

# **FINAL REPORT**

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## **HELLMAN RANCH WETLANDS CONCEPTUAL FEASIBILITY STUDY**

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# CONTENTS

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 PROJECT OBJECTIVE .....	1
1.2 SCOPE OF WORK .....	1
1.3 GENERAL SITE CONDITIONS .....	5
1.4 EXISTING HABITAT .....	5
<b>2.0 THE CONCEPTUAL RESTORATION PLANS .....</b>	<b>11</b>
2.1 ROUGH GRADING PLANS .....	11
2.1.1 <i>Habitat Goals</i> .....	12
2.1.2 <i>Existing Topography</i> .....	12
2.1.3 <i>Concept Topography for Concept Plan 1 – Moderate Restoration</i> .....	12
2.1.4 <i>Areas of Excavation for Concept Plan 1 – Moderate Restoration</i> .....	13
2.1.5 <i>Areas of Fill for Concept Plan 1 – Moderate Restoration</i> .....	16
2.1.6 <i>Concept Topography for Plan 2 – Maximum Feasible Plan</i> .....	17
2.1.7 <i>Areas of Excavation for Plan 2 – Maximum Feasible Plan</i> .....	17
2.1.8 <i>Areas of Fill for Plan 2 – Maximum Feasible Plan</i> .....	20
2.2 PRELIMINARY HYDROLOGIC MODELING .....	20
2.2.1 <i>Existing Tide Conditions</i> .....	23
2.2.2 <i>Tidal Conditions in the Restored Concept Wetlands Plan 1</i> .....	23
2.2.3 <i>Tidal Conditions in the Restored Concept Wetlands Plan 2</i> .....	29
2.3 REMEDIATION ALTERNATIVES FOR THE PROPERTY .....	35
2.3.1 <i>Re-Use/Disposal for Materials Not Needing Remedial Treatment</i> .....	36
2.3.2 <i>Remedial Treatment Options</i> .....	37
2.3.3 <i>Off-Site Disposal</i> .....	38
<b>3.0 COST ESTIMATES FOR MATERIALS MANAGEMENT .....</b>	<b>42</b>
3.1 COSTS FOR SOILS MANAGEMENT FOR CONCEPT PLAN 1 – MODERATE RESTORATION .....	42
3.2 COSTS FOR SOILS MANAGEMENT FOR CONCEPT PLAN 2 – MAXIMUM FEASIBLE RESTORATION .....	44
<b>4.0 ASSESSMENT OF REGULATORY FEASIBILITY .....</b>	<b>47</b>
<b>5.0 CONCLUSIONS.....</b>	<b>49</b>
<b>REFERENCES .....</b>	<b>52</b>

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## Appendix A – Materials Management Cost Estimates for the Moderate Restoration Concept

## Appendix B – Materials Management Cost Estimates for the Maximum Feasible Restoration Concept

## LIST OF FIGURES

- Figure 1 – Regional Vicinity and General Project Location Map
- Figure 2 - Land Parcels Comprising Los Cerritos Wetlands Complex
- Figure 3 – The Hellman Ranch Project Site
- Figure 4 – Existing Wetlands on the Hellman Property in 1996
- Figure 5 – Existing Site Topography
- Figure 6 - Vertical Zonation of Wetland Habitat
- Figure 7 - Conceptual Grading Plan for Restoration Concept 1– Moderate Restoration
- Figure 8 - Areas Targeted for Beneficial Re-Use of Fill Soil Material – Moderate Restoration Plan
- Figure 9 - Conceptual Grading Plan for Restoration Concept 2 – Maximum Feasible Restoration
- Figure 10 - Areas Targeted for Beneficial Re-Use of Fill Soil Material – Maximum Feasible Restoration
- Figure 11 - Model TEA Tidal Series
- Figure 12 - Tidal Fluctuations Under Spring Tide Conditions for Plan 1 – Moderate Restoration
- Figure 13 – Areas Inundated During Spring Low Tide for Concept 1– Moderate Restoration
- Figure 14 – Areas Inundated During Spring High Tide for Concept 1– Moderate Restoration
- Figure 15 – Tidal Inundation Frequency Curve for Plan 1 – Moderate Restoration
- Figure 16 - Tidal Fluctuations Under Spring Tide Conditions for Plan 2 – Maximum Feasible Restoration
- Figure 17 – Areas Inundated During Spring Low Tide for Concept 2 – Maximum Feasible Restoration
- Figure 18 – Areas Inundated During Spring Low Tide for Concept 2 – Maximum Feasible Restoration
- Figure 19 – Tidal Inundation Frequency Curve for Plan 2 – Maximum Feasible Restoration
- Figure 20 – Future Habitat Area Distributions for Plan 2 – Maximum Feasible Restoration

## LIST OF TABLES

- Table 1. Recorded Water Levels at Los Angeles Outer Harbor
- Table 2. Tidal Conditions for the Moderate Restoration Plan 1
- Table 3. Tidal Conditions for the Maximum Restoration Plan 2
- Table 4. Results of Previous Site Investigations Compared to Example Soil Screening Levels for use at Hellman Properties
- Table 5. Costs for Concept Plan 1 (Moderate Restoration) Materials Management Alternatives
- Table 6 Costs for Concept Plan 2 (Maximum Feasible Restoration) Materials Management Alternatives
- [Table 7. Habitat Areas of the Proposed Alternatives](#)

# 1.0 INTRODUCTION

Hellman Ranch in Seal Beach, California, is a large (approximately 175-acre) parcel of land that includes an active oil field, as well as degraded wetland areas. The regional vicinity and the location of Hellman Ranch are shown in Figure 1. The site is considered a part of the larger historic Los Cerritos Wetlands Complex that also includes other nearby properties that total approximately 496 acres in area roughly centered on the lower San Gabriel River as shown in Figure 2. Los Cerritos Wetlands was historically a complex of salt marsh, brackish marsh, and estuarine habitats. The project site for this report is a sub-area of Hellman Ranch referred to as the 100-acre deed restricted area. The project site is shown in Figure 3.

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Certain groups and agencies desire to restore areas of the Los Cerritos Wetlands to appropriate habitats and are acquiring on-site properties to facilitate that goal. The Los Cerritos Wetlands Authority (LCWA) is considering purchasing the 100-acre deed restricted area for the purpose of wetlands restoration (Project Site). Prior to any purchase agreement, the LCWA is researching the possible costs of soil remediation at the site. Oil extraction activities historically existed on the portion of the site subject to the possible purchase and presently occur on the remainder of the site, and certain contaminants have been documented to exist within the soil. Such soil contamination may require remediation prior to restoration and the costs of that activity may bear on the purchase agreement.

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## 1.1 Project Objective

The objective of this project is to quantify the probable costs for remediation of soils at the site that would likely be required for restoration. Soil remediation costs will be considered by the LWCA as part of any purchase agreement for the property. Estimating probable soil remediation costs requires preparation of a rough restoration plan to identify a concept for future restoration, and associated locations and depths of soil removal and/or modification. This report presents two concepts for future wetland restoration on the 100-acre deed restricted area on Hellman Ranch. Components of these restoration plans include a rough grading plan for each, analysis of future hydrodynamics, alternatives for soil remediation, costs for remediation, and assessment of regulatory feasibility.

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## 1.2 Scope Of Work

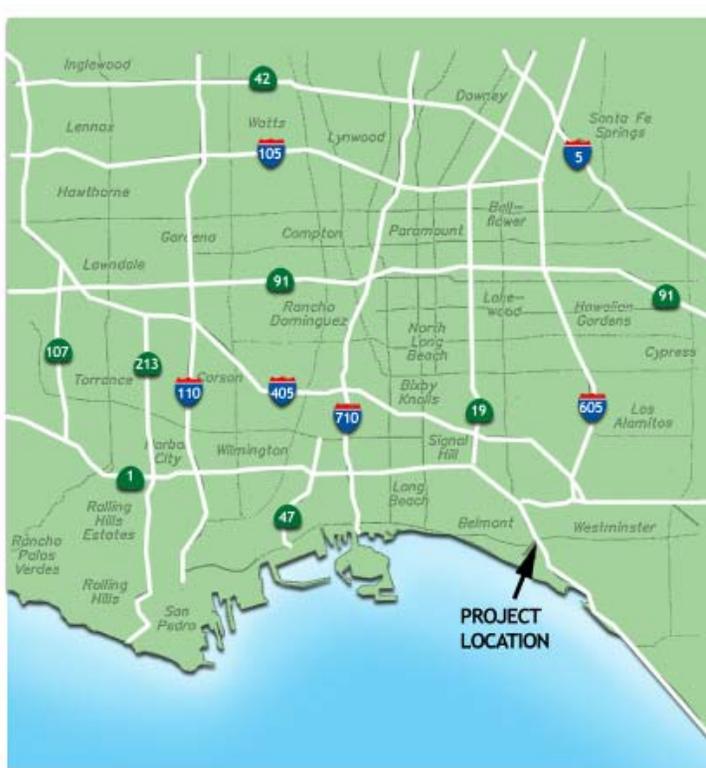
The consulting services contracted for this project included crafting a conceptual plan for maximum feasible habitat restoration that specifies the type and location of proposed habitat, required grading and hydrology. Based on that plan, the consultants will evaluate the feasibility of the most promising alternatives to clean-up each of the contaminated areas on the property that could be affected by the restoration and present costs of each clean-up alternative.

While the scope calls for preparation of one restoration concept, the restoration team identified the need to go beyond that scope and present two restoration concepts to show

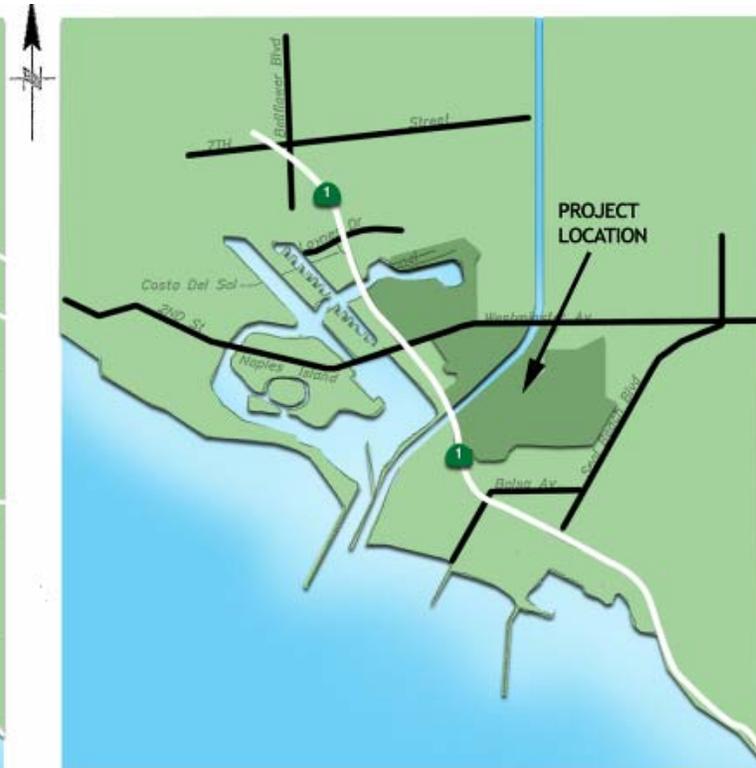
a range of options. The range of actions vary from a maximum feasible restoration option with higher remediation costs, and a less extensive restoration option with lower restoration costs. The following tasks are included in the contracted scope of work for this project:

1. Prepare a rough grading plan of the restoration concept;
2. Perform preliminary hydrologic modeling of the concept;
3. Prepare alternatives for material management;
4. Prepare cost estimates for materials management;
5. Assess regulatory feasibility of remedial actions; and
6. Prepare and submit a draft and final report of the findings and all work.

Two grading plans and two hydrologic modeling efforts were performed to address the two concept restoration plans.



VICINITY MAP  
NTS



LOCATION MAP  
NTS

Figure 1 – Regional Vicinity and General Project Location Map



Figure 2 – Land Parcels Comprising Los Cerritos Wetlands Complex



Figure 3 – The Hellman Ranch Project Site

### 1.3 General Site Conditions

Historically, Hellman Ranch was once a part of the San Gabriel River Estuary, a large network of wetlands at the downstream end of the San Gabriel River. Gradually, development of the area resulted in significant infilling of former wetlands and reduction of habitat area. Oil was discovered on Hellman Ranch in the 1900's and the site was in oil production for the majority of the 20<sup>th</sup> century. Remnants of oil activity and certain active oil operations still exist on property adjacent to the Project Site. There is some soil contamination from previous activities present on the Project Site. Consequently, the site contains remnants of this former activity with some areas of contamination.

Fill was placed over portions of the property during construction of the San Gabriel River flood control levees in 1967-68 as flood control. As a result, the Hellman property is higher in elevation than adjacent sites. The site has not been developed, but a drainage channel exists for stormwater runoff. This channel is connected to the lower San Gabriel River with a culvert outfitted with a flap gate. The flap gate is propped open by debris and seawater from the River penetrates through the culvert to the site.

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### 1.4 Existing Habitat

A degraded tidal salt marsh exists on the Hellman site where elevations are low enough that they can be influenced by the regular inundation of seawater. The degraded wetland contains subtidal and intertidal habitats. Intertidal habitat is comprised of mudflat and pickleweed areas. A more

comprehensive discussion of existing site conditions is presented in a previous report prepared for the site (Moffatt & Nichol 1996) and presented below.

Wetland delineations on the project site indicate that approximately 27.0 acres of wetland exist on the site according to State of California criteria, while 23.2 acres exist according to Federal government (U.S. Army Corps of Engineers) criteria (LSA, 1989 and CRM, 1996). The condition of the existing wetlands is "degraded" and "severely degraded" as described in the delineation done by LSA in 1989 for the previous Supplemental Environmental Impact Report (SEIR) for the Hellman Ranch Specific Plan (Michael Brandman Associates, MBA, 1987). CRM confirmed the degraded status of the wetland in 1996 (CRM, 1996).

A detailed survey was performed by Mr. Robert Radovich of the California Department of Fish and Game (CDFG) in 1980 which is referred to extensively throughout this section. This section summarizes pertinent information from the restoration plan prepared by LSA (1990). Information is also included from CRM (1996).

The Hellman property is located within the historic footprint of salt marsh and tidal channels comprising the Alamos Bay wetlands, which is part of the larger regional system. The wetlands, like others in Southern California, have been reduced in area and fragmented by development (Zedler, 1984). The Hellman property has also been significantly altered from its original condition by oil drilling starting in the 1930's and flood control in the early 1960's. The most important of these alterations was the channelization of the San Gabriel River by the U.S. Army Corps of Engineers in 1961-1962 (L. Flannery, Personal Communication, 1996), and the resultant removal of tidal influence over much of the lower-lying portions of the site. When the river was channelized, a culvert and flap gate were installed to maintain drainage from a swale on the Hellman property. The flap gate became propped partially open, allowing limited tidal flow to be reintroduced to the site and for re-establishment of wetlands to occur. Another major alteration of the site is the addition of large quantities of fill to portions of the site by the U.S. Army Corps of Engineers in 1967. Additional disturbance has resulted from many years of historical off-road vehicle use, soil discing, additions of small quantities of fill, and other types of human intrusion.

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This history of land use has transformed the Hellman site into an isolated and severely degraded wetland. A study performed by Coastal Resources Management (CRM, 1996) verified previous studies which concluded that the site is not extensively utilized by birds or fish and it is in substantial need of restoration.

The existing wetlands are presented in terms of four habitat types described below. Figure 4 shows existing wetlands on the site. Acreages referred to below are areas defined by wetland delineation according to State guidelines, which are generally more inclusive than areas delineated according to Federal guidelines.

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### Tidal Channel

Approximately 3.2 acres of tidal channels exist on the site. The narrow central channel that runs through the site contains brackish water due to its connection to the San Gabriel River. The bottom and lower banks of the channel are unvegetated mud, while the upper banks are vegetated with primarily common pickleweed (*Salicornia virginica*). A large quantity of algae, primarily *Enteromorpha sp.*, grows in the water of the channel, with a small amount of sea lettuce (*Ulva sp.*)

occurring near the channel mouth. This habitat was described as a "degraded wetland" by Radovich of the CDFG in the 1980 report, and confirmed by LSA (1989) and Levine (1995). As of the time of the last delineation in 1996, the degraded wetland condition at the Hellman site had remained unchanged (CRM, 1996).

### **Salt Marsh**

Approximately 14.9 acres of salt marsh habitat exist on-site. The 1996 verification of the previous delineation to State criteria, and the delineation done in 1996 according to Federal criteria classified salt marsh areas on the site (CRM, 1996). The classification of salt marsh is broadly interpreted for purposes of this project. The vegetation in the salt marsh at the Hellman site is very mildly influenced by tidal water. The term salt marsh is therefore used here to describe the vegetation rather than the physical characteristics of this habitat type. It encompasses some of the smaller vegetated areas which were classified as alkaline flats by the CDFG (1980), LSA (1989) and CRM (1996).

Due to degraded conditions, the vegetation on-site does not include many of the species which are often associated with a fully functional tidal salt marsh such as cordgrass (*Spartina foliosa*), shoregrass (*Monanthochloe littoralis*), sea-lavender (*Limonium californicum*) and saltwort (*Batis maritima*). However, the existing vegetation can be roughly compared to the vegetation types associated with normal tidal zones as described by Zedler (1982). In wetter areas of the salt marsh, vegetation is similar to that associated with the mid-littoral zone (i.e., the zone around mean higher high water). These areas are dominated by pickleweed and samphire (*Salicornia subterminale*) which form nearly pure stands in some locations. Other vegetation in these wetter areas includes such plants as fleshy jaumea (*Jaumea carnosa*), and alkali heath (*Frankenia grandiflora*). The drier portions of the vegetated wetlands are more characteristic of the upper littoral zone or the lower maritime zone. Pickleweed is still found, but these areas are dominated by facultative plants, i.e. plants which can grow in either wet or dry conditions. Dominant vegetation includes weedy, halophytic (salt tolerant) species such as saltgrass (*Distichlis spicata*), alkali weed (*Cressa truxillensis*) and fivehook bassia (*Bassia hyssopifolia*). In addition to these species, the drier wetland areas support a significant component of upland weeds such as annual grasses (*Bromus spp.*, *Avena barbata*), Russian thistle (*Salsola iberica*) and cheeseweed (*Malva parviflora*). These vegetated wetlands which lie outside the tidal channel were originally described as "severely degraded" by the CDFG (1980) and confirmed by LSA (1989) and CRM (1996).

### **Seasonal Ponds**

Approximately 2.0 acres of seasonal ponds exist on the site. The seasonal pond classification includes some of the area that was included by the CDFG (1980) under the broader term of the open water. MBA (1987) included the seasonal ponds in the category of alkaline flats. A separate category for seasonal ponds is established and applied in this case because the ponds have somewhat more wetland value than alkaline flats, and field studies have shown that ponding for a significant length of time is limited to only certain portions of the alkaline flats.

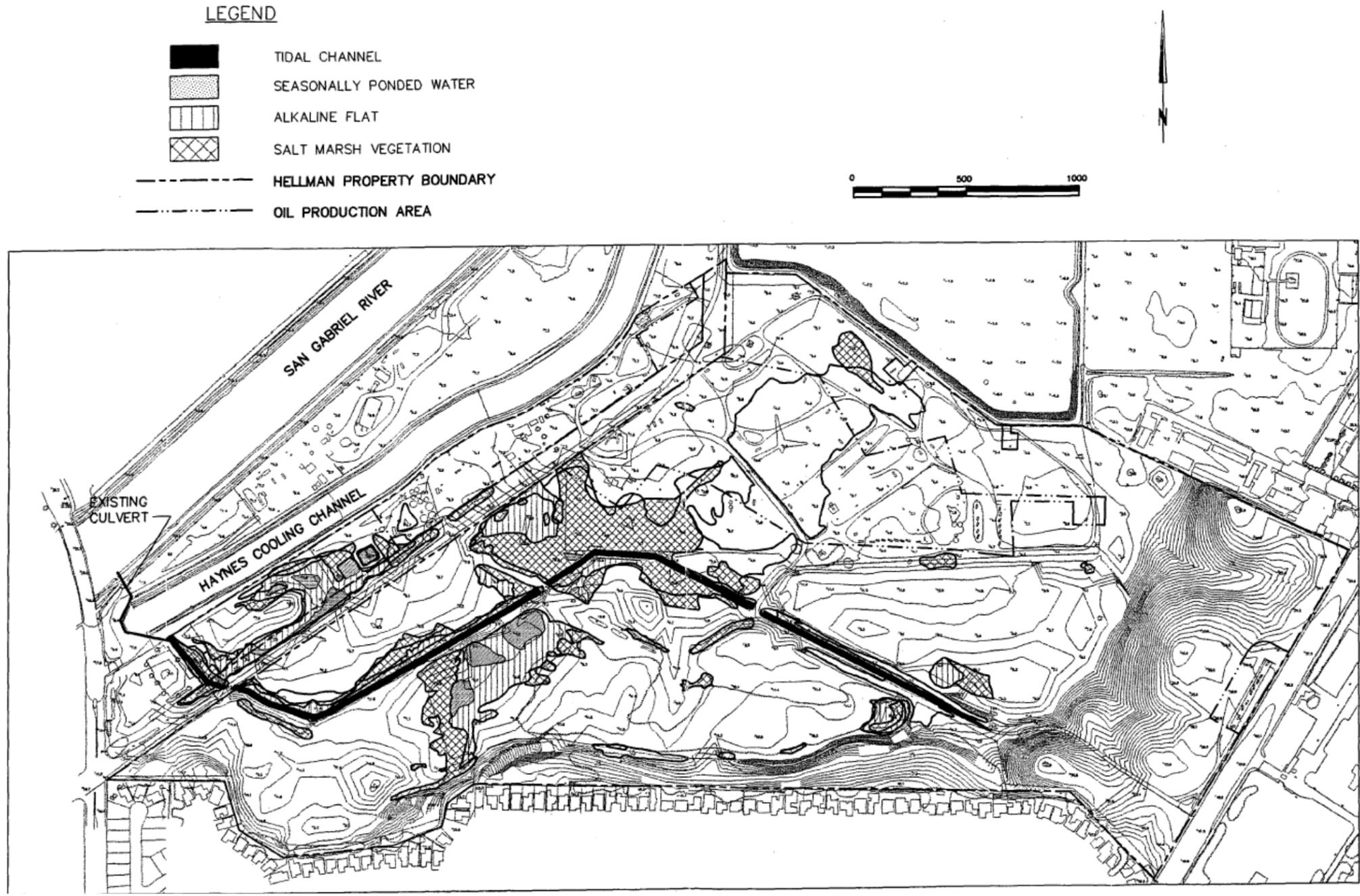


Figure 4 – Existing Wetlands on the Hellman Property in 1996

Much of the site has relatively impermeable soils, and where depressions occur these impermeable soils pond shallow water from seasonal rains and runoff. In some areas ponded water stands for months during a normal rainy season, while in other areas the ponds may last for several weeks after significant rains. Most of these seasonal pond areas are completely lacking vegetation, whereas others support small patches of pickleweed and other species. These areas were also originally described as "severely degraded" by the CDFG (1980) and confirmed by LSA (1989) and CRM (1996).

### **Alkaline Flats**

Approximately 7.0 acres of alkaline flats exist on the Hellman site. The classification of alkaline flats is applied in this summary to describe barren areas, i.e. less than 30% vegetative cover, which exhibits some hydrological indicators of wetlands. Small patches of pickleweed and facultative halophytes occur in some areas of these alkaline flats. Excluding the seasonal ponds, this is essentially the same classification originally used by the CDFG (1980) and LSA (1989).

## **3.2 Wildlife**

In general, the wildlife use of the site is quite low when compared with other, more fully functional salt marshes in the region (Levine, 1995). This is partly due to a lack of adequate tidal flushing which in turn has resulted in low habitat diversity (LSA, 1990). Additionally, the historical disturbance of the site has contributed to this lack of diversity, through both the destruction of vegetation and by contributing to poor soil conditions (Ibid). Finally, site use by off-road vehicles, hikers, off-road bicyclists and domestic animals has severely limited wildlife use of the site (Ibid). In his study for the CDFG (1980), Radovich observed that "the wildlife values of the subject wetland areas are poor." This observation was confirmed by CRM in 1996.

The two sensitive animal species that were identified as potentially occurring on the wetland portions of the site include the: 1) California least tern; and 2) Belding's savannah sparrow (Levine, 1995).

### **3.2.1 California Least Tern**

The California least tern (*Sterna antillarum browni*) is listed as an endangered species by both the CDFG and U.S. Fish and Wildlife Service (USFWS). This small tern forages primarily in near-shore ocean waters and river mouths. The tern also travels up rivers for short distances and will occasionally forage in adjacent or nearby waters such as cooling channels, tidal channels and significant ponds which contain fish. The CDFG has reported that the California least tern has been observed foraging in the tidal channel on the Hellman property (CDFG, 1980). More recently MBA and LSA biologists did not observe the California least tern on-site, but MBA biologists observed this species in the San Gabriel River Channel in the vicinity of the site (MBA, 1987 and LSA, 1989). Therefore, it is likely that the California least tern occasionally forages in the tidal

channel on-site, but the tidal channel would not be a primary foraging area. Since this species typically breeds on open, sandy beaches, there is no potential breeding habitat on-site. A survey of the site in 1995 did not document use by least terns (Levine, 1995).

### 3.2.2 Belding's Savannah Sparrow

As summarized in the LSA report of 1989, the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) is listed as an endangered subspecies by DFG and is a federal Category 2 Candidate for listing as an endangered species (a species for which listing may be warranted, but for which sufficient information to support such listing is not available). This subspecies is a resident in coastal salt marshes in Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties. The nearest documented breeding habitat for this bird is Anaheim Bay. It nests in stands of pickleweed, above the high tide line, and frequently forages in the intertidal areas. The DFG has reported the presence of the subspecies on the site (Comment on Draft EIR, 1987, and CDFG, 1980). However, breeding by the listed subspecies is not cited in these references. Furthermore, it is difficult to distinguish between the Belding's savannah sparrow and the non-endangered subspecies (*P.s. nevadensis*) during the winter when *P.s. nevadensis* is present. Surveys by MBA biologists during the 1987 breeding season indicate that the Belding's savannah sparrow did not breed on the site at that time. During field studies by LSA biologists during the winter of 1988-1989, the presence of *P.s. nevadensis* was noted (LSA, 1989). MBA and LSA biologists have independently determined that significant breeding habitat for the listed subspecies does not occur on-site. Massey, et al. (1977) and Levine (1995) do not list the site as occupied by this species. Given the available information, significant breeding by the Belding's savannah sparrow is not likely to occur on the site, but occasional breeding by very low numbers of these birds is possible. Up to ten breeding pairs were observed on-site in 2007 by the Rivers and Mountains Conservancy (Eric Zahn, Personal Communication, June 28, 2007). The site has outstanding potential for occupation by Belding's Savannah Sparrows after restoration. Design and restoration should be done sensitively to provide for their protection and to enable their use of the site during and immediately after work.

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Although the quality of the existing wetland is relatively poor, it does provide habitat for migratory birds, invertebrates, and probably fish. Effective restoration is possible on the site if conditions were improved to allow more frequent and extensive tidal flushing.

## 2.0 THE CONCEPTUAL RESTORATION PLANS

Restoration of the Hellman Ranch Wetlands can be accomplished with modifications to the existing site. Modifications should basically include:

1. Providing an improved connection to a reliable and relatively unrestricted seawater source; and
2. Lowering topographic elevations over substantial portions of the site to allow for tidal inundation and evolution of salt marsh habitats.

Therefore, wetland concept plans consist of grading plans for providing suitable three-dimensional geometry for formation of salt marsh habitat that would include new connection to the tides, and soils material management plans that present soil remediation options. These plans are presented and analyzed herein.

Two concept restoration plans are provided in this report. The first plan was presented in the initial Draft Report and retained for reference to the second plan. The first plan is a moderate restoration plan in terms of area restored and soil volume to managed and requiring disposal. It provides for 35 acres of wetlands that equals 150% of the federally-defined wetland area on-site. The second plan is a reasonable maximum feasible restoration plan in which aquatic habitat area is maximized over the site and soil volumes for disposal are also maximized. It provides for 60 acres of wetlands, or 250% of the federally-defined wetland area on-site. The plans are presented as Plan 1 (moderate plan) and Plan 2 (maximum feasible plan) throughout this document. Both plans preserve 9 acres of upland for raptor foraging in compliance with the deed restriction. Earthwork at former fill areas on the lowland of the Hellman site could unearth former Native American sites and investigations should occur prior to any construction.

### 2.1 Rough Grading Plans

The intent of the project is to create a condition of hydrology and soils at the site conducive to development of wetland habitat. Wetland habitat presently exists on portions of the site, but is desired to occupy all appropriate areas, and be complemented by transitional and upland habitat along the perimeter.

The grading plans presented herein are simplified versions of plans to establish salt marsh habitats. They are not intended to represent optimal plans yet, and their development is limited to the effort possible within this limited scope and budget. However, this acquisition planning effort serves as an initial attempt to show likely locations and depths of excavation under both moderate and maximum restoration scenarios. This information is then used to determine locations and the extent of possible remediation. The concept grading plans presented herein may significantly change prior to any actual restoration.

### 2.1.1 Habitat Goals

The desired wetland habitat for the site consists of a mix of subtidal habitat that is nearly always inundated (below mean lower low water, or the average of spring low tides and the zero mark on tide books/charts), intertidal habitat that alternates between being inundated and being exposed (between mean lower low water and mean higher high water, or the average of spring high tides), and supratidal habitat that is not typically submerged (above mean higher high water). Subtidal habitat is utilized primarily by fish, intertidal habitat is utilized primarily by fish, birds, crabs and worms, and supratidal habitat is primarily used by birds and rodents. Intertidal habitat further consists of unvegetated areas called mudflats, and vegetated areas consisting of pickleweed and/or cordgrass stands.

Habitats tend to form around the wetland perimeter at elevations relative to the tides. Typically, unvegetated salt marsh habitats form where inundation occurs greater than 41% of the time, and vegetated habitats evolve at areas where inundation occurs less than 41% of the time (Keith Merkel, Personal Communication, 2003). Tidal inundation curves show the percentage of time tides inundate certain elevations within a marsh. The curves can indicate elevations where habitats may form and are included in the tidal analysis in this report. Figure 5 shows a cross-section of wetland habitat formation relative to tidal water levels in the marsh.

This project seeks to establish a balance of these habitats on-site in the form of a naturalized condition. The proportions of the habitats can vary, depending on need within the region. Intertidal habitat is typically considered in greatest need, followed by subtidal habitat, and then supratidal habitat (Noel Davis, Chambers Group, Personal Communication with Chris Webb, June 5, 2007). Supratidal, or upland, habitat would form above the tides. Existing soils that may be re-used on-site at uplands will need to be tested for salinity during engineering to determine if levels are prohibitive to colonization of vegetation. If soil investigations are too saline, soil amendments may be needed to render existing soils sufficiently suitable to sustain vegetated habitat.

### 2.1.2 Existing Topography

Existing topography was assessed to identify how it could be modified with moderate effort to create new wetland areas, while capitalizing on existing low areas on the site. The entire site is relatively high compared to the tides and large areas need to be lowered for restoration. The center of the 100-acre deed restricted area is the lowest portion of the site, with relatively low areas extending upstream and downstream of it along the axis of the existing drainage/tidal channel. Surrounding terrain progressively rises in all directions and reaches a maximum to the east and south toward the residential mesas. Figure 6 shows the existing topography of the site.

### 2.1.3 Concept Topography for Concept Plan 1 – Moderate Restoration

For this study, modifications to existing topography were planned to capitalize on only the existing relatively low areas (below +4 to +6 feet, relative to mean sea level or MSL) on-site, to lower them further, and connect them to adjacent relatively low areas to form a

central tidal basin. This central basin area would be connected downstream to the tides and to more distant habitat areas upstream by enlarging and lowering the existing drainage/tidal channel along its entire length. Figure 7 shows a conceptual grading plan for this moderate restoration plan. Approximately 35 acres of area would be wetland under this scenario with the balance of the area (65 acres) being upland.

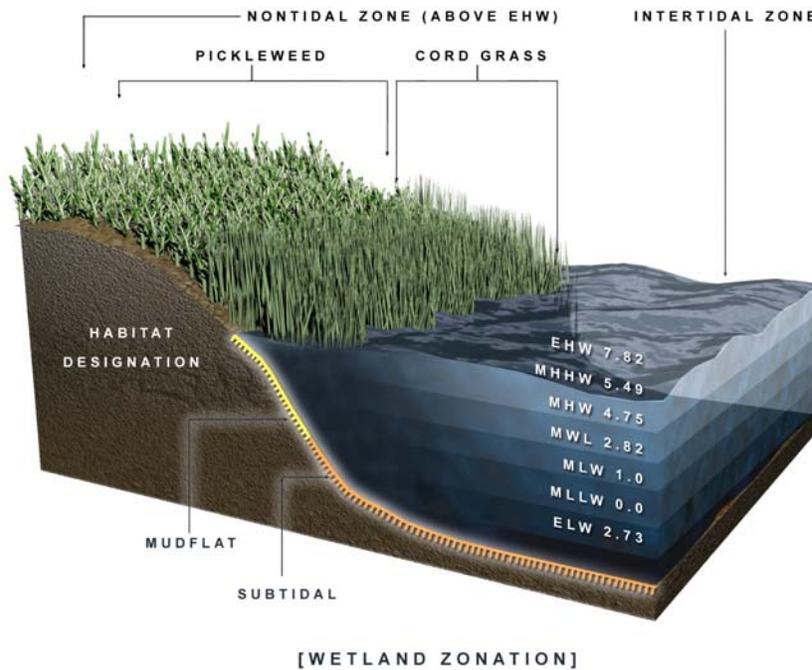


Figure 5 – Vertical Zonation of Wetland Habitat

### 2.1.4 Areas of Excavation for Concept Plan 1 – Moderate Restoration

Restoration areas on the site for the moderate plan (Concept Plan 1) are essentially defined as below the +4 foot contour MSL. Areas included within this footprint on the site are those that are either initially at or below that elevation, or those below approximately +6 feet MSL that are in proximity to the existing lower ground and could be incorporated into the “restoration footprint” with only moderate earthwork. Under this alternative, areas above +6 feet MSL are considered too high for relatively inexpensive modification for restoration.

This approach reflects maximum use of existing topographic conditions to create a central subtidal basin area (where existing wetland is concentrated on-site) that can “feed” adjacent new wetland areas with channels along existing lower portions of the site. Even with utilizing existing low ground for restoration, the volume of earth material to be

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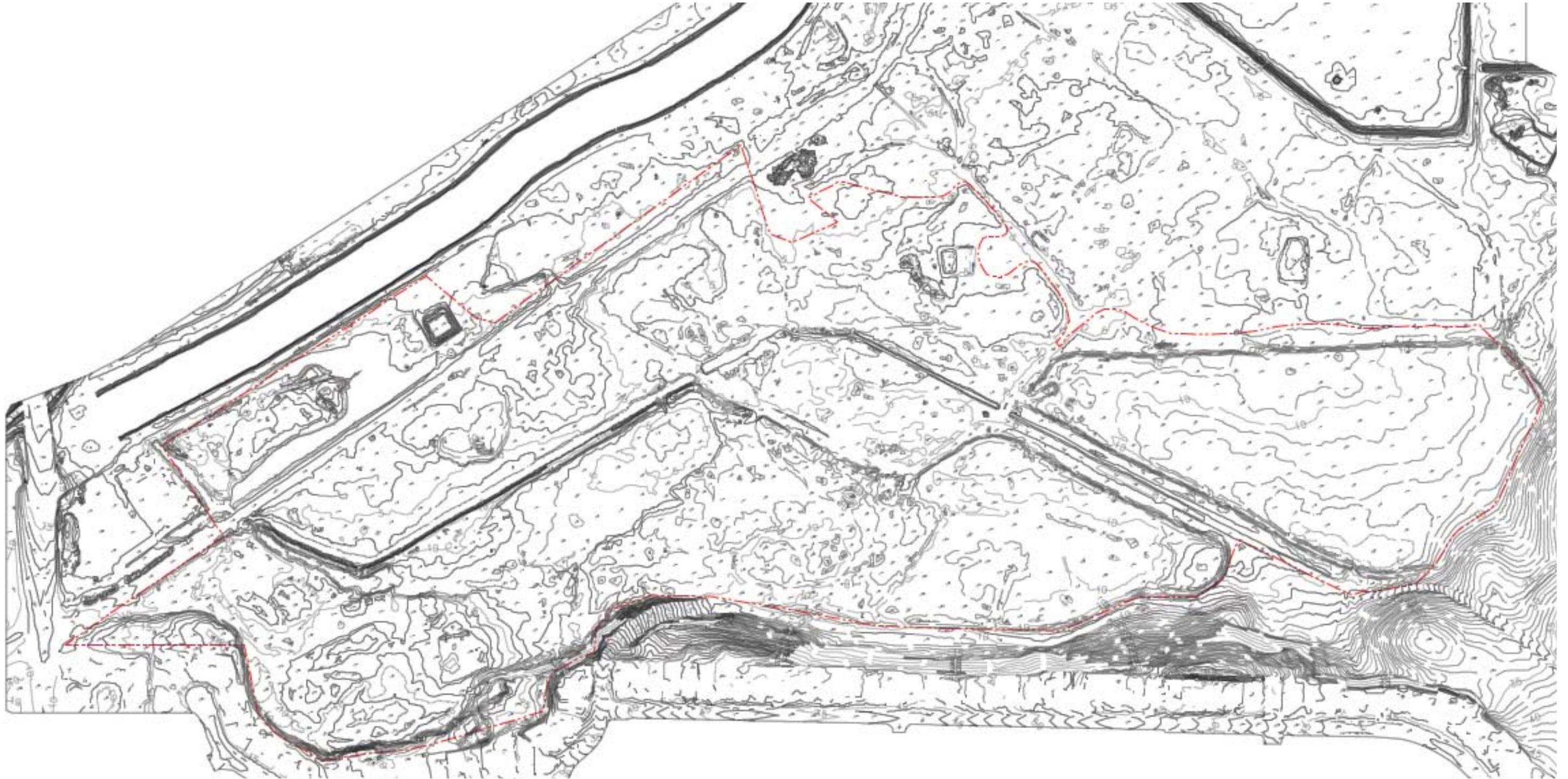


Figure 6 – Existing Site Topography

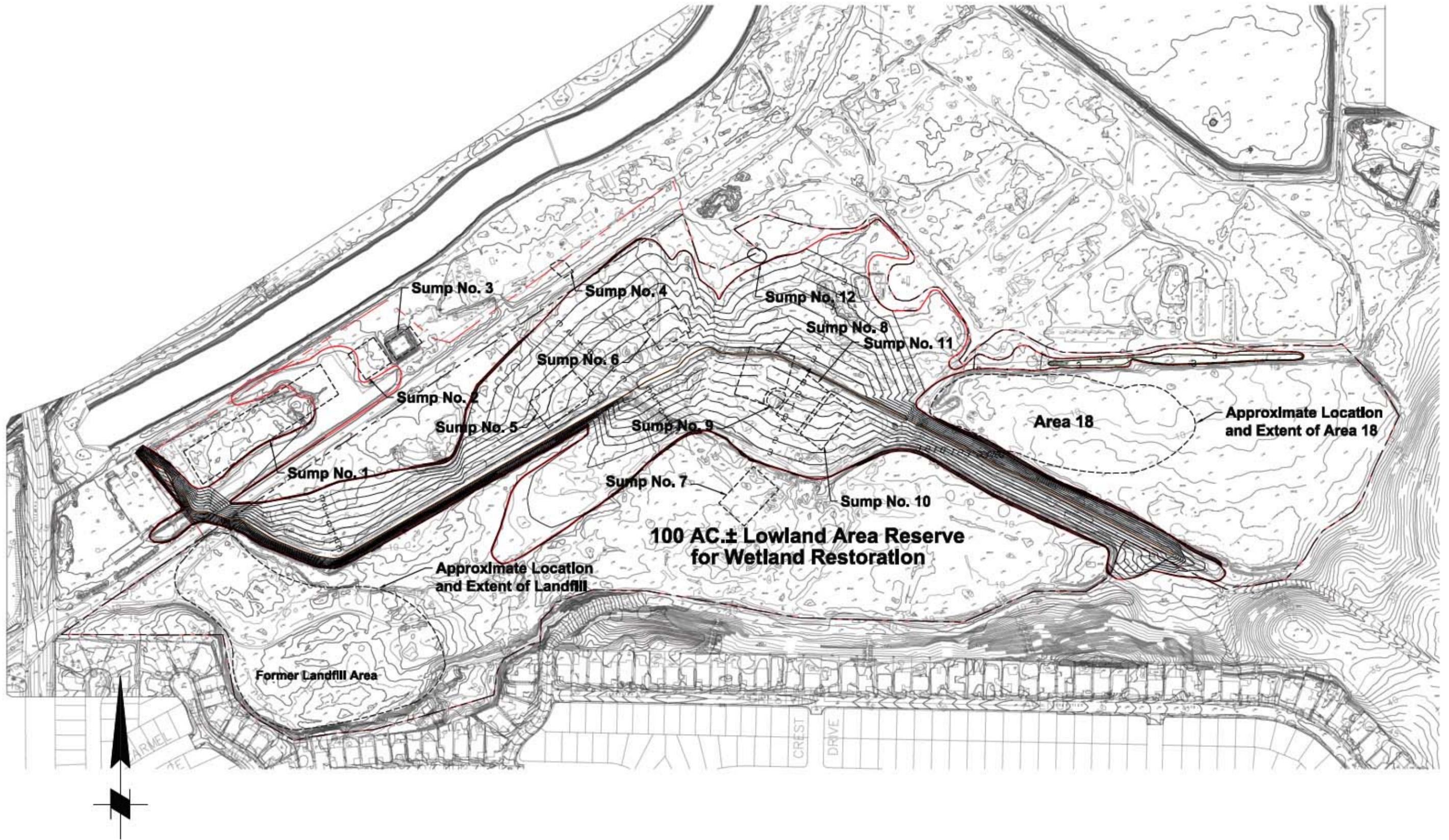


Figure 7 – Conceptual Grading Plan for Restoration Concept 1 – Moderate Restoration

excavated is approximately 200,000 cubic yards (cy). This material will have to either be re-used on site or disposed of off-site. A certain portion of this surplus soil is impacted with chemical contamination and may require remediation or special handling prior to re-use and is the subject of materials management.

### 2.1.5 Areas of Fill for Concept Plan 1 – Moderate Restoration

Re-use of surplus earth material generated from excavation is assumed to be used as fill at upland areas on the site. Surplus material can be extensively re-used on-site where needed based on site function under this alternative. Functional material re-use could include raising the entrance road, diking along the northern perimeter of the 100-acre deed restricted area, capping contaminated areas, and modifying upland habitat to become more variable in surface grade.

The entrance road into the Hellman site from Pacific Coast Highway is proposed to be raised by approximately 4 feet to approximately +12 feet MSL to keep it above any future high water levels under all conditions. Elevating the road would be done while not impinging on existing utility poles that stand along the roadway by maintaining the fill footprint for the road to within the footprint between the poles. Also, road fill cannot preclude access to an existing water line along the roadway owned by the City of Seal Beach. This project assumes that the waterline can remain in place and this assumption has been verified in discussions with the City. Concept design of the new road meets these requirements. The City will require that the existing City water line not be any deeper than 4 feet below the roadway or other ground-covering surface that is re-graded as part of the future restoration plan. SCE will also require sufficient access to maintain the current power poles. Additional discussions with the City and SCE should occur as part of more detailed restoration planning and engineering.

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**Deleted:** This project assumes that the waterline can remain in place but this assumption needs to be verified with the City prior to further work.

A dike will be required primarily along the northern perimeter of the 100-acre deed restricted area to prevent flooding of oil field land to the north and intrusion into the wetland from outside adjacent areas. The oil wells, roads, and infrastructure on the northern portion of the Hellman property need to be protected from flooding during high tides combined with stormwater input to the future marsh. The 100-acre deed restricted area should also be physically buffered from any activities outside of the restoration area and the dike will provide that type of buffer. The dike would reach up to approximately +8 feet MSL, or be between 3 to 5 feet above existing grade on average. The dike is envisioned to be landscaped with native vegetation, and to be easily removed or breached as needed during subsequent wetland restoration phases that will connect the northern parcel with the southern parcel in the future. Removing the dike would be a simple earth-moving operation that costs approximately \$3 per cubic yard, and the dike volume is small (less than 5,000 cubic yards) so the overall cost of that operation would be low.

Storm water runoff to the oil area north of the 100-acre deed restricted site will still need to be allowed to drain either to the San Gabriel River, the new wetland, or the Los Alamitos Retarding Basin to prevent flooding of infrastructure. Also, a dike may be needed along the perimeter of the Los Alamitos Retarding Basin. Flood waters from this

basin have inundated the Hellman site in previous years and a dike would serve to minimize the probability of this occurrence in the future.

Also, the southwest area of the site known as the former landfill, and Area 18 to the east should be capped with clean earth to maximize separation from restored habitat. This moderate project plan assumes that approximately 4 feet of clean earth fill is placed over these areas. The balance of surplus soil on-site could be completely re-used and remain on-site if approximately a two-foot thick layer of soil were placed over remaining uncontaminated upland sites. Approximately 50 acres of upland area are available for placement of fill if the 9-acre raptor foraging area is not used. The quality and diversity of that habitat could be improved by varying the upland topography by mounding. Fill soils will need to be assessed for their suitability to sustain upland habitat vegetation types. Much of the existing soil cover is soil originally dredged from the marine environment and likely possesses high salt content.

Sufficient opportunities for beneficial re-use of fill material exist on-site so that off-site disposal is not necessary for this concept unless the soil proves to be contaminated to levels that require off-site disposition. Figure 8 shows areas targeted for beneficial re-use of fill soil material.

#### **2.1.6 Concept Topography for Plan 2 – Maximum Feasible Plan**

For this concept, modifications to existing topography are more extensive to accomplish maximum feasible wetland restoration. The same basic configuration is assumed as for Concept Plan 1, with more area included around the perimeter at areas of the site that are above +6 feet and generally up to +10 feet MSL. A relatively large central basin area would be connected downstream to the San Gabriel River and upstream to new wetland by enlarging and lowering the existing drainage/tidal channel along its entire length. Figure 9 shows a conceptual grading plan for maximum feasible restoration. Approximately 60 acres of area would be wetland under this scenario with the balance of the area (40 acres) being upland. This concept grading plan is intended for planning purposes only and may significantly change prior to any actual restoration.

#### **2.1.7 Areas of Excavation for Plan 2 – Maximum Feasible Plan**

Restoration areas on the site are essentially defined as generally below the +10 foot MSL contour. All available areas are included within this restoration footprint with topography considered less of a constraint than for the moderate alternative. For this effort, areas above +10 feet MSL are assumed so high that earthwork volumes would be significant and pose a constraint to restoration.

The volume of earth material to be excavated is approximately 400,000 cy. This material will have to either be re-used on site or disposed of off-site. A certain portion of this surplus soil is impacted with chemical contamination and may require remediation or special handling prior to re-use and is the subject of materials management.

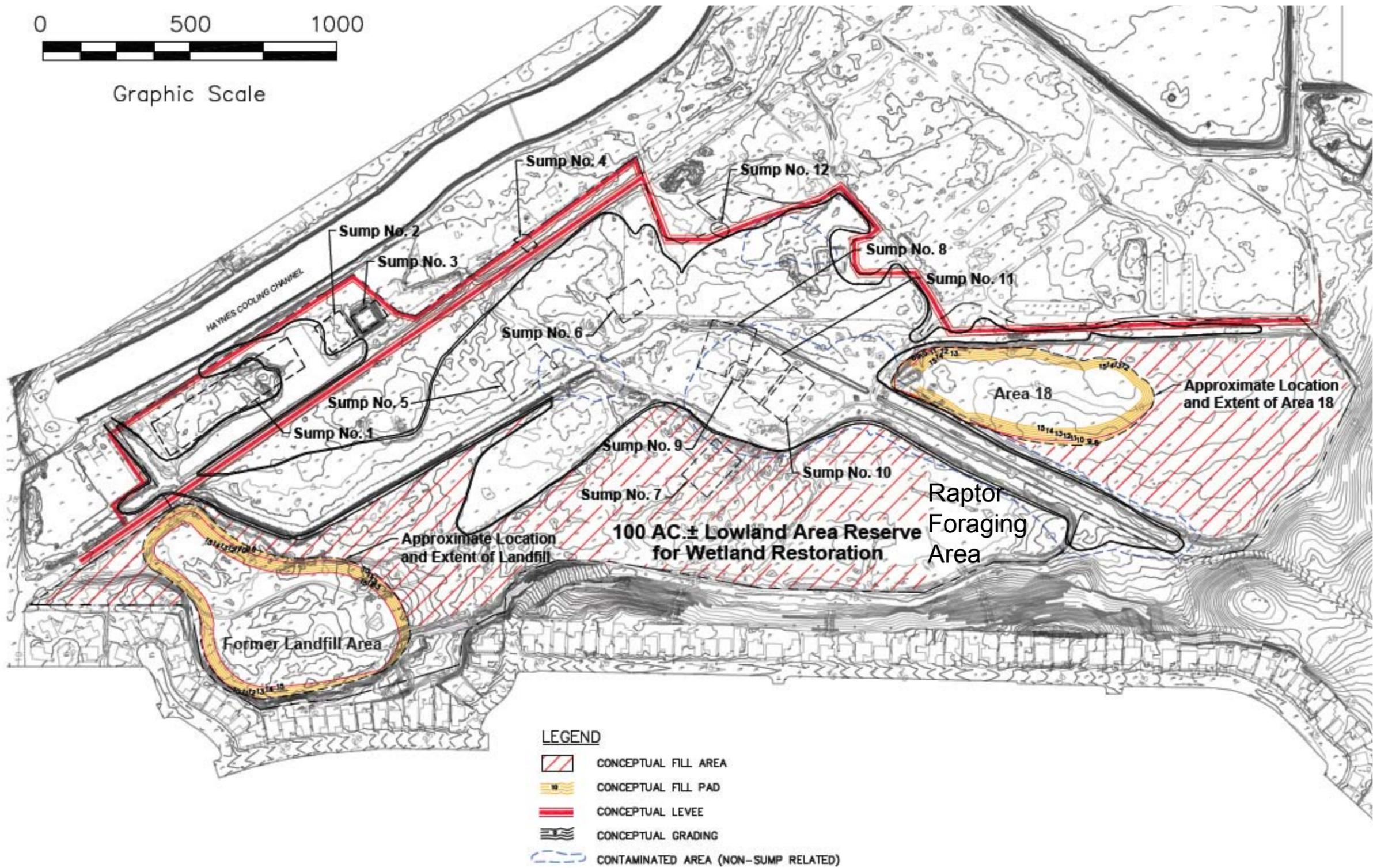


Figure 8 - Areas Targeted for Beneficial Re-Use of Fill Soil Material – Moderate Restoration Plan

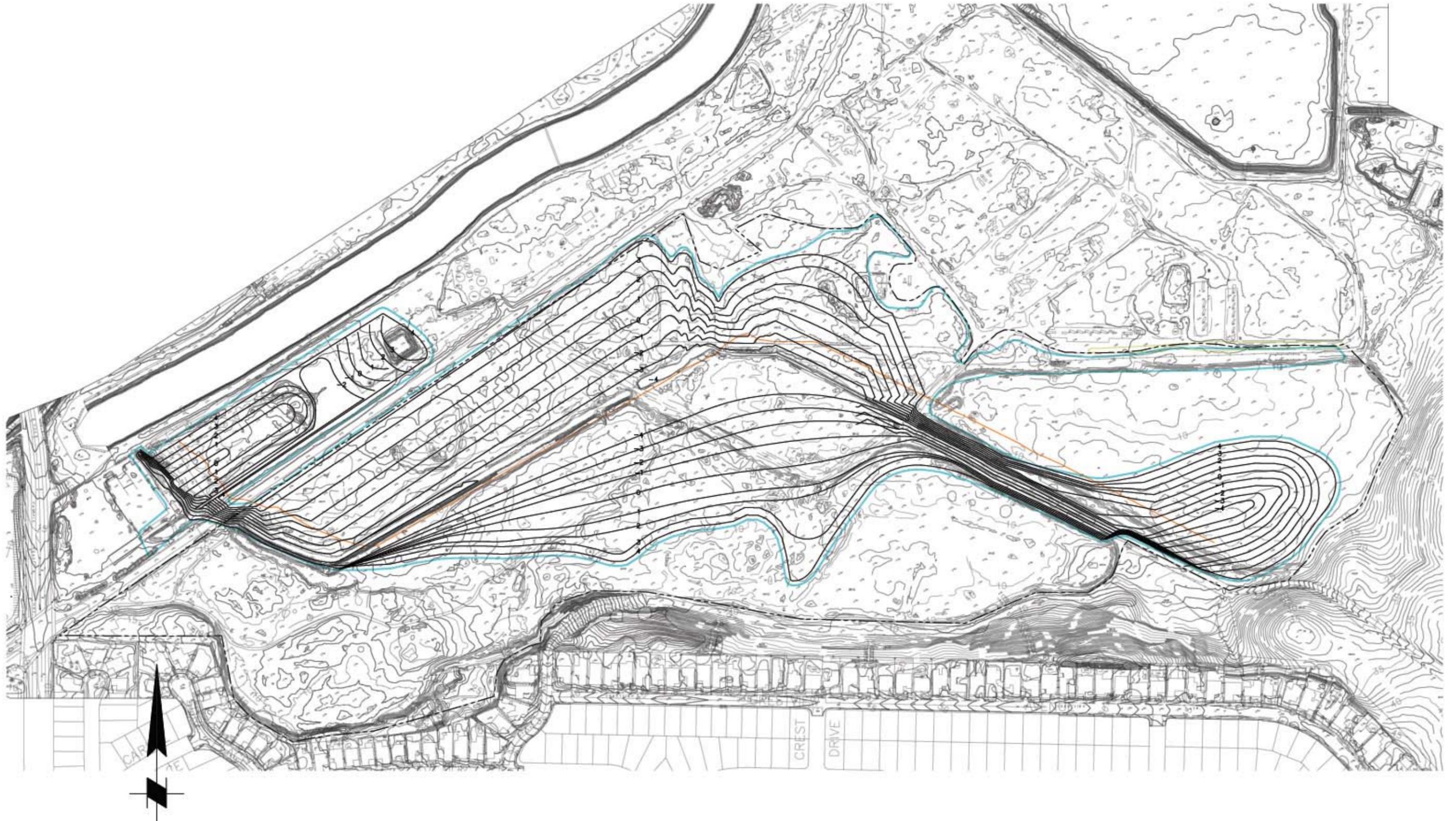


Figure 9 – Conceptual Grading Plan for Restoration Concept 2 – Maximum Feasible Restoration

### 2.1.8 Areas of Fill for Plan 2 – Maximum Feasible Plan

On-site fill is considered beneficial re-use of surplus earth material generated from excavation. Maximum on-site material re-use is not a goal of this maximum feasible restoration plan, and this volume of surplus material is not considered to be a constraint to planning in the approach. Material re-use includes raising the entrance road, diking along the perimeter of the 100-acre deed restricted area, capping contaminated areas, diking along the Los Alamitos Retarding Basin south boundary, and modifying upland habitat to a more limited extent than for the moderate alternative due to the small upland area available.

The entrance road into the Hellman site from Pacific Coast Highway is proposed to be raised the same as for Concept Plan 1 to keep it from being flooded. The existing power poles and City water line are assumed to be protected in place for this concept by providing the appropriate slopes and footprint to avoid these facilities. A dike will also be required along the northern perimeter of the 100-acre deed restricted area to prevent flooding of the oil field and intrusion into the wetland. The dike would reach up to approximately +8 feet MSL, or be between 3 to 5 feet above existing grade on average. The dike could be landscaped with native vegetation, and designed to be easily removed or breached for subsequent wetland restoration phases in the future. A dike would be appropriate around the Retarding Basin to prevent flooding into the Hellman site as has occurred in the past. Storm water runoff to the oil area north of the 100-acre deed restricted site will still need to be allowed to drain to either the San Gabriel River, the new wetland, or the Los Alamitos Retarding Basin to prevent flooding of infrastructure.

The former landfill area and Area 18 could be capped with clean earth to maximize separation from restored habitat. As with the Concept Plan 1, this Concept Plan 2 assumes that approximately 4 feet of clean earth fill is placed over these areas. Additional surplus soil on-site could be reused by placing a layer of soil over remaining uncontaminated upland sites. Approximately 30 acres of upland area is estimated to be available for fill if the 9-acre raptor foraging area is not included. The upland habitat diversity could increase by varying the upland topography with mounding.

Off-site material disposal is necessary for this alternative as sufficient opportunities for re-use of fill material on-site do not exist. Use of the entire volume of surplus material on-site for this alternative would raise the existing grade by an average of at least 8 feet. Figure 10 shows areas targeted for beneficial re-use of fill soil material under Concept Plan 2.

## 2.2 Preliminary Hydrologic Modeling

The project site is to be connected to a source of seawater for tidal exchange. The two possible sources of seawater for the site are the San Gabriel River (SGR) and Haynes Cooling Channel. Water temperatures in the SGR are elevated from effects of relatively warm water discharge from the upstream power plants, while water from Haynes Channel is the same temperature as ambient seawater. Initially, the Haynes Channel seemed to be

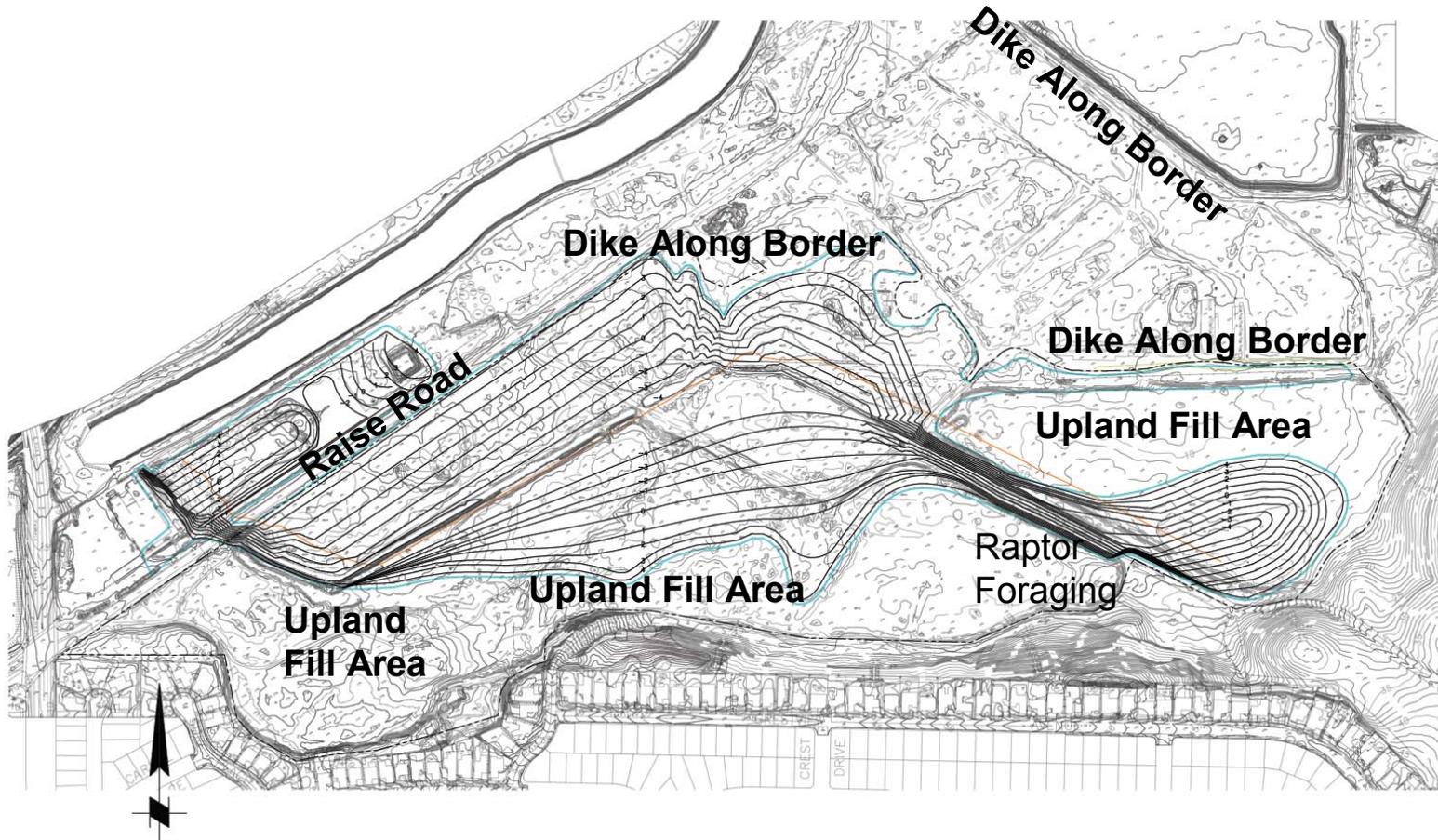


Figure 10 - Areas Targeted for Beneficial Re-Use of Fill Soil Material – Maximum Feasible Restoration

most suitable to provide seawater to the site, but representatives from the Haynes Power Generating Station (operated by the City of Los Angeles) relayed concerns over possible regulatory complications. As such, the SGR is assumed to serve as the source of seawater to the site for this conceptual-level study. The possible effect of elevated water temperatures could be to create a monotypic vegetated wetland habitat (assuming that the hydrologic regime is appropriate) that is most tolerant of high temperatures, such as pickleweed (Coastal Resources Management, 1996).

The proposed tidal connection between Hellman Ranch and the SGR for this analysis are two five-foot diameter culvert pipes from the river bank straight across the Haynes Channel and into Hellman Ranch. The pipes would cross through the banks and channel cross-section of the Haynes Channel at an invert elevation of approximately -6 feet MSL so their lengths would be as short as possible (300 feet-long). The cross-sectional area of the Haynes Channel is sufficiently large (at 1,275 square feet) to remain relatively unaffected hydraulically from the impedance caused by the pipes. There may be an opportunity to connect the site directly to the Haynes Cooling Channel in the future, but that is still to be determined. If that were to occur, the tide range at the site and water quality would more closely resemble that in lower Alamitos Bay and the ocean. No changes would occur to elevations of proposed dikes along adjacent low-lying areas.

Tides would be allowed to flood and ebb through the culverts with no restrictions. Management of storm water levels from the SGR is required to prevent flooding of areas outside of the 100-acre deed restricted area on Hellman. High water in Hellman Ranch could overtop new dikes and flood the oil field during flooding on the SGR and that would be unacceptable from environmental and oil operation perspectives. Self-regulating tide (SRT) gates would be installed on the SGR-side of the culverts to prevent stormflows in the SGR from entering the wetland culverts and flooding the site. The SRT gates close when water levels on the outside of the culvert opening reach above a specified water level, thus precluding water levels within the Hellman site from exceeding the desired elevation of approximately +5 feet MSL during combined high spring tides and stormflow conditions on the site.

Tidal hydrology of the restoration alternatives was analyzed using available data and a numerical model. The numerical model was used as a tool to quantitatively predict conditions after restoration. The future wetland was modeled to quantify tidal hydrology.

Tidal conditions are important for the wetlands because they control the daily hydrologic conditions of:

- Water levels that dictate the elevations of habitat;
- Circulation and flushing that depend on parameters of tide range and lags, and tidal prism – the affected properties are the rate of water turnover and residence time (thus affecting water quality); and
- Inundation conditions and frequencies that depend on parameters of tidal elevations over time (expressed as inundation curves) and tide lags – the affected properties are habitat distributions.

This analysis focuses primarily on tidal elevations and range, time lags, and inundation frequencies. A one-dimensional (link-node) numerical model was developed to quantify restored tidal hydrologic conditions. The hydraulic system is simulated by representing the system as a series of channels (links) and storage basins (nodes). Water levels in the storage basins and flow velocities in the channels that connect the basins are computed in the simulation. The water levels in the basins and the flow velocities in the channels are related through conservation of mass and momentum. The purpose of this effort is to perform an order-of-magnitude analysis to identify the feasibility of the restoration alternative for decision-making.

### 2.2.1 Existing Tide Conditions

Based on the previous study (M&N 1996), the tides in the SGR under dry weather conditions are closely approximated by the ocean tides measured at the Los Angeles Outer Harbor tide gage shown in Table 1. In order to compute typical wetland tidal behavior, an artificial two-week tidal sequence called Tidal Epoch Analysis (TEA) tide was used. This synthetic tide series has the same statistical mix of tidal elevations as the Los Angeles station. The driving tide is shown in Figure 11. The average spring high and low tides are +4.0 and -4.2 feet MSL, respectively. Processes of circulation, flushing, and inundation frequencies within the wetlands are dictated by the tides. Although not calculated, seawater residence times are all likely to be shorter than one week based on experience with other similar projects. This timeframe is indicated as the desired threshold for restoration for other similar sites (Wetlands Research Associates 1995). Under existing conditions limited tidal conveyance occurs at Hellman Ranch.

**Table 1 - Recorded Water Levels at Los Angeles Outer Harbor**

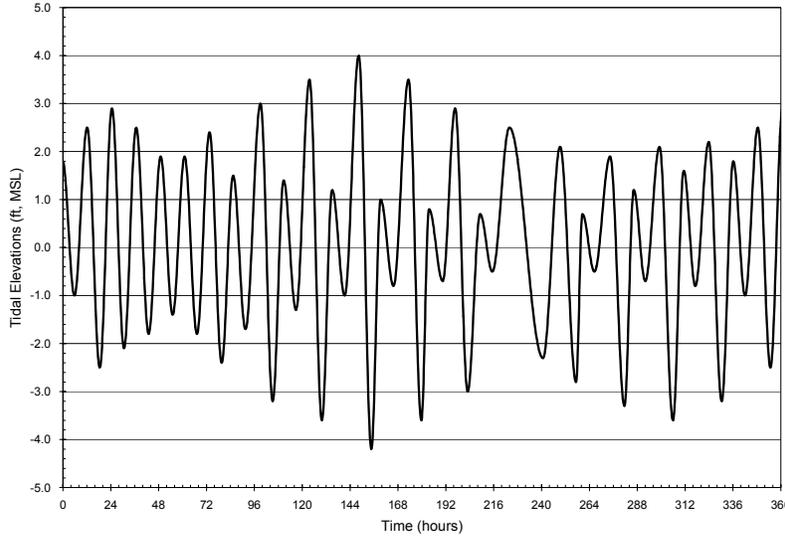
	Datum (ft, MLLW)	Datum (ft, MSL)
Extreme High Water (1/27/1983)	7.96	5.16
Mean Higher High Water (MHHW)	5.52	2.72
Mean High Water (MHW)	4.77	1.97
Mean Sea Level (MSL)	2.8	0.0
Mean Low Water (MLW)	0.95	-1.85
Mean Lower Low Water (MLLW)	0.0	-2.8
Extreme Low Water (12/17/1933)	-2.59	-5.39

### 2.2.2 Tidal Conditions in the Restored Concept Wetlands Plan 1

Figure 12 shows water surface elevations predicted during spring tidal conditions and lags of high and low tides in time, compared to the ocean for the site in a moderately restored condition. Table 2 shows each tidal parameter. Generally, low tides will be slightly attenuated at Hellman Ranch by the culvert connections to the SGR, but the effect of this attenuation is not detrimental to restoration. Tidal ranges at the site are still 6.5 feet in the marsh compared to 8 feet in the ocean, and are sufficient to provide for the desired range of aquatic habitats. Other wetland sites, both natural and man-made (e.g.,

Talbert Marsh at 4 feet, Inner Bolsa Bay at 1.5 foot, Carpinteria Marsh at 3 feet, Batiquitos Lagoon at 5 feet) experience a more constrained tidal range than would occur at Hellman and result in high quality marsh habitat. The areas that are inundated during low and high tides are shown in Figures 13 and 14, respectively.

The site will fill and drain sufficiently for wetland restoration, and habitat establishment could occur based on the tidal inundation frequency curve shown in Figure 15. As shown in the figure, unvegetated wetland areas will form at elevations from -2.6 feet MSL to +0.5 feet MSL, and vegetated marsh will form above that elevation up to +3.8 feet MSL. Subtidal habitat will comprise 6 acres (17%) of the wetland, mudflat will comprise 8 acres (23%) of the wetland, and pickleweed will comprise the remaining 21 acres (60%) of the wetland. Residence times are likely to be shorter than one week in the judgment of the engineer based on other similar projects.



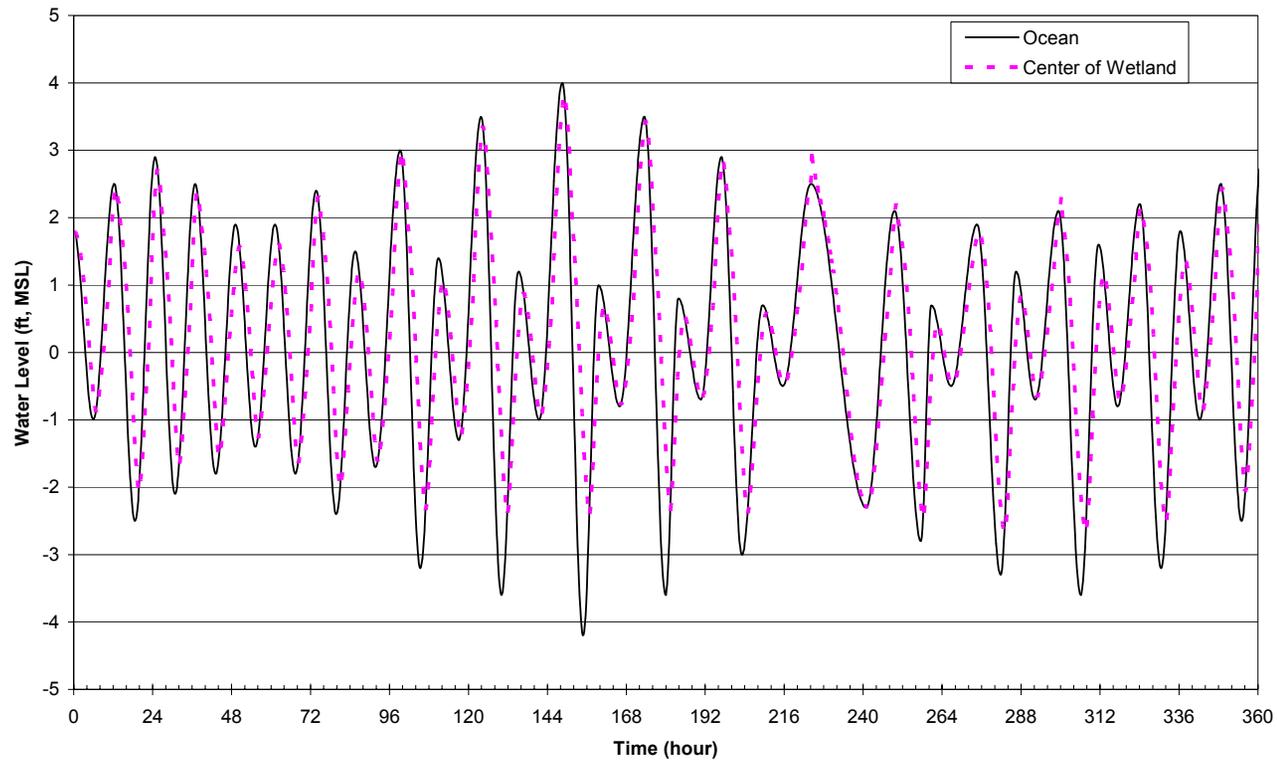
**Figure 11 - Model TEA Tidal Series**

Habitat areas over the site should be considered in the context of the restoration of the overall Los Cerritos Wetlands complex. Generally, the Los Cerritos Wetlands complex presently includes large upland habitat and pickleweed areas, with little subtidal area and mudflat. Restoration of the total complex will likely target converting uplands to wetland, and significantly increase subtidal and mudflat areas, depending on the conditions at remaining parcels.

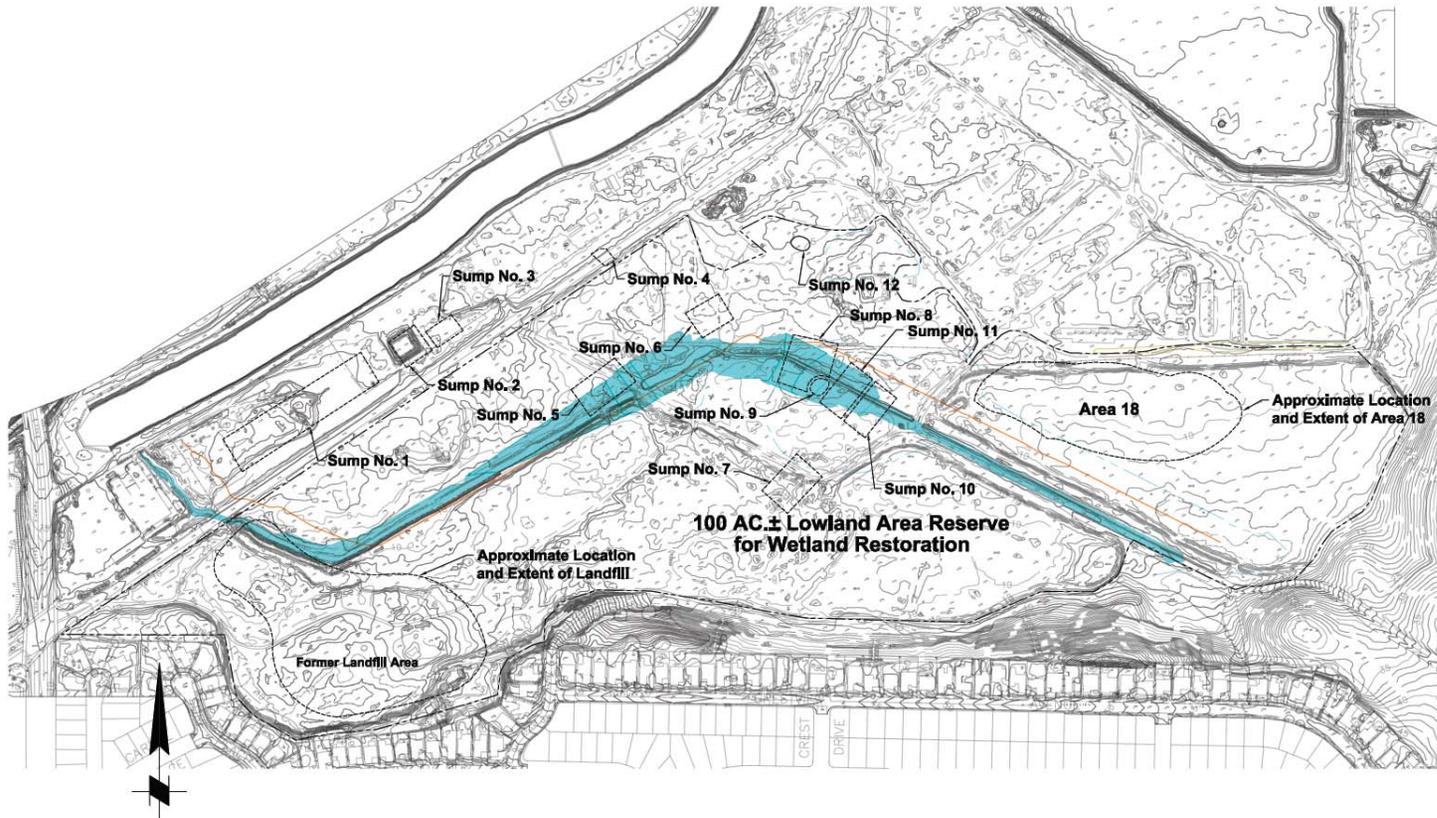
**Table 2. Tidal Conditions for the Moderate Restoration Plan 1**

Locations	Spring Tidal Range (Feet, MSL)	Spring Tidal Prism (Ac-Feet)
<b>San Gabriel River</b>	-4.2 to 4.0	Not Applicable
<b>Hellman Ranch – Moderate Restoration</b>	-2.5 to 4.0	100.0

**Culvert Invert @ -6 ft MSL**



**Figure 12 – Tidal Fluctuations Under Spring Tide Conditions for Plan 1 – Moderate Restoration**



**Figure 13 - Areas Inundated During Spring Low Tide for Concept 1 – Moderate Restoration**

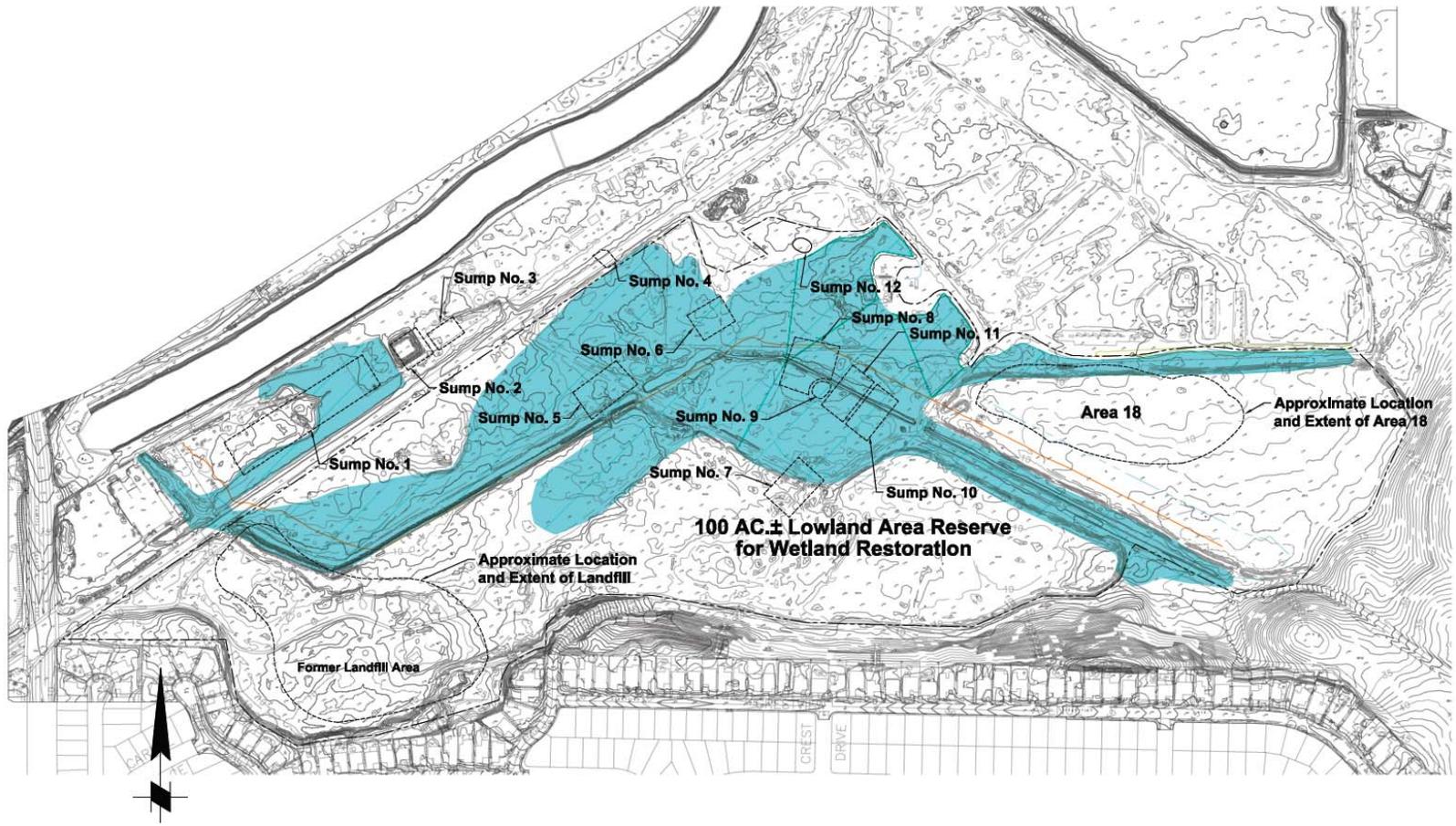


Figure 14 - Areas Inundated During Spring High Tide for Concept 1 – Moderate Restoration

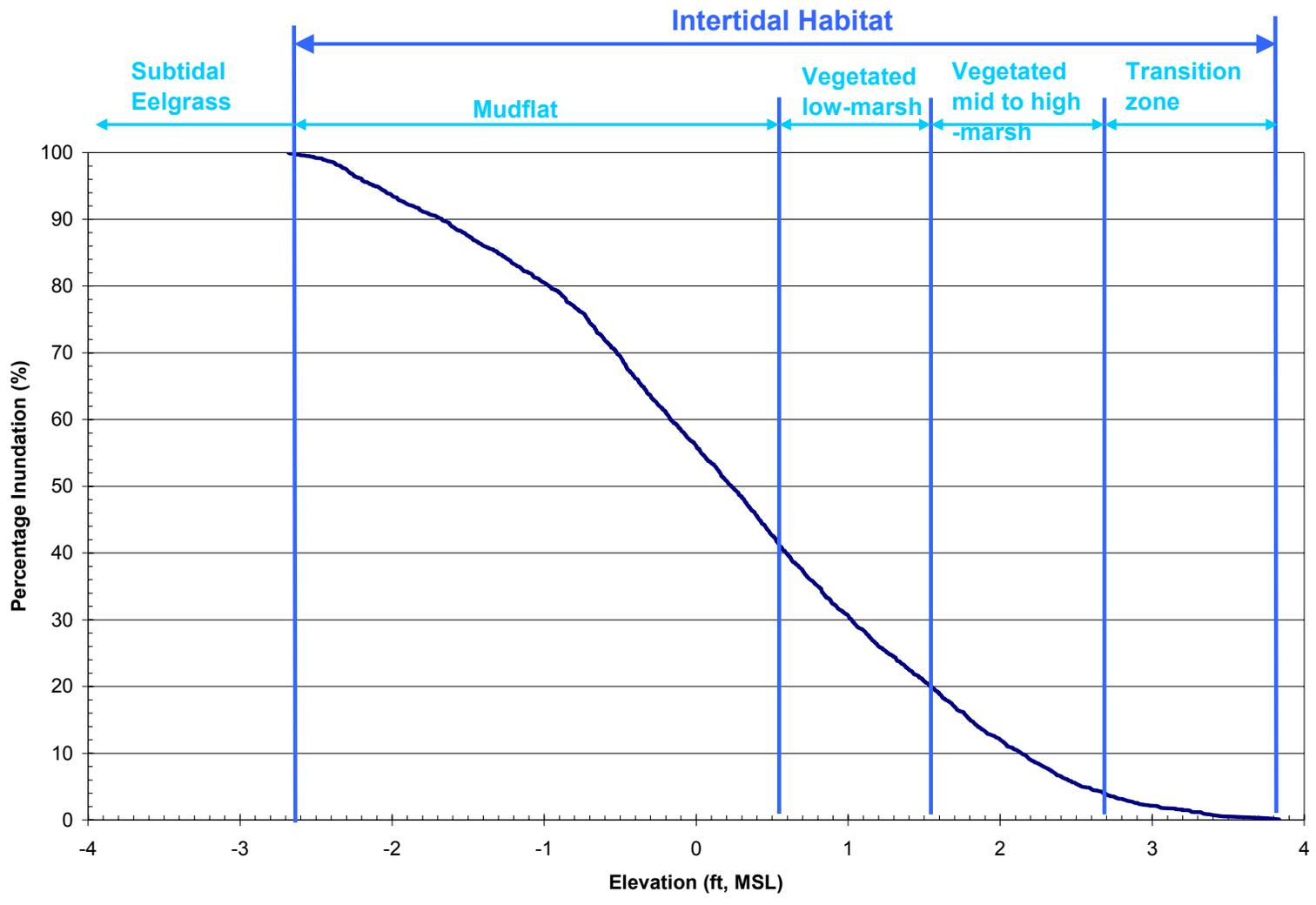


Figure 15 – Tidal Inundation Frequency Curve for Plan 1 – Moderate Restoration

### 2.2.3 Tidal Conditions in the Restored Concept Wetlands Plan 2

Figure 16 shows water surface elevations predicted during spring tidal conditions and lags of high and low tides in time for Concept Plan 2, the maximum feasible restored condition for the site, compared to the ocean. Table 3 shows each tidal parameter. As for the previous alternative, low tides are attenuated at Hellman Ranch by the culvert connections to the SGR, but the effect of tidal attenuation is not considered detrimental to restoration. Tides are further attenuated from Concept Plan 1 due to the increase in tidal prism (volume) provided by the increased tidal area in Concept Plan 2.

The tidal range at the site is compressed at both the high tide and low tide ends from the previous alternative due to a larger tidal prism having to pass through the culverts. The tide range is 5.8 feet in the marsh compared to 8 feet in the ocean. This condition should still be sufficient to provide for the desired range of aquatic habitats. As discussed above, other wetland sites experience a more constrained tidal range than would occur at Hellman and result in high quality marsh habitat. For example, Talbert Marsh is 27 acres and experiences a tide range of 4 feet, Inner Bolsa Bay at Bolsa Chica is 179 acres and experiences a tide range of 1.5 feet, Carpinteria Marsh is 39 acres and possesses a tide range of 3 feet, and Batiquitos Lagoon is 550 acres and possessed a tide range of approximately 5 feet. The areas that are inundated during low and high tides are shown in Figures 17 and 18, respectively. A larger tidal range can be achieved by installing larger diameter culverts (6-foot diameter rather than 5-foot diameter). This should open up the tide range to approximately 6.5 feet.

Habitat establishment would occur based on the tidal inundation frequency curve shown in Figure 19. Elevations of habitat are slightly modified from the previous concept but the proportion of habitat areas over the site are similar. Mudflat areas will form at elevations from -2.3 MSL to +0.5 feet MSL, and pickleweed areas will form above that elevation up to +3.4 feet MSL. Subtidal habitat will comprise 14 acres (23%) of the wetland, mudflat will comprise 14 acres (23%) of the wetland, and pickleweed will comprise the remaining 32 acres (54%) of the wetland. Future habitat areas are shown in Figure 20. Residence times are likely to be shorter than one week in the judgment of the engineer based on other similar projects.

**Table 3. Tidal Conditions for the Maximum Feasible Restoration Plan 2**

Locations	Spring Tidal Range (Feet, MSL)	Approximate Spring Tidal Prism (Acre-Feet)
<b>San Gabriel River</b>	-4.2 to 4.0	Not Applicable
<b>Hellman Ranch – Maximum Restoration</b>	-2.3 to 3.5	150.0

Culvert Invert @ -6 ft MSL

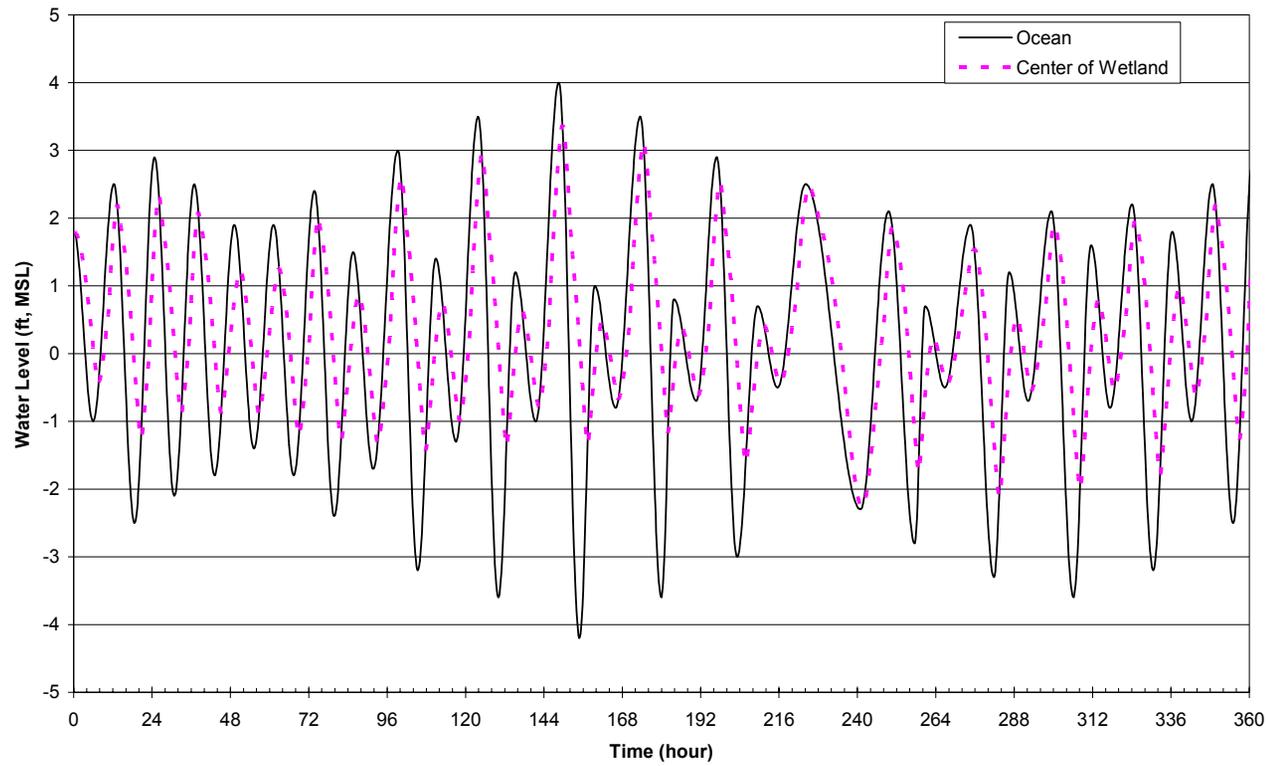
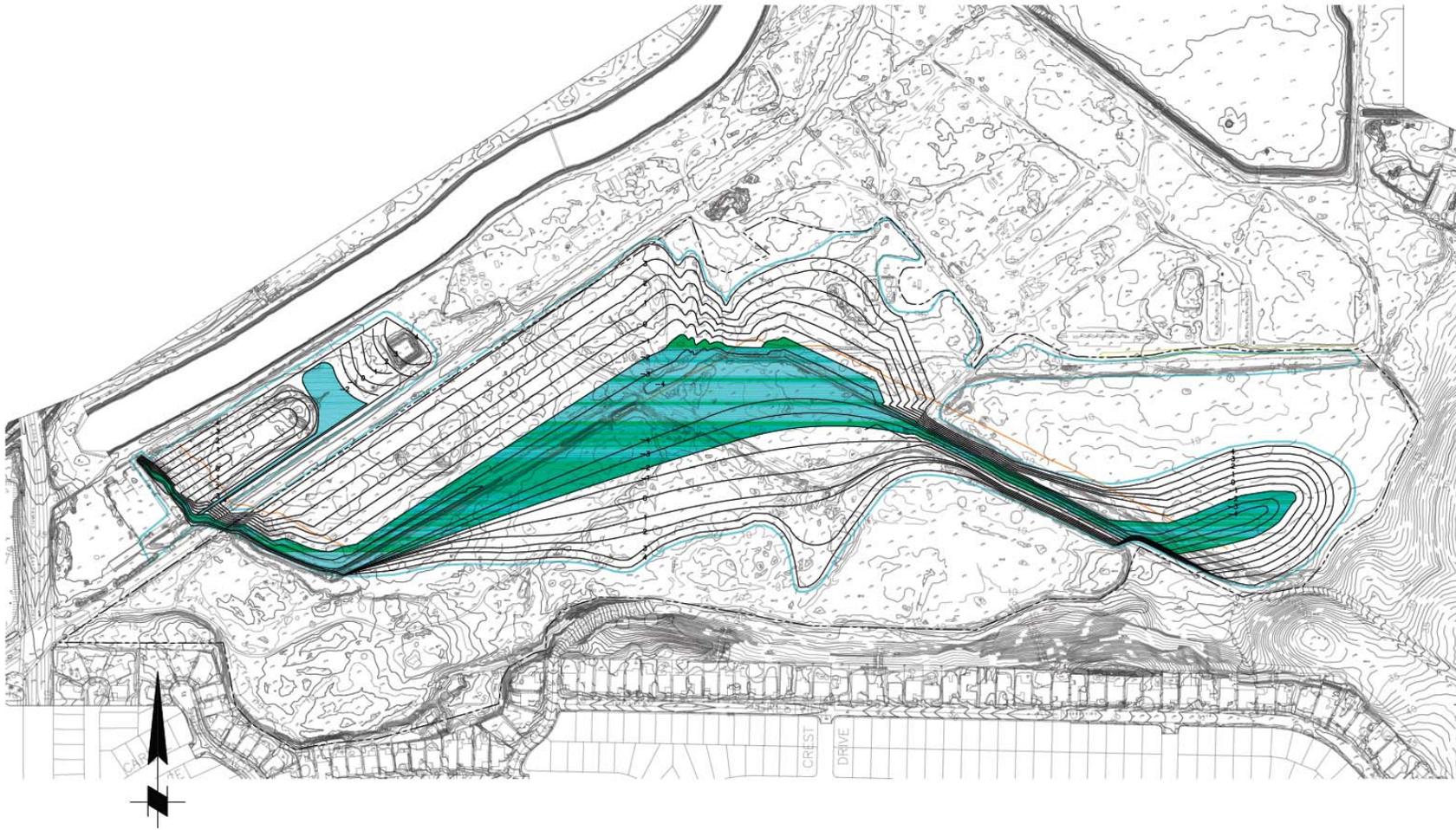


Figure 16 – Tidal Fluctuations Under Spring Tide Conditions for Plan 2 – Maximum Feasible Restoration



**Figure 17 - Areas Inundated During Spring Low Tide for Concept 2 – Maximum Feasible Restoration**

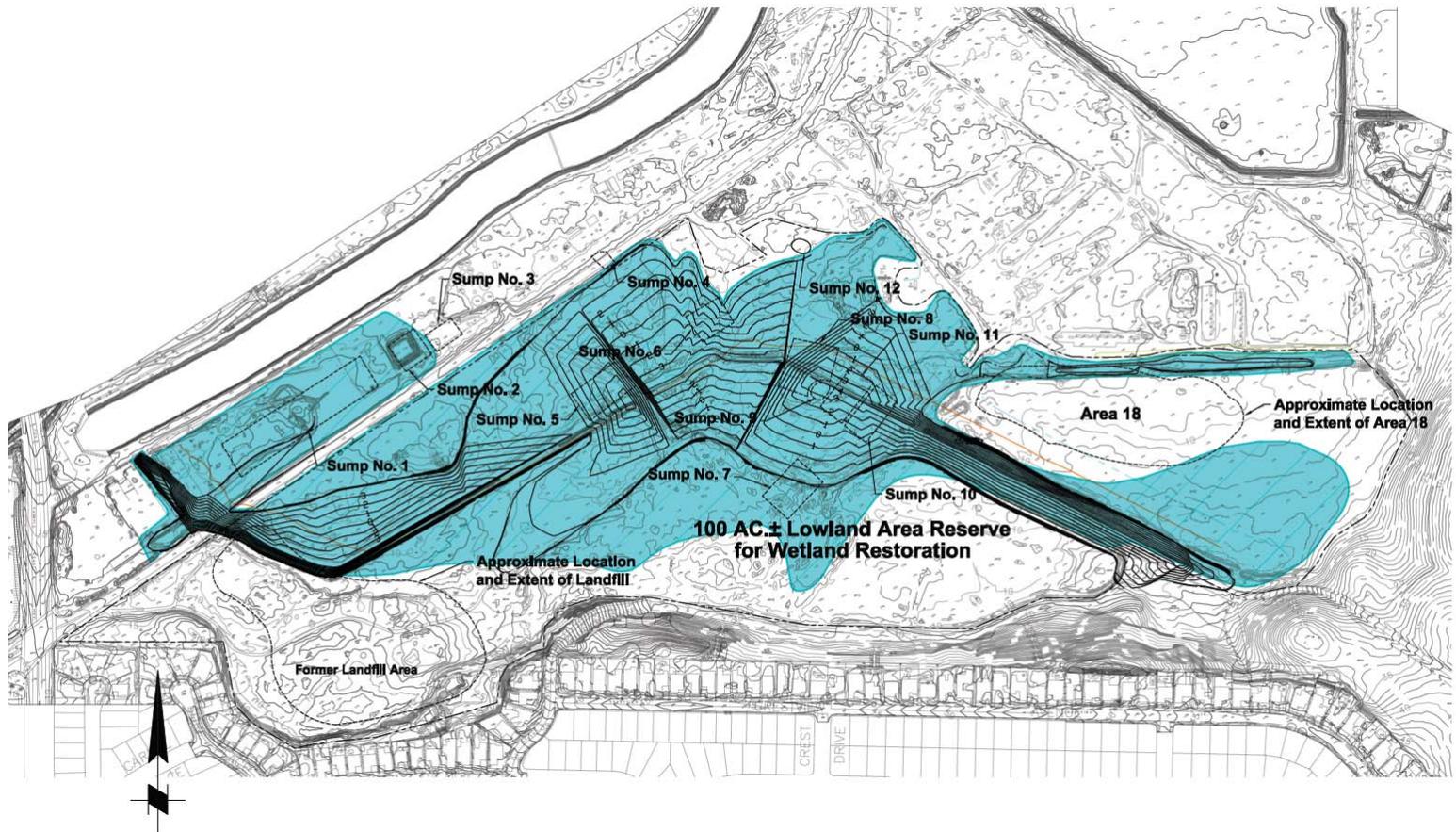
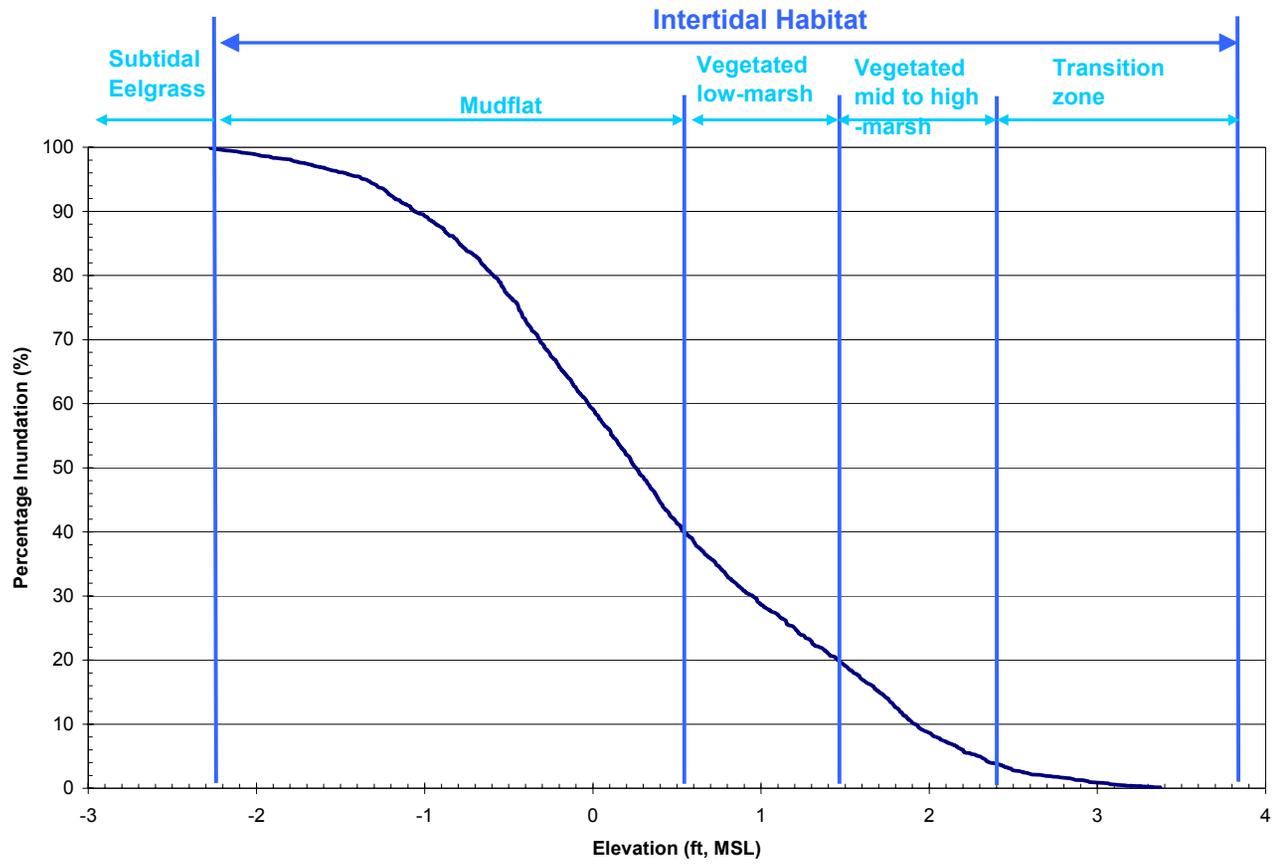


Figure 18 - Areas Inundated During Spring High Tide for Concept 2 – Maximum Feasible Restoration



**Figure 19 – Tidal Inundation Frequency Curve for Concept 2 – Maximum Feasible Restoration**

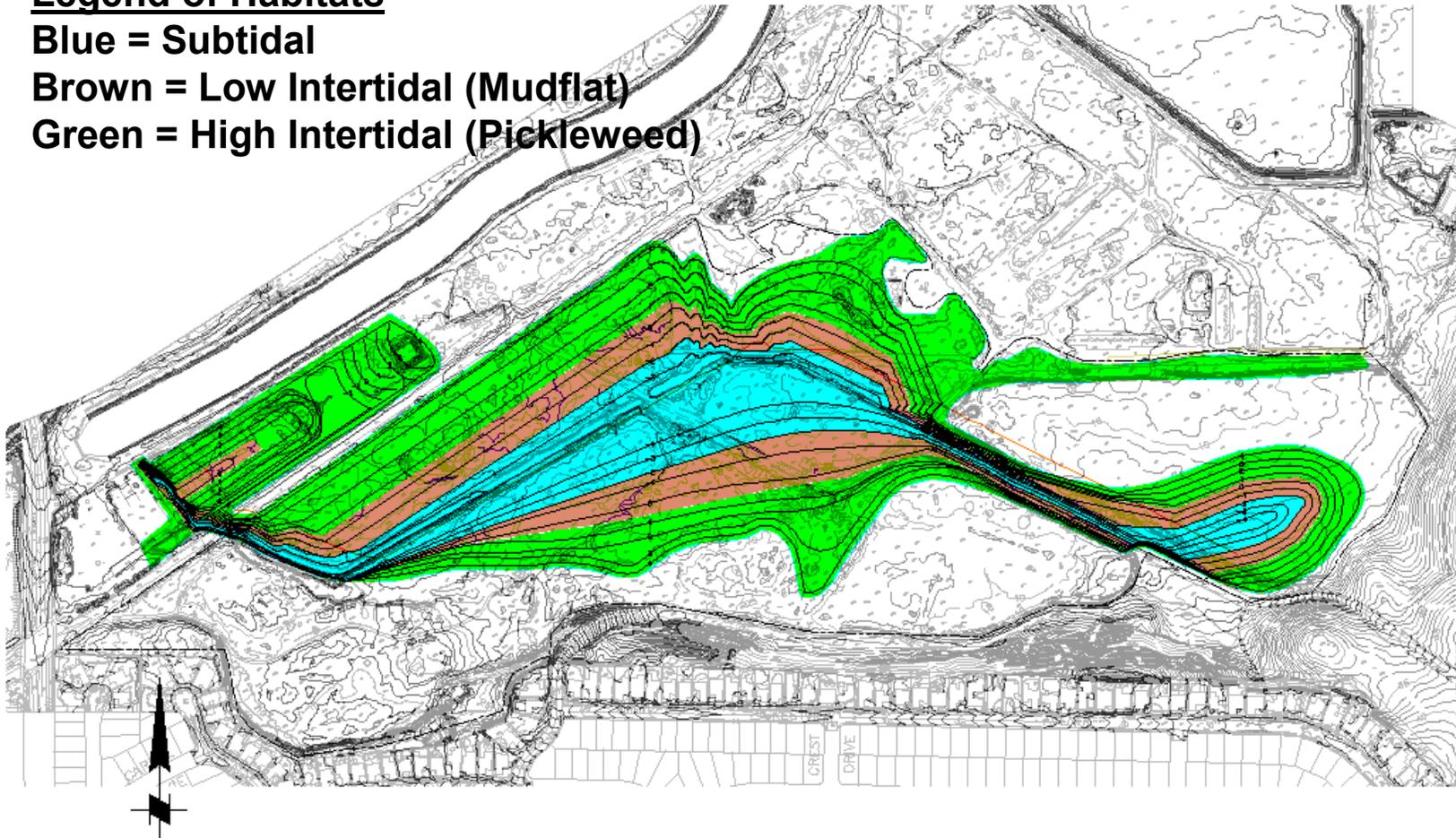
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**Legend of Habitats**

**Blue = Subtidal**

**Brown = Low Intertidal (Mudflat)**

**Green = High Intertidal (Pickleweed)**



**Figure 20 – Future Habitat Area Distributions for Plan 2 – Maximum Feasible Restoration**

As with the previous alternative, habitat areas over the site should be considered in the context of the restoration of the overall Los Cerritos Wetlands complex and not be limited to consideration of conditions at the Hellman site alone.

### 2.3 Remediation Alternatives for the Property

Restoration activities at the Hellman site will require extensive site grading to achieve the desired tidal inundation of the property. Previous site investigations (Geomatrix Consultants 2001, Anchor Environmental 2004a, and Anchor Environmental 2004b) identified areas of soil contamination throughout various portions of the property, mostly associated with the former sumps. Metals, PAHs and pesticide concentrations in these locations exceeded marine threshold screening values, suggesting that some of the soils from these areas may not be suitable for future restored conditions where they are exposed to aquatic organisms. As such, remedial alternatives were considered to address this issue.

The estimated soil cut volume needed to achieve target restoration conditions is approximately 200,000 cy for the moderate restoration plan and 400,000 cy for the maximum feasible restoration plan. Of this amount, up to 100,000 cy (25% to 50% depending on the plan selected) is estimated to be chemically impacted, and may require either some form of on-site containment and reuse, or off-site disposal.

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For the moderate restoration plan, approximately 27,000 cy of contaminated soil will likely originate from Sumps 1, 2, 5, 6, 8, 9, 10 and 11. Another 73,000 cy is impacted by metals as estimated from the remaining open areas planned for excavation<sup>1</sup>. For the maximum feasible restoration scenario, approximately 27,000 cy of contaminated soil will likely originate from Sumps 1 (east portion), 2 (west portion), 3, 5, 6, 7, 8, 9, 10 and 11. The remaining 73,000 cy of metal-impacted material is estimated from the remaining open areas planned for excavation.

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Soils located within sumps 4 and 12 also appear to be PAH impacted (Geomatrix Consultants 2001), but are not currently targeted for excavation. Even though these areas may not be targeted for excavation, these sumps may need to be addressed to provide a clean surface layer under the final restored conditions. As such, the estimated volume of impacted soils has been added to the total volume estimate requiring management. Other areas (i.e., Area 18, along the eastern boundaries of the drainage ditch bisecting the site, and the former landfill site) may also contain surface soils that will need to be addressed during the design phases so that contaminated surface soils are not left in place after construction. The cumulative potential volume of impacted material from these areas has not yet been quantified because it is assumed that these areas can be buried to eliminate any potential pathways for exposure.

<sup>1</sup> The estimated volume of contaminated sediments was calculated by totaling the cut volume for the entire surface area with previous chemical exceedances from past studies. It should be noted that most of these samples were from surface soils and may not actually extend to the full depth of excavation. Additional sampling and analysis could be used to refine this volume.

Determining remediation alternatives for the site requires consideration of the nature and extent of contamination relative to the proposed future site uses. The previous investigations conducted for the site compared soil concentrations to aquatic ecological risk assessment screening values to determine areas that should be considered “impacted” or “contaminated.” While this was an acceptable process for initial site planning to determine areas for removal to support future aquatic use scenarios, now that a target restoration design has been created and specific cut/fill areas identified, a more focused evaluation of the data compared to proposed future end use receptors must be considered before defining suitable placement or disposal locations for cut material, and possibly the need for treatment. This analysis is presented in this report.

The preferred maximum feasible alternative for site restoration (Figure 5) will generate approximately 400,000 cy of soil. Of this amount, almost 25% contains some level of elevated PAH, pesticide and/or metal concentrations. Past evaluations conducted at the site found that most open area (i.e. non sump related) metal and pesticide concentrations, while above conservative soil screening levels, were actually within the expected range of regional background concentrations and not likely a result of on-site contamination. Thus, it is assumed that the soils planned for excavation fall into one of three categories: clean, mildly impacted by regional contamination, and moderately impacted from past activities at the Hellman site.

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### **2.3.1 Re-Use/Disposal for Materials Not Needing Remedial Treatment**

Disposal options for the “clean” material include on-site re-use within the upland boundaries of the site and off-site disposal at either another construction site or Class III landfill. Aquatic ocean disposal is not typically allowed for upland soils; however, since much of the upland fill material at Hellman was dredged from the adjacent SGR and Cooling Channel, the EPA and Corps may be amenable to considering this alternative, subject to additional chemical and biological testing. Landfill disposal within Orange County is not a popular option because most of the available fill sites already have a net surplus of clean soil material for use as daily cover so any additional material may need to be classified as “waste” and not “alternative daily cover” which means that it counts against the landfill’s daily tonnage limit.

Disposal options for the “impacted” soils also includes unrestricted on-site re-use within the upland boundaries of the site for some of these soils as they are only very mildly impacted, or off-site disposal at a Class III landfill. Documented chemical concentrations for the soils targeted for excavation are well below Title 22 thresholds, and therefore the material would be suitable for disposal at Class III landfill. As with the “clean” soils, however, this is not a popular option because most of the available fill sites already have a net surplus of clean soil material for use as daily cover, and thus any additional material may need to be classified as “waste” and would not be needed as “alternative daily cover” (in which case the material counts against the landfill’s daily tonnage limit and, hence, requires a fully loaded tipping fee that can be quite costly).

### 2.3.2 Remedial Treatment Options

On-site re-use fill alternatives fall into two categories: exposed fill material and isolated fill material. Exposed fill material includes soil that is chemically and physically suitable, as is, for direct contact with upland terrestrial receptors (flora and fauna). Soils not suitable for direct contact with upland terrestrial receptors must be either (a) treated to remove the contaminants or render them non-bioavailable; or (b) isolated beneath clean material so that they are not in direct contact with sensitive ecological receptors. Treatment options may include bioremediation or cement-based stabilization.

#### Bioremediation

Bioremediation is a process where soils are injected with naturally occurring microbes and chemicals (e.g., hydrogen peroxide as a source of oxygen) to stimulate the natural biological degradation of organic contaminants. It is an inexpensive and effective tool for remediating PAH-impacted soils. It typically requires a certain time period to achieve the necessary concentration reductions, and is not effective for metals, which are also a concern for portions of the Hellman site. It may be applicable at Hellman, but that cannot be definitively stated as yet. More analysis of metals content at soil removal areas on-site and bioremediation effectiveness need to be performed that is not possible within the limited scope and budget available for this study. Commercially available bioremediation processes (e.g., GRACE Bioremediation Technologies) have shown that 8 months or so may be required to complete the process, at costs that can reach from \$50 to \$80 per cy (each cubic yard of material weighs approximately 1.65 tons). This timeframe may not be prohibitive for this project as implementation timeframes may be on the order of decades, but if it were ineffective for metals that exist on the Hellman site it may or may not achieve project objectives. The end product of this process is soil that could be re-used on-site or elsewhere that could provide added value to the project, or the material could be disposed of at a conventional landfill.

#### Cement-Based Stabilization

Cement-based stabilization is a process where contaminated soils are mixed with cement-based additives, such as Portland cement, lime, fly ash and kiln dust, to chemically bind the contaminants through a dynamic exothermic reaction. The process can be performed quickly and the material handled within hours. In addition to being cost-effective and suitable for treating both metal and organic contaminants, the cement stabilization process can be controlled to produce material suitable for constructing geotechnically stable dikes and berms, thereby incorporating the material into construction features already planned for the property. Recent pilot studies conducted for the Los Angeles Contaminated Sediments Task Force (U.S. Army Corps of Engineers 2001) showed that this technology can be conducted on-site for approximately \$30 per cy.

#### On-Site Encapsulation

On-site encapsulation requires the material to be sufficiently clean to be able to remain on-site and be covered by a layer of clean earth. Terrestrial soil screening benchmark

data were collected and compared to existing site characterization data to estimate the volume of soil available for use in exposed scenarios compared to that which requires containment or treatment. Soil screening values were considered from several sources, including the following:

- U.S. EPA – Soil Screening Levels (<http://www.epa.gov/ecotox/ecossl/>)
- USGS Soil Screening Data (<http://www.pwrc.usgs.gov/infobase/eisler/reviews.cfm>)
- Oak Ridge National Laboratory Ecological Benchmarks (<http://rais.ornl.gov/homepage/benchmark.shtml>)

In addition to the above resources, work conducted by the U.S. Fish & Wildlife Service for the Bolsa Chica Wetlands Restoration project was also evaluated to determine if applicable screening criteria could be used. The screening values provided in the Bolsa Chica documents are for aquatic receptors assuming a fully tidal exposure regime. The material to be reused and left on-site at Hellman will be primarily in upland areas rather than aquatic environments. Also, contamination levels at Bolsa Chica were much higher than those at Hellman Ranch. As such, the approach taken for Bolsa Chica is not deemed suitable at this time for restoration planning at Hellman Ranch. Table 4 presents a summary of available soil screening levels (SSL) that could be applied to the Hellman site.

A quick comparison of site data to the SSLs in Table 4 suggests that at least some portion of the material slated for excavation exceeds one or more of the soil benchmarks. Using these screening values as a tool for estimating worst case construction cost scenarios, this process suggests that these materials should not be used as exposed fill. Rather, this material should either be buried beneath a suitably clean soil layer or treated to immobilize the contaminants. It should be stressed that the use of SSLs for this type of an application is very conservative in nature and should only be conducted as a preliminary step for estimating potential areas of concern. Unless the site restoration plan allows for a balance between cut and fill activities, this phase is typically followed by a less-conservative screening level risk assessment to more accurately estimate areas of potential current and/or future risks to receptors specific to the study area. On-site encapsulation will cost the same as a typical earthwork operation at approximately \$5 per cy.

### **2.3.3 Off-Site Disposal**

Material can also be trucked off-site to a designated landfill for contaminated materials if it is determined to be too contaminated to remediate or leave on-site. Costs to truck material off-site can be as high as \$100 per cy. This option can be viable for very small and highly contaminated soils, but does not seem to be necessary for this project.

**Table 4. Results of Previous Site Investigations Compared to Example Soil Screening Levels for use at Hellman Properties**

					Soil Screening Levels				
Contaminant of Concern		Units	Mean Concentration	Minimum Concentration	Maximum Concentration	EPA Region 6 (Earthworm) 1/	EPA Region 5 Soil 2/	EPA Region 4 Soil 3/	ORNL Invertebrate 4/
	Solids, Total	%	81.968	60.8	99.9	NA	NA	NA	NA
	TRPH	mg/kg	1751	ND	68,000	NA	NA	NA	NA
<b>Metals</b>	Arsenic	mg/kg	7.87	0.96	40	60	5.7	10	60
	Chromium (Total)	mg/kg	32.1	8.58	57.6	NA	NA	NA	NA
	Copper	mg/kg	31.3	7.17	65.5	61	5.4	40	50
	Lead	mg/kg	30.1	3.22	240	500	0.0537	50	500
	Mercury	mg/kg	0.18*	ND	0.919	0.1	0.1	0.1	0.1
	Nickel	mg/kg	24.87	5.78	49.1	200	13.6	30	200
	Selenium	mg/kg	0.38	ND	1.27	NA	NA	NA	NA
	Silver	mg/kg	0.09	ND	0.23	NA	NA	NA	NA
	Thallium	mg/kg	0.24	ND	0.521	NA	NA	NA	NA
<b>Pesticides</b>	Zinc	mg/kg	94.4	31.2	207	120	6.62	50	100
	4,4'-DDD	ug/kg	0.7*	ND	2.8	NA	0.758	NA	NA
	4,4'-DDE	ug/kg	1.99*	ND	42	NA	0.596	NA	NA
	4,4'-DDT	ug/kg	1.89*	ND	22	NA	0.0035	NA	NA
	Aldrin	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Alpha-BHC	ug/kg	ND	1.8	1.8	NA	NA	NA	NA
	Beta-BHC	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Chlordane	ug/kg	7.19	ND	49	NA	0.224	NA	NA
	Delta-BHC	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Dieldrin	ug/kg	0.98	2.4	24	NA	0.00238	0.0005	NA
	Endosulfan I	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Endosulfan II	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Endosulfan Sulfate	ug/kg	NA	ND	ND	NA	NA	NA	NA

	Endrin	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Endrin Aldehyde	ug/kg	NA	ND	ND	NA	NA	NA	NA

						Soil Screening Levels			
Contaminant of Concern		Units	Mean Concentration	Minimum Concentration	Maximum Concentration	EPA Region 6 (Earthworm) 1/	EPA Region 5 Soil 2/	EPA Region 4 Soil 3/	ORNL Invertebrate 4/
<b>Pesticides (continued)</b>	Endrin Ketone	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Gamma-BHC	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Heptachlor	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Heptachlor Epoxide	ug/kg	NA	1.8	1.8	NA	NA	NA	NA
	Methoxychlor	ug/kg	NA	1.2	1.2	NA	NA	NA	NA
	Toxaphene	ug/kg	NA	ND	ND	NA	NA	NA	NA
<b>Polychlorinated biphenyls (PCBs)</b>	Aroclor-1016	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1221	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1232	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1242	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1248	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1254	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1260	ug/kg	NA	ND	ND	NA	NA	NA	NA
	Aroclor-1262	ug/kg	NA	ND	ND	NA	NA	NA	NA
<b>Polycyclic Aromatic Hydrocarbons (PAH)</b>	Acenaphthene	mg/kg	NA	0.059	0.059	20	20	NA	NA
	Acenaphthylene	mg/kg	NA	ND	ND	NA	NA	NA	NA
<b>Low Molecular Weight</b>	Anthracene	mg/kg	NA	0.02	0.02	NA	NA	NA	NA
	Fluorene	mg/kg	0.02	ND	0.53	30	122	30	30
	Naphthalene	mg/kg	0.05	ND	1.4	NA	0.994	0.1	NA
<b>High Molecular Weight</b>	Phenanthrene	mg/kg	0.04	ND	0.76	NA	NA	0.1	NA
	Benzo (a) Anthracene	mg/kg	0.013	ND	0.045	NA	NA	NA	NA
	Benzo (a)	mg/kg	0.01	ND	0.21	NA	NA	NA	NA

					Soil Screening Levels			
Contaminant of Concern	Units	Mean Concentration	Minimum Concentration	Maximum Concentration	EPA Region 6 (Earthworm) 1/	EPA Region 5 Soil 2/	EPA Region 4 Soil 3/	ORNL Invertebrate 4/
Pyrene								
Benzo (b) Fluoranthene	mg/kg	0.01	ND	0.052	NA	NA	NA	NA
Benzo (g,h,i) Perylene	mg/kg	0.01	ND	0.05	NA	NA	NA	NA
Benzo (k) Fluoranthene	mg/kg	0.01	ND	0.047	NA	NA	NA	NA
Chrysene	mg/kg	0.02	ND	0.13	NA	NA	NA	NA
Dibenz (a,h) Anthracene	mg/kg	NA	ND	ND	NA	NA	NA	NA
Fluoranthene	mg/kg	0.02	0.025	0.53	NA	NA	NA	NA
Indeno (1,2,3-c,d) Pyrene	mg/kg	0.01	0.022	0.023	NA	NA	NA	NA
Pyrene	mg/kg	0.04	ND	0.76	NA	NA	NA	NA

NOTES: \* ½ the detection limit was used for NDs to calculate mean values

ND - Non Detect

NA - Not Applicable

1/ U.S. EPA Region 6 Soil Screening Value for the protection of earthworms.

2/ U.S. EPA Region 5 Soil Screening Value for the protection of various flora and fauna.

3/ U.S. EPA Region 4 Soil Screening Value for the protection of various flora and fauna.

4/ Oak Ridge National Laboratory Soil Screening Level for the protection of invertebrates.

### **3.0 Cost Estimates for Materials Management**

Using the remediation options described in Section 2.3, recommendations are offered below for managing impacted soils during restoration activities at the Hellman Property. As presented earlier, soils planned for excavation can be grouped into one of three categories: (1) mildly impacted soils associated with the former sumps; (2) marginally impacted soils from the open areas of the property not likely associated with past site activities; and (3) clean soils not impacted with contaminants. The restoration plans presented in Section 2.0 present approaches for managing all of the planned cut material in a cost-effective and ecologically-protective manner. One of the objectives of this exercise is to evaluate potential “added” costs to the restoration projects associated with the management of impacted soils from past site operations. In this section, only those potential costs above and beyond normal construction costs are considered. Additional investigations should occur on the site to confirm and refine the costs presented in this document prior to restoration.

Transporting and disposing of excavated soils off-site is very costly and is typically less desirable if it can be avoided. Similarly, treating the material using chemical stripping processes or bioremediation technologies may be useful, but not necessarily be optimal because of the significant costs associated with those technologies and, in the case with bioremediation, the possibility that metals may not be sufficiently treated. Developing a restoration plan (Concept Plan 1) that achieves 100% disposal/re-use of the material on-site provides a cost effective solution, but does not necessarily achieve maximum habitat restoration potential (Concept Plan 2). With this thought in mind, two plans were developed that include varying extents of the following excavated soil disposal components:

- Excavate the most contaminated material from the sumps and treat it with cement-based additives to create a stable base material for constructing the retaining dike around the 100-acre deed restricted site, and raising the entrance road and capping Area 18 and the former landfill site;
- Excavate and move the marginally contaminated soils to the upland areas and use them as material for on-site encapsulation;
- Excavate and move the clean soils to the upland areas and use them as cover material; and
- Offsite disposal of surplus materials that cannot be accommodated on-site.

#### **3.1 *Costs for Soils Management for Concept Plan 1 – Moderate Restoration***

For Concept Plan 1, the moderate restoration option, all excavated materials could be re-used on-site and treatment costs are limited to only the most impacted soils from the former sump areas. In addition, the recommended treatment approach will produce a by-product (engineered fill material) to use for constructing perimeter dikes and raising the entrance road. Total remediation costs can be estimated by calculating the cost to treat up to 27,000 cy (or 44,550 tons) of impacted soils using cement-based or bio-remediation, or

trucking the material off-site. If remediated, this material would then be placed as base material for constructing the base of a retaining dike along the boundary of the 100-acre deed restricted property, to raise the entrance road to the site from Pacific Coast Highway, and/or to place as a cover over Area 18 and the former landfill area to the south. Sufficient capacity exists on-site to re-use remediated material. Table 5 shows probable costs to manage materials on-site in present dollars and in the five- and ten-year future, assuming the project experiences typical timeframes for additional investigations, approvals, and designs. All costs presented below and herein include a 25% contingency for future unknowns and may therefore be slightly conservative.

For cement-based remediation with additives, the high end treatment cost estimate of \$23/cy (\$14/ton) is used and yields a conservative estimated remediation cost of approximately \$800,000 if the work were done today. This number is very conservative because it (a) assumes all the impacted sump soils are suitable for treatment when, in reality, they possess varying degrees of contamination and some might not warrant treatment by immobilization, and (b) the upper end estimate for the per unit treatment cost is used.

Treatment using bioremediation can cost up to \$45/cy (\$27/ton) or \$1,500,000 for treating the same volume of impacted soils if the work were done today. Off-site disposal of the material at a landfill can cost between \$60 and \$100/cy (~~\$36~~ and ~~\$60~~/ton). The cost to perform this action can therefore be between \$2,000,000 and \$3,300,000 if the work were done today.

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On-site encapsulation of the remediated soils requires double-handling of soil for remediation, and for layering of remediated soil under clean soils. Double-handling of this soil to accomplish encapsulation would cost approximately an additional \$3 per ton for \$170,000 total above typical earthmoving costs for the project if the work were done today. This action does not constitute a separate on-site treatment method, but is supplemental to any remediation alternative (cement-based or bioremediation) and this cost is to be added to the alternative selected for the project.

Costs for the same work done in the five- and ten-year futures would be escalated by an average of 3% per year based on historical and recent construction industry cost trends. Considering escalation, costs to perform cement-based remediation would be \$900,000 in five years and \$1,000,000 in ten years. Costs to perform bio-remediation in five years would be \$1,700,000 and in ten years would be \$2,000,000, while costs to truck and dispose of the material off-site would be \$2,300,000 in five years minimum and \$2,600,000 in ten years minimum. Finally, costs to encapsulate the material on-site in five years would be \$200,000 and then would cost \$230,000 if done in ten years, and this cost is to be added to the cost of remediation.

**Table 5. Costs for Concept Plan 1 (Moderate Restoration)  
Materials Management Alternatives**

Material Management Method	Costs Including a 25% Contingency for Future Unknowns and Escalation of 3% on All Future Numbers		
	In Year 2007	In Year 2012	In Year 2017
Cement-Based Remediation (\$22.5/cy & \$14/ton)	\$800,000	\$900,000	\$1,000,000
Bioremediation (\$45/cy & \$27/ton)	\$1,500,000	\$1,700,000	\$2,000,000
Off-Site Disposal (\$60/cy & \$36/ton to \$100/cy & \$60/ton)	\$2,000,000 to \$3,300,000	\$2,300,000 to \$3,900,000	\$2,600,000 to \$5,000,000
On-Site Encapsulation (in addition to remediation costs) (\$5/cy & \$3.03/ton)	\$170,000	\$200,000	\$230,000

### 3.2 Costs for Soils Management for Concept Plan 2 – Maximum Feasible Restoration

For Concept Plan 2, the maximum feasible restoration option, approximately one-half of the excavated materials could be re-used on-site if desired (200,000 cy), but the remainder of the excavated material (200,000 cy) would likely have to be transported off-site for disposal because of insufficient upland area for mounding. The capacity for use of remediated soils (assuming cement-based stabilization for the entrance road and perimeter dike) is approximately 23,000 cy. Cement-based stabilization could be used to produce the engineered fill material for perimeter dikes and raising the road, while bioremediation could be used to treat the remaining 4,000 cy of sump material (27,000 cy - 23,000 cy = 4,000 cy) for use as upland fill. Alternatively, the remaining sump material could be trucked off-site to a landfill without being treated. The site can accommodate approximately 200,000 cy of fill material total, of which 23,000 cy could be used for the road and dikes, and the remaining 177,000 cy could be used to cover upland areas.

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Total remediation costs of sump materials are estimated for the three scenarios of:

1. Trucking all 27,000 cy off-site to a conventional disposal facility;
2. Using 23,000 cy of material to raise the entrance road and build a perimeter dike (assuming cement-based stabilization), and trucking 4,000 cy of remaining sump material to an off-site disposal facility; and

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3. Using 23,000 cy of material to raise the entrance road and build a perimeter dike, and using 4,000 cy of material to fill at upland areas in as part of a larger volume to be filled on-site.

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On-site encapsulation would not be needed for any of these scenarios because insufficient remaining area is available for this option. Table 6 shows probable costs for each alternative to manage materials in present dollars and in the five- and ten-year future, assuming the project experiences typical timeframes for additional investigations, approvals, and designs. All costs presented below and herein include a 25% contingency for future unknowns and may therefore be slightly conservative. An escalation factor of 3% per year is used in future projections and this factor is considered representative of this type of project (an earthwork type of project as compared to a materials-intensive project).

Assumptions used for unit costs for each remediation method in Concept 2 are the same as those for Concept 1. Costs for the same work done in the five- and ten-year futures would be escalated by an average of 3% per year. Considering escalation, costs to perform Materials Management Alternative 1 would be between \$4,400,000 to \$7,300,000 in five years and between \$5,100,000 and \$8,500,000 in ten years. Costs to perform Materials Management Alternative 2 in five years would be between \$3,200,000 and \$4,800,000 and in ten years would be between \$3,700,000 and \$5,500,000. Costs to perform Materials Management Alternative 3 in five years would be \$2,600,000 in five years minimum and \$3,000,000 in ten years minimum.

**Table 6. Costs for Concept Plan 2 (Maximum Feasible Restoration)  
Materials Management Alternatives**

Alternative	On-Site Uses of Material	Material Management Method(s) and Unit Cost	Material Quantity in Cubic Yards	Costs Including a 25% Contingency for Future Unknowns and Escalation of 3% on All Future Numbers		
				In Year 2007	In Year 2012	In Year 2017
1	None	Off-Site Disposal (\$60/cy & \$36/ton to \$100/cy & \$60/ton)	27,000	<del>\$2,000,000</del>	<del>\$2,300,000</del>	<del>\$2,700,000</del>
				to <del>\$3,300,000</del>	to <del>\$3,900,000</del>	to <del>\$4,500,000</del>
2	Dikes and Road	Cement-Based Remediation (\$22.5/cy & \$14/ton)	23,000	\$660,000	\$770,000	\$890,000
	None	Off-Site Disposal (\$60/cy & \$36/ton to \$100/cy & \$60/ton)	4,000	<del>\$300,000</del>	<del>\$340,000</del>	<del>\$400,000</del>
				to <del>\$500,000</del>	to <del>\$570,000</del>	to <del>\$670,000</del>
<b>Subtotals for Alternative 2</b>			<del>27,000</del>	<del>\$960,000</del>	<del>\$1,100,000</del>	<del>\$1,300,000</del>
				to <del>\$1,200,000</del>	to <del>\$1,300,000</del>	to <del>\$1,600,000</del>
3	Dikes and Road	Cement-Based Remediation (\$22.5/cy & \$14/ton)	23,000	<del>\$670,000</del>	\$770,000	\$890,000
	Upland Fill	Bioremediation (\$45/cy & \$27/ton)	4,000	<del>\$220,000</del>	<del>\$260,000</del>	<del>\$300,000</del>
<b>Subtotals for Alternative 3</b>			<del>\$27,000</del>	<del>\$890,000</del>	<del>\$1,030,000</del>	<del>\$1,190,000</del>

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## 4.0 Assessment of Regulatory Feasibility

Former staff of the U.S. Army Corps of Engineers Regulatory Department of the Los Angeles District (Josh Burnham of Anchor Environmental, LLC) were consulted regarding the materials management options to identify whether the proposed actions are feasible from a regulatory standpoint. Their conclusions were that the project is feasible as proposed, with the need to secure numerous approvals. The summary of that discussion is provided below.

The process of obtaining multi-agency approvals necessary for this project should be relatively straightforward, and is effectively managed by recognizing process interrelationships and preparing timely and technically accurate submittals. The process should be initiated by conducting an agency site meeting and preparation of a multi-agency jurisdictional determination (JD), delineating the extent of waters of the state, waters of the U.S. and adjacent wetlands on the property. The results of this evaluation represent the official buy-in from agency stakeholders that they do or do not intend to exert jurisdiction over various alternatives, and provides valuable insight on issues to be considered during the CEQA process. Fifteen (15) days for preparation and twenty-one (21) days for agency review of the JD can be assumed.

Specific to the remedial alternatives presented in this document, almost all agency jurisdiction and concern will be confined to those areas acknowledged in the JD process as waters of the state, U.S., and/or adjacent wetlands. Specific to the excavation of sumps, restoration/enhancement construction activities in jurisdictional areas, and discharges of treated or untreated soil in the uplands, while “clean” excavation is generally unregulated by Federal standards under the Clean Water Act (no 404 discharge), the area is tidal, meaning that the U.S. Corps of Engineers (USACE) at a minimum will have authority under Section 10 of the Rivers and Harbors Act. Historic wetland delineations on the site were compared to areas of proposed materials management and the project appears to be feasible. Existing wetlands on-site are clustered around the existing drainage channel through the site and areas to be filled are outside of the wetlands.

Furthermore, the need to mobilize tracked equipment such as front-end loaders on-site and in waters and/or adjacent wetlands of the U.S. will likely be treated as a Clean Water Act (CWA) Section 404 discharge. The Regional Water Quality Control Board (RWQCB) will regulate work within waters of the State as a Porter-Cologne issue, and as a CWA Section 401 water quality issue if the USACE also acknowledges Section 404 discharges. The California Coastal Commission (CCC) will consider all work on site, to include upland exposed or confined placement of excavated materials. The California Department of Fish and Game (CDFG) will likely choose to be consulted at a minimum, and may desire to issue a Streambed Alteration Agreement (SAA). The CDFG also requires a completed environmental review document under the California Environmental Quality Act (CEQA), but there is no interrelationship to Federal processes with CDFG.

Following completion of this phase, the preferred alternative must be selected, and the CEQA process (presumed Mitigated Negative Declaration), Cultural Resources (CR) surveys, and Biological Assessment (BA), in support of later Federal species consultations, should be initiated. The City of Seal Beach or the Los Cerritos Wetlands Authority could potentially be the CEQA lead agency and may require a local permit or approval for implementation. The CR surveys and the BA also provide valuable and necessary information for the CEQA process, as mitigations for potential habitat impacts, sensitive species windows, etc. must also be considered as part of the CEQA process. One-hundred eighty (180) days is required for CEQA, with nested sixty (60) day timeframes for the BA and CR work.

The RWQCB and the CCC will take no action until presented with an approved CEQA document. Furthermore, the USACE Regulatory Program cannot issue final permits without RWQCB and CCC approvals in place, and without Endangered Species Act (ESA), Essential Fish Habitat (EFH), and Section 106 (CR) consultations concluded. Federal (USACE) involvement is likely going to consist of issuance of a Nationwide Permit (NWP) 27, which will cover all necessary restoration construction activities, and possibly within a Nationwide Permit (NWP) 33 for temporary access issues (referred to as “stacked” permitting). The NWP process is an abbreviated and simple process outside of the necessary consultations for ESA, which will likely be an issue in this case.

Therefore, the next phase includes simultaneous application to USACE, the RWQCB, the CCC (assumes not being handled through a Local Coastal Plan as Seal Beach does not have an approved Local Coastal Plan), CDFG (if required), and initiation of Federal consultations on endangered species, EFH, and CR. As lead Federal agency, the USACE is responsible for initiating Federal consultations and the BA and CR surveys previously developed by CEQA, and participation and assistance of the Coastal Conservancy will be invaluable.

The timeline for issuance of the USACE NWP allows 60 days under federal administrative requirements, but that timeline may not or cannot be met unless all other consultations and permissions are received. In the vast majority of cases, the USACE timeline is not the limiting factor, with approvals delayed due to resolving Section 106 (National Historic Preservation Act), ESA, CCC, or RWQCB processes. For purposes of the timeline provided, final Federal approvals are shown as dependent on the 135-day USFWS consultation, based on the statutory length of a “formal” ESA consultation, and typical processes. It is possible, or even likely, that an “informal” consultation may be appropriate; however, assuming formal consultation allows for preparation of a discrete timeline and a conservative evaluation.

## 5.0 CONCLUSIONS

This study was commissioned by the State Coastal Conservancy [and Hellman, LLC](#) to identify the maximum feasible habitat restoration at the project site, including habitat type, location, required grading and hydrology. Based on that plan, this study evaluated the feasibility of the alternatives for cleaning-up each of the contaminated areas on the property that could be affected by that restoration. Finally, this study quantified costs of each clean-up alternative. Two restoration scenarios were developed, with varying materials management approaches for each. The work included preparing rough grading plans, performing preliminary hydrologic modeling, preparing soil remediation alternatives, estimating the costs of soil remediation, and assessing the regulatory feasibility of the projects. Conclusions are provided below.

1. Rough grading plans were prepared for the following two restoration options:
  - a. The moderate restoration option provides for significant restoration opportunity while minimizing the amount of soil excavation. Existing channels and low areas were used as the basis for establishing the plan. Grading could be done by removing approximately 200,000 cubic yards of earth to create a channel/basin network with elevations ranging from -4 feet relative to mean sea level (MSL) on the low end to +4 feet MSL on the high end. Surplus soil would be entirely re-used on-site in dikes, roads, and mounding on upland areas.
  - b. The maximum feasible restoration option provides for one of the largest restoration footprints possible, given site topographic constraints. More excavation is required for this concept as compared with the moderate restoration concept, with nearly 400,000 cy of soil to be removed to create the wetland. Wetland elevations would be similar to the moderate concept, and surplus soil would either be entirely removed off-site, or re-used where appropriate with the balance hauled off-site.
2. Preliminary hydrologic modeling was completed for both options that showed the site would experience slightly muted tidal conditions with two 5-foot diameter and 300 foot long culverts connected to the San Gabriel River (across the Haynes Cooling Channel). Nearly full tidal conditions could be created by installing pipes with 6-foot diameters. [Connecting to the Haynes Channel would increase tidal ranges and water quality to mimick conditions at lower Alamitos Bay.](#)
  - a. For moderate restoration, tidal elevations range from a high tide of +4 feet MSL to a low tide of -2.5 feet MSL during spring tides. The spring tidal prism would be approximately 100 acre-feet. This tide range is suitable for restoration, but expanding the range would be preferred.

- b. For maximum feasible restoration, tidal elevations range from a high tide of +3.5 feet MSL to a low tide of -2.3 feet MSL during spring tides. The spring tidal prism would be approximately 150 acre-feet. This tide range is also suitable for restoration, but expanding the range would also be beneficial.

3. Habitat areas that could be created over the site for the two different options are shown in the Table 7 below.

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**Table 7 – Habitat Areas of Proposed Alternatives**

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<b><u>Habitat Type</u></b>	<b><u>Moderate Restoration Alternative Habitat Areas (Acres)</u></b>	<b><u>Maximum Feasible Restoration Alternative Habitat Areas (Acres)</u></b>
<b><u>Subtidal</u></b>	<b><u>6</u></b>	<b><u>14</u></b>
<b><u>Mudflat</u></b>	<b><u>8</u></b>	<b><u>14</u></b>
<b><u>Vegetated Intertidal (Pickleweed)</u></b>	<b><u>21</u></b>	<b><u>32</u></b>
<b><u>Upland</u></b>	<b><u>65</u></b>	<b><u>40</u></b>
<b><u>TOTAL</u></b>	<b><u>100</u></b>	<b><u>100</u></b>

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4. Alternatives for soil remediation were conceived and include off-site disposal, on-site encapsulation, bio-remediation, and cement-based remediation. Each has advantages and disadvantages. With cement-based stabilization and bioremediation, the new soil can be used as the base of fill areas such as levees, roads, and upland mounds.

5. Approaches to managing sump materials vary for each restoration concept such as:

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- a. The moderate restoration concept would require excavation of approximately 200,000 cy of earth material, including 27,000 cy of contaminated sump materials. This option provides capacity for re-use of all surplus sump materials and clean materials on-site as fill, with significant capacity remaining for more fill at upland areas. All sump materials can be used as fill for a perimeter dike, raising the entrance road, and mounding at upland areas.
- b. The maximum feasible restoration concept would require excavation of approximately 400,000 cy of earth material, including ~~27,000~~ 27,000 cy of contaminated sump materials. This option provides capacity for one-half of the 400,000 cy of surplus material on-site as fill. Alternatives for materials management include with this option are:

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- i. Trucking all 27,000 cy of sump material offsite;
- ii. Re-using 23,000 cy of sump material (cement-stabilized) on-site in a dike and raised road base, and trucking the remaining 4,000 cy of sump material offsite; and
- iii. Re-using 23,000 cy of sump material (cement-stabilized) on-site in a dike and raised road base, and re-using 4,000 cy of sump material (bioremediated) on-site as upland fill.

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6. Costs to manage materials will range depending on the selected method as follows:

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a. For the moderate restoration alternative, costs will reach up to approximately \$900,000 for cement-based remediation in 2012 (assuming restoration occurs within five years from the date of this estimate), between \$2.3 million and \$3.9 million for off-site hauling, and up to \$1.7 million for bio-remediation. On-site encapsulation of materials remediated by either of the above methods may add another \$240,000 to project costs in five years.

b. For the maximum feasible restoration alternative, costs will be:

- i. All material hauled off-site will cost between \$2,300,000 to \$3,900,000 in 2012, and between \$2,700,000 and \$4,500,000 in 2017;
- ii. Sump materials used as a dike and raised road on-site and the remainder trucked off-site for between \$1,100,000 to \$1,300,000 in 2012, and between \$1,300,000 and \$1,600,000 in 2017; and
- iii. Sump materials used as dike, a raised road, and upland fill on-site for \$1,030,000 in 2012 and \$1,200,000 in 2017.

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7. The work can feasibly be done from a regulatory standpoint. Existing environmental regulations consider a wide variety of actions that can include performing cement-based remediation and bioremediation, and reuse of the material on-site as the base of fill areas, coupled with wetland restoration over a large portion of the site. A series of permits from local, regional, state and federal agencies will be required as well as satisfying CEQA, but the work can eventually be approved within the regulatory framework.

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8. Costs presented herein are for addressing sump materials only. Costs of other items associated with restoration would be in addition to costs to address sumps, and are not presented herein but will be incurred in the future as part of project implementation.

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**APPENDIX A**

**MATERIALS MANAGEMENT COST ESTIMATES**

**Costs for Concept Plan 1 (Moderate Restoration)  
Materials Management Alternatives**



**APPENDIX B**

**MATERIALS MANAGEMENT COST ESTIMATES**

**Costs for Concept Plan 2 (Maximum Feasible Restoration)  
Materials Management Alternatives**

**Hellman Ranch Contaminated Materials Management Cost Estimates  
Maximum Feasible Restoration Plan**

Management Option	Quantity	Units	Use/Method	Subtotal	Total	Years		
						2007 With a 25% Contingency	2012 With a 25% Contingency	2017 With a 25% Contingency
<b>Total Contaminated Volume</b>	27,000	cy	Haul off-site					
	44,550	tons						
	23,000	cy	Cement-based stabilization					
	37,950	tons						
Conversion 1 yard = 1.65 tons	4,000	cy	Bioremediated					
	4,000	cy	Hauled off-site					
	6,600	tons						
<b>Alternative 1 - All Trucked Off-Site</b>								
Off-site Disposal (Low End of Range)	\$ 60.00	yards	\$ 1,620,000					
	\$ 36.00	tons	\$ 1,603,800	\$1,603,800	\$2,004,750	\$2,323,505	\$2,694,384	
Off-site Disposal (High End of Range)	\$ 100.00	yards	\$ 2,700,000					
	\$ 60.00	tons	\$ 2,673,000	\$2,673,000	\$3,341,250	\$3,872,509	\$4,490,640	
<b>Alternative 2 - Dikes and Road, Remainder is Hauled Off-Site</b>								
Cement Stabilization	\$ 22.55	yards	\$ 518,650					
	\$ 14.00	tons	\$ 531,300	\$531,300	\$664,125	\$769,721	\$892,584	
Off-site Disposal (Low End of Range)	\$ 60.00	yards	\$ 240,000					
	\$ 36.00	tons	\$ 237,600	\$237,600	\$297,000	\$344,223	\$399,168	
Off-site Disposal (High End of Range)	\$ 100.00	yards	\$ 400,000					
	\$ 60.00	tons	\$ 396,000	\$396,000	\$495,000	\$573,705	\$665,280	
<b>Subtotal Alternative 2 - Low Range</b>				<b>\$768,900</b>	<b>\$961,125</b>	<b>\$1,113,944</b>	<b>\$1,291,752</b>	
<b>Subtotal Alternative 2 - High Range</b>				<b>\$927,300</b>	<b>\$1,159,125</b>	<b>\$1,343,426</b>	<b>\$1,557,864</b>	
<b>Alternative 3 - Dikes and Road, Remainder is Used as Fill On-Site</b>								
Cement Stabilization	\$ 22.55	yards	\$ 518,650					
	\$ 14.00	tons	\$ 531,300	\$531,300	\$664,125	\$769,721	\$892,584	
Bioremediation	\$ 45.00	yards	\$ 180,000					
	\$ 27.00	tons	\$ 178,200	\$178,200	\$222,750	\$258,167	\$299,376	
<b>Subtotal for Alternative 3</b>		<b>cy</b>	<b>\$ 709,500</b>	<b>\$ 709,500</b>	<b>\$ 886,875</b>	<b>\$ 1,027,888</b>	<b>\$ 1,191,960</b>	

Notes: All costs developed by M&N with information from Anchor Environmental, LLC and should be sufficient to cover soils costs.

Off-site disposal will require additional landfill tipping fees of approximately \$40 per cubic yard and possibly containment areas to dewater a portion of the material from the existing channel.

Cement stabilization will require additional equipment to mix the cement, till the material, and then lay it down for compaction. This estimate also assumes a mixture of Portland cement and kiln dust at a rate of approximately 2-3% should be sufficient.

Bioremediation costs are estimated based on published literature cost ranges assuming that large containment areas can be used instead of roll-off containers.