

Los Peñasquitos Management

FINAL REPORT

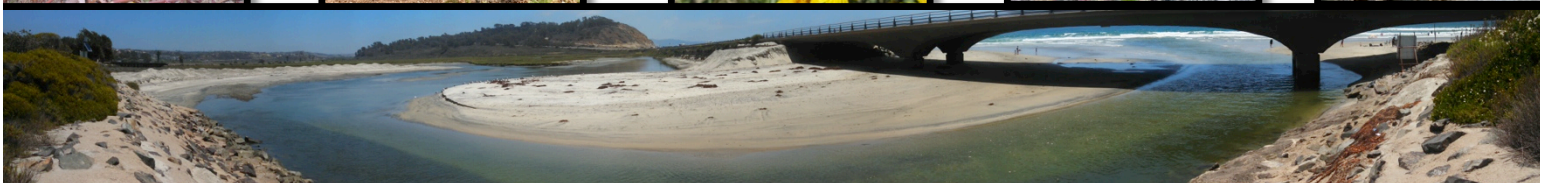
Contract # 5001772

TRANSNET ENVIRONMENTAL MITIGATION PROGRAM FY 2013

SUBMITTED TO:
San Diego Association of Governments

PREPARED BY:
LOS PEÑASQUITOS LAGOON FOUNDATION

August 14, 2014



I. INTRODUCTION

Background

Part of the Torrey Pines State Reserve, Los Peñasquitos Lagoon (LPL) is located in the County of San Diego's northern region between the coastal cities of La Jolla and Del Mar (See Figure 1 - Figure 3). LPL is a 510-acre coastal salt marsh that receives drainage from an approximately 60,000-acre watershed with three primary tributaries: Carmel Creek, Los Peñasquitos Creek and Carroll Creek. A State Preserve, LPL provides critical habitat for seven listed-species native to the region, serves as a stopover for migratory birds using the Pacific Flyway, provides essential fish habitat for marine species, and it the closest coastal lagoon to San Diego's only marine sanctuaries listed as Areas of Special Biological Significance by the State. LPL is included as a hardline preserve and core area in both County of San Diego's Multiple Species Conservation Program and the North County Multiple Conservation Program. LPL is also identified as a core area within Management Unit 7 (North Coast) of the Draft Management Strategic Plan for Conserved Lands in Western San Diego County, strategic plan for developed to help conserve regionally important species and habitats in San Diego.



Figure 1. Los Peñasquitos Watershed and Lagoon, State Map. Weston Solutions, Inc. 2012.



Figure 2. Los Peñasquitos Lagoon, Vicinity Map. Google Earth 2010.

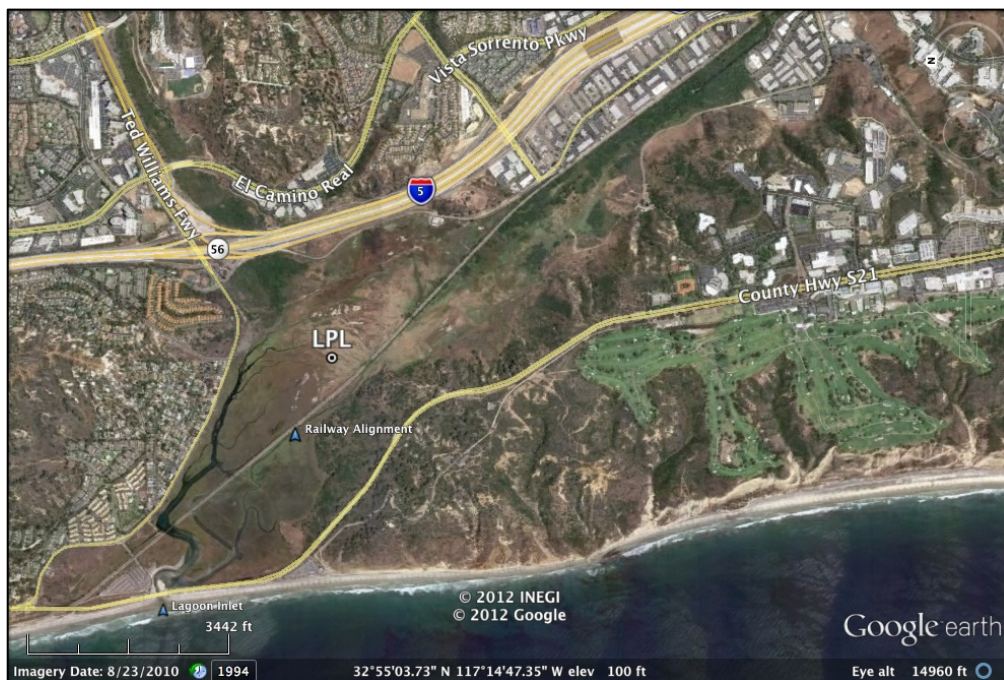


Figure 3. Los Peñasquitos Lagoon, Overview Map. Google Earth 2010.

Inlet Closures At Los Peñasquitos Lagoon

Large, fast-moving waves generated by winter storms in the North Pacific scour sand and cobbles from sources located along the beach and offshore sand bars (Figure 4). During the winter in north county San Diego this sediment moves south, pushed by storm surge, swell direction and the predominate longshore current (Figure 5). In the case of LPL, the closest sources of sand and cobble are located along the beaches and offshore sand bars along Del Mar Beach and Torrey Pines State Beach.



Figure 4. Large Winter Waves (~ 20 feet) off Torrey Pines State Beach. Photo by Mike Hastings.



Figure 5. Predominant Current and Sediment Movement along Torrey Pines State Beach.
Google Earth 2010.

Coastal lagoons serve as a natural sink for nearshore marine sediment. While the initial deposits of sand can be removed from the lagoons by storm runoff from the watershed during the winter and spring months, the cobbles often remain. The remaining cobbles can form sills that act as hardened structures that facilitate future sediment deposition in the lagoon inlets during subsequent wave and tidal events during the spring and early summer months. As the opportunity for measurable precipitation decreases late in the spring and into summer, lagoon outflows are diminished and are not always effective in removing sand from the inlet. Consequently, the tidal prism can become restricted during the summer

months and connectivity between the watershed and ocean diminished.

Urban development along the coast has compromised the natural state of most, if not all, coastal lagoons in southern California. Historically, the inlet at LPL meandered up and down the beach as storm runoff from the watershed, lagoon channel configuration and coastal processes (e.g. waves) helped to dictate where and when the inlet existed either temporarily or for extended periods of time. Urban encroachment along lagoon boundaries and within the lagoon itself during the last century has impaired the lagoon's natural resiliency to maintain an open inlet. Construction of Torrey Pines Road along the coast and a railway berm that bisects the lagoon are two examples of urban structures that modify the Lagoon's ability to operate naturally with regard to restoring its tidal prism (See Figures 6 to Figure 8).



Figure 6. Driving toward Los Peñasquitos Lagoon, 1920. Photo courtesy of the U.S. 101 Photo Gallery.



Figure 7. Construction of Highway 101 along Torrey Pines State Beach, 1932. Photo courtesy of U.S. 101 Photo Gallery.

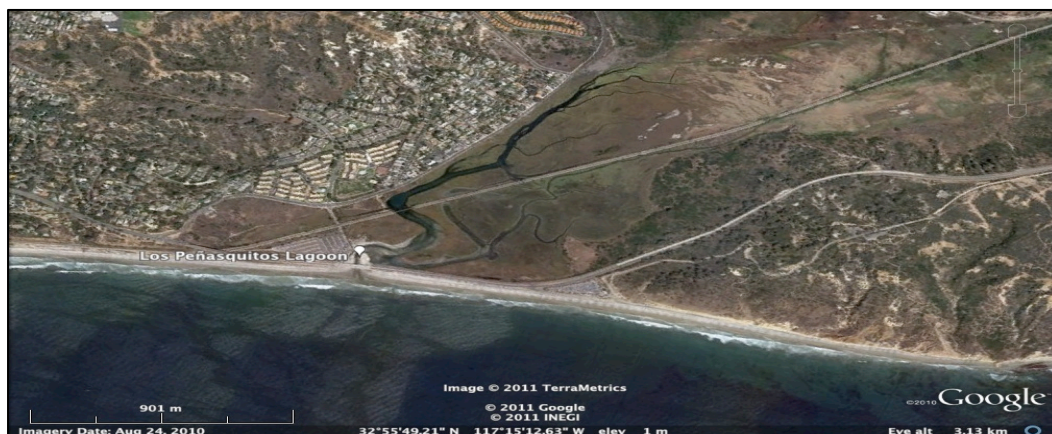


Figure 8. Urbanization at Los Peñasquitos Lagoon, 2010. Google Earth 2010.

Since 1983, LPLF has been adaptively managing the inlet at LPL. From 1983 to 2005, efforts focused on mechanical excavation under the lower bridge that has spanned the lagoon mouth since 1932. This was due in most part to the original lower bridge having 74 support columns that trapped most of the cobbles and sand under the bridge span (Figure 9). As sand and cobble piled up under the bridge, a

berm often developed that blocked the ocean from the lagoon. Lagoon inlet closures during the period were a frequent occurrence, often occurring two to three times a year or spanning an entire year. The lower bridge was replaced by the City of San Diego in 2005 with construction completed in 2007. The new bridge was designed to have a slightly wider span and only four support columns to reduce the frequency and volume of sediment deposition under the bridge (Figure 10). While this design 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 tends to remain open for longer periods of time, the tidal prism can still be reduced as sand and cobbles occlude and sometimes block the main channels from the ocean and tidal mixing.



Figure 9. Original Highway 101 Lower Bridge. Photo by Mike Hastings.



Figure 10. New Highway 101 Lower Bridge. Photo by Mike Hastings.

Problem Statement

Like many coastal lagoons in Southern California, LPL has been impacted by urban development and land use activities. Transportation infrastructure within and along LPL has altered its natural hydrology, impairing the Lagoon's ability to remain open to the ocean. As a result, reduced tidal circulation and extended inlet closures degrade water quality to levels that harm aquatic organisms, a key food source for larger organisms. Perennial freshwater input from the watershed makes the Lagoon vulnerable to prolonged inundation that impacts endangered plant species, endangered avian species, and native salt marsh species, as well as posing serious threats to local human populations from vector-borne brain encephalitis.

Since the 1970s, LPL has lost over 245 acres of remnant dune and salt marsh habitat due to impacts generated by urban encroachment, transportation corridors and land-use that have altered the Lagoon's natural processes and native landscapes. These urban stressors include accelerated sedimentation in the eastern portion of the Lagoon; perennial freshwater inputs from storm drain outfalls adjacent to LPL and from the Lagoon's three tributaries that were historically seasonal; and impaired tidal mixing due to transportation infrastructure that disrupt the Lagoon's natural ability to remain open to the ocean as it once did. Historic nesting areas for California least tern, Western snowy plover and Belding's savannah

sparrow have been permanently lost due to rapid habitat conversion caused by these urban stressors. Sensitive species and existing native vegetation communities and are still under constant threat. Wintering habitat for Western snowy plover and nesting habitat for Belding's savannah sparrow located near the Lagoon inlet are extremely vulnerable to prolonged inundation that can occur during impaired tidal circulation. Studies conducted by California State Parks (CSP) and California Department of Fish and Wildlife (formerly Fish and Game) show direct correlation between bird populations of these two listed species and the presence/absence of tidal circulation within LPL. Freshwater intrusion into LPL and impaired tidal circulation also threatens the remaining patches of the Nuttall's Lotus (*Lotus nuttallianus*) and Coulter's Goldfields (*Laesthenia glabratta ssp coulteri*) by reducing soil salinities to levels that are conducive to the spread of exotic species such as Veldt grass (*Ehrharta calycina*) and English Ryegrass (*Lolium perenne*). Trash and debris that enter LPL through storm drains, aerial deposition and incoming tides create potential threats to lagoon fauna, especially its birds, that can mistake small plastics and balloon fragments for food or become ensnared in abandoned fishing lines.

Project Goal, Objectives & Benefits

Project Goal: to protect LPL's biological resources and public use through restoring tidal circulation, buffering sensitive habitats, and removal of urban trash and debris.

Objectives used to achieve this goal include:

1. Excavation of the inlet area to reestablish connectivity with the ocean.
2. Protection of sensitive habitat by creating buffer zones.
3. Trash removal from around the Lagoon.
4. Improved baseline mapping of lagoon vegetation and species of concern.
5. Monitoring aquatic and terrestrial environs.
6. Community outreach/education.

The project will benefit sensitive vegetation communities and species, as it is essential for their short- and long-term protection and conservation. Over 26 years of continuous monitoring in LPL and relevant peer-reviewed literature highlight tidal circulation as the key component for protecting and preserving health in San Diego's tidal salt marshes for both aquatic and terrestrial species that require specific water quality and soils salinity parameters for both function and survival. Tidal circulation and flushing is essential for protecting and conserving LPL's sensitive salt marsh communities (i.e. remnant dune and salt marsh habitats) and individual sensitive species that include: Nuttall's Lotus (*Lotus nuttallianus*), Coulter's goldfields (*Laesthenia glabratta ssp coulteri*), Western snowy plover (*Charadrius alexandrinus nivosus*), Belding's savannah sparrow (*Passerculus sandwichensis beldingi*); Light-footed clapper rail (*Rallus longirostris levipes*); and Wandering skipper (*Panoquina errans*). Key benefits associated with adequate tidal mixing within LPL's channels include: recovery of healthy water quality parameters (e.g. dissolved oxygen, salinity, temperature) for aquatic species through the mixing of oceanic waters within lagoon channels; facilitating draw down times through tidal cycles (incoming and ebb tides) that pull freshwater out of the lagoon and reduce inundation times in areas above channel banks during flood

events; and maintaining water levels below lagoon channel banks during dry weather periods (perennial freshwater inputs into LPL cause the Lagoon waters to overtop tidal banks during inlet closures even when precipitation has not occurred). Sand and cobbles removed during excavation will be used to fill eroded banks and scour points near sensitive vegetation communities (e.g. Nuttall's Lotus) to provide a buffer from future erosion that can occur from both storm runoff and wave energy entering the lagoon during storm surges. Education and outreach efforts will bolster coastal stewardship efforts by helping to: inform members of the public about the need for adequate tidal circulation within LPL; management efforts designed to achieve and maintain tidal circulation; and important plant communities and sensitive species within LPL that rely on an active exchange of water between the watershed, lagoon and ocean. Volunteer trash/debris clean up efforts within LPL will help improve visual corridors and give volunteers an "up-close" view of the Lagoon and its resources, which is normally off-limits due to its status as a State Preserve. Volunteers will also learn about how cleaning up trash removes potential threats to lagoon fauna (e.g. birds), that can mistake small plastics and balloon fragments for food.

II. GENERAL SUMMARY OF WORK PERFORMED

The Project was issued its Notice to Proceed by SANDAG effective September 1, 2013 with an end date of November 1, 2014. The project was completed well ahead of schedule (i.e. on August 14, 2014) and included more matching funds through in-kind services than was required. Efforts pursued during the project included:

- September 2013 - project set up and monitoring.
- Quarter #1 (October - December 2013).
 - Permit compliance for inlet excavation and disposal.
 - Monitoring water quality parameters in lagoon channels.
 - Inlet inspections to determine status of LPL's ocean inlet and vulnerability for closure.
 - Planning and implementation of a trash/debris clean up at LPL conducted on December 5, 2013.
- Quarter #2 (January - March 2014).
 - Monitoring water quality parameters in lagoon channels.
 - Inlet inspections to determine status of LPL's ocean inlet and vulnerability for closure.
 - Planning and implementation of a trash/debris clean up at LPL conducted on February 8, 2014.
 - Coordinating scheduling and logistics for heavy equipment needed to perform inlet maintenance, as well as supplemental staff to assist with public safety during beach disposal efforts.
 - Pre-maintenance permit compliance for inlet excavation set to begin on April 7th.
 - Coordinating efforts with the City of San Diego for supplemental excavation and disposal work scheduled for April 21st.

- Reporting and invoicing for efforts conducted during Quarter #1.
- Quarter #3 (April - June 2014).
 - Reporting and invoicing for efforts conducted during Quarter #2.
 - Monitoring water quality parameters in lagoon channels.
 - Pre-maintenance permit compliance for inlet excavation set to begin on April 7th, including sensitive species surveys and grain size analysis.
 - Coordinating and conducting two separate inlet excavation efforts that took place at LPL from April 7th - April 11th and April 21st - April 28th, with no work conducted over the weekend.
 - Coordinating and conducting a third inlet excavation that took place at LPL from May 19th - May 23rd.
 - Project oversight and permit compliance (e.g. onsite monitoring) during inlet excavation efforts.
 - Post-maintenance permit compliance.
 - Preparation of draft Final Report.
- Quarter #4 - Final Report (July - August 14, 2014).
 - Reporting and Invoicing for efforts conducted during Quarter #3.
 - Continued development, review and revision of draft Final Report.
 - Final edits and completion of Final Report.
 - Invoicing for efforts conducted Quarter #4.

III. SUMMARY OF PROJECT DELIVERABLES

The following table provides a summary of project deliverables and their submission with project invoices.

Table 1. Summary of Project Deliverables.

<u>Summary of Deliverables Provided with Invoices</u>
Invoice 1 (Sept. - December 2013) Quarterly Report (October - December 2013) (Task 6)
Invoice 2 (January - March 2014) Monitoring Form: Pre-Inlet Excavation (Task 2) Water Quality Data: Pre-Inlet Excavation (Task 4) Plant Assemblages: Vegetation Map (Task 4) Quantified Loads of Trash Removed (Task 5) Quarterly Report (January - March 2014) (Task 6)
Invoice 3 (April 2014) Grain Size Analysis (Task 2) Monitoring Form: Pre- and Post-Inlet Excavation (Task 2) Photo Documentation (Task 2) Water Quality Data: Pre- and Post-Inlet Excavation (Task 4) Technical Report - April 2014 (Task 6)
Invoice 4 (May - June 2014) 2014 Summary Report for Inlet Excavation & Disposal (Task 2) Photo Documentation (Task 2) Quantified Loads of Sand Removed from the LPL Inlet (Task 3) Water Quality Data: Pre- and Post-Inlet Excavation (Task 4) 2014 LPL Post-Dredging Report: Channel Bathymetry & Inlet Elevation Profiles (Task 4) Quarterly Report (April - June 2014) (Task 6)
Invoice 5 (Final Report) Plant Assemblages: Vegetation Transects (Task 4) Baseline Conditions Model (Task 4) Final Report (Task 7)

IV. SUMMARY OF WORK PERFORMED BY PROJECT TASK

TASK 1. PROJECT MANAGEMENT & ADMINISTRATION

Description.

Efforts conducted under this task included: coordinating, facilitating, and managing project team efforts; accounting of project funds received and expended; coordinating invoicing and payments; and coordination/communication with SANDAG staff as needed.

Progress of Work (100% Complete)

During the project, the following key efforts occurred under Task 1:

- Project set up (accounting spreadsheet, budget spreadsheet, project folders).
- Managing and updating budget spreadsheet, and project folders.
- Accounting, review of SOW, line-item budgets, match requirements, etc.
- Communication/coordination with San Diego Coastkeeper, San Diego Surfrider and volunteer groups assisting with trash clean up events at LPL.
- Communication/coordination with CSP staff regarding trash clean up efforts and inlet excavation needs, schedule and logistics.
- Communication/coordination with City of San Diego regarding support and in-kind services for inlet excavation.
- Communication/coordination with staff from Southwest Wetlands Interpretive Association (SWIA) regarding support and project needs with regard to monitoring lagoon conditions (e.g. water quality and vegetation transects).
- Updating the LPLF's Board of Directors about project needs, progress and scheduling, and procurement of sub-contractors.
- Receipt, review and approval of sub-contractor invoices.
- Completion and submission of project invoices.
- Receipt, cataloging and deposit of SANDAG reimbursement checks.
- Coordinating reimbursements to project sub-contractors.
- Miscellaneous communication/coordination with project team, ancillary groups for project support and SANDAG contract management staff.

Deliverables

Invoices and Updated Scheduling. (See Table 1 for information related to submission of these deliverables)

Expenditures Applied to Match

Matching funds were not required for this task.

Compliance with Fee Schedule

Efforts and progress under Task 1 were in compliance with the fee schedule, which sets the line-item budget at \$5,000 and completed before the task end date of November 1, 2014.

Problems/Issues

None.

TASK 2. PERMIT COMPLIANCE

Description.

Efforts conducted under this task included managing permits and environmental documents required for Task 3. Activities conducted under Task 2 included: ensuring permits were valid to allow for inlet maintenance, agency notification, listed species monitoring, delineation of project area(s), grain size analysis, assessment of potential grunion habitat, managing of heavy equipment use, photo-monitoring and reporting required by resource agencies

Progress of Work (100% Complete)

During the project, the following key efforts occurred under Task 2:

- Preparation and submission of amendment request package to extend the termination date for the 401 Wetland Certification for Inlet Maintenance due to expire in December 2013.
- Inspections of the project area to evaluate inlet status and water levels, project needs and priorities with regard to restoring tidal circulation, permit compliance, surveys of sensitive species near and within the project area, etc.
- Sensitive species monitoring during inlet maintenance and disposal activities.
- Photo monitoring of disposal area to track potential turbidity plumes, debris removal needs, and dissipation of disposal piles.
- Miscellaneous communication/coordination with staff from CSP for right of entry and permit compliance monitoring.
- Miscellaneous communication/coordination with biological monitoring staff regarding dates and times for scheduled inlet maintenance, data logger retrieval, etc.
- Miscellaneous communication/coordination with staff from resource agencies (e.g. California Coastal Commission, Army Corps of Engineers) for permit compliance activities (e.g. notification of inlet excavation, meeting environmental conditions of permits, sensitive species surveys, grain size analysis results).

Deliverables

Monitoring Forms; Summary Report and Photo Documentation. (See Table 1 for information related to submission of these deliverables). Some key elements from the deliverables are presented below:

Grain Size Analysis.

Required by the Army Corps of Engineers, a grain size analysis was performed at the inlet prior to excavation efforts to determine the suitability of disposing excavated material excavated onto Torrey Pines State Beach. Grab-samples were taken at four locations within the inlet area (LPL1-LPL4) where excavation was to occur and spoils taken to the beach for disposal (See Figure 11). Samples were sent to a lab for grain size analysis using sieve and laser particle analysis. Results indicated that the samples taken from within the inlet were comprised predominantly of sand (i.e. over 96%) and characteristic of sand found on Torrey Pines State Beach with regard to grain size distribution and sorting (Figure 12).

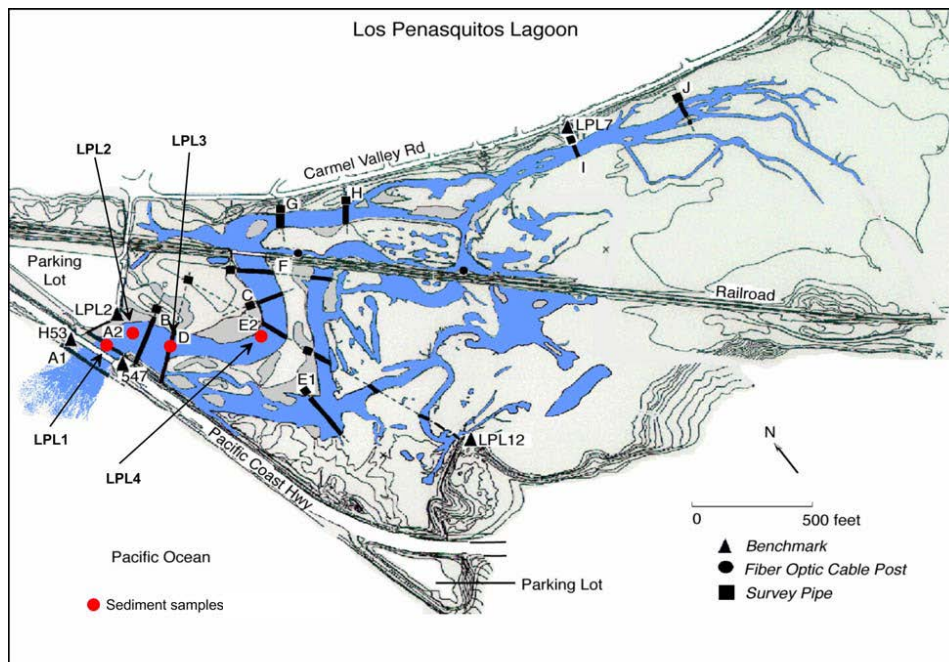


Figure 11. Sediment sample locations (LPL1-LPL4) at Los Peñasquitos Lagoon (March 2014).

Coastal Environments						Core Lab File No : 57111-414009EN					
Project Name : Los Penasquitos Lagoon Inlet Channel Dredging						Date : 3/31/2014					
Sample ID	Grain Size Description (Mean from Folk)	Median Grain Size, mm	Component Percentages								Silt & Clay
			Gravel	Sand Size					Clay		
				VCoarse	Coarse	Medium	Fine	VFine		Silt	
LPL1	mgr	0.26	3.46	1.56	8.17	42.32	40.00	3.02	1.01	0.45	1.46
LPL2	mgr	0.34	7.97	2.98	15.97	47.67	22.91	1.52	0.64	0.34	0.98
LPL3	mgr	0.26	0.00	1.81	4.62	46.16	42.23	3.45	1.24	0.50	1.73
LPL4	fgr	0.22	0.00	2.19	2.09	33.49	53.61	5.80	2.11	0.71	2.82

Figure 12. Results from grain size analysis for samples taken from the inlet at Los Peñasquitos Lagoon in March 2014.

Expenditures Applied to Match

Matching funds of \$6,500 through in-kind services were required under Task 2 according to the project contract. \$9,439.50 in match was provided for this task by the end of the project, representing an additional \$2,939.50 beyond what was required for Task 2 or 145% of what was required for match.

Compliance with Fee Schedule

Efforts and progress under Task 2 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$6,500 and the task was completed before the end date of November 1, 2014.

Problems/Issues

None.

TASK 3. INLET EXCAVATION & DISPOSAL

Description.

Restoring tidal circulation within LPL and improving draw-down times of freshwater inputs were achieved through mechanical excavation and removal of sand and cobbles that have accumulated between the Lagoon's main tidal channel and the ocean inlet. Excavation of an approximately 1,000' channel began at the deep-water mark located near the northern section of survey Transect E2 in the Lagoon's main (northern) channel and continue until Transect A1, located west of the lower Highway 101 Bridge (See Figure 13). Excavated spoils were hauled to Torrey Pines State Beach, where they were placed along a coastal bluff and within the tidal zone. Spoils placed along the bluff were re-contoured to mimic natural dune profiles and improve access for both the public and emergency vehicles from North Torrey Pines Road. Spoils placed within the tidal zone were naturally re-distributed horizontally along the beach by each tidal cycle.

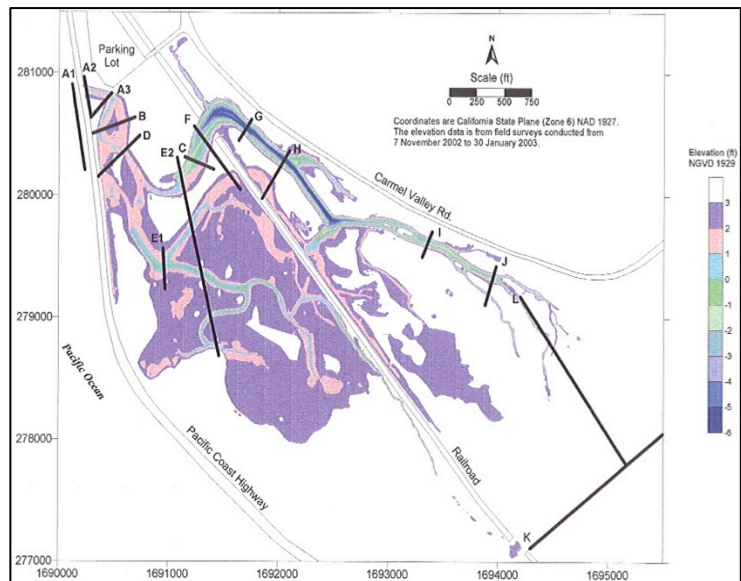


Figure 13. Survey Transects within Los Peñasquitos Lagoon. Coastal Environments 1995.

Progress of Work (100% Complete)

Summary of Inlet Excavation & Disposal Efforts

Three separate efforts were required to restore and maintain tidal circulation within LPL. The first effort (Phase 1) occurred between April 7, 2014 and April 11, 2014 and consisted of breaching the closed inlet to allow impounded waters to drain out of the Lagoon followed by excavation within the inlet area to re-establish tidal mixing within Lagoon channels to improve water quality. Approximately 2,000 cy was removed during the inlet breach and subsequent scour of the channel out to the ocean on April 7th. An additional 28,179 cy of sand and cobbles were loaded into dump trucks and hauled to Torrey Pines State Beach for disposal. Understanding that initial work to restore the inlet would not be enough to keep the mouth open due to the large volume of sand within the inlet area, a second effort (Phase 2) was scheduled for April 21st to April 28th with no work performed over the weekend. Excavation continued within the inlet area, moving toward the lower bridge that spans the inlet, and west of the bridge to lower beach profile elevations needed to improve lagoon outflows. Approximately 21,184 cy of sand and cobbles were loaded into dump trucks and hauled to Torrey Pines State Beach for disposal. Sand was also spoiled within the Lagoon's inlet area to help restore a remnant dune and beach area that had been steadily eroding since 2006. A third effort (Phase 3) was performed after the inlet at LPL closed on May 8th. Efforts focused on clearing the Lagoon's main channel that had been recently occluded with sand and cobbles from the ocean. Excavation of the inlet area and hauling/disposal spoils occurred from May 19th to May 23rd with approximately 4,170 cy of sand and cobbles placed on Torrey Pines State Beach. Efforts were extremely limited by lack of equipment and sharp tidal swings that reduced opportunities to excavate the inlet area and haul spoils to the beach for disposal. Photos of excavation and disposal efforts are provided below, along with a cumulative total of sand excavated from the inlet area and hauled to the beach during all three phases (See Figure 24).

Deliverables

Quantified Loads of Sand Removed from LPL Inlet (See Table 1 for information related to submission of these deliverables). Some key elements from the deliverables are presented below:



Figure 14. Equipment Staging Area Project Area, viewing north along N. Torrey Pines Road. Photo by Mike Hastings.



Figure 15. Access ramp used by heavy equipment to enter and exit staging area along N. Torrey Pines Road. Photo by Mike Hastings.



Figure 16. Equipment getting ready to enter LPL under the lower bridge along N. Torrey Pines Road. Photo by Mike Hastings.



Figure 17 Excavating the channel between Transect A1 and Transect A2. Photo by Mike Hastings.



Figure 18. Dumping excavated sand along the eroded bluff used for the heavy equipment staging area. Photo by Mike Hastings.



Figure 19. Excavating near the deep-water mark just west of Transect E2. Photo by Mike Hastings.



Figure 20. Placing excavated spoils along the waterline on Torrey Pines State Beach. In the foreground are sediment piles placed in front of the eroded bluff along N. Torrey Pines Road. Photo by Mike Hastings.



Figure 21. Placing excavated spoils along the eroded embankment to restore the remnant dune area eroded over the previous years. Photo by Mike Hastings.



Figure 22. Excavating near Transect A3 to widen and deepen the main channel. Photo by Mike Hastings.



Figure 23. Re-contouring sand piles placed along the eroded bluff adjacent to N. Torrey Pines Road. Photo by Mike Hastings.

Los Peñasquitos Lagoon Inlet Maintenance - Load Counts									
Work Period: April - May 2014									
Operator	Truck	Loads in cubic yards (y3)					Total cy Loaded	Total Loads	
		7-Apr	8-Apr	9-Apr	10-Apr	11-Apr			
NA	730C	2294	1612	1674	2015	2170	9765	315	
NA	730C	2263	1581	1643	1860	1860	9207	297	
NA	730C	2263	1581	1643	1860	1860	9207	286	
		6820	4774	4960	5735	5890	28179	898	

Operator	Truck	Loads in cubic yards (y3)						Total cy Loaded	Total Loads
		21-Apr	22-Apr	23-Apr	24-Apr	25-Apr	28-Apr		
Phil	725C	1075	900	925	1125	0	0	4025	161
Richard	740B	1216	608	1178	1672	2052	2280	9006	237
Anthony	730C	992	1054	1085	1395	1736	0	6262	202
Phil	730C	0	0	0	0	0	1891	1891	61
		3283	2562	3188	4192	3788	4171	21184	661

	Loads					Loads & Volume
	19-May	20-May	21-May	22-May	23-May	
Loads	35	45	67	109	22	278
Cubic Yards	525	675	1005	1635	330	4170

Total Hauled and Spoiled = 53533 cubic yards of material

Figure 24. Total amount of sand (cubic yards) excavated from the inlet at Los Peñasquitos Lagoon and hauled to Torrey Pines State Beach for disposal.

Expenditures Applied to Match

Matching funds of \$6,000 through in-kind services were required under Task 3 according to the project contract. \$45,590.59 in match was provided for this task by the end of the project, representing an additional \$39,590.59 beyond what was required for Task 3 or 760% of what was required for match.

Compliance with Fee Schedule

Efforts and progress under Task 3 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$70,000 and completed before the task end date of November 1, 2014.

Problems/Issues

The large quantity of sand within the inlet at LPL required three separate efforts to restore adequate tidal circulation through excavation and disposal of sand.

TASK 4. MONITORING

Description.

Task 4 included the collection and analysis of biological and physical monitoring data that was compiled and reviewed to assess Lagoon baseline health and the benefits achieved through restoring tidal circulation and excavation of the Lagoon's inlet area. Collected data was used to characterize water quality parameters; vegetation communities; channel bathymetry; and elevations within the Lagoon's inlet area. In addition, efforts to characterize baseline conditions (e.g. vegetation mapping within LPL) were pursued and applied as match for Task 4 through in-kind services for efforts that are complimentary to the Project.

Progress of Work (100% Complete)

During the project, the following key efforts occurred under Task 4:

- Characterizing and mapping baseline conditions (i.e. habitat) within LPL.
- Biological and physical monitoring of LPL.
- Surveys of channel bathymetry and inlet elevation profiles.
- Baseline conditions modeling.

Deliverables

Water Quality Data; Plant Assemblages; Channel Bathymetry; Inlet Elevation Profiles; and Baseline Conditions Model. (See Table 1 for information related to submission of these deliverables). Some key elements from the deliverables are presented below:

Water Quality

Figure 25 provides the locations of water quality monitoring stations and vegetation transects located within LPL. Water quality data indicated decreasing dissolved oxygen (DO) levels within the Lagoon during the extended closure that lasted from March 11th to April 7th. DO levels quickly dropped below 5 mg/l on March 11th (See Figure 26), indicating stressful conditions for aquatic species and triggering the project's special biological conditions set by its Coastal Development Permit (6-07-021-A1) that allow for mechanical excavation of the inlet. DO eventually hit 0 mg/l around March 18th before it temporarily rebounded most likely due to over wash from wave activity during a spring high tide event. However, DO continued to degrade until it reached and stayed at 0 mg/l until the inlet was breached on April 7th. Once tidal circulation was restored within Lagoon channels, water quality parameters quickly improved (See Figure 27).

The mouth at LPL closed again on May 8th due to shoaling of sand within the entrance of the inlet area (See Figure 28). DO quickly dropped below 5 mg/l, rebounding periodically due most likely to oxygen-rich ocean waters overtopping the berm during periods of high tide (See Figure 29). Healthy water quality parameters then improved after adequate tidal circulation had been restored within Lagoon channels (See Figure 30).



Figure 25. Water quality monitoring stations (W1-W3) and vegetation transects at Los Peñasquitos Lagoon. Southwest Wetlands Interpretive Association.



Figure 26. Water Quality Data: dissolved oxygen (yellow) and depth (red) prior to the 1st inlet opening on April 7th. Note how water levels rise in conjunction with declining dissolved oxygen. Data taken from monitoring station W2, shown in Figure 25.

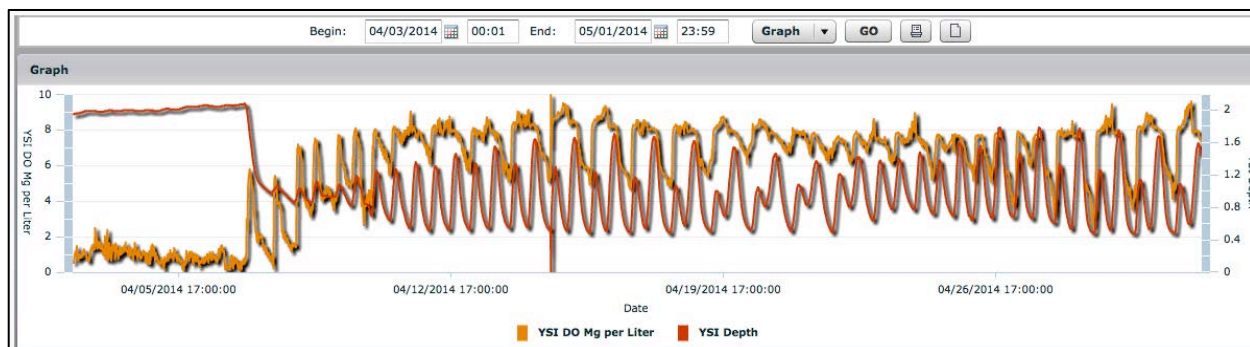


Figure 27. Water Quality Data: dissolved oxygen (yellow) and depth (red) (Pre- and Post -Inlet Opening). The inlet was breached on April 7, 2014, restoring the tidal signal and dissolved oxygen levels. Data taken from monitoring station W2, shown in Figure 25.



Figure 28. View of occluded inlet at Los Peñasquitos Lagoon with impounded water east of the lower bridge on May 7th.
 Photo by Mike Hastings.



Figure 29. Water Quality Data: dissolved oxygen (yellow) and depth (red) after the closure on 5/8/14. Note the rising water levels due to perennial dry weather inputs of freshwater from the Lagoon's tributaries in conjunction with declining dissolved oxygen due to the lack of tidal mixing from ocean waters. Data taken from monitoring station W2, shown in Figure 25.

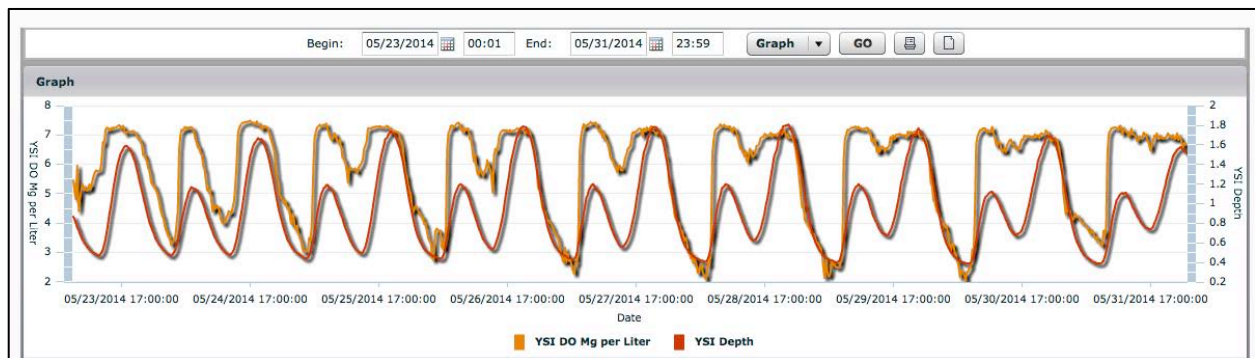


Figure 30. Water Quality Data: dissolved oxygen (yellow) and depth (red) within LPL restored to healthy levels after completion of inlet maintenance on 5/23/14. Data taken from monitoring station W2, shown in Figure 25.

Plant Assemblages & Habitat Delineations

Once a pristine salt marsh, LPL has been transformed into an urbanized coastal estuary with perennial inputs from the Lagoon's three main tributaries: Carmel Creek, Los Peñasquitos Creek and Carroll Creek.

As a result, the Lagoon's plant communities have been altered. A monitoring program was established in 1987 to examine dominant plant species type(s) and assemblages along established transects (See Figure 25). Results of this monitoring program has documented shifts in dominant plant species within areas dominated by salt marsh habitat (i.e. the western basin), as well as habitat conversion within the eastern basin and along the lagoon/watershed interface where the tributaries enter LPL. In some areas in the eastern portion of the Lagoon, entire transects have been abandoned due to the lack of access caused by the rapid encroachment of brackish and freshwater species (e.g. *Typha*) into LPL. Figure 31 to Figure 33 show both dominant species and shifts in their distribution/dominance along each transect over time.

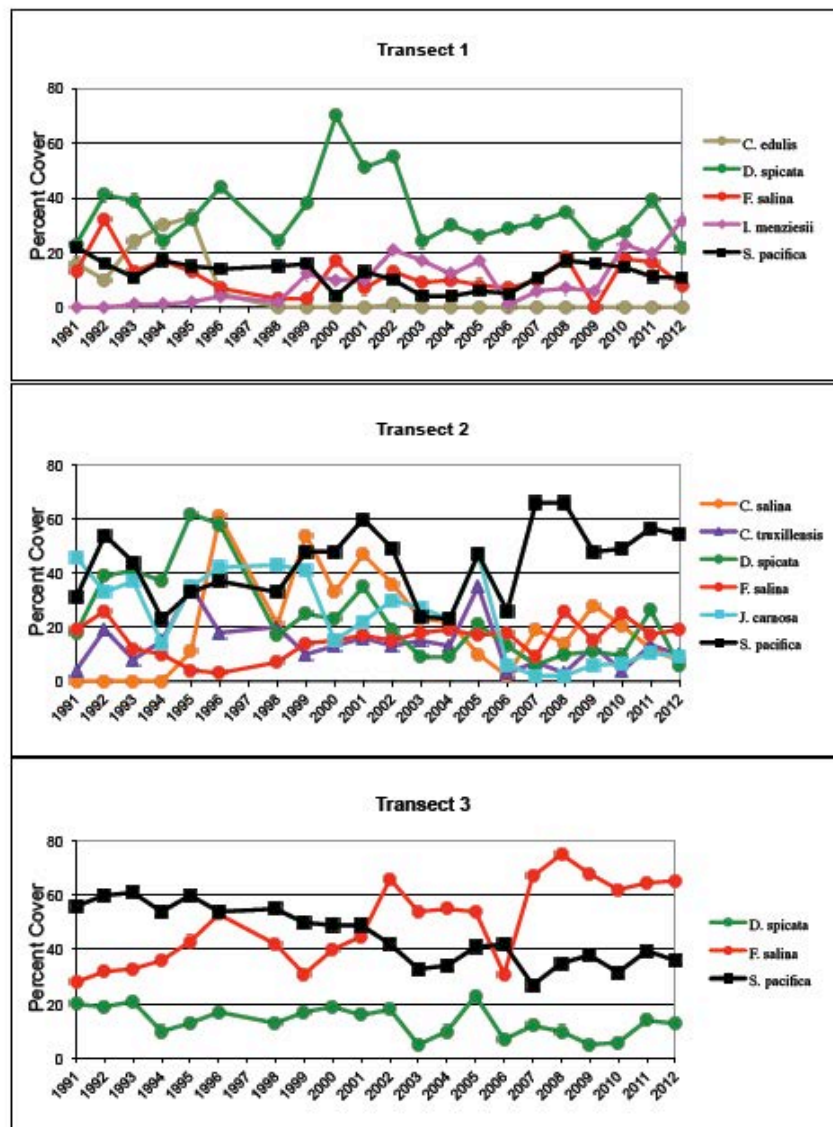


Figure 31. Shifts in dominant plant species and compositions in Los Peñasquitos Lagoon along Transects 1-3. Southwest Wetlands Interpretive Association.

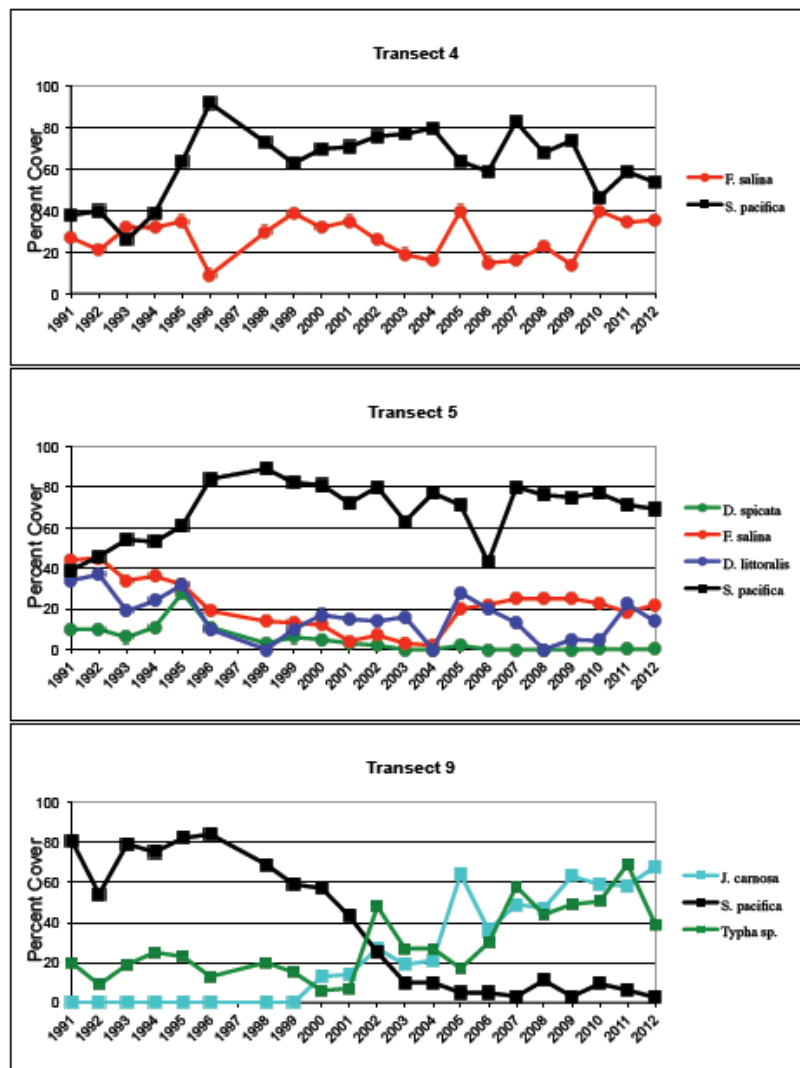


Figure 32. Shifts in dominant plant species and compositions in Los Peñasquitos Lagoon along Transects 4,5 and 9. Transects 6-8 and 10 have been abandoned due to the inability to access them caused by thick stands of Typha. Southwest Wetlands Interpretive Association.

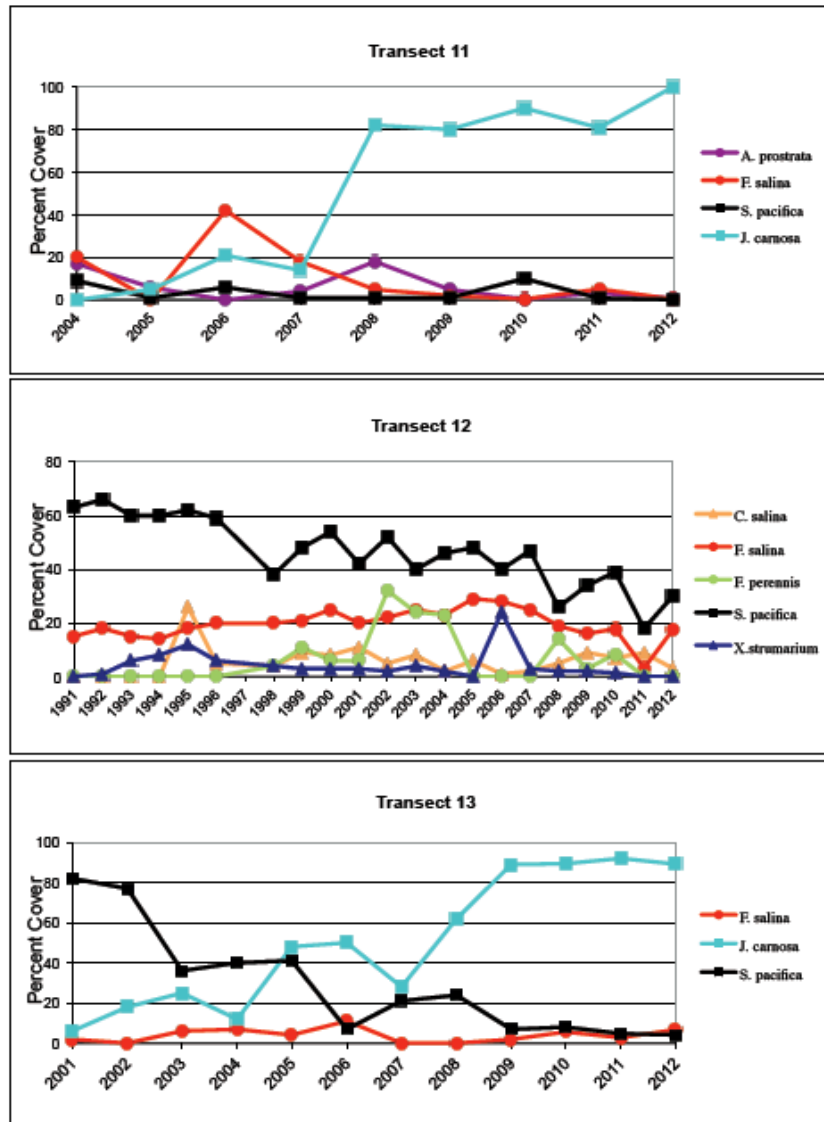


Figure 33. Shifts in dominant plant species and compositions in Los Peñasquitos Lagoon along Transects 11-13. Southwest Wetlands Interpretive Association.

In 2012, CSP in conjunction with LPLF and scientist from the Tijuana River National Estuarine Research Reserve embarked on an effort to map the entirety of LPL to develop a habitat map based on plant associations within the Lagoon. Recent aerial imagery, including LIDAR, was used in conjunction with field surveys to delineate vegetation associations that were then converted into a habitat classification map shown in Figure 34. While the western end of the Lagoon remains tidal salt marsh, habitat conversion has occurred in both the central and eastern portions of LPL, where brackish and riparian habitats now dominate in an area that was historically salt marsh.

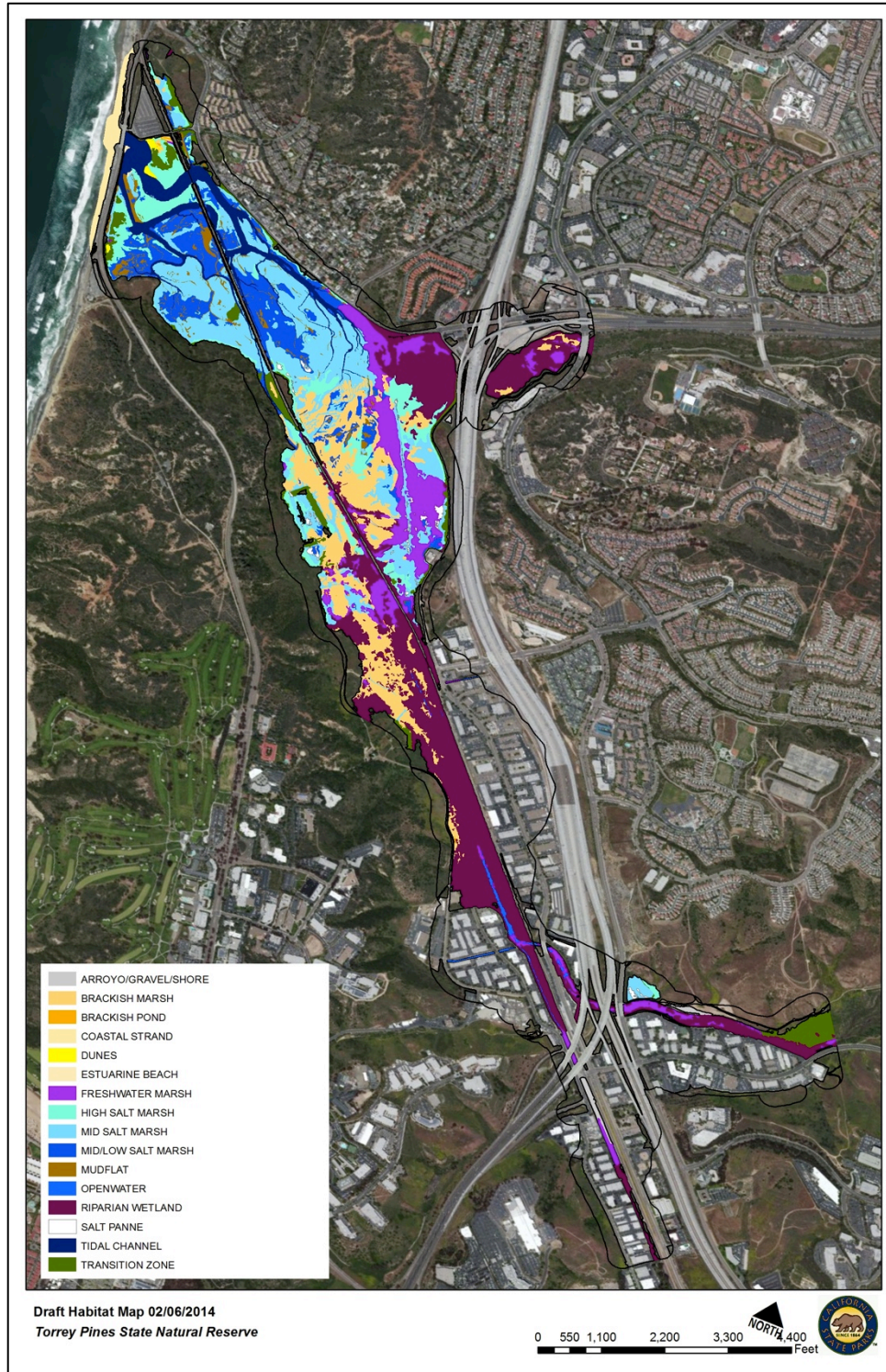


Figure 34. Habitat type determined by plant association delineation within Los Peñasquitos Lagoon. California State Parks.

Baseline Conditions Model

Information generated under a separate grant was used to develop a baseline conditions model that incorporated the habitat map in Figure 34 with the Sea Level Affecting Marshes Model (SLAMM). SLAMM simulates the dominant processes involved in wetland conversions and shoreline modifications during long-term sea level rise. Both a baseline conditions model and habitat trajectories were developed for LPL using SLAMM. Results from the preliminary running of SLAMM for LPL indicate a gradual shift from high marsh habitat to mid/low marsh habitat, with mudflats beginning to dominate the mid-portion of the Lagoon in 2080. While the riparian corridor does appear to move back toward the watershed, the progress of this transition is hampered by the elevation of this area that negates effective tidal influence that would be needed to convert this area back to salt marsh habitat. Results of SLAMM are provided in Appendix A.

Channel Bathymetry and Inlet Elevation Profiles

Surveys of channel bathymetry and inlet elevation profiles were conducted in May, after inlet excavation had been completed. Surveys were conducted along transects that were established in 1995 and monitored annually thereafter (See Figure 35). Results of the surveys indicate that channel configuration becomes relatively stable as you move east, away from the ocean inlet (Figure 36 and Figure 37). This demonstrates the dominance of the ocean processes (e.g. tides, storm surges) over lagoon outflows with regard to channel morphology west of the railway berm. Several lines of evidences indication the muting effects that the railway berm has on the effectiveness of large storm events in scouring lagoon channels through to the inlet from storm runoff discharged from the three lagoon tributaries and deposition of watershed sediments west of the railway.

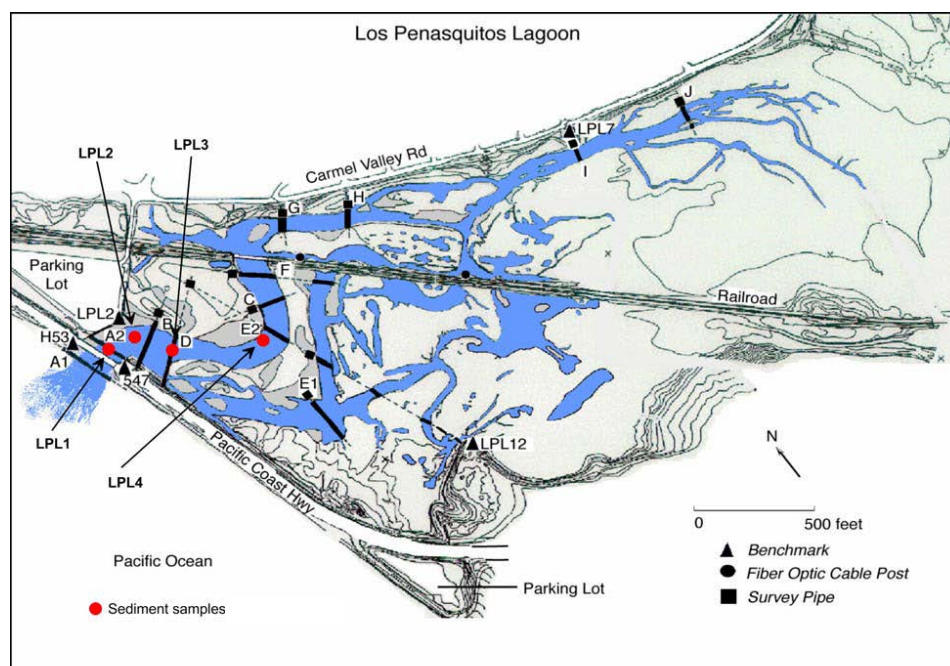


Figure 35. Survey transects in Los Peñasquitos Lagoon. Coastal Environments.

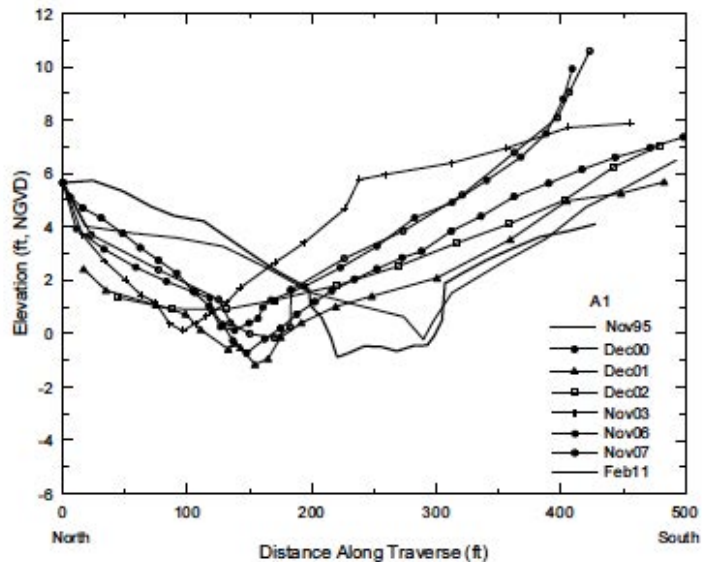


Figure 36. Changes in channel morphology at the ocean inlet along Transect A1. Coastal Environments.

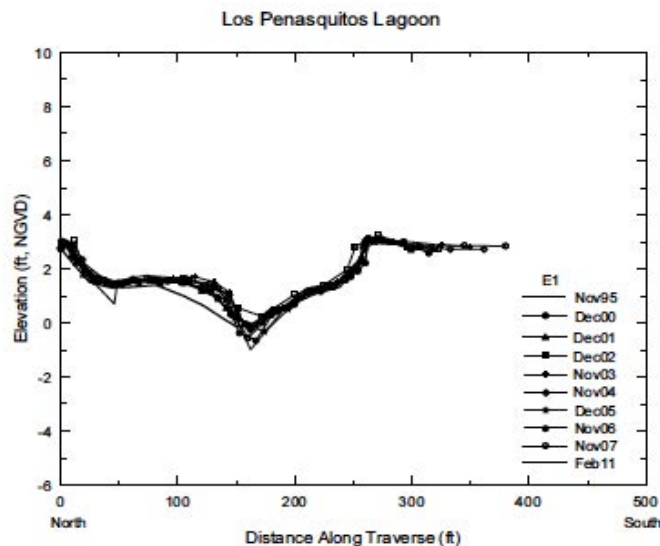


Figure 37. Changes in channel morphology at the ocean inlet along Transect E1. Coastal Environments.

Expenditures Applied to Match

Matching funds of \$66,800 through in-kind services were required under Task 4 according to the project contract. \$81,578.44 in match was provided for this task by the end of the project, representing an additional \$14,778.44 beyond what was required for Task 4 or 122% of what was required for match.

Compliance with Fee Schedule

Efforts and progress under Task 4 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$4,500 and the task was completed prior to its end date of November 1, 2014.

Problems/Issues

None.

TASK 5. TRASH/DEBRIS CLEAN UP & REMOVAL

Description.

Task 5 involved volunteer trash/debris clean up efforts focused on the removal and disposal of plastics and other urban debris from the inlet area and Lagoon borders prior to inlet excavation performed under Task 3. Staff from LPLF and CSP managed volunteer crews during the clean up and removal process.

Progress of Work (100% Complete)

During the project, the following key efforts occurred under Task 5:

- Conducting trash clean up with McGladery LLP at Los Peñasquitos Lagoon on 12/5/13.
- Conducting trash clean up with San Diego chapter of the Surfrider Foundation at Los Peñasquitos Lagoon on 2/8/14.
- Compiling data from field data sheets used to document trash types and amounts collected during the clean up on 12/5/13 and 2/8/14.

Deliverables

Quantified Loads of Trash Removed from LPL. (See Table 1 for information related to submission of these deliverables). Figure 38 provides the combined loads of trash and debris removed from LPL and surrounding areas is provided below, along with photos from both clean up events.

<p>Sorrento Valley Road (closed portion), Los Peñasquitos Lagoon Inlet, Location: Torrey Pines Beach and TPSR North Parking Lot Date: 12/5/13 & 2/8/2014 Time: 9am - 12 noon Group: McGladery LLC, SD Surfrider & Volunteers</p> <p>I-5, Carmel Valley Rd, marine, storm drain, beach use, cars (lot and N. Sources: Torrey Pines Rd)</p>		
DATA SHEETS	TOTAL	
Weight (pounds):	181	
Plastic Bags:	69	
Plastic Bottles:	24	
Plastic Bottle Caps:	106	
Plastic Lids, Cups, Straws:	87	
6-Pack Holders:	0	
Plastic Utensils:	30	
Plastic Food Wrappers:	169	
Cigarette/Cigarette Butts:	2407	
Cigarette Lighters	4	
Fishing line, nets, rope, traps, other boating items	29	
Syringes:	0	
Styrofoam:	1322	
Balloons:	40	
Other Plastics:	623	
Aluminum Cans:	40	
Metal:	17	
Glass Bottles:	32	
Other Glass:	79	
Paper:	314	
Cloth:	21	
Entangled or Dead Animals:	2 (birds)	
Other:	273	
Other:	ear plug, surfboard leash, lobster trap, blanket, 50 plastic balls, hair ball, bloody latex glove, upperware, tire in 2 pieces, tarp, blanket, paint can, road sign, sun glasses, pillow, drawings, condom, carpet foam, hanger, mirror, Tire, cd case, concrete slab gardening pot, pot and bowls, golf tee, pot and bowls, aluminum gum wrappers (5), National Geographic Mag, bungee cord, business card.	
Most Unusual Items		
Additional Comments:		

Figure 38. Combined data from trash/debris clean up events held along Sorrento Valley Road on 12/5/13 and within the inlet of Los Peñasquitos Lagoon and along Torrey Pines State Beach on 2/8/14.



Figure 39. Collecting trash along the eastern border of Los Peñasquitos Lagoon at Sorrento Valley Road on 12/5/13 with McGladry LLC. Photo by Mike Hastings.



Figure 40. Collecting trash along the eastern border of Los Peñasquitos Lagoon at Sorrento Valley Road on 12/5/13 with McGladry LLC. Photo by Mike Hastings.



Figure 41. Sign-in table for San Diego's Surfrider Foundations trash clean up at the Los Peñasquitos Lagoon Inlet and Torrey Pines State Beach on 2/8/14. Photo by Mike Hastings.



Figure 42. Examples of trash and debris collected during the clean up event at Los Peñasquitos Lagoon on 2/8/14. Photo by Mike Hastings.



Figure 43. Trash and debris collected at the trash/debris clean up event at Los Peñasquitos Lagoon on 2/8/14. Photo by Mike Hastings.

Expenditures Applied to Match

Matching funds of \$700 through in-kind services were required under Task 5 according to the project contract. \$1,078.00 in match was provided for this task by the end of the project, representing an additional \$378.00 beyond what was required for Task 4 or 154% of what was required for match.

Compliance with Fee Schedule

Efforts and progress under Task 4 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$450 and the task was completed before the end date of November 1, 2014.

Problems/Issues

None.

TASK 6. QUARTERLY REPORTING

Description.

Task 6 involved quarterly reporting that was prepared by LPLF and submitted to SANDAG staff.

Progress of Work (100% Complete)

Deliverables

Quarterly Reports. (See Table 1 for information related to submission of these deliverables)

Expenditures Applied to Match

No matching funds were required for Task 6.

Compliance with Fee Schedule

Efforts and progress under Task 6 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$1,000 and the task was complete prior to its end date of November 1, 2014.

Problems/Issues

None.

TASK 7. FINAL REPORTING

Description.

Task 7 involved the Final Report that was prepared by LPLF and submitted to SANDAG staff on August 14, 2014

Progress of Work (100% Complete)

Deliverables

Final Report. (See Table 1 for information related to submission of these deliverables)

Expenditures Applied to Match

No matching funds were required for Task 7.

Compliance with Fee Schedule

Efforts and progress under Task 7 were in compliance with the fee schedule, which sets the line-item (grant-funded) budget at \$5,000 and the task was completed prior to its end date of November 1, 2014.

Problems/Issues

None.

V. RESULTS AND CONCLUSIONS

Benefits to Los Peñasquitos Lagoon and Torrey Pines State Beach

The restoration of the tidal prism at LPL provided benefits both within the Lagoon and along Torrey Pines State Beach. Within the Lagoon, water quality (e.g. dissolved oxygen, salinity, pH and temperature) was restored to levels required for the health and survival of aquatic species that include fish species valuable to recreational fisheries (e.g. California halibut and anchovy) and invertebrates that provide a food source to both local and migratory bird species. Restoring the tidal prism also helped to protect the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), a State-listed endangered species. This bird nests within LPL's high marsh habitat, defined as the area just above tidal influence. During extended inlet closures, rising water levels caused by perennial flows of freshwater from the watershed can inundate the upper marsh, causing nests to be abandoned. By lowering levels of freshwater within the Lagoon, the project was also successful in helping protect Nuttall's Lotus (*Lotus nuttallianus*) and Coulter's goldfields (*Laesthenia glabrata ssp coulteri*), two 1B – listed plant species considered by the California Native Plant Society to be rare, threatened or endangered in California. Lowered water levels also restored valuable foraging habitat for two federally endangered birds, the Light-footed Clapper Rail (*Rallus Longirostris Levipes*) and Western Snowy Plover (*Charadrius alexandrinus nivosus*).

Project benefits also include the creation of just less than 1 acre (i.e. 0.91 acres) of remnant dune that had been lost to erosion over the previous decade due to lagoon outflows and increased inflows of storm surge and bores from the ocean due to the new lower bridge that spans the inlet. Completed in 2006, the new bridge provides a less obstructive span over the inlet, replacing the seventy-four columns used to support the old bridge with just four. As result, waves, bores and storm surges can enter the Lagoon inlet area relatively unobstructed due the lack of energy dissipation caused by the new bridge. Figure 44 to Figure 47 show the gradual loss of the remnant dune system adjacent to the north parking lot and east of the main tidal channel.



Figure 44. Inlet at Los Peñasquitos Lagoon in 2002. Note the remnant dune system to the east of the main channel. Google Earth.



Figure 45. Inlet at Los Peñasquitos Lagoon in 2008. Note the loss of the remnant dune system as the main channel shifts to the northeast. Google Earth.

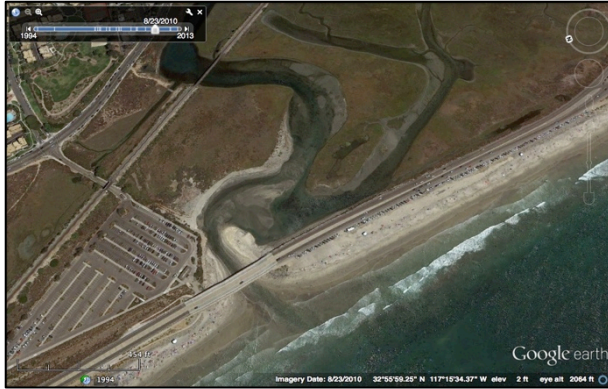


Figure 46. Inlet at Los Peñasquitos Lagoon in 2012. Note the continued loss of the remnant dune system as the main channel shifts to the northeast. Google Earth.



Figure 47. Inlet at Los Peñasquitos Lagoon in 2013. Note the almost complete loss of the remnant dune system as the main channel shifts to the northeast. Google Earth.

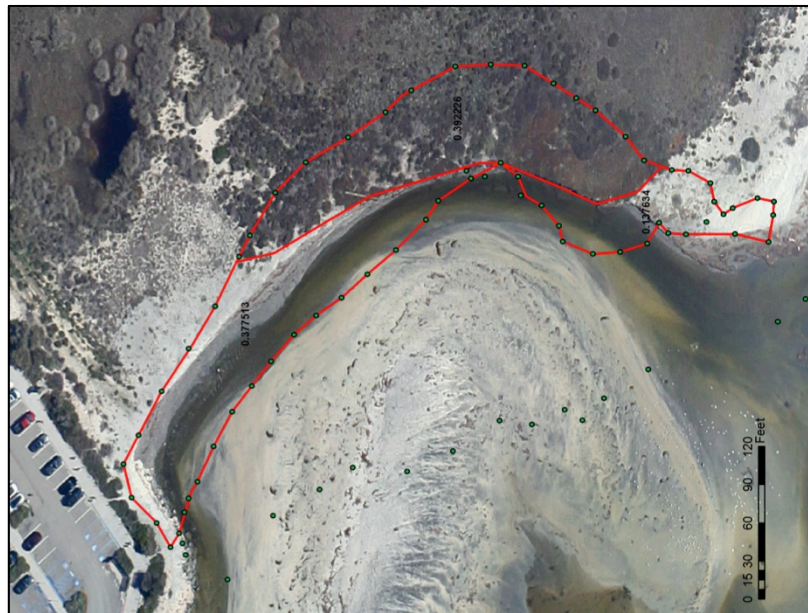


Figure 48. Delineation of the newly created 0.91 acres dune and beach area at the inlet of Los Peñasquitos Lagoon. The cell at the top of the photo delineates an area of vegetation that is no longer there due to undercutting and scour. No sand was placed on vegetated areas within the Lagoon inlet area.



Figure 49. Viewing the restored dune area from the north parking lot (looking east). Photo by Mike Hastings.



Figure 50. Viewing the lagoon inlet from the restored dune area (looking west). Photo by Mike Hastings.

Photo-documentation of inlet status before and after tidal circulation was restored is provided below:



Figure 51. View of the closed inlet at Los Peñasquitos Lagoon on 3/12/14. Photo by Mike Hastings.



Figure 52. Panoramic view of the closed inlet at Los Peñasquitos Lagoon on 3/12/14. Photo by Mike Hastings.



Figure 53. View of the open inlet at Los Peñasquitos Lagoon on 4/29/14 after tidal circulation was restored during Phase 2. Photo by Mike Hastings.



Figure 54. Panoramic view of the open inlet at Los Peñasquitos Lagoon on 4/29/14 after tidal circulation was restored during Phase 2. Photo by Mike Hastings.



Figure 55. View of occluded inlet at Los Peñasquitos Lagoon on 5/7/14, prior to its closure on 5/8/14. Photo by Mike Hastings.



Figure 56. Side view of occluded inlet at Los Peñasquitos Lagoon on 5/7/14, prior to its closure on 5/8/14. Photo by Mike Hastings.



Figure 57. View of the open inlet at Los Peñasquitos Lagoon on 6/24/14 after tidal circulation was restored during Phase 3. Photo by Mike Hastings.



Figure 58. Panoramic view of the open inlet at Los Peñasquitos Lagoon on 6/24/14 after tidal circulation was restored during Phase 3. Photo by Mike Hastings.

Project benefits along Torrey Pines State Beach generated by beach disposal of sand excavated from the LPL's inlet include the following:

- Covering of exposed riprap located along an eroded bluff that separates Torrey Pines State Beach and public parking spaces along N. Torrey Pines Road to improve public access and safety, as well as to serve as a soft buffer to reduce further erosion of the bluffs from winter waves, storm surge and extreme tide events.

- Re-contouring of sand placed along the upper beach to mimic the profile of a coastal dune extending from the lower beach to the bluffs to increase the total area of available beach for public use and improved access from N. Torrey Pines Road.
- Creation of potential spawning habitat for grunion caused by sand placement along portions of the lower beach that had been predominately cobblestones.
- Improved beach safety along Torrey Pines State Beach through the creation of a beach access ramp for emergency vehicles traveling on N. Torrey Pines Road.



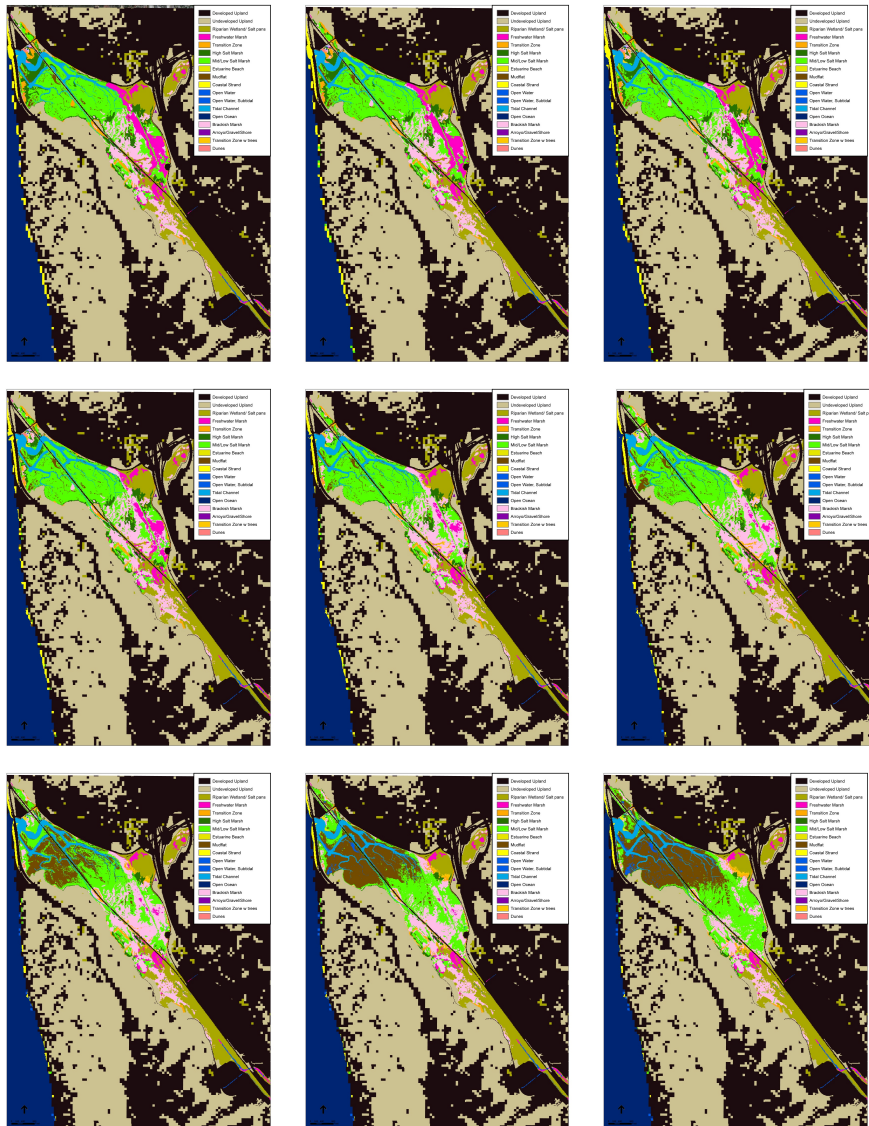
Figure 59. Evidence of coastal erosion and undercutting of N. Torrey Pines Road. Photo by Mike Hastings.



Figure 60. Soft-armoring of N. Torrey Pines Road and improved public access/safety using sand removed from the inlet at Los Peñasquitos Lagoon. Photo by Mike Hastings.

Appendix A

Results from Preliminary Run of Sea Level Affecting Marshes Model (SLAMM) for Los Peñasquitos Lagoon



PROJECT: Los Peñasquitos Management
SANDAG Transnet EMP Grant Program FY 2013
Grant No. 5001772
Final Report
Appendix A - Results from Preliminary Run of SLAMM for Los Peñasquitos Lagoon

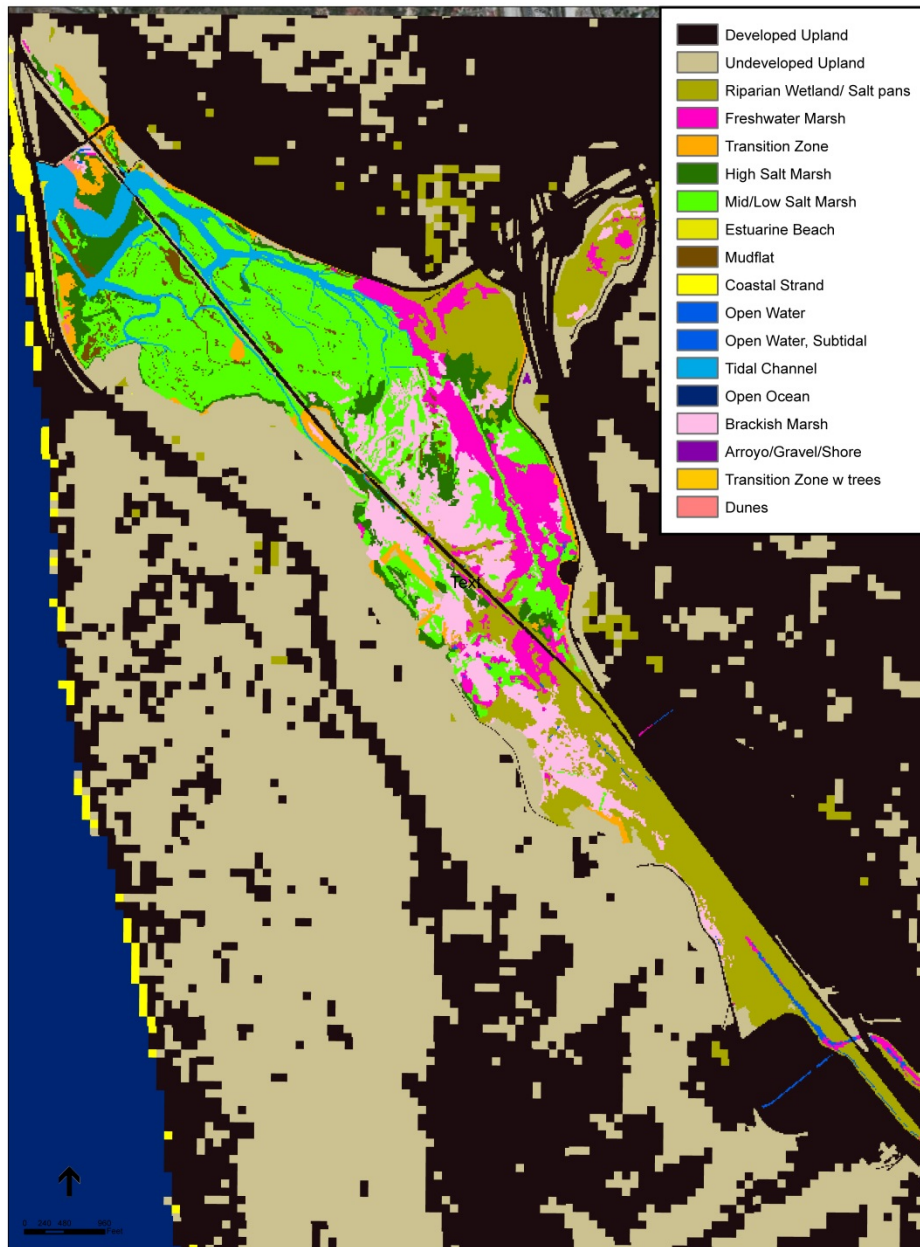


Figure 1. Habitat types and distribution in Los Peñasquitos Lagoon - 2014.

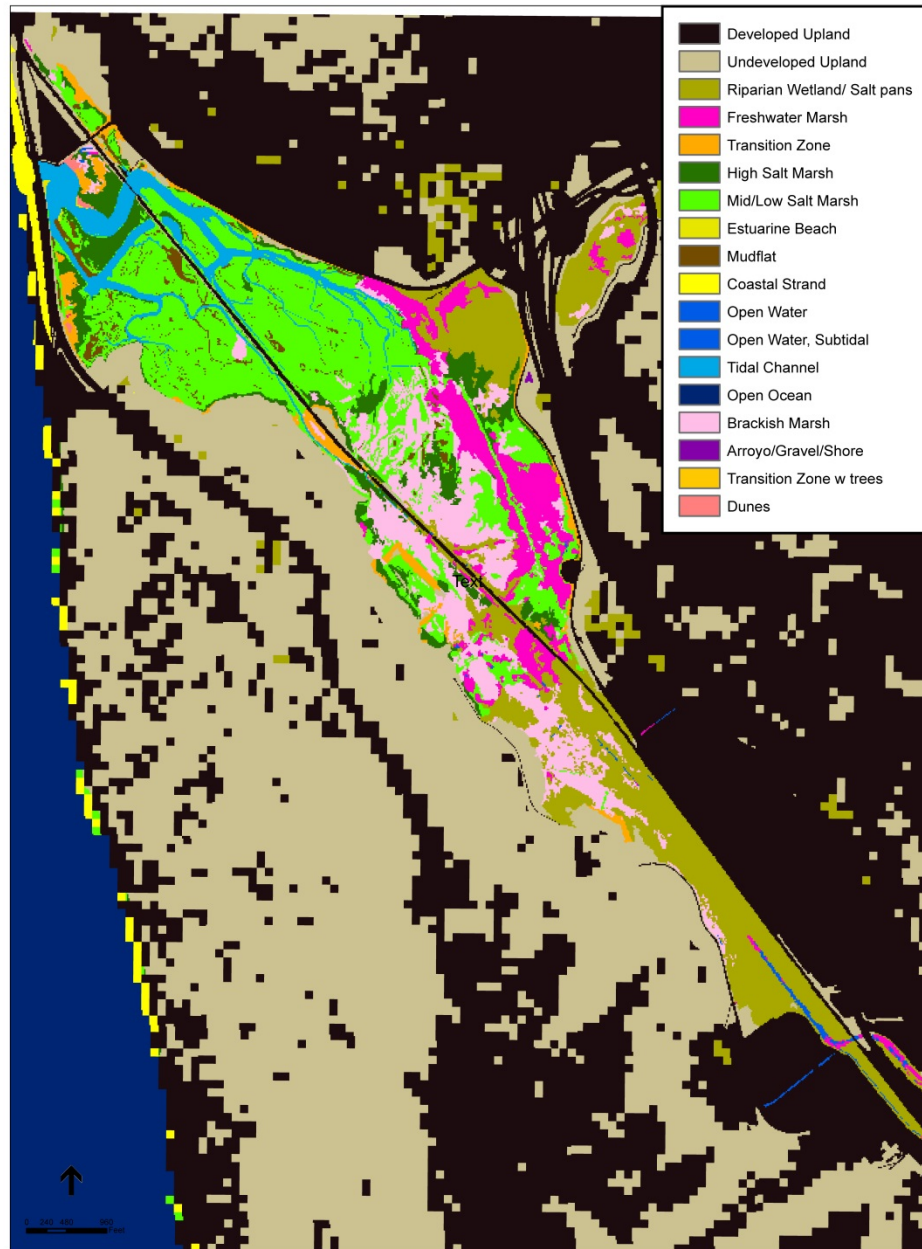


Figure 2. Habitat types and distribution in Los Peñasquitos Lagoon - 2030.

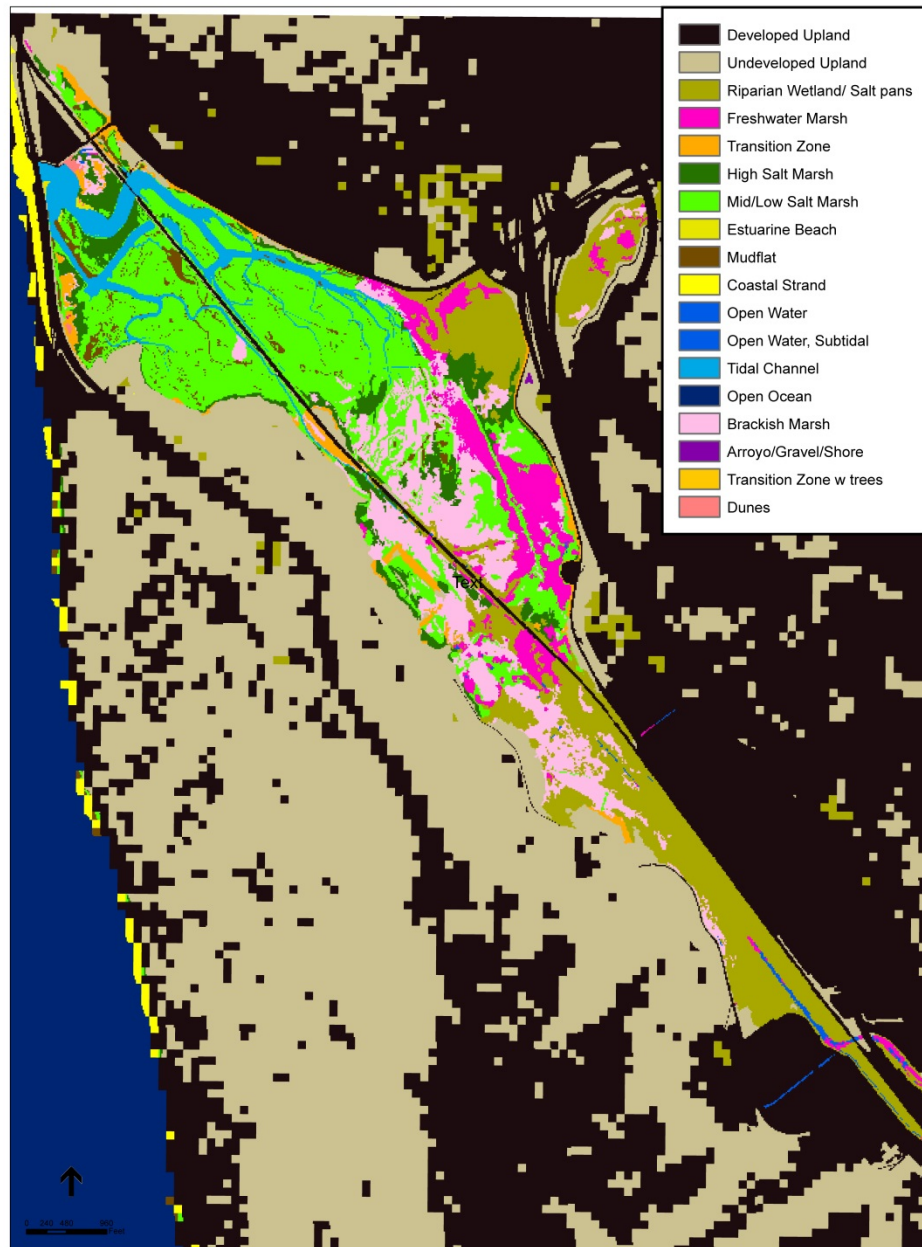


Figure 3. Habitat types and distribution in Los Peñasquitos Lagoon - 2040.

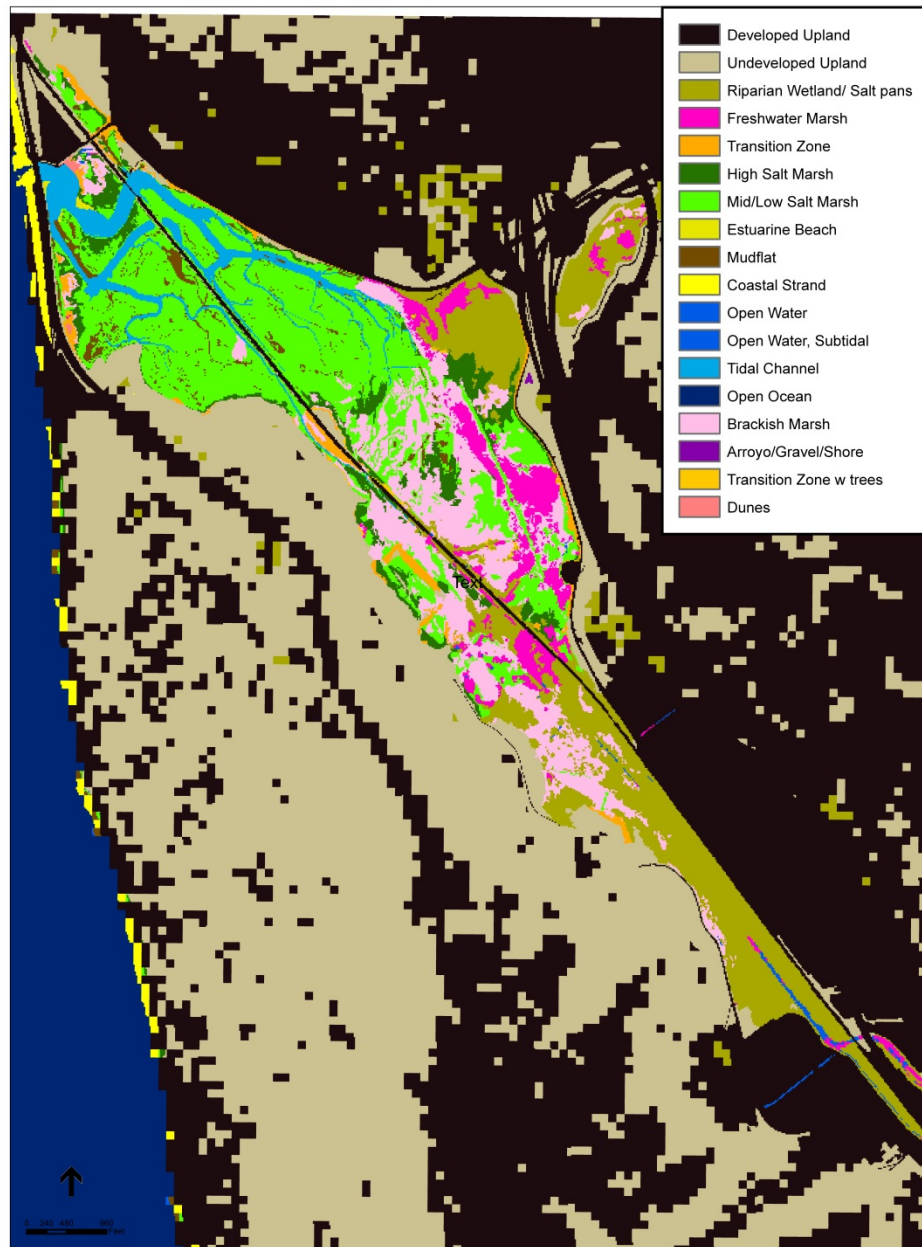


Figure 4. Habitat types and distribution in Los Peñasquitos Lagoon - 2050.

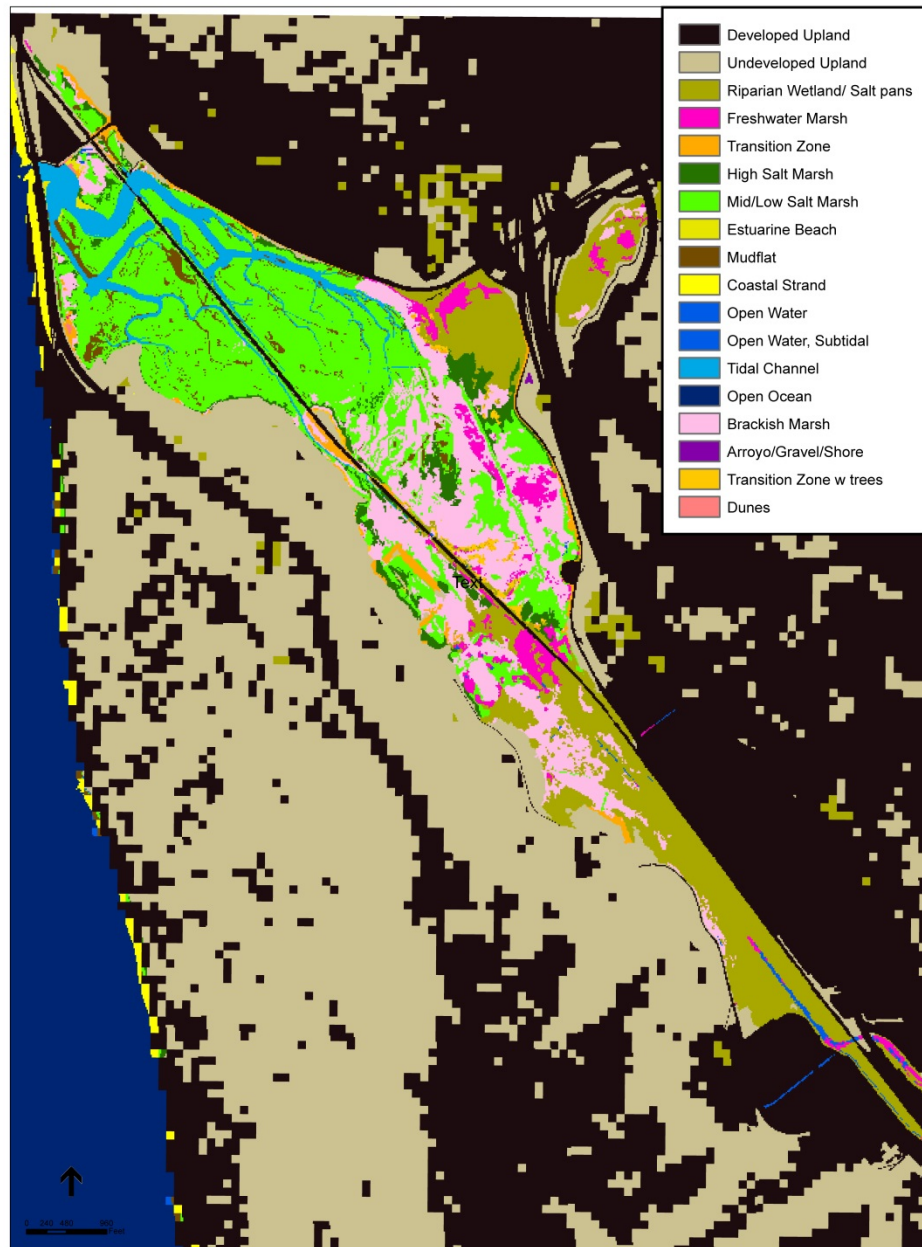


Figure 5. Habitat types and distribution in Los Peñasquitos Lagoon - 2060.

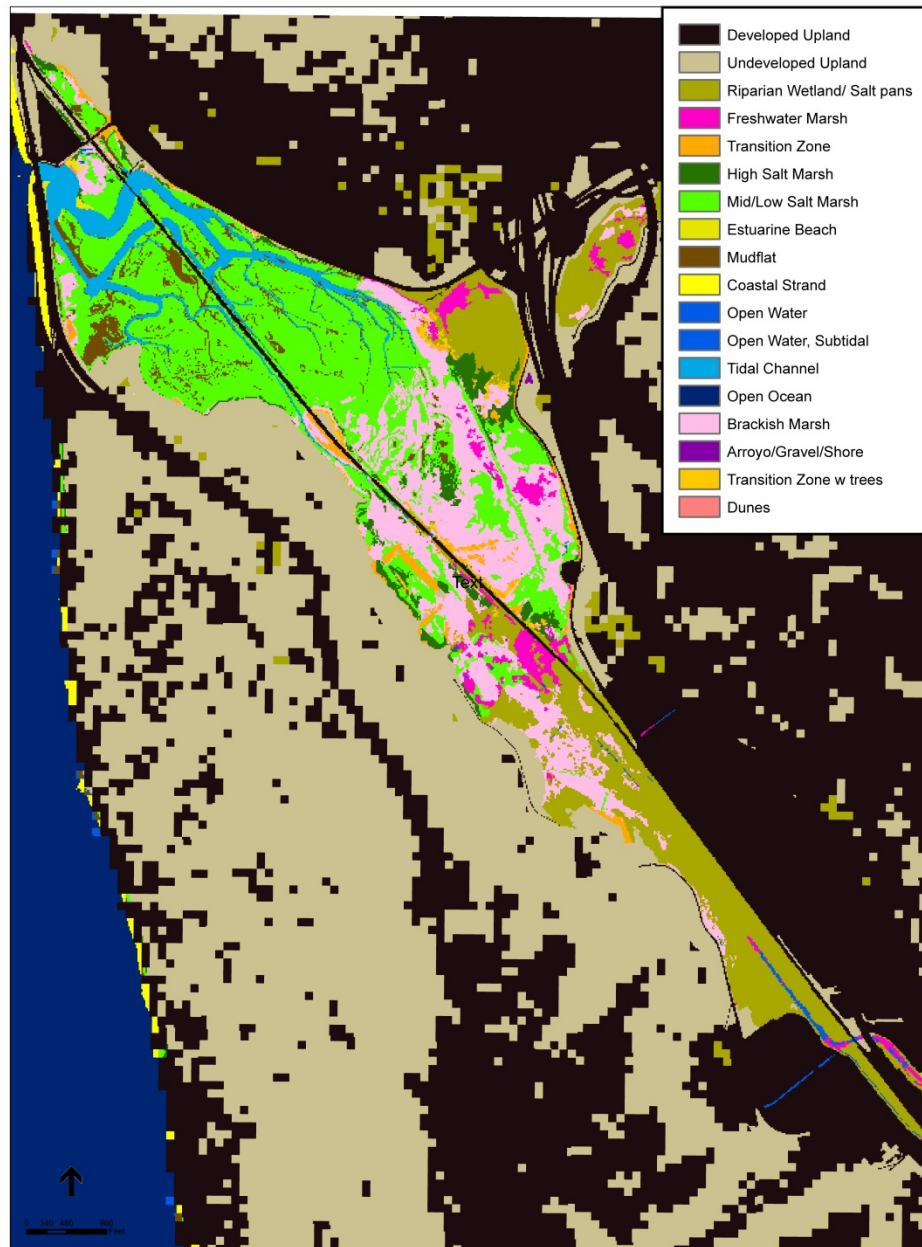


Figure 6. Habitat types and distribution in Los Peñasquitos Lagoon - 2070.

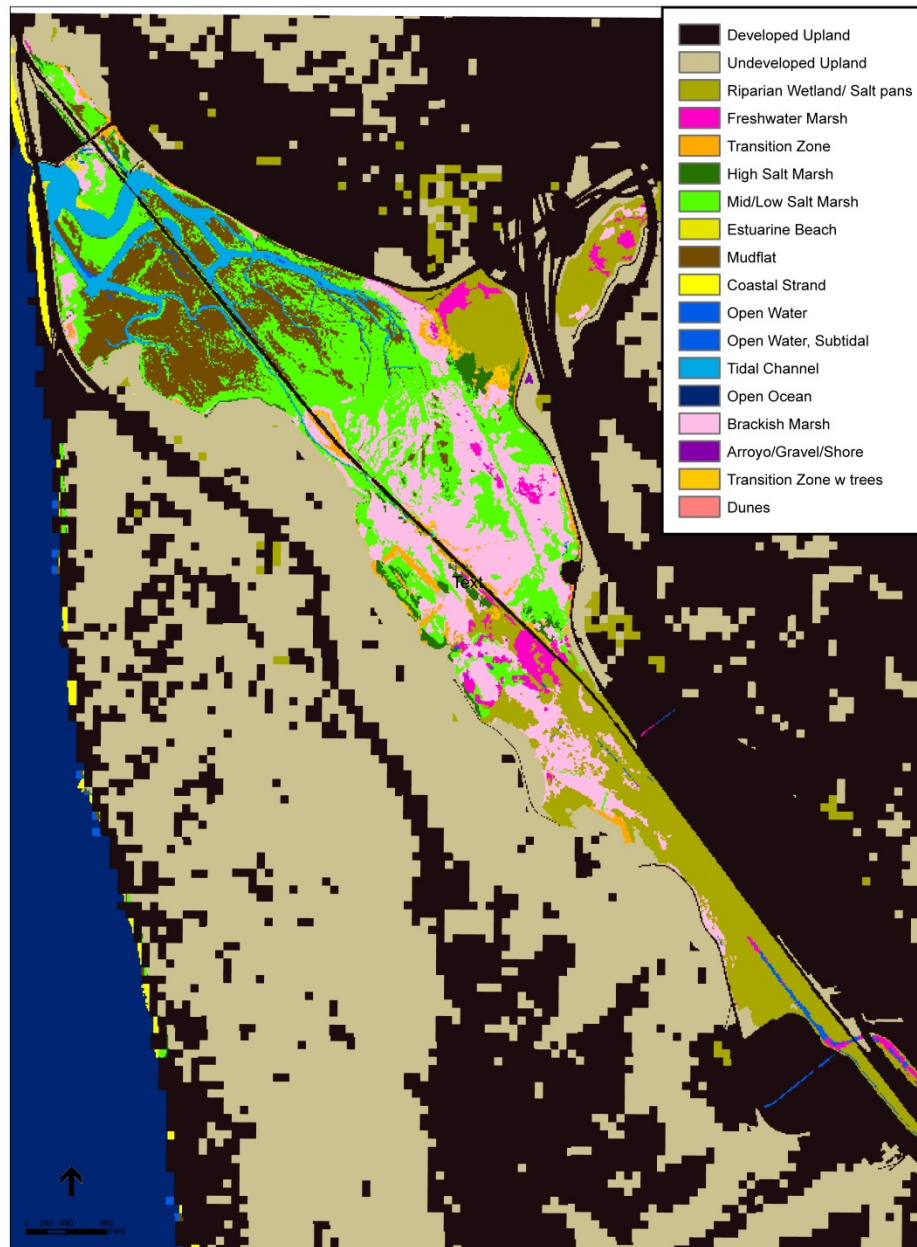


Figure 7. Habitat types and distribution in Los Peñasquitos Lagoon - 2080

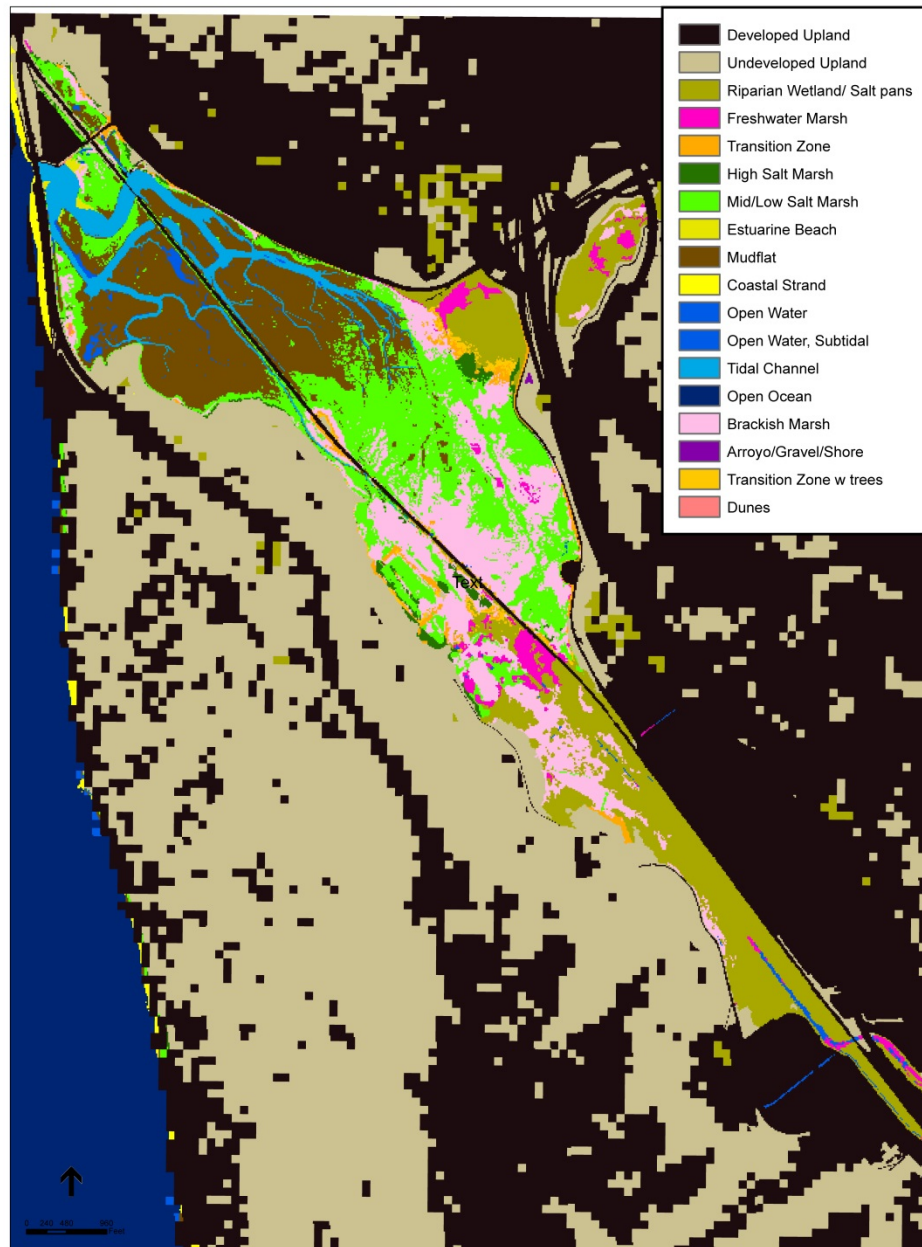


Figure 8. Habitat types and distribution in Los Peñasquitos Lagoon - 2000.

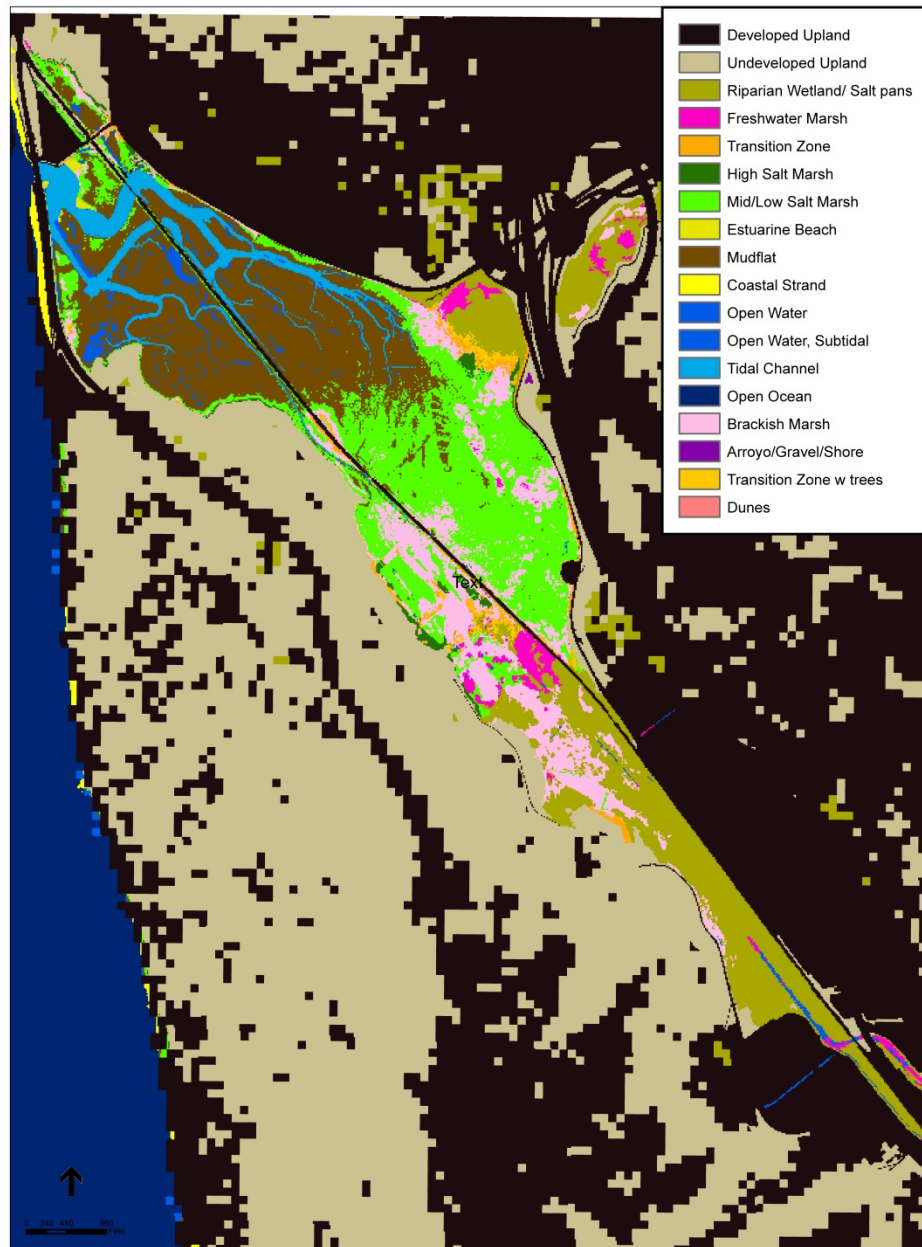


Figure 9. Habitat types and distribution in Los Peñasquitos Lagoon - 2100.