California Regional Water Quality Control Board

San Diego Region

Sediment TMDL for Los Peñasquitos Lagoon

STAFF REPORT
June 13, 2012

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Los Peñasquitos Lagoon

Staff Report

Adopted by the
California Regional Water Quality Control Board
San Diego Region
on June 13, 2012

Approved by the
State Water Resources Control Board
on ______________, 201x
and the
Office of Administrative Law
on ______________, 201x
and the
United States Environmental Protection Agency
on ______________, 201x

Cover Photograph by Cathryn Henning

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City of Del Mar
City of Poway
County of San Diego
Caltrans
Los Peñasquitos Lagoon Foundation
California State Parks
San Diego Coastkeeper
Coast Law Group
Tetra Tech, Inc.
US Environmental Protection Agency

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Abbreviations:

BAT:	Best Available Technology
BMP:	Best Management Practice
CWA:	Clean Water Act
CFR:	Code of Federal Regulations
EFDC:	Environmental Fluids Dynamic Code
EMC:	Event Mean Concentration
LA:	Load Allocation
LSPC:	Loading Simulation Program in C++
MLS:	Mass Loading Station
MOS:	Margin of Safety
MS4:	Municipal Separate Storm Sewer System
NPS:	Non-point Source Pollution
NPDES:	National Pollutant Discharge Elimination System
SANDAG:	San Diego Association of Governments
TBELs:	Technology Based Effluent Limitations
TMDL:	Total Maximum Daily Load
TSS:	Total Suspended Solids
TWAS:	Temporary Watershed Assessment Stations
US EPA:	United States Environmental Protection Agency
USGS:	Unites States Geological Survey
WQOs:	Water Quality Objectives
WLA:	Wasteload Allocation
WDRs:	Waste Discharge Requirements
WQBELs:	Water Quality Based Effluent Limitations (WQBELs)

Acknowledgements

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Members of the Stakeholder Advisory Group during a field visit to Los Peñasquitos Lagoon. (Pictured from left: Jay Shrake, Roshan Sirimanne, Clint Boschen, Kelly Barker, Charles Cheng, Ken Johansson, Ruth Kolb, Cheryln Cac, Edith Guttierrez, Cathryn Henning, Malik Tamimi, Mike Hastings.)

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Executive Summary

This staff report supports tentative Resolution No. R9-2012-0033, which will amend the *Water Quality Control Plan for the San Diego Basin (9)* (Basin Plan) to incorporate the sediment Total Maximum Daily Load (TMDL) for Los Peñasquitos Lagoon (Lagoon). The Basin Plan amendment will incorporate the TMDL, associated wasteload allocations, and required load reductions into the Basin Plan. This TMDL addresses the Clean Water Act section 303(d) sediment impairment for the Lagoon.

<u>Water Quality Impairment of Los Peñasquitos Lagoon</u>
Los Peñasquitos Lagoon is one of the few remaining and irreplaceable coastal lagoons in southern California providing valuable estuarine habitat as well as numerous other important beneficial uses. Over the course of the 20th century, the Lagoon has incurred a number of anthropogenic disturbances which, cumulatively have resulted in excessive sedimentation and the gradual degradation and loss of the estuarine habitat.

As required by section 303(d) of the Clean Water Act, the Lagoon was placed on the 1996 List of Water Quality Limited Segments due to sedimentation and siltation loads that exceeded water quality objectives. The beneficial uses that are most sensitive to increased sedimentation are estuarine habitat (EST) and preservation of biological habitats of special significance (BIOL). Estuarine uses of the Lagoon may include preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (such as marine mammals or shorebirds). Other beneficial uses listed in the Basin Plan for the Lagoon include contact water recreation, non-contact water recreation, wildlife habitat, rare, threatened or endangered species, marine habitat, migration of aquatic organisms, spawning, reproduction and/or early development, and shellfish harvesting.

Impacts associated with increased and rapid sedimentation include: reduced tidal mixing within Lagoon channels, degraded and (in some areas) net loss of saltmarsh vegetation, increased vulnerability to flooding for surrounding urban and industrial developments, increased turbidity associated with siltation in Lagoon channels, and constricted wildlife corridors.

The water quality objective for sediment is contained in the Basin Plan. The Basin Plan states, “The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.”

Numeric Target

The sediment water quality standard applies to sediment loading to the Lagoon and the accumulation of sediment in the Lagoon. The minimum protective target would be to reduce watershed sediment loads to non-anthropogenic levels and return the Lagoon to non-anthropogenic conditions with consideration given to background loading and other factors that also lend to impairment of beneficial uses. The numeric targets are calculated upon the historic condition (mid-1970s) when the sediment water quality standard was once met.

A historic coverage for the Los Peñasquitos watershed was developed for this period using US Geological Survey topographic maps from the 1970s. This land-use distribution was used to calculate the watershed numeric target using the LSPC watershed model. This historic (mid-1970s) sediment load of 12,360 tons per critical wet period (211 days), or 58.6 tons per day, represents the sediment TMDL watershed numeric target.

An analysis of the vegetation types present in the Lagoon was developed for the mid-1970s using historic aerial photographs from which the Lagoon numeric target was calculated (see Linkage Analysis, Section 7). The Lagoon numeric target is expressed as an increasing trend in the total area of tidal saltmarsh and non-tidal saltmarsh toward 346 acres. This target acreage represents 80 percent of the total acreage of tidal and non-tidal saltmarsh present in 1973.

Sources and Responsible Parties

Sources of sediment include erosion of canyon banks, exposed soils, bluffs, scouring stream banks, and tidal influx. Some of these processes are exacerbated by anthropogenic disturbances, such as land development within the watershed. Land development transforms the natural landscape by exposing sediment and converting pervious surfaces to impervious surfaces, which increases the volume and velocity of runoff resulting in scouring of sediment, primarily below storm water outfalls that discharge into canyon areas. Sediment loads are transported downstream to the Lagoon during storm events causing deposits on the salt flats and in Lagoon channels. These sediment deposits have gradually built-up over the years due to increased sediment loading and inadequate flushing, which directly and indirectly affects Lagoon functions and salt marsh characteristics.

There are two broad categories of sediment sources to the Lagoon: 1) watershed sources, and 2) the Pacific Ocean. The watershed sources consist of all point and non-point sources of sediment in the watershed area draining to Los Peñasquitos Lagoon. The total sediment contribution from all watershed sources is presented as the total wasteload allocation (WLA). The sediment contributions from the Pacific Ocean are considered a background source and are presented as the Load Allocation (LA). Hence, the responsible parties were assigned the total WLA and are jointly responsible for meeting the wasteload reductions required in this TMDL project. Responsible parties include the following: Phase I Municipal Separate Storm Sewer Systems (MS4s) copermittees (the County of San Diego, City of San Diego, City of Del Mar, and City of Poway), Phase II MS4s permittees, Caltrans, general construction storm water NPDES permittees, and general industrial storm water NPDES permittees.

Linkage Analysis

Reducing watershed sediment loads from the year 2000 levels to historic levels is a necessary component for restoring and providing long-term protection of the Lagoon's beneficial uses. Deposition of watershed sediment contributes to elevation increases within the Lagoon, leading to an increase in height relative to mean sea level. Elevation is a critical variable that determines the productivity, diversity, and stability of saltmarshes. The long-term existence of the saltmarsh depends on the success of the dominant plants, such as *Sarcoconia pacifica* (also referred to as *Salicornia virginica*) and *Frankenia salina*, and their close relationship to sediment supply, sea level change, and tidal range.

Reduced sediment loading consistent with the watershed numeric target will encourage the establishment of native vegetation in degraded areas. To represent the linkage between source contributions and receiving water response, models were developed to simulate source loadings and transport of sediment into the Lagoon. The models provide an important tool to evaluate year 2000 conditions, to evaluate historic conditions, and to calculate TMDL load reductions.

The Lagoon was capable of assimilating these historic sediment loads under historic Lagoon conditions. Because the Lagoon has evolved through time and accumulated over 40 years of watershed sediment loads, it cannot be assumed that the Lagoon, in the year 2010 conditions, can assimilate the same historic sediment loads. Evaluation of the extent of vegetation types in the Lagoon provides the necessary tool to assess how the Lagoon responds to watershed sediment load reductions and to establish a target Lagoon condition under which the Lagoon can again assimilate the historic sediment loads.

<u>TMDL, Allocations and Reductions</u>

TMDL = 12,360 tons per year

The maximum load of sediment that Los Peñasquitos Lagoon can receive from all sources and still meet the sediment water quality objective is 12,360 tons per year.

Wasteload Allocations to Watershed = 2,580 tons/year

A wasteload allocation (WLA) of 2,580 tons/year was assigned to the responsible parties. Collective wasteload reductions are required of the responsible parties.

Load Allocations to Ocean = 9,780 tons/year

The ocean was assigned a load allocation (LA) of 9,780 tons/year. Because the ocean is a natural background source, load reductions are not required of the ocean.

Margin of Safety = Implicit

Conservative assumptions were used in selecting the TMDL numeric targets and implementation activities to provide an implicit margin of safety.

The TMDL results are summarized in Tables ES-1 and ES-2.

Table ES-1. TMDL summary

Source	Critical Wet Period Load (tons)	Daily Load (tons)
Watershed contribution (WLA)	2,580	12.2
Ocean boundary (LA)	9,780	46.4
Margin of Safety (MOS)	implicit	implicit
TMDL	12,360	58.6

Table ES-2. Year 2000 vs. historical loads and percent reduction

Source	Year 2000 Load (tons)	Historical (mid-1970s) Load (tons)	Load Reduction (tons)	Percent Reduction Required
Watershed contribution (WLA)	7,719	2,580	5,139	67%
Ocean boundary (LA)	5,944	9,780	+3,836 (increase)	+39% (increase)
Total	13,663	12,360	1,303	10%

<u>Implementation of TMDL</u>

The responsible parties must develop a Load Reduction Plan that will establish a watershed-wide, programmatic, adaptive management approach for implementation. The plan will include a detailed description of implementation actions, as identified and planned by the responsible parties, to meet the requirements of this TMDL. All responsible parties are responsible for reducing their sediment loads to the receiving waterbody or demonstrating that their discharges are not causing exceedances of the wasteload allocation.

Monitoring Program

Monitoring is required to assess progress towards achieving the wasteload and load allocations and numeric targets. Furthermore, the monitoring program must be capable of monitoring the effectiveness of implementation actions to improve water quality and saltmarsh habitat and remediation actions to remove sediment from the Lagoon.

Compliance Schedule

Full implementation of the TMDL for sediment must be completed within 20 years from the effective date of the Basin Plan amendment. This timeline takes into consideration the planning needs of the responsible parties to establish a Load Reduction Plan, time needed to address multiple impairments, and provides adequate time to measure temporal disparities between reductions in upland loading and the corresponding Lagoon water quality response.

1 Introduction

The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) is the California state agency responsible for water quality protection in the southwest portion of the state of California. It is one of nine Regional Water Boards in California, each generally separated by hydrological boundaries. Each Regional Water Board consists of nine governor-appointed members who serve four-year terms. The San Diego Water Board, under its federally designated authority, administers the Clean Water Act (CWA) within the San Diego Region. In accordance with the CWA, the San Diego Water Board has adopted the *Water Quality Control Plan for the San Diego Region (9)* (Basin Plan) that specifies water quality standards for waters in the San Diego Region and implementation measures to enforce those standards.

Section 305(b) of the CWA mandates biennial assessment of the nation's water resources to identify and list waters not meeting their water quality standards. These waters are listed in accordance with CWA section 303(d); and the list is commonly referred to as the 303(d) list. The CWA requires states to establish a priority ranking for impaired waters and to develop and implement Total Maximum Daily Loads (TMDLs) or alternatives to address the impairments. A TMDL is a written, quantitative assessment of water quality problems and contributing pollutant sources. It identifies one or more numeric targets for restoring beneficial uses based on applicable water quality standards, specifies the maximum pollutant load that can be discharged and still meet water quality standards, allocates pollutant loads among sources in the watershed, and provides a basis for taking actions needed to meet the numeric target(s) and water quality standards.

The Los Peñasquitos Lagoon (Lagoon) is currently listed on the 303(d) list for sedimentation/siltation because the narrative sediment water quality objective is not being met. Sedimentation within the Lagoon impacts numerous beneficial uses, primarily those associated with protection of native habitats that depend on tidal inundation and/or salinity levels in non-tidal soils. Sedimentation increases elevations within the Lagoon, which leads to an increase in height relative to mean sea level. Elevation is a critical variable that determines the productivity, diversity, and stability of saltmarshes. The long-term existence of the saltmarsh depends on the success of the dominant plants, such as *Sarcoconia pacifica* and *Frankenia salina*, and their close relationship to sediment supply, sea level change, soil salinity, and tidal range (US EPA, 2005).

The San Diego Water Board proposes to amend its Basin Plan to incorporate a TMDL and implementation plan to address sedimentation problems adversely affecting water quality in the Lagoon. This TMDL Staff Report describes the scientific and technical basis for confirming sediment impacts, developing numeric targets, determining sediment sources, and establishing wasteload and load allocations. Compliance with the TMDL will be assessed by monitoring the Lagoon and contributing watershed.

For the technical portion of this TMDL, the San Diego Water Board relied on the report prepared by Tetra Tech entitled, *Los Peñasquitos Lagoon Sediment/Siltation TMDL* (Technical Support Document, Attachment 1).

2 Problem Statement

Under section 303(d) of the Clean Water Act (CWA), states are required to identify waters whose beneficial uses have been impaired due to specific constituents. Los Peñasquitos Lagoon was placed on the Section 303(d) list of Water Quality Limited Segments in 1996 for sedimentation and siltation with an estimated 469 acres affected. The Lagoon is subject to the development of a total maximum daily load (TMDL) (US EPA, 2009).

The Lagoon is an estuarine system that is part of the Torrey Pines State Natural Reserve. In addition to its marine influence, the Lagoon receives freshwater inputs from an approximately 60,000-acre watershed comprised of three major canyons (Carroll Canyon, Los Peñasquitos Canyon, and Carmel Canyon). Given the status of “Natural Preserve” by the California State Parks, the Lagoon is one of the few remaining native saltmarsh lagoons in southern California, providing a home to several endangered species (California State Parks, 2009). The Lagoon is ecologically diverse, supporting a variety of plant species, and provides nursery grounds and habitat for numerous bird, fish, and small mammal populations. The Lagoon also serves as a stopover for the Pacific Flyway, offering migratory birds a safe place to rest and feed, as well as providing refuge for coastal marine species that use the Lagoon to feed and hide from predators.

The San Diego Basin Plan states, “The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.” Beneficial uses listed in the Basin Plan for the Lagoon include contact water recreation; non-contact water recreation (although access is not permitted in most areas per California State Parks); preservation of biological habitats of special significance; estuarine habitat; wildlife habitat; rare, threatened or endangered species; marine habitat; migration of aquatic organisms; spawning, reproduction and/or early development; and shellfish harvesting. The beneficial uses that are most sensitive to increased sedimentation are estuarine habitat and preservation of biological habitats of special significance. Estuarine uses may include preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (such as marine mammals or shorebirds).

Impacts associated with increased and rapid sedimentation include: reduced tidal mixing within Lagoon channels, degraded and (in some cases) net loss of saltmarsh vegetation, increased vulnerability to flooding for surrounding urban and industrial developments, increased turbidity associated with siltation in Lagoon channels, and constricted wildlife corridors.

The Los Peñasquitos Lagoon Enhancement Plan and Program (1985), San Diego Basin Plan (1994), and Clean Water Act section 303(d) highlight sedimentation as a significant impact associated with urban development and a leading cause in the rapid loss of saltmarsh habitat in the Lagoon. Sediment reduction is a management priority.

The Lagoon's 565 acres include 262 acres of tidal saltmarsh (including salt panne, tidal channels, and mudflats) and non-tidal saltmarsh and 132 acres of freshwater marsh, herbaceous wetland, and woody riparian (for example southern willow scrub and mulefat scrub) habitats. The remaining 171 acres of saltmarsh and brackish marsh vegetation are impaired by excessive sedimentation, which converted the coastal saltmarsh to *Lolium* perenne infested non-tidal saltmarsh, freshwater marsh, and woody riparian habitats (California State Parks, 2011). The environmental processes that support wetland habitats in the Lagoon have been altered by urban development in three ways:

1) Increase in the volume and frequency of freshwater input,
2) Increase in sediment deposition, and
3) Decrease in the tidal prism.

These factors have led to decreases in tidal and non-tidal saltmarsh habitats and increases in freshwater habitats and the abundance of non-native species.

3 Background Information

This section describes the Los Peñasquitos watershed and Lagoon and provides background information on the impairment.

3.1 Los Peñasquitos Watershed Description

The Los Peñasquitos watershed is located in central San Diego County (Figure 1). Both the watershed and Lagoon are included in the Peñasquitos Hydrologic Unit (HU 906). In addition to the Los Peñasquitos watershed, the Peñasquitos HU includes Mission Bay and other coastal tributaries. The Los Peñasquitos watershed is 93 square miles (approximately 60,000 acres) and includes portions of the City of San Diego, City of Poway, City of Del Mar, and San Diego County (Figure 2). There are also several major road corridors and a railway within the watershed.

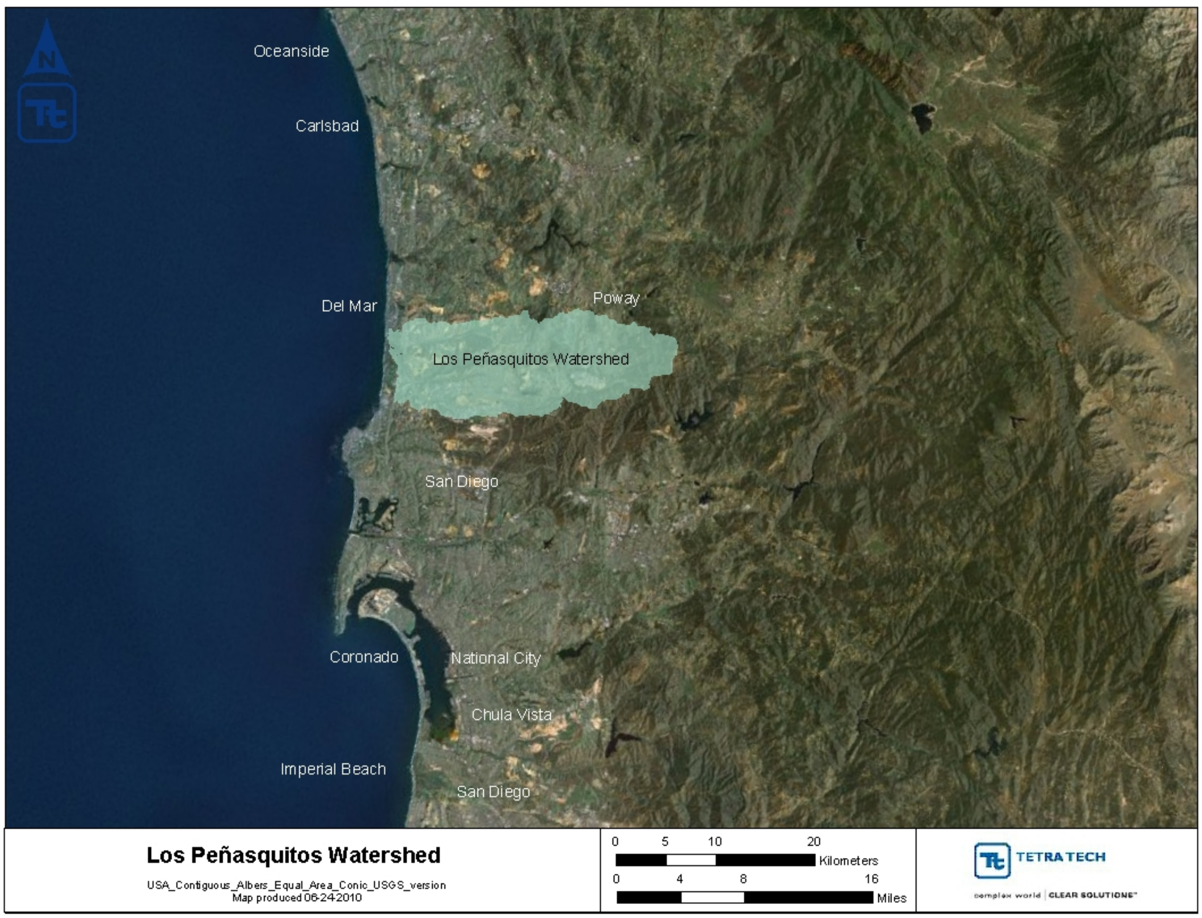

Figure 1. Location of the Los Peñasquitos watershed.

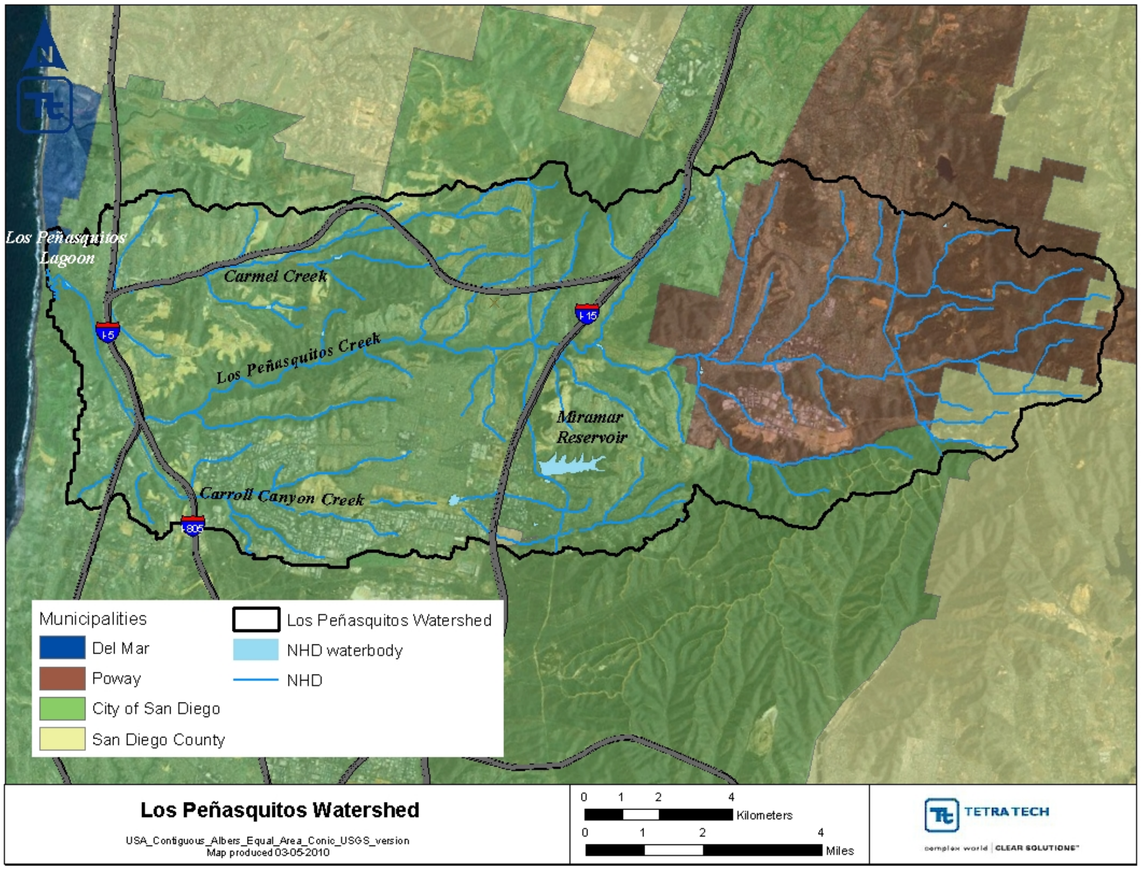

Figure 2. Municipalities and major roads within the Los Peñasquitos watershed.

The climate in the Los Peñasquitos watershed is like that of the entire San Diego Region, which is generally mild with annual temperatures averaging around 65°F near the coastal areas. Average annual rainfall ranges from nine to eleven inches along the coast. There are three distinct seasons in the San Diego Region. The summer dry season occurs from late April to mid-October. The winter season occurs from mid-October through early April and has two types of weather: 1) winter dry weather, and 2) wet weather. The winter wet weather season accounts for 85 to 90 percent of the annual rainfall.

Three major streams drain the watershed and flow into the Lagoon (Figure 2). Los Peñasquitos Creek is the largest catchment draining 59 square miles (approximately 37,760 acres) in the central portion of the watershed. Carroll Canyon Creek is the second largest catchment draining 18 square miles (approximately 11,520 acres) in the southern portion of the watershed. Carmel Creek is the smallest of the three catchments draining the remaining 16 square miles (approximately 10,240 acres) in the northern, coastal area. Los Peñasquitos Creek and Carroll Canyon Creek converge prior to entering the Lagoon. Miramar Reservoir drains 1 square mile (approximately 640 acres) of the Carroll Canyon Creek watershed. Miramar Reservoir retains imported drinking water and does not discharge downstream. Watershed elevation rises from sea level to 2,600 feet in the headwaters.

3.2 Los Peñasquitos Land Use and Population

Development within the Lagoon during the late 1800s and early 1900s altered Lagoon hydrology and set the stage for the Lagoon's vulnerability to impacts associated with intense development of the watershed that began in the mid-1970s. In 1888 a railway was constructed across the Lagoon on an elevated earthen berm just west of the current alignment of Sorrento Valley Road. This railway alignment was later abandoned and replaced in 1924. The new alignment of the railway line was placed on an elevated earthen berm that bisects the Lagoon, effectively cutting off several of the Lagoon's historic tidal channels. Both railway berms obstructed storm water flows from the watershed and facilitated sediment deposition in the southeastern portion of the Lagoon. Realignment of historic Highway 101 in the 1930s also modified the Lagoon's hydrology by realigning and fixing the ocean inlet under the southern bridge resulting in more frequent inlet closures.

In 1966 the upper Los Peñasquitos subwatershed was 9 percent urbanized (White and Greer, 2002); however, by 1975, the watershed experienced significant urbanization with agricultural areas being converted to urban uses, specifically in the Poway and Mira Mesa areas (City of San Diego, 2005). From 1966 to 1999, the acreage of urbanized land within the upper Los Peñasquitos Creek watershed increased by 290 percent (White and Greer, 2002), and by 2000, 54 percent of the Los Peñasquitos watershed was developed. Additional highway infrastructure was built in and around the Los Peñasquitos watershed to accommodate the increasing population growth. Realignment of Sorrento Valley Road (ca. 1966), Carmel Valley Road (1983), segments of the I-5 freeway (1994), and the State Route 56 overpass (1995) impacted the surrounding watershed.

To decrease impacts from road infrastructure, Sorrento Valley Road was converted to a bike path in 2003 and a new U.S. Highway 101 bridge was constructed over the Lagoon mouth in August 2005. To mitigate for impacts from State Route 56 and several other projects for the City of San Diego, the 27-acre El Cuervo Norte wetlands restoration project was created in the Peñasquitos Canyon Preserve. The El Cuervo Norte wetlands were designed to provide over 24 acres of southern willow scrub, oak-sycamore woodland and freshwater marsh habitat. The project consisted of approximately 9 acres of wetland creation, 14.3 acres of wetlands enhancement, 2 acres of upland native buffer, and 1.3 acres of park access road and a San Diego Gas & Electric power pole maintenance area (Dudek, 2010).

Land use associated with the mid-1970s time period is illustrated in Figure 3. Land-use/land cover data for the Los Peñasquitos watershed were not available for this period, therefore, a historical coverage was developed based on the location and type of structures that are shown in USGS topographic maps from the 1970s (primarily the La Jolla quadrangle – dated 1975).

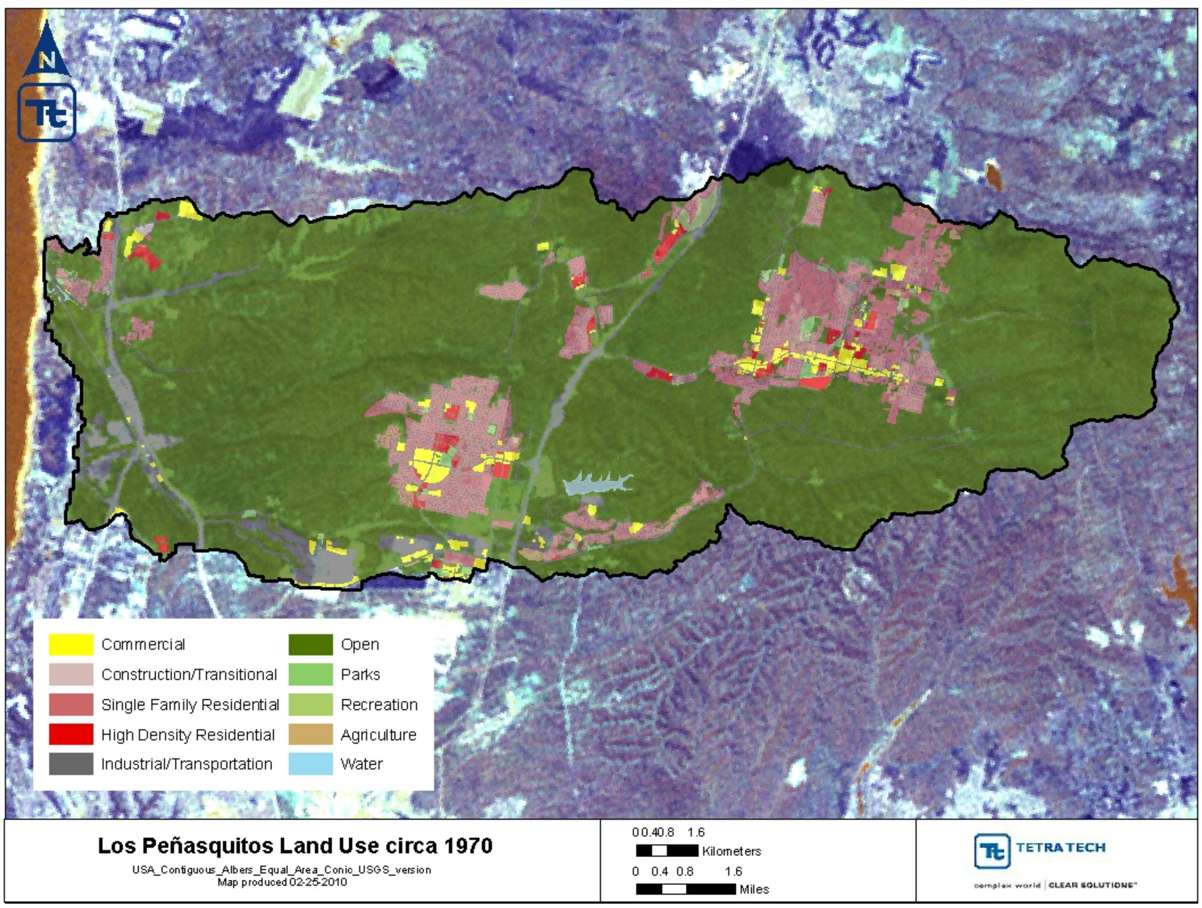

Figure 3. Historic land use in the Los Peñasquitos watershed (1970s).

Data detailing land use in the Los Peñasquitos watershed is available through the San Diego Association of Governments 2000 land-use coverage and is presented in Figure 4. Approximately 54 percent of the watershed has been developed, with 46 percent of that area classified as impervious. The largest single land-use type in the Los Peñasquitos watershed is open space (approximately 25,500 acres), followed by low density residential development (approximately 14,250 acres) and industrial/transportation (approximately 11,660 acres). Land use differences between the year 2000 and the historical time period are shown in Table 1.

To further characterize the land use changes, population trends are illustrated in Figure 5. Figure 5 depicts the expansive population growth from 1970 to 2010 in the San Diego region facilitated by intense development throughout the region.

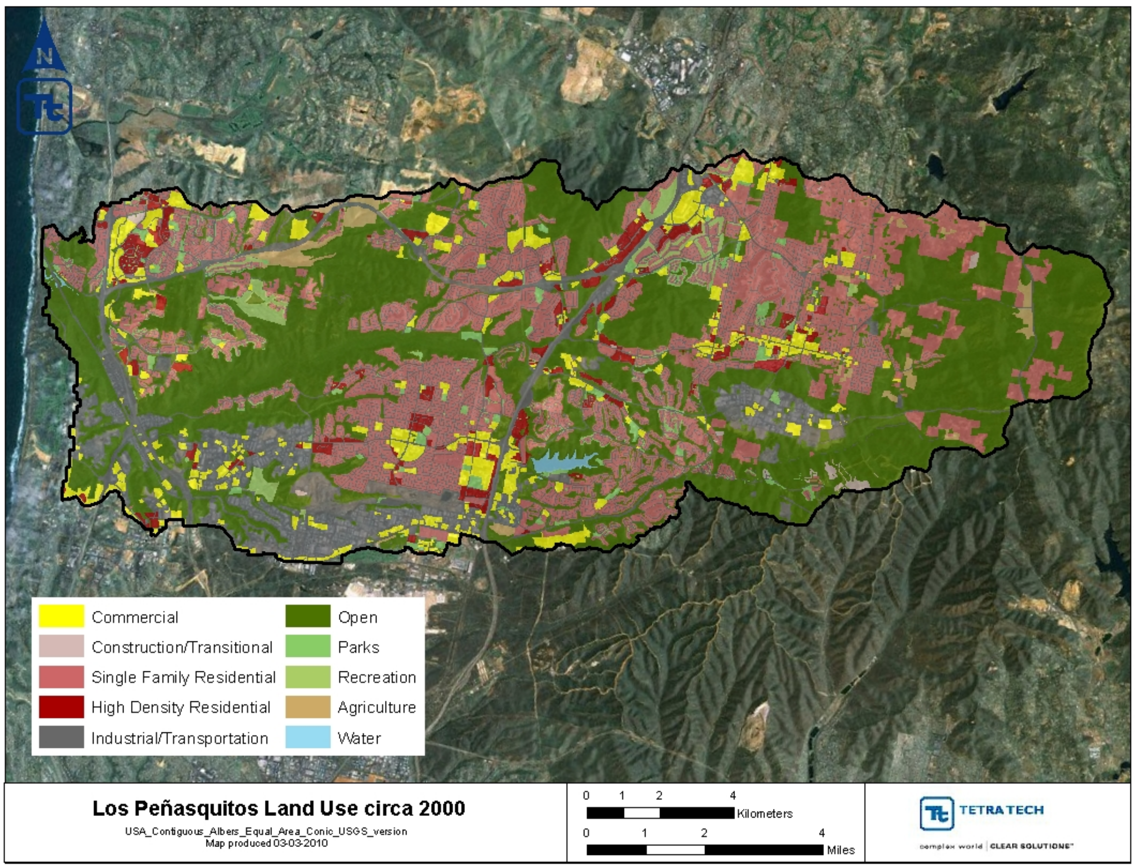

Figure 4. Year 2000 land uses in the Los Peñasquitos watershed.

Table 1. Year 2000 (SANDAG 2000) vs. historical land use comparison

Land Use	Year 2000 area (ac)	Year 2000 percent of total area	Historic, mid-1970s area (ac)	Historic, mid-1970s percent of total area	Percent change of total watershed area
Agriculture	741	1.24%	100	0.17%	1.07 %
Commercial	3,591	6.00%	1,088	1.82%	4.18%
Construction/ Transitional	169	0.28%	23	0.04%	0.24%
High Density Residential	1,840	3.07%	648	1.08%	1.99%
Industrial/ Transportation	11,654	19.46%	4,830	8.07%	11.40%
Open	25,463	42.52%	47,445	79.23%	-36.71%
Parks	1,326	2.22%	2,884	0.48%	1.73%
Recreation	670	1.12%	139	0.23%	0.89%
Single Family Residential	14,258	23.81%	5,155	8.61%	15.20%
Water	161	0.27%	160	0.27%	0.00%
Total	59,879	100.00%	59,879	100.00%	

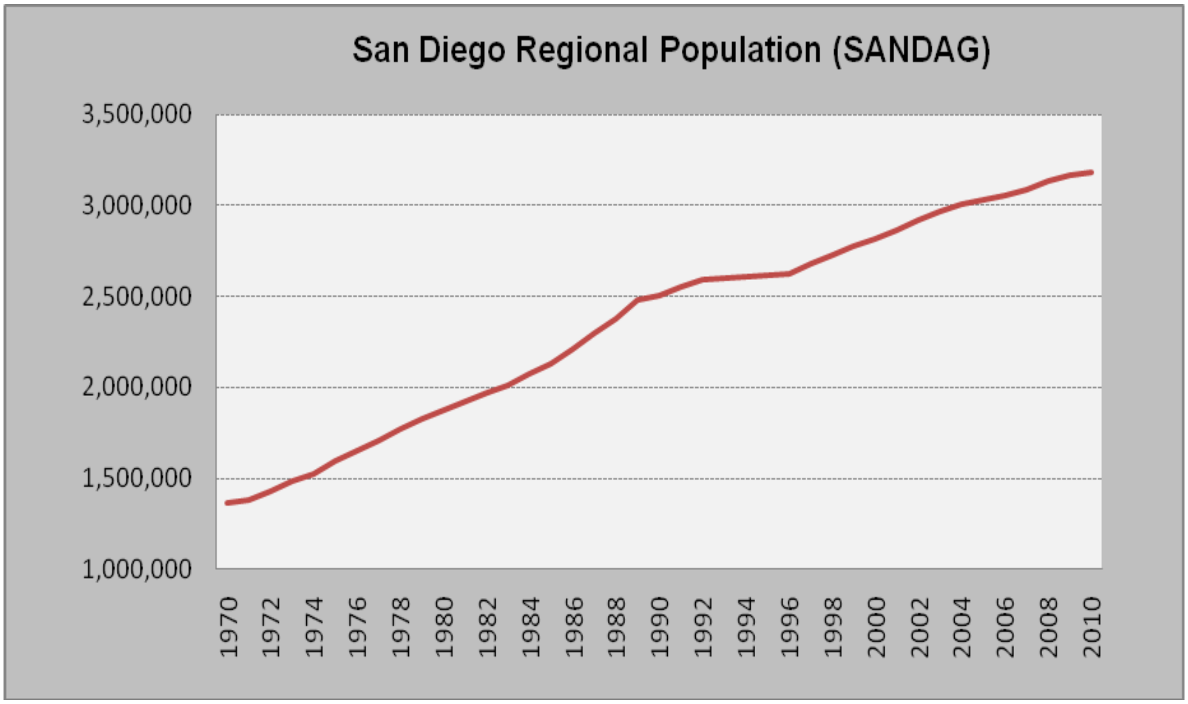

Figure 5. San Diego regional population trends (SANDAG, 2010).

3.3 Los Peñasquitos Lagoon Description

The Lagoon was formed many thousands of years ago when rising sea levels flooded the Peñasquitos Valley to form a deep marine embayment. Over the years, inflowing creeks deposited alluvial sediment, which gradually filled the embayment to form the small estuarine system seen today (Mudie et al. 1974). The Lagoon is in a dynamic state with continual influences from the tide and upstream runoff (Greer and Stowe, 2003). The Lagoon resides in Torrey Pines State Natural Reserve and is one of the few remaining native saltmarsh lagoons in southern California, thereby given the status of "Natural Preserve" by the California State Parks (Figure 6).

Figure 6. Photograph of Los Peñasquitos Lagoon. Tidal flows enter the Lagoon via a channel beneath the U.S. Highway 101 bridge and then bifurcate into the eastern and western branches.

The Lagoon is ecologically diverse, supporting a variety of plant species and providing habitat for numerous bird, fish, and small mammal populations. The saltmarsh daisy, San Diego sagewort, and coast wallflower reside in the Lagoon (LPL Foundation, 2011). The Lagoon also serves as a stopover for migratory birds and provides habitat for coastal marine and saltmarsh species. Listed bird species endemic to the Lagoon include the light-footed clapper rail (federally-listed, endangered), Belding's savannah sparrow (state-listed, endangered), California brown pelican (federally-delisted on November 17, 2009), western snowy plover (federally-listed, threatened) and California gnatcatcher (federally-listed, threatened) (Mudie et al. 1974). The Lagoon has also provided habitat for the federally-listed, endangered California least tern, although this species has not been observed in the Lagoon since 1980 (Cooper, 1984).

Maintaining a tidal prism and proper exchange between the ocean and the Lagoon are critical for maintaining adequate saltmarsh salinity levels. Tidal flow mainly keeps the mouth open; however, storm water flows play a role in re-establishing the thalweg in tidal channels and forcing sediment out of the inlet and back into the ocean. The role of storm water flows in performing these actions is diminished by the railway berm and by thick stands of riparian and brackish marsh habitat at the base of the Lagoon’s tributaries, which impede and detain runoff flows before they can scour the inlet area.

Deposition of sediment within the Lagoon inlet is caused primarily by tides, wave run up and storm surge that push sand and cobbles from nearby beaches and offshore sources into the inlet area (LPL Foundation and State Coastal Conservancy, 1985). Grain size analysis conducted at the Lagoon inlet indicate that sediment loading from the watershed may increase the build-up rate of sand bar formation, but the primary source of sedimentation in the Lagoon’s inlet area is the ocean (Elwany, 2008).

During periods when the Lagoon mouth is open, tidal flows from the Pacific Ocean enter the Los Peñasquitos Lagoon via a channel beneath the southern bridge at Torrey Pines Road, formerly referred to as Highway 101. Historical records indicate that the Lagoon was continuously connected to the ocean at least until 1888 (Mudie et al. 1974). Under present conditions, a permanent mouth opening to the ocean cannot be naturally maintained, except during exceptionally wet winters. This is primarily due to the loss of the inlet’s ability to meander along the beach and to the reductions in velocities of storm driven outflows. The Lagoon’s inlet is often mechanically dredged to alleviate the danger of flooding and to improve the health of the Lagoon.

Approximately 150 yards from the Lagoon mouth, the main Lagoon channel bifurcates (Figure 6). The eastern branch runs inland under the railroad trestle, then trends southeastward terminating in a series of small creeks that drain the few remaining salt flats and non-tidal marsh on the southeastern side of the Lagoon. The eastern branch receives flow from Carmel Creek (Figure 7). The western branch of the main channel system is generally narrower and shallower than the eastern branch. It runs in a southerly direction and terminates in a dendritic pattern of creeks that drain the marsh on the southwestern side of the Lagoon. Two of these poorly defined creeks connect with the combined Los Peñasquitos and Carroll Canyon Creeks, which flow into the Lagoon through a narrow (approximately 10 feet wide) channel on the west side of the railroad berm (Figure 8).

Figure 7. Photograph of Carmel Creek entering Los Peñasquitos Lagoon on January 3, 2011, shortly after a rain event. The creek flows along the dashed arrow, along SR 56 and beneath the I-5 freeway.

Figure 8. Photograph of the combined Los Peñasquitos and Carroll Canyon Creeks entering Los Peñasquitos Lagoon shortly after a rain event on January 3, 2011. The combined creeks flow along the dashed arrow, along the western side of the railroad berm.

3.4 Impairment Description

The Lagoon is listed as impaired on the 303(d) list for sedimentation/siltation. The 303(d) listing indicated that the entire Lagoon was not supporting beneficial uses and was impaired by sediment. Impacts due to sedimentation are not clearly differentiated from the impacts associated other stressors on the Lagoon such as freshwater inputs and physical barriers within the Lagoon.

3.4.1 Urbanization Impacts

Urbanization of the watershed has directly affected the natural drainage, pollutant loads, and hydrologic characteristics of the watershed (City of San Diego, 2005). The volume, velocity, duration, and timing of runoff events changes as the landscape changes from pervious to impervious. Recent research has shown that impervious surface is a useful metric to represent the imprint of land development on the landscape because it is directly related to runoff (Burton and Pitt, 2002; Scheuler, 1994). Land development typically results in increased runoff and erosion rates; accounting for up to 50 percent of sediment loads in urban areas (Burton and Pitt, 2002).

Impervious cover has been identified as the ‘unifying theme’ in stream degradation (US EPA, 1999); with stream degradation occurring with as little as ten percent imperviousness of the watershed (Scheuler, 1994). The effects of impervious surfaces on sedimentation rates in the watershed is exacerbated by the location of MS4 outfalls along or just below mesa tops that release concentrated storm flows into steep drainages with moderately to highly erosive soils (Weston 2009).

Continued sedimentation and freshwater inputs, both resulting from urbanization, have resulted in significant alterations to habitat (White and Greer, 2002; Greer and Stowe, 2003; CE, 2003; Mudie et al. 1974; LPL Foundation and State Coastal Conservancy, 1985). The encroachment of freshwater wetlands and reduction of saltwater marsh is evident in the National Wetland Inventory (NWI) maps from 1985 and 2009 (Figures 9 and 10). The location of different wetland types is also shown in maps that were included in the Los Peñasquitos Lagoon Enhancement Plan (1985) and in the Mudie et al. 1974 report (Figures 11 and 12). Although there are differences in the depiction of wetland areas from each study and time period, these maps show an encroachment of riparian, freshwater, and upland vegetation types in the eastern portion of the Lagoon that is likely related to sediment accumulation, year-round freshwater flows, and physical impediments to tidal flow.

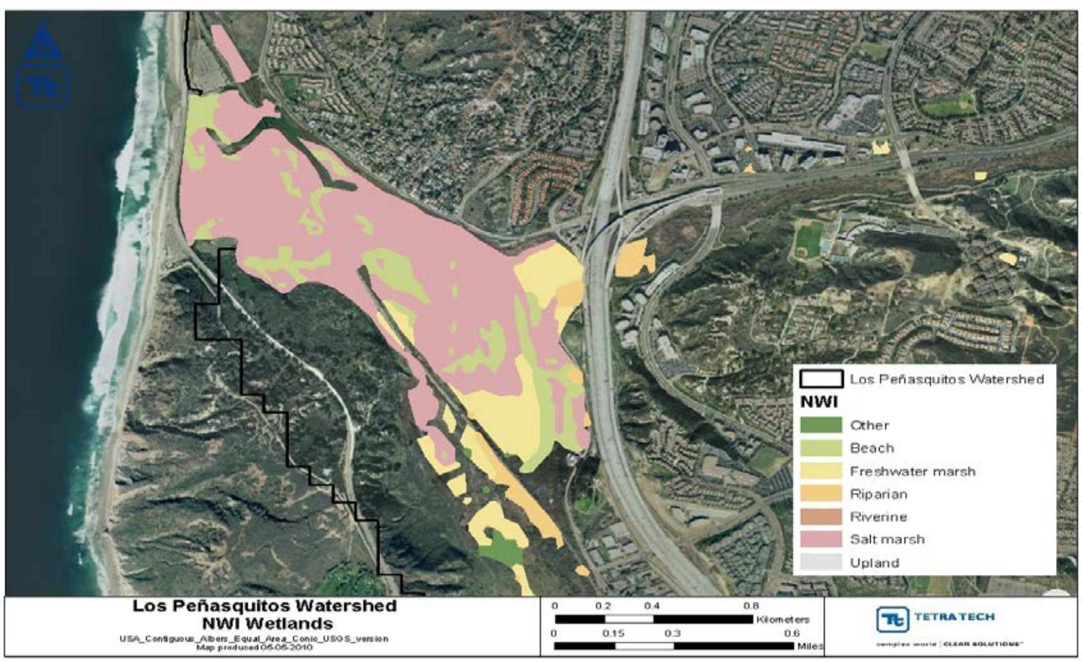

Figure 9. National Wetland Inventory (NWI) – 1985.

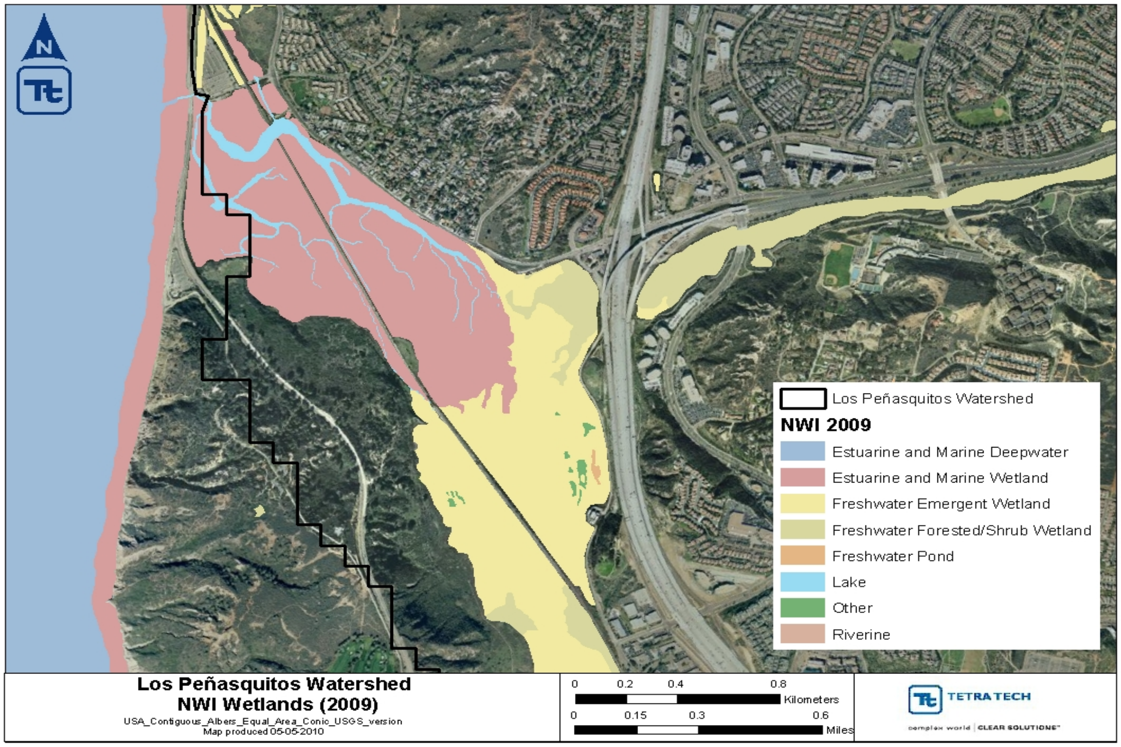

Figure 10. National Wetland Inventory (NWI) – 2009.

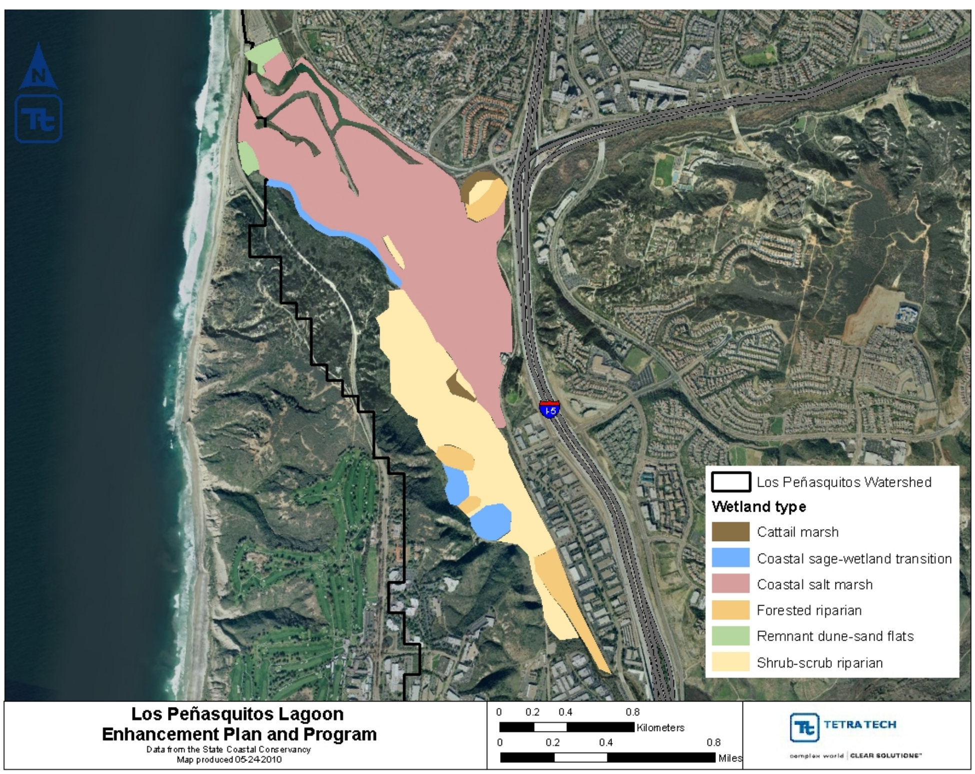

Figure 11. LPL Enhancement Plan – 1985 wetland types.

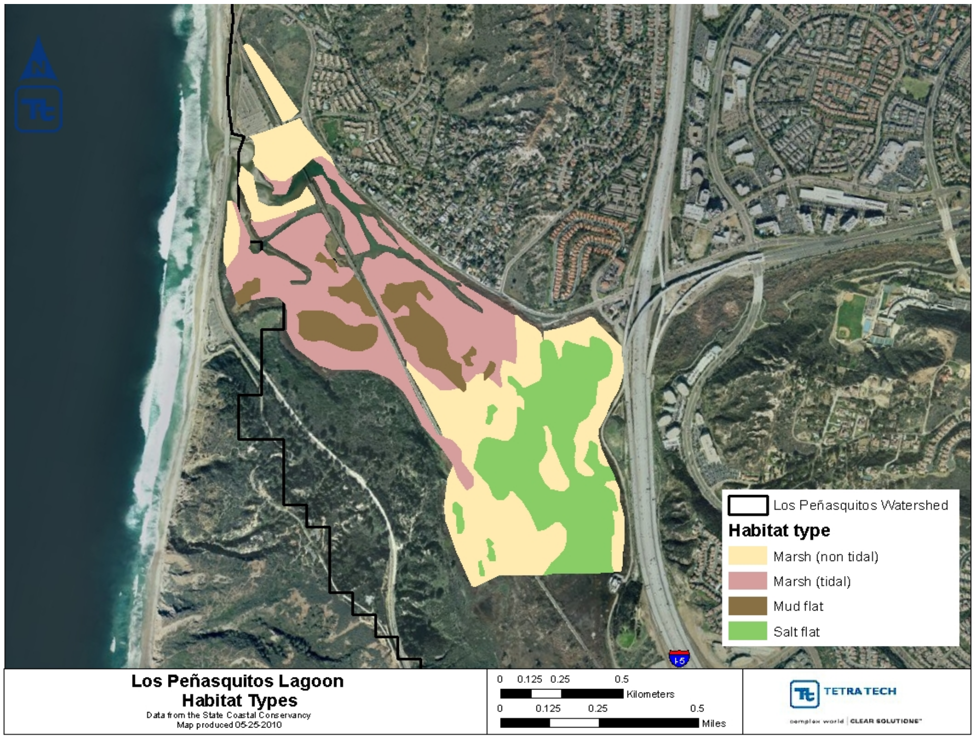

Figure 12. Historical lagoon wetland types (Mudie et al. 1974).

3.4.2 Sedimentation Impacts

Increased and rapid sedimentation results in reduced tidal mixing within Lagoon channels, degraded and net loss of saltmarsh vegetation, increased vulnerability to flooding for surrounding urban and industrial developments, increased turbidity associated with siltation in Lagoon channels, and constricted wildlife corridors. Specifically, deposition of watershed sediment contributes to elevation increases within the Lagoon, leading to an increase in height relative to mean sea level. Elevation is a critical variable that determines the productivity, diversity, and stability of saltmarshes. The long-term existence of the saltmarsh depends on the success of the dominant plants, such as *Sarcoconia pacifica* and *Frankenia salina*, and their close relationship to sediment supply, sea level change, soil salinity, and tidal range (US EPA, 2005). While these species can tolerate low salinity levels, year round inundation of freshwater and/or decreases in soil salinity prevent the ability of saltmarsh plants from outcompeting transitional or brackish marsh plant species.

Several studies have documented the influx of sediment originating in the watershed to the Lagoon. In 1985, the Los Peñasquitos Lagoon Enhancement Plan estimated that sedimentation had removed 25 acres from the coastal saltmarsh inventory. Mudie and Byrne (1980) estimate that sedimentation rates have increased to 50 cm/century since European settlement of the area. This increase in sedimentation was supported by an article published in 2000 by Cole and Wahl that examined a 3,600-year sediment core take from the Lagoon (Cole, 2000). In 1978 a coastal commission report concluded that unmitigated urbanization could double the annual sediment load within 30 years (Prestegaard, 1978). The main depositional areas in the Lagoon are just downstream of the I-5 Carmel Creek culverts and at the southern end of the Lagoon near Sorrento Valley. Gradual sediment accumulation in the Lagoon results in areas of higher elevation, which tidal water no longer reaches. Between 1968 and 1985, sediment from Carmel Valley had raised the elevation of the northeast corner of the Lagoon by 6.1 feet, which has resulted in the conversion of saltmarsh vegetation into riparian and cattail marsh (LPL Foundation and State Coastal Conservancy, 1985). The formation of cattail marsh promotes sediment retention, further exacerbating sedimentation impacts.

There are many potential sources that have influenced the accumulation of sediment within the Lagoon. Sources include erosion of canyon banks and bluffs, scouring stream banks, exposed soils, and tidal influx. Some of these processes are exacerbated by anthropogenic disturbances, such as land development within the watershed. Land development transforms the natural landscape and results in increased runoff resulting in scouring of sediment, primarily in open space areas located below storm water outfalls that discharge into steep canyons just below the mesa top.

Sediment loads are transported downstream to the Lagoon during storm events causing deposits on the salt flats and in Lagoon channels. These sediment deposits have gradually built-up over time due to increased sediment loading and inadequate flushing, which directly and indirectly affects lagoon functions and saltmarsh characteristics.

Legacy sediments from construction activities within the Lagoon (e.g. construction of the railway berms, construction and operation of the sewage treatment plant, and construction and operation of access roads) also play a role in the Lagoon’s sedimentation impairment.

3.4.3 Freshwater Impacts

Freshwater runoff from adjacent and upstream urban development reduces soil salinity, allowing brackish and freshwater plant species to encroach into the saltmarsh habitat (CE, 2003). White and Greer (2002) hypothesize that hydrology and soil salinity are significant drivers to maintain the distribution and abundance of Lagoon’s native saltmarsh vegetation types and, ultimately, the associated biological communities.

Most of the freshwater input into the Lagoon flows through Los Peñasquitos Canyon. Carroll Canyon Creek to the south and Carmel Creek to the north also contribute freshwater to the Lagoon. Historically, Los Peñasquitos Creek was the only tributary that flowed year-round, but only during years of above average precipitation. Carroll

Canyon and Carmel Creeks only flowed during significant rainfall events and then reverted back to dry washes or creekbeds. Beginning in the 1990s, Carroll Canyon and Carmel Creeks began flowing year-round due to increased urban development within the watershed. Year-round freshwater flows attribute to habitat conversion, which results in sediment related impacts as newly established riparian and brackish marsh plant species serve as sediment traps during low to medium storm flows.

A 1974 report by the California Department of Fish and Game expressed concerns associated with a significant increase in the flow of urban runoff draining into the Lagoon's eastern channel. This report concluded that increased runoff was the result of intensive residential development of the mesas northeast of the Lagoon. During the fall of 1973, this runoff volume amounted to approximately 1,500 gallons per day (Mudie et al.,1974).

Previous studies that focused on the Lagoon and the surrounding watershed provide additional information on historical conditions and hydrologic changes associated with urbanization. For example, White and Greer (2002) classified three distinct periods of urbanization within the upper Los Peñasquitos Creek watershed: 1965-1973 was classified as low urbanization (<15 percent), 1973-1987 as moderate urbanization (15-25 percent), and 1988-2000 as high urbanization (>25 percent). Across the entire time period, the 1-2 year flood interval increased from 229 cubic feet per second (cfs) to 745 cfs to 1,272 cfs in each respective period. Flow duration curves indicate increased baseflow, such as discharges above 1.7 cfs occurred more often during the period between 1973 to 1987 than the earlier period (White and Greer, 2002). This study also estimated a four percent increase in runoff since 1972, with an increase in minimum flows throughout the study equivalent to 17 percent per year. These findings are supported by a recent review of flow data in Los Peñasquitos Creek (Figure 13), which demonstrates a steady increase in monthly mean flows since the 1970s.

The above analyses illustrate the general urbanization trends throughout the watershed that impact the Lagoon. The analyses also assist with identifying a period in time when increased sediment delivery from development was not the primary concern for the Lagoon's ecological functions.

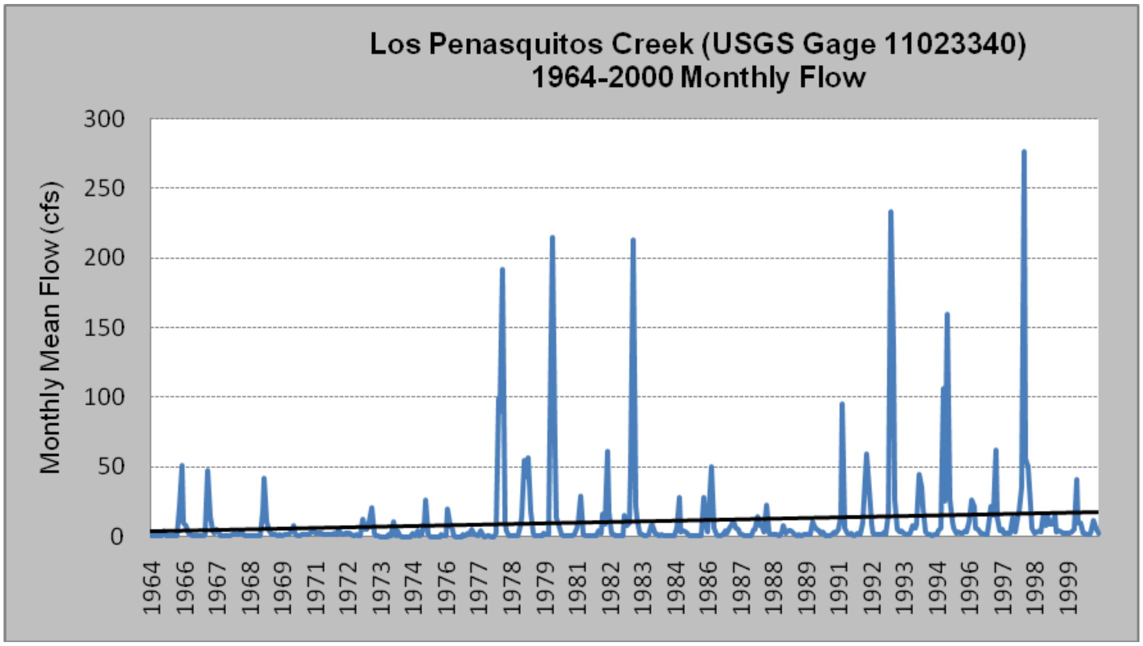

Figure 13. Hydrograph for Los Peñasquitos Creek.

3.4.4 Physical Impacts

As the region began to develop, urban infrastructure, including construction of the railroad (1880s-1925), altered the natural drainage and restricted tidal flows within the Lagoon. The original railroad was built along the eastern edge of the Lagoon (present Carmel Valley Road) and southwards across the salt flats. Construction of the Santa Fe Railroad (presently Burlington Northern Santa Fe Railroad) in 1925 moved the railway to the center of the Lagoon and cutoff several of its natural tidal channels by creating a barrier between the eastern and western portions of the Lagoon. Three railroad trestles provide the only connection between the eastern and western portions of the Lagoon. Later, the construction of Highway 101 (now referred to as Torrey Pines Road) in 1932 relocated the Lagoon's historic ocean inlet and confined the inlet to a single, narrow location under the lower bridge, which resulted in reduction of the Lagoon's tidal prism and exchange between the ocean and Lagoon (Mudie et al. 1974).

The North Beach Parking Lot was constructed in 1968 by State Parks in historically tidal areas that further influenced hydrologic exchanges (LPL Foundation and the State Coastal Conservancy, 1985).

3.4.5 Wastewater Treatment Plant Impacts

In response to increasing urban development within the watershed, two wastewater treatment plants operated from 1962-1972 and discharged effluent to the Lagoon and tributaries that ultimately reach the Lagoon. Although these facilities elevated minimum and median annual discharge values and assisted with maintaining the tidal prism, the effluent caused insect and odor problems (Mudie et. al. 1974), elevated nutrients (Bradshaw and Mudie, 1972), and depressed salinity concentrations (Torrey Pines State Natural Reserve, 2009). These problems continued until 1972 when surrounding areas were all connected to the San Diego Metropolitan sewer system. However, pump station failures have resulted in numerous sewage spills into the Lagoon. The most recent spill from Pump Station 64 occurred on September 9, 2011, during which over 1.9 million gallons of untreated sewage was discharged just upstream of the Lagoon. Impacts to water quality and aquatic species were recorded upstream and within the Lagoon's channels, as well as along local beaches outside of the lagoon inlet.

4 Numeric Targets

When calculating TMDLs, numeric targets are selected to result in attainment of the water quality standard. The numeric target is a measurable value for the pollutant of concern that, if achieved, will meet the water quality objectives (WQOs) for a waterbody and subsequently ensure the restoration and/or protection of beneficial uses. Achievement of the water quality standard for sediment in the Lagoon was interpreted using multiple lines of evidence to determine the numeric target for this TMDL.

4.1 Applicable Water Quality Standards

The narrative sediment WQO, as set forth in the Basin Plan states, “The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses” (San Diego Water Board, 1994).

The Basin Plan identifies the beneficial uses that are designated for Los Peñasquitos Lagoon (Table 2) (San Diego Water Board, 1994). Compliance with WQOs must be assessed and maintained throughout the waterbody to protect all beneficial uses. While the estuarine (EST) and preservation of biological habitats of special significance (BIOL) beneficial uses are the most sensitive to increased sedimentation, the narrative sediment WQO is applied to all beneficial uses.

Table 2. Beneficial uses designated for Los Peñasquitos Lagoon

Beneficial Use	Beneficial Use Description
REC 1	Includes uses of water for recreation activities involving body contact with water, where ingestion of water is reasonable possible. These uses include, but are not limited to, swimming, wadding, water skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.[1]
REC 2	Includes the use of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonable possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach combing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.[1]
BIOL	Includes uses of water that support designated area or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Beneficial Use	Beneficial Use Description
EST	Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
WILD	Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
RARE	Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or federal law as rare, threatened or endangered.
MAR	Includes uses of water that support marine ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
MIGR	Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.
SPWN	Includes uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. This use is applicable only for the protection of anadromous fish.
SHELL	Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes.

1. Access to some areas is not permitted per California State Parks.

4.2 Determining the Reference Condition

The narrative sediment WQO applies to sediment loading to the Lagoon and the accumulation of sediment in the Lagoon. One protective target would be to reduce watershed sediment loads to non-anthropogenic levels to help return and maintain the Lagoon to non-anthropogenic conditions with consideration given to background loading and other factors that also lend to impairment of beneficial uses. The numeric targets are calculated upon the historic condition when water quality standards were once met.

Available literature and past accounts of sedimentation impacts within the Lagoon were reviewed in the Technical Support Document (Attachment 1). This information provides the understanding of how watershed sedimentation results in impacts to the Lagoon's beneficial uses. Furthermore, this information was used in a weight of evidence approach to select the historic period that represents a time when water quality standards were being obtained.

The timeline of significant events and literature references (Figure 14 and Figure 15) summarizes the important changes in the Lagoon over time in relation to changes in land use (urbanization in particular) and other impacts discussed in Section 3 of this TMDL.

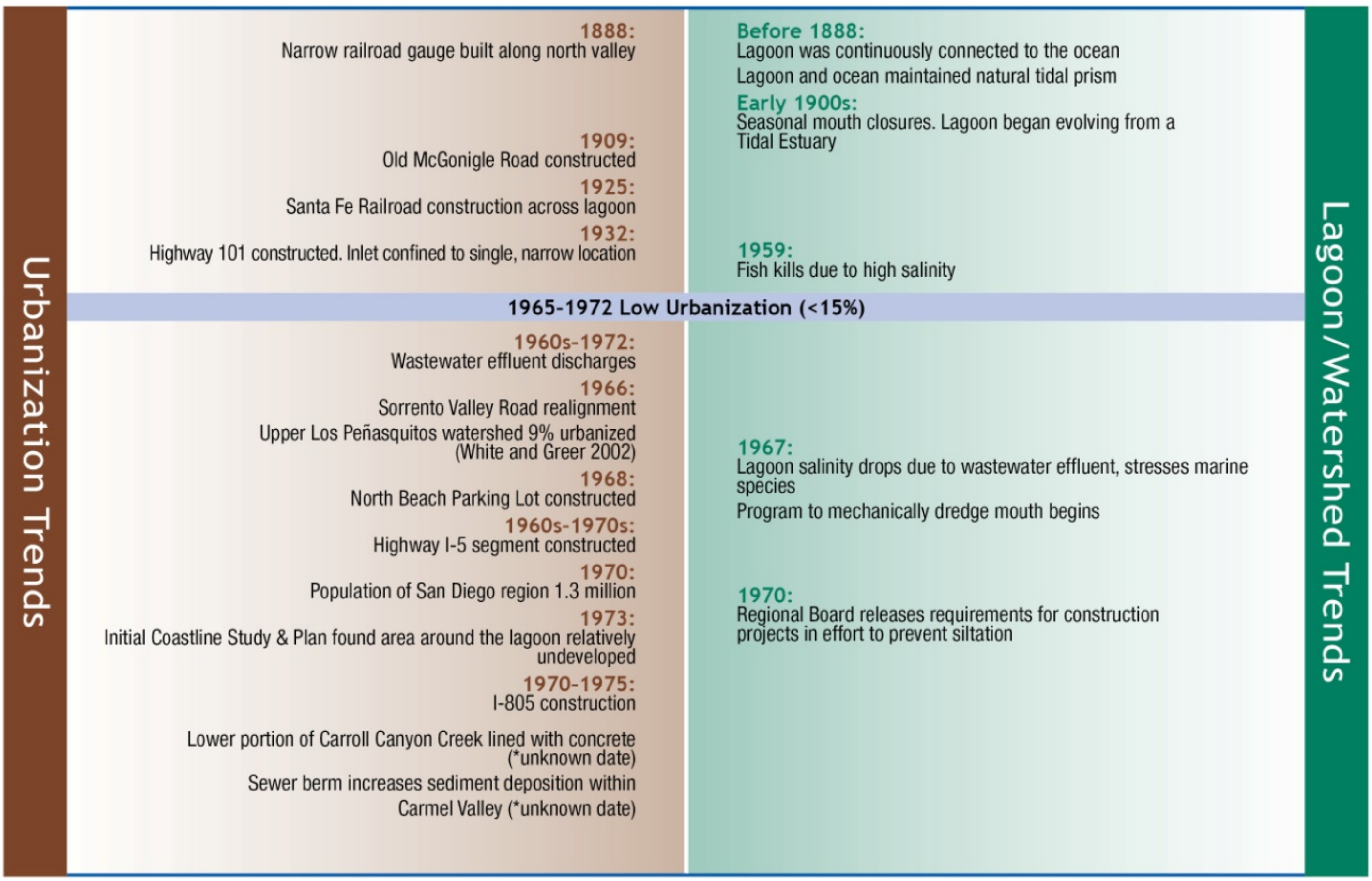

Figure 14. Timeline of urbanization and lagoon trends (1800s through early 1970s).

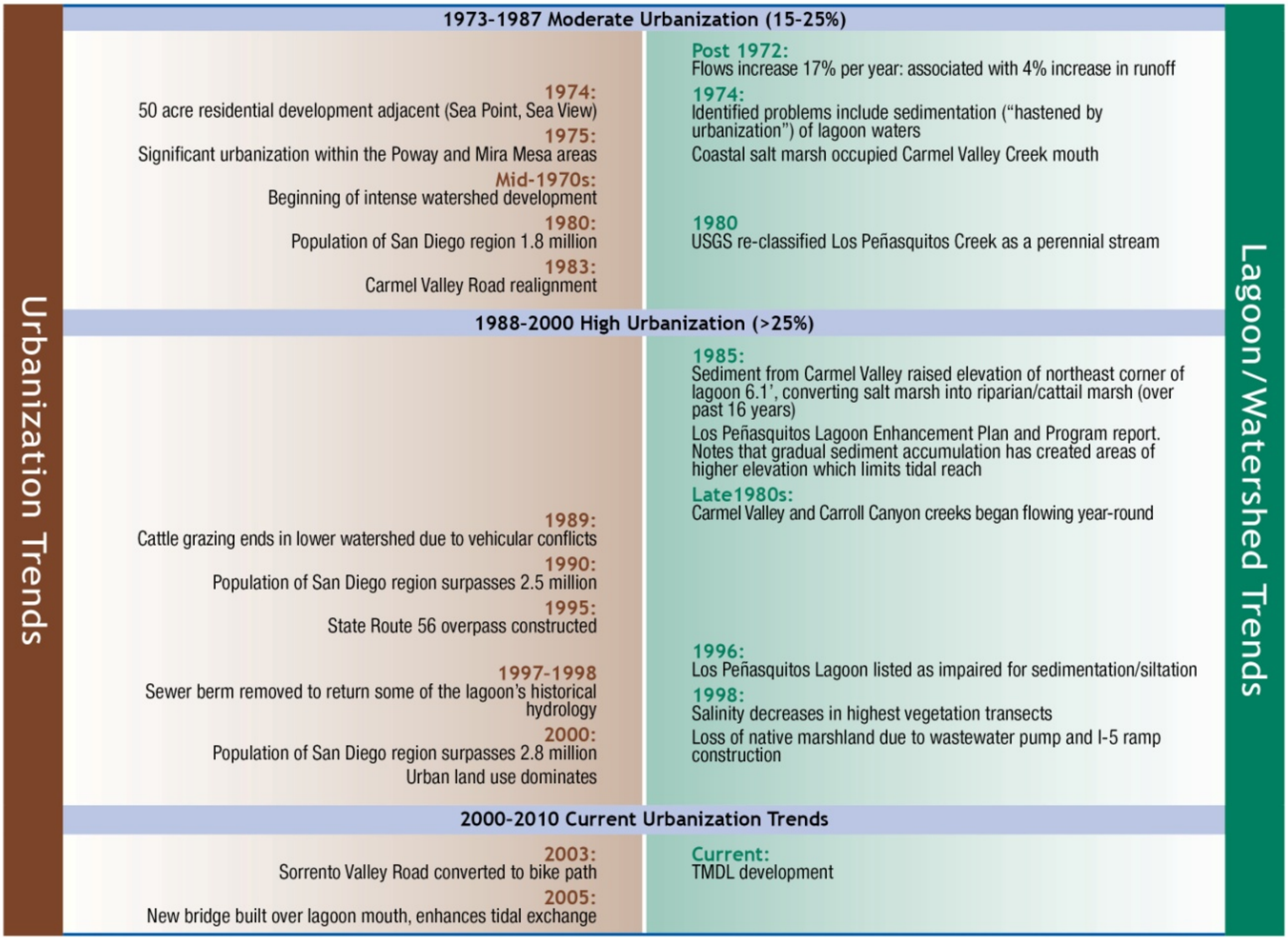

Figure 15. Timeline of urbanization and lagoon trends (mid-1970s through 2010).

Several lines of evidence were considered to determine the time period during which land-use distribution and Lagoon conditions supported water quality standards. This time period defines the reference condition upon which the numeric targets were calculated. The identified time period provides the link to the narrative sediment WQO and defines the conditions that will result in the protection of Lagoon beneficial uses from sedimentation. The lines of evidence considered include:

- **Urbanization trends**: A review of historical literature indicated that intensive development in the Los Peñasquitos watershed began in the mid-1970s. Land-use data shows a nearly 37 percent decrease in open space in the watershed beginning in the mid-1970s.
- **Population data**: Trend analysis of population data indicates that the population of the San Diego region has been steadily increasing since 1970.

- **Flow data**: Review of historical streamflow data from the US Geological Survey gage on Los Peñasquitos Creek and the conclusions drawn by White and Greer (2002) indicate that flow has increased substantially since the 1970s. White and Greer (2002) associated these flow increases with urbanization trends in the watershed.
- **Evaluation of Lagoon conditions:** As described in Section 3, Lagoon conditions have been influenced by several factors, which can be separated into watershed impacts and problems associated with the Lagoon mouth. Watershed impacts to the Lagoon include sediment delivery associated with land development, which increased substantially in the mid-1970s. The wastewater treatment plants impacted water quality in the Lagoon until 1972 when the area was connected to the city sewer system, making it difficult to differentiate between the wastewater impacts and development-associated impacts during this time period (pre-1972). Available literature indicates that sediment deposition from the watershed is not adequately flushed out of the system due to problems at the Lagoon mouth caused by the railroad berm (and other physical alterations) and sediment build-up at the ocean inlet. Note that the Highway 101 bridge abutments were recently replaced and have resulted in improved tidal exchange through the area. As discussed above, reductions in the tidal prism have resulted in increased sediment build-up at the ocean inlet. Sediment deposition at the ocean inlet are primarily a function of littoral forces (Elwany, 2008) and other factors that are largely separate from the sedimentation problems that originate from the watershed. These factors are important to understand in order to effectively manage and improve conditions within the Lagoon, but they are outside the scope of the sediment TMDL analysis.

Consideration of these various lines of evidence indicates that the Lagoon was likely achieving the water quality standard for sediment before the mid-1970s.

4.3 Watershed Numeric Target

A historic coverage for the Peñasquitos watershed was developed for the mid-1970s using US Geological Survey topographic maps (primarily the La Jolla quadrangle-dated 1975). This land-use distribution was used to calculate the watershed numeric target using the LSPC watershed model (see Linkage Analysis, Section 7). This historic (mid-1970s) sediment load of 12,360 tons per critical wet period (211 days), or 58.6 tons per day, represents the sediment TMDL watershed numeric target.

4.4 Lagoon Numeric Target

An analysis of the vegetation types and acreages present in the Lagoon was developed for the mid-1970s using historic aerial photographs (see Linkage Analysis, Section 7). This analysis determined a historic condition of 420 acres of salt marsh present during the time period. The Lagoon numeric target is expressed as an increasing trend in the total area of tidal saltmarsh and non-tidal saltmarsh toward 346 acres. This target acreage represents 80 percent of the total acreage of tidal and non-tidal saltmarsh present in 1973 (see Section 7.5).

5 Source Assessment

The purpose of the source assessment is to identify and quantify the sources of sediment to the Los Peñasquitos Lagoon. Sediment can enter surface waters from both point and non-point sources. Point sources typically discharge at a specific location from pipes, outfalls, and conveyance channels from, for example, municipal wastewater treatment plants or municipal separate storm sewer systems (MS4s). These discharges are regulated through waste discharge requirements (WDRs) that implement federal NPDES regulations issued by the State Water Board or the San Diego Water Board through various orders. Non-point sources are diffuse sources that have multiple routes of entry into surface waters. Some non-point sources, such as agricultural and livestock operations, are regulated under waivers of waste discharge requirements. The source assessment quantification is measured as an annual or daily load, which is then used to separate the load allocations or wasteload allocations for the TMDL. The following sections discuss the sediment sources that contribute to Los Peñasquitos Lagoon.

5.1 Sediment Processes within the Watershed

Wet weather events can cause significant erosion and transport of sediment downstream (especially from canyon areas below storm water outfalls). Dry weather loading attributes minimal sediment loading via nuisance flows from urban land-use activities such as car washing, sidewalk washing, and lawn over-irrigation, which pick up and transport the sediment into receiving waters. Due to the higher runoff potential associated with wet weather conditions, emphasis was placed on characterizing wet weather watershed loading.

Wet weather loading is dominated by episodic storm flows that wash off built up sediment on land surfaces, erode canyon areas below storm water outfalls, and scour stream banks. Erosion and scouring are exacerbated by anthropogenic disturbances, such as land development within the watershed. Development can expose sediment and increase the amount of impervious surfaces on formerly undeveloped landscapes. This reduces the capacity of the remaining pervious surfaces to capture and filter rainfall. As a result, a larger percentage of rainfall becomes runoff during any given storm. Subsequently, runoff reaches stream channels much more quickly, and peak discharge rates and total runoff volume are higher than before development for the same size rainfall event (SCCWRP, 2011). This process is termed hydromodification.

In the Los Peñasquitos Watershed, the results of hydromodification are most pronounced below storm water outfalls in open space areas that discharge into steep drainages, where canyon walls are eroding into creeks. This effect is illustrated in Figure 16. Sediment is transported downstream to the Lagoon during storm events and deposited on the salt flats and in the Lagoon channels.

Figure 16. Erosion of canyon walls below storm drain outfall in the Los Peñasquitos Creek watershed (Garrity and Collison, 2011).

In 2010, a geomorphic assessment of the Peñasquitos watershed was conducted. The goals of the assessment were to identify locations within the watershed that are the main sources of sediment to the Lagoon, identify processes (natural and anthropogenic) that contribute sediment, and identify and prioritize actions to reduce and manage sediment. This study identified multiple segments of Carroll Canyon Creek that highly contribute to sediment production and have increased sediment delivery potentials due primarily to hydromodification effects on open space areas and a channelized segment of Carroll Creek (City of San Diego, 2011).

5.2 Sediment Processes within the Lagoon

Sediment from the watershed is discharged to the Lagoon and then redistributed to other areas of the Lagoon by both anthropogenic and natural processes. Distribution of sediment within the Lagoon is affected by physical impediments within the Lagoon including the constricted Lagoon mouth, the buildup of the floodplain adjacent to the confluence of Los Peñasquitos and Carroll Canyon Creeks, and the railroad berm. These physical impediments do not directly contribute a sediment load to the Lagoon; therefore a daily sediment load for these structures cannot be calculated.

More information on the structure of the Lagoon can be found in Background Section 3.3.

5.3 Sediment Sources

There are two broad categories of sediment sources to the Lagoon: 1) watershed sources, and 2) the Pacific Ocean. The watershed sources consist of all point and non-point sources of sediment in the watershed area draining to Los Peñasquitos Lagoon. The total sediment contribution from all watershed sources is presented as the total wasteload allocation (WLA). Sediment contributions from the Pacific Ocean are considered background sources and are presented as the Load Allocation (LA).

5.3.1 Watershed Point Sources

Direct discharges from the watershed to the Lagoon include discharges from: 1) Carmel, Peñasquitos, and Carroll Canyon Creeks; and 2) gullies adjacent to the Lagoon. These are considered point sources. This is the case because virtually the entire Los Peñasquitos watershed is drained through the Phase I MS4 collection systems. The MS4 collection system is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) (San Diego Water Board, 2007). In addition, and as stated in the San Diego County MS4 permit, historic and current development makes use of natural drainage patterns and features as conveyances for urban runoff. Urban streams used in this manner are part of the municipalities MS4 regardless of whether they are natural, man-made, or partially modified features. In these cases, the urban stream is both an MS4 and a receiving water (Finding d.3.c, San Diego Water Board 2007). For this reason the Phase I MS4s can be thought of as the primary and ultimate point sources of sediment to the Lagoon.

Storm water runoff is regulated through the following NPDES permits: the San Diego County Phase I municipal separate storm sewer system (MS4) permit, the Phase II MS4 permit for small municipal dischargers, and the statewide storm water permits issued to Caltrans, construction sites, and industrial sites. The permitting process defines these discharges as point sources because storm water is discharged from the end of a storm water conveyance system.

Phase I Municipal Separate Storm Sewer System (MS4)
As discussed above, the Phase I MS4s can be thought of as the primary and ultimate point sources of sediment to the Lagoon. The principal MS4s contributing sediment to the Lagoon are owned or operated by the municipalities located throughout the Peñasquitos watersheds including the City of San Diego, City of Poway, City of Del Mar, and County of San Diego. Note that Caltrans, Phase II MS4s, and several construction and industrial sites discharge into the Phase 1 MS4s.

Phase I MS4s contribute sediment during both dry and wet weather events; however, it is during wet weather events when runoff from storm drain outfalls causes significant erosion along canyon walls below the outfalls and along creek channels that receive these flows. In addition, sediment build-up on land surfaces from various sources is washed into the storm drain outfalls during rainfall events. The increased volume, velocity, frequency and discharge duration of storm water runoff from developed areas has the potential to greatly accelerate downstream erosion, impair stream habitat in natural drainages, and negatively impact beneficial uses. Development and urbanization increase pollutant loads in storm water runoff and the volume of storm water runoff. Impervious surfaces can neither absorb water nor remove pollutants and thus lose the purification and infiltration provided by natural vegetated soil.

The change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes is called “hydromodification”, and results in increased stream flows and sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive streambank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Phase II Municipal Separate Storm Sewer System (MS4)
Phase II MS4s are storm water systems that serve public campuses, military bases, and prison and hospital complexes within or adjacent to other regulated MS4s, or which pose significant water quality threats. They are responsible for addressing water quality

concerns from their small MS4s. Table 3 identifies the traditional and non-traditional small MS4s within the Los Peñasquitos watershed. Non-traditional small MS4s are federal and State operated facilities that can include universities, prisons, hospitals, military bases.

Table 3. List of traditional and non-traditional small MS4s

Agency	Facility	Address
California Community Colleges	San Diego Miramar College	10440 Black Mountain Road San Diego, CA 92126-2999
University of California	University of California, San Diego	9500 Gilman Drive La Jolla, 92093
State Park	Torrey Pines State Beach	N Torrey Pines Road San Diego, CA 92037

Storm water discharges from Phase II MS4s typically discharge into Phase I storm drain systems. As with Phase I MS4s, pollutants that build up on land surfaces within the small MS4s are washed off during rainfall events. In addition, urbanized areas within the Phase II MS4s also generate flows that exacerbate the natural erosion and scouring processes of the creek.

Caltrans MS4s

The storm water discharges from most of the Caltrans properties and facilities within the Peñasquitos watershed discharge into a Phase I MS4 system. As with Phase I MS4s, pollutants build up on land surfaces owned by Caltrans and are washed off during rainfall events. In addition, runoff from these surfaces result in hydromodification flows that exacerbate the natural erosion and scouring processes of the receiving creek.

Groundwater Extraction Discharges

Discharges from ground water extraction activities to surface waters are not a contributor of sediment to the Lagoon. These discharges are regulated under waste discharge requirements, which specify that suspended sediment concentrations in the effluent be no more than 50 milligrams per liter and that discharges shall not cause the rate of deposition of solids and characteristics of inert solids in the sediment to be changed such that benthic communities are degraded.

Discharges of Hydrostatic Test Water and Potable Water

Discharges of Hydrostatic Test Water and Potable Water are those discharges resulting from testing of pipelines, tanks and vessels that are dedicated to drinking water purveyance and storage. These discharges are regulated under waste discharge requirements which require the implementation of Best Management Practices (BMPs) for flow and pollutants prior to entering receiving waters and/or the MS4 system.

Discharges from Utility Vault and Underground Structures

Discharges from Utility Vault and Underground Structures are not a contributor of sediment to the Lagoon. These intermittent discharges range from a few gallons to a few thousand gallons and are routed to the Lagoon directly or indirectly via the Phase I MS4 system.

Construction and Industrial Sites

During wet weather, runoff from industrial and construction sites has the potential to contribute sediment loading to the Lagoon. During dry weather, the potential contribution of pollutant loadings from industrial and construction storm water is low because non-storm water discharges are prohibited or authorized by permit only under the following circumstances: when they do not contain significant quantities of pollutants, where BMPs are in place to minimize contact with significant materials and reduce flow, and when they are in compliance with San Diego Water Board and local agency requirements.

As of March 2012, there were 81 industrial facilities enrolled under the general industrial storm water permit in in the Los Peñasquitos watershed. Table 4 identifies the industrial facilities within the Peñasquitos watershed. These facilities include mining facilities, manufacturing facilities, transportation facilities, etc. Potential pollutants from an industrial site will depend on the type of facility and operations that take place at that facility. Facilities that discharge sediment have a potential to adversely impact the impaired Lagoon. For example, the two sand mining operations in Carroll Canyon have the potential to discharge sediment from their operation. Facilities with impervious surfaces or that alter the natural drainage of a watercourse also have the potential to adversely impact the impaired Lagoon.

Table 4. List of industrial facilities

Operator	Facility	Address
US Marine Corps Commanding Gen	US Marine Corp Air Station Mir	45249 Miramar Way, San Diego, CA 92145
Sycamore Landfill Inc	Sycamore Landfill	14494 Mast Blvd, San Diego, CA 92145
Hanson Aggregates Pacific Southwest	Hanson Aggregates	9229 Harris Plant Rd, San Diego, CA 92145
New Leaf Biofuel	New Leaf Biofuel	2285 Newton Ave, San Diego, CA 92124
Fyfe Co LLC	Fyfe Co LLC	8380 Miralani Dr, San Diego, CA 92126
Vulcan Material dba Cal Mat Co	Carroll Canyon Aggregates	10051 Black Mountain Rd, San Diego, CA 92126

Operator	Facility	Address
Hydranautics	Hydranautics	8270 Miralani Dr, San Diego, CA 92126
YRC Inc	YRC Inc	9525 Padgett St, San Diego, CA 92126
Ontrac	Ontrac	7077 Consolidated Way, San Diego, CA 92121
Penick II LLC	Olson dr	9747 Olson Dr, San Diego, CA 92121
Miramar Truck Center	Miramar Truck Center	6066 Miramar Road, San Diego, CA 92121
Penske Logistics LLC	Penske Logistics LLC	7170 Miramar Rd Ste 800 to 900, San Diego, CA 92121
Bimbo Bakeries USA	Bimbo Bakeries USA	5662 Eastgate Dr, San Diego, CA 92121
Illumina Inc	Research Place	5200 Research Pl, San Diego, CA 92121
California Precision Products Inc	California Precision Products Inc	6790 Flanders Dr, San Diego, CA 92121
Tayman Industries Inc	Tayman Industries Inc	5692 Eastgate Dr, San Diego, CA 92121
Illumina Inc	Carroll Park Dr Facility	9440 Carroll Park Dr, San Diego, CA 92121
California Commercial Asphalt	Carroll Canyon	9234 Camino Santa Fe, San Diego, CA 92121
Ametek Programmable Power	Ametek Programmable Power	9250 Brown Deer Rd, San Diego, CA 92121
Leed Recycling	Leed Recycling	8725 Miramar Pl, San Diego, CA 92121
Westside Building San Diego LLC	Westside Building San Diego LLC	7465 Carroll Rd, San Diego, CA 92121
West Tech Contracting Inc	West Tech Contracting	7625 Carroll Rd, San Diego, CA 92121
Integrated Microwave Corp	Integrated Microwave Corp	11353 Sorrento Valley Rd, San Diego, CA 92121
Angel P Hayes	Aquarius Marine	9384 Frost Mar Pl, San Diego, CA 92121
Stone Yard Inc	Stone Yard Inc	8980 Crestmar Point, San Diego, CA 92121
Old Dominion Freight	Old Dominion Freight Lines	9850 Olson Dr,

Operator	Facility	Address
Lines		San Diego, CA 92121
Josh Degano	PCF Group	8585 Miramar Pl, San Diego, CA 92121
Expo Industries INC	Expo Industries INC	7455 Carrol Rd, San Diego, CA 92121
Deere & Company	T Systems International	7545 Carroll Rd, San Diego, CA 92121
Dale L Watkins	Shefield Platers Inc	9850 Waples St, San Diego, CA 92121
RR Donnelley	RR Donnelley	7590 Carroll Rd, San Diego, CA 92121
Pacira Pharmaceuticals, Inc.	Pacira Pharmaceuticals	10450 Science Center Dr, San Diego, CA 92121
USF Reddaway Inc Yrc Worldwide Enterprise Services Inc	USF Reddaway Inc 398 SDO	7075 B Carroll Rd, San Diego, CA 92121
Robertsons Ready Mix	Robertsons Miramar Plant	5692 Eastgate Dr, Miramar (2), CA 92121
United Parcel Service Freight	UPS Ground Freight Inc	7075 A Carroll Rd, San Diego, CA 92121
MZ3D Inc	MZ3D Inc	10739 Roselle St, San Diego, CA 92121
FedEx HD Pomona Industry	FedEx Ground Home Delivery	8515 Miramar Place, San Diego, CA 92121
ATK Space Systems	ATK Space Systems	9617 Distribution Ave, San Diego, CA 92121
Rhino Linings Inc	Rhino Linings Inc	9151 Rehco Rd, San Diego, CA 92121
San Diego City	Pump Station 64	10745 Roselle St, San Diego, CA 92121
San Diego City	Pump Station 65	12112 Sorrento Valley Rd, San Diego, CA 92121
Illumina Inc	Illumina Inc	9885 Towne Centre Dr, San Diego, CA 92121
Quikrete	Quikrete	9265 Camino Santa Fe, San Diego, CA 92121
Allan Co	Allan Co	6733 Consolidated, San Diego, CA 92121
MJB Freight Systems	Mjb Freight Systems	6225 Marindustry Dr,

Operator	Facility	Address
		San Diego, CA 92121
FedEx Freight Whittier	Fed Ex Freight West	5550 Eastgate Mall, San Diego, CA 92121
Dixieline Lumber Co	Dixieline Lumber Ne Miramar	7292 Miramar Rd, San Diego, CA 92121
Calbiochem Nova Biochem	EMD Biosciences Inc	10394 Pacific Center Ct, San Diego, CA 92121
Hanson Aggregates Pacific Southwest	Hanson Aggregates	9255 Camino Santa Fe, San Diego, CA 92121
San Diego City	San Diego City N City Water Re	4949 Eastgate Mall, San Diego, CA 92121
Pall Filtration & Separations	Pall Filtration & Separations	4116 Sorrento Valley Blvd, San Diego, CA 92121
Fed Ex	Fed Ex	10585 Heater Ct, San Diego, CA 92121
Fed Ex Ground Packaging System	Fed Ex Ground	9999 Olson Dr, San Diego, CA 92121
Presidio Components Inc	Presidio Components Inc	7169 Construction Ct, San Diego, CA 92121
Qualcomm Inc	Qualcomm Inc	5525 Morehouse Dr, San Diego, CA 92121
Escondido Ready Mix	San Diego Ready Mix	9245 Camino Santa Fe, San Diego, CA 92121
Overnite Transportation	UPS Freight	7191 Carroll Rd, San Diego, CA 92121
RE Hazard Contracting Co	Re Hazard Contracting Co	6465 Marindustry Dr # 6485, San Diego, CA 92121
Titan Linkabit	Titan	3033 Science Park Rd, San Diego, CA 92121
Frazee Paint	Frazee Paint	6625 Miramar Rd, San Diego, CA 92121
Van Can Co	Van Can Co	9045 Carroll Way, San Diego, CA 92121
IMS Electronics Recycling Inc	IMS Electronics Recycling Inc	12455 Kerran St 300, Poway, CA 92064
Mobile Mini Inc	Mobile Mini Inc	12345 Crosthwaite Cir, Poway, CA 92064
General Atomics	General Atomics	14107 Stowe Dr,

Operator	**Facility**	**Address**
Aeronautical Sys Inc Bldgs 14 & 15	Aeronautical Sys Inc Bldgs 14 & 15	Poway, CA 92064
Toray Membrane USA Inc	Toray Membrance USA Inc	13435 Danielson St, Poway, CA 92064
Joe Peterson	San Diego Crating and Packing	12678 Brookpriuter Pl, Poway, CA 92064
Sysco Food Services of San Diego	Sysco Food Services of San Diego	12180 Kirkham Rd, Poway, CA 92064
San Diego Granite Inc	San Diego Granite Inc	13026 Stowe Dr, Poway, CA 92064
FedEx Freight Inc	FedEx Freight Inc ESD	12055 Tech Center Dr, Poway, CA 92064
Atlas Transfer & Storage	Atlas Transfer & Storage	13026 Stowe Dr, Poway, CA 92064
All State Van & Storage Inc	All State Van & Storage Inc	12356 Mc Ivers Cct, Poway, CA 92064
Uke, Alan	Underwater Kinetics	13400 Danielson St, Poway, CA 92064
Poway City	Poway City Material Landing Fa	12325 Crosthwaite Cir, Poway, CA 92064
Valley Metals	Valley Metals	13125 Gregg St, Poway, CA 92064
Halllmark Circuits Inc	Hallmark Circuits Inc	13500 Danielson St, Poway, CA 92064
Vulcan Material dba Cal Mat Co	Poway	10975 Beeler Canyon Rd, Poway, CA 92064
County of San Diego	Poway Landfill	14600 Poway Rd, San Diego, CA 92064
POWAY UNIFIED SCHOOL DISTRICT	Poway USD Transportation	13626 Twin Peaks Rd, Poway, CA 92064
Cor O Van Co	Cor O Van Co	12375 Kerran St, Poway, CA 92064
Designer Molecules Inc	Designer Molecules Inc	10080 Willow Creek Rd, San Diego, CA 92131

As of June 2010, there were 23 construction sites covering 442 acres enrolled under the general construction storm water permit in the watersheds draining to the Lagoon (Figure 17). While construction projects are intermittent and occur over relatively short durations, sediment loads from these projects can be significant.

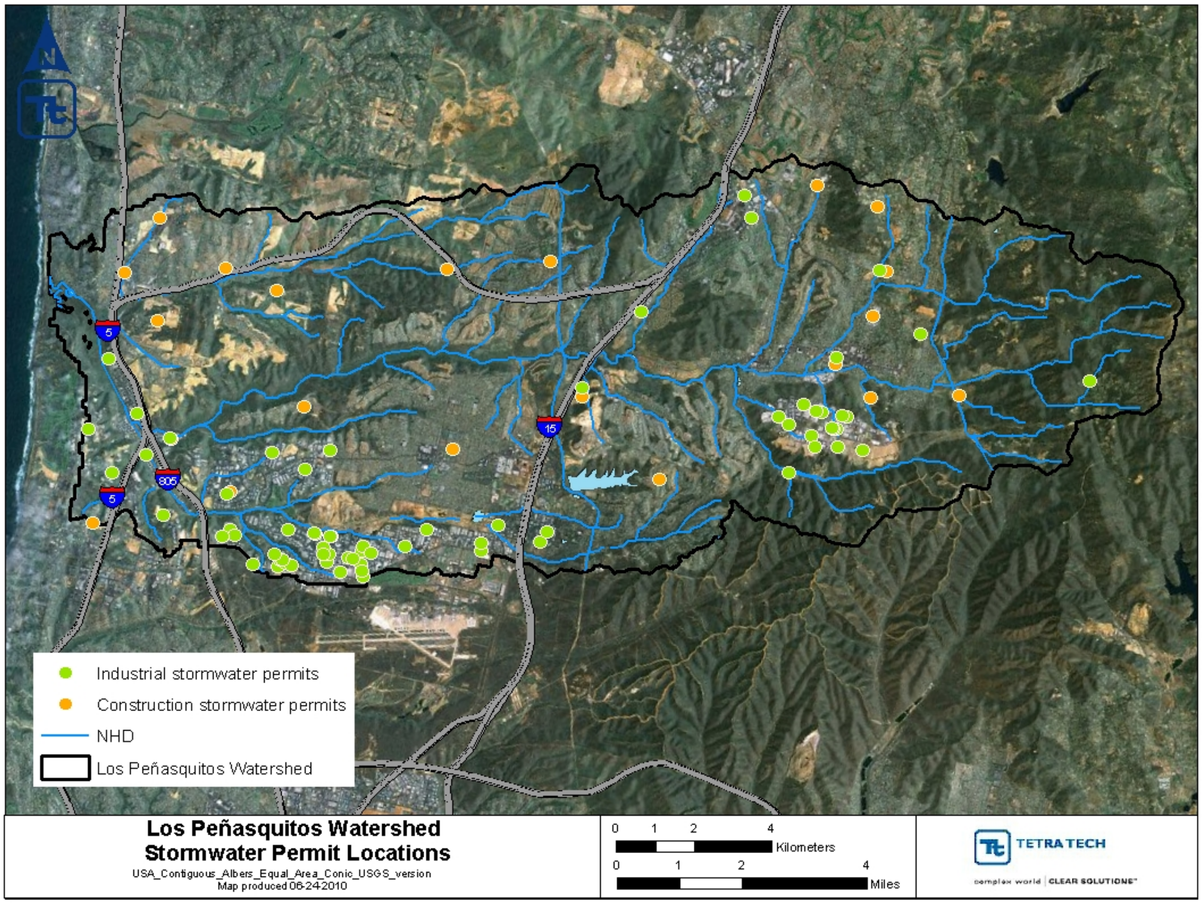

Figure 17. NPDES construction and industrial storm water permits as of June 2010.

5.3.2 Watershed Non-Point Sources

In this TMDL, the watershed sources also include all the *non-point sources located in the watershed* such as agriculture (1 percent of year 2000 land-use area) and open space (43 percent of year 2000 land-use area). This is the case because virtually the entire Los Peñasquitos watershed is drained through the Phase I MS4 collection systems. The total sediment contribution from all watershed sources is presented as the WLA.

5.3.3 Ocean Sediment Sources

Ocean sediment contributions are considered a background source and accordingly an LA is assigned to ocean sediment contributions from storm surges and wave action along the ocean boundary (see Identification of Load Allocations and Reductions Section 8.8). Sediment loads from the ocean are primarily a function of littoral forces and other factors that are largely separate from the sedimentation problem originating from the watershed.

There is a natural tendency for wave-deposited sand to accumulate at the mouth of Los Peñasquitos Lagoon. This leads to the gradual formation of a broad sand bar in the vicinity of the junction of the two main branches of the lagoon drainage system. However, ocean sediments are dredged routinely from the Lagoon mouth to alleviate the danger of flooding and to improve the health of the Lagoon. The dredging of ocean sediments prevents the migration of sediment upstream into the lagoon system and maintains tidal exchange with the lagoon, both of which serve to maintain the tidal prism and lagoon soil salinities.

5.4 Quantification of Watershed Sediment Sources

Sediment sources were quantified by land-use group because sediment loading is highly correlated with land-use practices. Since several land-use types share hydrologic or pollutant loading characteristics, many were grouped into similar classifications, resulting in a subset of nine categories for modeling. Selection of these land-use categories was based on the availability of monitoring data and literature values that could be used to characterize individual land-use contributions and critical sediment-contributing practices associated with different land uses. For example, multiple urban categories were represented independently (e.g., high density residential, low density residential, and commercial/institutional), whereas other natural categories were grouped. The three major land-use sources in the watershed are open space, low density residential, and industrial/transportation. All land uses were classified as generating point source loads because, although the sediment sources within the watershed may be diffuse in origin, the pollutant loading is transported and discharged to the Lagoon waters through the storm water conveyance system.

The sediment load contributed by each land-use type was calculated using the LSPC model (note that unpermitted direct discharges of sediment to receiving waters were not explicitly quantified in the modeling analysis). Modeling parameters were varied by land use to provide the correlation between sediment loading and land-use type. More information on land uses is contained in Background Section 3.2 and the Modeling Report (Attachment 2).

6 Data Analysis and Inventory

Multiple data sources were used to characterize the watershed and Lagoon, including stream flow and water quality conditions. Much of this information was recently collected by watershed stakeholders to assist with TMDL model development. Data describing the watershed's topography, land use, soil characteristics, meteorological data, and irrigation needs along with available bathymetric survey information and data sondes analyzing pressure and salinity were used to calibrate the watershed and Lagoon models. The Technical Support Document (Attachment 1) summarizes stream flow and total suspended sediment data used for calculation of the watershed numeric target.

7 Linkage Analysis

The technical analysis of the relationship between pollutant loading from identified sources and the response of the waterbody to this loading is referred to as the linkage analysis. The purpose of the linkage analysis is to quantify the maximum pollutant loading that can be received by an impaired waterbody and still attain the WQOs of the applicable beneficial uses. This numeric value is represented by the TMDL.

The linkage analysis for this TMDL is based on biological index linkages and computer models that were developed to represent the physical processes within the impaired receiving waterbody and associated watershed. The models provided estimation of sediment loadings from the watershed based on rainfall events, land use, and simulation of the response of the receiving water to these loadings. The following sections provide more detailed discussion regarding model selection and linkage analysis.

7.1 Linkage of Targets and Sources to Beneficial Uses

As discussed in the Numeric Targets section 4, this TMDL finds that the water quality objective for sediment in the Lagoon was being attained and beneficial uses were being supported under historic conditions (mid-1970s). It follows that the Lagoon was capable of assimilating historic sediment loads under historic Lagoon conditions. The historic Lagoon condition has evolved through time with continual natural and anthropogenic sediment deposition and alterations to the Lagoon's natural systems, including: constriction of the Lagoon's floodplain by development, relocation of the Lagoon's natural ocean inlet, year round fresh water input, elevated peak discharges and volumes of storm runoff from impervious surfaces, and construction of two railway berms across the Lagoon.

Development within the Lagoon and increased sediment discharge to the Lagoon over time has contributed to sediment buildup and higher elevations that limit tidal flow and the extent of saltmarsh vegetation. This trend has resulted in adverse impacts to beneficial uses, in particular, the estuarine (EST) and preservation of biological habitats of special significance (BIOL) beneficial uses. Deposition of watershed sediment contributes to elevation increases within the Lagoon, leading to an increase in height relative to mean sea level. Elevation is a critical variable that determines the productivity, diversity, and stability of saltmarshes (e.g. see Pennings and Callaway 1992, Zedler and Callaway 2000). The long-term existence of the saltmarsh depends on the success of the dominant plants, such as *Sarcoconia pacifica* (*Salicornia virginica*) and *Frankenia salina*, and their close relationship to sediment supply, sea level change, soil salinity, and tidal range (US EPA, 2005). This subset of estuarine habitat is of particular biological significance as it is estimated that only 10 percent of the original coastal marshland in San Diego County remains in existence (Mudie et al. 1974).

Watershed and Lagoon numeric targets were identified to calculate the watershed sediment load reduction required based on historical analysis, account for impairment of saltmarsh due to historic sediment loads, and to track implementation success.

It is expected that reduced sediment loading from storm water discharges consistent with the watershed sediment reduction target will encourage the establishment of native vegetation in degraded areas through various mechanisms. Implementation actions designed to reduce sedimentation will also likely reduce nuisance freshwater flows into the Lagoon that have contributed to observed habitat and beneficial use impacts. An adaptive management approach will be used to determine the most effective course of action to achieve the numeric targets and improve beneficial uses in the Lagoon (see Implementation Plan Section 9.3). Ultimately, sediment removal in some areas may be needed to remove the excess anthropogenic sediment that has been deposited since the mid-1970s to meet the requirements of this TMDL and to re-establish elevations conducive to saltmarsh habitats progression and diversity of species, as well as improved connectivity between the watershed, Lagoon, and tidal flow.

Reducing watershed sediment loads from the year 2000 levels to historic levels (mid 1970's) is a necessary component for restoring and providing long-term protection of the Lagoon's beneficial uses. To represent the linkage between source contributions and receiving water response, a dynamic water quality model was developed to simulate source loadings and transport of sediment into the Lagoon. The models provide an important tool to evaluate year 2000 conditions, to evaluate historic conditions, and to calculate TMDL load reductions.

As mentioned before, sedimentation within coastal estuaries and lagoons is a natural process, recently augmented by human activities in the watershed over the last 200 years with the majority of sedimentation impacts occurring over the past 40 years (see Figures 14 and 15). It is believed that the Lagoon was capable of assimilating these historic sediment loads under the historic Lagoon condition. Because the Lagoon has been impacted by sediment accumulation, as demonstrated by the type changes in salt marsh habitat over the last 40 years from watershed sediment loads and hydrologic inputs, it cannot be assumed that the Lagoon, in the year 2010 condition, can assimilate the same elevated sediment loads. The historic condition represents a time period prior to major land development in the watershed, but occurs at a period following major physical modifications to the lagoon (e.g. see Figure 14). Thus, the evaluation of the extent of vegetation types in the Lagoon provides the necessary tool to assess how the

Lagoon responds to watershed sediment load reductions and to establish a target Lagoon condition under which the Lagoon can again assimilate the historic mid-1970's sediment loads.

7.2 Model Selection and Overview

In selecting an appropriate approach for TMDL calculation, technical and regulatory criteria were considered. Technical criteria include the source contributions, critical conditions, constituents to be addressed, and the physical domain, which is one of the most important considerations in model selection and accounts for both watershed and receiving water characteristics and processes. Regulatory criteria include water quality objectives and procedural protocol such as US EPA's *Protocol for Developing Sediment TMDLs*. In selecting a modeling framework, the models' ability to enable direct comparison of model results to the selected numeric target must be considered. For the watershed loading analysis and implementation of required reductions, it is also important that the modeling framework allow for the examination of gross land-use loading.

The selected modeling system was divided into two components representative of the processes essential for accurately modeling hydrology, hydrodynamics, and water quality. The first component of the modeling system, the Loading Simulation Program in C++ (LSPC) model, is a watershed model that predicts runoff and external pollutant loading as a result of rainfall events. The second component, the Environmental Fluids Dynamic Code (EFDC) model, is a hydrodynamic and water quality model that simulates the complex water circulation and pollutant transport patterns in the Lagoon. LSPC was specifically used to simulate watershed hydrology and transport of sediments in the streams and storm drains flowing to the impaired Lagoon. The LSPC model was linked to the EFDC model to provide all freshwater flows and loadings as the EFDC model input.

The LSPC and EFDC models were used to calculate both historic and year 2000 conditions to establish the watershed numeric target and required load reductions from year 2000 conditions.

A complete discussion, including model configuration, hydrologic and hydrodynamic calibration and validation, and water quality calibration and validation of the LSPC and EFDC models is provided in the Modeling Report (Attachment 2). In summary, these models rely on several assumptions that attempting to predict natural processes in a highly complex system. However, models can still provide a useful tool for management decisions and their accuracy can be improved with the type and amount of data used to calibrate them.

The TMDL is not limited by the models or their implementation; however, the nature of the variability of precipitation in Southern California, which leads to an extremely difficult sampling problem, coupled with the lack of bank erosion and bed load transport data creates a degree of uncertainty in the TMDL. In light of this uncertainty, this TMDL establishes a Margin of Safety (MOS; see Section 8.11) and establishes an adaptive management approach, in which an effective monitoring system is put in place to obtain detailed sediment loading data while monitoring the response of the Lagoon.

7.3 Model Application

The models were initially calibrated to hydrologic and water quality data (see Section 6) to characterize year 2000 conditions in the watershed and Lagoon. Land-use conditions present during the mid-1970s were associated with loads that met the sediment WQO to characterize historic (mid-1970s) conditions. The 1993 El Niño time period (the critical wet period, October 1, 1992-April 30, 1993) was used to calculate sediment loads under historical and year 2000 conditions. Model simulations were performed using the same meteorological data to accurately compare the watershed and Lagoon response to the same weather conditions.

The resulting historical net annual sediment load was identified as the watershed numeric target, which represents the loading (assimilative) capacity for the Lagoon (i.e. the TMDL). Historic loads define the allowable load; therefore, required load reductions represent the difference between year 2000 sediment loads and historic (allowable) loads.

7.4 Mapping Vegetation Types in the Lagoon

Through the aerial photo interpretation effort, vegetation types of the Los Peñasquitos Lagoon were estimated for the year 1973 (historical conditions) and year 2010. Aerial photography has long been used to map and assess changes to wetlands (White and Greer, 2002).

Aerial photos were acquired from the County of San Diego to characterize historical vegetation types within the Lagoon. The vegetation types were interpreted from 1:12,000 scale, 1,200 dots per square inch scans of photos by staff at California State Parks. The photography was captured on November 25, 1973 with the exception of the southernmost photo, which was captured on June 17, 1974.

Aerial photos were acquired from USA Prime Imagery map service to characterize the year 2010 vegetation types within the Lagoon. The vegetation types were interpreted from the high resolution photos by staff at California State Parks. The photography was acquired for the fall of 2010 aerial from USA Prime Imagery's

I3_Imagery_Prime_World_2D map. This map presents satellite imagery for the world and high-resolution aerial imagery for the United States.

The photos representing historical vegetation types were geo-referenced to a minimum four locations within the marsh or low lying uplands to existing digital imagery. The fit appeared reasonable as transitions from one aerial to the next were not obviously misaligned and delineations fit well to modern high resolution aerial images. Individual pairs of points with high root mean square errors (RMSE) were discarded and replaced until an acceptable overall RMSE was achieved. The RMSE quantifies the distortion between a scanned aerial image and a rectified, geo-referenced base map. The average RMSE for the overall study was 7.65 pixels or 9.10 meters.

Vegetation types for historic and year 2010 conditions were heads-up digitized onscreen (at an approximate 1:2,500 scale), interpreted, and mapped into generalized classifications that could be reliably interpreted without field verification. Neither field verifications nor accuracy assessments were conducted. However, supplemental data was used to determine coarse elevations and vegetation types, including from SanGIS 2-foot topography and Google maps oblique aerials.

Vegetation types were classified as saltmarsh, non-tidal saltmarsh, non-tidal saltmarsh–*Lolium perrene* infested, freshwater marsh, southern willow scrub/mulefat scrub, herbaceous wetland, or upland land cover (urban, beach, dune, upland vegetation, etc.). Vegetation types are described below. Vegetation type extents under historic (mid-1970s) and year 2010 conditions are illustrated in Figures 18 and 19.

<u>Saltmarsh</u>

Description:	Exists below 6 feet (mean sea level) in elevation with an obvious tidal connection and no obvious presence of annual grasses or freshwater marsh vegetation. Also includes salt panne, mudflat, and tidal channels.
Indicators:	Deep brown and red-orange, smooth textured vegetation.
Common Species:	*Sarcoconia pacifica* (*Salicornia virginica*), *Frankenia grandiflora, Juamea carnosa*.
Confidence:	Moderate-High. High confidence that vegetation is saltmarsh. Moderate confidence that this vegetation is tidal.

<u>Non-tidal Saltmarsh</u>

Description:	Exists above 4 feet (mean sea level) in elevation with no obvious tidal connection, but presence of annual grasses or freshwater marsh vegetation.

Indicators: Deep brown and red-orange, smooth textured vegetation, but lighter in color than tidal saltmarsh due to less moisture. Includes salt panne with no obvious tidal connection.

Common species: *Sarcoconia pacifica* (*Salicornia virginica*)*, Frankenia grandiflora*. Vegetation distant from tidal connection has higher cover of *Frankenia salina* (orange color in aerials) and includes more brackish species (such as *Scirpus maritimus* and *Iva hayesiana*). This vegetation could be considered cismontane alkali marsh.

Confidence: Moderate-High. High confidence that vegetation is saltmarsh. Moderate confidence that this vegetation is non-tidal.

Non-tidal Salt Marsh – *Lolium perrene* infested

Description: Exists above 4 feet (mean sea level) in elevation with no obvious tidal connection. Dominated by annual grasses with presence of saltmarsh vegetation.

Indicators: Straw color of senescent annual grasses.

Common species: *Sarcoconia pacifica* (*Salicornia virginica*), *Frankenia grandiflora, Lolium perenne*. Could also contain *Bromus diandrus* or other non-native grass.

Confidence: Moderate.

Freshwater Marsh

Description: Freshwater marsh vegetation.

Indicators: Taller statured, more round-patterned, and pillowy-textured than saltmarsh and non-tidal saltmarsh vegetation. Lighter color than saltmarsh and non-tidal saltmarsh. Smooth texture and light color compared to Southern Willow Scrub/Mulefat Scrub.

Common species: *Typha* spp., *Scirpus californica, Scirpus americanus*

Confidence: High.

Southern Willow Scrub/Mulefat Scrub

Description: Tall-statured woody vegetation.

Indicators: Lumpy textured, bright green color. Presence of shadows.

Common species: *Salix lasiolepis, Baccharis sarothroides*.

Confidence: High.

Herbaceous Wetland (Unknown or Transitional Vegetation)

Description: A variety of vegetation types and textures mixed at close scales.

Indicators: Areas difficult to differentiate between vegetation types.

Common species: non-native grasses, freshwater marsh species, saltmarsh species, *Leymus tritichoides, Scirpus maritimus*, and others
Confidence: High.

Upland Land Cover (Urban, Beach, Dune, Upland Vegetation, etc.)
Description: Non-wetlands.
Indicators: Areas with urban infrastructure or non-wetland vegetation.
Common species: n/a
Confidence: High.

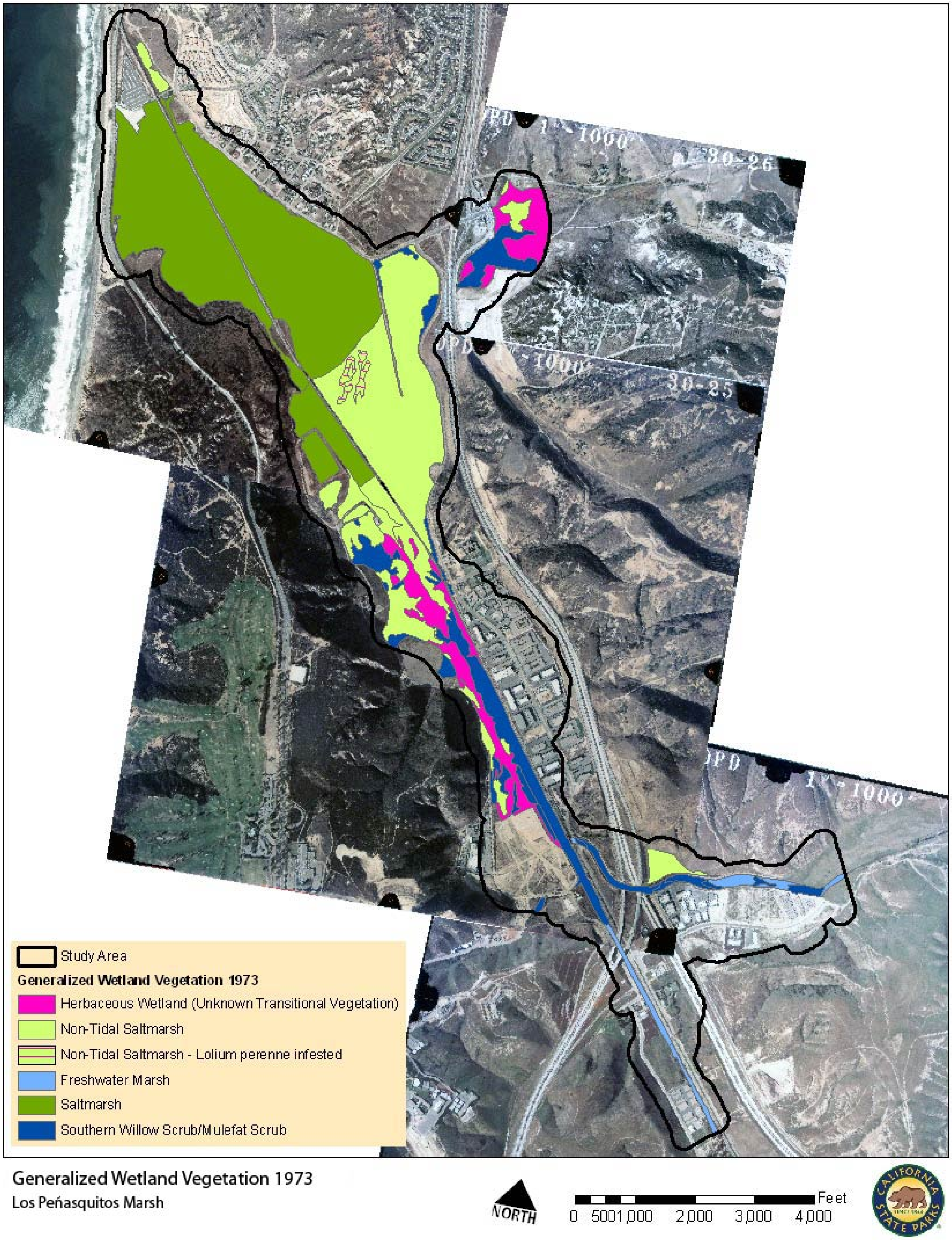

Figure 18. Historic wetland habitats within Los Peñasquitos Lagoon (California State Parks, 2011).

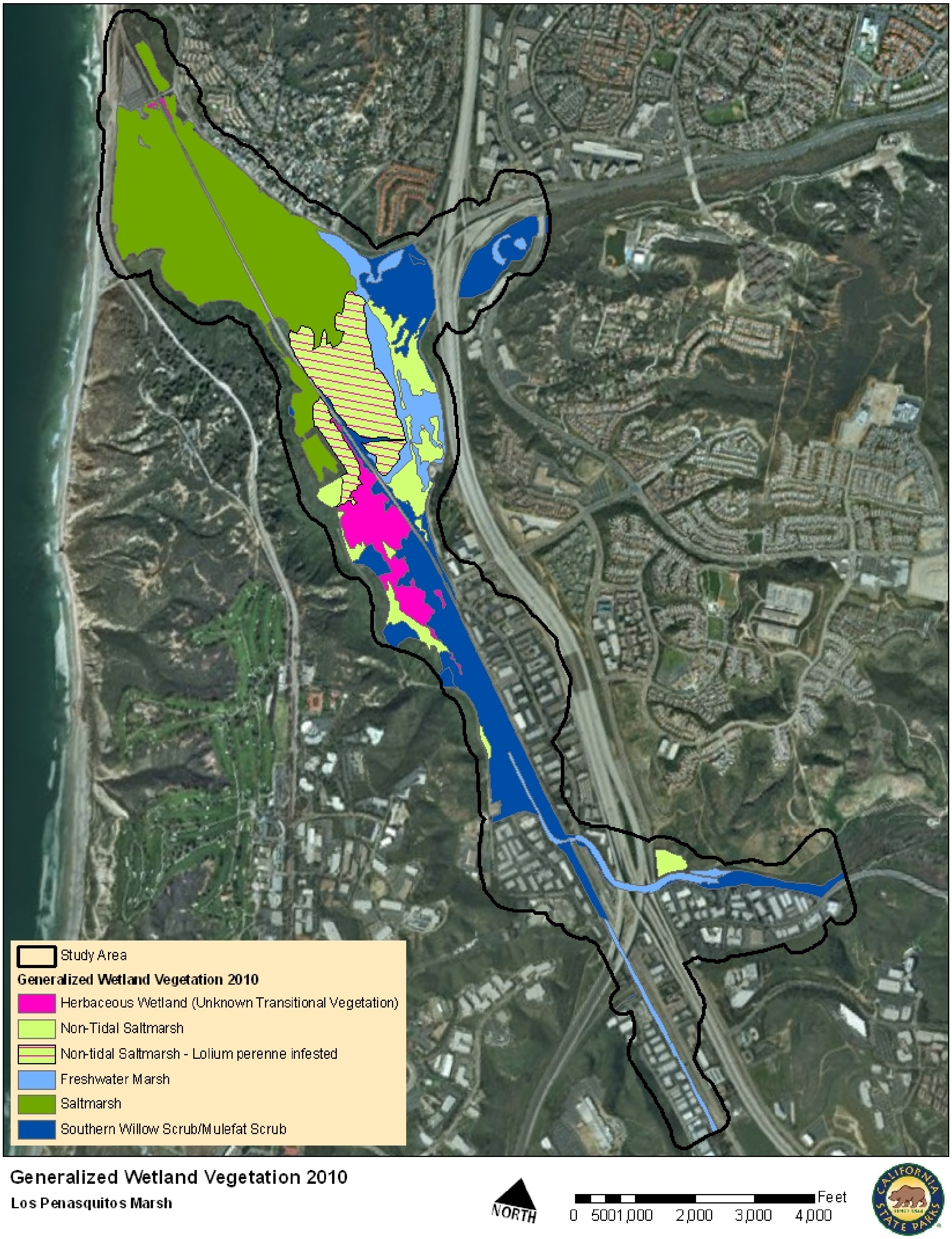

Figure 19. Year 2010 wetland habitats within Los Peñasquitos Lagoon (California State Parks, 2011).

7.5 Lagoon Mapping Application

Conditions present during the mid-1970s were associated with loads that met WQOs and did not adversely impact the Lagoon. To characterize this historical period, historic extent of vegetation types for the Lagoon were developed based on best available aerial photographs. Changes in vegetation types from 1973 to 2010 are summarized in Table 5.

Table 5. Summary of historical and year 2010 Lagoon vegetation types

Vegetation Types	**1973 acreage (ac)**	**2010 acreage (ac)**	**Change in acreage (ac)**
Saline Vegetation			
Tidal Saltmarsh	255	217	-38
Non-Tidal Saltmarsh	175	45	-130
Subtotal Saline	430	262	-168
Other Vegetation			
Non-tidal Saltmarsh - *Lolium perenne* (Perrenial Rye Grass) Infested, Non-native	4	67	63
Southern Willow Scrub/Mulefat Scrub	71	147	76
Freshwater Marsh	12	55	43
Herbaceous Wetland (Unknown or Transitional Vegetation)	49	34	-15
Subtotal Saline and Other Wetlands	566	565	-1
Upland Land Cover (Urban, Beach, Dune, Upland Vegetation, etc.)	639	640	1
Total Study Area	1205	1205	

The proposed numeric target highlights the importance of maintaining the critical saltmarsh and non-tidal saltmarsh habitats for protection of beneficial uses. Because the total study area of the Lagoon is constant, any increase in saltmarsh and non-tidal saltmarsh areas must be realized by reducing other areas. Of greatest priority and preference is the increase in areas of high biological importance (tidal saltmarsh and non-tidal saltmarsh) and reduction of areas with less biological importance, most notably the area identified as non-tidal saltmarsh-*Lolium perenne* infested. The Lagoon's 565 acres of non-upland land cover include 262 acres of tidal saltmarsh (including salt panne, tidal channels, and mudflats) and non-tidal saltmarsh and 132 acres of freshwater marsh, herbaceous wetland, and woody riparian (for example southern willow scrub and mulefat scrub) habitats. The remaining 171 acres of vegetation (not considering upland) is impaired and converted from coastal saltmarsh to *Lolium perenne* infested non-tidal saltmarsh, freshwater marsh, and woody riparian habitats (California State Parks, 2011).

The Lagoon numeric target is expressed as an increasing trend in the total area of tidal saltmarsh and non-tidal saltmarsh toward 346 acres. This target acreage represents 80 percent of the total acreage of tidal and non-tidal saltmarsh present in 1973.

Historic saltmarsh and non-tidal saltmarsh acreage is equivalent to 430 acres with 168 acres lost due to sedimentation, freshwater, and other physical factors discussed in the Background section of this Staff Report. Without available studies to determine what proportion of this loss is due to sedimentation over other factors, best professional judgment is used to determine the amount of habitat loss due to historic sediment discharges.

The target tidal and non-tidal saltmarsh acreage was calculated based upon the total acreage of tidal and non-tidal saltmarsh lost multiplied by a factor of 0.5. A factor of 0.5 indicates that half the acreage of tidal and non-tidal saltmarsh lost is due to sedimentation or 84 acres. Subtracting this lost acreage due to sedimentation from the historic extent of tidal and non-tidal saltmarsh results in the target acreage of 346 acres of tidal and non-tidal saltmarsh. This target acreage represents 80 percent of the total acreage of tidal and non-tidal saltmarsh present in 1973 and provides a reasonable consideration of factors beyond sedimentation that have led to the loss of saltmarsh and non-tidal saltmarsh.

If insufficient acreage is available for remediation based on the results of future monitoring efforts and field investigations, the Lagoon numeric target may be adjusted according to the amount of areas that are present and feasible for restoration. Any revision to the Lagoon numeric target will require a Basin Plan amendment (see Reconsiderations section 9.7).

8 Identification of Load Allocations and Reductions

The calibrated models and Lagoon mapping were used to simulate historical and year 2000 sediment loads to the Los Peñasquitos Lagoon from which numeric targets and load reductions were established. This section discusses the methodology used for TMDL development and the resulting loading capacities and required load reductions for Los Peñasquitos Lagoon. Other TMDL components are also discussed including the margin of safety (MOS), seasonality and critical conditions, and a daily load expression.

8.1 Loading Analysis

Year 2000 sediment loads to the Lagoon were estimated using the calibrated LSPC model, and receiving water conditions were simulated using the EFDC model (see Linkage Analysis, Section 7). Using the EFDC model, the assimilative capacity of the Lagoon was assessed and compared to the historical numeric target for evaluation of sediment loading.

8.2 Application of Numeric Targets

As discussed in Section 4, the narrative WQO for sediment was interpreted using a weight of evidence approach to determine a reference condition to define the TMDL numeric target (i.e., a historical period when the Lagoon was not impaired for sedimentation). Several lines of evidence were used to establish the mid-1970s as the historic time period including urbanization trends, population data, flow data, and evaluation of Lagoon conditions over time. The watershed and Lagoon numeric targets were determined using modeling and Lagoon mapping under historical (mid-1970s) conditions.

8.3 Load Estimation

Estimation of year 2000 watershed loading to the impaired Lagoon required use of the LSPC model to predict flows and sediment loads. The dynamic model-simulated watershed processes, based on observed rainfall data as model input, provided temporally variable load estimates for the critical period. These load estimates were simulated using calibrated and validated land-use specific processes associated with hydrology and sediment transport (see Attachment 2).

8.4 Identification of Critical Conditions

Due to the higher transport potential of sediment during wet weather, the 1993 El Niño time period was selected as the critical period for assessment. The 1993 El Niño time period (October 1, 1992-April 10, 1993) is one of the wettest periods on record over the past several decades. Statistically, 1993 corresponds with the 93rd percentile of annual rainfall for the past 15 years measured at the San Diego Airport (Lindbergh Field). Selection of this year was also consistent with studies performed by the Southern California Coastal Water Research Project (SCCWRP). An analysis of rainfall data for the Los Angeles Airport from 1947 to 2000 shows that 1993 was the 90th percentile year; meaning 90 percent of the years between 1947 and 2000 had less annual rainfall than 1993 (Los Angeles Water Board, 2002).

The watershed numeric target and load reductions were calculated based on modeling of historical (mid-1970s) land-use conditions and the same meteorological data in order to accurately compare the watershed and Lagoon response to the same weather conditions

8.5 Critical Locations for TMDL Calculation

Due to the variability and dynamic nature of conditions within the Lagoon (e.g., mouth closures, tidal fluctuations, sediment fate and transport, etc.), the entire modeled Lagoon area was assessed as the critical location. Load reductions for sediment were based on achieving the numeric TMDL target across the Lagoon.

8.6 Calculation of TMDL and Allocation of Loads

Conceptually, a TMDL is represented by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The wasteload allocation (WLA) portion of this equation is the total loading assigned to point sources. The load allocation (LA) portion is the loading assigned to non-point sources. The margin of safety (MOS) is the portion of loading reserved to account for any uncertainty in the data and computational methodology. An implicit MOS was incorporated for this TMDL.

Load calculations for sediment were developed based on watershed modeling results and meteorological conditions.

8.7 Wasteload Allocations

The point sources identified in the Los Peñasquitos watershed are Phase I MS4 co-permittees (San Diego County and the cities of San Diego, Poway, and Del Mar), Phase II MS4s, Caltrans, and construction and industrial storm water permit holders. The year 2000 estimated loads were solely the result of watershed runoff (land-use based) and streambank erosion and not other types of point sources. The total sediment contribution from all responsible parties in the watershed is presented as the WLA.

8.8 Load Allocations

According to federal regulations (40 CFR 130.2(g)), load allocations (LA) are best estimates of the non-point source or background loading. For the Los Peñasquitos watershed, non-point source contributions to MS4 systems are included in the WLAs described above, including contributions due to hydromodification and accelerated erosion. An LA was assigned to sediment contributions from storm surges and wave action along the ocean boundary (ocean sediment contributions). The ocean is a background source of sediment to the Lagoon. The LA calculated using the models represents the amount of ocean sediments coming from the ocean and depositing at the Lagoon mouth.

8.9 Summary of TMDL Results

The overall TMDL and its component loads are presented in Table 6. Daily loads are established by dividing the modeled loads by the number of days (211 days) within the critical wet period (October 1, 1992–April 30, 1993). Year 2000 loads, historical loads, and required reductions are presented in Table 7. Year 2000 loads were estimated based on modeling of year 2000 land-use conditions (from the SANDAG 2000 land-use coverage) and meteorological conditions from the critical wet period (October 1, 1992–April 30, 1993). As described in Section 4, the numeric targets were calculated based on modeling of historical (mid-1970s) land-use conditions and the same critical wet period meteorological data in order to accurately compare the watershed and Lagoon response to the same weather conditions. Historic loads define the allowable load; therefore, required load reductions represent the difference between year 2000 sediment loads and historic (allowable) loads.

Sediment dynamics within the Lagoon are dependent on a number of factors, including runoff volumes and the amount of sediment that is transported to the Lagoon from the watershed. These factors are important components in determining the timing and magnitude of erosion and depositional processes within the Lagoon. Modeling Lagoon sediment dynamics shows that reducing watershed sediment loads increases the amount of ocean sediments that deposit throughout the Lagoon. Therefore, the TMDL results show reduced sediment deposition from tidal/oceanic input during the critical wet period under historical conditions because of complex lagoon deposition/erosion dynamics. This is likely explained by the hydrodynamic conditions within the watershed and Lagoon. The higher storm water flows (due to hydromodification) from the watershed under current conditions flushes ocean sediments from the mouth, whereas the lower storm water flows under historic conditions allows more ocean sediments to accumulate in the mouth.

To meet the TMDL, the total load reduction required from the watershed is approximately 67 percent. Tidal input from the ocean boundary represents natural background loads; therefore, no reduction is required for this source category.

Table 6. TMDL summary

Source	Critical Wet Period Load (tons)	Daily Load (tons)
Watershed contribution (WLA)	2,580	12.2
Ocean boundary (LA)	9,780	46.4
Margin of Safety (MOS)	implicit	implicit
TMDL	12,360	58.6

Table 7. Year 2000 vs. historical loads and percent reduction

Source	Year 2000 Load (tons)	Historical (mid-1970s) Load (tons)	Load Reduction (tons)	Percent Reduction Required
Watershed contribution (WLA)	7,719	2,580	5,139	67%
Ocean boundary (LA)	5,944	9,780	+3,836 (increase)	+39% (increase)
Total	13,663	12,360	1,303	10%

8.10 Daily Load Expression

Load allocations are expressed in terms of net sediment load for the critical period (tons) because sediment delivery to streams is highly variable on a daily and annual basis. Loads were also divided by the number of days in the critical period (211 days) to derive daily loading rates (tons/mi^2/day). Because of the natural variability in sediment delivery rates, compliance with load allocations must be evaluated using a long-term, weighted rolling average.

8.11 Margin of Safety

A margin of safety (MOS) is incorporated into a TMDL to account for uncertainty in developing the relationship between pollutant discharges and water quality impacts. For this TMDL, an implicit MOS was included through application of conservative assumptions during selection of numeric targets and development of the implementation plan.

Conservative assumptions were applied when selecting the watershed numeric target. The following list describes several key assumptions that were used.

- **Critical condition** - The wet season that includes the 1993 El Nino storm events (10/1/92 – 4/30/93) was selected as the critical condition time period for TMDL development. This is one of the wettest periods on record over the past several decades. Because of the large amount of rainfall, sediment loads were significantly higher during this period than in other years with less rainfall.

- **Soil composition** - Soils that are more easily transported typically have higher proportions of smaller particles sizes (silt and clay fractions), as compared to local parent soils, because of differences in settling rates and other sediment transport characteristics. To account for these differences in the model, soils transported by surface runoff were assumed to be composed of 5 percent sand, twice as much clay as the percentage of clay within each hydrologic soil group, and the remainder assigned to the silt fraction.

- **Numeric target** - The historical analysis involved an extensive literature search and technical analysis in order to identify an appropriate time period for development of the numeric sediment target. This comprehensive 'weight of evidence' analysis considered all available information regarding urbanization and lagoon impacts over time in order to identify a conservative reference condition.

Conservative assumptions were applied when selecting the Lagoon numeric target. By selecting a Lagoon numeric target in addition to the watershed numeric target, assurance is provided that sediment discharged between the mid-1970s and the year 2000 will be accounted for. Furthermore, the Lagoon numeric target provides a direct assessment of Lagoon conditions relative to beneficial uses relative to the watershed loading target.

Lastly, conservative assumptions were employed in the implementation plan through outlining the adaptive management approach to be used in determine the acceptable balance of sediment loading relative to progress in achieving and maintaining beneficial uses in the Lagoon and other factors.

8.12 Seasonality

The federal regulations at 40 CFR 130.7 require that TMDLs include seasonal variations. Sources of sediment are similar for both dry and wet weather seasons (the two general seasons in the San Diego region). Despite the similarity of wet/dry sources, transport mechanisms can vary between the two seasons. Throughout the TMDL monitoring period, the greatest transport of sediment occurred during rainfall events. Dry weather will contribute a deminimus discharge of sediment; however, model calibration and TMDL development focused on wet weather conditions because sediment transport is dramatically higher during wet weather. Model simulation was completed for the October 1, 1992–April 30, 1993 wet period to account for the much greater sediment loading and associated impacts to the Lagoon during this time period.

9 Implementation Plan

Los Peñasquitos Lagoon (Lagoon) is impaired for sedimentation/siltation, requiring the development of a TMDL and an implementation plan. The goal of the implementation plan is to ensure water quality objectives (WQOs) for sediment are met in the Lagoon. Consistent with California Water Code section 13242, this implementation plan describes the required actions by responsible parties, establishes a timeline, identifies interim milestones, and outlines monitoring objectives that will be used to assess the success of TMDL implementation.

As discussed in the source assessment and allocation sections of this TMDL, increased sediment discharge to the lagoon over time has contributed to sediment buildup and higher elevations that limit tidal flow and the extent of saltmarsh vegetation. This trend has resulted in impacts to beneficial uses, in particular, the estuarine and preservation of biological habitats of special significance beneficial uses. Watershed and lagoon numeric targets were identified to calculate the watershed sediment load reduction required based on historical analysis and to track implementation success. Reduced loading from storm water discharges and sediment removal in some areas may be needed to meet the requirements of this TMDL and to re-establish a more natural connection between the watershed, lagoon, and tidal flow.

Compliance with this sediment TMDL shall be based on achieving the Lagoon numeric target within the compliance timeframe. The responsible parties can implement a variety of implementation strategies, including preservation and restoration; education and outreach; retrofitting, new development, and site management; storm water BMP project construction and maintenance; and monitoring. Responsible parties are encouraged to work collaboratively to achieve the numeric targets and allocations specified in this TMDL.

This implementation section includes discussion of implementation actions needed to address this TMDL and describes an adaptive management framework that accounts for environmental and political complexities, as well as the time and financial resources needed to restore a coastal lagoon. This framework includes the following implementation processes:

1) Implement and evaluate the effectiveness of BMPs and source control strategies in conjunction with remediation actions to remove sediment as necessary;

2) Evaluate the effectiveness of controlling sediment loading from Carroll Canyon, Los Peñasquitos, and Carmel Creeks.

3) Conduct monitoring to inform decision making and to evaluate compliance during and after implementation actions are completed.

4) Re-evaluate the WLAs and LAs, if necessary.

5) Evaluate compliance with interim and final milestones.

9.1 Regulation by the San Diego Water Board

The Porter-Cologne Water Quality Control Act provides that “All discharges of waste into the waters of the State are privileges, not rights.” Furthermore, all discharges are subject to regulation under the Porter-Cologne Act including both point and nonpoint source discharges.[1] In obligating the State Water Board and Regional Water Boards to address all discharges of waste that can affect water quality, the legislature provides the State Water Board and Regional Water Boards with authority in the form of administrative tools (waste discharge requirements [WDRs], waivers of WDRs, and Basin Plan waste discharge prohibitions) to address ongoing and proposed waste discharges. Hence, all current and proposed discharges must be regulated under WDRs, waivers of WDRs, a prohibition, or some combination of these or other administrative tools (e.g. Statewide Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program). Since the US EPA delegated responsibility to the State for implementation of the National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits.

The regulatory mechanisms to implement the TMDL include, but are not limited to, general NPDES permits, individual NPDES permits, MS4 permits covering jurisdictions

[1] See Water Code sections 13260 and 13376.

and flood control districts within these waters, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, the Statewide Storm water Permit for Caltrans Activities, and the authority contained in Sections 13263, 13267 and 13383 of the Water Code. For each discharger assigned a WLA, the appropriate Order shall be reopened or amended when the order is reissued, in accordance with applicable laws, to incorporate the applicable WLA(s) as a permit requirement consistent with federal regulation and related guidance.[2]

9.2 Responsible Party Identification

Under this TMDL, the responsible parties are collectively assigned a single WLA, which they are responsible for meeting. An aggregate WLA allows for flexibility in achieving the load reduction required to meet the TMDL and improve Lagoon conditions. Responsible parties include: Phase I MS4 copermittees (the County of San Diego, City of San Diego, City of Del Mar, and the City of Poway), Phase II MS4 permittees, Caltrans, and the General Construction and General Industrial Storm Water NPDES permittees.

The San Diego Water Board encourages cooperation among all the responsible parties. While all the responsible parties in the Los Peñasquitos watershed must reduce their collective sediment load, the Phase I MS4 systems collect and drain virtually the entire watershed. As such, the Phase I MS4 copermittees represent the ultimate point source conveyor of sediment to the Lagoon. Therefore, it is the responsibility of the Phase I MS4 copermittees to assume the lead role in coordinating and carrying out the necessary actions, compliance monitoring requirements, and successful implementation of the adaptive management framework required as part of this TMDL.

Individual industrial facilities and construction sites are subject to regulation on two levels: (1) The San Diego Water Board is responsible for enforcing the statewide general industrial and construction storm water NPDES permits for sites within its jurisdiction.; and (2) each local municipality is responsible, under the MS4 storm water permit, for enforcing its own ordinances and permits (for violations of its ordinances/permits by an individual industrial facility or construction site within its jurisdiction). The San Diego Water Board is responsible for ensuring that the MS4 copermittees comply with specific MS4 permit requirements regarding the MS4 copermittees implementation of BMPs, such as inspections and ordinance enforcement, for construction and industrial sites within their jurisdiction.

[2] 40 CFR 144.22(d)(1)(vii)(B); US EPA Memorandum “Revisions to the November 22, 2002 Memorandum ‘Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs’” (November 12, 2010).

The San Diego Water Board relies upon the municipality to enforce its ordinances/permits and then works with the municipality to coordinate information and actions to compel compliance at the local and state level.

9.3 Phased Implementation via the Adaptive Management Approach

A common problem in natural resource management involves a temporal sequence of decisions (or implementation actions), in which the best action at each decision point depends on the state of the managed system. Adaptive management is a structured iterative implementation process that offers flexibility for responsible parties to monitor implementation actions, determine the success of such actions and ultimately, base future management decisions upon the measured results of completed implementation actions and the current state of the system. This process enhances the understanding and estimation of predicted outcomes and ensures refinement of necessary activities to better guarantee desirable results. In this way, understanding of the resource can be enhanced over time, and management can be improved.

Adaptive management entails applying the scientific method to the TMDL. A National Research Council review of US EPA's TMDL program strongly suggests that the key to improving the application of science in the TMDL program is to apply the scientific method to TMDL implementation (NRC 2001). For a TMDL, applying the scientific method involves 1) taking immediate actions commensurate with available information, 2) defining and implementing a program for refining the information on which the immediate actions are based, and 3) modifying actions as necessary based on new information. This approach allows the Lagoon to make progress toward attaining water quality standards while regulators and stakeholders improve the understanding of the system through research and observation of how it responds to the immediate actions.

Implementation actions to achieve the numeric targets will be implemented via an iterative process, whereby the information collected at each step will be used to inform the implementation of the next phase. The project will be adjusted, as necessary, based on the latest information collected to optimize the efficiency of implementation efforts. Ultimately, the path moving forward is to create the physical conditions related to remediating sediment impacts associated with this TMDL.

The implementation effort can be divided into three primary phases for this TMDL, as described below:

- Phase I Implementation includes elements to reduce the amount of sediment that is transported from the watershed to the Lagoon. An important component of Phase I will be to secure the relationships and agreements between cooperating parties and to develop a detailed scope of work with priorities.

Phase I includes the following elements:

- Incorporate interim limits into WDRs and NPDES permits;
- Implement structural and nonstructural BMPs throughout the watershed; and
- Develop and initiate a comprehensive monitoring program, which includes compliance monitoring and targeted special studies.

If appropriate, the TMDL will be reconsidered by the San Diego Water Board at the end of Phase I to consider completed special studies or policy changes (see section 9.7).

- Phase II includes the implementation of additional watershed actions that are targeted to reduce sediment loads from high priority areas, as well as lagoon-specific actions that may be needed to facilitate recovery of beneficial uses that have been affected by various complex processes, including sedimentation, nuisance flows, reduced tidal circulation, and other factors. These actions may include Lagoon sediment remediation efforts, re-connecting the Lagoon's historic tidal channels, and maintenance of the Lagoon inlet in collaboration with State Parks, the San Diego Water Board, the Los Angeles-San Diego-San Luis Obispo (LOSSAN) Rail Corridor Agency, US EPA, and the watershed responsible parties. Phase II may also include additional upstream protections and BMP implementation to further reduce watershed sediment contributions. Responsible parties will develop, prioritize, and implement Phase II elements based on data from compliance monitoring and special studies.

- Phase III includes implementation of secondary and additional remediation actions, as necessary, to be in compliance with this TMDL.

9.4 Develop and Submit a Load Reduction Plan

Responsible parties are required to prepare and submit for San Diego Water Board review, comment, and revision, a Load Reduction Plan that demonstrates how they will comply with this TMDL. The San Diego Water Board expects that Load Reduction Plans will be developed collaboratively by the responsible parties within the watershed. The Load Reduction Plan shall be submitted to the San Diego Water Board within 18 months of the TMDL effective date, and reviewed by the San Diego Water Board Executive Officer within six months of submittal (this period will likely include a round of revisions by the responsible parties based on San Diego Water Board staff comments).

The Load Reduction Plan shall establish a watershed-wide, programmatic, adaptive management approach for implementation and include a detailed description of implementation actions, identified and planned by the responsible parties, to meet the requirements of this TMDL. Implementation actions identified by the Load Reduction Plan may include source control techniques, structural and/or non-structural storm water BMPs, and/or special studies that refine the understanding of sediment and pollutant sources within the watershed. The Load Reduction Plan shall include a description and objective of each implementation action, potential BMP locations, a timeline for project or BMP completion, and a monitoring plan to measure the effectiveness of implementation actions.

Storm Water Pollution Prevention Plans (SWPPPs) prepared by Phase II MS4s, Industrial Permittees, and Construction Permittees pursuant to their respective statewide general NPDES permits fulfill these entities responsibility to prepare a Load Reduction Plan. Permittees within the Los Peñasquitos watershed shall update their SWPPPs within 12 months of the TMDL effective date with any additional BMPs, monitoring, etc. to account for their site's potential to impact the receiving waterbody with respect to sediment. Sites identified through monitoring data or site inspections as posing an increased risk to the receiving water body may be directed to perform additional monitoring by the San Diego Water Board Executive Officer to quantify sediment load contributions to the receiving waterbody.

9.4.1 Comprehensive Approach

The comprehensive approach to the Load Reduction Plan requires that implementation efforts address all current TMDLs, current 303(d) listed waterbody/pollutant combinations, and other targeted impairments within the Los Peñasquitos watershed. A comprehensive approach to the Load Reduction Plan is consistent with implementation planning currently underway to address all of the impaired segments that were included in the approved bacteria TMDLs for San Diego Region Beaches and Creeks (San Diego Water Board, 2010).

The comprehensive approach to the Load Reduction Plan allows the responsible parties to proactively address other listed impairments within the watershed, which requires special studies to investigate sources and the water quality improvements needed to address these pollutants. Such special studies (discussed in more detail below) may significantly alter current understanding and refine the TMDL loading and/or allocations. This can impact the selection of subsequent implementation actions and how they are prioritized by responsible parties. A comprehensive approach to development of the Load Reduction Plan will provide a more cost effective and efficient approach for TMDL implementation and will have fewer potential environmental impacts associated with construction of structural BMPs (San Diego Water Board, 2010).

9.4.2 Load Reduction Plan Framework

With increased land development and inadequate management of runoff from impervious areas, increasing amounts of sediment are deposited into the Lagoon annually. To minimize the effects of runoff, proper sediment control can be achieved through the execution of implementation actions such as BMPs. Sediment implementation actions can be grouped into four categories: preservation and restoration, education and outreach, retrofitting, new development, and site management, and monitoring. Proposed activities presented in the Load Reduction Plan may be grouped into these categories, each is summarized below.

1) **Preservation and Restoration:** Significant areas of land have been set aside for open space. Such land acquisition and preservation prevents natural areas from being developed and disturbed. Additionally, the restoration of riparian buffers and wetlands can include the stabilization of steep slopes with native riparian vegetation. This not only helps restore the habitat but also the natural function of the stream.

2) **Education & Outreach:** As a source control technique, education and outreach can function as pollution prevention to reduce or eliminate the amount of sediment generated at its source. Education and outreach can be targeted at specific land user groups and/or staff involved with site maintenance. As an example, implementation actions such as municipal incentives can be used to encourage proper irrigation and landscaping and can significantly reduce volumes of runoff.

3) **Retrofitting, New Development, & Site Management:** Land development (MS4 contribution) is the primary source of anthropogenic sediment contribution above historical conditions. Development can expose sediment and contribute excessive amounts of sediment to the Lagoon. Additionally, increased imperviousness associated with development can lead to increased storm water runoff and soil erosion or gullying within the MS4 and receiving waters. Appropriate site management can partially or fully mitigate the effects of development. The Load Reduction Plan must identify and prioritize BMPs based on an analysis of opportunities and cost/benefit considerations. Furthermore, the Load Reduction Plan must detail BMP projects and locations. Storm water BMPs can be implemented to reduce the effects of pollutant loading and increased storm water flows from development. Structural BMPs include incorporation of low impact development (LID) and storm flow hydrograph matching into new projects. The same structural BMPs can be utilized to retrofit existing sites or be applied as regional MS4 BMPs to treat pollutants and/or flows prior to discharge

into receiving waters.

4) **Monitoring:** A coordinated monitoring plan is needed to establish existing watershed conditions (baseline conditions) from which future changes and anticipated improvement in water quality can be measured. Additional monitoring could focus on sensitive species, areas of saltmarsh coverage, extent of invasive plant species, BMP effectiveness, in-stream hydromodification, and/or reduction in impervious coverage. Additionally, monitoring is crucial in the assessment of implementation actions to gain an understanding of performance for future adaptive management actions.

9.5 Load Reduction Plan Implementation

The Load Reduction Plan must be implemented within 90 days upon receipt of San Diego Water Board comments and recommendation, but in any event, no later than 6 months after submittal.

9.6 Monitoring

Monitoring is required to measure the progress of pollutant load reductions and improvements in water and saltmarsh habitat acreage. The information presented in this section is intended to be a brief overview of the goals of the monitoring. Special studies may be planned to improve understanding of key aspects related to achievement of WLAs, LAs, and numeric targets, restore the beneficial uses, and to assist in the modification of structural and non-structural BMPs if necessary.

The goals of monitoring include:

1) To determine compliance with the assigned wasteload and load allocations.

2) To monitor the effect of implementation actions proposed by responsible parties to improve water and saltmarsh habitat quality including proposed structural and non-structural BMPs to reduce storm water run-off and sediment loading, and remediation actions to remove sediment from the Lagoon.

3) To monitor the extent of vegetation habitat acreages in the Lagoon and determine if additional implementation action should be required.

4) To implement the monitoring in a manner consistent with other TMDL implementation plans and regulatory actions within the Los Peñasquitos watershed.

The proposed monitoring program shall be included in the Load Reduction Plan submitted to the San Diego Water Board Executive Officer for review.

Monitoring shall be conducted under technically appropriate Monitoring and Reporting Plans (MRPs) and Quality Assurance Project Plans (QAPPs). The MRPs shall include a requirement that the responsible parties report compliance and non-compliance with interim milestones as part of annual reports submitted to the San Diego Water Board. The QAPPs shall include protocols for sample collection, standard analytical procedures, and laboratory certification. All samples shall be collected in accordance with SWAMP protocols. The monitoring program must establish the following elements:

1) Specification of the constituents, sample locations and frequency of monitoring.

2) The types of monitoring techniques to be used.

3) The standard operating procedures and appropriate quality assurance protocols.

4) Analytical techniques and objectives for the interpretation and analysis of information gathered.

5) A process for refining and modifying the monitoring design in response to changing objectives and improved information.

6) A designated laboratory with sufficient capacity and appropriate levels of certification.

The San Diego Water Board Executive Officer may reduce, increase, or modify monitoring and reporting requirements, as necessary, based on the results of the TMDL monitoring program.

9.6.1 Watershed Monitoring

Responsible parties must conduct suspended sediment, bedload, and flow monitoring to calculate total sediment loading to the Lagoon for each wet period (October 1 thru April 30) throughout the 20-year compliance period. The responsible parties must monitor enough storm events throughout to quantify total annual sediment loading over each wet period. The compliance point for the WLA shall be the Lagoon as measured through the cumulative sediment loading from Los Peñasquitos, Carroll Canyon, and Carmel Creeks prior to entering the Lagoon. The responsible parties must monitor as many stations as necessary to quantify sediment loading to the Lagoon. Because of the natural variability in sediment delivery rates, sediment loading shall be evaluated using a 3-year, weighted rolling average. The first average must be calculated following the third critical wet period after the TMDL effective date.

Responsible parties are encouraged to collaborate or coordinate their efforts with other regional and local monitoring programs to avoid duplication and reduce associated costs.

In addition to the TMDL constituents identified above, the responsible parties should consider conducting general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements.

9.6.2 Lagoon Monitoring

The responsible parties shall monitor the Lagoon annually in the fall for changes in extent of the vegetation types via aerial photography and/or land-based survey methods. Aerial photography must be conducted in accordance with compliance dates in Table 8 (below), specifically Items 1,8,9,10,11 and 12. Lagoon monitoring shall be consistent with the methodology used to calculate the numeric target described in Section 7.4. Aerial photos of the Lagoon must be acquired, digitized onscreen (at an approximate 1:2,500 scale), interpreted, and mapped into generalized classifications. Vegetation types must be classified as saltmarsh, non-tidal saltmarsh, freshwater marsh, non-tidal saltmarsh – *Lolium perrene* infested, freshwater marsh, southern willow scrub/mulefat scrub, herbaceous wetland, or upland land cover (urban, beach, dune, upland vegetation, etc.). Vegetation type classifications are described in Section 7.4. Ground truthing may be performed after aerial photo interpretation to distinguish between vegetation types.

9.7 Reconsiderations

Special studies may be used to refine source assessments, assign appropriate allocation based on updated information from the results of implementation actions and the monitoring program, and help focus implementation efforts. San Diego Water Board staff also recognize that the TMDL targets, allocations, and proposed implementation actions to reach those targets and allocations may change. The results of special studies submitted to the San Diego Water Board's Executive Officer will be considered during subsequent TMDL reopeners. In addition, it may be necessary to make adjustments to the TMDL to be responsive to new State policies and other regulations.

If appropriate, the TMDL will be reconsidered by the San Diego Water Board at the end of Phase I to consider completed special studies or policy changes.

The responsible parties always have the option to propose new numeric targets or a revised compliance schedule, with adequate support, to reopen the TMDL.

As the implementation of this TMDL progresses, the San Diego Water Board recognizes that revisions to the TMDL, WLA, LA, numeric targets, implementation plan, and potentially to beneficial uses and water quality objectives may be necessary in the future. Any future revisions to the Basin Plan necessary to implement this TMDL will require a Basin Plan amendment.

Revisions to the Basin Plan typically require substantial evidence and supporting documentation to initiate the Basin Plan amendment process. Given the severely limited resources available to the San Diego Water Board for developing Basin Plan amendment projects, developing the evidence and documentation to initiate a Basin Plan amendment will be the responsibility of the dischargers and/or other parties interested in amending the requirements or provisions implementing this TMDL.

The San Diego Water Board will initiate a Basin Plan amendment project to revise the requirements and/or provisions for implementing this TMDL (including, but not limited to, the TMDL, WLA, LA, numeric targets, implementation plan) if all the following conditions are met:

- Sufficient data are collected to provide the basis for the Basin Plan amendment.
- A report is submitted to the San Diego Water Board documenting the findings from the collected data.
- A request is submitted to the San Diego Water Board with specific revisions proposed to the Basin Plan, and the documentation supporting such revisions.
- TMDL revision is consistent with Basin Plan review priorities.

The San Diego Water Board will work with the project proponents to ensure that the data and documentation will be adequate for the initiation of the Basin Plan amendment. The San Diego Water Board will be responsible for taking the Basin Plan amendment project through the administrative and regulatory processes for adoption by the San Diego Water Board, and approval by the State Water Board, Office of Administrative Law, and US EPA.

9.8 Compliance Schedule and Determination

9.8.1 Compliance Schedule

As discussed above, the implementation schedule for this TMDL follows the form of an adaptive management strategy, tracks implementation progress with established milestones or interim goals, and sets forth a final compliance date. It is impractical for land managers to actually measure sediment loading on a daily basis; thus, compliance with the TMDL is most appropriately expressed as an average annual load and should be evaluated as a long-term running average to account for natural fluctuations and inaccuracies in estimating sediment loads.

The expected timeframe to achieve the required reduction in sediment loading is 20 years following TMDL approval. This timeline takes into consideration the planning needs of the responsible parties and other stakeholders to establish a Load Reduction Plan, time needed to address multiple impairments, and provides adequate time to measure temporal disparities between reductions in upland loading and the corresponding Lagoon water quality response.

Current studies and other implementation actions or projects are already underway to reduce sediment loading to the Lagoon and to gain a better understanding of source contributions. A variety of such projects will continue throughout the development of the Load Reduction Plan, ensuring there are no gaps in implementation efforts throughout the process.

At the end of the TMDL compliance schedule, as outlined in Table 8, waters must meet the Lagoon's sediment water quality standard and therefore, the Lagoon numeric target. If at any point during the implementation plan, monitoring data or special studies indicate that WLA will be attained but the Lagoon numeric target may not be achieved, the San Diego Water Board shall reconsider the TMDL to modify WLA to ensure that the Lagoon numeric target is attained.

Table 8. Implementation compliance schedule.

Item	Implementation Action	Responsible Party	Date
1	Obtain approval by OAL of Los Peñasquitos Lagoon Sediment TMDL = Establishes effective date of TMDL	San Diego Water Board, San Diego County, City of San Diego, City of Poway, City of Del Mar, Caltrans, General Storm Industrial and Construction permittees	Estimated June 2013
2a	Issue, reissue, or revise general WDRs and NPDES requirements for Phase I MS4s, including Caltrans, to	San Diego Water Board and State Water Board	Completed during permit renewal - within 5 years of applicable permit date, and every

Item	Implementation Action	Responsible Party	Date
	incorporate requirements for complying with TMDL and WLAs		5 years thereafter.
2b	Issue, reissue, or revise general WDRs and NPDES requirements for Construction and Industrial NPDES to incorporate requirements for complying with TMDL and WLAs	San Diego Water Board and State Water Board	Completed during permit renewal - within 5 years of applicable permit date, and every 5 years thereafter.
2c	Issue, reissue, or revise general WDRs and NPDES requirements for Phase II NPDES permittees to incorporate requirements for complying with TMDL and WLAs	San Diego Water Board and State Water Board	Completed during permit renewal - within 5 years of applicable permit date, and every 5 years thereafter.
3a	Completion of Load Reduction Plans	Phase 1 MS4s and Caltrans	Within 18 months of OAL effective date for sediment TMDL
3b	Approval of Load Reduction Plan	San Diego Water Board Executive Officer	Within 6 months of submittal
3c	Phased, adaptive implementation of Load Reduction Plan	Phase 1 MS4s and Caltrans	In accordance with Load Reduction Strategy – ongoing throughout the implementation
3d	Revision of SWPPPs	Construction, Industrial, and Phase II Permittees	Within 12 months of OAL effective date for sediment TMDL
4a	Submit annual Progress Report to the San Diego Water Board due January 31 each year	Phase 1 MS4s	Annually after reissuance of NPDES WDR
4b	Submit annual Progress Report to the San Diego Water	Caltrans	Annually after reissuance of NPDES

Item	Implementation Action	Responsible Party	Date
	Board due April 1 each year		WDR
5	Enforcement Actions	San Diego Water Board	As needed
6	Refine Load Reduction Plan	Phase 1 MS4s and Caltrans	As warranted by completion of special studies, additional monitoring and data compilation.
7	Reopen and reconsider TMDL	San Diego Water Board	As defensible through the collection of additional data and significant findings by the watershed stakeholders.
8	Meet Interim Milestone #1: Attain 20 percent required reduction in sediment loading (equivalent to 6691 tons of sediment per year) and/or show progress in improving Lagoon conditions consistent with the specified targets	MS4s and NPDES permittees	Within 5 years of approved TMDL
9	Meet Interim Milestone #2: Attain 40 percent required reduction in sediment loading (equivalent to 5663 tons of sediment per year) and/or show progress in improving Lagoon conditions consistent with the specified targets	MS4s and NPDES permittees	Within 9 years of approved TMDL
10	Meet Interim Milestone #3: Attain 60 percent required reduction in sediment loading (equivalent to 4636 tons of sediment per year) and/or show progress in improving	MS4s and NPDES permittees	Within 13 years of approved TMDL

Item	Implementation Action	Responsible Party	Date
	Lagoon conditions consistent with the specified targets		
11	Meet Interim Milestone #4: Attain 80 percent required reduction in sediment loading (equivalent to 3608 tons of sediment per year) and/or show progress in improving Lagoon conditions consistent with the specified targets	MS4s and NPDES permittees	Within 15 years of approved TMDL
12	Meet Final Milestone: Achieve Lagoon numeric target: the successful restoration of tidal and non-tidal salt marsh to achieve a lgoon total of 346 acres.[3]	MS4s and NPDES permittees	Within 20 years of approved TMDL

**Note: TMDL implementation schedule may be altered due to TMDL reconsideration; additionally, enforcement actions by the San Diego Water Board will be taken as necessary.*

9.8.2 Compliance for Phase I MS4s and Caltrans

The TMDL is achieved and thus the sediment water quality standard is attained when the Lagoon numeric target is met. If the Lagoon numeric target is not met, the responsible parties must demonstrate they have 1) complied with the WLA and 2) addressed historical sediment discharged to the Lagoon since the 1970s that the responsible parties caused or contributed to. Responsible parties can address the discharges of historical sediment in numerous ways including, but not limited to, Lagoon restoration activities and monitored natural reduction of sediment in the Lagoon. Monitored natural reduction of sediment refers to the reliance on natural processes to achieve site-specific restoration objectives within a time frame that is reasonable compared to that offered by other more active methods. Compliance is assessed through special studies and monitoring of the Lagoon and its contributing watershed.

[3] This can either mean:
1. Successful restoration of 80 percent of the 1973 acreage of lagoon salt marsh habitat (346 acres); or
2. Demonstrate, with reasonable assurance for success, the implementation of activities that will lead to sustainable restoration of 80 percent of the 1973 acreage of lagoon salt marsh habitat (346 acres).

If the later, then continued monitoring will be required to demonstrate successful achievement of the 80 percent target, and a funding source must be identified for necessary remedial measures.

Compliance with interim milestones shall be assessed based on each party's ability to demonstrate that it has complied with the interim milestones. Since sediment transport can vary immensely between wet and dry years, compliance with interim targets shall be achieved if the responsible parties can demonstrate that they have 1) shown progress in improving Lagoon conditions consistent with the Lagoon numeric target and/or 2) achieved the sediment load reductions outlined in Table 8. Progress can be demonstrated through monitoring and reporting on implementation actions achieved as outlined in the Load Reduction Plan, implementation action successes, and/or improvements in saltmarsh and non-tidal saltmarsh habitat. For other measures to be considered, they must be described in the Load Reduction Plan and be accompanied by a monitoring plan to measure progress.

9.8.3 Compliance for Phase II MS4s, Construction Permittees, and Industrial Permittees

Phase II MS4s, Construction, and Industrial NPDES Permittees are assumed to be in compliance with the TMDL and their contribution to the total WLA if they are enrolled and in compliance with their respective general statewide permit, and are found to not contribute to the sediment impairment in the Lagoon through monitoring data and/or inspections. The San Diego Water Board may direct individual Permittees under the Phase II MS4, Construction, and Industrial general storm water NPDES permits to obtain an Individual NPDES permit for their storm water discharges. Direction by the San Diego Water Board to obtain an individual NPDES permit may occur based upon program audits, state or local compliance inspections, and/or Permittee monitoring.

As discussed in Section 9.2 above, it is the responsibility of the Phase I MS4 copermittees to assume the lead role in coordinating and carrying out the necessary actions, monitoring requirements, and successful implementation of the adaptive management framework required as part of this TMDL. The San Diego Water Board relies upon the Phase I MS4s to enforce its ordinances/permits and then work with the San Diego Water Board to coordinate information and actions to compel compliance. The San Diego Water Board shall consider enforcement actions, as necessary, to control the discharge of sediment to any receiving waterbody that ultimately impairs the Lagoon to attain compliance with the sediment WLA specified in this TMDL.

10 Necessity of Regulatory Provisions

The Office of Administrative Law (OAL) is responsible for reviewing administrative regulations proposed by State agencies for compliance with standards set forth in California's Administrative Procedure Act, Government Code section 11340 *et seq*., for transmitting these regulations to the Secretary of State and for publishing regulations in the California Code of Regulations. Following State Water Board approval of this Basin Plan amendment establishing a TMDL, any regulatory portions of the amendment must be approved by the OAL per Government Code section 11352. The State Water Board must include in its submittal to the OAL a summary of the necessity for the regulatory provision. "Necessity" means the record of the rulemaking proceeding demonstrates by substantial evidence the need for a regulation to effectuate the purpose of the statute, court decision, provision of law that the regulation implements, interprets, or makes, taking into account the totality of the record. For purposes of this standard, evidence includes, but is not limited to, facts, studies, and expert opinion [Government Code section 11349(a)].

This Basin Plan amendment for sediment impairment of the Los Peñasquitos Lagoon meets the “necessity standard” of Government Code section 11353(b). Amendment of the Basin Plan to establish and implement the sediment TMDL for the Los Peñasquitos Lagoon is necessary because the existing water quality does not meet the applicable narrative sediment WQOs. Applicable State and federal laws require the adoption of this Basin Plan amendment and regulations as provided below.

The State Water Board and Regional Water Boards are delegated the responsibility for implementing the California Water Code and the federal CWA. Pursuant to relevant provisions of both, the State Water Board and Regional Water Boards establish water quality standards, including designated (beneficial) uses and criteria or objectives to protect those uses.

Section 303(d) of the CWA [33 USC section 1313(d)] requires the states to identify certain waters within its borders that are not attaining water quality standards and to establish TMDLs for the pollutants impairing those waters. US EPA regulations [40 CFR 130.2] provide that a TMDL is a numerical calculation of the amount of a pollutant that a water body can assimilate and still meet standards. A TMDL includes one or more numeric targets that represent attainment of the applicable standard, considering seasonal variations, a margin of safety, and load allocations. TMDLs established for impaired waters must be submitted to the US EPA for approval.

CWA section 303(e) requires that TMDLs, upon US EPA approval, be incorporated into the state's Water Quality Management Plans, along with adequate measures to implement all aspects of the TMDL. In California, these are the basin plans for the nine regions. Water Code sections 13050(j) and 13242 require that basin plans have a program of implementation to achieve WQOs. The implementation program must include a description of actions that are necessary to achieve the objectives, a time schedule for these actions, and a description of surveillance to determine compliance with the objectives. California law requires that a TMDL project include an implementation plan because TMDLs normally are, in essence, interpretations or refinements of existing WQOs. The TMDL has to be incorporated into the region's basin plan [CWA section 303(e)] because the TMDL supplements, interprets, or refines an existing objective.

11 Public Participation

Public participation is an important component of TMDL development. Federal regulations [40 CFR 130.7] require that TMDL projects be subject to public review. All public hearings and public meetings have been conducted as stipulated in the regulations [40 CFR 25.5 and 25.6] for all programs under the CWA. Public participation was provided through one public workshop and through the formation and participation of the third party stakeholder group, which met at least monthly between April 2009 and June 2011, and additionally thereafter as needed to discuss technical issues and review draft documents. In addition, staff contact information was provided on the San Diego Water Board's website, along with periodically updated drafts of the TMDL project documents. Public participation also took place through the San Diego Water Board's Basin Plan amendment process, which included a hearing and two formal public comment periods. Public comments from the first formal public comment period are available in Attachment 5. A chronology of public participation and major milestones is provided in Table 9.

Table 9. Public participation milestones

Date	Event
February 15, 2011	Public Workshop and CEQA Scoping Meeting
April 22, 2011	Draft Documents released for public review
February 15, 2012	Revised Draft Documents released for public review
June 13, 2012	Public Hearing and Adoption

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