LOS CERRITOS WETLANDS CONCEPTUAL RESTORATION PLAN

OPPORTUNITIES AND CONSTRAINTS REPORT

Prepared for:

Los Cerritos Wetlands Authority

100 North Old San Gabriel Canyon Road

Azusa, CA 91702

Prepared by:

moffatt & nichol

3780 Kilroy Airport Way, Suite 600

Long Beach, CA 90806

with

Tidal Influence

COASTAL RESTORATION CONSULTANTS

EVEREST

CHAMBERS GROUP

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M&N Job 7476

Executive Summary

The Los Cerritos Wetlands (LCW) complex represents an opportunity to restore approximately 560 acres of salt marsh, seasonal and other freshwater wetlands, open water, and transitional/upland habitat. Historically, the complex covered 2,400 acres and stretched two miles inland. Today, only remnants of the historic wetlands occur in degraded patches. The LCW Conceptual Restoration Plan (CRP) is to provide a roadmap for habitat enhancement and improved public access for the 200 acres of land owned by the Los Cerritos Wetlands Authority (LCWA) and City of Long Beach and, ultimately, the entire remaining LCW complex which includes land owned by others.

This report integrates results from previous tasks to develop a systematic overview of the project area in the context of opportunities and constraints for habitat restoration. Fortunately, there are many opportunities. These opportunities have been identified in this report as:

Topography / Landforms / Soils

- Existing ground elevations suitable for coastal wetlands
- Existing landforms can be used to control water
- Existing roads can provide high tide refugia
- Soils suitable for wetlands and uplands habitat cover
- Site location provides opportunities for nearby soil disposal
- Site size provides opportunities for onsite remediation
- Presence of earthquake fault through site may be deterrent to other development

Tidal Exchange / Local Watersheds / Hydrology

- Site location provides tidal exchange enhancement opportunities
- Site location provides freshwater enhancement opportunities
- Altered geomorphology minimizes sedimentation-related maintenance
- Watershed activities will provide improved water quality

Ecology

- Already existing ecologically-valuable areas
- Habitat potential for degraded land areas
- Already existing special status species
- Potential for freshwater habitat
- Conversion of upland areas to wetlands habitat area
- Adjacency to wildlife corridors and connectedness

Climate Change

- Utilization of sea level rise (SLR) for tidal exchange
- Existing Hellman site topography provides for habitat adjustment
- Potential to restore “natural” sedimentation
- Potential to accommodate upslope transgression of habitats
- Potential to increase flood protection

Infrastructure

- Lease agreements include reconfiguration of oil infrastructure
- LCWA-owned property includes the San Gabriel River levees

Human Interaction

- Public access to large open space area
- Synergy with LCW stewardship program
- Active local stakeholders
- Cooperative efforts with local university
- Adjacent existing public use areas
- Limited visibility from housing developments
- Already existing infrastructure for public interpretation

Regulatory / Implementation

- Potential for additional land acquisition
- Potential funding opportunities
- Potential for agency coordination

As is typical in most projects, there are also many constraints to restoration. These constraints have been identified as:

Topography / Landforms / Soils

- Historical and current land uses have altered natural topography
- Landform changes limit natural processes
- Existing soil quality limits restoration success
- Earthquake fault may constrain oil infrastructure reconfiguration and/or cause damage to the wetlands

Tidal Exchange / Local Watersheds / Hydrology

- Human disturbance has altered tidal exchange
- Human disturbance has altered freshwater hydrologic functioning
- Human disturbance has altered geomorphology
- Poor water quality can impair restoration success

Ecology

- Protection of existing sensitive habitat resources
- Simplified food webs

Climate Change

- Modification of habitat proportions with climate change
- Limited areas for upslope transgression of habitats as sea level rises
- Steep perimeters support only narrow habitat bands as sea level rises
- Limited natural sediment supply
- Flood protection with SLR

Infrastructure

- Incorporation of existing and future-remaining oil infrastructure
- Fragmentation and encroachment by roadways
- Protection of existing flood control systems
- Fragmentation and encroachment by utilities

Human Interaction

- Habitat sensitivity to urban surroundings
- Habitat sensitivity to public access
- Onsite homeless encampments
- Maintaining positive public perception
- Potential impacts to surrounding neighborhoods
- Archaeological resource protection

Regulatory / Implementation

- Land ownership by other entities
- Easements by other entities
- Limited funding
- Compensatory mitigation restrictions
- Permitting and environmental reviews
- Compliance with the City of Long Beach Local Coastal Program and General Plan

This Opportunities and Constraints Report identifies considerations for the LCW conceptual restoration planning and will be a useful guide for the next step of this study, the task for "Identification of Preliminary Restoration Alternatives." Numerous opportunities exist that can be capitalized on to increase the success and effectiveness of the project and minimize impacts and costs. The constraints to restoration also need to be considered and either avoided, remediated, or otherwise factored into the planning and design effort. No fatal flaws to restoration have been identified, and abundant options exist to optimize habitat restoration and achieve other project goals and objectives.

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** Note: in Section 3.0, the subsection titles for opportunities are shown in green and the subsection titles for constraints are shown in red.*

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LIST OF ABBREVIATIONS

APE	Area of Potential Effect
CDFG	California Department of Fish and Game
CDP	Coastal Development Permit
COLB	City of Long Beach
CRP	Conceptual Restoration Plan
CSULB	California State University of Long Beach
CWA	Clean Water Act
HOA	Home Owners Association
IPCC	Intergovernmental Panel on Climate Change
LCP	Local Coastal Program
LCW	Los Cerritos Wetlands
LCWA	Los Cerritos Wetlands Authority
LCW SP	Los Cerritos Wetlands Stewardship Program
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
RMP	Resource Management Plan
RWQCB	Regional Water Quality Control Board
SEADIP	South East Area Development and Improvement Plan
SGR	San Gabriel River
SLR	Sea Level Rise
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency

Photographs in this document have been provided by Taylor Parker and Eric Zahn of Tidal Influence, Craig Frampton and Kim Garvey of Moffatt & Nichol, Spencer Johnson of Kinnetic Laboratories Inc., and the Los Angeles Department of Water and Power.

1.0 INTRODUCTION

The Los Cerritos Wetlands (LCW) complex affords the opportunity to restore over 500 acres of salt marsh, seasonal and other freshwater wetlands, open water, and transitional/upland habitat. The general location of the LCW complex is shown in Figure 1-1.

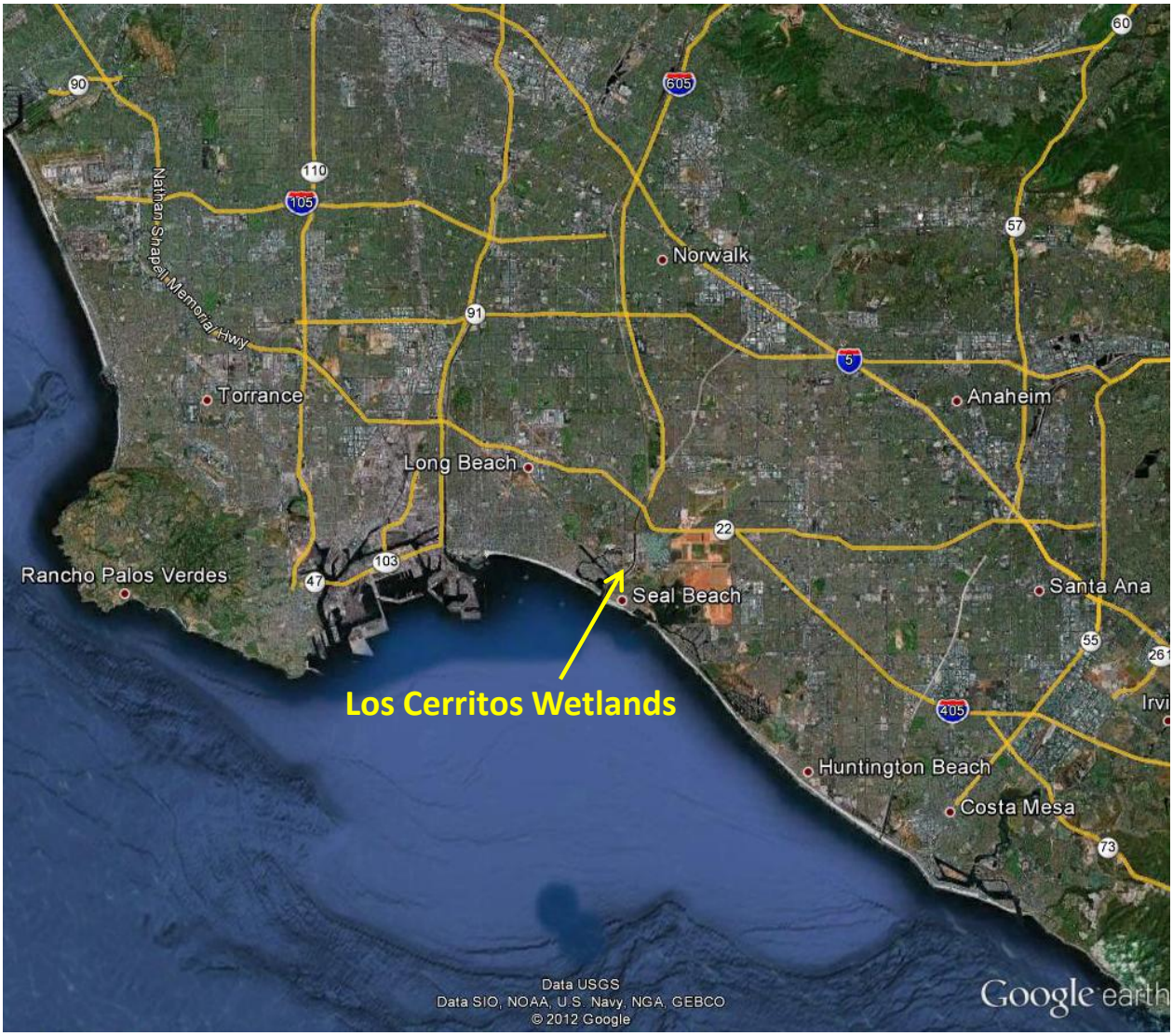


Figure 1-1. Vicinity Map

The LCW site falls within both the City of Long Beach (Los Angeles County) and City of Seal Beach (Orange County). It is generally bounded by commercial areas to the south, industry to the north, and residential and mixed use areas to the east and west. This surrounding infrastructure is described further in this report. Several waterways, including the San Gabriel River, run through or adjacent to the site.

Historically, as late as 1895, the LCW complex covered approximately 2,400 acres and stretched approximately two miles inland. The extent of this vast LCW complex can be seen in the overlay of Figure 1-2. Over the past century, the wetlands have been used for farming, oil production, landfills, burn dumps, and urban development. Today, only remnants of the historic wetlands occur in degraded patches.

Figure 1-2. Overlay of Historic Wetlands on Modern Day Aerial Photo

The LCW Conceptual Restoration Plan (CRP) is to provide a roadmap for habitat enhancement and improved public access for approximately 200 acres owned by the LCWA and the City of Long Beach ("Base Project") and potentially the entire 563-acre complex which includes land currently owned by others (multiple private landowners, the California State Lands Commission, the City of Los Angeles, and the County of Orange). Figure 1-3 shows the boundaries and the land ownership of the entire LCW complex. Figure 1-4 shows specific areas within the LCW complex which are referenced throughout this report.

Legend

- Base Project Properties
- LCW Property Boundaries
- No Change to Existing Uses
- LCW Entire Complex Boundary
- LA/OC County Boundary

N

0 250 500 1,000 1,500 2,000 Feet

Sources: City of Long Beach GIS 2011, Survey (Provided by WRA) 1996, Survey (MDA Consultants) 1992, L.A. County Assessor's Parcel Data 2007

5/24/2012

Figure 1-3. Entire LCW Complex Property Ownership Map

MOFFATT & NICHOL

Project location: Long Beach & Seal Beach, CA

Los Cerritos Wetlands Conceptual Restoration Plan

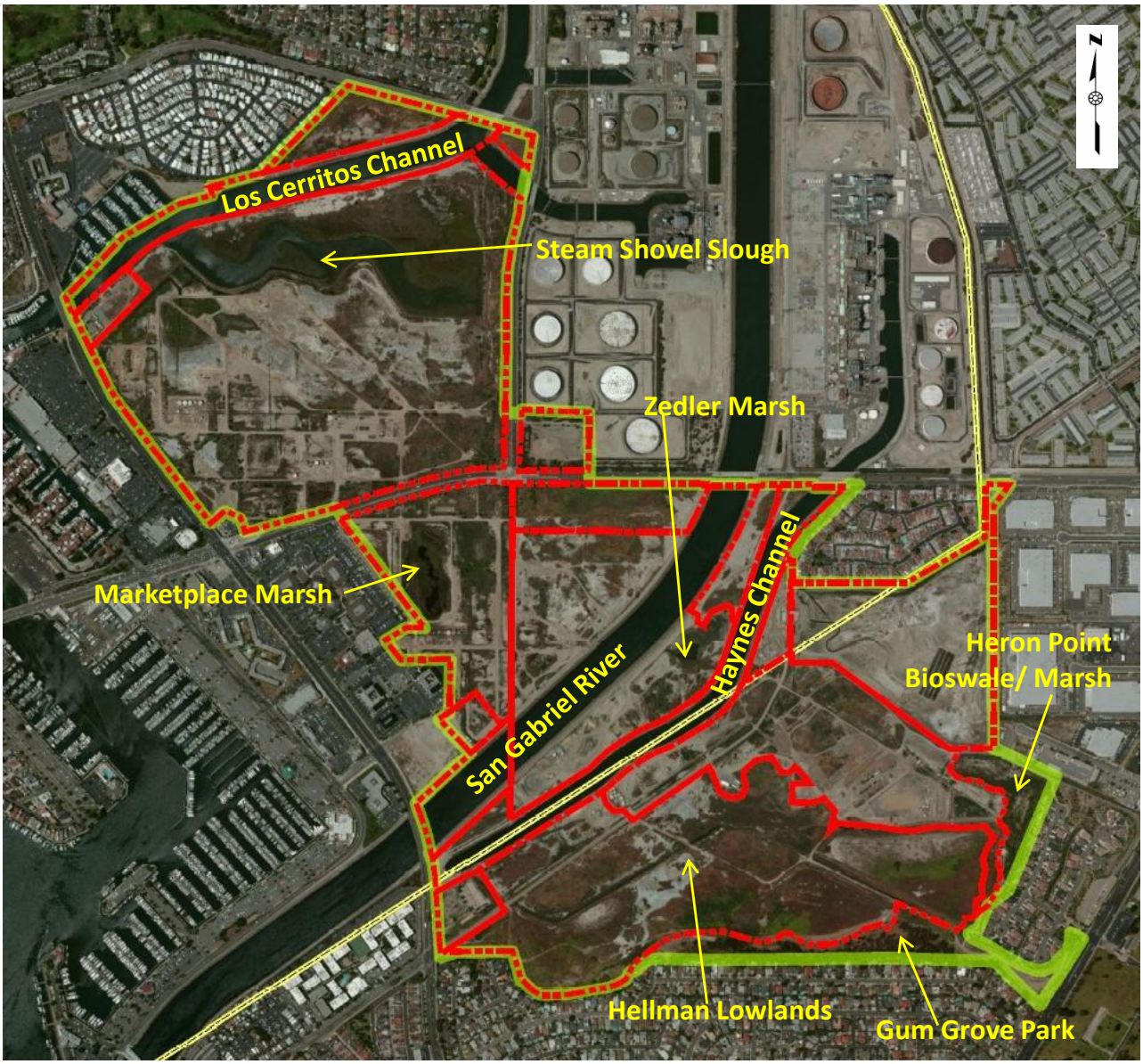


Figure 1-4. Map of Specific Areas Referenced in This Report

Based on current property ownership and oil lease agreements within the LCW complex, a time-phased implementation approach is envisioned. The CRP will need to take into account construction phases which could be separated by many years, perhaps decades, based on when property is obtained from private landowners, oil infrastructure is reconfigured, and/or funding is available. The need for this multi-phased approach is discussed in various sections of this report.

The purpose of this report is to identify the constraints and opportunities that help define potential restoration alternatives and the feasibility of those alternatives.

2.0 SCOPE OF WORK

The scope of work for the overall study includes the following tasks:

- Task 1 – Base data collection and topographic mapping;
- Task 2 – Characterize biological resources and extent of special status species;
- Task 3 – Characterize hydrologic and hydraulic conditions;
- Task 4 – Characterize upstream activities impacting the wetland;
- Task 5 – Conduct an initial environmental study to identify potential contaminant types and sources;
- Task 6 – Evaluate options for sediment management or disposal;
- Task 7 – Develop opportunities and constraints to habitat restoration;
- Task 8 – Develop concepts for public access and interpretation;
- Task 9 – Public involvement;
- Task 10 – Develop process for meetings of the Steering and Technical Advisory Committees;
- Task 11 – Refine project objectives;
- Task 12 – Develop and evaluate restoration alternatives;
- Task 13 – Develop consensus on alternatives;
- Task 14 – Prepare conceptual restoration plan (final report);
- Task 15 – Issues for next phase of restoration planning; and
- Task 16 – Project management.

This report is the deliverable for Task 7 and is meant to characterize the opportunities and constraints to habitat restoration. Specifically, this report integrates results from previous Tasks (1, 2, 3, 4, 5, 6, 9 and 10) to develop a systematic overview of the project area and defines the opportunities and constraints for habitat restoration. The opportunities and constraints include existing site conditions such as topography and soil characteristics, ecology/biology, hydrology, onsite and surrounding infrastructure, future climate change conditions, mitigation funding opportunities, and ownership status of the properties within the entire LCW complex.

This list of opportunities and constraints will continue to expand and be refined based on ongoing input from the LCWA Steering Committee, Technical Advisory Committee, and community stakeholders.

3.0 OPPORTUNITIES AND CONSTRAINTS

Fortunately, there are many opportunities to restore habitat and provide for public education and enjoyment, while protecting the surrounding areas and onsite infrastructure. These opportunities include existing habitat (e.g. Zedler Marsh and Steam Shovel Slough), proximity to several potential tidal connections, potential utilization of future sea level rise (SLR), proximity to wildlife corridors, collaboration with local universities, enthusiastic stakeholders, and the potential acquisition of additional land for restoration.

There are also many constraints which must be considered in developing the restoration alternatives. Some of these are hard constraints which are not flexible (e.g. surrounding power plants, roads, and neighborhoods which encroach on the wetlands), while some may be able to be modified to remediate the constraint (e.g. reconfiguration of onsite oil infrastructure). None of the identified constraints make restoration infeasible.

Opportunities and constraints have been organized into the following categories:

- Topography / Landforms / Soils
- Tidal Exchange / Local Watersheds / Hydrology
- Ecology
- Climate Change
- Infrastructure
- Human Interaction
- Regulatory / Implementation

Each of these categories is discussed in the sections that follow. The subsection titles for opportunities are in green and the subsection titles for constraints are in red.

3.1 Topography / Landforms / Soils

The opportunities and constraints related to topography, landforms, and soils are presented in this section. Topography is used in this section to describe the overall ground level across the site. Landforms describe discrete physical features of the landscape such as levees, berms, fills, pits, depressions, and channels. The soils discussion addresses opportunities and constraints related to location, and chemical and physical properties of the existing soils/sediment within the project site.

3.1.1 Opportunities

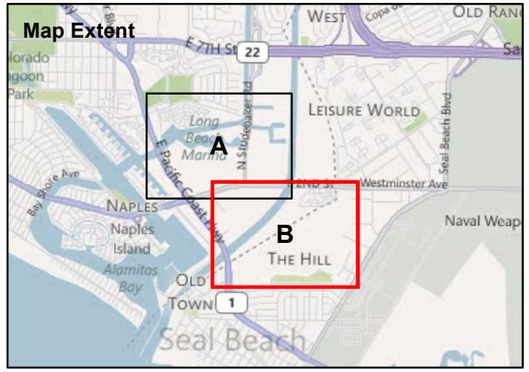
3.1.1.1 Existing Ground Elevations Suitable for Coastal Wetlands

The existing ground elevations throughout large areas of the LCW site are within the ground elevation range of coastal wetlands habitat of Southern California. These potential habitats based on the existing elevations are shown in Figure 3-1. As can be seen on this figure, the majority of the area northwest of the San Gabriel River (SGR) consists of existing ground elevations that would support high marsh and marsh plain with some mudflat and open water habitat. The majority of area southeast of the SGR consists of ground elevations that would support high marsh, transition, and upland habitats.

This provides an opportunity to restore a balance of coastal wetlands habitat and adjacent higher habitats with a relatively small amount of earthwork compared to other Southern California coastal wetlands restoration projects (e.g., Bolsa Chica Wetlands). It appears that some areas have not been excavated or filled so these areas provide opportunities to preserve the historical topography of the land. Areas with fill may function as transitional/upland areas.

LCW Site Northwest of the San Gabriel River

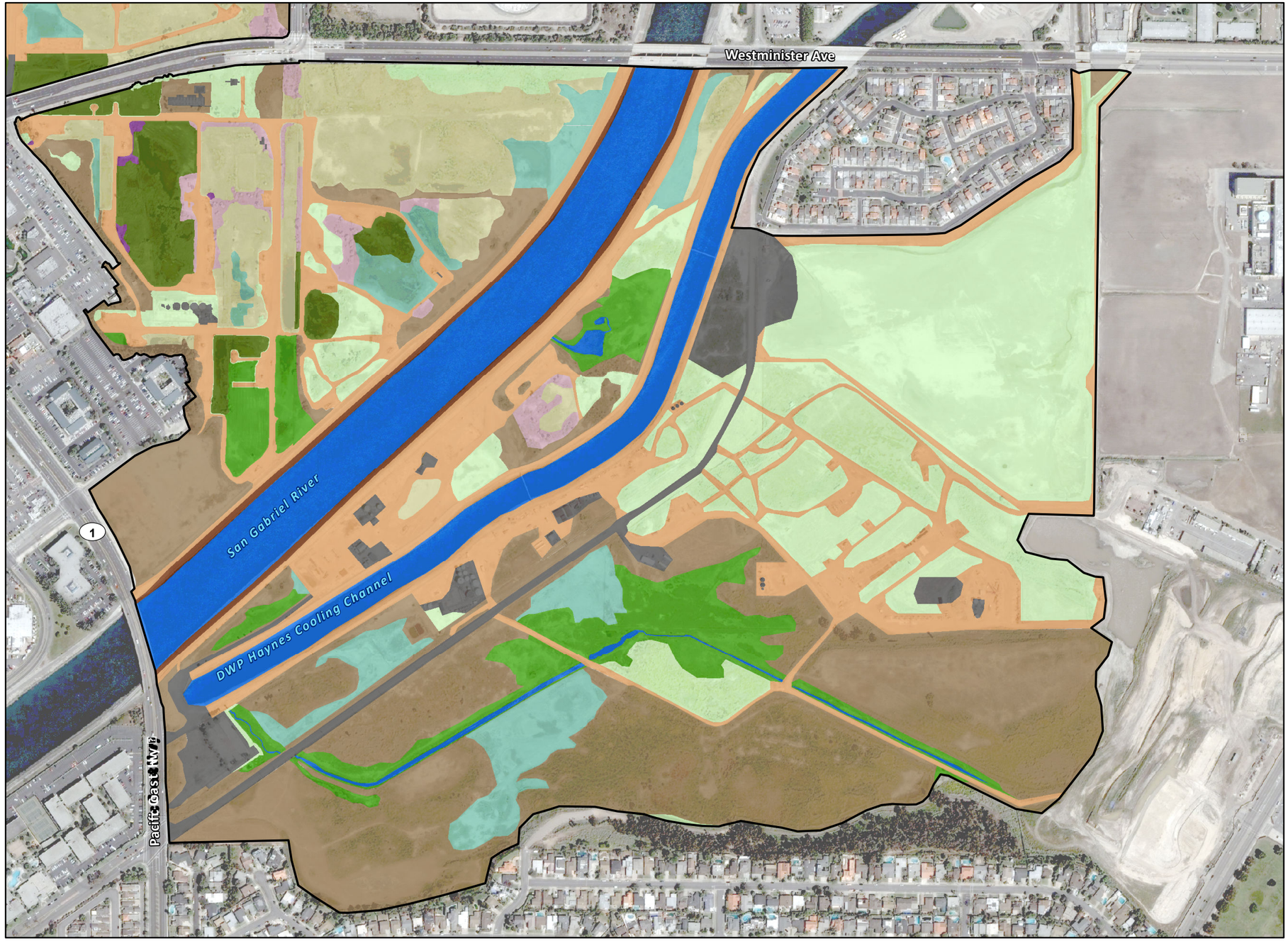
LCW Site Southeast of SGR (including Haynes Channel seen in photo)



Study Site Boundary

Habitat Type

- Rocky Intertidal Zone
- Subtidal Marine
- Mudflat
- Southern Coastal Salt Marsh
- Salt Flat
- Southern Willow Scrub
- Mulefat Scrub
- Alkali Meadow
- Southern Coastal Brackish Marsh
- Ruderal Wetlands
- Ruderal Uplands
- Vegetation Free Zone
- Development



C:\Users\Eric Zahn\Documents\ArcGIS\AddIns\Desktop 10.0\GIS_data\ExistingHabitat_021712.mxd

Existing Habitat

View B

500 250 0 500 Feet

Figure 3-1. Current Habitat Distribution on Base Project Properties

Tidal Influence

C:\Users\Eric Zahn\Documents\ArcGIS\AddIns\Desktop 10.0\GIS_data\zahn\Cartography\ReportGraphics\ExistingHabitat.pdf

3.1.1.2 Existing Landforms Can Be Used To Control Water

There are numerous landforms located across the project site that provide potential opportunities to control water and thus are attributes to restoration; some of these landform features are illustrated in Figure 3-2.

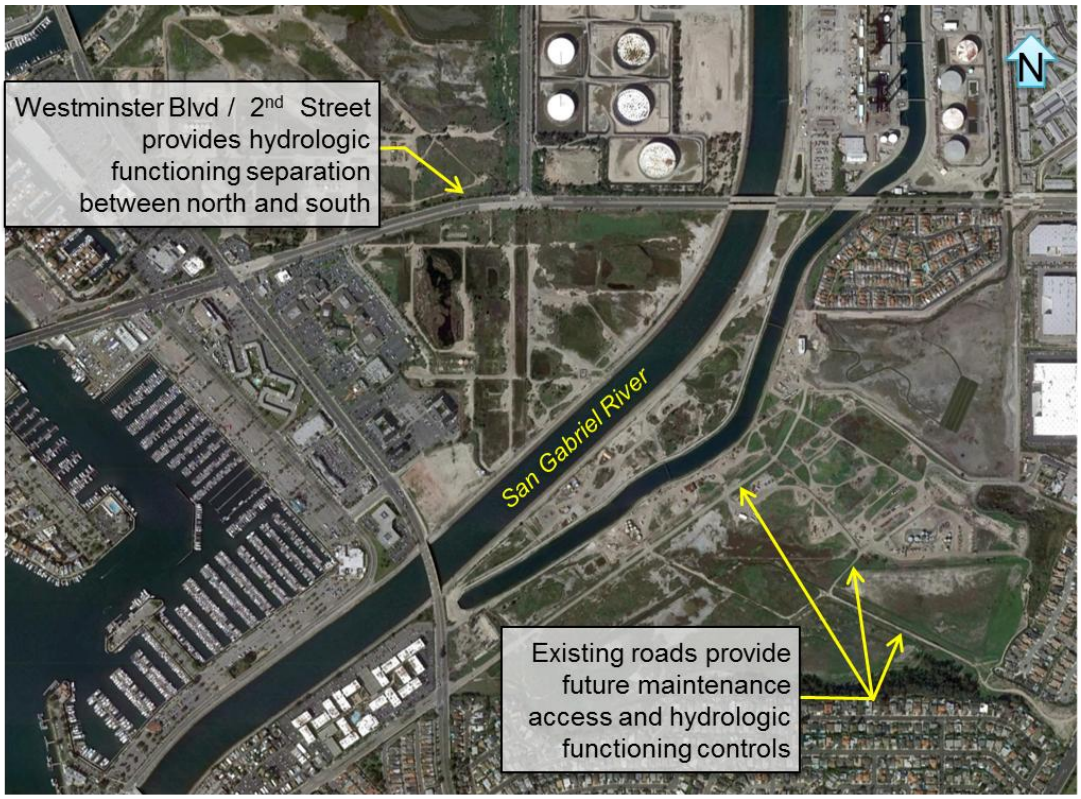


Image Source: Google Earth Pro

Figure 3-2. Los Cerritos Wetlands Landform Opportunities

Westminster Blvd/ 2nd Street separates the LCW Partners property to the northwest from the City of Long Beach and LCWA Phase 1 properties to the southeast. This landform provides an opportunity to restore hydrologic functioning (e.g., freshwater inputs and/or tidal flushing) to this southeastern area while avoiding impacts to the privately-owned lands to the northwest. This also provides an opportunity in the current plan to include hydraulic connections (e.g., open channels and/or culverts) to the privately-held lands that would be activated (e.g., opened or connected) in the future as part of a phased implementation approach.

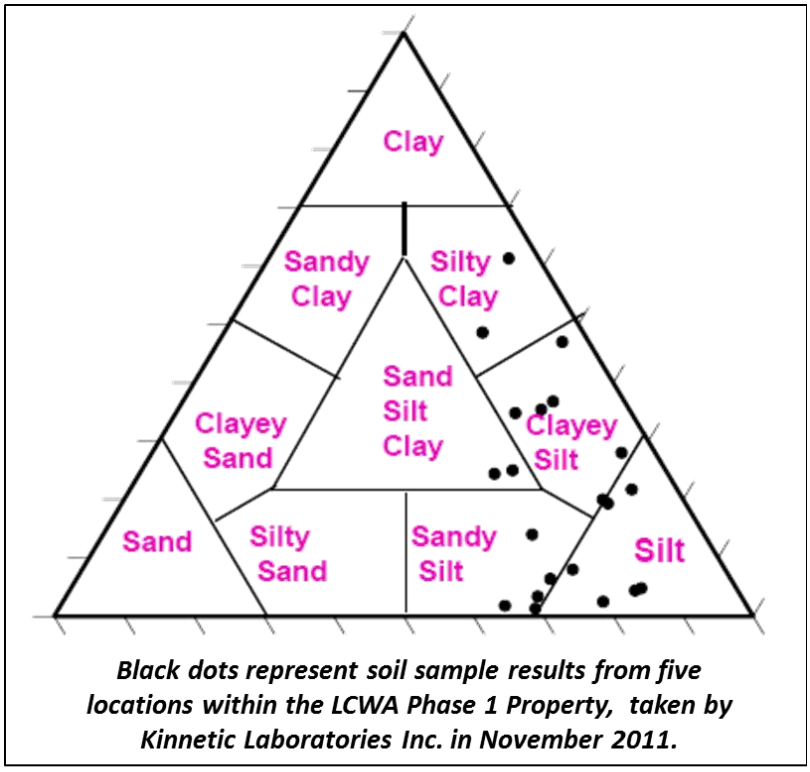
There are also numerous roads running across the site that are primarily used to access oil exploration and production areas. The roads could also be used to control future saltwater and/or freshwater hydrologic functioning.

3.1.1.3 Existing Roads Can Provide High Tide Refugia

Many of the roads located throughout the site are elevated above surrounding ground elevations. These roads provide opportunities to create high tide refugia habitat for birds and other wildlife.

3.1.1.4 Soils Suitable for Wetlands and Uplands Habitat Cover

The relatively low ground elevations throughout large areas of the LCW site provide an opportunity to restore wetlands with a minimal amount of earthwork. Based on analysis of soil samples collected in limited locations within the project site (Kinnetic 2012; Converse Consultants 1996), it appears that the onsite soils consist of sandy silts, clayey silts, and silts, as indicated in Figure 3-3. In addition, there are isolated areas of sand and gravel associated with fill activities (e.g., roads). These soils provide opportunities for onsite reuse as cover material for wetlands and upland habitat, if suitable.



Source: Kinnetic 2012

Figure 3-3. Sheppard Sand-Silt-Clay Plot of Onsite Soils

The *LCW CRP Soils Contamination and Grain Size Characteristics Report* (Kinnetic 2012) and *Soil Management Report* (Everest 2012b) provide further information relevant to the suitability of soils for various uses.

3.1.1.5 Site Location Provides Opportunities for Nearby Soil Disposal

The location of the LCW site lends itself to several options for beneficial reuse and disposal of excavated soil (Everest 2012b). The site is close to nearby beaches, which provides an opportunity for beneficial reuse of soil found suitable for placement on nearby beaches (e.g., East Beach in Seal Beach and Peninsula Beach in Long Beach). The site is located in proximity to the Ports of Long Beach and Los Angeles, both of which have occasional needs of sediment for landfill projects.

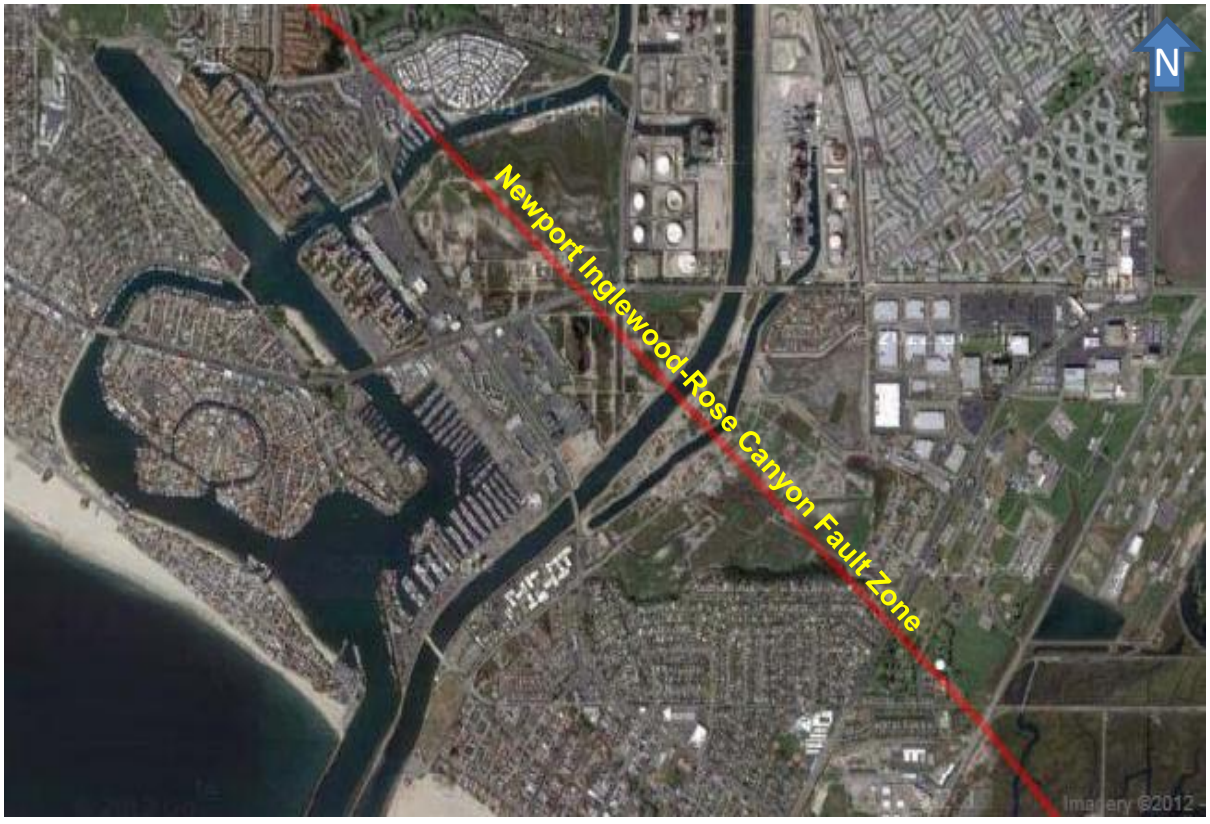
This provides an opportunity for disposal of both clean and contaminated (within limits) soil at Port landfill areas if the timing of restoration coincides with the timing of Port landfill projects.

3.1.1.6 Site Size Provides Opportunities for Onsite Remediation

Given the anticipated nature of soil contamination (see constraints below) and available space within the site, there may be opportunities to perform onsite remediation and reuse. The remediated materials provide opportunities for onsite reuse for berms, levees and upland construction (Everest 2012b). The ability to treat contaminated soil onsite would also reduce the need to transport material offsite, thereby reducing the greenhouse gas emissions associated with such transportation activities. Project costs may also be reduced with less off-site hauling and disposal.

3.1.1.7 Presence of Earthquake Fault Through Site May Be a Deterrent to Other Development

The fault line of the Newport-Inglewood-Rose Canyon Fault runs parallel to the coastline and across the site, as illustrated in Figure 3-4. The project area is subject to high earthquake risk making it is less desirable for human development and infrastructure. The presence of the fault provides an opportunity for restoration by limiting other development pressures.



Source: Caltrans (http://dap3.dot.ca.gov/shake_stable/)

Figure 3-4. Newport-Inglewood-Rose Canyon Fault Zone

3.1.2 Constraints

3.1.2.1 Historical and Current Land Uses Have Altered Natural Topography

As illustrated in Figure 3-5, historical and current oil exploration and production activities and other industrial uses have significantly altered the natural topography of the LCW complex. These uses have created extensive areas characterized by non-natural topography consisting of roads, berms, basins, and drainage channels. These alterations in natural topography generally represent constraints to restoration.

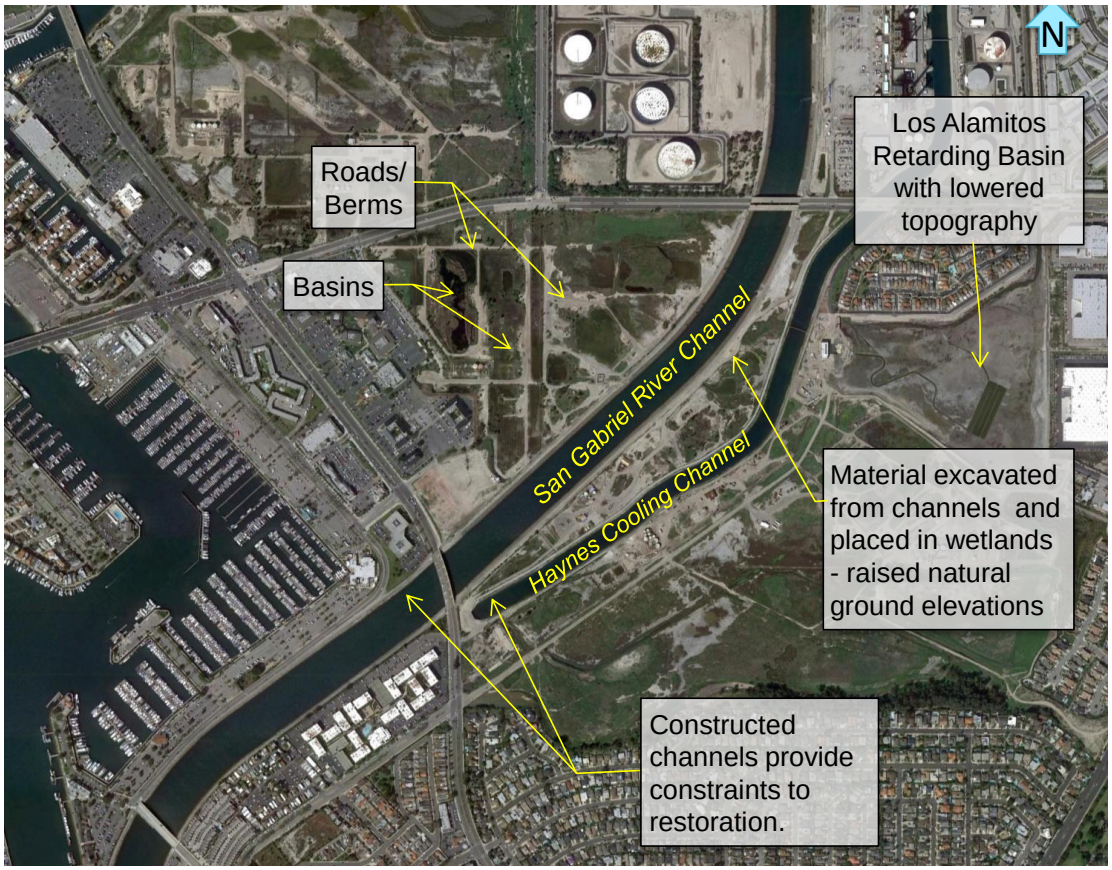


Image Source: Google Earth Pro

Figure 3-5. Non-Natural Topography

The construction of the SGR channel and Haynes Cooling Channel have substantially altered the natural topography of these areas. Although these channels provide a significant opportunity to introduce water into the LCW complex (as discussed in the following sections 3.2.1.1 and 3.2.1.2), the existing levees significantly fragment the once vast natural floodplain and subsequently constrain habitat connectivity and sedimentation throughout the LCW complex. In addition, material excavated to create these two channels was placed in the wetlands, thereby artificially raising ground elevations, especially in the portion of the site located southeast of the Haynes Cooling Channel (Hellman site).

Furthermore, substantial excavation was performed to lower the topography to create the Los Alamitos Retarding Basin; this non-natural topographic feature provides an additional constraint on habitat restoration by altering the natural habitats that would form in these areas if subject to fluvial influences and/or tidal exchange. It may provide an opportunity for material disposal, however.

A complete historical timeline of the LCW site (dating back to 1598) is available on the intoloscerritoswetlands.org CRP website. The timeline includes a chronology of the early settlers on the site and property acquisitions and development over the years.

3.1.2.2 Landform Changes Limit Natural Processes

There are numerous man-made landforms that pose constraints to restoration, many of which are shown in Figure 3-6. The levees that contain the SGR Channel pose a constraint to restoration of hydrologic functioning since the function of the levees must remain (or be replaced) in order to maintain or enhance flood protection. Likewise, as long as the Haynes Cooling Station needs ocean cooling water, the levees that define the Haynes Cooling Channel represent a constraint to restoration. The ground elevations and composition of these landforms (rock, compacted soil, and concrete) are not conducive for wetlands or any natural habitat. There are several oil berms and artificial basins located throughout the site that limit restoration options due to ground elevation, composition, and location.

Image Source: Google Earth Pro

Figure 3-6. Example Landform Constraints

All these landform features (levees, berms, and basins) have substantially altered the natural processes that existed prior to human disturbance, and now pose constraints to restoration.

3.1.2.3 Existing Soil Quality Limits Restoration Success


Oil Clean-up Operation

Owing to years of human disturbance, a large portion of the onsite soils are compacted and/or contaminated (Kinnetic 2012; Anchor Environmental 2003; Geomatrix Consultants 2001; M&N 2007). The primary contaminants are those contaminants associated with oil exploration and production operations such as burn dumps, sumps, pipeline leakage, equipment maintenance, and equipment operation. These contaminants consist primarily of petroleum hydrocarbons and related organic compounds.

It is also likely that site soils contain heavy metals and other inorganic contaminants associated with oil operations. Hydrocarbons in soil can become toxic to plants and animals if concentrations are high enough and it may be difficult or impossible to establish native plant communities on contaminated soils. Restoring tidal connections to areas with contaminated soils could result in hydrocarbon contamination of water and would be detrimental to marine organisms and could spread contamination to new areas. In addition to the contaminants, the compacted nature of existing soils in some areas of the site precludes the establishment of vegetation; resulting in fugitive dust and odor problems. Some of the likely areas expected to pose constraints within the LCWA Phase 2 property are illustrated in Figure 3-7. Other properties with historic and current land use for oil operations are likely to have similarly constrained areas.

Source: Kinnetic 2012

Figure 3-7. Sumps, Former Landfill Areas, and Waste Material Disposal Sites in the LCWA Phase 2 Property

A large volume of soil has been imported to fill areas and improve roadway bases. In addition, rubble and other debris have been brought to the site for legal and illegal waste disposal activities in the past. These landfills within and adjacent to the project site are shown in the previous Figure 3-7 and the following Figure 3-8.

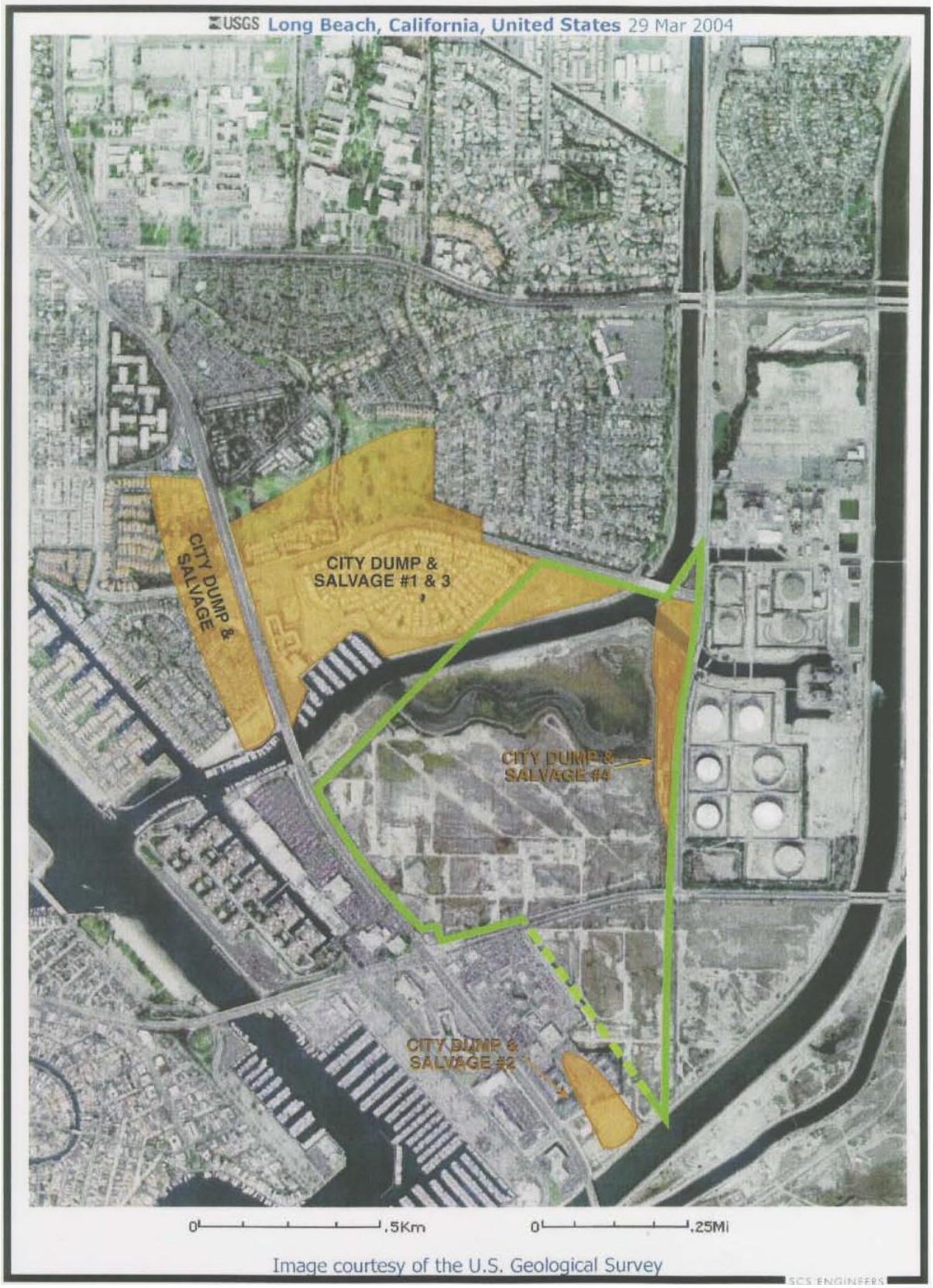


Figure 3-8. Former Landfill Area in the LCW Partners Property

Anecdotal evidence indicates that even soil salinity levels have been altered from natural conditions with relatively high soil salinities in the fill areas located within the LCWA Phase 2 area. The import of waste and fill material, combined with compaction and altered salinity levels, have all worked to substantially alter the composition and texture of soil throughout various locations within the site.

In addition, it is likely that pesticides are present in the soils because the site has captured upstream and local runoff for years and it is expected that some of that runoff contained levels of pesticides in the past. Further, excavated and dredged material from onsite and offsite locations that has been placed within the project site may contain contaminants associated with past land use practices.

The alteration of site soils poses a constraint to restoration by limiting the natural establishment of vegetation within natural habitats and at natural ground elevations. Without the implementation of soil improvement activities such as tilling, screening, leaching, and addition of soil amendments, it is likely that revegetation operations and/or natural recruitment will be less effective.

The *LCW CRP Soil Contamination and Grain Size Characteristics Report* (Kinnetic 2012) provides further information about the soil conditions of the project area.

3.1.2.4 Earthquake Fault May Constrain Oil Infrastructure Reconfiguration and/or Cause Damage to the Wetlands

The fault line of the Newport-Inglewood-Rose Canyon Fault runs parallel to the coastline and across the LCW complex. The project area is subject to high earthquake risk making it is less desirable for human development and infrastructure (opportunity discussed above). However, this fault may also constrain options for reconfiguration of oil infrastructure such that this infrastructure does not straddle the fault line. From the perspective of wetlands habitat, the presence of the fault may result in damage if a severe earthquake occurs. The wetland habitat may be damaged due to liquefaction, lateral spreading, levee/berm failure, contamination from sewage spills, and pollution from oil spills associated with ruptured pipelines and other oil exploration and production equipment. For these reasons, the presence of the Newport-Inglewood-Rose Canyon Fault represents a constraint to restoration.

3.2 Tidal Exchange / Local Watersheds / Hydrology

The opportunities and constraints related to tidal exchange, local watersheds, and hydrology are presented in this section. Tidal exchange is used in this section to describe the reintroduction of ocean water into the site. Local watersheds are the drainage areas that supply runoff to the site via flood control channels, channels, culverts, and surface runoff and precipitation. The hydrology discussion in this section includes other issues related to hydrology such as groundwater and water quality. Detailed discussion on tidal hydraulics and the LCW watershed can be found in the *LCW CRP Hydrologic and Hydraulic Baseline Report* (M&N 2011) and *Watershed Impacts Report* (Everest 2012), respectively.

3.2.1 Opportunities

3.2.1.1 Site Location Provides Tidal Exchange Enhancement Opportunities

With the exception of the SGR Channel, the Haynes Cooling Channel and the Steam Shovel Slough, the entire site is cut off from tidal exchange. In addition, a leaky flap-gate on a storm drain provides a muted tide range to a small portion of the LCWA Phase 1 and 2 properties. As shown in Figure 3-9, the site is situated in close proximity to several tidally-influenced water bodies, including the SGR, the Los Cerritos Channel and the Haynes Channel. Figure 3-9 shows the general direction of water flow in these waterways based on existing power plant operations and also shows other existing hydraulic features on and adjacent to the LCW complex.

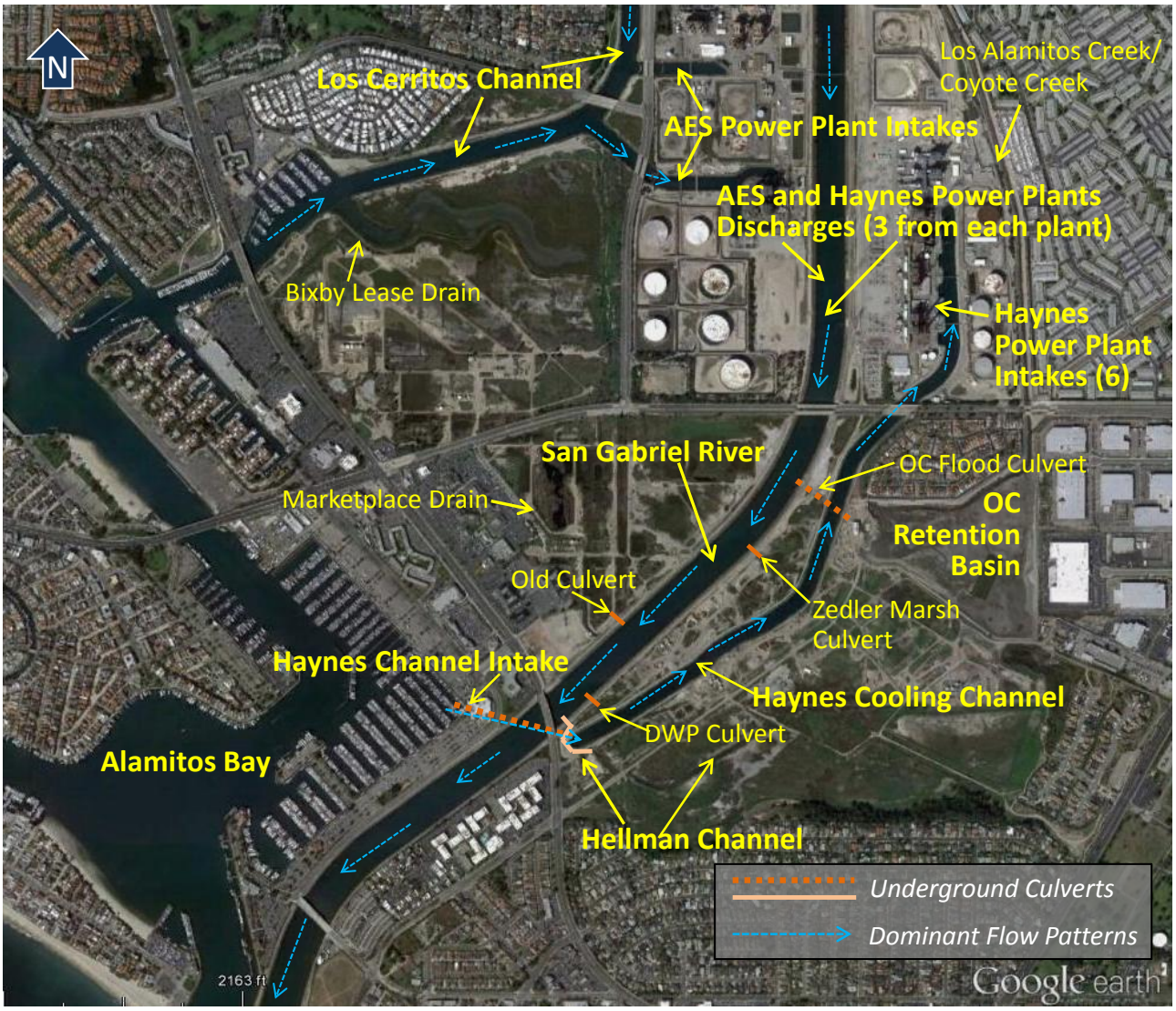


Figure 3-9. Existing Hydraulic Features In and Surrounding the LCW Complex

The close proximity to the SGR, Haynes Channel, and Los Cerritos Channel provides multiple opportunities to restore tidal exchange throughout the site by connecting to these water bodies with open channels and/or culverts (M&N 2011).

There are storm drains in the SGR Channel levees that allow drainage of local runoff from the site into the river. With minimal modification (e.g., installation of tide gates), these storm drains offer an opportunity to provide limited tidal exchange. Although such changes would be of limited scope in terms of extent (area) and range (muted tide range), this represents an opportunity to provide limited tidal exchange in the early phases of a multi-phased restoration approach.

3.2.1.2 Site Location Provides Freshwater Enhancement Opportunities

The location of the site adjacent to and between the Los Cerritos Channel and the SGR provides opportunities to enhance freshwater influence by tapping into those water sources (Sheng and Wilson 2009; M&N 2011). At the low end of the enhancement spectrum, culverts could be used to provide limited freshwater inputs throughout small targeted portions of the site. For example, controlled pulses of freshwater could be redirected from the river channels and/or storm drains into portions of the site. At the high end of the enhancement spectrum, portions of the levees could be removed, thereby providing freshwater influence over a larger area and during a greater duration. Of course, flood protection would have to be maintained or improved at all times so substantial manipulation of the levees would have to include the provision of adequate flood protection through other means (e.g., raising of elevations elsewhere, infrastructure relocation/removal, or pumping).

In addition to direct precipitation, the site currently receives runoff from adjacent properties such as the surface runoff coming from the Marketplace retail area that drains into the City of Long Beach / Marketplace Marsh property (Everest 2012a). Although this water likely contains pollutants associated with urban land uses, it provides a good source of water that has helped to maintain Marketplace Marsh, and it provides an example of the opportunities that such water sources can provide for restoration. To that end, the proximity of the site to adjacent lands provides additional opportunities to divert and utilize local runoff for restoration. Such opportunities include local roadways and lands surrounding the LCW Partners, the LCWA Phase 1, and the LCWA Phase 2 properties.

3.2.1.3 Altered Geomorphology Minimizes Sedimentation-Related Maintenance

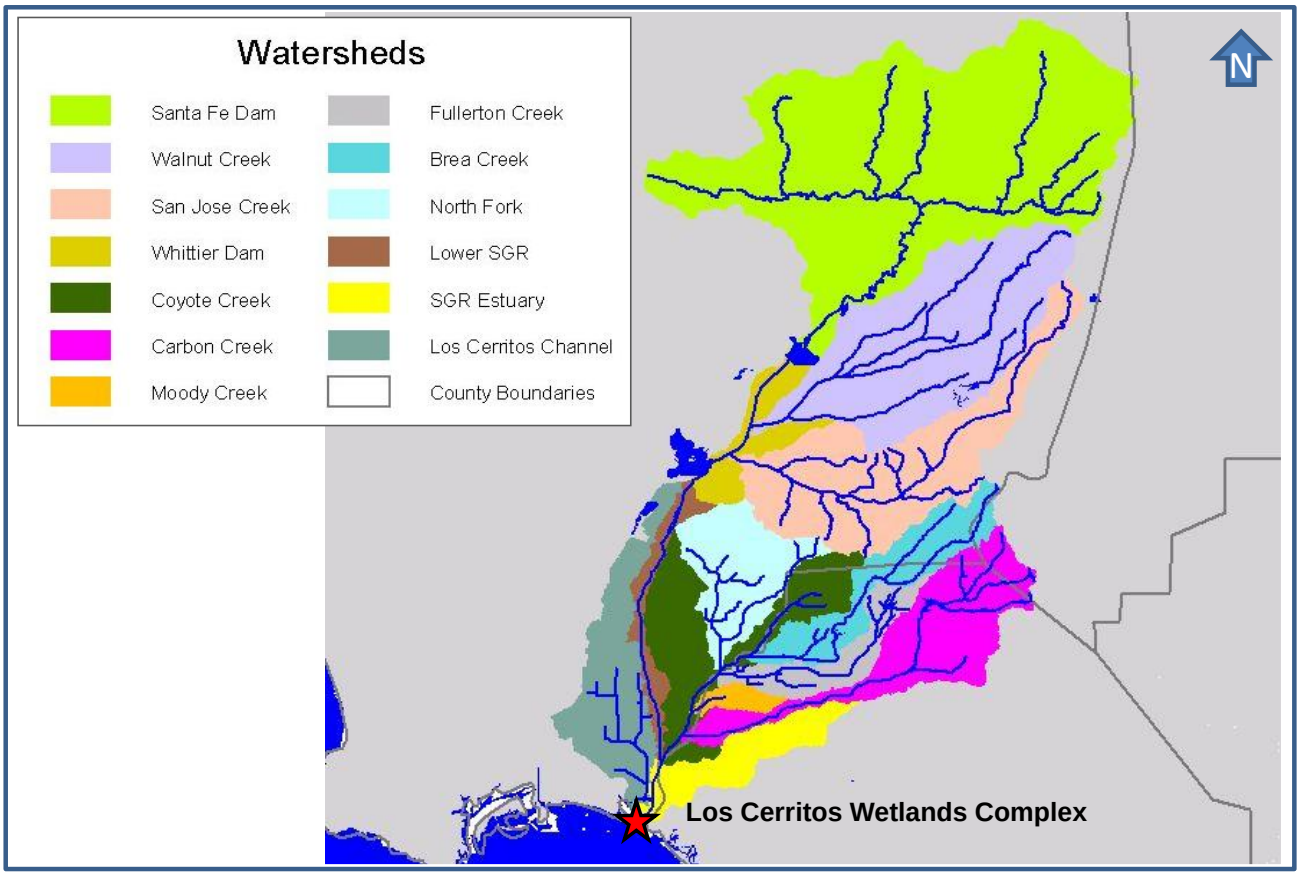
The SGR and Los Cerritos Channel are highly controlled water bodies with concrete-lined channels as well as reservoirs and debris basins in the upstream areas. These features change the amount and type of sediment that reaches the site. The result is an overall reduction in sediment and a relative increase in the portion of fine-grained (e.g., silt and clay) versus large grained (e.g., sand and gravel) sediment.

In addition, the presence of the Long Beach Breakwater and SGR Jetties reduces the longshore transport of littoral sediment (sand) that reaches the site. The net effect of these human alterations is that the site is morphologically stable with relatively low levels of erosion or sedimentation. This provides an opportunity to restore coastal wetland habitats in an area that will not require expensive excavation and dredging to remove fluvial and/or littoral sediments.

3.2.1.4 Watershed Activities Will Provide Improved Water Quality

Figure 3-10 shows the overall watershed area of the LCW complex. There are numerous ongoing and planned activities in the upstream watersheds as well as in the local watersheds surrounding the site. These were assessed as part of Task 4 of this study and documented in the *LCW CRP Watershed Impact Report* (Everest 2012a). The following watershed activities or water quality improvement projects were identified as potentially significantly impacting the LCW complex:

- The development and implementation of total maximum daily loads (TMDLs) in the upper watersheds is expected to result in substantial improvements to water quality (trash, metals, pesticides, and nutrients) in the Los Cerritos Channel and the SGR.
- There are plans to significantly reduce or eliminate the cooling water intake for both the AES Power Station and Haynes Power Station, which would alter circulation patterns and associated discharges these two facilities have on water quality within the lower reach of the SGR.
- Within the local watersheds, ongoing activities to reduce pollutants (e.g., trash collection) are expected to continue at current or increased levels in the future and these activities are expected to improve water quality in the future. In addition, it is anticipated that the Cities of Long Beach and Seal Beach will increase the implementation of Best Management Practices (e.g., catch basin inserts, trash screens, and continuous deflective separation units) throughout the local watersheds to reduce the amount and type of pollutants that reach the LCW site.



Source: Everest International Consultants 2012

Figure 3-10. Watershed Areas Draining to the LCW Complex

The implementation of ongoing and planned watershed activities represents an opportunity to restoration by providing improved water quality in the future.

3.2.2 Constraints

3.2.2.1 Human Disturbance Has Altered Tidal Exchange

The infrastructure and grading changes associated with decades of human disturbance have significantly altered the natural processes that provided tidal exchange to the wetlands (M&N 2011). Levees and berms have isolated most of the site from natural sources of tidal exchange via open channels. Hydraulic control structures (storm drains and culverts) limit tidal exchange to the small area that still receives some tidal influence.

The Steam Shovel Slough, the SGR, and the Haynes Cooling Channel do maintain various levels of tidal exchange; however, natural processes have been altered substantially.

The Haynes Cooling Channel receives tidal exchange via an inverted siphon that runs under the SGR; however, that source of tidal exchange is constrained for use in restoration because the operators of the Haynes Power Station are concerned about impacts to the quality of their water associated with restoration activities. The location of the Haynes Cooling Channel presents an access constraint to the SGR as it limits the ability to easily connect the SGR to the LCWA Phase 2 property. Currently a small, leaky (propped-open tide gate) storm drain provides limited tidal exchange to the LCWA Phase 2 property; while this connection could be improved, space in the area is limited, thereby presenting a constraint to tap into this water source.

The AES Power Station draws cooling water through Alamitos Bay via the Los Cerritos Channel. While this does improve the overall circulation within Alamitos Bay, it significantly alters natural tidal exchange since it represents an additional (artificial) flood tide component that impacts Steam Shovel Slough and nearby areas. Existing levees and berms constrain opportunities to tap into Steam Shovel Slough to enhance tidal exchange while the influence of the AES Power Station impacts the tidal exchange that can be achieved.

3.2.2.2 Human Disturbance Has Altered Freshwater Hydrologic Functioning

The infrastructure and grading changes associated with decades of human disturbance have significantly altered the natural processes that provide freshwater hydrologic functioning to the wetlands. Levees and berms have isolated most of the site from natural sources of freshwater influence by disconnecting and/or eliminating the connection between the river channel and its floodplain. Hydraulic control structures (storm drains and culverts) limit freshwater influence for the remaining sources of water that do reach the site.

Even if the site were connected to the floodplain, there would still be substantial constraints associated with the seasonality and duration of upstream freshwater flow inputs (M&N 2011). This is because numerous upstream controls have been built in the past that substantially alter natural flow regimes. For example, upstream dams and reservoirs can trap so much water in the upstream areas that the river can be almost dry during storm events. The net result of these impacts is that sources of freshwater influence are now limited to direct precipitation onto the LCW site and local runoff from adjacent properties.

3.2.2.3 Human Disturbance Has Altered Geomorphology

Highly controlled water bodies in the upstream areas include the concrete-lined SGR and the Los Cerritos Channel, as well as reservoirs and debris basins. These features change the amount and type of sediment that reaches the site. The result is an overall reduction in sediment and a relative increase in the portion of fine-grained (e.g., silt and clay) versus large grained (e.g., sand and gravel) sediment. In addition, the presence of the Long Beach Breakwater and the SGR jetties reduces the longshore transport of littoral sediment (sand) that reaches the site.

The net effect of these human alterations is that the site is morphologically stable with relatively low levels of erosion or sedimentation. This poses a constraint to the restoration of wetlands habitats because natural processes rely on sediment inputs to maintain geomorphic processes. For example, in the presence of natural geomorphic processes sediment inputs from upstream would replenish sediment washed away from the wetlands during large storm events; however, if upstream sediment inputs are reduced then the wetlands may erode during storm events. Occasional inputs of upstream sediment would also provide fresh sources of nutrients and other organic material that can help to maintain healthy ecological processes within the wetlands. The alteration of natural geomorphology represents a constraint to restoration.

3.2.2.4 Poor Water Quality Can Impair Restoration Success

The watershed area of the LCW complex is primarily comprised of urban land uses from the SGR and Los Cerritos Channel with California 303(d) list impairments including metals and trash (Everest 2012a). The quality of water currently entering the LCW site is largely unknown because there is limited data. However, the local runoff most likely contains urban pollutants commonly associated with urban land uses such as trash, nutrients, metals, and bacteria.

The quality of water coming down the two rivers (SGR and Los Cerritos Channel) is impacted by trash, metals, nutrients, and pesticides associated with upstream land uses (California

Trash in Los Cerritos Channel Near Power Plant Intake

Regional Water Quality Control Board (RWQCB) 2000a & 2000b; Stein and Ackerman 2007; Schiff et. al., 2006; Sheng and Wilson 2009). Discharges from all facilities draining to the area of the wetlands restoration site are regulated by permits issued by the Regional Water Quality Control Board (California RWQCB 2000c, 2000d, and 2004). The permits contain limitations

on constituents in the discharges including temperature. The two power plants which discharge to the San Gabriel River Estuary have been in violation of their temperature limitations approximately a dozen times over the past decade (Birosik 2012). The discharges in general result in elevated water temperatures in the lower reach of the SGR (California RWQCB 2000c, 2000d, and 2004).

The water quality of upstream and local water sources poses a constraint to restoration. Trash also presents an aesthetic impact to humans and it can impact wildlife in numerous ways. Elevated metals and other chemical pollutants can impair vegetation and adversely impact wildlife. Elevated water temperatures can also impact aquatic wildlife by precluding site use by some species while stressing some of the wildlife that use the site. Poor water quality poses a constraint to restoration.

3.3 Ecology

There is potential for a large and high-functioning restoration project at the LCW complex. The potential to enhance substantial areas of rare wetland habitats on the LCW site comes from the current condition with large areas of degraded low elevation habitat, proximity to tidal waters, and space available for movement of salt marsh habitats as sea level rises. Also, the opportunity now exists to consider the priorities for acreages of different habitat types as sea level rises. Within the LCW complex, there are currently a variety of special status species using both high quality remnant habitats and degraded areas (Tidal Influence 2012). The opportunity for restoration of high-functioning wetlands at the site would provide sensitive species with larger and less-fragmented habitat areas. In some cases, the sensitive elements of the ecosystem in this project area may constrain potential alternatives aimed at reaching the goals of this restoration project, as discussed in Section 3.3.2.1 below.

The historic 2,400-acre LCW complex included open water, subtidal marine water, coastal salt marsh, freshwater wetland types, salt flats, and surrounding uplands. Present day, this habitat area has been reduced to around 500 acres of open space, of which approximately 50 acres are high-functioning tidal wetlands. Much of the 500 acres are: 1) filled with salty dredge material which does not support native plant communities; 2) isolated from tidal exchange; and 3) converted to ruderal upland habitats and disturbed wetland remnants. This history of disturbance has led to a reduction in ecologically-functional habitat through the alteration of food webs. Food webs are altered by a shift in dynamics of top and mid-level predator populations, loss of large grazers, extirpated endemic species, small populations of surviving native organisms, alteration of larval and propagule dispersal dynamics, and the proliferation of vast invasive plant populations. Consequently, any remaining functional habitats should be recognized as valuable resources worth protecting through the restoration process.

3.3.1 Opportunities

With so much of this project area being disturbed, there are expansive areas with the potential to be converted into a structurally and functionally diverse array of coastal habitat types that: 1) expand

on existing habitat areas; 2) introduce new desired habitat types; or 3) offer habitat for special status species. This can all be accomplished without altering existing valuable habitat areas. The LCW is also in close proximity to the Seal Beach National Wildlife Refuge and connected to the SGR wildlife corridor and the Pacific Ocean; all with the potential to introduce mobile wildlife to the site. In addition, the site receives freshwater run-off from surrounding urban areas which might help support a diversity of wetland habitats.

3.3.1.1 Existing Ecologically-Valuable Areas

The remaining ecologically valuable areas which exist on site offer opportunities and potential models for this restoration project. These sites include: a) Steam Shovel Slough with its natural geomorphological form; b) Zedler Marsh; and c) Hellman Lowlands. For these sites, there are opportunities for expanding and/or improving the existing tidal habitats with small-scale, cost effective enhancements such as removing old collapsed culverts, perforation of existing dikes, and other small hydraulic alterations to increase tidal exchange. These sites also provide opportunities for restoration through community-based stewardship programming and effective land management (discussed further in Sections 3.6.1.2 and 3.6.1.3).

The *LCW CRP Habitat Assessment Report* (Tidal Influence 2012) provides a detailed analysis of existing and potential habitat types at Los Cerritos Wetlands, based on recent and previous technical studies.

3.3.1.2 Habitat Potential for Degraded Land Areas

The large expanses of heavily degraded land throughout the wetlands complex offer the opportunity for the introduction of appropriate habitat types that are not present, but are desirable or appropriate. For example, the LCW presently does not support intact natural coastal sage scrub habitat. However, the presence of remnant individual plants like *Malosma laurina* (laurel sumac), *Artemisia californica* (California sagebrush), and *Cleome isomeris* (bladderpod) indicates that this plant community can be established. Additionally, simply creating depressions perched above the water table in low lying areas can eventually lead to the establishment of wetland habitat.

3.3.1.3 Existing Special Status Species

There are opportunities to enhance habitats for sensitive species in both degraded and higher functioning areas of the LCW complex.

Birds

Belding's Savannah Sparrows use both highly valuable tidal salt marsh areas of the Hellman Lowlands, Zedler Marsh, and Steam Shovel Slough, and in low quality non-tidal wetlands areas on the LCWA Phase 1 property and the LCW Partner's parcel. California least terns have been observed foraging in shallow water habitats in the same areas, as well as in the Haynes Channel, the SGR, and the Los Cerritos Channel. Burrowing owls have been observed using pipes and holes in active industrial areas of the LCW complex. There are opportunities to enhance habitats for these species by increasing high quality habitat at the site.

Other Animals

The Pacific green sea turtle is found in the SGR year-round. Reconfiguration of the river levees might offer an opportunity to provide more resources for this species. Several rare insect species also inhabit the LCW, including the wandering skipper butterfly and several species of tiger beetle.

Plants

Southern tarplant (*Centromadia parryi* ssp. *australi)* thrives in disturbed conditions. This plant has extensive populations throughout the wetland complex. The populations are concentrated in areas that are consistently disturbed, including areas within oil operation easements. Other special status plant species that exist on site, (e.g. *Suaeda esteroa*), depend on tidal salt marsh conditions.

The presence of these plants on the LCW site provides the potential for local seed dispersal in the restoration project. Restoration could include introduction of rare and extirpated plant species like *Nemacaulis denuadata denuadata* (coast wooly heads) and *Cordylanthus maritimus maritimus* (salt marsh bird's beak).

3.3.1.4 Potential for Freshwater Habitat

The seasonal input and artificial year-round flows of freshwater into the LCW site offers an opportunity to capture and cleanse run-off and support freshwater wetland habitats. This opportunity is exemplified by the Heron Pointe bioswale project that captures run-off from the adjacent residential community and drains into a large freshwater marsh.

3.3.1.5 Conversion of Upland Areas to Wetlands Habitat Area

Weed-infested, highly disturbed, and unvegetated upland areas are currently extensive at the LCW complex due to historical impacts and current management (e.g. fuel/fire breaks). The LCWA Phase 2 property has the potential for conversion of upland into tidal wetlands habitat and allowing for upslope transgression of habitat during potential future SLR (discussed in a following section).

The bioswale created as part of the Heron Pointe development is an excellent example of the opportunities to convert upland area into freshwater wetlands. This project not only has created the best freshwater wetlands habitat in the area, but also successful capture and controls run-off from the adjacent development. There are several other upland locations throughout the complex that have the opportunity to be converted in a similar manner.

3.3.1.6 Adjacency to Wildlife Corridors and Connectedness

The adjacency of wildlife sources like the Seal Beach National Wildlife Refuge, the SGR wildlife corridor, and the Pacific Ocean offer the opportunity to accommodate mobile species that may migrate between urban natural spaces. The Seal Beach National Wildlife Refuge contains over 900

acres of coastal salt marsh habitat that is connected to the LCW via a wildlife corridor that runs just south of the Heron Pointe residential community.

The SGR is a major wildlife corridor that connects the San Gabriel Mountains and the Pacific Ocean to the LCW. Terrestrial wildlife, like coyotes, utilize the River to traverse urbanized areas as they travel from El Dorado Nature Center, and other open spaces in the watershed, to LCW. The River's open connection to the Pacific Ocean allows for the Pacific green sea turtles to enter the LCW complex and also offers the opportunity for the restoration project to provide nursery habitat for important commercial and recreational fish stocks.

This site provides a great opportunity to reduce/remove/alter impediments that block the daily migration of mobile organisms, while still providing flood protection, taking sea level rise into consideration, and not disturbing existing developments. Connectedness could be much improved by removing portions of levees along the SGR, Haynes Cooling Channel, and/or Los Cerritos Channel, or by creating wildlife tunnels or bridges over/under major roadways like 2nd Street or Seal Beach Boulevard that fragment the site internally and externally.

3.3.2 Constraints

No ecological constraints that would preclude extensive salt marsh restoration within the project area were identified. There are important constraints, however, that will need to be considered as alternative restoration designs are developed. Four main types of ecological constraints to restoration at the LCW were identified: 1) existing biological resources; 2) simplified food webs; 3) the urban context of the site; and 4) contaminated soils. The latter constraints are discussed in Sections 3.6.2.1 and 3.1.2.3, respectively. The first two are discussed below.

3.3.2.1 Protection of Existing Sensitive Resources

The LCW currently supports a range of sensitive species. The need to minimize negative impacts to these species will constrain some potential restoration strategies. Restoration designs should seek to limit short-term disturbance and provide opportunities for long-term expansion and persistence of populations. However, as the habitats on the site change due to restoration activities and SLR, the site may not support all the same species that it does today.

Birds

Three special status bird species, Belding's savannah sparrow, California least tern, and burrowing owl, actively use the LCW. Of these three, the State endangered Belding's Savannah Sparrow is the only one known to nest on site. This species is endemic to Southern California and Northern Baja California salt marshes. It breeds only in pickle weed marsh habitat and only occasionally leaves the salt marsh to forage (usually to adjacent beaches). Belding's savannah sparrows are currently known to inhabit tidal and non-tidal pickle weed habitat throughout the LCW. Individuals of this species do not tend to move long distances within marshes; however, little is known of their ability to relocate in response to restoration actions. Great caution should be taken when grading or

re-introducing tides to known breeding areas; these actions should only be undertaken outside of breeding season. Restoration of tidal salt marsh habitat should greatly benefit this species.

The federally endangered California least tern uses open-water habitats within the LCW for foraging. These birds do not currently nest on site, but there are historic breeding records for the area. Restoration actions may lead to temporary changes in visitation to the site since this species is highly mobile. Impacts to this species can be avoided by seasonally timing restoration actions and designing for increased open-water foraging habitat. Restoration of tidal salt marsh will increase the foraging area for this species.


Burrowing Owl

Burrowing owls are not state or federally protected, but are listed as second priority California Bird Species of Concern by the California Department of Fish and Game (CDFG). Burrowing owls nest underground, typically in abandoned mammal burrows, however they are not currently known to nest within the LCW. Burrowing owls have been observed onsite, outside of breeding season, using ground squirrel burrows.

A variety of other California Bird Species of Concern have been documented at the LCW. These species include the American white pelican, loggerhead shrike, northern harrier, short-eared owl, yellow-breasted chat, and black skimmer. Other species covered by the Migratory Species Act have been identified at the LCW as well. Restoration actions will need to be timed so as not to have negative impacts on these species.

The large eucalyptus trees at Gum Grove Park are used by several species of raptors for nesting. Many of these birds forage in the open, weedy uplands nearby. The California Coastal Commission has required that nine acres of grassland be restored on the LCWA Phase 2 parcel for raptor foraging. The footprint of this area has been defined and approved. Its current location may interfere with opportunities for tidal wetlands restoration on that acreage. However, there is the potential to work with Coastal Commission staff to relocate this required grassland habitat to an upland area that has less potential to be restored to tidal wetlands. An excellent location could be Area 18 (northeast area of the LCWA Phase 2 property, see Figure 3-7), which is likely to remain uplands due to constraints from existing contamination and oil infrastructure.

Other Animals

The federally threatened Pacific green sea turtles actively use the SGR year round. This species is attracted to the site because of warm effluent from the up-stream power plants. Restoration actions within the SGR could potentially impact this species. As part of the *Watershed Impact Report,* (Everest 2012a), the CWA Section 316(b) compliance was identified to have the potential to affect restoration efforts due to changes to hydraulic and hydrologic conditions in the LCW complex.

There are currently plans to decommission the power plants (i.e., eliminating power generating station discharges into the SGR) so the long-term trajectory for this species at the site is not known.

The wandering skipper butterfly has been identified throughout the LCW. This rare butterfly uses salt grass (*Distichlis spicata*) as a larval food plant. Several species of tiger beetle also occur at the LCW. These rare and specialized insects are known to be highly sensitive to habitat disturbance and are an important species in salt panne communities.

Coyotes are active throughout the LCW, and while they are not a special status species, they play a critical role in the ecosystem as a top carnivore. The protection of habitat for coyotes will ensure that populations of small mammalian herbivores, like Audubon cottontail rabbits and California ground squirrels, are controlled.

Plants

Several sensitive plant species are found within the LCW. Their presence is generally less of a constraint to restoration actions than the presence of sensitive animals. For instance, if areas where these plants currently occur are to be altered, propagule collection and plant salvaging, and subsequent planting on restored sites will adequately protect these species.

3.3.2.2 Simplified Food Webs

As habitats are fragmented and isolated, native species are lost and food webs are altered. Restoration actions can increase biodiversity and improve the health of food webs, but it is often impossible or implausible to re-introduce critical organisms. The consequences of simplified food webs are often difficult to predict.

3.4 Climate Change

The earth's surface will experience substantial changes over the next century as the climate changes with increasing CO_2 concentrations, warming temperatures and sea level rise (SLR). Low lying coastal areas in southern California will probably experience important shifts in many climatological factors, including increasing average and extreme temperatures, altered intensity

and seasonality of storms, drought cycles and wildfire regimes. In addition, nearshore ocean waters may experience changes in sea surface temperature, ocean acidification and related factors.

All of these factors have the potential to drive changes in the ecological communities along the California coast. Changing climate will have important effects on native habitats, communities and species. In coastal salt marshes, where physiological challenges for plants currently include summer drought, high salt concentrations and at least occasional inundation by seawater, projections for increasing temperatures, longer droughts would lead to changes in evaporation, soil moisture and salinity in high marsh and transition zones. These physical changes are important in controlling productivity, competitive interactions, zonation and diversity of salt marsh communities. Some of these physical changes may be sufficiently large to drive local extinctions of populations (as species ranges shift northward), or to make habitats suitable for colonization for species currently distributed further to the south.

Researchers are already documenting shifting ranges and altered phenologies in both plants and animals in response to the changing climate. Recent projections suggest that a majority of endemic California plants will lose more than 80% of their current ranges within 100 years due to climate change (Loarie et al, 2008).

On the positive side, there are opportunities to consider assisted migration strategies for conserving biological diversity and functions in the Los Cerritos Wetlands given: a) the early stages of restoration planning for the site, b) the potential to incorporate long-term planning horizons and c) the fragmented nature of southern California coastal wetland habitat. On the flip side, there will likely be additional loss of native biodiversity in fragmented wetland habitats with climate change.

Sea Level Rise

Sea level is rising and the rate of rise will continue to increase over time. There is a broad range of predictions for SLR, with current model scenarios predicting 18 cm (7 inches) to 5 m (16 feet) of rise over the next century (Hanson 2007; IPCC 2007; Rahmstorf 2007). The most likely outcomes of 60 cm rise by 2065 and 140 cm by 2100 (IPCC 2001, the California Natural Resources Agency, 2009 and 2010, California State Coastal Conservancy 2009) or even lower projections (Houston and Dean 2011) will cause dramatic changes to tidal and low elevation upland habitats in Southern California. There are two main ways that salt marsh habitats can adapt to rising sea level: 1) migration of habitats up-slope; and 2) accretion (sedimentation) in equilibrium with SLR.

Migration of Habitats (Elevation)

As sea level rises, all intertidal elevations within salt marshes will be inundated more frequently. This will cause low marsh habitat to convert to mudflat and subtidal habitat; mid marsh to convert to low marsh; and so on. Non-tidal areas (uplands) will start to be influenced by tides and convert to transitional and salt marsh habitat. However, uplands surrounding most Southern California salt marshes have been developed, limiting the potential for up-slope migration. Without mitigating circumstances, many of our coastal salt marshes will be converted to marine (subtidal) habitats

within the next century under even fairly conservative SLR estimates. The proportions of different types will change with rising sea level, and certain habitats may be eliminated in some areas.

Sedimentation

Intertidal marshes may be able to adjust to slowly increasing sea levels if there is adequate suspended sediment in the tidal waters from fluvial sources. Suspended sediment can settle out in the quiet waters of tidal salt marshes and raise the elevation of the sediment surface. In natural salt marshes, an equilibrium is reached that results in the typical marsh geomorphology seen in reference systems: broad marsh plains (mid marsh) with low-gradient transitions to low marsh and high marsh habitats. It is not clear yet whether this equilibrium will be maintained with SLR even in cases where there is appropriate sediment available. Some models predict that accretion will be higher at lower tidal elevations where inundation time is longer. This would contribute to long-term resilience of existing habits. Nevertheless, natural accretion, in cases where suitable sediment supply exists, holds the highest potential for mitigation of tidal wetland loss from SLR in many Southern California systems.

Responses to SLR

There will be widespread and unpredictable human responses to climate change and SLR. Owners (public and private) of low-lying properties adjacent to waterways, wetlands and along the coast will seek to protect their interests from flooding. Strategies to provide flood protection will have direct effects on the hydrology and sediment budget of adjacent habitats. Probable flood protection strategies include increased levee heights (resulting in placement loss of habitats), and efforts to detain flows upstream (altering sediment and freshwater flows).

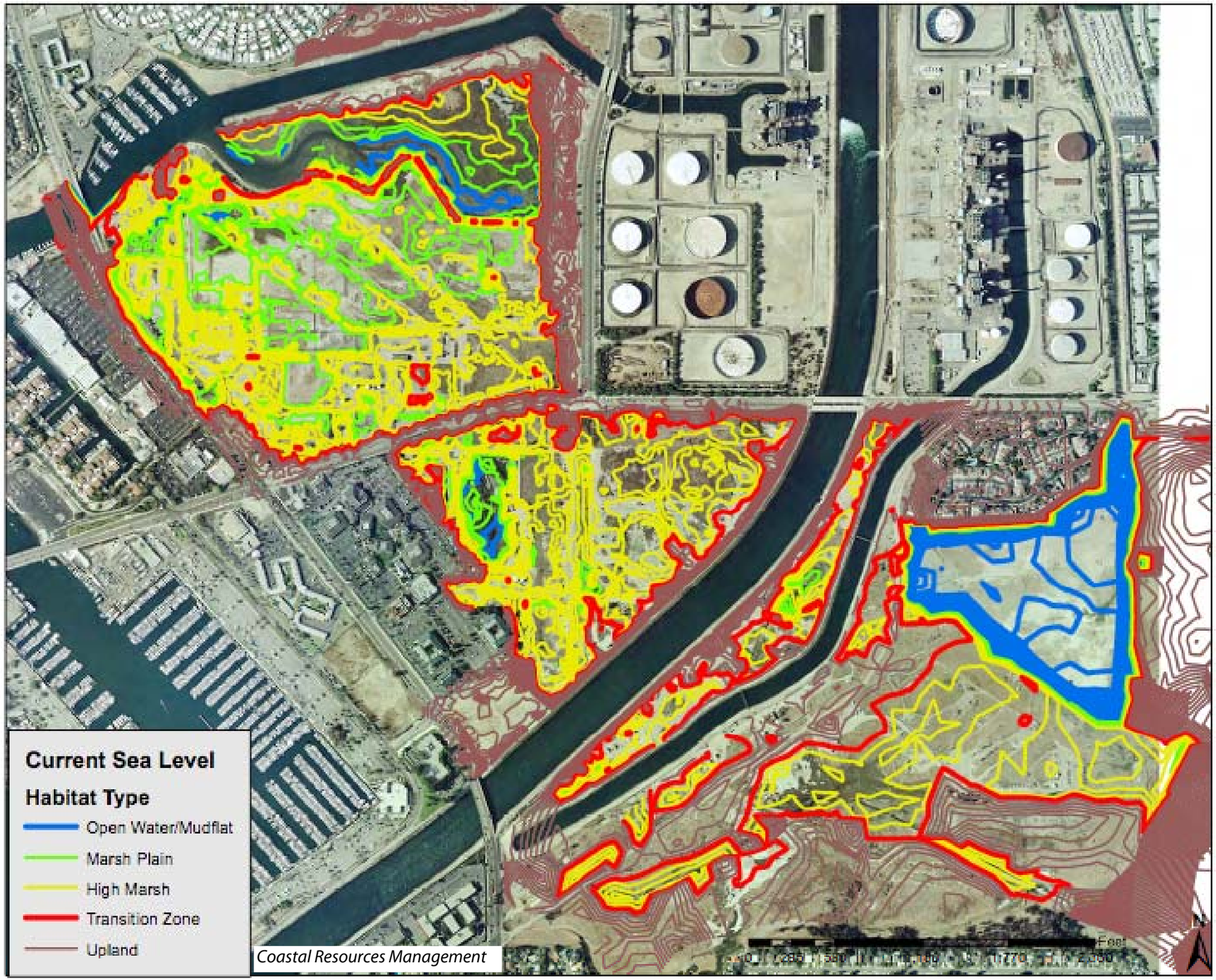
SLR and Restoration Design

At the LCW, there are multiple opportunities to integrate climate change and SLR into restoration designs that will maximize ecological diversity over time, reduce the cost of restoration, and provide benefits to neighbors. Climate change and SLR also place important constraints on potential restoration strategies. The following overview of opportunities and constraints related to climate change and SLR will be used to guide conceptual restoration designs.

3.4.1 Opportunities

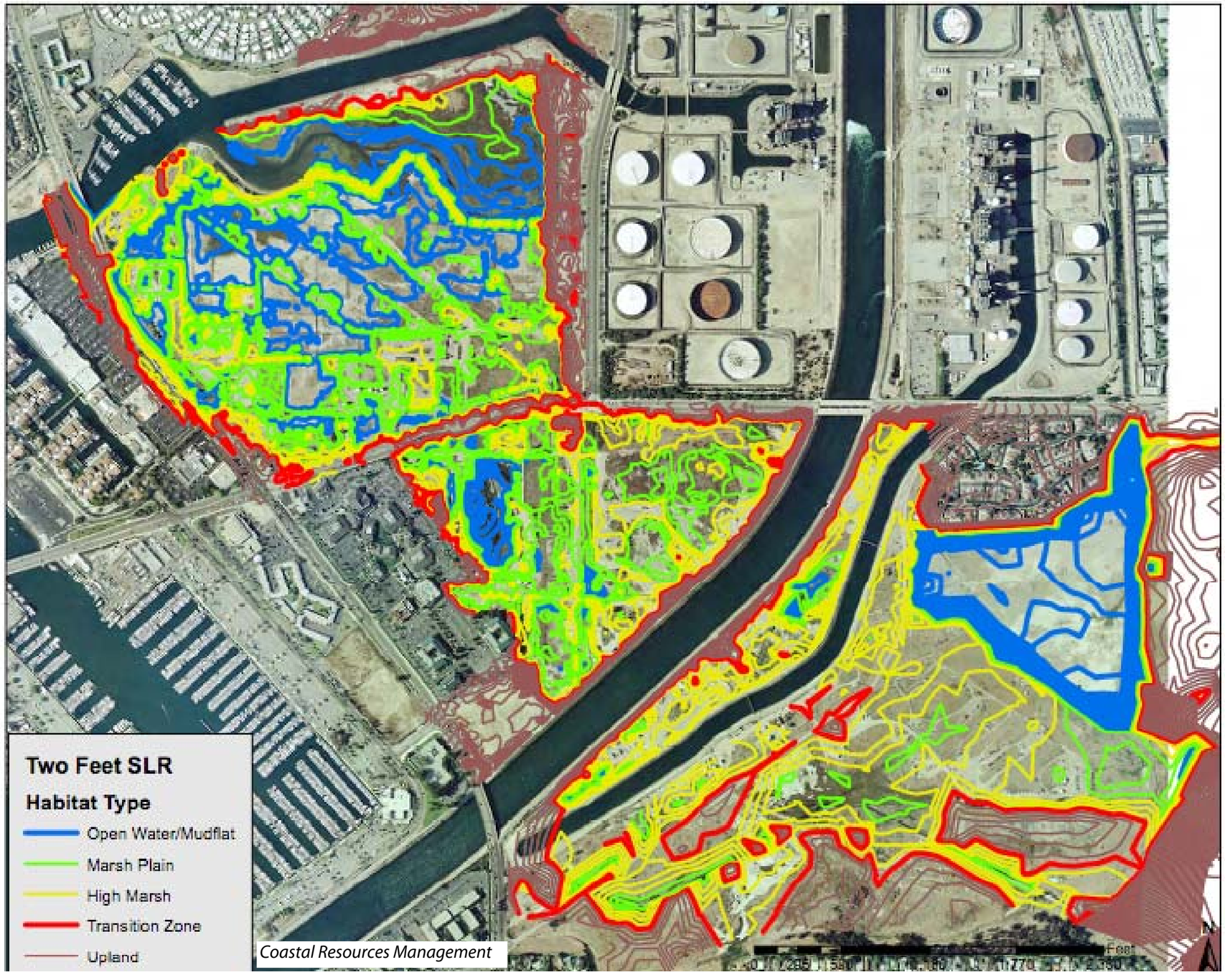
3.4.1.1 Utilization of Sea Level Rise for Tidal Exchange

SLR alone could restore tidal hydrology to much of the LCW complex if adequate connections are made to adjacent tidal waters (see Figure 3-11through Figure 3-13). Assuming restoration of tidal exchange of the three biggest areas of the LCW complex (Hellman, Marketplace Marsh and habitats adjacent to Steam Shovel Slough) the general response to SLR will be conversion of low elevation upland to wetland, low intertidal habitat to subtidal habitat, and increasing inundation of other intertidal levels. Where there is room to accommodate upslope transgression, the sequence of habitats will shift to higher elevations. Where there is no room for upslope transgression, the system will lose high intertidal habitats.



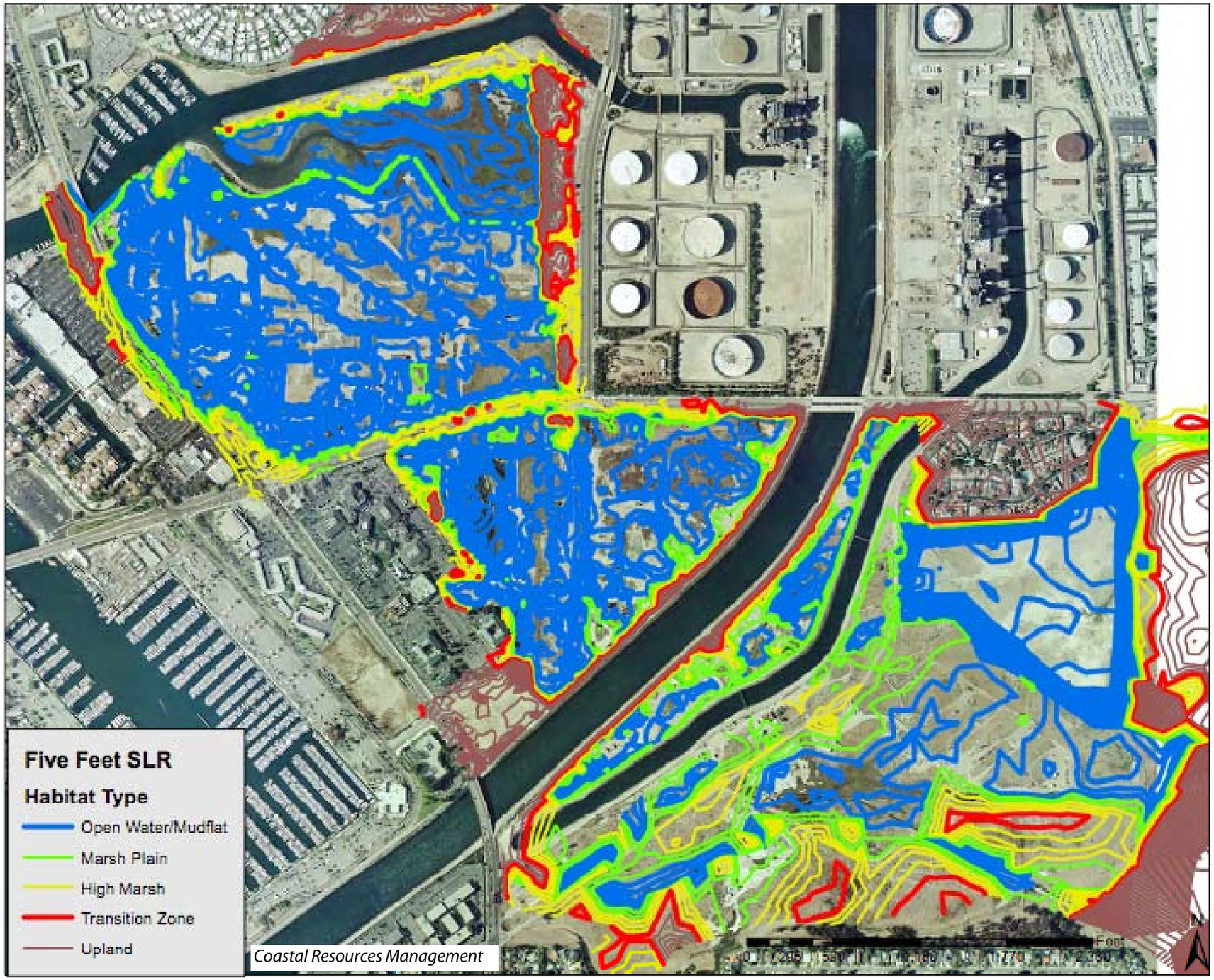
Note: This graphic is for conceptual purposes only. Due to potential inaccuracies in the topographic survey base file, application of this data is limited.

Figure 3-11. Theoretical Habitat Types Based on Existing Elevations and Current Sea Level



Note: This graphic is for conceptual purposes only. Due to potential inaccuracies in the topographic survey base file, application of this data is limited.

Figure 3-12. Theoretical Habitat Types Based on Existing Elevations and Future Potential Two-Feet Sea Level Rise



Note: This graphic is for conceptual purposes only. Due to potential inaccuracies in the topographic survey base file, application of this data is limited.

Figure 3-13. Theoretical Habitat Types Based on Existing Elevations and Future Potential Five-Feet Sea Level Rise

Inundation of Marketplace Marsh and Bryant Parcels after Rain Event (2005-2006)

Inundation of LCW Partners Parcel After Rain Event (Winter 2005-2006)

Wetlands will expand on the sites where tidal connections are present. With tidal connections, a 2-foot rise in sea level would produce expanded areas of subtidal and low intertidal habitat as upland and high marsh areas were reduced in Marketplace Marsh and south of Steam Shovel Slough. The higher elevations across large areas of the Hellman property would limit the amount of habitat transgression. With a 5-foot rise in sea level substantial areas of the entire LCW complex would be inundated at high tide and habitat conversion would be dramatic.

3.4.1.2 Existing Hellman Topography Provides for Habitat Adjustment

Most of the LCW complex lies at elevations within a few feet (vertically) of tidal action, but slopes on the south and south-eastern of the Hellman property provide a good accommodation space for upslope transgression of habitats. These could be expanded or modified when the site is graded to increase the area of upper intertidal habitats in the future.

3.4.1.3 Potential to Restore Natural Sedimentation

Suspended sediment in tidal waters at the LCW complex is low and unlikely to support significant accretion of marsh habitats over the next century. Restoration designs allowing natural sedimentation would increase resilience of the system

3.4.1.4 Potential to Accommodate Upslope Transgression of Habitats

Because of the limited potential for sedimentation and accretion within the LCW complex, the remaining opportunity for adapting to SLR is to provide the accommodation space for habitats to migrate upslope. Several options should be considered: 1) consolidate industrial uses and utilities in suitable higher elevation sites with protection from SLR; 2) use soils excavated on site to raise elevations for protection of consolidated industrial uses, utilities and transportation corridors, and for providing high marsh and transitional habitats with higher sea levels; and 3) use soils excavated onsite to build gentle slopes on existing upland habitats to allow for transgression.

3.4.1.5 Potential to Increase Flood Protection

The Conceptual Restoration Plan can include design options that increase flooding protection to neighbors with future SLR. Material is available for berming and flood containment as needed to protect adjacent properties.

3.4.2 Constraints

3.4.2.1 Modification of Habitat Proportions with Climate Change

Changes associated with moderate or high SLR rates will convert existing intertidal habitats into functionally lower intertidal and subtidal habitats in the future. The proportions of wetland habitat will change. Also, sensitive breeding bird populations may be increasingly vulnerable to extreme tide levels and late season storms associated with climate change.

3.4.2.2 Limited Areas for Upslope Transgression of Habitats as Sea Level Rises

The fragmented and altered state of the LCW complex and surrounding areas limit the potential accommodation (upslope transgression) of habitats on the site as sea level rises. Much of the periphery of the complex is developed; natural upland landforms remain primarily at the LCWA Phase 2 / Hellman property.

3.4.2.3 Steep Perimeters Support Only Narrow Habitat Bands as Sea Level Rises

The steep artificial edges of the basins will also limit accommodation of upper intertidal and transitional habitats with increasing sea level. Steep artificial edges (e.g. east of Steam Shovel Slough) will support, at best, very narrow bands of high intertidal habitat with higher sea levels. Riprap, rubble piles and unvegetated levee slopes will not support high quality habitat.

3.4.2.4 Limited Natural Sediment Supply

The delivery of new sediment to the site by tide water is unlikely to contribute substantially to the resilience of the LCW complex to SLR. The LCW site is somewhat isolated from littoral processes including sediment transport, and the future management of the SGR is unlikely to provide the site with extended periods of exposure to tide water with high suspended sediment load.

3.4.2.5 Flood Protection with SLR

Infrastructure in the area will be at risk with SLR. Existing transportation and utility corridors, industrial operations, and flood control structures within and on the edges of the LCW complex may need modifications in the future.

3.5 Infrastructure

Infrastructure on City of Long Beach Property

Infrastructure includes existing onsite oil operations and utilities, onsite and surrounding roads, flood control levees, and other uses by easement holders (Table 3.1). The functionality of most of this infrastructure must be retained, but it may be possible to modify or relocate this infrastructure to accommodate restoration. Examples include reconfiguration of oil pipelines in cooperation with the oil operators and installation of bridges along major roadways to allow for habitat and/or hydraulic connection from one side of a road to the other. In general, existing and future-remaining infrastructure is a significant constraint to habitat restoration, but there are also opportunities such as the requirements from the lease agreements with the oil operators.

Table 3.1 Easement Holders

Easement Holder	Nature of Easement
LCWA Phase 1 and Phase 2 Properties	
Signal Hill Petroleum Inc.	Oil operations on the LCWA properties
Hellman Properties LLC	Personnel and vehicular access through the LCWA properties
BreitBurn Management Company LLC	Gas lines easement through the LCWA properties
L.A. County Department of Public Works	SGR levee maintenance (flood control)
City of L.A. Department of Water and Power	Haynes Cooling Channel maintenance
L.A. County Vector Control	Personnel and vehicular access for vector control activities
Orange County Vector Control	Personnel and vehicular access for vector control activities
City of Long Beach Property	
Signal Hill Petroleum Inc.	Personnel and vehicular access through the COLB property
LCW Oil Operations LLC	Oil operations on the COLB property
LCWA	Personnel and vehicular access through the City property to the LCWA properties
L.A. County Vector Control	Personnel and vehicular access for vector control activities

3.5.1 Opportunities

3.5.1.1 Lease Agreements Include Reconfiguration of Oil Infrastructure

Both the LCWA and the City of Long Beach lease agreements with the oil operators include favorable clauses for relocating oil infrastructure and abandoning wells.

Oil Operator Lease Site

For the LCWA "Bryant" site, the agreement (SHPI and LCWA 2006) between the LCWA and the oil operators, Signal Hill Petroleum, Inc. (SHPI, "SIGNAL") reads:

"7. Modifications to Easements and Right-of-Way Area. The parties agree that in order to accommodate the restoration of the Surface Property as contemplated by this Agreement, it may be necessary to modify the Right-of-Way Area, Joint Use Easements, Access Easements and Pipeline and Utility Easements and relocate oil facilities within the Pipeline and Utility Easements. SIGNAL shall agree to the reasonable relocation or modification of the easements referenced in this Section 7 and shall relocate SIGNAL's oil facilities including its pipelines and utilities at SIGNAL's cost as is reasonably necessary to accommodate such relocation or modification of the easements and right-of-way, provided that: (i) such relocation or modification shall be in coordination with a final restoration or redevelopment plan approved by LCWA for the LCWA Intended Use including a final precise grading plan, (ii) such restoration plan is not subject to an appeal or legal challenge within the statute of limitations for filing under CEQA, (iii) such restoration plan has previously been approved by SIGNAL, which approval shall not be unreasonably withheld; (iv) SIGNAL shall not be required to relocate the pipeline crossing under the SGR, (v) SIGNAL shall only be required hereunder to relocate any given segment of SIGNAL's oil facilities one time at SIGNAL's cost; and (vi) SIGNAL shall complete relocation within one year of all other conditions being met.

8. Abandonment of Wells. SIGNAL shall be responsible for the ultimate abandonment of all oil and gas wells on the Surface Property to a standard acceptable to the State of California Division of Oil, Gas and Geothermal Resources and suitable for the LCWA Intended Use of the Surface Property."

Oil Infrastructure on LCWA Phase 1 Property

For the City of Long Beach (COLB) "Marketplace Marsh" site, there is a similar agreement with the oil operators on that site, LCW Oil Operations LLC. The agreement (LCW and COLB 2010) reads:

> *"12. Modifications to Easements. The parties agree that in order to accommodate the City's Intended Use, it may be necessary to modify the Easements and relocate facilities and or improvements used in connection with the Oil and Gas Operations, including without limitation, idled, closed, and active wells, pipelines, and utilities {collectively, "FACILITIES"), within the Easements. LCW agrees to the reasonable relocation or modification of the Easements and shall relocate those Facilities which are reasonably necessary to accommodate such relocation or modification of the Easements, provided that the following conditions have been satisfied: (i) LCW has not been required to relocate the same Facilities within the previous ten (10) year period ending on the date the current relocation request is received by LCW; (ii) LCW is not required to expend any costs related to or arising from such relocation or modification other than costs for Remediation required to be performed by LCW pursuant to this Agreement, including the Remediation LCW is required to perform arising from or related to the relocation or modification of Facilities currently located within the Non-Exclusive Easements; (iii) the requesting party has obtained any necessary permits or governmental approvals for both the actual relocation and the new operations and/or Facilities; (iv) the restoration plan provides a seamless transition of new operational replacement Facilities before existing Facilities are shut down so that LCW's Oil and Gas Operations are not interrupted for any period of time exceeding twenty-four (24) hours; (v) the aggregate cost and expense of continued Oil and Gas Operations to LCW will not be materially increased; (vi) such relocation or modification shall be in coordination with a final restoration or redevelopment plan approved by City and other applicable regulatory agencies for the City's Intended Use including a final grading plan; (vii) such restoration plan is not subject to a CEQA appeal or other legal challenge; (viii) such restoration plan has previously been approved by LCW, which approval shall not be unreasonably withheld; (ix) LCW is able to reasonably complete the relocation within one (1) year of all other conditions being met; and (x) the reasonably projected ultimate recovery from the Oil and Gas Operations, including from currently idled wells, as mutually agreed upon by the parties after they have negotiated in good faith for a minimum of seven (7) days, has not been materially diminished. Without limiting the generality of the foregoing, City shall pay, or cause a third party to pay, any and all reasonable costs incurred by LCW in relocation or modification of any Facilities, including all costs required to improve any relocated Facility so that same shall be operable at the new location, but excluding costs for Remediation required to be performed by LCW pursuant to this Agreement. In lieu of relocation provided in this Section 12 and at the request of either party hereto, the parties shall negotiate in good faith to sell the Facilities subject to relocation to City or its successors if the reasonable fair market value of the*

Facilities and all future production associated therewith is less than the reasonable relocation costs for said Facilities.

13. Abandonment of Wells. If LCW, in its sole and absolute discretion, decides to permanently abandon any oil and gas well on the Surface Property, then LCW, at its own cost and expense, shall be responsible for the ultimate abandonment of such oil and gas wells on the Surface Property to a standard acceptable to the State of California Division of Oil, Gas and Geothermal Resources at the time of abandonment and suitable for the City's Intended Use. If, however, the abandonment arises out of a relocation required pursuant to Section 12, then City shall bear or cause a third party to bear the cost and expense of such abandonment."

The relocation and modification of the oil operations is an opportunity not only as it pertains to restoration on these properties, but also as path-setters for reconfiguration of oil infrastructure on other properties.

3.5.1.2 LCWA-Owned Property Includes the SGR Levees

The LCWA Phase 1 property ownership includes the levees along the SGR, as well as the land under the river waters, for the reach of the river between the two LCWA Phase 1 sites, (as shown on Figure 1-3). Although regulatory requirements and flood control may constrain levee modification, LCWA ownership of the levees within the project site should allow for greater flexibility and efficiency for implementing levee modifications.

3.5.2 Constraints

3.5.2.1 Incorporation of Existing and Future-Remaining Oil Infrastructure


Oil Infrastructure on City of LB Property

An obvious constraint to restoration is the presence of oil infrastructure (tanks, wells/pumpjacks, pipelines, sumps, roads, etc.) and the retention of mineral rights by the oil operators in current lease agreements. A map of the known existing oil infrastructure within the entire LCW complex is shown in Figure 3-14. From this map, it can be seen that oil infrastructure currently exists on a large majority of the complex. Although not shown on Figure 3-14, there are also clearance zone requirements around the oil wells and pipelines (50 feet vegetation-free radius around wells and 10 feet clearance on both sides of the pipelines). The oil operators' access roads, visible in the aerial photograph throughout the site, represent a potentially-modifiable constraint to restoration, i.e. access for oil operators will

need to be maintained, but the configuration of the oil roads may be able to be modified for the CRP in coordination with the oil operators.

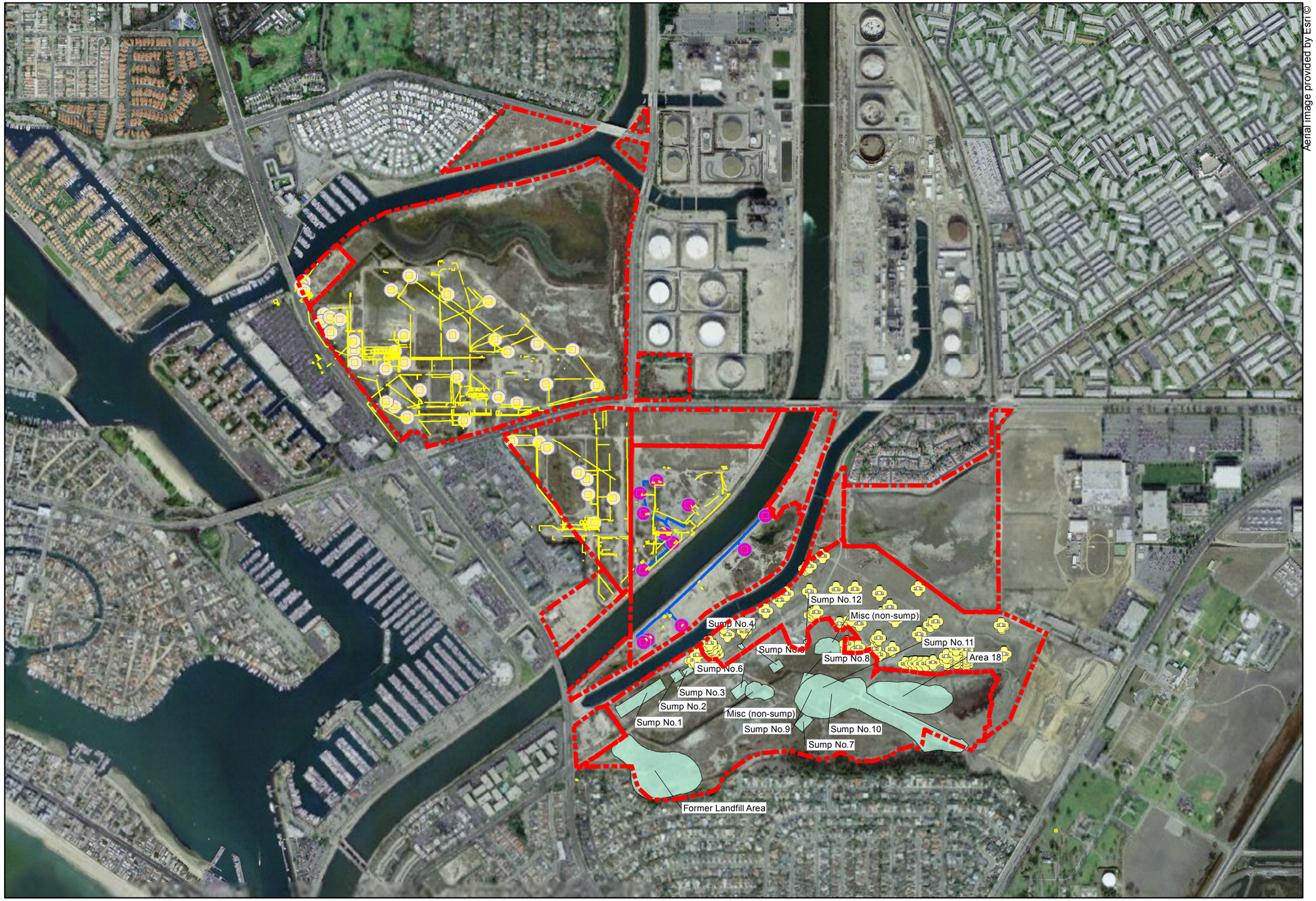
Much of the oil infrastructure will remain even after restoration is completed. For all restoration alternatives, there will be the need to allocate space for and protect oil infrastructure on the site. This will have the downside effects of both reducing the area available for habitat and fragmenting the LCW complex.

As discussed in the previous section, the LCWA Phase 1 and City of Long Beach properties' lease agreements include "reasonable" relocation and modification of oil operations. Based on preliminary discussions with some oil operators, it is probable that this would entail reconfiguration of some oil operations roadways and relocation/consolidation of oil pumpjacks and associated pipelines, but all within the same property boundaries, and not including relocation of tank farms.

For the other LCW complex properties currently in private ownership, it is likely that any existing oil operations would continue under lease agreements even if these properties were acquired by the LCWA. And, it is assumed, that oil operations reconfiguration for those properties would be similar to those for the current LCWA and City of Long Beach lease agreements.

More formal discussions with the oil operators will occur as part of this restoration project to better understand and negotiate the potential changes to oil operations. It is likely that any oil infrastructure reconfiguration agreements will not be finalized in the near-term, and so restoration alternatives developed for this study will have to be based on assumptions. It is also not known when/if oil operations on the publicly-owned properties will cease.

It should be noted that previous studies have been completed to assess the feasibility of interim wetland restoration while oil extraction activities remained on what is now the LCWA Phase 1 and 2 properties (e.g. M&N 2006 and 2007). The studies determined conceptual plans to restore tidal influence between locations of active oil wells and by isolating oil operations from the tides with levees or dikes. Although oil infrastructure is and will continue to be a significant constraint to restoration, it is feasible to develop restoration alternatives in areas of active oil operations.



Aerial image provided by Esri ©

Legend

- Hellman LLC. Oil Infrastructure (Tanks and Pumps)
- LCW Partners & City of LB Oil Wells
- LCWA Phase 1 Oil Wells
- LCW Partners & City of LB Oil Pipelines
- LCWA Phase 1 Oil Pipelines
- Contaminated Areas (LCWA Phase 2)
- LCW Property Boundaries

Notes:

1.) Geospatial accuracy of some map features cannot be gauranteed as surveys were provided by outside sources. This document is intended to be used for planning purposes only.

2). For features depicting oil infrastructure, additional survey and/or field verfication is required.

3.) Oil pipelines on Hellman (retained) property not shown. Data currently not available.

N

0 250 500 1,000 1,500 2,000 Feet

Sources: MDA Consultants 1992 Survey, WRA 1996 Survey, L.A County Assessor's Parcel Data 2007, Anchor 2003.

1/31/2012

Figure 3-14. Existing Oil Infrastructure on the LCW Complex

MOFFATT & NICHOL

Project location: Long Beach & Seal Beach, CA

Los Cerritos Wetlands Conceptual Restoration Plan

3.5.2.2 Fragmentation and Encroachment by Roadways

Several roads transect the LCW complex and separate it from adjacent open space. Fragmentation constrains the diversity of species with limited mobility. The surrounding roadways (and surrounding infrastructure) are shown in Figure 3-15. Not only do roadways surround the site, but a major road (Westminster Blvd./Second St.) divides the complex into two isolated parts. Although these roadways are a significant constraint, there is the potential to create wildlife tunnels or culverts or bridges over/under these roads to provide habitat and/or hydraulic connectivity within and external to the LCW complex.

Figure 3-15. Roadways and Other Infrastructure Surrounding the LCW Complex

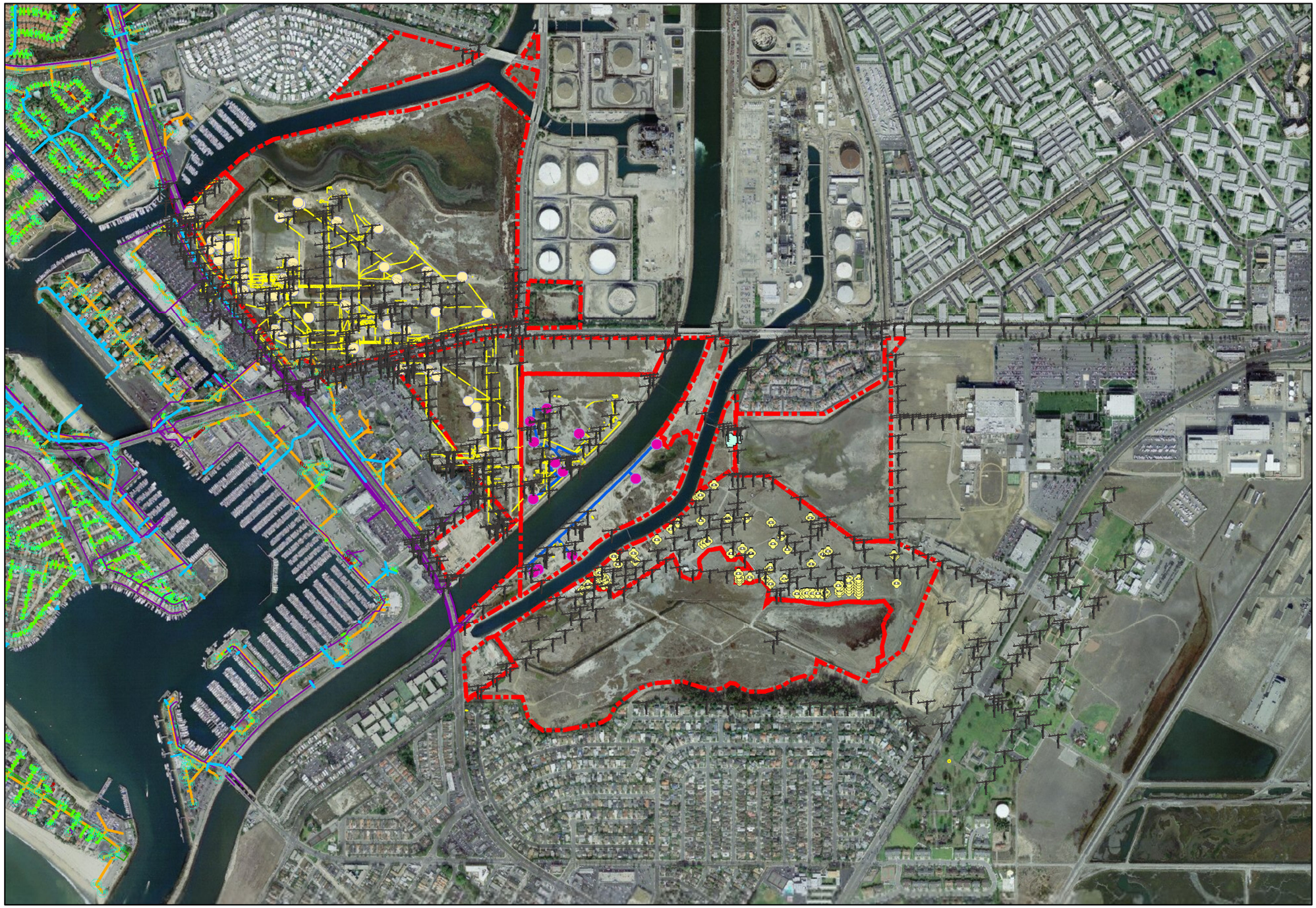
Additionally, as discussed in the previous section, dirt and some paved roadways exist within the LCW areas for oil operators' access. There is a potential to modify these in cooperation with the oil operators to minimize habitat fragmentation within the site. A related constraint is the close proximity of the major roads to the site and the effects that these roads impinge on habitat. Restoration alternatives will need to be designed to minimize the noise and traffic effects from these bordering roads to habitat areas.

3.5.2.3 Protection of Existing Flood Control Systems

The SGR and Los Cerritos Channel are major flood control pathways for the region. Any modifications to the levees, channels, or storm drains within these systems cannot compromise the flood protection to the surrounding areas.

3.5.2.4 Fragmentation and Encroachment by Utilities

Utilities on the project site include oil pipelines, gas lines, storm drains, overhead electrical and telephone wires, a limited number of water and sewer lines, and the County of Orange flood control pump station adjacent to the County retention basin. Figure 3-16 shows the currently known utilities within and bordering the LCW complex. (Further effort will be required for detailed engineering to determine all utility locations). As discussed previously, there may be some opportunity to remove and reconfigure oil pipelines, but the potential to relocate other utilities on site is not known at this time.



Aerial image provided by Esri ©

Legend

- Power Poles
- Poles Misc.
- Hellman LLC. Oil Infrastructure (Tanks and Pumps)
- LCW Partners & City of LB Oil Wells
- LA/OC County Boundary
- LCWA Phase 1 Oil Wells
- LCW Partners & City of LB Oil Pipelines
- LCWA Phase 1 Oil Pipelines
- Storm Drain Mains
- Oil Pipelines
- Reclaimed Water Mains
- Reclaimed Water Laterals
- Sewer MH
- Sewer Laterals
- Sewer (Misc.)
- Sewer Mains
- Sewer (Abandoned)
- OC Pump Station
- LCW Property Boundaries

Notes:

1.) Geospatial accuracy of some map features cannot be gauranteed as surveys were provided by outside sources. This document is intended to be used for planning purposes only.

2). Water pipelines not shown. Data currently not available.

3.) Not all utility data shown on Los Cerritos Wetlands. Some utility data currently not available.

N

0 250 500 1,000 1,500 2,000 Feet

Sources: City of Long Beach GIS 2011, Survey (Provided by WRA) 1996, and Survey (MDA Consultants) 1992, L.A. County Assessor's Parcel Data 2007, Anchor 2003

2/1/2012

Figure 3-16. Existing Utilities on and Surrounding the LCW Complex

MOFFATT & NICHOL

Project location: Long Beach & Seal Beach, CA

Los Cerritos Wetlands Conceptual Restoration Plan

3.6 Human Interaction

LCW's history of human interaction and the potential for future interactions provides both opportunities and constraints to the site's restoration. Going back millennia, this area was culturally significant. The native peoples called the area Povunn'nga: the birthplace for the Tongva (Gabrielino) people's creator-god and spiritual being: Chengiichngech. Over the past century, the Hellman, Bixby, Bryant and Stearns families found value in this land for agriculture and industry. Oil companies have subsequently utilized the LCW complex for most of the previous century as well, and currently maintain four oil leases. The site has also been a resource for electric power generation, flood control, and recreation.

Local residents have historically viewed the wetlands from the other side of private land fence lines and have demonstrated a desire for the LCW complex to be restored and made accessible. The desire for access is exemplified in the well-utilized trails along the periphery of the conservation area, the popularity of the SGR Bike Trail, and through the mission statements of several non-profit interest groups. In 2006, with the creation of the LCWA and subsequent acquisition of wetland properties for the public trust, human interaction has taken a new direction through the LCWA's Stewardship Program.

Community Event

3.6.1 Opportunities

3.6.1.1 Public Access to Large Open Space Area

Open space is limited in the local area and Los Cerritos Wetlands offers a superb opportunity for the development of public use areas and educational programming. Currently, due to private land holdings and current land uses, the site is not very accessible to the public. General public access is limited to the site's peripheries or via the LCW Stewardship Program (see following section). Even the 200 acres of public land still are not accessible without escort because of existing oil operations.

After the restoration is complete, the site has high potential to be used more by the public for a variety of beneficial uses. Parts of the site are already used for cycling, hiking, birding, and fishing; a great opportunity exists to expand upon these active beneficial uses.

3.6.1.2 Synergy with LCW Stewardship Program

A Stewardship Program has been forged by the LCWA and this has brought together the active local stakeholders. The LCW Stewardship Program (LCW SP) was developed in 2007 by the LCWA and fully implemented in 2009. The group is active on the LCWA Phase1 and Phase 2 areas, in particular Zedler Marsh and Hellman Lowlands. These areas are excellent models of community-based restoration and effective land management. Additionally, the large-scale restoration project benefits by having a well-informed public, fostered by the LCW SP.

While currently, community-based restoration, revegetation, and education activities within the LCW complex are relegated to small areas of the public land holdings and limited in scope, the future large-scale project would benefit by involving the LCW SP in appropriate aspects of the restoration's implementation, management and maintenance.

3.6.1.3 Active Local Stakeholders (Non-Profit Groups)

Several non-profit interest groups exist that have restoration of LCW as their mission. With proper outreach provided, these groups will become major supporters of the restoration project. They also offer the opportunity to gather information about the site's historical beneficial uses. Currently identified interest groups, limited here to community groups and homeowner associations, include the following: Los Cerritos Wetlands Land Trust, Los Cerritos Wetlands Stewards, Friends of Colorado Lagoon, Save Our Beach, EcoLink, Green Long Beach, Surfrider Long Beach Chapter, Aquarium of the Pacific, El Dorado Chapter of Audubon, Port of Long Beach, Los Angeles and SGRs Watershed Council, Alamitos Heights Improvement Association, Bay Harbour HOA, Belmont Shores Mobile Estates, Bixby Village HOA, University Park Estates Neighborhood Association, Island Village HOA, Pacific Villas HOA, Naples Improvement Association, Spinnaker Bay HOA, and Heron Pointe HOA.

3.6.1.4 Cooperative Efforts With the Local University

California State University, Long Beach (CSULB) resides within 1/2 mile of the site, making it an attractive location for use as an outdoor classroom and a field research site. Ecological monitoring and other research projects can be accomplished by student researchers that will provide professional level data to aid in the management of the restoration and to quantify the project's success. This would be similar to the relationships between San Diego State and the Tijuana Estuary, or UC Santa Barbara and Carpinteria Marsh and Devereaux Slough.

3.6.1.5 Adjacent Existing Public Use Areas

There are several existing public access areas interfacing the site that provide an opportunity for a comprehensive interpretive trail system. The possibility exists to connect to and compliment these presently established areas and improve upon their beneficial uses and educational potential. Appropriate design of a comprehensive trail system within the project site could maximize connectivity with presently identified public use points (Figure 3-17). With the exception of the cultural trail at Heron Pointe, no interpretative signage exists on or near the site. A well-designed and interactive interpretive display program would greatly enhance public awareness of the LCW.

Gum Grove Park is an established public use area with a trail that meanders through a 100-year old eucalyptus grove. Gum Grove is utilized regularly by dog-walkers, BMX-bikers, and local families. Gum Grove Park connects to the Heron Pointe Cultural Center that contains interpretive signage adjacent to the Heron Pointe residential community. These two areas would benefit from being better connected to the SGR Bike Trail which currently is the most heavily used public area. This Class A bike trail bisects the LCW and extends along the SGR for over 25 miles from Azusa to Seal Beach.

Kayakers in Alamitos Bay regularly access Steam Shovel Slough, which is a low impact way to recreate in coastal wetlands. An opportunity exists to build off of this public use and create more tidal creek networks large enough for kayaking. A popular fishing hole also exists at the south end of the Haynes Cooling Channel. If this current fishing hole is maintained and enhanced by the restoration project, it presents an opportunity to focus fishing activities on one location and keep it from spreading to sensitive habitat areas.

3.6.1.6 Limited Visibility From Housing Developments

The LCW is surrounded mostly by industrial and commercial areas. The surrounding residential areas have limited viewsheds upon the wetlands. This provides the opportunity to make larger changes in the landscape without impacting an unmanageable number of residential viewsheds.

3.6.1.7 Already Existing Infrastructure for Public Interpretation

New developments of open space are challenging to build in the coastal zone. However, the LCW contains several existing structures and building foundations that provide opportunities to be more easily converted into public interpretation areas. Several old oil operation foundations exist that would provide great places for interpretive kiosks throughout the wetlands complex. The State Lands Commission parcel has a large enough existing foundation to house an interpretive center and a parking lot. The old Bixby Ranch Land Company building and Bryant Lease office also offer potential sites for future offices or education facilities. Lastly, a small building exists near Marketplace Marsh, on the City of Long Beach parcel, which could be converted into a storage space or educational facility.

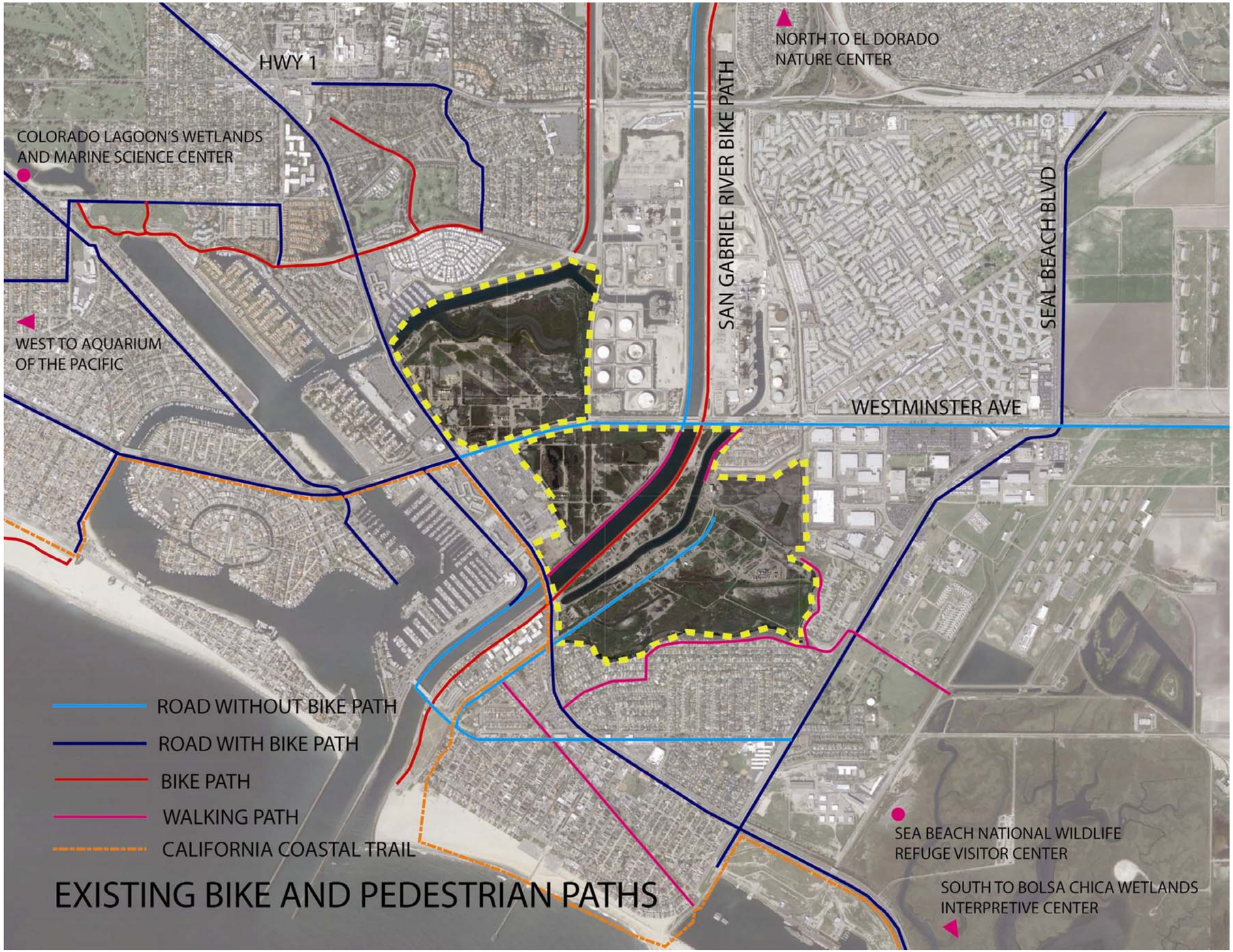


Figure 3-17. Potential Public Use Access Points

3.6.2 Constraints

3.6.2.1 Habitat Sensitivity to Urban Surroundings

The LCW is heavily encroached upon, fragmented and has many edges exposed to urban impacts. Light, noise and air pollution must be buffered, which constrains restoration potential. More resilient habitat types will need to be established along the urban edges that buffer more sensitive habitat areas towards the interior.

Restoring native ecosystems at the urban interface creates challenges and potential constraints on design. Non-native predators that thrive in urban settings (e.g., red fox, rats, and cats) are known to prey on sensitive wildlife in salt marshes, especially light-footed clapper rails. It may not be desirable to restore cord grass marsh (the clapper rail's preferred nesting habitat) in areas accessible to urban predators.

Finally, invasive exotic species are more likely to reach restored habitats along urban interfaces. This is true of plants and animals. Algerian sea lavender, *Limonium ramosissimum*, is a horticultural escapee that is invasive in salt marshes. Many invasive or undesirable animals that were once kept as pets are released into urban open spaces. Common examples in freshwater wetlands in Southern California include the red-eared slider and bullfrogs, both of which decimate native aquatic species.

3.6.2.2 Habitat Sensitivity to Public Access

While inviting the general public to recreate in our urban wildlands is important to building awareness and promoting healthy communities, this also gives the public potential access to areas that are sensitive to disturbance. The three most popular recreation activities that occur presently at Los Cerritos Wetlands are dog walking, cycling, and fishing. Each of these activities has the potential to constrain the establishment of healthy coastal ecosystems if they are not properly controlled and relegated to areas that are the most resilient to public access. Public access areas will need to be designed so that they offer the opportunity for the public to view the wetlands, but not "love it to death." Public access facilities must be designed and maintained to protect the restoration from inviting high disturbance activities such as off-roading, bonfires, or hunting. Lastly, public access areas should be properly buffered from areas that are hosting special status species populations or that host other sensitive ecological phenomena.

3.6.2.3 Onsite Homeless Encampments


Onsite Homeless Encampment

This site is attractive to vagrancy and homeless encampments. Encampments are quick to be established in areas with thick vegetation that are hidden from public view. These encampments pose a public safety hazard and are extremely disruptive to wetlands habitats. The propensity for humans to take up residence in the wetlands limits the location of certain types of habitats, thus constraining the restoration's potential.

3.6.2.4 Maintaining Positive Public Perception

Maintaining a positive public perception of the restoration project is critical to its success. Negative public perception can lead to measures that may delay, derail, or limit the efficacy of the project. Consistent and effective outreach throughout the planning and implementation process can mitigate this constraint.

3.6.2.5 Potential Impacts to Surrounding Neighborhoods

This restoration is in close proximity to residential and commercial areas. Humans that work and live in the area have the potential to be impacted by this restoration project. In addition to flood protection discussed previously, there are other factors that need to be considered.

Vector Control

Wetlands often have standing water for long periods of time that attract mosquitoes and other vectors for disease. Vector Control agencies have the jurisdiction to take the necessary measures to control such situations, which may result in habitat destruction. This scenario constrains the potential locations of certain standing water wetlands habitat types. Vector control access trails may be required aspects of the restoration design.


Onsite Standing Water

Fire Safety

Open spaces in California can become dry and flammable during the summer months. Habitats established along urban edges should not threaten neighboring developments (residential, commercial, and industrial) with potential wildfires. Proper setbacks and firebreaks must be maintained, thus constraining the plant palette in those areas. Invasive annual plant species will also need to be controlled to reduce fuel for wildfires. Keeping trails out of potential wildfire threatened areas is also advisable.

Bordering Homes and Adjacent Vegetation

Desirable Viewsheds

Some areas within the LCW are highly visible from local neighborhoods and residences. Restored areas within view of homes should be aesthetically pleasing and offer an improvement to the overall landscape. The installation of large, non-deciduous trees, or other permanent obstructions, that may block vistas is not advisable. This situation constrains the design of urban edges along residential areas.

Bordering Homes – Viewshed

3.6.2.6 Archaeological Resource Protection

The location of potential archaeological/cultural resources limits the areas where certain restoration activities can occur without instituting proper mitigation measures. Cultural resources in a wetlands context may include Native American dune habitations, hunting blinds, buried shoreline sites that have become exposed over time, or sunken boats, wharfs, or other historic waters-edge cultural resources. Excavation has the potential to disturb these resources. Archaeological resources are most likely to occur in areas that were historically upland. These upland areas are limited throughout the project area which helps to reduce the influence of this constraint on restoration.

A records search of the LCW CRP study area was recently conducted by Chambers Group to identify specific locations where cultural resources have been found in and near the project area. The purpose of the records search was to identify all previously recorded cultural resources (prehistoric and historic archaeological sites, historic buildings, structures, objects or districts) within the area of potential effect (APE), as required by Section 106 of the National Historic Preservation Act (NHPA) of 1966 and its implementing regulations, 36 CFR Part 800. Results of the search identified a total of 102 previously recorded sites within a one-mile radius of the APE, of which six are situated within the direct APE. There were 16 National Register sites identified, all within the one-mile buffer of the APE. National Register sites are those that have been evaluated and determined by the Department of Interior, National Park Service to be historic places meriting preservation. See Appendix A for further information on the records search.

Disturbance to any identified sites should be avoided if at all possible. If impacts to cultural resources cannot be avoided, then evaluation and/or mitigation of the resource may be necessary. Evaluation involves excavation sampling of the resource to determine if the resource is eligible for the national and state registers of historic places. Mitigation of eligible resources would involve a negotiated sampling and/or documentation of the resource prior to impacts, based on a work plan agreed to between all involved agencies and parties. In addition, a qualified cultural resources monitor should be present during all ground disturbing activities on the site to identify if any cultural resources are disturbed during project construction.

3.7 Regulatory / Implementation

The previous sections discussed physical-, technical/science-, and social-related opportunities and constraints. This section will summarize land ownership, economic and legal/regulatory factors which relate to the implementation of this project. Two of the factors, land ownership and compensatory mitigation, are both potential opportunities as well as constraints. Several of the factors drive the need to complete the restoration in a time-phased manner. Accordingly, the CRP will need to be developed such that this phasing can be accommodated.

3.7.1 Opportunities

3.7.1.1 Potential for Additional Land Acquisition

Over 300 acres of the LCW complex are owned by private entities (LCW Partners, Hellman Properties LLC, Bryant, Alamitos Bay Partners, Loynes LLC, and Lyon Communities) or other entities (City of Los Angeles DWP, County of Orange, and California State Lands Commission) not involved in wetlands restoration. Perhaps the most significant of all opportunities, the acquisition of this land by the LCWA would be a major triumph. Acquisition of this land is dependent upon both availability of funds by the LCWA and the willingness to sell by the landowners. For the County of Orange, City of Los Angeles, and State Lands Commission properties, there may be the potential for the LCWA to be granted restoration easements in lieu of LCWA property ownership.

3.7.1.2 Potential Funding Opportunities

Implementation of the restoration project will be obviously dependent on funding – shorter-term funding for design, environmental review, permitting and construction and longer-term funding for maintenance and monitoring. Although it is early in the process, some potential funding sources can still be identified. Preliminarily, these funding sources are:

- Entities seeking to obtain compensatory mitigation credits. The most likely entity would be one of the Ports, but other entities are also possible. Related to this is the opportunity to utilize future SLR to obtain future mitigation credits for subtidal habitat, i.e. as sea level rises, the amount of subtidal habitat within the LCW complex will increase. Entities may not need immediate mitigation credits, but could bank on these for their future potential projects.
- Entities, such as Cities or Ports, seeking water quality/TMDL credits;
- Entities, such as Cities or Ports, seeking carbon sequestration credits; and
- State or Federal grants.

3.7.1.3 Potential for Agency Coordination

Because of the nature of the project and the nature of the governing LCWA joint powers authority, the potential for agency coordination, cooperation, and involvement is high. In general, this will benefit the project by selection of a well-designed and well-vetted alternative with cost efficiencies.

3.7.2 Constraints

3.7.2.1 Land Ownership by Other Entities

Although there is the potential future opportunity for the LCWA to acquire additional land, these acquisitions are likely to occur in the future over many years, if not decades. Accordingly, the restoration alternatives must accommodate future acquisitions via phased implementation.

3.7.2.2 Easements by Other Entities

A previous section discussed constraints related to onsite infrastructure as required by easement agreements between the landowner and oil operators (lease-holders). In addition to these physical constraints, there are also potential legal and planning constraints such as site access, additional legal proceedings, and oil operator agreement and cooperation on restoration plans.

3.7.2.3 Limited Funding

Funding availability will be limited, and therefore cost will be a key criterion for selection of a restoration alternative.

3.7.2.4 Compensatory Mitigation Restrictions

If compensatory mitigation is identified as the funding source, the types of habitat within the restoration alternatives could be constrained. For example, an entity requiring mitigation credit for a mudflat area would want the LCW restoration plans to maximize the amount of mudflat area. This amount of mudflat may not be the desired habitat based on biological objectives.

3.7.2.5 Permitting and Environmental Reviews

The restoration alternatives must be designed in cognizance of future regulatory permitting and environmental review processes. The likely regulatory agencies are:

- U.S. Army Corps of Engineers;
- U.S. Fish and Wildlife Service;
- NOAA National Marine Fisheries Service;
- U.S. EPA;
- California Coastal Commission;
- California State Lands Commission;
- California Department of Fish and Game;
- State and Regional Water Boards;
- Orange County Flood Control District;
- Los Angeles County Flood Control District;
- Southern California Air Quality Management District;
- City of Long Beach; and
- City of Seal Beach.

These agencies will impose constraints on the project in the form of permit conditions and mitigation requirements. These constraints are likely to affect both the design of the project, as well as construction activities.

Environmental reviews will be in compliance with the California Environmental Quality Act and National Environmental Protection Act. These processes will impose constraints on the project, as well as identify potential construction impacts such as air quality and traffic.

Coastal Commission permits already exist which impose current and past requirements and conditions on the LCW site. The 2001 Coastal Development Permit (CDP) #5-97-367 (original and amendment –A1) was for the subdivision and development of the Hellman Properties LLC site, and preservation of the 100 acre Hellman Lowlands area (now the LCWA Phase 2 property). Of relevance to the current CRP are conditions related to: a) dedication of Gum Grove Park, b) public access, c) archeology, and d) raptor foraging habitat. The other existing CDP is E-10-011 (hearing date of 11-17-2010) which relates to vegetation clearing for Signal Hill Petroleum's stormwater maintenance activities on the LCWA Phase 1 property.

3.7.2.6 Compliance with the City of Long Beach Local Coastal Program and General Plan

The City of Long Beach Local Coastal Program (LCP) (COLB 1980) and General Plan (COLB 2011) designate land uses by location, type and density, address public access issues, and set forth design and development standards. The LCWA Phase 1, City of Long Beach (Marketplace Marsh), LCW Partners, Loynes LLC, Alamitos Bay Partners, and Bryant (retained) properties are within the City of Long Beach and thus fall under the City of Long Beach LCP and General Plan, specifically the South East Area Development and Improvement Plan (SEADIP). The City of Seal Beach does not have a certified LCP.

The 1980 COLB LCP stated that "there is much land in SEADIP being used for oil production. When this resource is depleted, the land will be available for urban development." Fortunately for the sake of wetland restoration, the LCW area was ultimately removed from the certified version of the LCP (described further below).

The majority of the LCW complex is part of the "SouthEast Area", (SEADIP). A map of SEADIP and its subareas are shown in Figure 3-18.

In circa 1980, there was a portion of the LCW, just south of the Los Cerritos Channel, which was defined as a "waterland" in the LCP. The parcel was a County of Los Angeles "island" enclosed in the City of Long Beach. The County delegated to the City the planning responsibility for its parcels as part of the SEADIP plan and, by extended agreement, authorized the City to include the parcels in the COLB LCP Resource Management Plan (RMP). However, the L.A. County portions of SEADIP, as well as other LCW SEADIP areas, were deleted from the LCP by the Long Beach City Council pending State determination of the boundaries of the Wetlands. Although the City of Long Beach annexed this area in 1997, it has remained an "Area of Deferred Certification" in the City's LCP.

Table 3.2 is an extract from the 1980 LCP which lists the deleted subareas and the proposed uses at the time. The LCP states that "when this portion is restored to the LCP, the RMP in Section 6 (of the LCP) shall apply." (COLB 1980).

Table 3.2 SEADIP Areas Deleted from City of Long Beach LCP (COLB 1980)

SEADIP Area	Owner/Developer (Circa 1980)	Acreage	Proposed Use
33	Bixby	55	Marsh and Trails
11a	Bixby	91	Residential
25	Bixby	49	Business Park
26a	Bryant	10	Residential
26b	Bryant	28	Business Park
27	Bryant	20	Residential
28	Orange County	5	Retention Basin
30	Bryant	3	Stream Side Park
11b	Ree	6	Residential

The SEADIP "PD-1" part of the City of Long Beach General Plan has gone through many amendments over the years. The SEADIP program was first adopted by the Long Beach City Council in 1977 as a Specific Plan under California Law, as an amendment to the then current General Plan. A planned development ordinance was also adopted then by the City which regulates the properties. The latest version of PD-1 is January 3, 2006 and includes a section titled "Responsibility for Construction and Maintenance of Wetlands and Buffers".

As cited on the City of Long Beach SEADIP "A New Plan for Southeast Long Beach" webpage (http://www.lbds.info/planning/advance_planning/seadip.asp), the City has begun the task of updating the SEADIP and is urging everyone to get involved in this process. The updated plan would guide the growth and development of this area for the next 10 – 20 years. Through a series of neighborhood meetings and a public workshop, the SEADIP update will provide all residents and stakeholders with the opportunity to create a shared vision.

Although the City General Plan and SEADIP are evolving documents, the LCW restoration planning effort must be cognizant of the provisions and guidelines of these and related documents.

Figure 3-18. City of Long Beach SEADIP Areas Map (COLB 2006)

4.0 SUMMARY

This Opportunities and Constraints Report identifies considerations for the LCW CRP and will be a useful guide for the next step of this study, "Identification of Preliminary Restoration Alternatives." The opportunities and constraints identified herein are based on previous LCW CRP tasks, including existing site data collection, discussions with the Steering and Technical Advisory Committees, and previous LCW studies. These reports are referenced throughout this document.

The opportunities and constraints were categorized and discussed under these general topics:

- Topography / Landforms / Soils
- Tidal Exchange / Local Watersheds / Hydrology
- Ecology
- Climate Change
- Infrastructure
- Human Interaction
- Regulatory / Implementation

Brown Pelicans at Steam Shovel Slough

Numerous opportunities were identified that can be capitalized upon to increase the success and effectiveness of the project and minimize impacts and costs. These opportunities include topography and landforms supportive of wetlands habitat, proximity to potential tidal connections, already existing habitat areas (e.g. Zedler Marsh and Steam Shovel Slough), utilization of future sea level rise, proximity to wildlife corridors, and future watershed improvements. Other opportunities include collaboration with local universities, enthusiastic stakeholders, and the potential acquisition of additional land for restoration. The latter is a significant opportunity (and constraint) to enable the restoration of the entire LCW complex.

The constraints to restoration also need to be considered and either avoided, remediated, or otherwise factored into the planning and design effort. The degree of constraint imposed by each factor varies. Some constraints will be difficult to avoid and thus must be incorporated into the CRP (e.g. surrounding power plants, roads and neighborhoods, an earthquake fault through the site), while some may be able to be modified to remediate the constraint (e.g. reconfiguration of onsite oil infrastructure, construction of bridges along surrounding roadways, habitat transition zones for sea level rise). Limited project funding is another obvious constraint which must be considered for any alternative. None of the identified constraints make restoration infeasible.

In conclusion, no fatal flaws to restoration exist, and there are abundant options to optimize habitat restoration, public enjoyment, and other project goals and objectives. This CRP is in itself a major opportunity to restore a significant wetlands complex.

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APPENDIX A

CULTURAL RESOURCES RECORDS SEARCH

Chambers Group Inc., 2012

Record Search Findings for the Los Cerritos Wetlands Project

Chambers Group conducted a cultural resource literature review and records search from the South Central Coastal Information Center (SCCIC) located at California State University in Fullerton in February and March of 2012. The SCCIC is a branch of the California Historic Resources Information System (CHRIS) established by the Office of Historic Preservation (OHP) to manage information concerning cultural resources and associated studies. SCCIC maintains records for Orange, Ventura, and Los Angeles Counties. The records search provides information on archaeological sites, historic resources, and cultural resources investigations recorded within a one-mile radius of the APE. During the records search, the OHP's Historic Property Data File (HPDF), as well as a variety of publications and manuscripts were consulted. The HPDF includes the following types of properties:

- National Register of Historic Places (NRHP);
- California Historical Landmarks (CHL);
- California Points of Historical Interest (PHI); and
- California Register of Historical Resources (CRHR).

The purpose of the records search is to identify all previously recorded cultural resources (prehistoric and historic archaeological sites, historic buildings, structures, objects or districts) within the area of potential effect (APE), as required by Section 106 of the National Historic Preservation Act (NHPA) of 1966 and its implementing regulations, 36 CFR Part 800. This report includes a review of all previously recorded archaeological and historic archaeological resources as well as previously conducted archaeological investigations and/or studies within a one-mile radius of the APE.

Chambers Group contacted the Native American Heritage Commission (NAHC) and requested a search of their Sacred Lands Inventory to determine if any recorded Sacred Lands or other features of cultural importance were within or near the APE. The NAHC provided Chambers Group with a list of tribes affiliated with the project area and recommended that Chambers Group contact the individuals on the list to seek additional information regarding cultural resources in proximity to the APE. Any additional information or comments provided by any of the tribes listed by the NAHC should be forwarded to the project proponent to be taken into consideration.

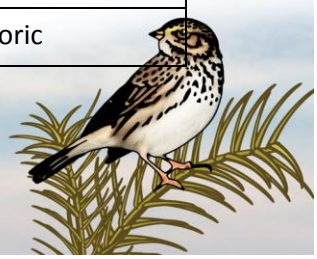
SCCIC Records Search Results: Sites

Results of the records search conducted at the SCCIC identified a total of 102 previously recorded sites within a one-mile radius of the APE. Of the 102 total sites previously recorded within the study area, only six sites were situated within the direct APE. See Table A-1 for the complete listing of the sites located within a one-mile radius of the APE and/or within the direct APE. There were also 16 National Register sites identified, all within the one-mile buffer of the APE. These sites are shaded gray in Table A-1.

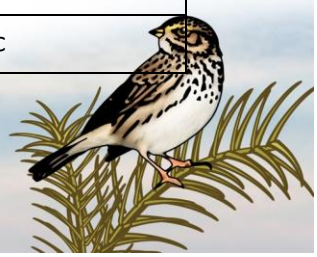
Table A-1. Archaeological/Historic Sites

Primary #	Trinomial	Other Identifier	Site Type
19-001821	CA-LAN-1821		Prehistoric
19-186926			Historic
19-187657			Historic
30-000256	CA-ORA-256		Prehistoric
30-000850	CA-ORA-850		Prehistoric
30-000851	CA-ORA-851		Prehistoric
19-000102	CA-LAN-102		Prehistoric
19-000178		HRI # 029580	Multi-component
19-000232	CA-LAN-232		Prehistoric
19-000233	CA-LAN-233		Prehistoric
19-000234	CA-LAN-234		Prehistoric
19-000235	CA-LAN-235		Prehistoric
19-000272	CA-LAN-272		Prehistoric
19-000273	CA-LAN-273		Prehistoric
19-000274	CA-LAN-274		Prehistoric
19-000275	CA-LAN-275		Prehistoric
19-000306	CA-LAN-306		Multi-component
19-000702	CA-LAN-702		Prehistoric
19-000705	CA-LAN-705		Prehistoric
19-001000	CA-LAN-1000		Prehistoric
19-001001	CA-LAN-1001		Prehistoric
19-001002	CA-LAN-1002		Prehistoric
19-001003	CA-LAN-1003		Prehistoric
19-001004	CA-LAN-1004		Prehistoric
19-001005	CA-LAN-1005		Prehistoric
19-001006	CA-LAN-1006		Prehistoric
19-001007	CA-LAN-1007		Prehistoric

Primary #	Trinomial	Other Identifier	Site Type
19-002616			Prehistoric
19-003040H			Historic
19-186115	CA-LAN-056	CHL-1014, HRI# 079355	Historic
19-186880			Historic
19-187656			Historic
30-000257	CA-ORA-257		Prehistoric
30-000258	CA-ORA-258		Prehistoric
30-000259	CA-ORA-259		Prehistoric
30-000260	CA-ORA-260		Prehistoric
30-000261	CA-ORA-261		Prehistoric
30-000262	CA-ORA-262		Prehistoric
30-000262	CA-ORA-262		Prehistoric
30-000263	CA-ORA-263		Prehistoric
30-000264	CA-ORA-264		Prehistoric
30-000264	CA-ORA-264		Prehistoric
30-000265	CA-ORA-265		Prehistoric
30-000322/30-001188	CA-ORA-322/1118		Multi-component
30-000364	CA-ORA-364		Prehistoric
30-000852	CA-ORA-852		Prehistoric
30-001455	CA-ORA-1455		Prehistoric
30-001472	CA-ORA-1472		Prehistoric
30-001473			Prehistoric
30-001539			Prehistoric
30-001541			Prehistoric
30-001542			Multi-component
30-001545			Prehistoric
30-001546			Prehistoric



Primary #	Trinomial	Other Identifier	Site Type
30-001644			Prehistoric
30-120045			
30-120046			
30-120047			
30-120048			
30-120049			
30-120953			
30-156069		NR-83001221	Historic
30-176491			Historic
30-176492			Historic
30-176493			Historic
30-176494			Historic
30-176495			Historic
30-176506			Historic
30-176507			Historic
30-176508			Historic
30-176509			Historic
30-176510			Historic
30-176511			Historic
30-176512			Historic
30-176513			Historic
30-176514			Historic
30-176516			Historic
30-176517			Historic
30-176518			Historic
30-176519			Historic
30-176520			Historic
30-176521			Historic



Primary #	Trinomial	Other Identifier	Site Type
30-176522			Historic
30-176524			Historic
30-176525			Historic
30-176526			Historic
30-176527			Historic
30-176528			Historic
30-176529			Historic
30-176530			Historic
30-176531			Historic
30-176532			Historic
30-176533			Historic
30-176803			Historic
30-176840			Historic
30-179842			
30-179842			Historic
30-179843			Historic
	CA-ORA-020		Historic
		CHL-219	Historic
	CA-ORA-1544		Prehistoric

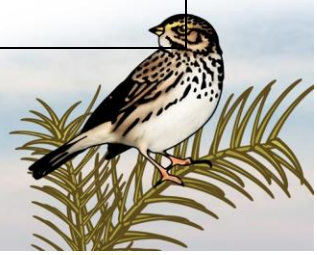
SCCIC Records Search Results: Studies/Reports

A total of 95 previous cultural resource studies were conducted within a one-mile radius of the APE. Of the 95 total previous studies, 25 were conducted within the direct APE. Please see the following Table A-2 for a complete listing of studies conducted within a one-mile radius of the APE and/or within the direct APE.

Table A-2. Studies/Reports

Report #	Title of Report	Date Conducted	Author(s)
LA-2114	Archaeological Investigations of the Proposed California Shores Property, Long Beach, California	June 1990	Jeanette A. McKenna of McKenna et al.
LA-3583	The Los Angeles Basin and Vicinity: A Gazetteer and Compilation of Archaeological Site Information	May 1974	Bonnie M. Bucknam of Archaeological Research Inc.
LA-4266	A Deeply Buried Human Skull and Recent Stratigraphy at the Present Mouth of the San Gabriel River, Seal Beach, California	1965	Cheilagh T. Brooks, Bert L. Conrey and Keith A. Dixon
LA-5890	Cultural resource Survey of the Bixby Ranch Parcel near Alamitos bay, Los Angeles County, California	May 1996	Ivan H. Strudwick, William McCawley, Deborah McLean and Bradley L. Sturm of LSA Associates Inc.
LA-6107	Phase I Cultural Resources Assessment: Los Alamitos Pump Station Project in Long Beach, Los Angeles County, and Seal Beach, Orange County, California	February 2003	Richard S. Shepard of BonTerra Consulting
LA-6999	Cultural Resource Assessment Cingular Wireless Facility No. SB 104-02, Los Angeles County, California	December 2001	Curt Duke and Judith Marvin of LSA Associates, Inc.
OR-0493	Archaeological Survey Report: The Hellman Property in Seal Beach, CA	January 1980	Archaeological Associates, Ltd.
OR-0639	Archaeological Test Report on the Hellman Property Located in the City of Seal Beach, California (Tract 11302)	August 1981	Scientific Resource Surveys Inc.
OR-1049	Landing Hill	1958	Peter Redwine
OR-1272	A Baseline Archaeological Study for the City of Seal Beach, California	January 1991	Gary Stickel of Environmental Research Archaeologists

Report #	Title of Report	Date Conducted	Author(s)
OR-1581	Cultural Resource Assessment of the Hellman Ranch, Seal Beach, California	March 1997	Nancy A. Whitney-Desautels, PhD or Scientific Resource Surveys Inc.
OR-1608	A Research Design and Investigation Program for Test Level Evaluations of Archaeological Sites Located on the Hellman Ranch, City of Seal Beach, California	November 1996	Gary Stickel PhD of Environmental Research Archaeologists
OR-1609	A Research Design for the Evaluation of Archaeological Sites within the Hellman Ranch Specific Plan Area	July 1997	Andrew York, James H. Cleland and Michael Baksh of KEA Environmental
OR-1610	An Archaeological Site Survey of the Hellman Ranch, City of Seal Beach, California	July 1996	Gary Stickel of Environmental Research Archaeologists
OR-1643	A Research Design for the Evaluation of Archaeological Sites within the Hellman Ranch Specific Plan Area	September 1997	Andrew York, James H. Cleland and Michael Baksh of KEA Environmental
OR-1644	A Research Design for the Evaluation of Archaeological Sites within the Hellman Ranch Specific Plan Area	November 1997	Andrew York, James H. Cleland and Michael Baksh of KEA Environmental
OR-1931	Archaeological Resources Protection Plan, Decommissioning of the Research, testing, and Evaluation Area, naval Weapons Station, Seal Beach, Orange County, California	March 1997	Douglas M. Davy of Foster Wheeler Environmental Corporation
OR-2033	Research Design for Evaluation of Coastal Archaeological Sites in Northern Orange County, California	January 1987	Roger D. Mason, Scientific Resource Surveys, Inc.
OR-2774	Phase I Cultural resources Assessment: Los Alamitos Pump Station Project in Long Beach, Los Angeles County, and Seal Beach, Orange County, California	February 2003	Richard S. Shepard of BonTerra Consulting
OR-3391	Mitigation Plan for Significant Cultural Resource Discoveries Hellman Ranch Specific Plan Area, Seal Beach, California	April 2003	Andrew York, James H. Cleland, Lorraine Willey and Charlane Gross of EDAW inc.



Report #	Title of Report	Date Conducted	Author(s)
OR-3762	Negative Archaeological Monitoring Report for the Hellman Ranch Tank Farm Replacement Project, City of Seal Beach, California	June 2009	Candace Ehringer MA, RPA of EDAW
OR-3821	Identification and Evaluation of Historic Properties, City of Seal Beach Sewer Capital Improvement Projects (Southern Portion/Downtown Area), City of Seal Beach, Orange County, California	December 2009	Bai Tom Tang and Michael Hogan of CRM Tech
OR-3828	Piecing Together the Prehistory of Landing Hill: A Place Remembered	2007	James H. Cleland, Andrew L. York and Lorraine M. Willey of EDAW
OR-4034	The Los Angeles Basin and Vicinity: A Gazetteer and Compilation of Archaeological Site Information	May 1974	Bonnie M. Bucknam of Archaeological Research Inc.
OR-1816	A Research Design and Investigation Program for Test Level Evaluations of Archaeological sites Located on the Hellman Ranch, City of Seal Beach, California	July 1996	Gary Stickel of Environmental Research Archaeologists
LA-0012	Environmental Database for the "Pacific Highland Townhouses" Project in the City of Long Beach, California	October 1973	Robert Crabtree of Environmental Impact Reports, Inc.
LA-0057	A Reconnaissance and Evaluation of the Archaeological Resources of The Veterans Administration Hospital Long Beach, California	July 1974	N. Nelson, University of California, Los Angeles
LA-0491	Inventory of Archaeological Resources, CSULB Campus	June 1977	Keith A. Dixon
LA-0503	Archeological resources and Policy Recommendations of Long Beach	July 1974	Keith A. Dixon
LA-0522	Test Level Investigations Conducted on Sites CA-LAN-275 and CA-LAN-275	June 1979	Theodore Cooley of Archaeological Resource Management Corp.

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LA-0939	The Sims Pond Site, CA-LAN-702, Alamitos Bay, Los Angeles County, California	December 1980	Lawrence P. Allen, Archaeological Resource management Corporation
LA-0987	The Bridge replacement on Anaheim Road at the Los Cerritos Channel, City of Long Beach, California	February 1981	D. Van Horn and J. Brock of Archaeological Associates
LA-10483	Cultural Resources Assessment for the Alamitos Bay marina Rehabilitation Project, City of Long Beach, Los Angeles County, California	October 2009	Terri Fulton or LSA Associates, Inc.
LA-11137	Improvements at 231. N. Marina Dr., Alamitos Bay, Long Beach, Scuba Survey Report	October 2009	Phuong Trinh, US Army Corps of Engineers, Los Angeles District
LA-2399	Los Angeles-Long Beach Harbor Area Cultural Resource Survey	April 1978	Lois J. Weinman and E. Gary Stickel
LA-2792	Review of "Initial Study and Negative Declaration, Arboretum II, Museum/Gallery; with "Archaeological Test Report on the Japanese Garden Arboretum/Museum Site (Lan-235)…", prepared by Scientific Resource Surveys, Inc., Santa Ana, December 1980	April 1981	Keith A. Dixon
LA-2794	Reviving Puvunga, An Archaeological Project at Rancho Los Alamitos	September 1972	Keith A. Dixon
LA-2795	Correspondence Regarding CSULB Archaeological Sites	March 1993	Keith A. Dixon
LA-2864	Comment on Second Incomplete Draft of "A Research Design and Implementation guidelines for the Preservation of Archaeological Resources in Campus Development Projects, California State University, Long Beach; Work in Progress as of 1 July 1993"	July 1993	Keith A. Dixon

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LA-4091	Assessment of Archaeological Resources at the Rancho Los Alamitos Historic Ranch and Gardens	October 1997	Randall Milliken and William R. Hildebrandt of Far Western Anthropological Research Group, Inc.
LA-4269	Archives of California Archaeology	March 1974	Robert E. Schenk
LA-4270	Archaeological Testing for The Information Booth Project California State University Long Beach	December 1933	Jackson Underwood
LA-4274	Archaeological Survey and Testing for the Pipeline Project California State University, Long Beach	December 1993	Jackson Underwood
LA-4275	Archaeological Testing at the Central Plant Site, California State University, Long Beach	October 1993	Jackson Underwood
LA-4276	Archaeological Testing of Phase I, The Pedestrian Walkway, Parking Structure B California State University, Long Beach	November 1993	Jackson Underwood
LA-4277	Archaeological Testing at the Ticket Booth Site, California State University, Long Beach	October 1993	Jackson Underwood
LA-4355	A Cultural Resources Management Plan for the California State University, Long Beach	April 1994	Cherilyn E. Widell of the Office of Historic Preservation
LA-5215	A Cultural Resources Investigation of the Proposed Long Beach Ocean Desalination Project, Long Beach, Los Angeles County, California	August 2001	Jeanette A. McKenna of McKenna et al.
LA-5727	A Report of Test Excavations CA-LAN-702	October 1975	Marie G. Cottrell of Archaeological Research, Inc.
LA-6089	Literature Review, Field Reconnaissance, and Grading Monitoring of an Abandoned Oil Field in Long Beach, California	June 2002	Steven McCormick and David D. Ferraro of SWCA Environmental Consultants

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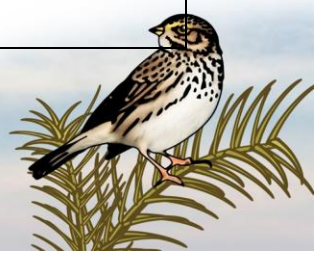
LA-6163	Archaeological Test Excavations at CA-LAN-702	May 1975	Marie Cottrell of Archaeological Research Inc.
LA-8437	A Phase I Cultural Resources Investigation of Assessor Parcel Number 3128-009-065 in the City of Lancaster, Los Angeles County, California	October 2004	Jeanette A. McKenna of McKenna et al.
LA-8489	Cultural Resource Assessment Cingular Wireless Facility No. SM 118-03, Long Beach, Los Angeles County, California	September 2003	Curt Duke and Judith Marvin of LSA Associates, Inc.
LA-8497	A Research Design and Implementation Guidelines for the Preservation of Archaeological Resources in Campus Development Projects, California State University, Long Beach	October 1993	Mark Raab and Matthew Boxt
LA-8498	A Cultural Resources Management Plan for the California State University, Long Beach	May 1994	Mark Raab and Matthew Boxt
OR-0481	The 9+ Acre L.A. Department of Water and Power Property Located at the Corner of 1st and Ocean Avenue in the City of Seal Beach, CA	November 1979	Archaeological Associates, Ltd.
OR-0790	Cultural Resources Assessment of Two Study Areas in the Seal Beach National Wildlife Refuge, Anaheim Bay	October 1985	James Brock of Archaeological Advisory Group
OR-0930	Memorandum for Record, A Change in the Disposal Site for the Anaheim Bay Dredging Project, Survey of the Seal Beach Area, Orange County, California	August 1988	Ion Motkin
OR-1290	Cultural resources Survey Report for the UNOCAL Property at 99 Marina Drive, Seal Beach, California	March 1993	Roger D. Mason of Chambers Group Inc.
OR-1301	Historical review and Archeological Report for the UNOCAL On-shore Facility at 99 Marina Drive in Seal Beach, California in Two Parts	August 1993	Harry Kelsey and Nicholas M. Magalousis



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OR-1348	Addendum to Cultural Resources Survey Report for the UNOCAL Property at 99 Marina Drive, Seal Beach, California	June 1993	Roger D. Mason of Chambers Group Inc.
OR-1500	The 20 Acre Site of Proposed New Residential Housing on the Naval Weapons Station, Seal Beach	April 1981	David M. Van Horn PhD of Archaeological Associates, Ltd.
OR-1540	Draft Report: Archaeological Resources of the Seal Beach Naval Weapons Station, Orange County, California; The Corona Annex, Riverside County, California; and the Fallbrook Annex, San Diego County, California	November 1987	Ronald M. Bissell of RMW Paleo Associates
OR-1541	Draft Report: Archaeological Resources of the Seal Beach Naval Weapons Station, Orange County, California; The Corona Annex, Riverside County, California; and the Fallbrook Annex, San Diego County, California	January 1988	Ronald M. Bissell of RMW Paleo Associates
OR-1568	Extended Phase I Exploratory Survey for the MILCON P-902 Naval Weapons Station Seal Beach, Orange County, California	April 1997	Joyce M. Clevenger of Ogden Environmental and Energy Service Company
OR-1599	Phase I - Overview Survey and Phase II - Archaeological, Historical, and Architectural Evaluation of Cultural Resources on the naval Weapons Station, Seal Beach	June 1993	Joyce M. Clevenger, Kathleen Crawford, and Andrew Pigniolo of Ogden Environmental and Energy Service Company
OR-1607	Archaeological Monitoring of Trenching for Improvements on and Near the Softball Facility, Seal Beach naval Weapons Station, Orange County, California	November 1997	Ron M. Bissell of RMW Paleo Associates
OR-1755	Cultural Resources Records Search and Literature Review Report for a Pacific Bell Mobile Services Telecommunications Facility: CM 093-01 in the City of Huntington Beach, California	April 1998	Roger D. Mason of Chambers Group Inc.

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OR-1897	Historic Properties Overview and Evaluation on the Naval Weapons Station, Seal Beach	March 1997	Joyce M. Clevenger and Kathleen Crawford of Ogden Environmental and Energy Service Company
OR-1958	Phase I-Overview Survey and Phase II-Archeological, Historical, and Architectural Eligibility of Cultural Resources on the Naval Weapons Station, Seal Beach	February 1995	Joyce M. Clevenger and Kathleen Crawford of Ogden Environmental and Energy Service Company
OR-1960	Archeological Resource Protection Plan for the Background Study Sampling Areas at Naval Weapons Station, Seal Beach, Orange County, California	August 1995	Roger D. Mason and Richard Cerreto of Chambers Group Inc.
OR-1969	Final Historic and Archaeological Resources Protection (HARP) Plan for the Naval Weapons Station, Seal Beach	February 1997	Joyce M. Clevenger and Kathleen Crawford of Ogden Environmental and Energy Service Company
OR-1989	Archaeological Resources Protection Plan, Decommissioning of the Research, Testing, and Evaluation Area, Naval Weapons Station, Seal Beach, Orange County, California	July 1995	Judy Berryman and Roy Pettus of Bechtel National Inc.
OR-2072	Archaeological Services at Naval Weapons Station (NAVWPNSTA), Seal Beach, California (CH2M Hill Prime Contract No. N6871-96-D-2299), relative to Sampling at Installation Restoration (IR) Sites 12, 16, 25, 37, 42, 44/45, AOC 6, SWMU 24, 56, 57, OSR, and Building 128	May 2000	Ronald M. Bissell of RMW Paleo Associates
OR-2284	Archaeological Resources Protection Plan for Installation Restoration Sites 5, 8, 12, 16, 21, 40, 44 and 46 at Naval Weapons Station, Seal Beach, Orange County, California	March 1995	Roger D. Mason and Richard Cerreto of Chambers Group Inc.
OR-2285	Archaeological Monitoring at Repair Site #21, Naval Weapons Station (NAVWPNSTA) Seal beach, California	November 2000	Ronald M. Bissell of RMW Paleo Associates

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OR-2286	Archaeological Monitoring at Repair Site #21, Naval Weapons Station (NAVWPNSTA) Seal beach, California	January 2001	Ronald M. Bissell of RMW Paleo Associates
OR-2604	Cultural Resource Assessment At&T Wireless Services Facility No. 13001A, Orange County, California	August 2002	Curt Duke of LSA Associates, Inc.
OR-2608	Cultural Resource Assessment Cingular Wireless Facility No. CM 085-04, Orange County, California	January 2003	Curt Duke of LSA Associates, Inc.
OR-2687	Archaeological Monitoring of Trenching for the Main Telephone Cable Feed Vault on the Seal Beach Naval Weapons Station, California	October 2000	Jason Miller of RMW Paleo Associates
OR-2688	Replacement of a Segment of Clay Sewer Pipe, Naval Weapons Station, Seal Beach, Orange County, California	September 2000	David Bailee, Environmental Director of the Naval Weapons Station, Seal Beach
OR-3174	Preliminary Draft Final Historic and Archaeological Resources Protection (HARP) Plan for the Naval Weapons Station, Seal Beach	November 1995	Ogden Environmental and Energy Services Co., Inc.
OR-3175	National Register of Historic Places, Evaluation of Cold War-Era buildings and Structures, Naval Weapons Station, Seal Beach, Orange County, California	November 1999	JRP Historical Consulting Services
OR-3379	Final Archaeological Data Recovery Report for a Portion Prehistoric Archaeological Site CA-ORA-322/1118 to Mitigate Impacts of Soil Removal Remediation	November 2003	James Carl Chatters
OR-3402	Results of Records Search and Archaeological Reconnaissance for Royal Street Communications Site LA0663 (SCE Edison Park-Seal Beach)	June 2006	Robert J. Wlodarski, MA, RPA of Cellular Archaeological Resource Evaluations

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OR-3561	Record Search and Field Reconnaissance for Proposed Bechtel Wireless Telecommunications Site, Wells Fargo Bank, Huntington Beach, CA	June 2009	Robert J. Wlodarski, MA, RPA of Cellular Archaeological Resource Evaluations
OR-3562	Negative Archaeological Monitoring Report for the 400 Marina Drive Development Project, City of Seal Beach, California	January 2009	Monica Strauss of EDAW Inc.
OR-3735	Due Diligence Historical Archaeological Resources Review, City of Seal Beach Sewer Capital Improvement Projects, City of Seal Beach, Orange County, California	December 2008	Bai Tom Tang or CRM Tech
OR-4002	Work Plan for Presence/Absence Archaeological Testing of a Portion of Site CA-ORA-322/1118 Gardeners Road and Bolsa Avenue, naval Weapons Station, Seal Beach, California	January 2002	Jackson Underwood of EDAW
OR-4023	Cultural Resources Records Search and Survey Report for the Ocean Place Project, Seal Beach, Orange County, California	September 2005	Susan Underbrink of Chambers Group, Inc.
OR-4035	Los Angeles-Long Beach Harbor Area Cultural Resource Survey	April 1978	Lois J. Weinman and E. Gary Stickel
OR-4089	Section 106 Compliance Information-City of Seal Beach Water Tank Fence Replacement Project, Seal Beach Naval Weapons Station	March 2001	Lee Whittenberg, Director of Development Services for the City of Seal Beach
OR-4143	Sprinkler System Replacement at CA-ORA322/1118, Reference #5758 SER. N45W/0153	December 2004	David Bailee, Environmental Director of the Naval Weapons Station, Seal Beach
OR-4906	Archaeological Resources Protection Plan for Installation Restoration Sites 4, 8, 9, SWMU 56 at Naval Weapons Station, Seal Beach, Orange County, California	November 1994	Roger D. Mason and Larry A. Carbone of Chambers Group Inc.