprehensive evaluation of value and sustainability than is provided by focusing merely on financial indicators.

1 "Triple Bottom Line". The Economist. November 17, 2009. Retrieved 14 August 2014.

Performance Metrics

Performance metrics developed for this criterion include an evaluation of whether the concepts generate multiple benefits. When identified, additional benefits will be quantified where possible using the appropriate metrics (e.g., reduced costs associated with flood management within Sorrento Valley). Qualitative data will also be considered when it supports quantitative analysis or in the absence of quantifiable metrics.

10.2.2 Concept Assessment

The assessment of each of the four Lagoon Concepts developed in Chapter 7 is summarized in **Table 10-3** using the performance assessment criteria and metrics presented in Section 10.2.1. Lagoon Concepts are then ranked based on the results with the ranking for each criterion shown in the row below the assessment criteria. Ranking is from 1 to 4, with 1 representing the top rank and 4 the lowest.

Results of the Lagoon Concept Comparative Analysis

Lagoon Concept 2 (Freshwater Management) = The Preferred Lagoon Concept

The results of the assessment summary determine that Lagoon Concept 2 is the preferred approach for large-scale recovery of salt marsh in Los Peñasquitos Lagoon. As shown in **Table 10-3**, Lagoon Concept 2 provides the best approach as it ranked either first or second against the assessment criteria and performance metrics used for the comparative analysis with an average ranking of 1.7. While the HEM indicates that Lagoon Concept 2 will fall short of generating 84 acres of additional salt marsh by 2030, it does provide the best approach to meeting the goals and objectives of the updated Lagoon Enhancement Plan when compared to the other Lagoon Concepts. The ability of Lagoon Concept 2 to generate 103 acres of transitional areas within the marsh plain by 2030 (under modeled conditions) supports the need to make Los Peñasquitos Lagoon a resilient system with regard to climate change by facilitating upslope migration of salt marsh in response to sea level rise. As such, Lagoon Concept 2 may generate additional salt marsh acreage by 2035 when Lagoon Sediment TMDL Compliance is required. It should be noted that compliance requires a “movement toward” 84 acres and does not specify an exact acreage by 2035.

Lagoon Concept 4 (Elevation Reduction & Freshwater Management)

Lagoon Concept 4 also performed strongly against most of the assessment criteria and performance metrics, having four first place rankings and three second place rankings for an average score of 2. However, it’s overall ranking in the comparative analysis between Lagoon Concepts was reduced to second place due its use of wide-scale grading that made Lagoon Concept 4 perform poorly with regard to impacts to sensitive species and habitats, cost effectiveness, and long-term maintenance needs. Furthermore, CSP has expressed interest in pursuing a more passive approach to salt marsh restoration in Los Peñasquitos Lagoon to adhere to management policies that govern State Preserves and preference for an adaptive approach versus an aggressive approach to restore salt marsh in the short term.

TABLE 10-3
ASSESSMENT OF LAGOON CONCEPTS

Assessment Criteria	Assessment Metric	Lagoon Concept 1 No Action	Lagoon Concept 2 Freshwater Management	Lagoon Concept 3 Elev. Reduction	Lagoon Concept 4 Elev. Reduction and FW Management
1A. Salt Marsh Restoration (Zone 3) – Meeting TMDL Requirement of 84 acres of additional salt marsh by 2035 (158 acres = 2010 baseline)	Acres of salt marsh established - measured by habitat projection modeling for 2030.	162 acres or **+4 acres** from 2010	232 acres or **+ 74 acres** from 2010	163 acres or **+5 acres** from 2010	264 acres or **+106 acres** from 2010
1B. Salt Marsh Restoration (Zone 3) – Maximizing salt marsh acreage by 2050 and 2070.	Acres of additional salt marsh established - measured by habitat projection modeling for 2050 & 2070	174 acres or **+12 acres** by 2050 & 159 acres or **+1 acre** by 2070	272 acres or **+114 acres** by 2050 & 293 acres or **+135 acres** by 2070	166 acres or **+8 acres** by 2050 & 165 acres or **+7 acres** by 2070	296 acres or **+138 acres** by 2050 & 312 acres or **+154 acres** by 2070.
	Ranking	**4**	**2**	**3**	**1**
2. Expansion of Brackish Marsh (Zone 3)	Area and depth of freshwater inundation reduced – measured by habitat projection modeling.	-	reduced	-	reduced
	Ranking	**3**	**1**	**3**	**1**
3. Inlet Maintenance (Zone 1)	Improved tidal exchange and reduced sediment built-up -measured by inlet modeling.	No increase to tidal prism nor improved hydrology in lagoon channels	Moderate increase to tidal prism & improved hydrology in lagoon channels	Moderate increase to tidal prism	Greatest increase to tidal prism & improved hydrology in lagoon channels
	Ranking	**4**	**2**	**3**	**1**
4. Protection and Enhancement of Existing Salt Marsh (Zone 2)	Acres of salt marsh restored/enhanced – measured by restoration design.	Lowest potential	High Potential through expansion of existing acreage to act as buffer by 2030	Lowest potential	High Potential through expansion of existing acreage to act as buffer by 2030
	Ranking	**4**	**2**	**4**	**2**

Assessment Criteria	Assessment Metric	Lagoon Concept 1 No Action	Lagoon Concept 2 Freshwater Management	Lagoon Concept 3 Elev. Reduction	Lagoon Concept 4 Elev. Reduction and FW Management
5. Enhancement of Riparian Areas (Zone 4)	Acres of degraded riparian habitat enhanced/restored - measured by acres designated for habitat enhancement in design.	Lowest potential	Enhancement most likely to mitigate impacts associated with implementation	Low potential	Enhancement most likely to mitigate impacts associated with implementation
	Ranking	**4**	**2**	**3**	**2**
6. Public Safety and Health	Area of freshwater ponding reduced – measured by habitat projection modeling and estimated improvement in circulation.	-	reduced	-	reduced
	Ranking	**3**	**1**	**3**	**1**
7. Impact to Sensitive Species and Habitat	Significant Impact to Sensitive Species and Habitat – compared to other alternatives.	None	Low	High	Higher
	Ranking	**1**	**2**	**3**	**4**
8. Long-Term Adaptability and Sustainability	Acres of transitional zone established – measured by habitat projection modeling.	27 acres (existing)	176 acres	38 acres	124 acres
	Ranking	**4**	**1**	**3**	**2**
9. Cost Effectiveness	Cost per acre of high salt marsh – measured by engineering analysis	$0/acre	$26-75k/acre	$200-540k/acre	$69 – 190k/acre
	Ranking	**1**	**2**	**4**	**3**
10. Long-Term Maintenance	Annual cost of O&M – compared to other alternatives.	Low	Low-Medium	High	Medium
	Ranking	**1**	**2**	**4**	**3**
11. Contribution to Climate Change During Implementation	Projected CO2 emissions during implementation and sequestration by salt marsh	Emissions = None Sequestration = Low	Emissions = Low Sequestration = High	Emissions = High Sequestration = Low	Emissions = Highest Sequestration = Highest
	Ranking	**3**	**1**	**4**	**2**
	Average Ranking 1-11	**3.0**	**1.7**	**3.4**	**2.0**

Assessment Criteria	Assessment Metric	Lagoon Concept 1 No Action	Lagoon Concept 2 Freshwater Management	Lagoon Concept 3 Elev. Reduction	Lagoon Concept 4 Elev. Reduction and FW Management
12. Multiple Benefits to Identify Funding Sources	Multi-benefits – measured by average of other metrics	-	High	Low	Medium
	Ranking	**4**	**1**	**3**	**2**
	Average Ranking 1-12	**3.0**	**1.6**	**3.4**	**2.0**
	Final Ranking	**3**	**1**	**4**	**2**

Lagoon Concept 1 (No Action)

Lagoon Concept 1 (No Action) performed better than Lagoon Concept 3 (Elevation Reduction) since it delivers basically the same reduced benefits while avoiding impacts and costs associated with wide-scale grading. Since Lagoon Concept 1 is the no-action alternative, it ranked highest in the Impact to Sensitive Species and Habitat criterion. However, it should be noted that this criterion does not consider on-going impacts associated with "no action." For example, the advancement of brackish habitat within Zone 3 that would occur under Lagoon Concept 1 would generate impacts to sensitive species and habitat within Los Peñasquitos Lagoon and require continued maintenance efforts to maintain the status quo and not to promote improvements to lagoon habitats.

Lagoon Concept 3 (Elevation Reduction)

Lagoon Concept 3 ranked the lowest amongst the concepts, due in most part to the lack of a freshwater management component that causes this approach to perform poorly with regard to most of the assessment criteria. This is evident in its ranking for: Salt Marsh Recovery; Continued Habitat Conversion; Public Safety and Health; Long-Term Adaptability and Sustainability; and Contribution to Climate Change (ability to sequester carbon). The large amount of disturbed land due to grading that would be performed under Lagoon Concept 3 caused this approach to also rank low along Impact to Sensitive Species and Habitat, Cost-Effectiveness, Long-Term Maintenance, and Contribution to Climate Change (emissions by heavy equipment during implementation).

10.3 Evaluation and Prioritization of Public Access, Safety, and Education Concepts

This section presents the performance criteria used in the assessment of the Public Access, Safety, and Education Concepts (Public Access Concepts) presented in Chapter 8. Unlike Lagoon Concepts, most of the Public Access Concepts will not be ranked since they all present value and will most likely need to be coordinated with larger projects that dictate the available funding and timeline for the design, permitting, and implementation of these improvements. However, Highway 101 improvements were ranked since they present three main alternatives that provide a varying array of potential costs and benefits.

10.3.1 Concept Assessment Criteria and Metrics

Public Access Concepts presented Chapter 8 were developed to meet the applicable goals and objectives identified through the stakeholder process and presented in **Table 6-1**. These goals are directly related to community public access, safety, and education (Goal 4, Goal 6 and Goal 7) and include consistency with existing CSP plans and policies. Goals include long-term sustainability of projects that considers sea level rise, long-term funding, and operation and maintenance costs (Goal 5 and Goal 8). Finally, the applicable goals include the protection and promotion of Los Peñasquitos Lagoon's value within a regional context (Goal 9). Opportunities presented in Chapter 8 will be evaluated using assessment criteria and performance metrics developed from these refined goals and associated objectives presented in **Table 10-4**.

TABLE 10-4
ASSESSMENT CRITERIA AND METRICS FOR EVALUATION OF PUBLIC ACCESS CONCEPTS

Assessment Criteria	Metrics for Concept Evaluation	Goals Addressed
1. Trail User Safety - Does the concept improve current public safety on key trail route?	Creation of improved safety features of existing or expanded trail(s) that produce measurable reductions in the risk of pedestrian and bike accidents and injuries.	4
2. Recreational Users Safety on Multi-Use Trails and Area - Does the concept improve safety of overall recreational users by creating new improvements (infrastructure) to multi-use routes and areas around the Lagoon?	Creation of new infrastructure that that produces measurable reductions in the risk of recreational user conflict from multi-use trails and access areas (e.g. separate bike and pedestrian lanes/areas).	4
3. Community Education Opportunities – Does the concept improve opportunities for public education and increase awareness and stewardship of the Lagoon and watershed?	Concept includes education elements for the public to become more engaged in the stewardship of the Lagoon and watershed.	6
4. Consistency with Current State Park Plans and Policies – Does the concept manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of CSPs?	Concept is consistent with CSP plans and policies for the Marsh Natural Preserve.	7
5. Long-Term Sustainability - Does the concept consider long-term sustainability including sea level rise?	Concept has considered potential impacts from sea level rise and has features that can adapt as conditions change to continue to provide public access.	5
6. Regional Value of the Lagoon – Does the concept promote the value of the Lagoon to the community and region?	Concept includes elements to improve connectivity of trails, bike routes, and access points to transit centers and regional trail systems to improve regional value of the Lagoon as a destination point. Concept provides educational opportunities to improve understanding of the value of the natural systems to the region's economic growth and value.	9
7. Capital and Long-Term Maintenance Costs – Does the concept provide multi-benefits costs effectively and minimize long-term O&M compared to other concepts?	Multi-benefits are achieved by meeting the other goals and estimated implementation costs and level of O&M.	8
8. Favorability for Funding– Does the concept provide elements that can be funded through larger transportation projects or other funding sources?	Concept has elements that can be integrated with larger transportation and transit projects planned or projected in the future, or other funding sources.	8

10.3.2 Concept Assessment

As presented in **Table 6-2** of Chapter 6, the outcome of Workshop 3 was a list of opportunities and constraints for the each of the primary access routes and trails to and around Los Peñasquitos Lagoon. These key access routes and trails include:

- Marsh Trail
- Hilltop
- Highway 101
- Carmel Valley Road
- Sorrento Valley Road

The assessment of Public Access Concepts from Chapter 8 is summarized in **Table 10-5** for each of the five key trail and pathway improvements using the assessment criteria and performance metrics listed in **Table 10-4**. Each Public Access Concept identifies which criteria it contributes to and which types of funding sources may be available to assist in its planning and implementation.

10.4 Evaluation and Prioritization of Vector Habitat Remediation Concepts to Protect Public Health & Safety

The following section presents an evaluation of Vector Habitat Remediation Concepts (Vector Concepts) using assessment criteria developed for the County of San Diego's Vector Habitat Remediation Program (VHRP). Managed by the Department of Environmental Health (DEH), the VHRP focuses primarily on mosquito species that can transmit West Nile virus with the focal species being *Culex tarsalis*. Section 10.4.1 provides a brief description of each of the assessment criteria, which are presented in **Table 10-6** to show how they correspond to and support the final set of goals developed for the updated Lagoon Enhancement Plan. Performance metrics are also provided to allow quantifiable measures used to evaluate each Vector Concept against the assessment criteria. Finally, the four Vector Concepts from Chapter 9 are presented in **Table 10-7** alongside the assessment criteria to identify whether they meet each criterion.

10.4.1 Assessment Criteria and Performance Metrics

Assessment criteria was taken from the VHRP since this program will provide a key funding source to design and implement Vector Concepts identified in Chapter 9. Each criterion is presented below along with the corresponding performance measure to demonstrate how it can be measured for success and the nexus to the goals of the updated Lagoon Enhancement Plan and VHRP guidelines.

Known Mosquito Breeding Location (VCP Designation)

The DEH designates priority vector management locations based on complaints from the public and/or the ongoing presence of mosquito breeding habitat detected during field monitoring efforts. These sites are assigned a record identification and name under the Vector Control Program (VCP). The Vector Concepts presented in this section are evaluated against this criterion based on whether or not it has received a VCP Site identification number, which serves as the performance metric.

Potential Breeding Habitat for *Culex Tarsalis* (Ponded Water)

This criterion is used to qualify potential breeding habitat for *C. tarsalis* within Los Peñasquitos Lagoon, western reaches of its tributaries and storm water conveyance systems (MS4). Having a criterion specific to *C. tarsalis* is important for evaluating and prioritizing Vector Concepts since this species presents the greatest threat to public health and sensitive receptors due to its ability to transmit West Nile virus to human hosts. Performance metrics used for this criterion are based on site conditions that include year-round ponding of fresh and brackish water with characteristics (e.g. depth, wind protected) that lend to favorable breeding habitat for this mosquito species.

Proximity to Urbanized Areas and Sensitive Receptors

According to the County's VHRP, *C. tarsalis* has a range of approximately 2-mile radius from its breeding habitat. Therefore, a proximity-based criterion is important to help better evaluate and prioritize Vector Concepts with regard to their ability to improve the protection of public health in urban areas near the Lagoon and its urbanized floodplain, as well as open space areas such as TPSNR. Identified locations of potential sensitive receptors are also considered under this criterion, since they are the most vulnerable to West Nile virus and other forms of vector-borne brain encephalitis. Performance metrics for this criterion are based on proximity of the Vector Concept site to human populations with sensitive receptors in urban areas that include local communities and businesses, as well as identified recreational areas that include TPSNR.

Consistency with Wetland Design Guidelines for Vector Control

This criterion provides the needed nexus between the proposed Vector Concept and Wetland Design Guidelines for Vector Control provided in the County's VHRP. The Wetland Design Guidelines provide an alternative approach to vector management that looks to the restoration and enhancement of natural systems within a wetland as a preferred approach to control and abate mosquito population through the reduction of potential breeding habitats. The Wetland Design Guidelines aim to avoid potential impacts to sensitive habitats and species that can occur through hand distribution of larvicide in wetland areas or low-level aerial applications from helicopters. Reduction of ponded water through improved tidal connectivity and/or habitat restoration are examples of Vector Concepts that fall under Wetland Design Guidelines and that are captured under this criterion. Performance metrics used to measure a Vector Concept against this criterion is whether or not the proposed concept is consistent with VHRP's Wetland Design Guidelines.

TABLE 10-5A
ASSESSMENT SUMMARY OF PUBLIC ACCESS CONCEPTS (MARSH TRAIL)

Assessment Criteria/Concept	Marsh Trail Realignment	North End At-Grade Trail Crossing	North End Under-Pass Crossing	North End Over-Pass Crossing	Hilltop & Marsh Trail Access
1. Trail User Safety - Does the Concept improve current public safety on key trail route?	Improves user safety by moving trail above tidal influence.	Improves user safety by creating formal crossing of Highway 101.	Improves user safety by creating a grade separated crossing of Highway 101.	Improves user safety by creating a grade separated crossing of Highway 101.	Improve user safety by providing a staging area and access point for emergency response near the mid-point of the Marsh Trail
2. Recreational Users Safety on Multi-Use Trails and Area -- Does the Concept improve safety of overall recreational users by creating new improvements (infrastructure) to multi-use routes and areas around the Lagoon?	NA	NA	NA	NA	NA
3. Community Education Opportunities – Does the Concept improve opportunities for public education and increase awareness and stewardship of the Lagoon and watershed?	Removes existing impacts to lagoon resources and provides new locations for educational opportunities.	Promotes trail use and related educational opportunities through improved access from TPSNR's South Beach parking lot.	Promotes trail use and related educational opportunities through improved access from TPSNR's South Beach parking lot	Promotes trail use and related educational opportunities through improved access from TPSNR's South Beach parking lot	Provides lagoon overlook and associated educational opportunities.
4. Consistency with Current State Park Plans and Policies – Does the Concept manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of CSPs?	Improves consistency of Marsh Trail with CSP plans and polices of no net loss of trail miles within TPSNR.	Will have to balance safety/access benefits with potential localized habitat impacts.	Will have to balance safety/access benefits with potential localized habitat impacts.	Will have to balance safety/access benefits with potential localized habitat impacts	New staging and trail access is consistent with 1985 Lagoon Enhancement Plan
5. Long-Term Sustainability -Does the Concept consider long-term sustainability that includes sea level rise?	Moved Marsh Trail above elevations of predicted sea level rise.	May need to be integrated with improvements to Highway 101.	May need to be integrated with improvements to Highway 101.	May need to be integrated with improvements to Highway 101.	Provides additional trail miles that may be lost in TPSNR due to sea level rise or for established trails that need to be closed due to safety issues.
6. Regional Value of the Lagoon – Does the Concept promote the value of Los Peñasquitos Lagoon to the community and regio**n?**	Makes the Marsh Trail more accessible to a larger group of users.	Makes the Marsh Trail more accessible to a larger group of users.	Makes the Marsh Trail more accessible to a larger group of users.	Makes the Marsh Trail more accessible to a larger group of users.	Creates new overlook accessible from a heavily used tourist corridor.
7. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost effectively and minimize long term O&M compared to other concepts?	Reduces impacts to resources, improves access, and reduces O&M costs.	Least expensive of 3 Crossing Alternatives, needs to be implemented with Highway 101 improvements.	Most direct access, best accessibility option of the 3 Crossing Alternatives.	Most complicated and potentially most expensive of the 3 Crossing Alternatives.	Creates new visual and physical access, staging area already disturbed, adds new O&M requirements.
8. Favorability for Funding– Does the Concept provide elements that can be funded through larger transportation projects or other funding sources?	Resource protection is best angle for funding.	Public safety and potentially accessibility.	Public safety and accessibility.	Public safety and potentially accessibility.	Accessibility and education.

TABLE 10-5B
ASSESSMENT SUMMARY OF PUBLIC ACCESS CONCEPTS (HIGHWAY 101)

Assessment Criteria/Concept	Western edge improvements – Parallel parking	Western edge improvements – Head-in parking	Western edge improvements – No parking	Eastern edge improvements – Parallel parking	Eastern edge improvements – Head-in parking
1. Trail User Safety – Does the Concept improve current public safety on key trail route?	Reduces conflicts between pedestrian, bicycle, and vehicular uses.	Reduces conflicts between pedestrian, bicycle, and vehicular uses.	Maximizes pedestrian and bicyclist safety by removing vehicular traffic.	Improves safety by establishing a separate lane for pedestrian to reduce conflicts from bicycles and vehicles traffic	Maximizes safety by physically separating pedestrian traffic from bicycles and vehicles
Ranking	2	3	1	2	1
2. Recreational Users Safety on Multi-Use Trails and Area - Does the Concept improve safety of overall recreational users by creating new improvements (infrastructure) to multi-use routes and areas around the Lagoon?	Creates multi-use route along beach with moderate improvements to recreational user safety.	Creates multi-use route along beach minor improvements to recreational user safety.	Creates multi-use route along beach that maximizes recreational user safety by eliminating conflicts associated with vehicle access.	Provides missing segment of Lagoon loop trail.	Provides missing segment of Lagoon loop trail.
Ranking	2	3	1	2	1
3. Community Education Opportunities – Does the Concept improve opportunities for public education and increase awareness and stewardship of Los Peñasquitos Lagoon and its watershed.	Promenade would provide better education opportunities.	Promenade would provide better education opportunities.	Promenade would provide better education opportunities.	Could integrate educational material about Lagoon along trail.	Could integrate educational material about Lagoon along trail.
Ranking	1	1	1	1	1
4. Consistency with Current State Park Plans and Policies – Does the Concept manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of CSPs.	Improves beach access and user safety.	Improves beach access and user safety.	Improves beach access and user safety while reducing the need for CSP rangers to respond to incidents involving or associated vehicular traffic.	Improves public access with minimal resource impacts.	Improves public access with minimal resource impacts.
Ranking	2	2	1	1	1
5. Long-Term Sustainability – Does Concept consider long-term sustainability that includes sea level rise.	Vulnerable to sea level rise that could constrain multi-use opportunities for pedestrian, bike, and vehicular use	Vulnerable to sea level rise that could constrain multi-use opportunities for pedestrian, bike, and vehicular use	Provides greater opportunity for retreat while maintaining pedestrian and bicycle facilities.	Less costly to abandon due to sea level rise due to minimal investment in infrastructure.	More costly to abandon due to sea level rise due to implementation costs.
Ranking	2	2	1	1	2
6. Regional Value of the Lagoon – Does the Concept promote the value of Los Peñasquitos Lagoon to the community and region.	Provides safer public access to the beach while still providing public parking at no cost.	Provides safer public access to the beach while still providing public parking at no cost with more spaces available than under the parallel parking alternative.	Removes free public parking with closest opportunity occurring north of the inlet at Carmel Valley Road.	Provides public access along the western edge of the Lagoon.	Provides public access along the western edge of the Lagoon.
Ranking	2	1	3	1	1
7. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost effectively and minimize long-term O&M compared to other concepts.	Keeps fewer parking spaces, likely increases O&M.	Keeps more parking space, likely increases O&M.	Removes parking spaces, but will require O&M.	Least expensive, fewer resource impacts, lowest O&M.	More expensive and higher O&M.
Ranking	2	2	1	1	2
Overall Ranking	2	3	1	1	1
8. Favorability for Funding– Does the Concept provide elements that can be funded through larger transportation projects or other funding sources.	Not as favorable as head-in parking since it will provide less parking and in a manner (parallel) that has been converted to head in parking in other areas along Coastal Highway 101 within the region (Solana Beach, Encinitas)	Likely more favorable due to higher parking count and in an alignment that has been used recently by SANDAG for road improvements.	Probably the least favorable as it removes all free parking opportunities along this stretch of Highway 101.	Has to be done in conjunction with or after western edge improvements, but provides a reduced cost for implementation than the cantilevered boardwalk alternative.	Does not have to be done in conjunction with or after western edge improvements. A costlier approach than using the shoulder to create a separate walkway if included in a larger transportation improvement project.
Ranking	2	1	3	1	2

TABLE 10-5C
ASSESSMENT SUMMARY OF PUBLIC ACCESS CONCEPTS (CARMEL VALLEY ROAD)

Assessment Criteria/Concept	Close user created trails	Pedestrian improvements	Regional project integration
1. Trail User Safety - Does the Concept improve current public safety on key trail route?	Improves safety by removing portions of user created trails that are not maintained by CSP and directs pedestrians to established walkways.	Improves user safety along Lagoon edge.	Opportunity for multi-use and user safety improvements.
2. Recreational Users Safety on Multi-Use Trails and Area – Does the Concept improve safety of overall recreational users by creating new improvements (infrastructure) to multi-use routes and areas around the Lagoon?	NA	Improves pedestrian safety for multi-use with bicycles and vehicles.	Could create a multi-use route and improve overall user safety.
3. Community Education Opportunities – Does the Concept improve opportunities for public education and increase awareness and stewardship of the Lagoon and watershed?	Provides educational opportunities about closures.	Educational features could be integrated along the edge of the Lagoon.	Provides additional educational opportunities through integration with regional trail networks.
4. Consistency with Current State Park Plans and Policies – Does the Concept manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of CSPs?	Closures are consistent with CSP's Resource protection policies.	Improvements are consistent with access and resource policies but would need to be included in the updated TPSNR Trail Management Plan.	Regional projects will need to integrate CSP policies and capacity (e.g. maintenance, enforcement), otherwise they may conflict.
5. Long-Term Sustainability – Does the Concept consider long-term sustainability that includes sea level rise?	NA	Improvements along existing Carmel Valley Road would be at risk long-term with sea level rise.	Significant portions of Carmel Valley Road along the lagoon are at risk in the long-term due to sea level rise.
6. Regional Value of the Lagoon – Does the Concept promote the value of the Los Peñasquitos Lagoon to the community and region?	Preserves native habitat for future generations.	Improves pedestrian access along the edge of the Lagoon.	Improves connectivity to regional trail network and bike lanes.
7. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost effectively and minimize long term O&M compared to other concepts?	Will eliminate any O&M that is being done.	Most of the length is cost effective with a few higher costs areas, low O&M overall.	To be determined since increased use could result in increased O&M.
8. Favorability for Funding– Does the Concept provide elements that can be funded through larger transportation projects or other funding sources?	Low costs, habitat protection.	Habitat impacts challenging and potential issues of access and right of way (easements, jurisdiction).	Reducing fragmentation of regional trail networks is a priority for SANDAG and other entities.

TABLE 10-5D
ASSESSMENT SUMMARY OF PUBLIC ACCESS, SAFETY AND EDUCATION CONCEPTS (SORRENTO VALLEY ROAD)

Assessment Criteria/Concept	Multi-use Path improvements	Connectivity improvements	Regional project integration
1. Trail User Safety - Does the Concept improve current public safety on key trail route?	Provides separate pedestrian trail and creates safer higher speed bicycle path.	Provides missing connectivity to CVREP for bicycles and pedestrians.	Provides missing connectivity to California Coastal Trail, Sea to Sea Trail, and Coastal Rail Trail.
2. Recreational Users Safety on Multi-Use Trails and Area – Does the Concept improve safety of overall recreational users by creating new improvements (infrastructure) to multi-use routes and areas around the Lagoon.	Improves user safety by providing alternatives for slow and fast user groups.	Provides multi-use connectivity between the Lagoon and community/public parking located along SR 56.	Provides missing connectivity to California Coastal Trail, Sea to Sea Trail, and Coastal Rail Trail.
3. Community Education Opportunities – Does the Concept improve opportunities for public education and increase awareness and stewardship of the Lagoon and watershed?	Educational features could be integrated at both ends and along the lagoon edge.	Educational features could be integrated on either side of I-5 and in CVREP.	Educational features could be integrated into regional trail networks.
4. Consistency with Current State Park Plans and Policies – Does the Concept manage public access along Los Peñasquitos Lagoon in a manner that is consistent with resource protection in a State Preserve and in compliance with the plans and policies of CSPs?	Improvements are consistent with access and resource policies of CSP, though it is located within the jurisdiction of City of San Diego.	Improvements are consistent with access and resource policies of CSP, though it is located within the jurisdiction of City of San Diego.	Regional projects will need to integrate CSP and City of San Diego policies, otherwise they may conflict.
5. Long-Term Sustainability – Does the Concept consider long-term sustainability that includes sea level rise.	Improvements should consider grade adjustments to account for sea level rise.	Improvements must be capable of handling regular flooding by storm events.	Improvements should consider grade adjustments to account for sea level rise.
6. Regional Value of the Lagoon – Does the Concept promote the value of Los Peñasquitos Lagoon to the community and region?	Improves pedestrian access and educational features.	Creates new connectivity to surrounding communities.	Integrates lagoon edge features with regional trail networks.
7. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost effectively and minimize long term O&M compared to other concepts	Provides multiple benefits, may increase O&M	O&M may be challenging due to regular flooding during storm events	Would probably require additional MOUs and MOAs with regional trail management entities and land owners
8. Favorability for Funding– Does the Concept provide elements that can be funded through larger transportation projects or other funding sources	Recreation, Education, Non-vehicular commuting. Mitigation/improvements as part of NCC PWP/TREP.	Regional connectivity, Non-vehicular commuting. Mitigation/improvements as part of NCC PWP/TREP	Regional connectivity, non-vehicular commuting. Mitigation/improvements as part of NCC PWP/TREP

TABLE 10-6
|ASSESSMENT CRITERIA AND METRICS FOR EVALUATION OF VECTOR CONCEPTS

Assessment Criteria	Metrics for Concept Evaluation	Goals Addressed
1. Known Mosquito Breeding Location (VHP Designation) – Is the site a known DEH mosquito breeding site**?**	DEH Site identification.	DEH VHRP Guidelines
2. Potential Breeding Habitat for *Culex tarsalis* (Ponded Water) – Does the site possess conditions that can result in breeding habitat for the species that carries West Nile virus and are these conditions persistent throughout the year?	Site conditions that include persistent year round ponding of freshwater, which is less than 4 ft. deep, does not circulate or flush for long periods of time, and is not open water that is subject to wind effects.	DEH VHRP Guidelines
3. Proximity to Urbanized Area and Sensitive Receptors – Is the site located near potential sensitive receptors?	Proximity of the site to adjacent to residential communities and/or recreational areas where people would be exposed to mosquitos from the site within a 2-mile radius.	DEH VHRP Guidelines
4. Consistency with Wetland Design Concepts for Vector Control – Is the Concept consistent with the DEH VHRP wetlands design guidelines for vector habitat remediation?	Concept is consistent with DEH VHRP wetland design guidelines that are presented in **Table 10-7**.	DEH VHRP Guidelines
5. Improvement of Larvicide Treatment Effectiveness – Does the Concept improve conditions that allow for more effective larvicide treatment?	Concept improves conditions for more effective larvicide treatment through removal of vegetation and/or elimination of standing water through improved circulation and drainage.	DEH VHRP Guidelines
6. Potential Impact to Sensitive Habitat and Species – Does the Concept have the potential to impact sensitive habitat and/or species?	Concept has considered potential impacts to sensitive habitat and species and has either avoided or minimized these impacts, such that no significant impact will occur.	10, DEH VHRP Guidelines
7. Contribution to Conservation and Improved Water Quality – Does the Concept contribute to conservation of natural resources and provide for water quality improvements?	Concept includes elements to contribute to natural resource conversation and protection of Beneficial Uses that include improved water quality, providing multi-benefits to the community and business that includes Ecosystem Services.	1, 3, 4, DEH VHRP Guidelines
8. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost effectively and provide for feasible long-term O&M compared to other concepts?	Multi-benefits are achieved by meeting the other goals and for minimizing long-term O&M costs that can be part of the overall restoration O&M.	8, DEH VHRP Guidelines

TABLE 10-7
SUMMARY OF KEY CONCEPTS THAT REDUCE MOSQUITO PRODUCTION – DEH VHRP DESIGN GUIDELINES

DEH VHRP Design Guidelines

Wetland and Water Quality Treatment System Design

General Concepts

- Incorporate steep edges to minimize vegetation along wetland margins.
- Maximize deep, open water areas to provide predator habitat, water circulation, and wave action.
- Ensure surface connection and multiple flow paths among wetland cells and pools.
- Minimize still, isolated, shallow areas.
- Facilitate access for surveillance, maintenance, and mosquito control activities.

Created Wetlands and Effluent Treatment Ponds

- Design to achieve a hydrological regime unfavorable for mosquito production (e.g. avoid isolated pools or repeated drying/inundation cycles during periods of peak mosquito activity; incorporate water conveyance to facilitate relatively rapid changes in water level).
- Include permanent, open water pools with a depth of 1.5 meters or more.
- Ensure connections (multiple flow paths) between wetland cells and pools.
- Incorporate mosquito-eating fish.

Storm Water Treatment Facilities

- Design to limit water retention time to less than 72 hours.
- Where feasible, cover open water structures that hold water longer than 72 hours.
- Include trash racks, debris screens, or similar components to prevent clogging.
- Where feasible, install curtains, valves, or similar components to prevent mosquito access.
- Avoid use of loose riprap or other materials that can create standing water.
- Incorporate on-going maintenance.

WATER MANAGEMENT

General Concepts

- Water delivery systems, drainage systems, levees, and other water control structures should be designed and maintained to minimize mosquito production (e.g. promote rapid flooding and quick drawdown, enhance populations of naturally occurring predators of mosquitoes, etc.).
- Where feasible, limit the presence of standing, shallow water (< 30 cm depth) to less than 72 hours.
- Provide circulation and wave action.

Created Wetlands and Effluent Treatment Ponds

- Adequately size and maintain water control structures and pumps.
- Use sprayers, spinning wheels or other systems to promote agitation and wave action.
- Use of recirculating water sprinkler systems to prevent mosquito activity.

Storm Water Treatment Facilities

- Ensure water retention time is less than 72 hours.
- Ensure active maintenance to avoid clogging of drains, pipes, and outfalls.

VEGETATION MANIPULATION

General Concepts

- When possible, limit vegetation to narrow strips (< 5 m wide).
- Remove dense emergent vegetation and sediment that limits wave action and predator access.
- Provide access for mosquito surveillance and control activities.

Created Wetlands and Effluent Treatment Ponds

- Remove vegetation and sediment as part of ongoing maintenance.

Storm Water Treatment Facilities

- Remove vegetation and sediment as part of ongoing maintenance.

Improvement of Larvicide Treatment Effectiveness

Wetland systems present challenges to vector management that utilize larvicide applications. Hand-delivered applications of larvicide can be effective for specific locations that are accessible, such as ponded water below storm drain outfalls in urban areas. However, Los Peñasquitos Lagoon contains numerous areas of potential breeding habitat that are inaccessible due to thick stands of cattails (*Typha*). The Lagoon also contains sensitive areas with rare and endangered plants and foraging/nesting habitats for listed birds that are vulnerable to trampling during hand application efforts. Spatial challenges that prevent comprehensive treatment using hand application across the Lagoon's 565 acres and the use of motorized boats within the lagoon channels conflict with management policies for a State Marsh Natural Preserve. Because of the inherent limitations involved in hand applications of larvicide, DEH tends to use aerial applications by helicopter. While this method can treat larger areas and avoids direct impacts to Los Peñasquitos Lagoon's sensitive habitats, it does present potential impacts to bird species due to the low-level flights. Aerial applications of larvicide also tend to be ineffective in riparian and brackish marsh due to the tree and plant canopies that cover areas of potential breeding habitats of freshwater mosquitos such as *C. tarsalis*. Performance metrics used for this criterion focus on the Vector Concept's ability to improve the effectiveness of larvicide applications through removal of vegetation within riparian and brackish areas and/or elimination of standing water through improved circulation and drainage.

Potential Impacts to Sensitive Habitat & Species

This criterion considers potential impacts to sensitive habitat and/or species that could be generated by a Vector Concept. Los Peñasquitos Lagoon's status as a State Marsh Natural Preserve places the protection of its native habitats and sensitive species as paramount over all other activities within the Lagoon. This criterion captures the need to prioritize habitat and species while not discounting the importance of protecting public health through improved vector management of *C. tarsalis*. Performance metrics for this criterion consider whether the Vector Concept has considered potential impacts and has either avoided or minimized them. The nature of the impacts (temporary or permanent) is also considered, since temporary impacts generated during implementation can be justified if the Vector Concept delivers greater benefits to habitat and/or public health during post-implementation.

Contribution to Conservation and Improved Water Quality

Potential contribution to conservation and improved water quality is captured under this criterion to improve evaluation of Vector Concepts ability to support Los Peñasquitos Lagoon's role as a State Marsh Natural Preserve and its Beneficial Uses identified in the San Diego Basin Plan. Performance metrics used for this criterion consider whether a Vector Concept includes elements that contribute to natural resource conservation and protection of Beneficial Uses that include improved water quality.

Capital and Long-Term Maintenance Costs

Capital and long-term maintenance costs must also be considered when evaluating Vector Concepts to factor in sustainability and additional costs that can accrue beyond implementation. Performance metrics for this criterion consider whether Vector Concepts provide multiple benefits while minimizing long-term O&M costs.

10.4.2 Concept Assessment

Assessment results for Vector Concepts presented in Section 10.4 are summarized in **Table 10-8** using the assessment criteria and performance metrics summarized in Section 10.4.1 and **Table 10-7**. Each of the four Vector Concepts is evaluated in **Table 10-8** against the assessment criteria and then ranked from 1 (highest) to 4 (lowest) based on overall performance. **Table 10-8** also includes an additional criterion not provided in Section 10.4.1 to help identify Turnkey (i.e. shovel-ready) Projects, since these projects are given preference for funding from the VHRP. A combined ranking or prioritization is then assigned that integrates a Vector Concept's performance against Assessment Criteria 1-8 and Criterion 9 to identify those projects that can be considered competitive for funding through the VHRP Competitive or Directed Grant Programs.

The results of the assessment as presented in **Table 10-8** indicate the following prioritization of the Vector Concepts:

Higher Priority Projects

- Reduction of Mosquitos Breeding Habitat in Zone 3 – Freshwater Management of DEH Site 557.
- Reduction of Mosquitos Breeding Habitat in Zone 4 – Freshwater Management of Storm Drain Outfalls from Sorrento Valley Road - Tripp Court Outfall.

Lower Priority Projects

- Reduction of Mosquitos Breeding Habitat in Zone 2 – Improving Flow through McGonigle Road Culvert – DEH Site 626.
- Reduction of Mosquitos Breeding Habitat in Zone 2 – Freshwater Management of DEH Site 626.

TABLE 10-8
SUMMARY OF THE ASSESSMENT OF VECTOR CONCEPTS

Assessment Criteria	Metrics for Concept Evaluation	Improving Flow through McGonigle Road Culvert – DEH Site 626	Freshwater Management of DEH Site 557	Freshwater Management of DEH Site 626 Storm Drain Outfall	Freshwater Management – Tripp Ct. Storm Drain Outfall
1. Known Mosquito Breeding Location – Is the site a known DEH mosquito breeding site**?**	DEH Site identification.	✔ DEH Site 626	✔ DEH Site 557	✔ DEH Site 626	
2. Mosquito Abundance and Type/Threat Permanence and Recurrence – Does the site possess conditions that can result in breeding habitat for the species that carries West Nile virus and are these conditions persistent throughout the year?	Site conditions that include persistent year round ponding of freshwater, which is less than 4 ft. deep, does not circulate or flush for long periods of time, and is not open water that is subject to wind effects.	✔ Storm water ponds behind culvert due to structural failures that impede circulation and draw-down times of impounded waters.	✔ Freshwater fed by groundwater ponds with poor drainage.	✔ Storm water and dry weather flows ponds behind concrete weir in stilling basin.	✔ Storm water and dry weather flows pond in open channel and at outfall due to blockage and poor drainage.
3. Proximity to Urbanized Area and Sensitive Receptors – Is the site located near potential sensitive receptors?	Site is located adjacent to residential communities and/or recreational areas where people, including sensitive receptors, would be exposed to mosquitos within a 2-mile radius from the site, .	✔ Located next to communities, commercial area, and park.	✔ Located next to communities, commercial area, and park.	✔ Located next to communities, commercial area, and park.	✔ Located next to communities, commercial area, and park.
4. Consistency with Wetland Design Concepts for Vector Control – Is the Concept consistent with the DEH VHRP wetlands design guidelines for vector habitat remediation?	Concept is consistent with DEH VHRP Wetland Design Guidelines that are presented in Table 10-7.	✔ Concept is consistent with guidelines.	✔ Concept is consistent with guidelines.	✔ Concept is consistent with guidelines.	✔ Concept is consistent with guidelines.
5. Improvement of Larvicide Treatment Effectiveness – Does the Concept improve conditions that allow for more effective larvicide treatment?	Concept improves conditions for more effective larvicide treatment through removal of vegetation and/or elimination of standing/stagnant water through improved circulation and drainage.	✔ Project will address standing water.	✔ Project will address standing water and reduce reed type vegetation.	✔ Project will address standing water.	✔ Project will address standing water.
6. Potential Impact to Sensitive Habitat/Species – Does the Concept have the potential to impact sensitive habitat and/or species?	Concept has considered potential impacts to sensitive habitat and species and has either avoided or minimized these impacts, such that no significant impact will occur.	✔ Project minimizes impacts and mitigation.	✔ Project minimizes impacts and mitigation.	✔ Project minimizes impacts and mitigation.	✔ Project minimizes impacts and mitigation.
7. Contribution to Conservation and Improve Water Quality – Does the Concept contribute to conservation of natural resources and provide for water quality improvements?	Concept includes elements to contribute to natural resource conversation and protection of Beneficial Uses that include improved water quality, providing multi-benefits that in to the community and business that includes Ecosystem Services.	✔ Project improves salt marsh habitat and water quality.	✔ Project improves salt marsh habitat and water quality.	✔ Project improves water quality.	✔ Project improves salt marsh habitat and water quality.
8. Capital and Long-Term Maintenance Costs – Does the Concept provide multi-benefits cost-effectively and provide for feasible long-term O&M?	Multi-benefits are achieved by meeting the other goals and for minimizing long-term O&M costs that can be part of the overall restoration O&M.	✔ Project has multi-benefits and reduces long-term O&M.	✔ Project has multi-benefits and reduces long-term O&M.	✔ Project has multi-benefits and reduces long-term O&M.	✔ Project has multi-benefits and reduces long-term O&M.
	Overall Ranking	**2**	**1**	**4**	**3**
9. Project Readiness for Implementation – Is it a Turnkey Project, including design and implementation?	VHRP prefers applications for Turnkey Projects that are ready for implementation or combine design, permitting, and construction as part of the application.	No design and permitting completed. Will most likely require a MOA with the City of San Diego and CSP for long-term maintenance.	Investigation of groundwater sources is needed prior to design (currently underway). No design and permitting completed.	Coordination is needed with the City of San Diego on design approach. No design and permitting completed.	City may move forward with design and permitting in 2016/2017 (FY2017).
	Ranking for Project Readiness	**4**	**3**	**2**	**1**
	Overall Ranking	**3**	**2**	**3**	**2**

CHAPTER 11
Next Steps

Chapter 11 outlines key actions to pursue in following the completion of the Los Peñasquitos Lagoon Enhancement Plan (Lagoon Enhancement Plan) update. The chapter begins with a summarized description of "next steps" needed to move the preferred Lagoon Restoration and Enhancement Concepts (Lagoon Concepts) from Chapter 10, Public Access & Safety Concepts (Public Access Concepts) from Chapter 8 and Vector Habitat Concepts (Vector Concepts) in Chapter 9 toward implementation so that they can be "shovel ready" and better aligned for funding. Chapter 11 then proceeds to discuss coordination and collaboration opportunities with key stakeholder groups on the local, watershed and regional levels. Inlet maintenance, ecosystem services (flood management, carbon sequestration), species management (wildlife corridors, sensitive species, invasive species), monitoring program, and improving the Los Peñasquitos Lagoon Foundation's capacity are also discussed with regard to their roles in providing ongoing support for the goals and objectives of the updated Lagoon Enhancement Plan. The chapter concludes with a brief listing of federal, state, and local plans that the updated Lagoon Enhancement Plan is in compliance with.

11.1 Next Steps – Restoration Design Phase for the Preferred Lagoon Concept

As demonstrated in Chapter 10, Lagoon Concept 2 (Freshwater Management through Channel Improvements) was selected through comparative analysis as the preferred conceptual approach toward large-scale restoration of salt marsh and transitional areas in Los Peñasquitos Lagoon. Moving Lagoon Concept 2 toward implementation will require additional efforts beyond the scope of the Lagoon Enhancement Plan update. Understanding the need to map out the next steps, a Restoration Design Phase was developed with the goal of making make large-scale recovery and enhancement of Los Peñasquitos Lagoon's native salt marsh "shovel ready." The Restoration Design Phase aims to achieve this goal through pursuing the following objectives:

1. Establish quantifiable metrics to describe baseline conditions for water entering Los Peñasquitos Lagoon from the watershed (surface and sub-surface flows) and along its boundaries (storm water outfalls), as well as entering/exiting through the ocean inlet.
2. Develop a freshwater "conceptual model" for the Lagoon using data sets generated by Objective 1 along with additional data sets to be used in conjunction with future modeling and design efforts.
3. Ensure that inlet maintenance efforts maintain tidal circulation in lagoon channels at a level that supports the recovery of salt marsh habitat and transitional areas in Los Peñasquitos Lagoon in conjunction with protection of sensitive species and public safety.

4. Attempt to build consensus for supporting the design, permitting and implementation of the preferred Lagoon Concept from key stakeholder groups that include:
   a. California State Parks (CSP)
   b. State Coastal Conservancy (SCC)
   c. Los Peñasquitos Lagoon Foundation (LPLF)
   d. City of San Diego
   e. Local community members and business owners
   f. Select non-profits and volunteer groups active in the Torrey Pines State Natural Reserve (TPSNR)
   g. Resource agency staff
   h. Wetland experts.
5. Develop, assess, and select alternative approaches to implementing the preferred Lagoon Concept (Lagoon Concept 2).
6. Evaluate alternative approaches to implement Lagoon Concept 2 through a Design and Feasibility Study.
7. Select the restoration alternative that best optimizes the balance of long-term resiliency of salt marsh habitat recovery, implementation and maintenance costs, sensitive habitat/species disturbance, and mitigation requirements.
8. Develop the design of the selected alternative from the Design and Feasibility Study.
9. Conduct regular meetings with key stakeholder groups that include CSP, LPLF, the City of San Diego, resource agency staff, and wetland experts to solicit input and facilitate consensus building during design phases (e.g. 30%, 50%, 90%) and prior to pursuing environmental documentation.
10. Coordinate efforts between updated Lagoon Enhancement Plan and the Water Quality Improvement Plan (WQIP) prepared for the Los Peñasquitos Watershed so that watershed improvements support recovery and resilience of salt marsh habitat transitional areas in Los Peñasquitos Lagoon.
11. Complete necessary agreements with key land owners that include CSP and SCC.
12. Prepare and complete an Environmental Impact Report (EIR) under the California Environmental Quality Act (CEQA) and Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA).
13. Secure required resource agency permits and waivers.
14. Identify potential funding sources for implementation of the preferred Lagoon Concept.

The Restoration Design Phase will build upon the efforts conducted during the Lagoon Enhancement Plan update that included detailed vegetation mapping, baseline condition modeling, and habitat trajectory modeling. Since salt marsh restoration design and implementation is being driven, in part, by the Los Peñasquitos Lagoon Sediment Total Maximum Daily Load (Lagoon Sediment TMDL), CSP and LPLF will work with the City of San Diego to meet objectives of the Restoration Design Phase. Additional stakeholder involvement and input will be solicited with opportunities that include a Resource Advisory Committee (RAC) comprised of select resource agency staff and landowners; a Scientific Technical Advisory Committee (TAC) comprised of experts in the fields of wetland ecology, salt marsh restoration, coastal and lagoon processes, and modeling; public workshops; and presentations to individual stakeholder groups.

It is expected that the following key steps will be required to complete the Restoration Design Phase and meet each objective (OBJ):

1. Initial Study and Addressing Key Data Gaps (OBJ: 1-3).
2. Establish a Scientific Technical Advisory Committee to help guide both modeling and design efforts, as well as compliance under CEQA/NEPA, acquisition of resource agency permits, and potential funding mechanisms and/or opportunities (OBJ: 4-9. 11-14).
3. Restoration Modeling (OBJ: 1-3).
4. Land Owner and Resource Agency Consultation (OBJ: 4-9, 11-14).
5. Design and Feasibility Study (OBJ: 5-13).
6. Environmental Documentation that includes CEQA/NEPA and resource agency permits (OBJ: 12 & 13).
7. Identification of funding opportunities (OBJ: 14).

Conducting an Initial Study and filling key data gaps will be the first step of the Restoration Design Phase with additional data gaps filled at the appropriate milestones (e.g. chemical analysis of sediment to be excavated in areas designated for focused grading). With guidance from the TAC, the Restoration Design Phase will then move to better characterize hydrodynamic function of existing conditions within Los Peñasquitos Lagoon and develop alternative approaches to modify lagoon channels and elevation gradients through engineering analysis supported by modeling efforts that integrate lagoon inlet processes, watershed inputs, lagoon inlet functions, tidal datum (current and adjusted for sea level rise), flood water attenuation and release, and sediment conveyance through the lagoon channels (during storm events). Results from these efforts will then be incorporated into the Habitat Evolution Model (HEM) developed for Los Peñasquitos Lagoon that will be used to conduct a feasibility assessment of the alternative approaches developed for the preferred Lagoon Concept with consideration to balancing large-scale recovery of salt marsh and transitional areas with estimated construction cost, estimate maintenance needs and associated costs, disturbance to sensitive habitats/species, and mitigation requirements. The final outcome of HEM evaluation process will be the selection of the preferred approach for implementing Lagoon Concept 2 that will then undergo engineering design. Once sufficiently detailed for environmental assessment, the design will then be reviewed and certified under the CEQA/NEPA process. Consultation with the RAC and TAC will occur throughout the Restoration Design Phase to solicit input and guidance needed to facilitate acquisition of permits/waivers and move toward final design. The design will undergo review by CSP, LPLF, and the City prior to finalization and development of construction plans and specifications. Input from resource agencies and stakeholders during the CEQA and permit review periods will also be considered and incorporated where appropriate into the final design. Potential funding sources are identified for the near-term to assist in moving these concepts through implementation, though it is acknowledged that this list is not comprehensive and will need to be updated as funding opportunities close and new ones become available.

A brief summary of these key steps needed to complete the Restoration Design Phase and make salt marsh restoration in Los Peñasquitos Lagoon “shovel ready” is provide in the following sub-sections.

11.1.1 Initial Study & Addressing Data Gaps

The Initial Study and key data gaps identified during the conceptual analysis and evaluation of potential habitat trajectories for Los Peñasquitos Lagoon are summarized in the following section and will be addressed in the Restoration Design Phase for the preferred Lagoon Concept. As expressed in Chapter 7, perhaps the largest data gap exists with regard to surface and sub-surface freshwater inputs to Los Peñasquitos Lagoon and how to effectively manage them both within the Lagoon and its watershed to support large-scale recovery of salt marsh and transition zones in a sustainable manner through the long-term. While the nexus between freshwater inputs and the rapid advance and establishment of brackish habitat in the upper lagoon has been clearly demonstrated, a freshwater conceptual model and a set of metrics are needed. The model and associated metrics will help to establish reliable freshwater management goals and milestones, inform hydrodynamic modeling within lagoon channels, and guide the conceptual design of alternative approaches for implementing the preferred Lagoon Concept. Alternative approaches may include modifying existing channel dimensions to enhance tidal flushing and draw down of impounded waters; restoration of historic channel alignments that are currently fragmented; and/or locating and design of new channels for dewatering purposes. For this reason, the following section is spent addressing data gaps specific to freshwater inputs to Los Peñasquitos Lagoon and providing key action items needed to fill them. Additional data gaps specific to conducting a Restoration Design Phase for large-scale recovery of salt marsh and transitional areas in an urbanized coastal estuary are also described in this section.

Surface and Groundwater Inputs of Freshwater

Data Gaps

Freshwater inputs to Los Peñasquitos Lagoon include surface flows from the creeks and storm drains that discharge directly to the Lagoon, as well as groundwater that seeps in as subsurface flows. Once seasonal in nature and driven by episodic event, freshwater inputs to Los Peñasquitos Lagoon now occur daily even during extended periods of dry weather as documented by the lagoon monitoring program since 1995. Data gaps as they apply to surface flows from creeks and storm water conveyance systems are further discussed below along with data gaps associated with groundwater presence and extent within the Lagoon. Previously presented in Chapter 7, uncertainties related to the influence freshwater inputs on habitat conversion and establishment are restated to provide additional justification of the need to fill the associated data gaps. Development of a Freshwater Conceptual Model for Los Peñasquitos Lagoon will then be discussed to help address these uncertainties. Action Items are then presented to help fill these data gaps and develop the Freshwater Conceptual Model that will be used to inform additional modeling and design efforts needed to further move Lagoon Concept 2 toward implementation.

Data sets for surface flows entering Los Peñasquitos Lagoon from its main tributaries have been collected in low frequency efforts that were designed more to document presence of flow and to allow rough estimates of daily and seasonal variations. Vegetation transects, soil salinity sampling, and aerial imagery have demonstrated the impacts of daily freshwater intrusion into the Lagoon's native salt marsh habitat. However, developing reliable metrics through more focused monitoring efforts will be needed to generate a quantifiable baseline and spatial extent of freshwater inputs to the Lagoon. Developing these metrics will help to better characterize and define the nexus between freshwater inputs from surface flows entering Los Peñasquitos Lagoon from its tributaries and vegetation type conversion between halophytes to glycophytes. Establishing reliable metrics for surface flows of freshwater inputs to the Lagoon will also greatly assist efforts in the watershed to reduce dry weather flows under the WQIP by helping establish a baseline to which water reduction efforts can be compared to over subsequent years.

Currently there are limited data sets for dry weather inputs from storm water conveyance systems that discharge directly into the Lagoon and at the base of its tributaries. Field investigations have identified several cases of dry weather inputs of water from storm drains that include facilities at Carmel Valley Road and Portofino Drive and within Sorrento Valley. However, these inputs have not been quantified. Since it appears that the source of these discharges is from subsurface flows that enter the storm water conveyance system, rather than surface flows of visible runoff, discussion of dry weather inputs will be further described under sub-surface flows.

Groundwater contributions to dry weather water flows into Los Peñasquitos Lagoon are also believed to contribute to habitat conversion. Groundwater typically generates two types of freshwater inputs: sub-surface flows that extend into the Lagoon and seeps that enter storm water conveyance systems that discharge directly into the Lagoon or at the head of its tributaries. Sub-surface flows into Los Peñasquitos Lagoon have not been monitored and limited data sets are available in Sorrento Valley to track the potential underground advance of a volatile organic compound plume. Large areas of inundation visible north of Pump Station 65 are believed to be due, in part, to subsurface flows entering Los Peñasquitos Lagoon from Carmel Valley. Evidence of groundwater inputs entering storm water conveyance has also been observed along Carmel Valley Road near Portofino Road and in areas of Sorrento Valley adjacent to I-5 improvements (e.g. retaining wall along the southbound bypass and at Tripp Court). Quantifying and characterizing these flows will help inform management efforts to reduce their impact on native lagoon habitats and contribution to breeding areas of *Culex tarsalis* within and around Los Peñasquitos Lagoon.

Uncertainties

As expressed in Chapter 7, there currently exists two primary uncertainties with regard to freshwater inputs and the role they play with regard to baseline conditions and potential habitat trajectories in Los Peñasquitos Lagoon (See below).

- **Uncertainty 1, Relative contributions of freshwater from surface water and groundwater on habitat conversion:** Higher levels of groundwater may sustain freshwater and brackish marsh habitats if surface freshwater is removed or reduced. It is hypothesized that groundwater levels are low enough that freshwater and brackish marsh would be replaced by other habitats with a reduction in freshwater surface flow.
- **Uncertainty 2, Vegetation response to reduction in freshwater influence in existing transition/conversion zones prior to tidal inundation:** Reduction of freshwater without increases in tidal water may lead to invasion by weeds. It is hypothesized that transitional habitat (salt marsh to upland) would establish in this zone. Little data exists on the conversion of brackish/freshwater marsh to transition zone vegetation in areas that would not be tidally influenced in the near term.

Addressing these uncertainties through the development of the Freshwater Conceptual Model will be necessary to verify assumptions made with regard to the ability to recover salt marsh and transitional habitat in the Lagoon through freshwater management to be pursued in the preferred Lagoon Concept, as well as inform design alternatives meant to dewater areas of brackish habitat and ponded water that facilitate habitat conversion and breeding of *C. tarsalis*. The Freshwater Conceptual Model will also help inform the planned phasing of the restoration to allow for adaptive management and assessment of restoration efforts. A phased approach will allow for gathering of data on the performance of the restoration efforts and is the most appropriate for the Lagoon given these uncertainties that may not be able to be fully quantifiable. An opportunity to develop the first phase of the restoration to allow for assessment of effectiveness of proposed restoration approaches through adaptive management is the current work being done by the City of San Diego in the Sorrento Valley portion of the site as discussed in Chapter 7. The first phase (Phase 1) of the restoration is further discussed in Restoration Design Phase (Section 11.1), along with brief description of how it will be used to inform Phase 2 restoration.

Action Items

Filling these data gaps can be performed through the development of freshwater monitoring program that considers surface flows entering Los Peñasquitos Lagoon from both its tributaries and storm water outfalls. A groundwater investigation will also be needed to identify both depth and extent of groundwater intrusion into the Lagoon. Initial data sets generated by these efforts will be used to develop the Freshwater Conceptual Model that will be used to help characterize baseline conditions with regard to freshwater inputs. The model will also be used to further refine the monitoring program for surface flows and groundwater intrusion by identifying priority areas requiring additional monitoring and/or adapting monitoring methods to better address key uncertainties as they apply to salt marsh restoration, enhancement, and long-term preservation. The Freshwater Conceptual Model will also help to improve understanding of urban inputs to dry weather flows (e.g. augmentation from landscape irrigation) and greatly assist in the development, implementation, and assessment of management measures aimed at reducing dry weather inputs from the identified sources around the Lagoon and more importantly from the watershed through means such as source control (e.g. installing smart irrigation), low-flow diversions, and capture/re-use.

Key elements of the monitoring plan used to develop the Freshwater Conceptual Model for Los Peñasquitos should include the following:

- **Continuous Surface Flow Measurements** – Conduct continuous flow measurements within the Lagoon's main tributaries (Carmel Creek, Los Peñasquitos Creek and Carroll Canyon Creek) to improve understanding of watershed inputs needed to characterize current baseline conditions. Continuous data sets are preferred since they are able to better capture variations in flow rates that can be attributed to urban landscape runoff (e.g. peak flows in the evenings or early morning hours when irrigation tends to occur), improve the accuracy of monitored responses to rain events within each tributary (e.g. development of hydrographs), and measure seasonal variation with regard to discharge rates into Los Peñasquitos Lagoon. Data sets generated by the monitoring program will be compared to data sets generated by permanent and temporary flow gauges and monitoring stations operating within the watershed to improve comprehensive understanding of dry weather and storm runoff inputs to Los Peñasquitos Lagoon from its watershed.

- **Direct Discharge Investigation** – An investigation of direct flows into Los Peñasquitos Lagoon from storm drains along its borders and within its historic floodplain (e.g. Sorrento Valley) need to be conducted to characterize the contribution of storm water conveyance systems to dry weather inputs of freshwater into the Lagoon and its tributaries. Measured flow and source identification will be included in this investigation to determine the direct and indirect contribution of irrigation runoff, dewatering systems and/or urban infrastructure to elevated water tables and seepages.

- **Groundwater Investigation** – An investigation within the floodplain and upper reaches of Los Peñasquitos Lagoon is needed to determine the depth and extent of groundwater entering the Lagoon from the watershed. A groundwater contour map will be developed to demonstrate the influence and contribution of groundwater levels to the establishment of brackish habitat and invasive glycophytes in areas of historic salt marsh and transitional areas within Los Peñasquitos Lagoon's marsh plain. Data generated by the groundwater investigation (e.g. from piezometers) will also be used to help inform design alternatives to be developed in the Design & Feasibility Study for freshwater management elements of the preferred Lagoon Concept. Alternative approaches may include excavation additional channels designed to collect and divert groundwater away from the upper lagoon and into tidal channels or pumping of groundwater for beneficial reuse. Measurement of groundwater conductivity as a determination of salinity is also needed to estimate the limits of the freshwater, brackish and salt water boundaries within the sub-surface of the upper lagoon. The results of the groundwater investigation will be used to further develop the Freshwater Conceptual Model.

  Locations for groundwater monitoring stations in the upper reaches of Los Peñasquitos Lagoon will be determined in consultation with CSP and LPLF after consideration of pre-existing data sets/monitoring efforts, sensitive habitats and species, and access needs. Proposed locations for monitoring stations to be installed outside of CSP lands will be coordinated with the appropriate landowners and resource agencies, since the study area may extend into the Carmel Valley and Sorrento Valley to capture groundwater levels and potential charging from urban sources in the western reaches of these drainage basins adjacent to the Lagoon.

- **Coordination with Los Peñasquitos Lagoon Biologic Monitoring Program and Watershed WQIP** – Biological monitoring of Los Peñasquitos Lagoon has been conducted continuously since 1987 under the supervision of LPLF and guidance of wetland experts that include Joy Zedler, Chris Nordby, Greg Williams, and Jeff Crooks. As a result, Los Peñasquitos Lagoon has one of the longest, uninterrupted data sets for coastal lagoons in California. Data sets generated by this monitoring program include water quality (e.g. dissolve oxygen (DO), salinity, and temperature), faunal sampling of aquatic species, and vegetation transects that take into account plant associations and soil salinity. Additional efforts have included nutrient sampling to help inform a regional study on the effects of eutrophication of coastal lagoons and potential sources. The monitoring program was expanded in 2012 to include four continuous monitoring stations with telemetry to provide access to "real time" data sets and deployment of pressure sensors to help calibrate tidal influence within lagoon channels. These efforts were conducted to help provide a better characterization of Lagoon's aquatic environs in areas of tidal influence and below lagoon tributaries. Continuing the monitoring program will be needed to inform and calibrate modeling efforts to be conducted during the Design & Feasibility Study through the introduction of valuable data sets and the ability to discern between trends and aberrations with regard to lagoon health and habitat trajectories needed to evaluate the success of large-scale salt marsh restoration under the preferred Lagoon Concept. The monitoring program will most likely need to be expanded to include monitoring protocols developed to measure the success of salt marsh restoration and other lagoon improvements (e.g. reduction of mosquito breeding areas favorable to *C. tarsalis*) implemented under the preferred Lagoon Concept.

  Coordination with the Los Peñasquitos Watershed WQIP will provide great value with regard to setting baseline metrics for freshwater inputs from the watershed that will be used to assess and evaluate reduction efforts within the watershed that are conducive to salt marsh recovery and improved vector management in Los Peñasquitos Lagoon through the long-term.

Engineering Surveys (Channel Cross-Sections & Inlet Area)

Elevation surveys of the marsh plain, channel cross-sections and the inlet area have been conducted within Los Peñasquitos Lagoon almost annually since 1995. Continuing these surveys while incorporating additional transects will be needed to better inform modeling efforts for lagoon hydrodynamics and inlet morphology that will be conducted during the Restoration Modeling. Additional transects within the Lagoon will most likely include alignments that better depict changes in elevation gradients across the inlet area that include areas of persistent shoaling. It is also expected that additional survey transects will be needed for both Torrey Pines State Beach and within Sorrento Valley. Elevation surveys along Torrey Pines State Beach have been conducted to a certain degree by LPLF, Scripps Institution of Oceanography (SIO) and the San Diego Association of Governments (SANDAG). However, these efforts have been conducted in more of a piece-meal fashion to answer specific questions and currently do not adequately characterize how coastal processes affect Los Peñasquitos Lagoon and its inlet area (e.g. beach profiles and inputs of marine sediments). Having a better understanding of how coastal processes affect lagoon dynamics (e.g. hydrology, water quality) will be needed to inform efforts to be conducted under Restoration Modeling and Restoration Design, as well as to better quantify and qualify impacts to the inlet at Los Peñasquitos Lagoon from beach nourishment efforts within the Oceanside Littoral Cell. Additional surveys within Sorrento Valley will help better inform monitoring and modeling efforts used to determine baseline conditions and needed improvements for hydrologic connectivity between the Lagoon and this section of the watershed that includes both Los Peñasquitos Creek and Carroll Canyon Creek. Survey transects will most likely be needed for Carmel Creek to better characterize this tributary to Los Peñasquitos Lagoon.

Action Item

Modify the existing survey program at Los Peñasquitos Lagoon and Torrey Pines State Beach to incorporate additional transects needed to better inform hydrodynamic modeling of coastal processes, the inlet area and within lagoon channels. Include survey transects for Sorrento Valley and Carmel Creek to better inform hydrodynamic modeling of watershed inputs. Conduct surveys at a frequency that will capture seasonal variation with follow up surveys conducted as needed (e.g. before and after excavation of the inlet area to restore tidal mixing within Los Peñasquitos Lagoon).

Sediment Characterization

Sediment characterization within areas identified for implementation of the preferred Lagoon Concept will be performed to determine soil suitability for preferred plant types and associations under baseline conditions and modified conditions (e.g. improved flushing and tidal mixing from channel modifications, sea level rise). Grain size and chemical composition will also be required for areas identified for focused grading and/or excavation within Los Peñasquitos Lagoon and the lower reaches of its watershed to determine opportunities for beneficial re-use (e.g. beach disposal) and to help quantify hauling and disposal costs under the Restoration Design Phase. Identifying sampling locations within the study area to determine soil suitability for recovery of salt marsh and transitional habitats can be performed during the initial stages of the Restoration Design Phase once the project footprints are identified for each alternative approach. Additional sampling locations will most likely be needed once areas for channel modification and focused grading have been delineated. Sampling within the inlet area for grain size already occurs as part of annual inlet maintenance program. Chemical analysis is not required as samples consistently show more than 90% sand.

Action Item

Perform sediment characterization (e.g. grain size analysis, salinity) as needed to determine baseline conditions within the preferred Lagoon Concept's project area and to establish potential targets (e.g. increased salinity, soil-type) needed to facilitate recovery of salt marsh and transitional areas to promote upslope migration in response to sea level rise. Conduct soil compaction, grain size, and chemical analysis for areas designated for grading and excavation pursuant to construction needs and compliance with resource agency protocols with regard to disposal, potential onsite reuse, and/or beneficial use nearby (e.g. disposal on Torrey Pines Beach).

11.1.2 Scientific Technical Advisory Committee (TAC)

A TAC will be needed to help guide modeling and design efforts, as well as compliance under CEQA/NEPA and acquisition of resource agency permits. It is anticipated that the TAC will be comprised of experts in the field of wetland ecology, coastal and lagoon processes, salt marsh restoration, and modeling. Preference will be given to prospective TAC members that demonstrate one or several of these qualifications along with experience working with Los Peñasquitos Lagoon. It is anticipated that representatives from CSP and the SCC will also participate on the TAC as key land owners within the Lagoon and adjacent upland areas. The intent of the TAC is to ensure that both the restoration approach and final design maximize improvements that can be sustained within the Lagoon while also meeting the goals and objectives of the updated Lagoon Enhancement Plan. The TAC will draw upon their collective experience to help frame realistic expectations and guide adaptive management with regard to salt marsh restoration through "lessons learned" within the region and Los Peñasquitos Lagoon itself.

Action Item

LPLF and CSP will organize and implement the TAC according to the specifications provided above.

11.1.3 Restoration Modeling

Key efforts to be conducted under Restoration Modeling are summarized below.

Inlet Dynamic Modeling & Assessment of Inlet Maintenance

A Quantified Conceptual Model (QCM) will be used to mimic inlet dynamics at Los Peñasquitos Lagoon to help predict and quantify inlet processes under existing conditions and alternatives for implementing the preferred Lagoon Concept. The QCM will also allow integration of projected sea level rise scenarios and account for increased sediment deposition within the inlet area associated with beach replenishment activities planned for the region. The QCM operates on two core concepts:

- All water flows entering and leaving the system should balance.
- The net erosion/sedimentation of the inlet channel results from a balance of erosive (fluvial and tidal) and constructive wave processes.

Based on these concepts, the QCM evaluates tidal inlet morphology and resulting lagoon hydrology while accounting for the fact that bar-built estuaries such as Los Peñasquitos Lagoon are often defined by a morphologically unstable inlet area that influences lagoon stage, volume and flows. The model dynamically simulates time series of inlet, beach, and lagoon state based on external forcing from waves, tides, and inputs from tributaries. These simulations can be run with a range of variations of external conditions to reflect predicted scenarios for inlet morphology and maintenance requirements (e.g. restoring the tidal prism through mechanical excavation) over selected time series to support assessment and evaluation of alternative approaches for implementing the preferred Lagoon Concept under the Design and Feasibility Study. The QCM has been verified extensively using field data.

Hydrodynamic Modeling

Hydrodynamic modeling of Los Peñasquitos Lagoon channels and flood stages will be performed using an Environmental Fluid Dynamics Code (EFDC) model. This model was selected based on its support amongst the resource agencies and the fact that an EFDC model framework had already been prepared during the development of the Lagoon's Sediment TMDL. EFDC is considered a general purpose modeling package for multi-dimensional simulations of flow, sediment transport, and biochemical processes in receiving water bodies that include coastal estuaries. Aside from its ability to model hydrodynamics, salinity and temperature transport; the EFDC can be adapted to simulate the following:

- Cohesive and non-cohesive sediment transport
- Eutrophication processes
- Near-field and far-field discharge dilution from multiple sources
- Transport and fate of toxic contaminants in the water and sediment
- Transport and fate of various life stages of fish and invertebrates.

The EFDC model framework has been prepared and configured to simulate hydrodynamics within and sediment transport to Los Peñasquitos Lagoon. A preliminary model grid has been developed for and watershed loading has been simulated using a Loading Simulation Program in C++ to provide a general characterization of watershed inputs and lagoon impacts based on land use runoff coefficients and other processes. Additional modules will be developed and integrated into the EFDC framework followed by calibration of the model to include data sets that were not available during its initial development. Ultimately, the EFDC model will be used to help characterize hydrodynamic conditions (existing and modified) within Los Peñasquitos Lagoon needed to initiate development of alternative approaches for implementing the preferred Lagoon Concept identified in Chapter 10 of the updated Lagoon Enhancement Plan. These approaches will consider different lagoon channel and grading options through an iterative process to determine alternative approaches to optimize habitat restoration through effective use of freshwater management measures and improved flushing through increased tidal prism. The model results will also inform potential phasing of the restoration to allow for adaptive management and assessment of restoration efforts.

Results from the EFDC model and QCM model will then be incorporated into Habitat Evolution Model (HEM) that will be used to further develop and refine alternatives for implementing the preferred Lagoon Concept. HEM will focus on three primary areas:

- Incorporating the hydrodynamic modeling results to represent an area of freshwater influence in the Lagoon under existing conditions and with the restoration options.
- Incorporating the QCM model results to define how the inlet dynamics (and consequently, lagoon tidal datums and vegetation establishment) will change over time in response to sea level rise.
- Calibrating the HEM's river accretion module to better simulate inputs from the Los Peñasquitos Watershed.

Ultimately, the HEM will provide a tool for analyzing and evaluating the optimal approach for balancing large-scale recovery of salt marsh and transitional areas with estimated construction costs, maintenance needs and associated costs, disturbance to sensitive habitats/species, and mitigation requirements. Based on this evaluation, an alternative will be selected and further developed as part of the Design and Feasibility Study and will include the appropriate phasing elements to meet the timeframes established in the updated Lagoon Enhancement Plan, facilitate adaptive management, meet key milestones such as TMDL compliance under the Lagoon Target, and to coincide with potential opportunities provided in planned improvements to transportation infrastructure (e.g. the railway alignment through Los Peñasquitos Lagoon) over the next 50 years for the North County Coastal Corridor.

11.1.4 Land Owner and Resource Agency Consultation

As the major landowner and primary resource manager of Los Peñasquitos Lagoon, CSP will continue to play a major role in determining the approach and methods used to restore salt marsh to the Lagoon during the Restoration Design Phase. CSP will continue to work directly with LPLF, the City of San Diego, and select resource agencies to further develop and complete the final design and implementation of the preferred Lagoon Concept. CSP will also actively participate with the TAC, providing their own areas and levels of expertise in managing the resources provided by Los Peñasquitos Lagoon, a State Marsh Natural Preserve, and its linkages to the TPSNR. SCC will also actively participate in this effort as both a representative of the California Natural Resources Agency (CNRA) and landowner. SCC roles under CNRA include: protecting coastal resources on both the local and regional scale, managing in-lieu fee programs for compensatory mitigation, and carbon sequestration programs that identify coastal salt marsh as one of the prime habitat types for trapping greenhouse gases. SCC currently owns a parcel of land that sits between Sorrento Valley and the upper reaches of the Lagoon that has been identified for enhancement opportunities under Phase 1 implementation of the preferred Lagoon Concept. Aside from ongoing consultation with both CSP and SCC, it is expected that formalized agreements (i.e. Memorandums of Agreements and/or Understanding) with both of these state agencies will be required prior to implementation of salt marsh restoration under the preferred Lagoon Concept and improvements identified for the riparian corridor that extends through SCC's parcel and into Los Peñasquitos Lagoon from Sorrento Valley.

Early and ongoing consultation with representatives from key regulatory agencies will have an important role in informing the progression toward Final Design. It is expected that participation from the following resource agencies will be needed to help guide the Restoration Design Phase:

- Army Corps of Engineers (ACOE)
- United States Fish & Wildlife (USFW)
- San Diego Regional Water Quality Control Board (SD Water Board)
- California Department of Fish & Wildlife (CDFW)
- California Coastal Commission (CCC)
- Both CSP and SCC (as resource managers and landowners).

LPLF and CSP have already initiated early consultation with resource agencies that participate in the Southern California Wetland Recovery Project's Wetlands Managers Group. In early 2016, the Wetlands Managers Group selected large-scale salt marsh restoration in Los Peñasquitos Lagoon as a priority in their revised Work Plan for Southern California. Representing a regional perspective, members of the Wetlands Managers Group will be selected to participate on a RAC to be set up as a vehicle to solicit resource agency input in an efficient and collaborative manner during the Restoration Design Phase. Additional members of the regulatory agencies charged with reviewing projects under CEQA/NEPA and issuing permits within the Los Peñasquitos Watershed will also be identified and invited to participate on this RAC. It is expected that the RAC will meet twice a year to provide input with the understanding that additional meetings will most likely be needed during the initial stages of the Restoration Design Phase. Efforts will be made to capture their input the with regard to restoration approaches, engineering design, policy, respective guidance documents, permit requirements, potential mitigation, and compliance expectations.

11.1.5 Design & Feasibility Study

Following preliminary results from Restoration Modeling, a Design and Feasibility Study will be initiated to examine alternative methods to design and implement the preferred Lagoon Concept using a phased approach. Design elements for consideration will most likely include potential variations in the layout of channels, channel dimensions, and limits of grading of adjacent areas. Engineering cost estimates will be prepared for each alternative to help determine and compare feasibility as it relates to factors that include construction, hauling disposal of excavated material, impacts to sensitive habitats and species, mitigation requirements, and long-term maintenance needs. It is anticipated that the Design and Feasibility Study will be prepared in a two-step fashion to allow consideration of results and lessons learned during Phase 1 to be applied later in the development and consideration of alternatives for Phase 2 restoration.

Stakeholder involvement will be necessary to ensure that consideration of design alternatives and selection of the final design are properly vetted prior to CEQA/NEPA review and certification. LPLF, CSP, City of San Diego, RAC, and TAC will need to be consulted for input with regard to the development of alternatives to be assessed and evaluated during the Design and Feasibility Study, as well as the selection process for determining the best alternative for implementing the preferred Lagoon Concept for both Phase 1 and Phase 2. Once consensus has been achieved between these key stakeholder groups, engineering designs will be further developed for the selected alternative to levels that provide a basis for an EIR/EIS under CEQA/NEPA, while also facilitating acquisition of resource agency permits/waivers. Final designs (Phase 1 and Phase 2) will be completed during the acquisition of resource agency permits once all conditions and terms are known and validated.

As described in Chapter 6 and Chapter 7, phasing allows for an adaptive approach needed to reduce risks associated with trying to restore salt marsh in a complex system with numerous feedback loops and synergistic relationships between the watershed, lagoon, and coastal processes. An adaptive approach is also beneficial in attempting to mitigate ongoing stressors from urban areas adjacent to Los Peñasquitos Lagoon and within its watershed, as well as stressors and opportunities generated by climate change. The phased approached also allows for integration of additional elements as opportunities arise through programs such as the Vector Habitat Remediation Program and planned improvements for transportation infrastructure identified for the North County Coastal Corridor over the next 50 years. These additional elements may include the following:

- Dewatering of areas that contribute to vector habitat within Los Peñasquitos Lagoon but are located outside of the proposed project area for large-scale salt marsh recovery.
- Reconnecting historic tidal channels by removing portions the railroad berm or negotiating realignment possibilities should the current alignment be abandoned.
- Restoration and enhancement of the area north of the North Beach parking lot through improved tidal connectivity.
- Enhancing existing salt marsh habitat in Los Peñasquitos Lagoon to better support sensitive species.

As discussed in Chapter 7, implementation of the preferred Lagoon Concept will be conducted in two separate but complimentary phases. Phase 1 involves a pilot restoration project that will be used to help inform further development for large-scale salt marsh restoration to be pursued during Phase 2. The Phase 1 Pilot Restoration Project will further refine and apply design elements generated during the conceptual-level development of Lagoon Concept 2 (i.e. preferred Lagoon Concept) in an area with similar characteristics as the project area identified for Phase 2. Phase 1 also includes management and design elements within the historic floodplain in Sorrento Valley needed to support downstream salt marsh restoration for both Phase 1 and Phase 2.

These Phase 1 design elements include the following:

1) Lagoon “Pilot” Salt Marsh Restoration – restoration of up to 23 acres of historical salt marsh.
2) Sediment Management and Enhancement of the Riparian Corridor – improvement to sediment management to better address increased sediment accumulation above and below the confluence of Los Peñasquitos Creek and Carroll Canyon Creek that has led to habitat conversion and establishment of invasive plant species in an area that was historically transitional wetlands and floodplain.
3) Freshwater Management – improved connectively between the upstream creek channels and tidal channels located within Los Peñasquitos Lagoon through the creation of braided channel systems needed to reduce prolonged freshwater inundation and ponding that leaches salt from soils and contributes to loss of salt marsh habitat due to the establishment of invasive plant species (e.g. Italian Rye grass) and other glycophytes.
4) Reduction of Mosquito Breeding Habitats – reduction of mosquito breeding habitats by addressing freshwater ponding and stagnation at storm drain outfalls, within the unconnected creek channels, and depressions within the project area.
5) Reduction of Upstream Flood Risk – improved flood management through flood channel enhancement in the upstream portion of the project.

These five elements address existing conditions that include conversion of historical salt marsh and transitional habitats to large areas of brackish marsh and invasive grass from numerous factors including: an increase in freshwater flows during dry weather coupled with prolonged periods of storm flow and dry weather flows inundation; degraded riparian habitats due to sediment accumulation and establishment of invasive plant species within the understory; increased mosquitos breeding habitat due to water stagnation in fragmented channels, depressions and areas that lack connectivity to tidal channels, and flood risk from larger storm events.

The Phase 1 Pilot Restoration Project (Phase 1 Project) will use similar restoration approaches and strategies of Lagoon Concept 2 presented in Section 7.2 and in Chapter 10. Focusing on the area southwest of the railroad berm within Zone 3, the Phase 1 Project will serve as the first step toward meeting the Lagoon Sediment TMDL compliance target of an additional 84 acres by 2035 and help fulfil ongoing load reduction targets. Aside from helping meet Lagoon Sediment TMDL targets, the Phase 1 Project will help inform large-scale restoration to occur within Los Peñasquitos Lagoon during Phase 2. The restoration effort will include increasing tidal connection and inundation through extension and expansion of the existing tidal channel located downstream of this area, addressing sediment management within Sorrento Valley and the riparian corridor upstream of the proposed restoration site, and managing freshwater inputs through the improvements in the connectivity of existing branching channel systems between the upstream channel and the tidal channel. Options for focused grading and removal of surface sediments to increase tidal inundation and exposure to more saline sediment will also be part of the restoration. Salt marsh restoration conducted under the Phase 1 Project will be monitored to confirm successful conversion of the current degraded condition dominated by non-native grass (Italian rye grass) to native salt marsh vegetation and transitional habitats. Future phases will therefore learn from the effectiveness of the management measures implemented in Phase 1 that are consistent with the approaches for the larger restoration planned for the Phase 2.

11.1.6 Pursuit of CEQA and NEPA Determination

This section provides an abbreviated description of the CEQA/NEPA process and justification for combining salt marsh restoration to be pursued under both Phase 1 and Phase 2 into one CEQA/NEPA document. Key steps in the CEQA/NEPA process are then identified to help provide a road map for determination under both.

Compliance with CEQA will be required to support discretionary actions to fund and implement the restoration Los Peñasquitos Lagoon. The basic purposes of CEQA are to:

1. Inform the public and government decision makers regarding potential significant environmental effects of proposed activities.
2. Identify ways in which potential environmental damage can be avoided or significantly reduced.
3. Prevent significant, avoidable environmental damage by requiring changes in projects through the use of alternatives or mitigation measures.
4. Disclose to the public the reasons why a government agency approved the project if significant environmental effects are involved.

Compliance with NEPA will also be required to support acquisition of a permit from ACOE under Section 404 of the Federal Clean Water Act. The requirements of both CEQA and NEPA, along with other environmental regulations will dictate mitigation opportunities and requirements and shape the Final Design. As mentioned earlier, resource agency staff will be invited to review and comment during the development and completion of the Design and Feasibility Study and throughout EIR process to frame agency requirements and expectations early on to inform Final Design and facilitate permit acquisition.

While the design and implementation of salt marsh restoration in Los Peñasquitos Lagoon has been separated into phases, CEQA and NEPA determination will be pursued for both Phase 1 and Phase 2 together. Combining both Phase 1 and Phase 1 into one CEQA/NEPA document will avoid the perception of a "piece-meal" approach to developing the project (i.e. trying to present a phased project as two separate projects) that can create issues during regulatory review and delay approval under CEQA/NEPA and permit acquisition.

The following key steps will be undertaken in completing the CEQA/NEPA process for the preferred Lagoon Concept:

- Confirm the appropriate CEQA Lead Agency and the roles of others that may implement restoration phases will be the first step taken in the initiation of the CEQA compliance process. While CSP is the landowner, the City of San Diego has been the lead in funding the Restoration Design Phase.
- Consult with regulatory agencies and key stakeholders to clarify their roles, responsibilities with regard to the overall process, schedule, and requirements for both CEQA and NEPA. Consultation may also be needed to clarify the phased approach for implementing the preferred Lagoon Concept under CEQA/NEPA and the process for amending these documents once Phase 2 has been further developed in terms of approach and restoration design.
- Conduct and complete the necessary initial studies, reporting, and restoration design needed to initiate and complete CEQA/NEPA review. It is assumed that biological resources will be the primary focus, followed by cultural resources due the following:
  - Los Peñasquitos Lagoon contains numerous sensitive species that may be found within or adjacent to the proposed project areas for Phase 1 and Phase 2 salt marsh restoration (See **Table 4-9** and **Table 4-10**). Biological surveys will be required to identify presence or absence of these species and potential impacts (direct and indirect) to these species as they related to the proposed project area, scheduling, and construction methods.
  - Preliminary analysis indicates that the proposed footprint for excavation and grading will not impact cultural resources, which are confined primarily to upland areas that border Los Peñasquitos Lagoon. However, given the rich history of indigenous presence and activities surrounding the Lagoon and its upland areas, protection of cultural resources will need to be addressed. LPLF will continue to work closely with archaeologists from CSP and representatives of the Kumeyaay Nation to ensure that cultural resources are protected and that any findings (should they occur) are properly identified, excavated and recorded.
  - Paleontological resources are not expected since excavation will not occur to the depths that would trigger the possibility of impacting fossils. However, consultation will occur,

as needed, with the appropriate monitoring entity (e.g., San Diego Natural History Museum).

- Prepare Draft CEQA/NEPA Documents (Initial Studies, EIR, EIS) for internal review by the CEQA Lead Agency and key stakeholder groups that include resource agencies. Conduct as needed revisions based on feedback during this review process.
- Release Draft EIR/EIS for public review and comment. Conduct as needed revisions based on feedback during this review process.
- Prepare the Final CEQA/NEPA Documents. Written responses to all comments received on the Draft CEQA/NEPA documents will be prepared for internal review and then revised and published for public and agency review prior to approval of the project. A Mitigation Monitoring and Reporting Plan (MMRP) will also be completed. As needed, the CEQA team will support the CEQA Lead Agency and responsible agencies in preparing CEQA Findings and draft resolutions to support certification and project approval.
- Amend the Final CEQA/NEPA documents as needed to include Phase 2 elements and final design and determine the appropriate avoidance and mitigation measures.

11.1.7 Resource Agency Permits/Waivers

LPLF and CSP will consult the RAC to understand expectations and requirements with regard permits and waivers for both Phase 1 and Phase 2 prior to completion of the CEQA/NEPA documents in order to expedite the review and approval process. Following certification of the CEQA/NEPA documents, LPLF will submit permit application packages to the appropriate regulatory agencies identified below:

  - CDFW – compliance under the Section 1602 Streambed Alteration Agreement and California Endangered Species Act (CESA)
  - CSP – Right of Entry Permit and/or Science Collection Permit
  - San Diego Water Board – Section 401 Certification or Waste Discharge Authorizations
  - CCC – Coastal Development Permit
  - ACOE – Nationwide 404 Permit or Individual Permit
  - USFW – Consultation.

- With support from City staff, LPLF and CSP will also work on the local level to pursue the necessary permits (e.g. Site Development Permit), compliance determinations (e.g. Multiple Species Conservation Plan), authorizations for working within or next to easements (e.g. waterlines, powerlines, railway), and needed agreements (MOAs and/or MOUs) on the local level.

11.1.8 Potential Funding

There exist numerous sources to potentially fund the completion of the Restoration Design Phase and the phased implementation of the preferred Lagoon Concept. Key opportunities identified during the Lagoon Enhancement Plan update are provided below with the understanding that future updates will be necessary as current opportunities close and new ones emerge.

Lagoon Sediment TMDL – Lagoon Compliance Target

Responsible Parties named under the Lagoon Sediment TMDL include the City of San Diego, City of Del Mar, City of Poway and County of San Diego with Caltrans participating in a secondary role. This group is responsible under the TMDL to meet load reduction targets (e.g. sediment) and a Lagoon Target that requires restoring an additional 84 acres of salt marsh by 2035. While most of the funding allocated by Responsible Parties will be dedicated to watershed improvements under the WQIP, there does exist opportunities to fund improvements in Los Peñasquitos Lagoon that tie directly into meeting the Lagoon Target. The City of San Diego is currently funding the initial steps for the Restoration Design Phase for both Phase 1 and Phase 2 efforts to help meet targets for both load reduction and salt marsh restoration within the Lagoon. City-funded efforts include installation of piezometers within the upper Lagoon to better characterize ground water elevations, reach, and salinity levels. While the City has expressed interest in funding other portions of the Restoration Design Phase, annual budgets require review and approval by City Council and the mayor's office with consideration to other funding priorities and needs throughout the City's jurisdiction. Therefore, City involvement from a funding perspective must be considered and confirmed on an annual basis.

Regional Storm Water Permit – Supplemental Environmental Project & Alternative Compliance

National Pollutant Discharge Elimination System Permit (NPDES) are developed and administered on a regional level, hence the name Regional Storm Water Permit. Operators of municipal storm water conveyance systems (MS4) are considered Phase 1 Dischargers under the permit and, therefore, must meet its requirements that typically involves implementing monitoring programs and measures to reduce "constituents of concern" and other pollutants within a watershed or smaller drainage unit that can impair water quality and Beneficial Uses of the receiving waterbody. Inability to comply with requirements of the Regional Storm Water Permit can result in punitive measures that include fines and/or mitigation requirements.

When the enforcement action under the Regional Storm Water Permit involves a single event or a series of related events (e.g. sewage spills), the discharger can either opt to pay a fine or mitigate damage through a Supplemental Environmental Project (SEP). SEPs typically involve the development and implementation of a specific project or short-term program designed to offset impacts generated by the discharge(s) in question. While this may provide funding for elements of the Restoration Design Phase or during implementation of the preferred Lagoon Concept, SEPs are typically not reliable funding mechanisms for several reasons. In general, SEPs must be tied directly to an illegal discharge near the project area and can only be initiated by the discharger in lieu of paying a fine or to avoid pending legal action. SEPs cannot be imposed upon a discharger by resource agencies (e.g. San Diego Water Board) or the affected landowner and must be completed during short timeframe (1-3 years).

Understanding that some impacts cannot be abated or eliminated, the San Diego Water Board is considering alternative compliance as an appropriate measure for mitigation for Phase 1 Dischargers on a case by case basis under the newly revised Regional Storm Water Permit. Alternative compliance would create an opportunity for offsite mitigation for Phase 1 Dischargers in situations where onsite compliance is not practicable. While it has not been determined if alternative compliance will be available as an option, there stands a chance that restoration, enhancement and preservation of Los Peñasquitos Lagoon's valued habitats could be eligible for funding. This is due in most parts to the Beneficial Uses the Lagoon provides and its current status as an impaired water body under Section 303(d) of the Clean Water Act, which makes it a priority for restoration and enhancement efforts in the State.

LPLF and CSP currently coordinate efforts with the San Diego Regional Water Board to identify priority projects that could be eligible for funding under a SEP and/or alternative compliance should the latter be approved.

Proposition 1 State Bond Funds

Funded through the Water Quality, Supply, and Infrastructure Improvement Act of 2014, Proposition 1 (Prop 1) was approved by voters in November 2014. Prop 1 was developed to serve several purposes that include generating funding to address water quality, water supply, watershed protection and restoration, abating climate change through carbon sequestration, and protecting valued nearshore habitats that include Marine Protected Areas. Prop 1 funds are currently being allocated through various rounds by the SCC, CDFW, Wildlife Conservation Board (WCB), State Water Resources Control Board (State Water Board) and the Ocean Protection Council (OPC). Each agency has their own set of guidelines with regard to requesting proposals for projects with regard to requirements and funding priorities that may change from round to round. **Table 11-1** provides brief summary of total Prop 1 allocation of money, relevant Prop 1 priorities, funds to be allocated through grants during FY 2015/2016, and relevant priorities for each of these agencies.

Carbon Sequestration Credits (Cap and Trade)

An opportunity to secure funding for implementing the preferred Lagoon Concept could occur through programs such as Cap and Trade. Currently the SCC is working with other state agencies (e.g. CDFW, Air Resources Board) to develop a carbon sequestration protocol for coastal and delta wetlands in California that could be used to direct Cap and Trade funds toward salt marsh restoration, enhancement and preservation in Los Peñasquitos Lagoon. Please refer to Section 11.6.5 for further discussion regarding carbon sequestration in coastal wetlands and quantifying their contribution to abating climate change through the trapping of greenhouse gasses.

TABLE 11-1
PROP 1 FUNDING AMOUNTS AND PRIORITIES BY STATE AGENCY

Agency	Total Prop 1	Relevant Prop 1 Priorities	FY 2015/2016	Relevant 2015/2016 Priorities
CDFW	$285,000,000	• Restoring, protecting or enhancing habitat; • Modernizing stream crossings, culverts, and bridges; • Reconnecting historic flood plains; • Installing or improving fish passage • Improving ecological functions; • Acquisition from willing sellers; • Improving local watershed management; and • Removing sediment or trash.	$24,000,000	• Restore Coastal Watersheds (CWAMP Action). ○ Modernize stream crossings, large-scale habitat projects in strategic coastal estuaries. • Habitat Restoration, Conservation, and Enhancement. ○ Protect, restore, or enhance water dependent habitats (e.g. streams, rivers, lakes and wetlands) for fish and wildlife. • Enhance Fish Migration (CWAMP Action). ○ Completing culvert and bridge improvements and small dam removal projects
WCB	$200,000,000	• Increase availability and quality of water in streams, particularly by protecting and restoring ecological flows. • Remove key barriers to securing enhanced flows for nature. • Infrastructure (e.g. gauges) for evaluating stream flow conditions in California streams.	$38,400,000	Provide and protect enhanced stream flow in those streams that provide the following: • Support for anadromous fish; • Support for special status, threatened, endangered or at risk species; • Provide wildlife corridors; and • Resilience to climate change.
SCC	$100,500,000	• Watershed adaptation to reduce the impacts of climate change. • River parkways • Aquatic, wetland and migratory bird ecosystems including fish and wildlife corridors. • Remove barriers to fish passage. • Protect and restore coastal watersheds including but not limited to, bays, marine estuaries, and nearshore systems. • Reduce pollution or contamination of rivers, lakes, stream, or coastal waters. • Improve watershed health, instream flows, fish passage, coastal or inland wetland restoration.	$15,000,000	• Water sustainability • Protect and enhance anadromous fish habitat • Wetland restoration • Urban greening

Agency	Total Prop 1	Relevant Prop 1 Priorities	FY 2015/2016	Relevant 2015/2016 Priorities
OPC	$30,000,000	• Reduction of pollution and contaminants from sources including storm water, non-point source discharges, agricultural runoff, etc. • Sea Level Rise: risk reduction and improvement in resiliency of the built environment and natural environment. Example Projects: o Wetland restoration and protection, o Diadromous fish passage, reduce water quality impacts to coastal waterways. o Prevent or reduce water pollution or contamination, o Protect and restore coastal watersheds (bays, estuaries, nearshore ecosystems).	$9,500,000	• Reduction of pollution and contaminants from sources including storm water, non-point source discharges, agricultural runoff, etc. • Sea Level Rise: risk reduction and improvement in resiliency of the built environment and natural environment in the face of sea-level rise.
State Water Board	$2,145,000,000	• SWB Prop 1 priorities are not relevant to Los Peñasquitos Lagoon.		

SOURCE: California Wetlands Recovery Project (December 2015 Board of Governors Meeting).

TransNet

TransNet refers to the ½ cent sales tax for local transportation projects within the County of San Diego that was first approved by voters in 1998 and extended an additional 40 years in 2004. Funds generated by TransNet are managed and distributed through programs administered by SANDAG that include the Environmental Mitigation Program (EMP). EMP provides low- to mid-level funding opportunities (i.e. below $1 million) which could be used for ancillary projects that support recovery of salt marsh habitat and protection of sensitive species directly or through implementation of the preferred Lagoon Concept.

Vector Habitat Remediation Program

The County of San Diego's Department of Environmental Health manages the Vector Habitat Remediation Program (VHRP) to fund projects that aim at reducing or eliminating mosquito breeding habitat as a direct or indirect benefit. Funds are administered through a Direct and Competitive Grants Program. Direct Grants are open year-round with a maximum amount of $50,000 eligible for award. Competitive Grants are available once a year and capped at $500,000 as the maximum award. Projects are classified as "Study" for planning projects or special studies, or "Turn Key" for those ready for implementation. While a project does not necessary need to have all construction permits to be considered "Turn Key," CEQA determination and final design are most likely needed to be competitive. A requirement of the VHRP program is that projects eligible for funding must address populations of *Culex tarsalis* due to this species ability to transmit brain encephalitis (e.g., West Nile Virus) with priority given to funding "Turn Key" projects.

The VHRP may be able to provide partial funding for implementing the alternative selected in the Design and Feasibility Study for the preferred Lagoon Concept (Phase 1 or Phase 2) assuming it contains the appropriate elements that enhance mosquito abatement efforts (e.g. extending a channel to dewater an area of ponded water). As mentioned, the Design and Feasibility Study will provide a phased approach to implementing large-scale recovery of salt marsh and transitional areas so that vector management elements can be part of the final design, but implemented at a later date when funding or other opportunities are available.

Mitigation

In-lieu fees

Efforts are currently underway to explore options to develop and implement a regional in-lieu fee program to be managed by the SCC. This program would operate as a hub for mitigation credits, similar to a mitigation bank, that could be provided for offsite, compensatory mitigation for development projects and operation needs. The idea behind this approach for compensatory mitigation is to collect multiple credits that could then be applied as a lump sum to a larger, more comprehensive project such as large-scale restoration of native habitats. This strategy aims at generating more comprehensive, far-reaching benefits that may not be realized by small scale mitigation efforts by looking at systemic improvements that can consider ecosystem services or ecologic function provided by a wetland rather than merely replacing "habitat" through the short-term (e.g. 5 years sign-off that can be typical for small-scale compensatory mitigation). Assuming this program is approved, in-lieu fees could be used to fund restoration and preservation of salt marsh habitat in Los Peñasquitos Lagoon through implementation of the preferred Lagoon Concept once it is "shovel-ready."

Mitigation Banking

Mitigation banking involves a site where wetlands and/or other aquatic resources or natural habitats are restored, created, enhanced, or in exceptional circumstances, preserved, expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. For purposes of the Clean Water Act, Section 404 (33 U.S.C. 1344), use of a mitigation bank can only be authorized when impacts are unavoidable. While mitigation banking presents funding opportunities for recovering salt marsh habitat in Los Peñasquitos Lagoon, the Lagoon's status as a State Preserve (owned and managed by CSP) currently does not lend to this approach. Perhaps the biggest obstacle involves monitoring/maintenance easements that are typically instituted in areas funded through mitigation banking that could place CSP in a position where another State Agency or management group (e.g. Joint Power Authority) is dictating management decisions and efforts.

Compensatory Mitigation

Compensatory mitigation involves the restoration, enhancement, creation, and (under exceptional circumstances) preservation of wetlands, wetland buffer areas, and other natural habitats, carried out to replace or compensate for the loss of wetlands or natural habitat area or functional capacity resulting from Federal-aid projects funded pursuant to provisions of Title 23, U.S. Code. Compensatory mitigation usually occurs in advance of, or concurrent with the impacts to be mitigated, but may occur after such impacts in special circumstances. Similar to Mitigation Banking, compensatory mitigation can have its short-comings when it involves funding large-scale restoration projects. Habitat type and acreage to be created or recovered through compensatory mitigation is generally predetermined and subject to strict requirements such that funding must be directed to the specific habitat type that is being mitigated. For example, mitigation funds received to create or recover deep water habitat may not be used to fund creation or recovery of other habitat types (e.g. salt marsh) that may lend better to the ecologic landscape of a wetland or ecotone between a wetland and its upland habitats. Given that coastal salt marsh is a highly scarce resource, impacts to this habitat types makes Los Peñasquitos Lagoon attractive for potential compensatory mitigation through entities such as the Port of Los Angeles, Port of Long Beach, Southern California Edison, Caltrans, and SANDAG.

Public Works Plan/Transportation and Resource Enhancement Program

TransNet funds have been used to support efforts mitigate impacts generated by transportation improvements planned under the San Diego North County Corridor Program. Guided by the Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP), mitigation measures have included large-scale restoration efforts planned for San Elijo Lagoon and Buena Vista Lagoon and a separate, secondary fund established to assist ongoing management needs and priorities for areas of sensitive habitats that are impacted by transportation infrastructure but do not qualify for large-scale restoration funding through the PWP/TREP. In 2016, ACOE, SANDAG and Caltrans established an endowment from this secondary mitigation fund to support annual inlet maintenance at Los Peñasquitos Lagoon in perpetuity. This fund was established to offset long-term impacts to the Lagoon caused by transportation infrastructure that led to frequent and often extended inlet closures that impaired its natural function and, at times, devastated entire populations of aquatic organisms.

11.2 Next Steps – Public Access Concepts

Next steps for Public Access Concepts using a phased approach have been provided within Chapter 8 for each concept. It should be noted that some efforts may not be completed within the prescribed timeframe or phase, since funding may need to be coordinated with regional efforts to improve trail networks and/or modify transportation infrastructure such as North Torrey Pines Road segment of Highway 101 in response to sea level rise. When this occurs, efforts not completed can be pushed to a later phase. Conversely, Phase 2 elements may be completed during Phase 1 if funding opportunities are presented. Integrating Public Access Concepts into the TPSNR Trail Management Plan update and related plans developed by the City of San Diego and SANDAG should be pursued to avoid potential conflicts and ensure that final design of the Public Access Concept meet expectations of user groups and public safety needs by law enforcement. Stakeholder participation should be conducted for each Public Access Concept early in the planning and development stages to build consensus and align expectations prior to implementation. As mentioned in Chapter 6 and Chapter 8, the conceptual designs presented in for Public Access Concepts have already been vetted through the stakeholder process that included public workshops held in 2012/13. Action items specific to moving Public Access Concepts toward implementation will be more precisely defined once they are integrated into the updated TPSNR Trail Management Plan.

11.2.1 Potential Funding

Potential funding opportunities for Public Access Concepts depend in part on the overall cost involved in development and implementation, as well as the need (or lack of) to coordinate with larger efforts within the region (e.g. improvements to transportation infrastructure). Low-cost components, such as closing user created trails along Carmel Valley Road, will most likely be funded entirely or at least in part by CSP based on its priority ranking within the updated TPSNR Trail Management Plan and annual budget allowances. Initiating planning and design efforts for the more expensive components of the Public Access Concepts (e.g. realignment of Highway 101 and Marsh Trail) could be possible during Phase 1 assuming they can be funded through CSP's annual budget dedicated toward trail improvements. Grant-based funding may also be available through programs such as the Prop 1 where Public Access Concepts can be integrated into a larger multi-benefit project or directed specifically at reducing fragmentation to the California Coastal Trail. Implementation of the more expensive components of Public Access Concepts will most likely require funding through regional programs that include SANDAG's PWP/TREP for north county San Diego. Using TransNet funds generated through a regional sales tax, the PWP/TREP will provide funding opportunities to projects that improve multi-modal transportation with emphasis on pedestrian and bicycle use, as well as efforts to connect fragmented trails networks and bike paths within the region. Lastly, private funding may also be a potential source from local businesses whose employees benefit from the use of trails to potential large donors that support these community resources.

11.3 Next Step – Vector Concepts

As described in Chapter 9, Vector Concepts can be considered as "stand-alone" projects to be implemented in the near-term (i.e. Phase 1) to protect public health or developed in conjunction with the phased implementation of the preferred Lagoon Concept. This phased approach has been selected for improving flow through McGonigle Road Culvert (Vector Concept 1) where initial efforts (e.g. replacing the damaged culvert) could be completed during Phase 1 followed by modifications to nearby lagoon channels to improve hydraulic capacity in conjunction with implementation of the preferred Lagoon Concept during Phase 2.

Vector Concepts proposed for Phase 1 implementation include:

- Vector Concept 1 – Improved Flow through McGonigle Road Culvert (VCP Site 626), Part 1 (Culvert Replacement)
- Vector Concept 2 – Storm Outfall Modification to Reduce Impoundment of Discharged Waters Near VCP Site 626.
- Vector Concept 4 – Modification to Storm Drain Outfalls at Tripp Court and Sorrento Valley Road.

Vector Concepts proposed for Phase 2 implementation include:

- Vector Concept 1 – Improved Flow through McGonigle Road Culvert (VCP Site 626), Part 2 (Channel improvements if feasible)
- Vector Concept 3 – Dewatering of VCP Site 577.

Similar to the approach identified for preferred Lagoon Concept in Section 11.1, identifying and filling data gaps will be necessary to fully develop the turn-key approach and prepare the grant applications for each Vector Concept. While not as developed as the Lagoon Concepts, preliminary efforts directed toward the Vector Concepts include field investigations and consultation with staff from the County of San Diego's VHRP. Data and model results generated by the Design and Feasibility Study for the preferred Lagoon Concept will be used to fill data gaps identified for the proposed Vector Concepts. Data gaps as they apply to the Vector Concepts are summarized below.

Freshwater & Storm Water Inputs

Inputs of freshwater and storm water runoff will need to be characterized for each Vector Concept. A brief description of each Vector Concept a is it relates to this data gap is provided.

Vector Concept 1. Improved Flow through McGonigle Road Culvert (VCP Site 626)

Recent field reconnaissance and monitoring of water levels within the main channel segment west of the road indicated that the primary input of waters to this area are tidal in nature. Inspections of the two primary storm water outfalls located along Carmel Valley Road indicate that they most likely do not contribute to dry weather inputs of water, but large areas of scour below the outfalls did suggest that storm discharges may be responsible for additional sediment deposition in areas located downslope. Quantifying and qualifying the contribution of these outfalls to water quality, flow within the channel, plant type (upland, salt marsh) and habitat health may be needed to better understand the role they play with both the current condition of the project site and efforts to improve it through the design and implementation.

Action Item

Develop and conduct a monitoring and assessment study to better characterize the contribution of the localized storm water conveyance systems to dry weather inputs, sedimentation and contaminant loading to the project area that includes the tidal channel and surrounding habitats (salt marsh, transitional, upland). Coordinating efforts with the City of Del Mar should be pursued since the storm water conveyance systems near the project area are within their jurisdictional boundary. Aside from conducting the appropriate monitoring program for these facilities, the City of Del Mar is responsible for ongoing maintenance and implementing potential improvements such as re-routing storm water flows to a single outfall discharge point or away from this area.

Vector Concept 2. Storm Outfall Modification to Reduce Impoundment of Discharged Waters Near VCP Site 626.

Only a site inspection at the impoundment area has been conducted to photo-document the site. Additional work will need to be performed to better understand and characterize dry and wet weather discharges from this storm water outfall, since water quality within the impoundment appears to be impaired based on visual inspections that identified debris, trash, and algae blooms within the basin

Action Item

Develop and conduct a monitoring and assessment study to better characterize the contribution of the localized storm water conveyance systems with regard to dry weather inputs, sedimentation, and contaminant loading to the impoundment located just off of Carmel Valley Road. Results from this study will allow better evaluation of alternatives to remove the impoundment or, if water quality cannot be improved, justify keeping the impoundment in place to keep trash and contaminant loading isolated from the main channel while the appropriate measures are pursued to improve water quality in discharges from the storm water outfall at this location.

Vector Concept 3. Dewatering of VCP Site 577.

Data gaps for Vector Concept 3 related to freshwater and storm water inputs should be addressed under the Freshwater Management Program and modeling to be conducted as part of the Feasibility Study for the Preferred Lagoon Concept.

Action Item

Conduct additional studies (if needed) by building upon data sets and findings generated from the Freshwater Conceptual Model and results from modeling conducted as part of the Design and Feasibility Study for the preferred Lagoon Concept.

Vector Concept 4. Modification to Storm Drain Outfalls at Tripp Court and Sorrento Valley Road.

Initial site inspections have been conducted to photo-document the site. Additional work will need to be performed to better understand and characterize dry and wet weather discharges from the storm water outfall and adjacent conveyance structures, as well as hydrologic impediments that facilitate standing water at this location.

Action Item

Develop and conduct a monitoring and assessment study to better characterize the contribution of the localized storm water conveyance systems dry weather inputs, sedimentation and contaminant loading at the project location along Sorrento Valley Road and Tripp Court. Results from this study will allow better evaluation of alternatives to improve dewatering of this location and if flows can be routed through to lagoon channels, pumped out for beneficial reuse or diverted to nearby sewer infrastructure.

11.3.1 Potential Funding

It is anticipated that the County of San Diego's Department of Environmental Health VHRP will be the primary source of funding for the Vector Concepts, since they aim at reducing or eliminating mosquito breeding habitat as a direct or indirect benefit. As mentioned previously, Vector Concepts presented in the updated Lagoon Enhancement Plan will need to be presented as Two-Step Turn Key projects to be eligible for funding.

11.4 Stakeholder Coordination & Collaboration

The following section highlights key coordination and collaboration opportunities with stakeholder groups moving forward with implementation of the updated Lagoon Enhancement Plan on the local, watershed and regional levels. It is not meant to be an exhaustive listing and it is understood that opportunities to coordinate with stakeholder groups not listed in this section will manifest during the implementation of the Lagoon Enhancement Plan and should be considered based on their ability to help make Los Peñasquitos Lagoon a more resilient system and empower stewardship of coastal resources.

11.4.1 Local Level

California State Parks (CSP)

CSP has worked closely with LPLF since the Foundation's inception and designation as the lead entity for most management efforts in Los Peñasquitos Lagoon. Collaboration and coordination with CSP occurs on several levels from guiding management decisions to "boots on the ground" activities in the Lagoon. Since 1983, CSP has been represented on the LPLF's Board of Directors and currently holds two of the seven positions available. This ensures that CSP is involved in all aspects of decision making with regard to day-to-day management and planned improvements for to the Lagoon. CSP and LPLF have also worked together to help ensure that regional and watershed-based plans are developed in a manner that best protects Los Peñasquitos Lagoon. This was evident in the development of the third-party Lagoon Sediment TMDL during which CSP and LPLF successfully secured the Lagoon Compliance Target (i.e. recovery of up to 84 acres of salt marsh) as the primary compliance measure over load reduction, with the latter being the typical compliance measure for most TMDLs. Between 2012 and 2015, CSP and LPLF also worked directly with staff from Caltrans and SANDAG to establish an endowment to fund inlet maintenance in perpetuity to offset impacts generated by transportation infrastructure within Los Peñasquitos Lagoon and along its boundaries. CSP staff also works directly with LPLF to provide assistance with regard to CEQA and resource agency permits, often serving as the Lead Agency and permit applicant. LPLF often coordinates with CSP staff to provide in-kind services that include allocating staff and equipment to support ongoing management efforts that include annual inlet maintenance, invasive species management, education/outreach and sensitive species management.

Moving forward with the implementation of the updated Lagoon Enhancement Plan, efforts have been made to better define the roles of CSP and LPLF with regard to management and lagoon improvement projects. A Memorandum of Agreement (MOA) has been drafted by CSP and will be formalized in 2017/8. It is expected that the MOA will better clarify CSP's role with regard to supporting LPLF's efforts that include implementation and ongoing maintenance for the preferred Lagoon Concept, mechanisms to transfer funding directly to LPLF to support their efforts, and improving control over access to the Lagoon by third-parties to reduce potential impacts to sensitive plants and listed species. LPLF is also collaborating and coordinating with CSP staff on integrating public use improvements at Los Peñasquitos Lagoon through the TPSNR Trail Management Plan currently being updated.

Torrey Pines Association & Torrey Pines Docents

Founded in 1950, the Torrey Pines Association (TPA) was formed to help protect the rare Torrey pine tree (*Pinus torreyana*) and is the oldest operating NGO in the TPSNR. TPA supports improvements within the Reserve through its large membership base, education and outreach efforts, and fund-raising activities that includes its annual Art in the Pines Festival. Some of TPA's achievements include achieving the park's status as a State Natural Reserve; expanding the boundaries of TPSNR with the acquisition of the Extension located north of Carmel Valley Road; and helping get Los Peñasquitos Lagoon designated as a State Marsh Natural Preserve. TPA worked closely with LPLF and CSP to help initiate the update of the Lagoon Enhancement Plan through their grant program and assistance in organizing the public workshops that served as the foundation of the stakeholder process discussed in Chapter 6. LPLF plans to continue its partnership with TPA that is facilitated with the inclusion of a previous TPA president on the Foundation's Board of Directors. Since LPLF does not have members, the Foundation will continue to work with TPA to leverage their large membership base for public education and outreach efforts and potential fund raising opportunities. Other coordination and collaboration opportunities include working with TPA on their ongoing program to track wildlife movement throughout TPSNR using cameras located along known wildlife corridors.

Organized in 1975, the Torey Pines Docents (Docents) is the oldest volunteer groups in the CSP System. Docents provide a support base for CSP staff at TPSNR and are trained in various aspects of the Reserve that include a base in natural sciences. The Docents focus primarily on education and outreach efforts that include guided walks and children's education program, as well as supporting maintenance efforts along TPSNR's trail network, performing invasive/non-native plant removal and beach clean ups. LPLF has coordinated with the Docents in the past, providing plenary sessions about management needs and priorities within Los Peñasquitos Lagoon at the annual Docent meeting. LPLF plans to continue working with the Docents to expand the education and outreach efforts include additional opportunities that focus on Los Peñasquitos Lagoon and its sharing the vital role it holds as coastal estuary within TPNSR.

Scripps Institution of Oceanography

Located just south of TPNSR, the Scripps Institution of Oceanography (SIO) is one of the leading institutions for marine science, climate change, and coastal processes. LPLF has coordinated efforts with several research groups at SIO to have a better understanding of how coastal processes (e.g. wave propagation, sediment transport) affect the health the Lagoon. One current project aims at addressing how physics impacts important biological and chemical processes within Los Peñasquitos Lagoon during an El Niño event to help determine potential effects of climate change on morphodynamics and hydrodynamics of a coastal estuary in San Diego. LPLF will continue working with SIO to foster opportunities for interdisciplinary projects within Los Peñasquitos Lagoon and support efforts to expand the scope of study to include the effects of shoreline transport of sand on inlet stability and beach profiles with emphasis on proposed beach nourishment efforts planned for the region. Another potential opportunity for collaboration between LPLF and SIO include studying the Lagoon's role in the health and viability of two nearby California Marine Protected Areas – San Diego Scripps Coastal State Marine Conservation Area (ASBS #31) and Matlahuayl State Marine Reserve, which includes the La Jolla ASBS #29.

University of California, San Diego

Located above SIO, the University of California, San Diego (UCSD) also offers opportunities to work with students and faculty to provide educational opportunities and supplement LPLF's ongoing work to manage Los Peñasquitos Lagoon. The UCSD Jacobs School of Engineering has worked with LPLF to provide students access to the Lagoon's inlet area for a focused study on inlet geomorphology to highlight management needs that include annual restoration of tidal channels through excavation of marine sediments. LPLF will continue to work with faculty and students from UCSD to provide field studies and related research opportunities.

San Diego State University

Though not located near Los Peñasquitos Lagoon, San Diego State University (SDSU) provides several programs that could offer coordination and collaboration opportunities to increase our understanding of the Lagoon's urbanized watershed and the wildlife that utilizes the remaining areas of open space. Specific SDSU programs of interest include the Watershed Science Institute and the Institute for Ecological Monitoring and Management. Recent SDSU projects within the Los Peñasquitos Watershed include documenting genetic variation in mule deer to improve understanding the role that habitat fragmentation plays on the long-term resiliency of one of the watershed's remaining megafauna. LPLF will continue to work with academic institutions such as SDSU to expand the scope of interdisciplinary research and projects on the watershed and regional level.

Local Communities

Several communities border Los Peñasquitos Lagoon and the western reaches of its watershed that include Torrey Pines and the sub-divisions of Carmel Valley. Working with community members through forums such as community planning groups and public workshops has been performed in the past and will continue moving forward with the implementation of the updated Lagoon Enhancement Plan.

11.4.2 Watershed Level

As mentioned previously, a comprehensive watershed-based approach was selected as the optimal approach for making Los Peñasquitos Lagoon a resilient system through improved management of urban stressors contribute to and, in some cases, drive lagoon impairment. Key opportunities for coordination and collaboration at the watershed-level are highlighted below.

Water Quality Improvement Plan for the Los Peñasquitos Watershed

As discussed in throughout the updated Lagoon Enhancement Plan, coordination with the Water Quality Improvement Plan (WQIP) prepared for the Los Peñasquitos Watershed will provide the greatest opportunity to improve and protect Los Peñasquitos Lagoon using a watershed-based approach. The WQIP provides a management tool for regulatory compliance under Regional Storm Water Permit and the San Diego Basin Plan that was recently updated to include both the Lagoon Sediment TMDL and County-wide Bacteria TMDL. Understanding the value of watershed-based approach to improving water quality and the health of receiving waters, Responsible Parties worked with LPLF and CSP to align goals and objectives of the WQIP with those of the updated Lagoon Enhancement Plan. Under the WQIP, drivers for impairment of Los Peñasquitos Lagoon's Beneficial Uses were identified as "water quality conditions" and ranked according to management priorities. The following water quality conditions were identified as "High Priority" with regard to their roles in contributing to Los Peñasquitos Lagoon's impairment and inclusion on CWA Section 303(d).

- Freshwater discharges during dry weather.
- Transport of sediment from upstream sources (current and historical) during rain events.
- Bacteria accumulations as measured during both wet and dry weather at Torrey Pines State Beach near the Los Peñasquitos Lagoon inlet.

Continued coordination and collaboration with Responsible Parties on developing and implementing structural and non-structural strategies that address these High Priority Water Quality Conditions will be needed to support improvements to Los Peñasquitos Lagoon in the near-, mid- and long-term.

Los Peñasquitos Canyon Preserve

The Los Peñasquitos Canyon Preserve is comprised of the lower portion of the Los Peñasquitos Sub-watershed and is managed by the City of San Diego's Open Space Division of Parks and Recreation Department with support from the Friends of Los Peñasquitos Canyon Preserve, a 501(c)(3). LPLF has worked in the past with these two management entities to construct and maintain an offline sediment basin along the lower reach of Los Peñasquitos Creek to intercept storm-driven sediment loads before they can reach Los Peñasquitos Lagoon. During this project, LPLF consulted directly with Open Space Division staff to ensure that the project footprint did not interfere with established trail use and that disturbed areas were replaced with native plant species endemic to the Preserve. LPLF expects to continue working with the City's Open Space Division and Friends of Los Peñasquitos Canyon Preserve to improve the health and connectivity these two Preserves through projects such as invasive species management, connecting fragmented trail networks and improving wildlife corridors. LPLF retains at least one position on its Board of Directors for a representative of the City of San Diego, to improve coordination for watershed-based efforts since its jurisdiction covers approximately 72% of the watershed.

City of San Diego – Operations & Maintenance Division

The City of San Diego's Operations and Maintenance Division (O&M) was recently integrated into the Transportation and Storm Water Department. In the past O&M has provided services to LPLF in the form of heavy equipment and operators to assist in lagoon inlet maintenance efforts through an MOU with CSP and LPLF. Maintaining this partnership will provide both assistance and relief moving forward with future inlet maintenance efforts. While funding has been secured through the Lagoon Inlet Endowment, LPLF will continue to partner with O&M and CSP to maintain the needed agreements and protocols should efforts required to restore and maintain tidal connectivity surpass available funding (e.g., following beach nourishment efforts north of Los Peñasquitos Lagoon). Other opportunities include using O&M services to perform emergency breaching of impounded waters during inlet closures to abate threats to public health from vector-borne illness and flooding risks when large-scale efforts are not feasible.

San Diego Water Board

LPLF and CSP will continue to work with staff from the San Diego Water Board to maintain a list of candidate projects in Los Peñasquitos Lagoon that may qualify for compliance under a SEP should the opportunity arise following a violation within the watershed.

11.4.3 Regional and State Level

California Coastal Commission

Established under the California Coastal Act to help implement the California Coastal Management Program, the mission of the California Coastal Commission (CCC) is to "protect, conserve, restore and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations." LPLF has worked closely with staff from the CCC since the Foundation's creation in 1983 to help develop and certify the original Lagoon Enhancement Plan in 1985. During that timeframe, the CCC worked with the City of San Diego, LPLF and the SCC to establish the mitigation requirements for development within portions of Los Peñasquitos Lagoon's watershed as a condition for approving the City's Local Coastal Program for the area. As a result, developers are required to submit a one-time payment fee into the Lagoon Deposit Fund as a condition of their development permits (e.g. grading or construction). Managed by the SCC, funds from this account can only be used for improvements or managements needs within Los Peñasquitos Lagoon. Other examples of coordination and collaboration with CCC staff include establishing biological conditions on LPLF's permits for inlet maintenance and conditioning Federal Consistency Certification for Army Corps Encinitas-Solana Beach Coastal Storm Damage Reduction Project to be required to mitigate impacts to Los Peñasquitos Lagoon's inlet area caused by increasing sand availability within the littoral cell caused by beach nourishment efforts. LPLF will continue to work with CCC staff to certify the updated Lagoon Enhancement Plan, permit its projects, and ensure that regional and local projects either avoid impacts Los Peñasquitos Lagoon or provide sufficient mitigation that is acceptable to LPLF, CSP and other involved stakeholder groups.

California Department of Fish & Wildlife

LPLF will work with staff from the California Department of Fish Wildlife (CDFW) to align goals and objectives, as well as funding priorities, under their Prop 1 grant program during implementation of the updated Lagoon Enhancement Plan. Please refer to **Table 11-1** for a description of their Prop 1 program and priorities.

Coastal Sediment Management Workgroup

The Coastal Sediment Management Workgroup (CSMW) is a collaborative task force of state, federal and local/regional entities organized to review and address concerns about sediment imbalances within State's coastal watersheds that contribute to shoreline erosion along the coast and excessive sediment within coastal habitats. The CSMW is developing the California Coastal Sediment Master Plan (SMP) to help guide implementation of their Regional Sediment Management (RSM) Strategy Plans at the local levels through Coastal RSM Plans. The mission of the SMP is to:

> *Develop a comprehensive master plan for the conservation, restoration, and preservation of the valuable sediment resources along the coast of California, in order to reduce shoreline erosion and coastal storm damages, provide for environmental restoration and protection, increase natural sediment supply to*

> *the coast, restore and preserve beaches, and optimize the beneficial use of material dredged or excavated from ports, harbors, wetlands, and other opportunistic sediment sources.*

CSMW intends Coastal RSM Plans to utilize a "system-based approach that seeks to solve sediment-related problems by designing solutions that fit within the context of a regional strategy." Key elements of the RSM include:

- Integrating management of littoral, estuarine and riverine sediments to achieve balanced and sustainable solutions that are more effective and efficient.
- Recognizing that sand and sediment processes are important components of coastal systems and their economic and environmental vitality.
- Acknowledging that sediment management actions can have potential economic and ecological implications beyond a given site or intended effects over an extended time series (i.e., "decades or more")

LPLF was able to present its inlet management program and key concerns about beach nourishment efforts planned for the region to the CSMW on 1/20/2016. Continued coordination with the CSMW and SANDAG (a lead agency in the San Diego RSM) will be critical to ensure that large-scale beach nourishment projects planned within Oceanside Littoral Cell, such as the Encinitas-Solana Beach Coastal Storm Damage Reduction Project, do not impact Los Peñasquitos Lagoon. Current methods under consideration include beach nourishment and stabilization efforts using sand dredged from offshore sources similar to the methods employed by SANDAG in the Regional Beach Sand Project II (RBSP II) but at an exponentially larger scale.

South Coast Wetlands Recovery Project

The South Coast Wetlands Recovery Project (SCWRP) is a partnership of state and federal resource agencies that work cooperatively to fund projects that acquire, restore and enhance wetland habitats in Southern California. The vision of the SCWRP is "to re-establish the quality, quantity and connectivity of wetlands in Southern California, in order to support wetland species and provide human refuges within the urban landscapes." SCWRP provides both direct and coordinated funding for wetland projects and uses their Work Plan and the primary vehicle for prioritizing projects within the region. Generally, the Work Plan is revised every five years, though projects can be added at any time based on approval by the SCWRP Governing Board. In early 2016, the SCRWP's Wetland Managers Group and Governing Board approved large-scale restoration of salt marsh within Los Peñasquitos Lagoon as a priority project on the SCWRP Work Plan. LPLF currently participates on the SCWRP's Wetlands Advisory Group (WAG) to help shape regional strategies to improve the resiliency of coastal wetlands in Southern California. LPLF and CSP will also work with directly with the SCWRP's Wetland Managers Group through the Regulatory Advisory Committee (RAC) created to provide guidance for the design, permitting and implementation of the preferred Lagoon Concept.

State Coastal Conservancy

Established under the California Coastal Act to help implement the California Coastal Management Program, the State Coastal Conservancy (SCC) is responsible for coastal land acquisition, resource restoration and enhancement programs along the California coast through Section 31100 of the Public Resources Code. As mentioned previously, LPLF worked directly with staff from the SCC to develop and certify the 1985 Lagoon Enhancement Plan that emphasized public participation early in the planning process through open workshop formats to capture local interests, concerns and preferences with regard to management priorities within Los Peñasquitos Lagoon. Since that time, LPLF has worked with SCC staff to develop and implement projects and programs within Los Peñasquitos Lagoon using monies from the Lagoon Deposit Fund (managed by SCC). Examples include the long-term monitoring program, permitting and funding inlet maintenance, and initiating the update of the Lagoon Enhancement Plan. LPLF anticipates continued coordination and collaboration with SCC staff through the implementation of the updated Lagoon Enhancement Plan and coordinating efforts with elements of SCC's Strategic Plan 2013-2018. LPLF currently collaborates with SCC staff through the SCWRP and the RAC created to provide guidance for the design, permitting and implementation of the preferred Lagoon Concept.

SANDAG/Caltrans

LPLF anticipates ongoing, as needed coordination and collaboration with staff from SANDAG and Caltrans to fund and implement elements of the updated Lagoon Enhancement Plan. The primary vehicle for this effort will most likely be the PWP/TREP that sets aside mitigation funding for impacts to sensitive habitats derived from transportation infrastructure within North Coast Corridor in San Diego County. The Los Peñasquitos Lagoon Inlet Endowment is a primary example of mitigation funding set up through the PWP/TREP. LPLF staff will work with staff from SANDAG and Caltrans, and associated wetland management groups, on an annual basis to assess funding needs to maintain tidal circulation within Los Peñasquitos Lagoon through planned excavations of the inlet area with funding supplied initially through a wasting account until the endowment's principal investment can accrue interest. Other potential opportunities include SANDAG's Environmental Mitigation Program (EMP) that allocates funding generated through TransNet to projects to that fall within one or more of the following categories:

- Maintenance and Enhancement of Extant Populations of Management Strategic Plan for Conserved Lands in Western San Diego County (MSP) Species and their Habitats
- Threat Reduction to MSP Species and their Habitats from Invasive Species
- Recovery Projects for Native Habitats Impacted by Wildfire
- Habitat Maintenance
- Access Control/Management
- Volunteer Coordination.

Caltrans operates a similar program in coordination with the California Natural Resources Agency termed the Environmental Enhancement and Mitigation Program (EEMP). Both the EMP and EEMP require applications that include a short proposal to be considered and ranked for funding under each program on an annual basis. LPLF also anticipates working with SANDAG and associated stakeholder groups on the Shoreline Preservation Working Group to ensure that impacts generated by beach replenishment efforts within the region do not impair Los Peñasquitos Lagoon and that unavoidable impacts are adequately mitigated (e.g. increased funding for inlet maintenance to remove additional sand). LPLF also anticipates collaborating with staff from Caltrans and SANDAG regarding public access improvements around Los Peñasquitos Lagoon identified in Chapter 8 and Section 11.2 that include connecting fragmented sections of regional trail systems and bike paths around Los Peñasquitos Lagoon and to other areas within TPSNR.

Tijuana River National Estuarine Research Reserve & Southwest Wetlands Interpretive Association

Scientist from Tijuana River National Estuarine Research Reserve (TRNERR) currently conduct ongoing monitoring of biological, chemical and physical processes within Los Peñasquitos Lagoon through a contract between SCC and the Southwest Wetlands Interpretive Association (SWIA). LPLF works with TRNERR to perform as needed modifications to the monitoring program for Los Peñasquitos Lagoon using adaptive management with emphasis on generating data sets that lend to improved management and informed decision making. In 2014, LPLF expanded the monitoring program through funding provided by the County to San Diego’s VHRP that established three additional continuous monitoring stations located within lagoon channels have been included in the annual monitoring program to provide better spatial and temporal representation of water quality parameters within the Lagoon. LPLF also coordinates efforts with the TRNERR monitoring team and scientists from SIO to use data generated at Los Peñasquitos Lagoon for comparison with other coastal estuaries in San Diego County to provide a regional perspective about the health and management needs of coastal watersheds in Southern California.

Southern California Coastal Water Research Project

The Southern California Coastal Water Research Project (SCCWRP) is a research institute focusing on the coastal ecosystems of Southern California from watersheds to the ocean. Formed as a Joint Powers Authority (JPA), SCCWRP aim is to gather the necessary scientific information needed to allow informed decisions by member agencies with regard to coastal stewardship efforts in the Southern California coastal environment. Scientists from TRNERR currently collaborate with SCCWRP providing data from Los Peñasquitos Lagoon for regional studies that look at management challenges such as eutrophication due to nutrient loading in coastal estuaries. LPLF anticipates continued coordination and collaboration with SCCRWP through TRNERR efforts and other studies (e.g. managing intermittent coastal lagoons) on an as needed basis.

11.5 Inlet Management

11.5.1 Los Peñasquitos Lagoon Inlet Endowment

The Los Peñasquitos Lagoon Inlet Endowment (Inlet Endowment) was established by Caltrans and SANDAG in 2016 to help mitigate impacts to the Lagoon's inlet from existing transportation infrastructure and to provide regional mitigation credits for improvements planned under the North Coast Corridor PWP/TREP. LPLF and CSP worked with staff from Caltrans and SANDAG to determine funding needs with the expectation that the endowment will be able to fund inlet maintenance efforts in perpetuity. A Science Review Panel to determine the need for inlet maintenance and approve funding allocation for annual inlet work at Los Peñasquitos Lagoon. LPLF will work directly with CSP, SANDAG, and the Science Review Panel to submit the appropriate documents and notifications required to allocate funding from the Inlet Endowment on an annual basis or as needed if circumstances require multiple efforts to restore and maintain tidal connectivity. LPLF has already received funding for inlet maintenance in 2016 from a wasting funds account set up to fund inlet maintenance at the Lagoon until the endowment is set up and sufficient interest has accrued.

11.5.2 Coordination with California State Parks

Coordination with CSP will be required for various aspects of inlet maintenance moving forward that include formalizing an MOU between CSP and LPLF, provision of in-kind services and permit renewal. Currently LPLF is working with CSP to establish a more formalized agreement with regard to management and maintenance efforts within Los Peñasquitos Lagoon that include inlet work. It is expected that a MOU will be finalized in 2017/8 and will identify LPLF as the primary agent working in coordination CSP staff for inlet maintenance efforts. It is anticipated that the MOU will also identify roles with regard to permit applications and procurement efforts for selecting sub-contractors. LPLF will continue to work with CSP to provide in-kind services needed to support inlet maintenance efforts and reduce overall cost. In-kind services provided by CSP in the past have included: permit processing, heavy equipment and operators, biological surveys and monitoring, onsite construction management, and public safety. LPLF will also coordinate with CSP and the appropriate regulatory staff to update and renew existing permits for inlet maintenance that are set to expire in late 2017.

11.5.3 City of San Diego – Transportation and Storm Water Development

In the past, LPLF and CSP have worked with the City of San Diego's Transportation & Storm Water Department to provide in-kind services for inlet maintenance that include heavy equipment and operators provided from the City's O&M Division. In 2016, LPLF and CSP formalized a MOA that would continue this service for a 5-year period. While costs incurred through routine inlet maintenance will be covered primarily through the Inlet Endowment, the MOA will provide added relief and additional emergency services during years where multiple openings are required. It is anticipated that LPLF and CSP will pursue an extension of the 5-year MOA when it is set to expire or formalize a new MOA if City protocol dictates.

11.5.4 County of San Diego – Department of Environmental Health

In the past, LPLF has coordinated efforts with the County of San Diego Department of Health (DEH) to conduct both water quality testing following inlet openings and support vector management priorities (e.g., *C. tarsalis*) identified in the Vector Habitat Remediation Program (VHRP). LPLF expect to continue working with DEH staff to ensure that protecting public safety can be integrated into managing the resources and sensitive species of Los Peñasquitos Lagoon. It is expected that LPLF and CSP will enter into a formal agreement with DEH so that VHRP can conduct vector management within the Lagoon and along its borders without impacting species within a State Preserve. Efforts will also be made to explore opportunities within the VHRP to support annual inlet maintenance since maintaining tidal circulation is the most effective means for controlling populations of *C. tarsalis* during the larval stage of development. Please see Section 11.6.1 for more information.

11.5.5 Resource Agency Permits

Inlet maintenance at Los Peñasquitos Lagoon is currently subjected to conditions set by the following CEQA determination and resource agency permits:

- **CEQA** – A Categorical Exemption was issued in 2008 to cover inlet maintenance with State Parks as the Lead Agency. Title: Maintenance of Lagoon Mouth Tidal Flows at Los Peñasquitos Lagoon (07-08-SD-08), SCH #: 2008058162.
- **Right of Entry Permit** – CSP issues this permit annually
- **Coastal Development Permit** – CCC (06-07-021-A1)
- **Section 401 Wetland Certification** – San Diego Water Board (No. 07C-094-A1)
- **Section 1602 and CESA** – Waived by CDFW
- **Informal Consultation under Section 7 of the Endangered Species Act** – USFW (FWS-SDG-08B0543-09I0141)
- **Section 404 Individual Permit** - ACOE (SPL-2007-01134-RRS).

LPLF will work with CSP and the appropriate resource agency staff to request extensions where possible (e.g. Section 404 Individual Permit) and apply for new permits if required. SANDAG staff has indicated that funding from the Inlet Endowment will be available to secure the appropriate permits beyond 2017 and that efforts can be coordinated leading up to the disbursement of funds prior to the spring of 2017.

11.5.6 Assessment of Maintenance Program and Methodologies

Understanding the importance of adaptive management, LPLF will explore opportunities to improve inlet maintenance following the results of the Inlet Dynamic Modeling to be performed under the Design & Feasibility Study for the preferred Lagoon Concept (See Section 11.1). It is anticipated that the success of large-scale recovery of salt marsh under the preferred Lagoon

Concept and/or improved flushing of lagoon waters may require augmentation of the current methodology employed for inlet maintenance at Los Peñasquitos Lagoon. Elements that may be considered include: expanding the current project footprint to include the southern channel; removing larger volumes of sand to expand the Lagoon's tidal prism; and/or modifying channel dimensions and alignments in a manner that promote channel stability and improved tidal exchange.

11.6 Ecosystem Services

Los Peñasquitos Lagoon provides numerous ecosystem services to surrounding communities and within the region as a whole. Protecting and, where possible, enhancement of these ecosystem services will require stakeholder coordination and collaboration. Examples include improving vector management to protect public safety and working with the City of San Diego's Transportation and Storm Water Department to include elements within their flood management program for Sorrento Valley that support planned improvements to Los Peñasquitos Lagoon's habitats and efforts to reduce viable breeding habitat for freshwater mosquitos. Ecosystem Services provided by the Lagoon are briefly summarized in the following sub-sections.

11.6.1 Public Health – Vectors

The presence and, at times, proliferation of *Culex tarsalis* in Los Peñasquitos Lagoon presents a serious concern for public safety with regard this species of mosquito's ability to transmit West Nile Virus and other forms of brain encephalitis to human hosts. Continued coordination and collaboration with the County of San Diego's Department of Environmental Health's VHRP will need to continue through the implementation of the updated Lagoon Enhancement Plan, which contains goals and objectives for protecting human health from vector-borne illness. Examples include coordinating inlet restoration efforts with VHRP staff to expedite breaching the inlet when it has been determined that impounded waters have created a measured health risk to human populations around the Lagoon due to population increases in *C. tarsalis* and/or the detection of brain encephalitis in local birds that include sentinel chickens located in the east end of Los Peñasquitos Lagoon. VHRP may also provide additional funding opportunities for lagoon improvements that support vector management through the implementation of Turn-Key projects.

11.6.2 Public Health – Water Quality

While LPLF has collected an extensive database for water quality within Los Peñasquitos Lagoon, these parameters that focus more on water chemistry (e.g. dissolved oxygen) and its effects on aquatic life. Biological indicators (e.g. e-coli) for fecal contamination are not measured consistently at Los Peñasquitos Lagoon since water contact for recreational use is not permitting within the Lagoon given its status as a State Preserve. Limited budget and processing requirements for indicator bacteria samples make indicator bacteria monitoring testing infeasible under the current lagoon monitoring program. Understanding the need to protect public health with regard to water-based recreation along Torrey Pines State Beach, LPLF has partnered in the past with groups such as San Diego Coastkeeper to conduct as needed sampling of Los Peñasquitos Lagoon's waters and its tributaries for indicator bacteria. LPLF also coordinates water quality testing for indicator bacteria at the inlet and along Torrey Pines State Beach following mechanical inlet openings with the County's Department of Health so that the beach can be posted to protect public health until bacteria levels are below State standard for human contact. LPLF will continue to coordinate efforts with such groups to continue water quality testing for indicator bacteria as needed or to help develop an ongoing program that will most likely be required under the County-wide Bacteria TMDL.

11.6.3 Disadvantaged Communities

Disadvantaged communities are defined as "a community with an annual median household income that is less than 80 percent of the statewide annual median household income" (CWC § 79505(a)). Based on this definition, there are several disadvantaged communities located near Los Peñasquitos Lagoon and are identified by the State accordingly:

- Disadvantaged Community Tracts – (ID #0607300830, #06073008361, and #06073017035)
- Disadvantaged Community Blocks (ID #060730083052, #060730083612, #060730083643, #060730083632, #060730083433, #060730083432, #060730083403, and #060730170353)

Los Peñasquitos Lagoon provides the closest opportunity for members of these disadvantaged communities to enjoy the natural and recreational resources of the Lagoon in conjunction with other areas within the TPSNR. Implementation of the updated Lagoon Enhancement will provide education and outreach opportunities regarding the value of tidal salt marsh and coastal resources through enhanced local and regional trail networks, safe viewpoints, and educational opportunities (e.g. information panels) to support coastal stewardship efforts.

11.6.4 Flood Management

The City of San Diego's Transportation and Storm Water Department provides flood management services at the base of all three tributaries that empty into Los Peñasquitos Lagoon's using their Master Channel Maintenance Plan. Flood management within urbanized watersheds can be extremely difficult since efforts to optimize diversion and dewatering efforts can generate impacts to natural drainages and creeks, as well as receiving waterbodies downstream. This holds true especially within Sorrento Valley, where the historic floodplain has been reduced to a narrow pilot channel cut through the middle of a commercial business park developed in the 1960s and 1970s before delineation of the FEMA floodplain. As a result, many of the businesses in Sorrento Valley are highly vulnerable to flooding once capacity of the channel has been exceeded during storm events with moderate to excessive precipitation. Understanding the need to protect local business, LPLF has been working with the City to modify their approach to improve flood management within Sorrento Valley while minimizing downstream impacts. Rather that focus solely on maximizing capacity within the pilot channel, restoring elements of the natural floodplain (e.g. construct meandering channels) will be considered. This approach has been developed to provide restoration and enhancement opportunities within the riparian corridor that dominates the lower portion of the pilot channel and provide protection to sensitive downstream habitats within Los Peñasquitos Lagoon that include the area designated for large-scale recovery of salt marsh. LPLF will continue to work with the City's Transportation and Storm Water

Department on the development of this alternative approach for flood management for Sorrento Valley and considering its application to other channel segments within the Los Peñasquitos Watershed.

11.6.5 Climate Change Abatement (Greenhouse Gas Sequestration)

Restoring tidal salt marshes in North America is "one of the most effective measures for sequestering carbon" (Trulio, L. 2007). This is due in most part to their ability to "sequester carbon at a rate about 10-fold higher on an area basis than any other wetland ecosystem due to high sedimentation rates, high soils carbon content, and constant burial due to sea level rise" (Brigham *et al* 2006). Salt marsh is also highly effective in trapping methane due to high salinity rates that abate the release of this greenhouse gas. Brackish and freshwater marsh are not as effective with regard to capturing greenhouse since methane is released at a higher rate than when compared to regimes of higher salinity. Therefore, recovering salt marsh even at the expense of brackish and freshwater marsh provides far greater value with regard to abating climate change through the sequestering of greenhouse gases.

Recent efforts have been made to quantify carbon sequestration rates for wetland habitats using methods provided by the State Air Resources Board (ARB) in 2014/15 that are currently being updated for use in 2016. Using the 2014/15 methodology it has been estimated by project proponents that the UC Santa Barbara North Campus Open Space Wetland Restoration will sequester an estimated 540 metric tons of carbon over 100 years following the restoration of just 34 acres of wetland and 20 acres of upland (Southern California Wetlands Recovery Project 2015 Work Plan Report). Habitat trajectory modeling predicts that the preferred Lagoon Concept for Los Peñasquitos Lagoon will provide much greater benefits regarding metric tons of carbon sequestered through the long-term. Habitat trajectory modeling predicts 74 acres of additional salt marsh and 103 acres of additional transitional/upland habitat will be achieved in Los Peñasquitos Lagoon by 2030 through the implementation of the preferred Lagoon Concept. By 2050, habitat trajectory modeling predicts that salt marsh restoration in Los Peñasquitos Lagoon will have added an additional 114 acres of salt marsh with additional acreage due to upslope migration in response to sea level rise.

Following the release of ARB's updated methods for quantifying carbon sequestration, efforts should be made to calculate sequestration rates for Los Peñasquitos Lagoon under existing conditions (i.e. current acreage by habitat classification) and with projected acreage of salt marsh and transition areas to be recovered through the implementation of the preferred Lagoon Concept. This would provide valuable insight with regard to Los Peñasquitos Lagoon's ability to abate climate change as an ecosystem service enhanced through implementation of the preferred Lagoon Concept and provide an additional criterion for evaluating alternative approaches developed in the Design and Feasibility Study. Establishing these metrics will also help to further justify converting areas of brackish marsh back to historical salt marsh within Los Peñasquitos Lagoon, since both are considered "wetland habitat" native to Southern California by resource agency protocols. Finally, providing quantified metrics for carbon sequestration at the acre unit of habitat will most likely attract additional funding opportunities for salt marsh recovery and long-term maintenance in Los Peñasquitos Lagoon from third-parties interested in carbon sequestration credits. This is especially prudent given that the State of California is currently setting up the mechanisms for issuing carbon credits for wetland restoration and enhancement through a Cap and Trade program using a wetland carbon sequestration protocol for coastal and delta wetlands in California being developed by the SCC under their Project No. 13-024-01.

11.6.6 Improved Public Access

Please refer to Chapter 8 and Chapter 11 for more information related to public access and opportunities/constraints for improvements.

11.6.7 Science and Education

Improving science and education opportunities in Los Peñasquitos Lagoon will be a priority moving forward with the updated Lagoon Enhancement Plan. As previously discussed, efforts have already been made to provide these opportunities to faculty and students UCSD and SIO with plans to include SDSU for their work in the watershed. While LPLF has provided science and education opportunities to high school and junior high school students, a formalized program has not been established since LPLF currently lacks the capacity to effectively manage it. In the meantime, LPLF will work with CSP, TPA and the Torrey Pines Docents to explore opportunities to expand current education and outreach programs and activities to include Los Peñasquitos Lagoon. Aside from these programs, LPLF will still also offer opportunities directly to interested schools within the county to augment science programs with field visits to the Lagoon. LPLF envisions the development of its own educational program once the appropriate staff can be hired to further develop and manage these programs. LPLF will also explore opportunities to partner with other lagoon-based non-profits to expand existing educational programs and/or create new curriculum that is consistent with standards in local schools so that students can receive the appropriate credits for their efforts.

11.7 Species Management

11.7.1 Wildlife Corridors

Transportation infrastructure located both along and within Los Peñasquitos Lagoon have restricted wildlife movement between the Lagoon and other sections of the TPSNR (e.g., TPNSR Extension). In addition, the construction of major freeways (I-805, I-5, SR 56), and industrial parks in Sorrento Valley have constrained wildlife movement from Los Peñasquitos Lagoon's three sub-watersheds. The improvement of connectively between segments of TPSNR, the Lagoon and its watershed with regard to wildlife movement was identified during the stakeholder workshops discussed in Chapter 6. Opportunities to improve wildlife corridors will be identified and evaluated by LPLF in collaboration with TPA, who has funded research to identify wildlife movement and preferred corridors within the TPSNR. TPA currently operates an ongoing wildlife monitoring program using motion-detecting cameras located throughout TPSNR, including Los Peñasquitos Lagoon, to track wildlife movement with emphasis on dominant predators (e.g.

bobcats, coyotes) and mesopredators (e.g. skunks, opossums). In the past, funding for these efforts have been restricted primarily to small-grant programs administered by resource agencies, wildlife organizations and TPA. Future opportunities to fund studies and implement improvements to wildlife corridors may be available through the SANDAG's PWP/TREP. LPLF will coordinate with SANDAG and Caltrans to ensure that wildlife corridors are restored and/or enhanced in a manner that best promotes wildlife movement within TPSNR and between the Lagoon and its watershed. Currently the PWP/TREP has identified opportunities to improve wildlife corridors to Los Peñasquitos Lagoon from Carmel Valley and Los Peñasquitos Canyon Preserve in conjunction with public trail improvements to improve connectivity to these sub-watersheds. LPLF will also identify opportunities to coordinate efforts with local universities (SDSU) and wildlife entities (Conservation Biology Institute) that specialize in studying wildlife movement, effectiveness of wildlife corridors, and genetic variability within local populations of mega fauna (e.g. mule deer).

11.7.2 Sensitive Species

Effectively managing Los Peñasquitos Lagoon's sensitive species will require ongoing efforts that include surveys to estimate population size and health of individual species and developing management programs that aim at stabilizing, enhancing and expanding existing populations to improve resiliency. LPLF will need to coordinate efforts with CSP, TPA and Torrey Pines Docents who conduct sensitive species surveys within TPSNR to ensure that indices of sensitive species are regularly updated, accurate, and accessible. Coordination with these entities will also help to identify areas of potential overlap and data gaps to improve efficiency and effectiveness of the monitoring programs. LPLF should also coordinate efforts with regional entities (SANDAG, Audubon) and resource agencies (CSP, CDFW, USFW) that perform surveys throughout coastal San Diego to inform management programs and priorities for listed species to ensure that population surveys are accurate and informative for species recovery for Los Peñasquitos Lagoon, TPSNR and on a regional scale. Having more precise and informative indices of sensitive species within Los Peñasquitos Lagoon will greatly aid management efforts, help avoid unintended impacts, and inform CEQA and permitting for the preferred Lagoon Concept, Vector Concepts, Public Access Concepts, and other efforts to improve the Lagoon and its habitats (e.g. annual inlet maintenance).

Plants

As mentioned previously, Los Peñasquitos Lagoon contains 35 sensitive plants in its wetland, dune and transition zones that include upland areas. California Native Plant Society identifies six of species as RE-1B (Plants Rare, Threatened and Endangered in California and elsewhere), six species as RE-2 (Plants Rare, Threatened and Endangered in California but more common elsewhere), and seven listed as RE-4 (Plants of Limited Distribution). Currently, only Coulter goldfields (*Lasthenia glabrata ssp. coulteri*) is regularly monitored in Los Peñasquitos Lagoon on an annual basis. LPLF will work with TRNERR and CSP to assess and evaluate the possibilities of expanding the monitoring program to include additional sensitive plant species in Los Peñasquitos Lagoon and developing the appropriate management frameworks and programs.

LPLF will also work with CSP to limit access to the Lagoon for vegetation monitoring by third-parties to avoid potential impacts related to additional foot traffic in areas of sensitive habitats and unintended take of listed birds. Rather, LPLF and CSP should explore opportunities to have TRNERR conduct all monitoring efforts within Los Peñasquitos Lagoon since they have a better understanding of sensitive areas within the Lagoon and will already be in the field conducting the annual biological monitoring. TRNERR will also provide better transparency with regard to compliance monitoring to be performed under the Lagoon Sediment TMDL for the Lagoon Compliance Target. Determining vegetation associations and indicators of restoration success tend to be subjective due to the complexities of habitat type and distribution in coastal estuaries within an urbanized setting. As such, LPLF is concerned that compliance monitoring performed by third-parties (e.g. consultants) will not represent accurate findings and may be skewed toward achieving compliance rather than informing management decisions needed to protect the health and resilience of Los Peñasquitos Lagoon's sensitive habitats and species.

Birds

Monitoring and managing Los Peñasquitos Lagoon's sensitive bird species is currently confined to annual bird census performed by the Torrey Pines Docents and species-specific surveys performed by CSP, CDFW and USFWS throughout the region. LPLF will work with these entities to consolidate data (e.g. bird counts, nesting habitat) specific to Los Peñasquitos Lagoon and indicative of species viability within the regional setting. LPLF will also explore opportunities to perform additional surveys to improve understanding of population health and distribution of listed bird species within Los Peñasquitos Lagoon and its upland areas.

Reptiles

Historically, Los Peñasquitos Lagoon provided habitat to six reptile species that range from federally-listed (Coast horned lizard – *Phrynosom blainvilii*) to state-listed species of concern (e.g. California legless lizard – *Anniella pulchra*) (See **Table 4-10** for a complete listing). LPLF will work with CSP to expand their current monitoring program for reptiles to the Lagoon since current efforts focus on upland areas of TPSNR.

Insects

Not much effort has been made to monitor and document the presence/absence of sensitive insect species within Los Peñasquitos Lagoon and surrounding areas. At this time, only the Wandering skipper (*Panaquina errans*) has been observed in Los Peñasquitos Lagoon, using the Lagoon as breeding and foraging habitat as this species prefers salt grass (*Distichlis spicata*) as a larval host plant. LPLF will work with CSP to develop a monitoring program for insects within Los Peñasquitos Lagoon and its upland areas.

Fish

Los Peñasquitos Lagoon currently does not provide habitat for any sensitive fish species or anadromous species. Recent efforts to detect tidewater goby within the Lagoon failed to locate this species. According to USFW surveys, preferred habitat and presence of tidewater goby does not occur south of the Santa Margarita Watershed, which is located more than 25 miles north of Los Peñasquitos Lagoon.

11.7.3 Invasive Species Management

Invasive species management within Los Peñasquitos Lagoon focuses primarily on plant species with CSP leading the effort to eradicate them through ongoing treatments and removal programs. LPLF will work with CSP staff to expand their program where needed and support species-specific efforts. LPLF will also coordinate with local communities, watershed stakeholders, and Caltrans to limit the availability of invasive species that can be transported downstream to Los Peñasquitos Lagoon through storm runoff and/or aerial dispersion. LPLF will also work with CSP, TRNERR and other groups to monitor invasive faunal species and develop management programs that aim to reduce and/or eradicate them to support the health of Los Peñasquitos Lagoon and its native species.

11.8 Monitoring Program

Adaptive management of the Los Peñasquitos Lagoon Monitoring Program will continue into the future with focus on identifying and implementing methods that support decision making with sound science. Preserving the program's continuous data sets will be a priority to maintain the connectivity between historic and contemporary data sets to capture evolving trends and highlight aberrations due to episodic events or anomalies. LPLF will look to continue its partnership with scientists from TRNERR to ensure that monitoring approaches in Los Peñasquitos Lagoon are dependable with regard to answering key questions about lagoon health and protection/preservation of sensitive species and habitats. Collaboration with TRNERR also ensures that the monitoring program employs methods that are accepted in both the science and regulatory communities and generate data sets that can be applied to other coastal wetlands within the region. LPLF will work with SCC staff and other key stakeholders to identify funding mechanisms to support the ongoing monitoring program beyond 2017 when the current grant expires.

11.9 Increasing Capacity of the Los Peñasquitos Lagoon Foundation

Increasing capacity of LPLF will help to improve the Foundation's ability to effectively manage Los Peñasquitos Lagoon, coordinate complimentary efforts on a both a regional and watershed scale, develop and pursue funding streams, and support coastal stewardship amongst diverse stakeholder groups. Key areas of expanding LPLF capacity include hiring of new staff while also developing an intern program for students looking to gain experience working in coastal estuaries. Key roles that should be considered as new positions within LPLF include (but are not limited to):

- **Associate Director** – Assisting LPLF's Executive Director in helping coordinate and manage efforts within Los Peñasquitos Lagoon and its watershed, as well as support LPLF's efforts on a regional scale.

- **Development Director** – Develop and implement fundraising and stewardship campaigns that includes: grant writing, event coordination and educational programs.
- **Finance & Administration Director** – Provide financial consultation, perform accounting/payroll work in conjunction with the LPLF's Treasurer and provide assistance during audits (e.g., AB-133).
- **Education Director** – Develop scientific curriculum-based environmental education programs that meet California Academic Content standards for schools. The Education Director would work with TPA, Torrey Pines Docents, and other lagoon-based non-profits to provide a comprehensive program that compliments educational programs currently available at the Reserve while avoiding unnecessary overlap or competition between TPA, Torrey Docent and LPLF educational and/or training programs. Efforts will be made to have educational programs in line with accepted standards for curriculum within the appropriate school districts to allow students to receive credit. The Education Director will also look at opportunities to attract students from Disadvantaged Communities within the region to create educational opportunities from low-income areas that would most likely not be available.
- **Education Coordinator** – Implement educational programs and assist the Education Director in coordinating efforts with end user groups (e.g. K-12 schools, university students), non-academic NGOs (TPA, Torrey Docents, SD Coastkeeper), and CSP staff.
- **Lead Ecologist** – Coordinate and collaborate with CSP and TRNERR with regard to sensitive species management, invasive species management, permit compliance (e.g. sensitive species surveys), wetland delineations, QA/QC data sets, vegetation/habitat mapping, and monitoring restoration projects.
- **Associate Biologist** – Provide assistance to the Lead Ecologist and other LPLF staff.
- **Community Outreach Coordinator** – Focus on programs and projects that involve members of local communities (e.g. Torrey Pines and Carmel Valley) to foster coastal stewardship through education and outreach programs such as invasive plant management and/or maintenance of revegetation sites.
- **GIS Specialist** – Provide Geographic Information Systems (GIS) services currently performed by CSP staff.
- **CEQA/Permitting Specialist** – Provide CEQA, NEPA and agency permit consultation, prepare permit application packages and manage existing permits and waivers for LPLF's ongoing programs (e.g., inlet maintenance) and projects (e.g., large-scale recovery of salt marsh).
- **Website Developer/Manager** – Manage LPLF's website to include "up to date" information about Los Peñasquitos Lagoon and LPLF's efforts. Develop as needed components/portals to improve dissemination of reports, data sets and integration of TRNERR's dashboard website for the Lagoon's telemetered water quality monitoring stations.

LPLF will also work with CSP to identify and secure office space within or nearby TPSNR with potential locations including the Adobe that currently serves as the main office/facility for CSP staff at the Reserve; an office in the North Parking lot to provide proximity to the inlet area and monitoring stations; or an office on CSP property in between the mechanic and real estate office on Carmel Valley Road, just east of N. Torrey Pines Road. LPLF will also coordinate efforts with CSP, TPA and Torrey Pines Docents to explore opportunities to construct field labs and other education-based structures to compliment field studies associated with lagoon monitoring efforts and educational programs.

11.10 Compliance Assessment with Local, State and Federal Plans

Aligning the updated Lagoon Enhancement Plan with other management plans and programs is important to facilitate coordination and collaboration with stakeholder groups to protect and preserve function and ecosystem services provided by Los Peñasquitos Lagoon and its watershed on a local and regional level. Demonstrating how the updated Lagoon Enhancement Plan supports and is supported by other resource management plans, State mandates and climate policy will also help secure funding from bond-funded grants such as Prop 1. Below is a list of relevant reports, plans, programs and projects that support elements of the updated Lagoon Enhancement Plan.

11.10.1 Federal

- Clean Water Act
- Recovery plans for federally-listed Species (Endangered Species Act)

11.10.2 State

- California @ 50 Million: The Environmental Goals and Policy Report
- California Climate Adaption Strategy/Safeguarding California: Reducing Climate Risk Plan
- California Coastal Management Program
- California Coastal Sediment Management Master Plan
- California Essential Habitat Connectivity Strategy for Conserving a Connected California
- California Water Action Plan
- California Water Action Plan
- California Wildlife Action Plan
- Completing the California Coastal Trail
- Recovery plans for state-listed Species.
- State Coastal Conservancy's Strategic Plan (2013-2018)
- State Parks General Plan
  - Torrey Pines Natural Resource Management Memo
  - Torrey Pines Reserve Trail Management Plan

11.10.3 Regional & Local

- Climate Ready Program (Coastal Conservancy)
- Environmental Mitigation Program (SANDAG)
- North Coast Corridor Program (SANDAG)
- Regional Storm Water Permit (National Pollutant Discharge Elimination System)
  - Los Peñasquitos Sediment TMDL
  - San Diego County Bacteria TMDL
- San Diego Basin Plan
- San Diego Integrated Regional Water Management Plan
- San Diego Regional Management Plans and Subarea Plans
  - Multiple Species Conservation Program & Subarea Plan
  - Multi-Habitat Planning Area (MHPA) – Los Peñasquitos Lagoon is identified as a Core Biological Area identified for conservation.
  - Management Strategic Plan for Conserved Lands in Western San Diego County
- Southern California Wetlands Recovery Project

References

AECOM, CDFG. 2011. *Vegetation Classification Manual for Western San Diego County, First Edition*. Prepared for the San Diego Association of Governments, February 2011.

Atkins, M.D. 1978. *Insects in Perspective*. MacMillan Publishing Co., New York. 513 pp.

Balo, K. 2009. Restoration Plan for the Soledad Valley Pipeline Emergency Water Main Break. City of San Diego's Public Utilities Department. 14pp.

Bean, L. J. and H. W. Lawton. 1973. *Some Explanations for the Rise of Cultural Complexity in Native California with Comments on Proto-Agriculture and Agriculture*. In Ballena Press Anthropological Papers Number 1. Edited by L. J. Bean. Ballena Press, Ramona, California.

Beller EE, Baumgarten SA, Grossinger RM, Longcore TR, Stein ED, Dark SJ, Dusterhoff SR. 2014. Northern San Diego County Lagoons Historical Ecology Investigation: Regional Patterns, Local Diversity, and Landscape Trajectories. Prepared for the State Coastal Conservancy. SFEI Publication #722, San Francisco Estuary Institute, Richmond, CA.

Bertness, M.D. 1991. Zonation of Spartina spp. in New England salt marshes. Ecology 72:138-148.

Boland, J. 1993. *The breeding populations of Belding's Savannah Sparrow at Los Peñasquitos Lagoon.* Unpublished report. Pacific Estuarine Research Lab, San Diego State University. Final report prepared for the Los Peñasquitos Lagoon Foundation.

Brigham, S.D., J.P. Megonigal, J.K. Keller, N.P. Bliss, and C. Trettin. 2006. *The Carbon Balance of North American Wetlands*. Wetlands 26:889-916.

California Department of Fish and Game. 2001. Coastal Wetlands – Emergent Marshes, in *California Living Marine Resources: A Status Report*, California Department of Fish & Game, pp. 483-486.

City of San Diego. 2005. *Los Peñasquitos Watershed Management Plan*. City of San Diego's Storm Water Division.

Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT). 2013. State of California Sea-Level Rise Guidance Document. March 2013.

Coastal Environments. 2003. *Report #9. Monitoring Program for the Los Peñasquitos, Lagoon Hydrodynamics*. Final report prepared for the Los Peñasquitos Lagoon Foundation.

Coastal Environments. 2010. *Results of Sediment Grain Size Analysis*. Prepared for the Los Peñasquitos Lagoon Foundation.

Coastal Frontiers. 2002. 2001 Regional Beach Monitoring Program Annual Report. Prepared for SANDAG, October 2002.

Cole, K. and E. Wahl. 2000. *A Late Holocene Paleoecological Record from Torrey Pines State Reserve, California.* Quaternary Research. University of Washington. 53:341-451.

Copper, E and R. Webster. 1984. *Bird Surveys of Los Peñasquitos Lagoon, March - July of 1984*. Prepared by Woodward-Clyde Consultants.

Coppock, D. 1985. *Los Peñasquitos Lagoon Enhancement Plan and Program.* Prepared for Los Peñasquitos Lagoon Foundation and State Coastal Conservancy. 119 pp.

Crooks, J. and K. Uyeda. 2010**.** *The Physical, Chemical, and Biological Monitoring of Los Peñasquitos Lagoon. Annual Report: July 1, 2009 – June 30, 2010.* Southwest Wetland Interpretive Association and the Tijuana River National Estuarine Research Reserve. Final report prepared for the Los Peñasquitos Lagoon Foundation.

Crooks, J., M. Cordery, and K. McFarland. 2006. *The Physical, Chemical, and Biological Monitoring of Los Peñasquitos Lagoon. Report: July 1, 2005 – November 30, 2006.* Southwest Wetland Interpretive Association and the Tijuana River National Estuarine Research Reserve. Final report prepared for the Los Peñasquitos Lagoon Foundation.

Crooks, J., J. MucCullough, H. Bellringer and M. Cordery. 2014. *The Physical, Chemical and Biological Monitoring of Los Peñasquitos Lagoon*, July 1, 2012-June 30, 2013.

Crooks, K. 2002. *Relative Sensitivities of Mammalian Carnivores to Habitat Fragmentation.* Conservation Biology, Volume 16, No. 2. Department of Biology, University of California, Santa Cruz. April 2002.

Daly, H.V. 1978. *Introduction to Insect Biology and Diversity*. McGraw-Hill Book Co., New York, NY. 564 pp.

ENTRIX, Pacific Estuarine Research Laboratory, and Phillip Williams & Associates. 1991. Draft EIR/EIS Report, Tijuana Estuary Tidal Restoration Program.

ESA PWA. 2011. *Los Peñasquitos Watershed Geomorphic and Sediment Transport Assessment.* A report prepared for the Storm Water Department of the City of San Diego.

Fisher, R.N., and Case, T.J., 1997, *A field guide to the reptiles and amphibians of coastal southern California*: Lazer Touch, San Mateo, California. 46 p

Flick, R.E. 2006. *Dana Point to the Mexican Border, In Living with the Changing California Coast,* Griggs. G., Patsch, K., and Savoy, L. University of California Press: pp.474-514.

Flick, R., J. R. Wanetick, M. H. S. Elwany, R. S. Grove, B. W. Waldorf. 2011. *Beach changes from construction of the San Onofre Nuclear Generating Station, 1964-1989*. *Shore & Beach* 78(4), pp 12-25.

Gallegos, D. 1992. Patterns and Implications of Coastal Settlement in San Diego County: 9000 to 1300 Years Ago. In *Essays on the Prehistory of Maritime California*, edited by T. L. Jones, No. 10, pp. 217-230. Center for Archaeological Research at Davis.

Gallegos, Dennis R. and Carolyn E. Kyle. 1988. *Five Thousand Years of Maritime Substance at Ballast Point Prehistoric Site SDi-48 (W-164), San Diego, California.* Unpublished report on file at the South Coastal Information Center, San Diego State University.

Gee, P.J. 1972. *An Introduction to the Burning of Vegetation by California Indians.*

Gibson, D. G.D Williams and J. Boland. 1994. *The Physical, Chemical, and Biological Monitoring of Los Peñasquitos Lagoon. Annual Report: July 1, 1993 - June 30, 1994.* Final report prepared for the Los Peñasquitos Lagoon Foundation.

Greer, K and K. Roeland. 2010. Wandering skipper survey at the Los Peñasquitos Lagoon, San Diego, California.

Greer, K and S. McCutcheon. 2013. Population estimate of wandering skipper in a portion of Los Peñasquitos Lagoon, San Diego, California.

Greer, K, D. Stow. 2003. *Vegetation Type Conversion in Los Peñasquitos Lagoon: An examination of the Role of Watershed Urbanization*. Environmental Management Vol 31, No. 4 pp. 489-503.

Hastings, M. 2012. Los Peñasquitos Lagoon Mouth Maintenance Report - 2012. Prepared for State Coastal Conservancy and Resource Agencies.

Holland, R.F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California.* State of California, the Resources Agency, Department of Fish and Game.

Hubbs. C.L., T.W. Whitaker and F.M.H. Reid. 1991. *Torrey Pines State Natural Reserve*. Natural Preserve and Lagoon.

Inman D.L. 1983. *Application of Coastal Dynamics to the Reconstruction of Paleocoastlines in the Vicinity of La Jolla, California*. In *Quaternary Coastlines and Marine Archaeology*, edited by P. M. Masters and N.C. Flemming, pp.1-49. Academic Press, New York.

Institute of Water Research. 2002. http://www.iwr.msu.edu/rusle/factors.htm.

Kimley-Horn & Associates, Inc. 2003. *Sediment Study/Alternative Analysis, Los Peñasquitos lagoon.* Original Report: September 2003, Revised Report: November 2003. A report prepared for the Los Peñasquitos Lagoon Foundation.

LeGrange, Lee. 1985. The History of Mouth Openings and Closures for Los Peñasquitos Lagoon (1965-1985). Unpublished report.

Los Peñasquitos Lagoon Enhancement Plan and Program. 1985. Los Peñasquitos Lagoon Foundation and California State Coastal Conservancy.

Luomala, K. 1978. Tipai-Ipai. In *California*, edited R. F. Heizer, pp. 592-609. Handbook of North American Indians, vol 8, W. C. Sturtevant, general editor. Smithsonian Institution, Washington D.C.

Masters, Patricia M., and Dennis R. Gallegos. 1997. Environmental Change and Coastal Adaptations in San Diego County during the Middle Holocene. In *Archaeology of the California Coast during the Middle Holocene,* edited by Jon M. Erlandson and Michael A. Glasgow. Perspectives in California Archaeology No. 4. Institute of Archaeology, University of California, Los Angeles.

Mealy, M. and R. Ruston. 2010. *Torrey Pines State Nature Reserve ADA Trails and Overlooks Project Archaeological Investigations*. California Department of Parks and Recreation, Southern Service Center.

Miller, J. N. 1966. *The President and Pat Molluscan Faunas of Four Southern California Lagoons*. M.S. thesis, U.C. San Diego.

Mudie, P.J., B Browning, J. Speth. 1974. The Natural Resources of Los Peñasquitos Lagoon. Department of Fish and Game, Coastal Wetland Series No. 775.

Noah, Anna C. 1998. *Prehistoric Fishing on the San Diego Coast*. PCAS Quarterly, 34 (2), Spring 1998.

Nordby, C. and J. Covin. 1988. *Physical, Chemical and Biological Monitoring of Los Peñasquitos Lagoon. July 1, 1987 – June 30, 1988.* Pacific Estuarine Research Lab (San Diego State University). Final report prepared for the Los Peñasquitos Lagoon Foundation.

Nordby, C.S and J.B Zedler. 1991. Responses of fish and macrobenthic assemblages to hydrologic disturbance in Tijuana Estuary and Los Peñasquitos Lagoon, California. *Estuaries* vol 14, No. 1, p 80-93.

National Research Council. 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*. Washington, DC: The National Academies Press. https://doi.org/10.17226.13389.

Patton, R. Ornithologist. Personal communication regarding the presence of least Bell's vireo in Los Peñasquitos Lagoon.

Pignolio, A., K. Crawford, and M. Mealy. 1993. Historic properties of the North County Transit District Maintenance Facility Alternatives, Camp Pendleton, Oceanside, and Carlsbad California. Ogden Environmental and Energy Services Company. Prepared for Myra L. Frank and Associates, Los Angeles.

Pignolio, A., J Aguilar, S. Farmer, and N. Brodie. 2010. Archeological Monitoring, Evaluation, and Data Recovery at Site CS-SDI-19721 for the Los Peñasquitos Creek Sediment Basin Project. Laguna Environmental. Prepared for the Los Peñasquitos Lagoon Foundation. October 2010.

Pourade, R. F. 1966. *Ancient Hunters of the Far West*. The Union Tribune Publishing Company, San Diego.

Prestegaard, K. 1975. *Stream and Lagoon Channels of the Los Penasquitos Watershed, California, with an Evaluation of Possible Effects of Proposed Urbanization*. Graduate Division of the University of California, Berkely.

RECON. 2011. Annual report for maintenance and monitoring at Carmel Valley Road Water Main Break Restoration Project. Prepared for City of San Diego's Public Utilities Department. 11pp.

Rogers, M. J. 1966. The Ancient Hunters-Who Were They? In *Ancient Hunters of the Far West*, edited by R. F. Pourade, pp. 23-110. The Union Tribune Publishing Company, San Diego.

San Francisco Estuary Institute. September 2014. *Northern San Diego County Lagoons Historical Ecology Investigation.*

SD County. 2011. Personal communication with staff from the Department of Environmental Health regarding treatment efforts for *Culex tarsalis* at Los Peñasquitos Lagoon.

Shipek, F. C. 1982. Kumeyaay Socio-Political Structure. In *Journal of California and Great Basin Anthropology* 4(2): 296-303.

Smith, D. 2004. Personal communication regarding the two waterline breaks within Los Peñasquitos Lagoon in 2004.

Smith, D.S. 2009. Torrey Pines State Natural Reserve, Vegetation Management Statement.

Southern California Wetlands Recovery Project. 2015. *Southern California Wetlands Recovery Project 2016 Work Plan Report*. Approved December, 2015.

State Coastal Conservancy. 2018. *Strategic Plan 2013-2018*.

Tetra Tech. 2010. Los Peñasquitos Lagoon Sediment/Siltation TMDL, Attachment 1, Technical Support Document to the Staff Report for the Sediment TMDL for Los Peñasquitos Lagoon. Prepared for the City of San Diego, Storm Water Department and US EPA. October 20, 2010.

Tijuana River National Estuarine Research Reserve (TRNERR). 2012. *The Physical, Chemical, and Biological Monitoring of Los Peñasquitos Lagoon.*

Trulio, L., J. Callaway and S. Crooks. 2007. *White Paper on Carbon Sequestration and Tidal Salt Marsh Restoration*. December, 2007.

United States Department of Agriculture. 1973. *Soil Survey, San Diego Area, California.*

Unitt, P. 2004. San Diego County Bird atlas. Proc. San Diego Soc. Nat. Hist. 39.

Wade, S. A., Van Wormer S.R. and H. Thomson. 2009. 240 Years of Ranching: Historical Research, Field Surveys, Oral Interviews, Significance Criteria and Management Recommendations for Ranching Districts and Sites in the San Diego Region.

Weston Solutions, Inc. 2009. *Los Peñasquitos Lagoon TMDL – Watershed Phase I Sediment Source Identification Study for the Los Peñasquitos Watershed*. Final Report prepared for the City of San Diego.

White, M and K. Greer. 2002. *The Effects of Watershed Urbanization on Stream Hydrologic Characteristics and Riparian Vegetation of Los Peñasquitos Creek, California.* Prepared for the San Diego Foundation July 2002.

White, M and K. Greer. 2006. The Effects of Watershed Urbanization on the Stream Hydrology and Riparian Vegetation of Los Peñasquitos Creek, California. Landscape and Urban Planning 74 (2006) 125-138.

Willey, G. R., and P. Phillips. 1958. *Method and Theory in American Archaeology*. University of Chicago Press.

Williams, G., J. West, and J. Zedler. 2002. *Shifts in Fish and Invertebrate Assemblages of Two Southern California Estuaries During the 1997-98 El Niño*. Bulletin of the Southern California Academy of Sciences.

Zedler, J. 1983. *Freshwater impacts in normally hypersaline marshes*. Estuaries. December, Vol. 6, Issue 4, pp 346-355.

Zedler, J.B. and W.P. Magdych. 1984. *Freshwater Release and Southern California Coastal Wetlands: Technical Reports: Report 2. Review of Salinity Effects and Predictions of Estuarine Responses to Lowered Salinity.* The San Diego Association of Governments.

Zedler, J.B., C.S. Nordby and B. E. Kus. 1992. The Ecology of Tijuana Estuary, California: A National Estuarine Research Reserve. NOAA Office of Coastal Resource Management, Sanctuaries and Reserves Division, Washington D.C.

Zembal, R. and S.M. Hoffman. 2010. A survey of Belding's savannah sparrow (*Passerculus sandwichensis beldingi)* in California 2010.

Zembal, R. and S.M. Hoffman. 2014. Status and Distribution of the Light-footed (Ridgway's) Rail in California. 2014 Season. State of California, the Resources Agency, Department of Fish and Wildlife. Wildlife Division.

APPENDIX B

PUBLIC SCOPING INFORMATION: NOP AND COMMENT LETTERS

NOTICE OF PREPARATION

PROJECT TITLE: Los Peñasquitos Lagoon Enhancement Plan, Program Environmental Impact Report

December 8, 2017

The California Department of Parks and Recreation (CDPR) is the Lead Agency under the requirements of the California Environmental Quality Act (CEQA) and will be preparing a Program Environmental Impact Report (PEIR) for the Los Peñasquitos Lagoon Enhancement Plan. CDPR is requesting the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. A brief description of the Project, the park unit's location, and a brief description of possible environmental effects are included.

Interested organizations or individuals may also respond to this notice with comments regarding the information contained within it.

Responses must be sent to CDPR no later than January 22, 2018. Please include your name and contact information or the name of a contact person in your organization or agency, if appropriate. Please reference the following project title in the subject line of your correspondence that is provided below.

Project Title: Los Peñasquitos Lagoon Enhancement Plan, Program Environmental Impact Report

Electronic submittals may be sent to the following email address:

Email: SDCD.CEQA@parks.ca.gov

Hard copies can be mailed to the following contact and address:

Cindy Krimmel, Environmental Planner
San Diego Coast District
California Department of Parks and Recreation
4477 Pacific Highway
San Diego, CA 92110
Phone (619) 688-3260

PROJECT DESCRIPTION: The proposed project would enhance Los Peñasquitos Lagoon through reconfiguration of the channel network in the lagoon to provide better freshwater management and enhanced tidal exchange/influence. The project would also identify vector and trails management opportunities. Beginning in 2013, an updated Lagoon Enhancement Plan was developed to provide guidance on restoring Los Peñasquitos Lagoon's (Lagoon) habitats, protecting listed species, reducing threats to public health, and involving stakeholder groups with regard to coastal resource stewardship. Conceptual-level alternatives for restoring and enhancing the Lagoon's native habitats were developed as part of the process, and are identified in the updated Los Peñasquitos Lagoon Enhancement Plan (Enhancement Plan), which provides guidance over future design and implementation of lagoon improvements. In general, the conceptual-level alternatives focused on restoring salt marsh and transition habitats to allow for upslope migration of salt marsh in responses to sea level rise using various strategies.

Based on evaluation of criteria such as impacts to habitat and sensitive species during construction, contribution to climate change, and sustainability, one of the conceptual alternatives, referred to as Freshwater Management within the updated Enhancement Plan, was identified as the proposed project. The proposed project has three primary elements:

- Lagoon enhancement - modifications to the tidal channels to enhance areas of historic salt marsh. These areas of historic salt marsh have converted to a brackish system from both surface freshwater and groundwater inputs. Channel improvements would provide features in areas where salt marsh is expected to develop over time in response to sea level rise. Freshwater management measures would include decreases of input through watershed runoff reduction, potential diversion, and beneficial use of these flows where feasible.
- Vector management – vector management incorporating measures such as structural improvements to reduce stagnant water within storm drain systems, channel modifications to improve tidal circulation, and channel creation to connect areas of inundation to reduce residence time.
- Trail improvements – proposed improvements/enhancements to existing trails, identification of trails that are anticipated to become inundated with sea level rise, and opportunities to create linkages to regional trail networks and public transit centers.

A PEIR has been selected by CDPR as the appropriate overarching environmental evaluation document for current and future management priorities within the Lagoon, taking into account sea level rise.

PROJECT LOCATION: The Project site is State Marsh Natural Preserve that is part of the Torrey Pines State Natural Reserve located in northern San Diego County (see attached Figure 1-1). Los Peñasquitos Lagoon is a 565-acre coastal estuary that receives drainage from an approximately 59,212-acre watershed comprising three primary sub-drainages: Carmel Valley, Los Peñasquitos Canyon, and Carroll Canyon.

POSSIBLE EFFECTS AND MITIGATION: The scoping process is designed to elicit comments from the public, responsible agencies, and interested parties on the scope of the Draft PEIR. A preliminary list of probable environmental effects and considerations that could be related to the project implementation is identified below to initiate the scoping process.

The following issues will be evaluated: Public Access and Recreation, Hydrology, Water Quality and Sediment Management, Geology/Soils, Biological Resources, Cultural Resources, Paleontological Resources, Public Services and Utilities, Public Health and Safety, Climate Change and Greenhouse Gas Emissions, Air Quality, Traffic, Noise, and Odor.

PUBLIC INFORMATION: The following websites shall provide digital availability of the Notice of Preparation posting, Lagoon Enhancement Plan, and updates regarding progress with draft and final PEIR documents:

- https://www.parks.ca.gov/?page_id=983
- https://www.parks.ca.gov/?page_id=657
- https://www.parks.ca.gov/?page_id=658
- http://www.lospenasquitos.org/planning/lagoon-enhancement-plan/
- http://www.torreypines.org/index.php/management-plans

In addition, copies of the PEIR and related documents can be reviewed at CDPR's San Diego Coast District Office located at:

California Department of Parks and Recreation
San Diego Coast District
4477 Pacific Highway
San Diego, CA 92110
Phone (619) 688-3260

A public meeting will be held at Sumner Auditorium on the campus of Scripps Institution of Oceanography (SIO) on January 6, 2018 from 10:00am to 12:00pm, located at 8625 Kennel Way, La Jolla CA 92037. Please note that parking for Sumner Auditorium on the campus on SIO is limited to faculty and students only with strict parking enforcement. Free parking for the public can be found along La Jolla Shores Drive. A location map for Sumner Auditorium is provided in Figure 1-2.

FIGURE 1-1
Los Peñasquitos Lagoon Location Map

FIGURE 1-2
Sumner Auditorium Location Map

FIGURE 1-1. Los Peñasquitos Lagoon Location Map

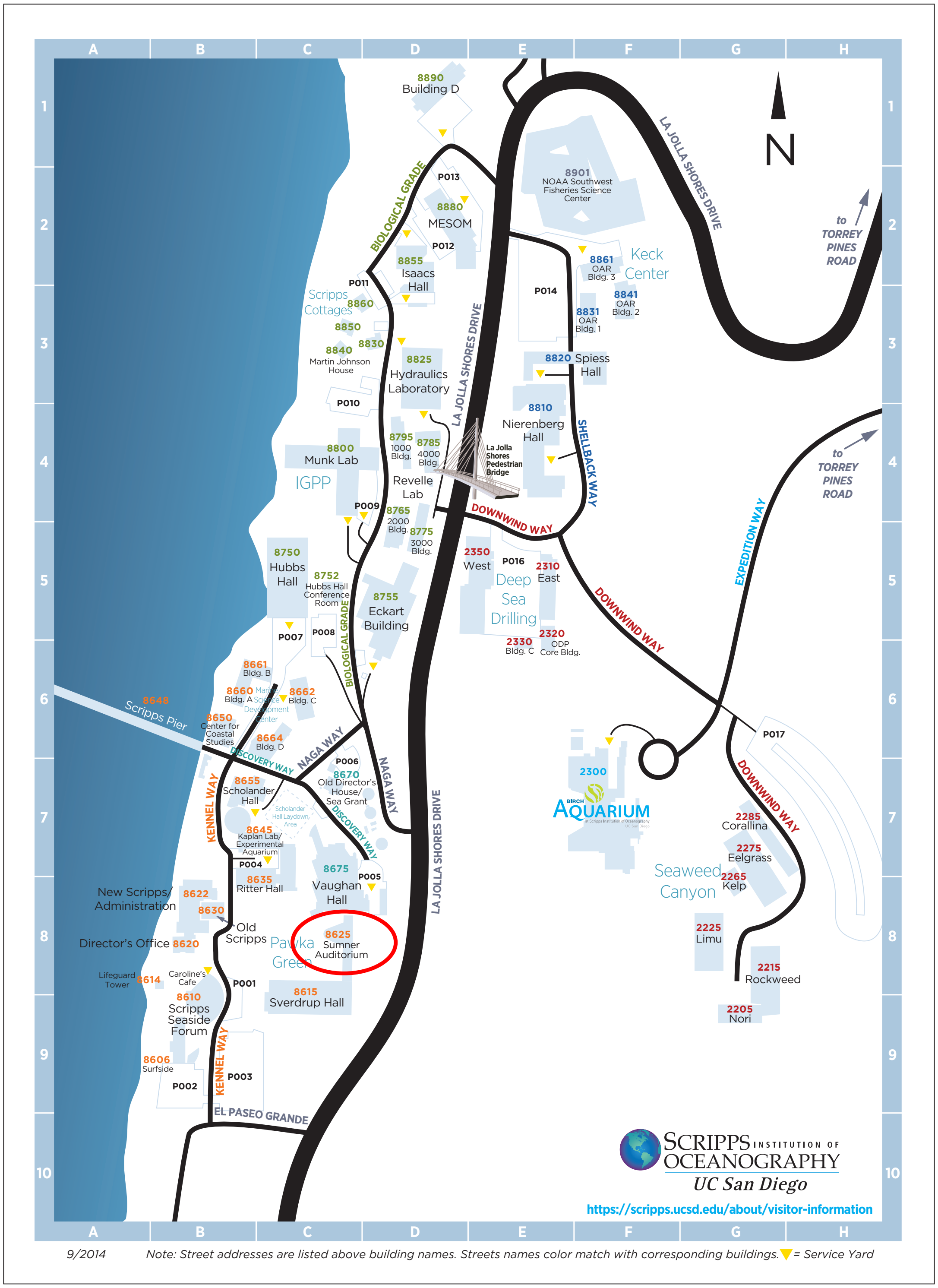


FIGURE 1-2. Sumner Auditorium Location Map

County of San Diego

MARK WARDLAW
DIRECTOR

PLANNING & DEVELOPMENT SERVICES
5510 OVERLAND AVENUE, SUITE 310, SAN DIEGO, CA 92123
(858) 694-2962 • Fax (858) 694-2555
www.sdcounty.ca.gov/pds

KATHLEEN A. FLANNERY
ASSISTANT DIRECTOR

January 22, 2018

Cindy Kimmel
Environmental Planner
San Diego Coast District
California Department of Parks and Recreation
4477 Pacific Highway
San Diego, CA 92110

Via e-mail to: sdcd.ceqa@parks.ca.gov

COMMENTS ON THE NOTICE OF PREPARATION OF A PROGRAM ENVIRONMENTAL IMPACT REPORT FOR THE LOS PEÑASQUITOS LAGOON ENHANCEMENT PROJECT

The County of San Diego (County) reviewed the California Department of Parks and Recreation (Department) Notice of Preparation of a Program Environmental Impact Report (PEIR) for the Los Peñasquitos Lagoon Enhancement Plan dated December 8, 2017 (Project). Please note that none of these comments should be construed as County support for this Project.

COUNTY DEPARTMENT OF PARKS AND RECREATION

1. The County Department of Parks and Recreation (DPR) supports both options 1 and 2 to provide access to and from the Trans County Trail to local trails in the area.

2. If any changes to the alignment of the Trans County Trail are proposed for this Project, please contact DPR trails coordinator Margaret Diss at 858-966-1372 or by e-mail at margaret.diss@sdcounty.ca.gov.

VECTOR CONTROL PROGRAM

1. The Vector Control Program (VCP) is responsible for the protection of public health through the surveillance and control of mosquitoes that are vectors for human disease including West Nile virus (WNV). The VCP supports the Project's focus on vector management including measures to reduce stagnant water and improve tidal circulation to reduce potential breeding habitat for mosquitoes.

   The VCP respectfully requests that the PEIR address potential impacts from possible mosquito breeding sources created by lagoon enhancements and/or during the construction process, and that the enhancements be designed and constructed in a manner to minimize those impacts.

a. Specifically, ensure construction-related depressions created by grading activities, vehicle tires, and excavation do not result in areas that will hold standing water. In addition, ensure drains, BMPs, and other structures do not create a potential mosquito breeding source. Any area that is capable of accumulating and holding at least ½ inch of water for more than 96 hours can support mosquito breeding and development. Finally, if habitat remediation is required for the Project, the design should be consistent with guidelines for preventing mosquito habitat creation.

b. Please note, the VCP has the authority pursuant to state law and County Code to order the abatement of any mosquito breeding that does occur either during construction or after the Project is completed that is determined to be a vector breeding public nuisance. The VCP will exert that authority as necessary to protect public health if the Project is not designed and constructed to prevent such breeding.

c. The VCP routinely monitors and treats portions of the Los Peñasquitos Lagoon as necessary to prevent mosquito breeding and associated public health risks. Access to the lagoon for monitoring and any treatment warranted should be retained for Vector Control Program staff during construction and after lagoon enhancements are made.

d. For your information, the County of San Diego Guidelines for Determining Significance for Vectors can be accessed at: http://www.sandiegocounty.gov/content/dam/sdc/pds/docs/vector_guidelines.pdf and the California Department of Public Health Best Management Practices for Mosquito Control in California is available at: http://www.cdph.ca.gov/HealthInfo/discond/Documents/BMPforMosquitoControl07-12.pdf

2. The VCP appreciates the opportunity to participate in the environmental review process for this Project. If you have any questions regarding these comments, please contact Daniel Valdez at 858-688-3722 or by e-mail at Daniel.Valdez@sdcounty.ca.gov.

The County appreciates the opportunity to comment on this Project. We look forward to receiving future documents related to this Project and providing additional assistance at your request. If you have any questions regarding these comments, please contact Timothy Vertino, Land Use / Environmental Planner, at (858) 495-5468, or via e-mail at timothy.vertino@sdcounty.ca.gov.

Sincerely,

Eric Lardy, AICP
Group Program Manager, Advance Planning Division
Planning & Development Services

E-mail cc: Jason Paguio, Policy Advisor, Board of Supervisors, District 3
Vincent Kattoula, CAO Staff Officer, LUEG
Marcus Lubich, Senior Park Project Manager, DPR
Traci Mitchell, Administrative Analyst, DEH

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
Environmental and Cultural Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710

January 3, 2018

Darren Smith
California Department of Parks and Recreation
4477 Pacific Highway
San Diego, CA 92110

Sent via e-mail: sdcd.ceqa@parks.ca.gov

RE: SCH# 2017121036; Los Penasquitos Lagoon Enhancement Plan Project, City of San Diego; San Diego County, California

Dear Mr. Smith:

The Native American Heritage Commission has received the Notice of Preparation (NOP) for Draft Environmental Impact Report for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.), specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, § 15064.5 (b) (CEQA Guidelines Section 15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an environmental impact report (EIR) shall be prepared. (Pub. Resources Code § 21080 (d); Cal. Code Regs., tit. 14, § 15064 subd. (a)(1) (CEQA Guidelines § 15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources with the area of project effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a **separate category of cultural resources**, "tribal cultural resources" (Pub. Resources Code § 21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment (Pub. Resources Code § 21084.2). Please reference California Natural Resources Agency (2016) "Final Text for tribal cultural resources update to Appendix G: Environmental Checklist Form," http://resources.ca.gov/ceqa/docs/ab52/Clean-final-AB-52-App-G-text-Submitted.pdf. Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code § 21084.3 (a)). **AB 52 applies to any project for which a notice of preparation or a notice of negative declaration or mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. § 800 et seq.) may also apply.

The NAHC recommends **lead agencies consult with all California Native American tribes** that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments. **Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws**.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a **lead agency** shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
   a. A brief description of the project.
   b. The lead agency contact information.
   c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code § 21080.3.1 (d)).
   d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code § 21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A **lead agency** shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code § 21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or environmental impact report. (Pub. Resources Code § 21080.3.1(b)).
   a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code § 65352.4 (SB 18). (Pub. Resources Code § 21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
   a. Alternatives to the project.
   b. Recommended mitigation measures.
   c. Significant effects. (Pub. Resources Code § 21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
   a. Type of environmental review necessary.
   b. Significance of the tribal cultural resources.
   c. Significance of the project's impacts on tribal cultural resources.
   d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code § 21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code sections 6254 (r) and 6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code § 21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
   a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
   b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code section 21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code § 21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
    a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
    b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code § 21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code section 21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code section 21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code § 21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code section 21084.3 (b). (Pub. Resources Code § 21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
        i. Planning and construction to avoid the resources and protect the cultural and natural context.
        ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
        i. Protecting the cultural character and integrity of the resource.
        ii. Protecting the traditional use of the resource.
        iii. Protecting the confidentiality of the resource.
    c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    d. Protecting the resource. (Pub. Resource Code § 21084.3 (b)).
    e. Please note that a federally recognized California Native American tribe or a nonfederally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code § 815.3 (c)).
    f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code § 5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An environmental impact report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 21080.3.2.
    b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code section 21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code § 21082.3 (d)).

    This process should be documented in the Cultural Resources section of your environmental document.

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires **local governments** to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code § 65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code § 65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code section 65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code sections 5097.9 and 5097.993 that are within the city's or county's jurisdiction. (Gov. Code § 65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    - **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    - **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    - **a.** If part or all of the APE has been previously surveyed for cultural resources.
    - **b.** If any known cultural resources have been already been recorded on or adjacent to the APE.
    - **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
    - **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    - **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.

  b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
  a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
  b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
  a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, section 15064.5(f) (CEQA Guidelines section 15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
  b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
  c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

Please contact me if you need any additional information at gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Toth

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst
(916) 373-3714

cc: State Clearinghouse

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
2177 Salk Ave, Suite 250
Carlsbad, California 92011

In Reply Refer To:
FWS-SDG-18B0077-18TA0398

January 19, 2018
Sent by Email

Cindy Krimmel
Environmental Planner
California Department of Parks and Recreation - San Diego Coast District
4477 Pacific Highway
San Diego, California 92110

Subject: Comments on the Notice of Preparation of a Program Environmental Impact Report for the Los Peñasquitos Lagoon Enhancement Plan

Dear Ms. Krimmel:

The U.S. Fish and Wildlife Service (Service) has reviewed your December 8, 2017, Notice of Preparation (NOP) of a Program Environmental Impact Report (PEIR) for the Los Peñasquitos Lagoon Enhancement Plan (Enhancement Plan). The project details and comments provided herein are based on the information provided in the NOP and our knowledge of sensitive and declining vegetation communities in the region, our cooperative agreement for financial assistance to the Los Peñasquitos Lagoon Foundation for "Planning for Enhancement of Los Peñasquitos Lagoon" (F17AC00567), our participation at meetings of the Regulatory Advisory Committee (RAC) for the Enhancement Plan PEIR, and our participation in the Multiple Species Conservation Program (MSCP) and the City of San Diego's (City) MSCP Subarea Plan (SAP).

The primary concern and mandate of the Service is the protection of public fish and wildlife resources and their habitats. The Service has legal responsibility for the welfare of migratory birds, anadromous fish, and endangered animals and plants occurring in the United States. The Service is also responsible for administering the Federal Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.), including habitat conservation plans (HCP) developed under section 10(a)(1)(B) of the Act. The City participates in the Service's HCP program by implementing its SAP.

The project is located within the 565-acre Los Peñasquitos Lagoon that is part of the Torrey Pines State Natural Reserve. The project is within the City's MSCP SAP and is identified within the Multi-Habitat Planning Area (MHPA or preserve) in the City's SAP.

According to the NOP, the PEIR has been selected by the California Department of Parks and Recreation (CDPR) as the overarching evaluation document for current and future management priorities within Los Peñasquitos Lagoon. The NOP also identifies a proposed project to enhance Los Peñasquitos Lagoon by reconfiguring the channel network in the lagoon to provide better freshwater management, enhanced tidal exchange/influence, and improved vector control and public access consistent with the updated Enhancement Plan, dated August 2016.

The Service's main concerns are: 1) potential impacts to federally listed species and their habitats; 2) identifying the overall vision and goals based on the programmatic nature of the project; 3) that the PEIR address all short-term and long-term (i.e., future phases) conceptual actions identified in the Enhancement Plan instead of focusing on one concept or alternative; and 4) consistency with the City's SAP. Our comments and recommendations are in the appendix.

We appreciate the opportunity to comment on this NOP. We are hopeful that further consultation among our agencies will ensure the protection we find necessary for the biological resources that would be affected by this project. If you have questions or comments regarding this letter, please contact Patrick Gower at (760) 431-9440.

Sincerely,

DAVID ZOUTENDYK

Digitally signed by DAVID ZOUTENDYK
Date: 2018.01.19 13:19:55 -08'00'

for Karen A. Goebel
Assistant Field Supervisor
U.S. Fish and Wildlife Service

cc: SDCD.CEQA@parks.ca.gov

APPENDIX

U.S. Fish and Wildlife Service Comments and Recommendations on the Notice of Preparation for a Program Environmental Impact Report for the Los Peñasquitos Lagoon Enhancement Plan

1. Because the PEIR will be considered the overarching evaluation document for current and future management priorities within Los Peñasquitos Lagoon, we recommend that it comprehensively address all short-term and long-term (i.e., future phases) actions identified in the updated Los Peñasquitos Lagoon Enhancement Plan (Enhancement Plan; dated August 2016) instead of focusing on one concept/alternative. During the RAC meetings it was stated that the PEIR will focus on Lagoon Concept 2- Freshwater Management as described in the Enhancement Plan. However, the Enhancement Plan included other concepts or alternatives over three phases. Further, we understand that the City of San Diego (City) may be producing a project specific California Environmental Quality Act document for a pilot project associated with Lagoon Concept 2 that could tier-off of the PEIR. We are concerned that the PEIR will be duplicative with the City's effort and therefore recommend that the PEIR be more comprehensive and set the stage for future phases by addressing all concepts and management actions for all phases as described in the Enhancement Plan. For instance, we recommend that the PEIR address the potential phase 3 action of reconnecting historic tidal channels by removing portions of the railroad berm to facilitate implementation of such actions when opportunities are available, such as when the double-tracking of the railroad is planned and implemented in the future.

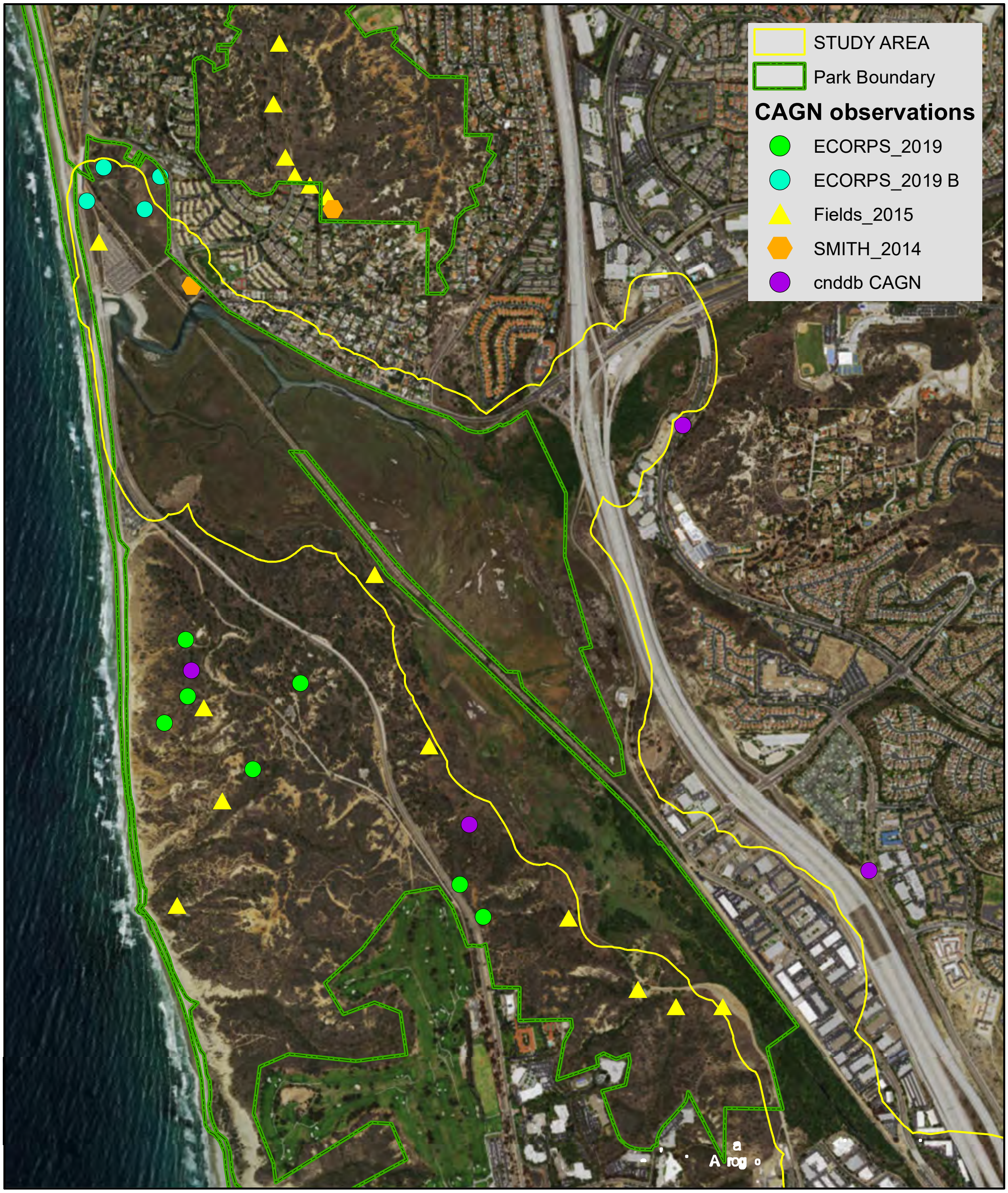
2. The PEIR should identify an overarching vision and a subset of goals for enhancing Los Peñasquitos Lagoon. These goals should be specific and measurable so they can be used as a metric to compare the various concepts/alternatives or management actions identified in the Enhancement Plan as well as later incorporated into an adaptive management program for evaluating implementation success and planning future actions. Based on discussions at the RAC meeting on January 9, 2018, the Assessment Criteria and Metrics for Conceptual Evaluation in Table 10-1 of the Enhancement Plan may be adopted and possibly refined to be such goals. The PEIR could then utilize these goals to describe the decision process for evaluating all of the alternatives and why Lagoon Concept 2 was chosen as the proposed project for Phase 1.

3. The PEIR should include the estimated size and descriptions of habitats that are existing, that will be impacted, and will ultimately result from each of the concepts/alternatives identified for Phase 1 in the Enhancement Plan. For example, and as discussed at the RAC meetings, because the habitat identified as 'transitional zone' will replace relatively large acreages of existing freshwater and brackish marsh habitats, this 'transition zone' habitat category needs to be clearly defined or renamed in terms of whether it is an upland or wetland, and what vegetation community will be expected over time. We understand that the anticipated acreage of habitats impacted at a programmatic level are subject to change when project specific planning is completed; however, the estimates are important for comparing the different concepts/alternatives. We also understand, that there may be some uncertainty of what vegetation community may occur in the 'transition zone' over time and recommend that the PEIR describe this uncertainty and how the City's plan to implement a pilot enhancement action could be utilized to evaluate whether the proposed actions can meet the vision and goals for enhancing Los Peñasquitos Lagoon before implementing enhancement actions on a larger scale.

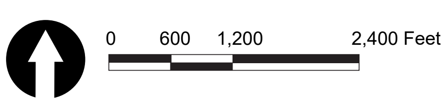
The PEIR should explain the relationship of the Enhancement Plan with the City's Multiple Species Conservation Program Subarea Plan (SAP) and what components of the project can be covered under the City's SAP. If a project proposes to impact federally listed species not covered or if the project is not consistent with the provisions of the City's SAP, consultation under section 7 of the Act may be required.

APPENDIX C

LOS PEÑASQUITOS LAGOON MARSH WETLAND BIOLOGICAL RESOURCE LOCATIONS



Source: ESRI



Coastal California Gnatcatcher Location Map

APPENDIX D

CULTURAL RESOURCE AND CONSULTATION INFORMATION

AB 52 Requirements

Timeline:

- Tribe requests to be put on the Lead Agency's general notification list. A Tribe can request to be added to the list at any time, if they are not already on the notification list.
- Lead agency, within 14 days of a decision to undertake the project or determination that a project application is complete, notifies the Tribe(s) on its list that are associated geographically or culturally with the project area.
- The Tribe has 30 days to request consultation or decline.
- If the Tribe does not respond, declines consultation, or the request comes in after the 30 day window, the Lead agency had no further obligation under AB52
- If the Tribe requests consultation, the lead agency must begin consultation within 30 days, and before the release of the Negative Declaration, Mitigated Negative Declaration or the EIR.
- There is no limitations on the time allowed for consultation, continues until parties agree or one party decides that after a good faith effort, no agreement will be reached.
- Any measures agreed upon must be included in the draft EIR.

The Tribe, or other interested parties, can still provide information at any time (including at public meetings and comment periods) to the Lead Agency; however, this is not a requirement under AB 52.

Sacred Lands File & Native American Contacts List Request

Native American Heritage Commission
1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691
916-373-3710
916-373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: Programmatic EIR for the Los Peñasquitos Lagoon Enhancement Plan

County: San Diego

USGS Quadrangle Name: 7.5' Del Mar

Township: 14 south **Range:** 4 West **Section(s):** 25

Company/Firm/Agency: Los Peñasquitos Lagoon Foundation

Street Address: P.O. Box 940

City: Cardiff by the Sea **Zip:** 92007

Phone: 760 271-0574

Fax: 760 454-2453

Email: mikehastings1066@gmail.com

Project Description:

The project consists of CEQA certification of the updated Los Peñasquitos Lagoon Enhancement Plan through a Programmatic Environmental Impact Report (PEIR). A PEIR has been selected to provide the opportunity for the lagoon enhancement plan to serve as an over-arching guidance document for management needs/priorities for Los Peñasquitos Lagoon and further development of lagoon improvement concepts for habitat, public access, and vector management to be conducted outside of the PEIR through a separate CEQA process (e.g project-level EIRs). The Notice of Preparation is expected to be released in late October and LPLF is requesting contact information to be included in the distribution list for CEQA.

NATIVE AMERICAN HERITAGE COMMISSION
Environmental and Cultural Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710

October 12, 2017

Mike Hastings
Los Peñasquitos Lagoon Foundation

Sent by E-mail: mikehastings1066@gmail.com

RE: Proposed Los Peñasquitos Lagoon Enhancement Plan Project, near the City of Del Mar; Del Mar USGS Quadrangle, San Diego County, California

Dear Mr. Hastings:

A records search of the Native American Heritage Commission (NAHC) *Sacred Lands File* was completed for the area of potential project effect (APE) referenced above with negative results. Please note that the absence of specific site information in the *Sacred Lands File* does not indicate the absence of Native American cultural resources in any APE.

Attached is a list of tribes culturally affiliated to the project area. I suggest you contact all of the listed Tribes. If they cannot supply information, they might recommend others with specific knowledge. The list should provide a starting place to locate areas of potential adverse impact within the APE. By contacting all those on the list, your organization will be better able to respond to claims of failure to consult. If a response has not been received within two weeks of notification, the NAHC requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact via email: gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Toth

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst
(916) 373-3714

Native American Heritage Commission
Native American Contact List
San Diego County
10/12/2017

Barona Group of the Capitan Grande
Edwin Romero, Chairperson
1095 Barona Road — Kumeyaay
Lakeside, CA, 92040
Phone: (619) 443 - 6612
Fax: (619) 443-0681
cloyd@barona-nsn.gov

Campo Band of Mission Indians
Ralph Goff, Chairperson
36190 Church Road, Suite 1 — Kumeyaay
Campo, CA, 91906
Phone: (619) 478 - 9046
Fax: (619) 478-5818
rgoff@campo-nsn.gov

Ewiiaapaayp Tribal Office
Michael Garcia, Vice Chairperson
4054 Willows Road — Kumeyaay
Alpine, CA, 91901
Phone: (619) 445 - 6315
Fax: (619) 445-9126
michaelg@leaningrock.net

Ewiiaapaayp Tribal Office
Robert Pinto, Chairperson
4054 Willows Road — Kumeyaay
Alpine, CA, 91901
Phone: (619) 445 - 6315
Fax: (619) 445-9126

Iipay Nation of Santa Ysabel
Clint Linton, Director of Cultural Resources
P.O. Box 507 — Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760) 803 - 5694
cjlinton73@aol.com

Iipay Nation of Santa Ysabel
Virgil Perez, Chairperson
P.O. Box 130 — Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760) 765 - 0845
Fax: (760) 765-0320

Inaja Band of Mission Indians
Rebecca Osuna, Chairperson
2005 S. Escondido Blvd. — Kumeyaay
Escondido, CA, 92025
Phone: (760) 737 - 7628
Fax: (760) 747-8568

Jamul Indian Village
Erica Pinto, Chairperson
P.O. Box 612 — Kumeyaay
Jamul, CA, 91935
Phone: (619) 669 - 4785
Fax: (619) 669-4817

Kwaaymii Laguna Band of Mission Indians
Carmen Lucas,
P.O. Box 775 — Kumeyaay
Pine Valley, CA, 91962
Phone: (619) 709 - 4207

La Posta Band of Mission Indians
Javaughn Miller, Tribal Administrator
8 Crestwood Road — Kumeyaay
Boulevard, CA, 91905
Phone: (619) 478 - 2113
Fax: (619) 478-2125
jmiller@LPtribe.net

La Posta Band of Mission Indians
Gwendolyn Parada, Chairperson
8 Crestwood Road — Kumeyaay
Boulevard, CA, 91905
Phone: (619) 478 - 2113
Fax: (619) 478-2125
LP13boots@aol.com

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Los Penasquitos Lagoon Enhancement Plan, San Diego County.

Native American Heritage Commission
Native American Contact List
San Diego County
10/12/2017

Manzanita Band of Kumeyaay Nation
Nick Elliott, Cultural Resources Coordinator
P. O. Box 1302 — Kumeyaay
Boulevard, CA, 91905
Phone: (619) 766 - 4930
Fax: (619) 766-4957
nickmepa@yahoo.com

Manzanita Band of Kumeyaay Nation
Angela Elliott Santos, Chairperson
P.O. Box 1302 — Kumeyaay
Boulevard, CA, 91905
Phone: (619) 766 - 4930
Fax: (619) 766-4957

Mesa Grande Band of Mission Indians
Mario Morales, Cultural Resources Representative
PMB 366 35008 Pala Temecula Rd. — Kumeyaay
Pala, CA, 92059
Phone: (760) 622 - 1336

Mesa Grande Band of Mission Indians
Virgil Oyos, Chairperson
P.O Box 270 — Kumeyaay
Santa Ysabel, CA, 92070
Phone: (760) 782 - 3818
Fax: (760) 782-9092
mesagrandeband@msn.com

Pauma Band of Luiseno Indians - Pauma & Yuima Reservation
Temet Aguilar, Chairperson
P.O. Box 369 — Luiseno
Pauma Valley, CA, 92061
Phone: (760) 742 - 1289
Fax: (760) 742-3422

San Pasqual Band of Mission Indians
John Flores, Environmental Coordinator
P. O. Box 365 — Kumeyaay
Valley Center, CA, 92082
Phone: (760) 749 - 3200
Fax: (760) 749-3876
johnf@sanpasqualtribe.org

San Pasqual Band of Mission Indians
Allen E. Lawson, Chairperson
P.O. Box 365 — Kumeyaay
Valley Center, CA, 92082
Phone: (760) 749 - 3200
Fax: (760) 749-3876
allenl@sanpasqualtribe.org

Sycuan Band of the Kumeyaay Nation
Lisa Haws, Cultural Resources Manager
1 Kwaaypaay Court — Kumeyaay
El Cajon, CA, 92019
Phone: (619) 312 - 1935
lhaws@sycuan-nsn.gov

Sycuan Band of the Kumeyaay Nation
Cody J. Martinez, Chairperson
1 Kwaaypaay Court — Kumeyaay
El Cajon, CA, 92019
Phone: (619) 445 - 2613
Fax: (619) 445-1927
ssilva@sycuan-nsn.gov

Viejas Band of Kumeyaay Indians
Julie Hagen,
1 Viejas Grade Road — Kumeyaay
Alpine, CA, 91901
Phone: (619) 445 - 3810
Fax: (619) 445-5337
jhagen@viejas-nsn.gov

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Los Penasquitos Lagoon Enhancement Plan, San Diego County.

Native American Heritage Commission
Native American Contact List
San Diego County
10/12/2017

Viejas Band of Kumeyaay Indians
Robert Welch, Chairperson
1 Viejas Grade Road
Alpine, CA, 91901
Phone: (619) 445 - 3810
Fax: (619) 445-5337
jhagen@viejas-nsn.gov

Kumeyaay

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Los Penasquitos Lagoon Enhancement Plan, San Diego County.

California State Parks

PROJECT SPECIFIC NATIVE AMERICAN CONSULTATION

☐ *Confidential information enclosed*

Project Title: Programmatic EIR for the Los Penasquitos Lagoon Enhancement Plan

Park Unit: Torrey Pines SNR **District:** San Diego Coast **Native American Tribal Territory/ies:** Kumeyaay

Tribal Liaison for project: Nicole Turner **Tribal Liaison for district:** Nicole Turner

District Superintendent: Robin Greene

☒ **Letter/** ☒ **Email Sent to Native American Heritage Commission (NAHC) requesting:**
☒ **Sacred sites search,** ☒ **consultation list,** ☐ **other:**

Date of correspondence to NAHC: **Date of follow-up correspondence to NAHC:** 10-12-2017

Date of NAHC Response: 10-12-2017

NAHC Sacred Lands File Search Results: ☒ Negative ☐ Positive ☐ Possible ☐ Other:

Native American contact/s for sacred lands/sites:

Additional information from NAHC:

List of Tribal Representative/s and affiliation/s as indicated by NAHC:

Name	**Affiliation**	**Method/s* and Date/s of initial contact**	**Method/s* and Date/s of replies**	**Method/s* and Date/s of additional contact**	**Method/s* and Date/s of replies**	**Comments**
Edwin Romero Chairperson	Barona Group of the Capitan Grande	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 1-30-2018	L E C V P	Left Voice Message with Candy Loyd Executive Assistant
Ralph Goff, Chairperson	Campo Band of Mission Indians	Letter 1-8-2018 Email 1-12-2018	Letter 1-26-2018	L E C V P	L E C V P	Response letter from Ralph Goff sent via email from Marcus Cuero requesting consultation.
Michael Garcia, Vice Chairperson	Ewiiaapaayp Tribal Office	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 2-5-2018	L E C V P	

Robert Pinto, Chairperson	Ewiiaapaayp Tribal Office	Letter 1-8-2018	L E C V P	Voice Message 2-5-2018	L E C V P	
Clint Linton, Director of Cultural Resources	Iipay Nation of Santa Ysabel	Letter 1-8-2018 Email 1-12-2018	Email1-12-2018 would like to consult	L E C V P	L E C V P	
Virgil Perez, Chairperson	Iipay Nation of Santa Ysabel	Letter 1-8-2018	L E C V P	L E C V P	L E C V P	Consulting with Clint Linton for Santa Ysabel, Met with Clint to discuss the project 2/6/2018. Overall supportive of project and understanding that this is programmatic and no formal project design is being proposed at this time. I let him know I will include him/invite him to any formal consultation meetings.
Rebecca Osuna, Chairperson	Inaja Band of Mission Indians	Letter 1-8-2018	L E C V P	L E C V P	L E C V P	Called 2-5-2018 and 2-6-2018 and it just rang; no voicemail
Erica Pinto, Chairperson	Jamul Indian Village	Letter 1-8-2018	L E C V P	Voice Message 2-5-2018	L E C V P	Transferred to Lisa Cumper who handles environmental concerns, left voice message
Carmen Lucas	Kwaaymii Laguna Band of Mission Indians	Letter 1-8-2018	L E C V P	Voice Message 1-30-2018	L E C V P	Phone conversation 2-5-2018, no concerns at this time.
Javaughn Miller, Tribal Administrator	La Posta Band of Mission Indians	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 2-5-2018	L E C V P	
Gwendolyn Parada, Chairperson	La Posta Band of Mission Indians	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 2-5-2018	L E C V P	
Nick Elliott, Cultural Resources Coordinator	Manzanita Band of Kumeyaay Nation	Letter 1-8-2018 Email 1-12-2018	L E C V P	Phone Conversation 1-30-2018	L E C V P	Informed that Nick Elliot was deceased.

Angela Elliott Santos, Chairperson	Manzanita Band of Kumeyaay Nation	Letter 1-8-2018	L E C V P	Voice Message 1-30-2018	L E C V P	
Mario Morales, Cultural Resources Representative	Mesa Grande Band of Mission Indians	Letter 1-8-2018 Email 1-20-2018	L E C V P	Voice Message 1-30-2018	Phone Conver 1-30-2018	Received call back was informed that he did reply to my email. I could not find the email. Resent the email requesting response that he received it and let him know that I will include him on future consultation meetings. Email 1-30-2018 asked to send the necessary documents.
Virgil Oyos, Chairperson	Mesa Grande Band of Mission Indians	Letter 1-8-2018 Email 1-12-2018	L E C V P	Phone Conversatio 1-30-2018 Email 1-30-2018	L E C V P	Spoke with the Mesa Grande Office and was informed that if they had any concerns they would reply but did not recall receiving notice. I was informed that the email NAHC had on file was not responded to and provided a new email and that I should send the letter to this address chairman@mesagrandeband-nsn.gov. An email was sent to this email address.
Temet Aguilar, Chairperson	Pauma Band of Luiseno Indians	Letter 1-8-2018	L E C V P	Voice Message 1-30-2018	L E C V P	
John Flores, Environmental Coordinator	San Pasqual Band of Mission Indians	Letter 1-8-2018 Smail 1-12-2018	Letter 12-12-2017	L E C V P	L E C V P	received letter in response to NOP for PEIR requesting updates and information that would be useful to better understanding history. Update if boundary changes. Recommend San Pasqual Cultural Monitor.
Allen E. Lawson, Chairperson	San Pasqual Band of Mission Indians	Letter 1-8-2018 Email 1-12-2018	Letter 1-22-2018	L E C V P	L E C V P	Response letter from Dave Toler requesting consultation.

Lisa Haws, Cultural Resources Manager	Sycuan Band of the Kumeyaay Nation	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 1-30-2018	L E C V P	
Cody J. Martinez, Chairperson	Sycuan Band of the Kumeyaay Nation	Letter 1-8-2018 Email 1-12-2018	L E C V P	Voice Message 1-30-2018	L E C V P	was refeered to Sheila Silvas (executive director) voice mail and left a message.
Julie Hagen, Viejas Band of the Kumeyaay Indians	Viejas Band of Kumeyaay Indians	Letter 1-8-2018 Email 1-12-2018	Letter 1-20-2018	L E C V P	L E C V P	Letter response from Earnest Pingleton - project site has cultural significance or ties to Viejas, requests a Kumeyaay Cultural Monitor on site for ground disturbing activities and to update on new developments such as inadvertent discovery of cultural resources. NT Sent email aknowledging letter 1-29-2018
Robert Welch, Chairperson	Viejas Band of Kumeyaay Indians	Letter 1-8-2018 Email 1-12-2018	Letter 1-20-2018	L E C V P	L E C V P	Received Letter from Earnest Pingleton 1-20-2018
		L E C V P	L E C V P	L E C V P	L E C V P	

**L=letter, E=email, C=phone conversation, V=voice message, P=in person,* = , =*

Consultation meeting/s

Date/Location	**Attendees**	**Discussion**
1/14/2018	Dave Toler (San Pasqual); Mike Hastings (Penasquitos Lagoon Foundation); Nicole Turner (DPR Archaeologist); Darren Smith (Services Manager	Discussion included overview of project and Dave expressed that the area as Ipai/Tipai territory and that Kumeyaay are most likely descendants. Dave expressed that the San Pasqual Band wants to make sure they are included in future consultation in the PEIR process and related projects. DPR will send the enhancement plan along with the draft PEIR when it is ready for comments. There are cultural concerns with the trail alignment and San Pasqual Band wants to be consulted during the design phase of the trail. Dave expressed that this is ancestral territory and there would be an interest in interpreting regional origin story of the watershed (meeting notes on file at DPR SDCD office).

Additional Information:

Emails 5/2/2018 were sent to those requesting consultation, Dave Toler (San Pasqual Band) Ralph Goff and Marcus Cuero (Campo), Mario Morales (Mesa Grande), and Clint Linton (Santa Ysabel), with 3 date options for a formal consultation meeting.

Attach copies of all correspondence to this form.

Sacred Lands File & Native American Contacts List Request

Mike Hastings <mikehastings1066@gmail.com> Wed, Oct 11, 2017, 3:32 PM

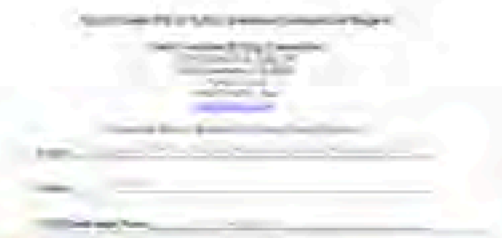
to nahc

Dear staff,

Please see attached form for consideration. My contact information is on the form should you have any questions or require additional information.

Regards,
Mike

--
Mike Hastings
Executive Director
Los Peñasquitos Lagoon Foundation
P.O. Box 940
Cardiff by the Sea, CA 92007



Sacred-Lands-File-...