LOS CERRITOS WETLANDS CONCEPTUAL RESTORATION PLAN

SOIL CONTAMINATION AND GRAIN SIZE CHARACTERISTICS REPORT

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June 2012

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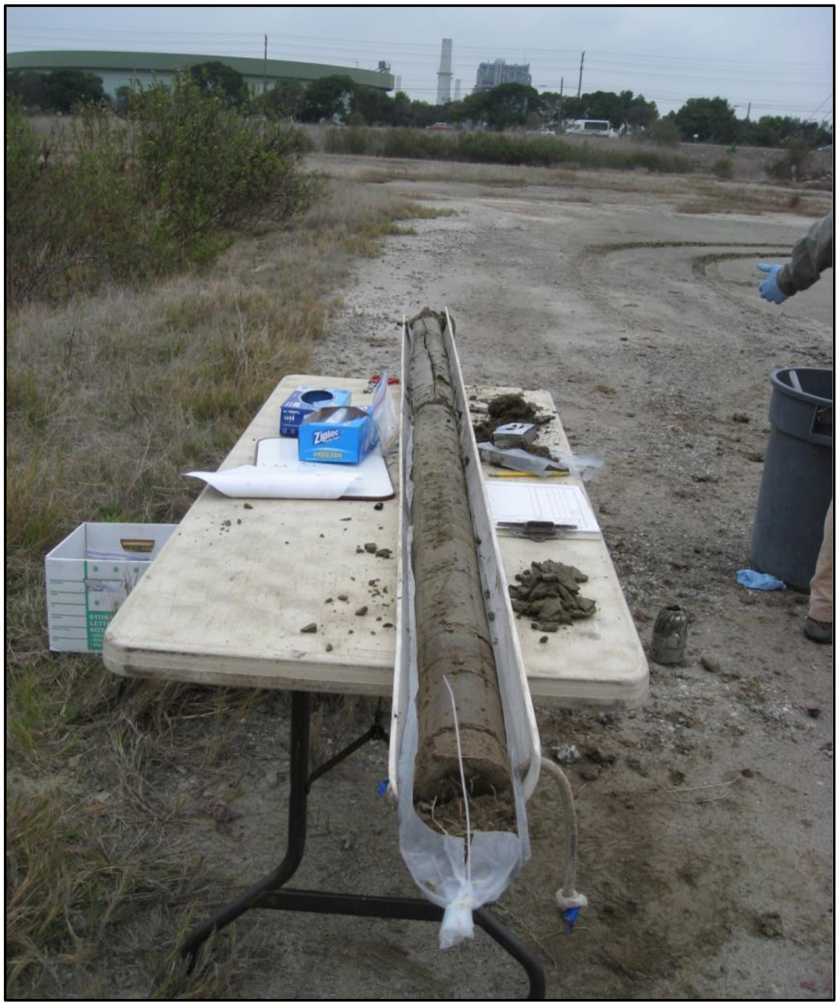

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EXECUTIVE SUMMARY

The Los Cerritos Wetlands (LCW) complex has been used for oil exploration and recovery for the past 90 years. In addition, certain areas were used as landfill for disposal of clean construction materials. Exploratory trenches indicated that construction materials comprised 10-40% of the fill, but also identified petroleum-contaminated soils and isolated cases of elevated pesticides within the landfill area. Other areas were used to dispose of dredged material associated with excavation of the cooling water intake channel for the Haynes Power Plant. Waste products from drilling operations were stored in sumps located throughout the property. The process of building out the infrastructure to extract, store and transport oil has had unavoidable impacts on the soils of the LCW complex.

This task was designed to review available information on the contaminants present in the soils, the horizontal and vertical distribution of these contaminants, and to assess whether the concentrations of these contaminants are likely to be of concern if these soils are reused in an aquatic environment. Additional data was to be obtained by conducting a reconnaissance survey designed to examine grain size distributions associated with the upper 10 feet of soil within the LCWA Phase 1 (previously Bryant) parcel. This report provides the data for the LCWA and City of Long Beach properties ("base project" of approximately 200 acres).

Prior investigations have focused on total recoverable petroleum hydrocarbons / total petroleum hydrocarbons (TRPH/TPH), a variety of metals, polyaromatic hydrocarbons (PAHs), and organochlorine pesticides. Information on polychlorinated biphenyls (PCBs) are generally not available based upon early investigations that suggested these compounds were not expected to have been used.

TRPH/TPH

Most early studies focused on TRPH and TPH associated with sumps. TPH concentrations are highest in sumps and in the vicinity of historic tank farms, but are also widespread throughout all areas where these contaminants have been measured. Additional information from the Phase II Environmental Site Assessment (ESA) studies in the OTD/Edison site, LCWA Phase 2 (Hellman Ranch), and LCWA Phase 1 (Bryant) parcels adequately identifies the principal areas of contamination, but additional data will be needed when the sumps are being remediated.

Metals

Metals have not been the focus of studies conducted to identify contaminants in the LCWA and City of Long Beach properties. Most investigations indicate that metal concentrations are mostly within the range of typical background concentrations although a few are associated with sumps and elevated levels of TPH. Anchor (2004b) found that high concentrations of lead, in particular, were strongly correlated with high concentrations of TPH in sumps. Other metals such as arsenic, vanadium, barium and chromium also tend to be elevated in the sumps and are associated with some drilling muds. In most cases, extremely elevated concentrations of one or two metals were reported at a limited number of sites. Sampling densities were not sufficient to identify distinct patterns of association with any particular feature or location.

Organochlorine Pesticides

Chlordane compounds, DDT compounds and their derivatives and dieldrin are the most common pesticides found in this region. Although large numbers of analyses have not been conducted, these compounds tend to be present in surface soils. In the LCWA Phase 2 (Hellman Ranch) parcel, these compounds tended to occur along an access road and were not encountered in the sumps. Very high concentrations of DDE, DDT, chlordane and dieldrin were present in surface soils at two sampling points. The associated report suggests that the sampling points were saturated with water at the time of the survey which may indicate that these were low spots where water would pond after small rain events.

Evaluation of the OTD/Edison site was constrained by the analytical detection and reporting limit values used for organochlorine pesticides. The analytical detection limits used for organochlorine pesticides at the OTD/Edison site were quite elevated compared to detection limits used for other analytes of concern. In all cases, the reporting limits for organochlorine compounds were well about the NOAA ERL values. In the case of chlordane, reporting limits were nearly 10 times the NOAA ERM.

Data Gaps

No data were available on contaminants on the City of Long Beach (Marketplace Marsh) property or any of the additional 300 acres of property of potential future acquisition. Depending on the specific future restoration plans for the Marketplace Marsh property and future availability of data for the privately-owned properties, Phase I ESA work may be necessary as a first step towards identification of areas that are likely to have been used as sumps or for storage and transport of oil.

Also depending upon the specific future restoration plans, further work may be necessary to: a) assess the extent of metal contamination in the vicinity of the LCWA sites that had elevated concentrations of arsenic, cadmium, lead, mercury, nickel and zinc, and b) delineate the magnitude and extent of elevated concentrations of pesticides contamination in areas away from the sumps. Based upon existing data, surface samples will likely be sufficient for delineating the areas for pesticides since they were not detected at depth.

It should also be noted that a formal Sampling and Analysis Plan and additional comprehensive sampling and test will be done during the future preliminary engineering phase for the specific restoration alternative selected.

Content

Figures

Tables

1.0 INTRODUCTION

The Los Cerritos Wetlands Authority (LCWA) was established in 2006 through a Joint Powers Agreement between the San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy (RMC), State Coastal Conservancy (SCC), City of Long Beach, and the City of Seal Beach. The mission of the LCWA is "to provide a comprehensive program of acquisition, protection, conservation, restoration, maintenance and operation, and environmental enhancement of the LCW Complex, consistent with the goals of flood protection; habitat protection and restoration; and improved water supply, water quality, groundwater recharge, and water conservation."

The base project of the LCW Conceptual Restoration Plan (CRP) includes four primary properties (Figure 1) that encompass approximately 200 acres of land. These parcels include:

- LCWA Phase 1 Separate Parcel (OTD/Edison Parcel) (5 acres);
- LCWA Phase 1 (Previously Bryant) Property (67 acres);
- LCWA Phase 2 (Previously Hellman Ranch) Property (100 acres); and
- City of Long Beach / Marketplace Marsh Property (34 acres)

There is also the potential to include eight additional parcels in the CRP which would bring the total acreage up to approximately 500 acres (Figure 2). All of these properties have been highly modified over the years with the addition of fill material and drilling and installation of oil wells, pipelines, tank farms and other structures necessary to support oil extraction and transport. The extent to which historical land use activities have impacted soils within these parcels is highly variable.

This report provides a summary of the types of contaminants present in soils and current knowledge regarding the extent of contamination for the LCWA and City of Long Beach properties ("base project" of approximately 200 acres). Suitability of detection limits and issues of reuse of these soils in aquatic environments is addressed. This report also identifies data gaps and the potential need for a Phase I ESA for the site parcels that have not yet been acquired by the LCWA and currently have no ESA documentation.

A second goal of this task was to obtain soil cores for grain size analysis at selected points in the base project study area. Suitable materials will be required for dikes, islands, transitional habitat, and upland cover. Grain size characteristics are considered to be important in determining material disposal and/or re-use options. New sediments exposed as the result of excavation for tidal channels must also not contribute inappropriate ecological risk.

Source: Moffatt & Nichol 2011

Figure 1. Land Parcels Currently Under Public Ownership.

Source: Moffatt & Nichol 2012

Figure 2. Map of Entire Los Cerritos Wetland Complex.

2.0 SCOPE OF WORK

The scope of work for the overall study includes:

Task 1 – Base data collection and topographic mapping;

Task 2 – Characterize biological resources and extent of special status species;

Task 3 – Characterize hydrologic and hydraulic conditions;

Task 4 – Characterize upstream activities impacting the wetland;

Task 5 – Conduct an initial environmental study to identify potential contaminant types and sources;

Task 6 – Evaluate options for sediment management or disposal;

Task 7 – Develop opportunities and constraints to habitat;

Task 8 – Develop concepts for public access and interpretation;

Task 9 – Public involvement;

Task 10 – Develop process for meetings of the Steering and Technical Advisory Committees;

Task 11 – Refine project objectives;

Task 12 – Develop and evaluate restoration alternatives;

Task 13 – Develop consensus on alternatives;

Task 14 – Prepare conceptual restoration plan (final report);

Task 15 – Issues for next phase of restoration planning;

Task 16 – Project management.

This report is the deliverable for Task 5. The scope of work addresses two separate elements. The first portion of this task involved reviewing all available Phase I and Phase II environmental site assessments (ESA) for the base project (LCWA and City of Long Beach) parcels. This initial review was intended to summarize existing data and identify any potential data gaps.

The second element of this task was to conduct a brief reconnaissance survey to assess soil stratigraphy across a profile of 4 to 5 sites across the LCWA Phase 1 parcels. The objective of this survey was to assess general grain size characteristics and determine the horizontal consistency and continuity of sediment profile characteristics across the site. Cores or borings were taken to a depth of approximately 10 feet below ground surface (BGS) at each location. The cores were to be logged using standard methods of visual and textural characterization and subsampled from up to three strata within each core for laboratory analysis of percent sand, silt, and clay. Data from this task are utilized for a preliminary screening of potential re-use alternatives.

3.0 SOIL CONTAMINATION AND GRAIN SIZE DATA

The following sections provide a summary of the types of soil contaminants known to be present at each site, concentrations and any available information regarding the vertical and horizontal distribution of contaminants. Physical characteristics of the soils are also noted when information was available.

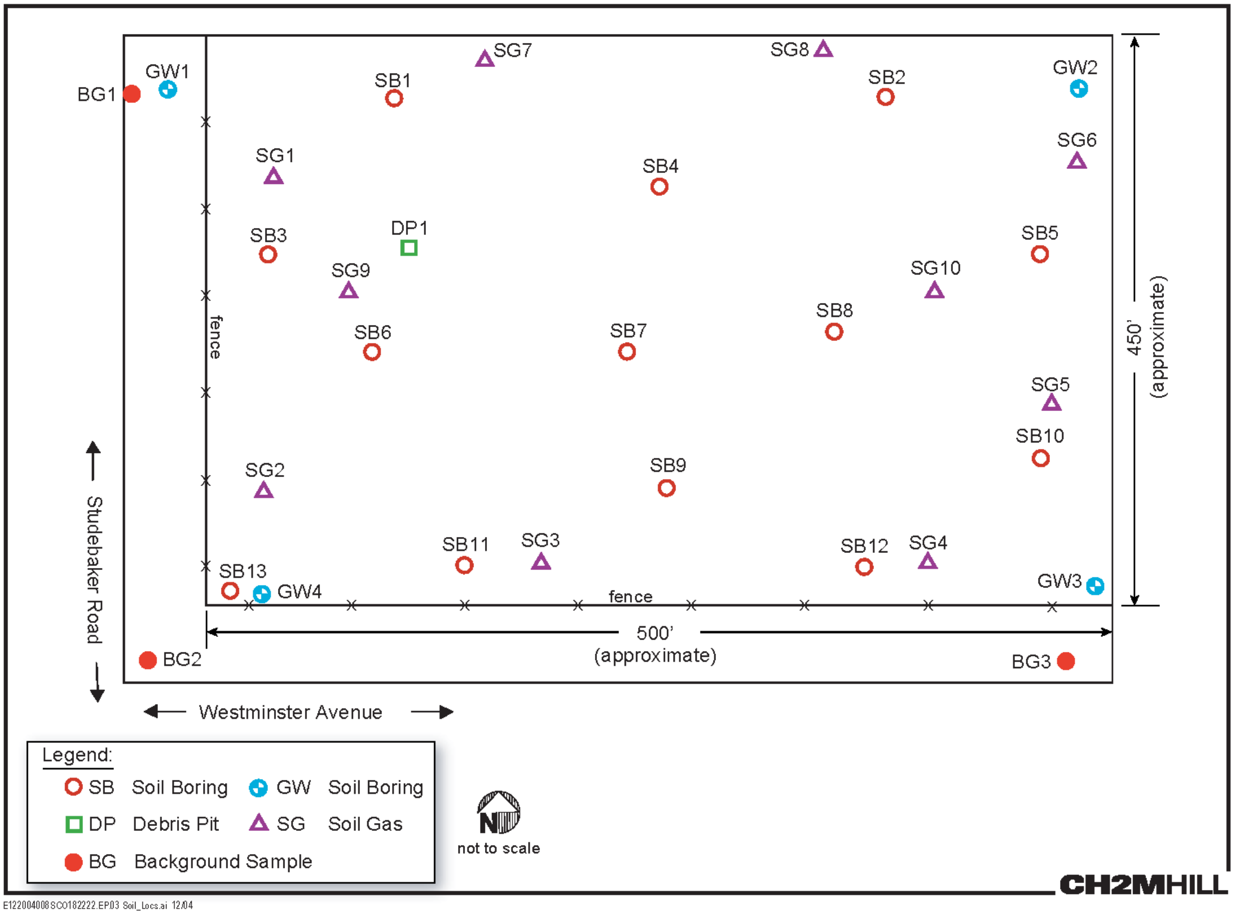
3.1. LCWA Phase 1 Separate Parcel (Previously OTD/Edison Parcel)

This small parcel is located on the northeast corner of Studebaker road and 2nd Street in Long Beach, California. This 5.1-acre property is now owned by the Los Cerritos Wetlands Authority. A Phase I ESA was conducted by CH2MHILL (2000). The investigation focused on areas of potential concern (AOPC) based upon historical and current activities being conducted at the time of the survey.

The Phase I ESA identified three AOPCs that included a drums storage area, a maintenance area and another area with discarded batteries.

> ***Drums Storage Area:*** Nine 55-gallon drums containing petroleum product were identified in the southwest corner of the site. No staining or leaks were observed around the drums. These drums were situated on pallets in a dirt area with no secondary containment. Due to the potential for a hazardous material to have impacted surface soils in the vicinity of the drum storage area, this area is an AOPC.
>
> ***Maintenance Area:*** Leaking equipment and soil staining were observed in the southwest corner of the site in an area that was being used for vehicle maintenance. Due to the potential for petroleum releases to have impacted surface soils in the vicinity of the maintenance area, this area is an AOPC.
>
> ***Discarded Battery Area***: An area of discarded batteries was located in the southwest corner of the site. Due to the potential for battery acids and lead to have impacted the soil, this area is an AOPC. All three AOPC's recommended for further investigation and sampling in the area.

This investigation was followed by a Phase II ESA designed to determine if there was onsite contamination that could pose a significant threat to human health and the environment, and potentially trigger regulatory action. Soil, soil gas, and groundwater samples were collected throughout the Site to assess the possible presence of subsurface impacts from past site uses. Soil samples were collected from three depths ((0.5, 5, and 10 feet below ground surface [bgs]). Soil samples were then analyzed for metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and chlorinated pesticides (including polychlorinated biphenyls [PCBs] at the drum storage area). Figure 3 shows the sampling locations throughout the site.



Source: CH2MHILL 2004

Figure 3. Soil Sampling Sites in the OTD/Edison Parcel

Overall, VOC, SVOC, chlorinated pesticides, and PCB concentrations did not exceed industrial PRGs, TTLC, and 10 times STLC screening criteria in the majority of the soil and soil gas samples collected at the site; and the soil appears to be minimally impacted with respect to potential impacts to humans in an industrial setting.

Arsenic was the only analyte for which concentrations often exceeded the industrial PRG. However, this metal is frequently measured in California at background concentrations that exceed industrial PRGs. One soil sample, collected at 5 feet bgs and soil samples from another location considered representative of background conditions, exhibited a lead concentration that exceeded 10 times the STLC. These samples would normally be subjected to a Waste Extraction Test (WET) as the next step in determining where the sample would be considered to exceed levels necessary to considered hazardous waste to human health.

The lead concentration in one sample and both nickel and vanadium concentrations in another exceeded the TTLC screening criteria (Table 1). However, concentrations of lead, nickel, and vanadium for the deeper samples at these two locations were below the TTLC screening criteria. Although highly elevated, the distribution of these contaminants appeared localized and may have been due to a small piece of metallic lead in the core or other artifacts.

Soil gas concentrations for VOCs did not exceed the conservative shallow soil gas ESLs for the commercial/industrial land use scenarios and thus, were not considered to pose a significant impact to indoor air at a future onsite building. Hydrogen sulfide gas was not detected in the 10 soil gas samples (including one duplicate) collected at the Site. Methane concentrations in soil gas samples were several orders of magnitude below the lower explosive limit (LEL) of 5 percent (50,000 ppm). Furthermore, no VOCs or SVOCs were detected in groundwater samples collected at the Site.

When compared with NOAA ERLs and ERMs (Table 1 and Table 2), lead, nickel and several organochlorine pesticides (DDE, DDT, chlordane and dieldrin) are present at highly elevated concentrations that would suggest that the site would not be suitable for aquatic habitat without remediation. Surface soils at one location (EPTC 3-4 SB 07-01) had concentrations of DDE, DDT and chlordane that were all well above the NOAA ERM values. The measured concentration of DDE at SB 07-01 was nearly 20 times the ERM. Elevated concentrations of multiple organochlorine pesticides were measured surface samples at SB 07, SB 08, SB 012, and SB 013. Most contamination appears to be in the vicinity of two sampling points, SB07 and SB08.

In most cases, detection limits used for both chlordane compounds and dieldrin were too high to be used for comparison with aquatic life criteria. The detection limits used in this survey were based upon human health criteria consistent with other Phase I and II Environmental Site Assessments. As a result, any measureable concentrations of these compounds would readily exceed the ERLs.

Table 1. Metals (mg/kg) in Soils at the LCWA Phase 1 - OTD/Edison Parcel.

Sample Number	Depth (ft)	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Ti	Va	Zn
EPTC 3-4 BG01-01	5	0.75 U	3.12	123	0.502	1.39	21.2	12	26.6	38.5	0.0469 J	0.25 U	45	0.75 U	0.25 U	0.75 U	50.5	63.6
EPTC 3-4 BG02-01	5	0.75 U	5.84	148	0.429	1.34	22.8	11.3	35.1	56.2	0.064 J	0.164 U	23.8	0.75 U	0.25 U	0.75 U	42.3	151
EPTC 3-4 BG03-01	5	0.75 U	1.81	112	0.472	1.12	20.9	11.4	18.6	5.35	0.0256 J	0.518	17.3	0.75 U	0.25 U	0.75 U	42.8	52.9
EPTC 3-4 DP 01-01	0.5	0.75 U	4.32	100	0.345	0.872	19.8	7.55	16.6	41	0.047 J	0.0551 U	14.6	0.75 U	0.25 U	0.75 U	30.9	63.4
EPTC 3-4 DP 01-02	5	0.75 U	3.37	140	0.511	1.24	21.3	11.3	28.8	14.8	0.0528 J	0.25 U	20.8	0.75 U	0.25 U	0.75 U	41.2	61.1
EPTC 3-4 SB 01-01	0.5	0.75 U	5.3	154	0.561	1.3	22.4	12.6	27.8	10	0.0574 J	0.657	22.5	0.75 U	0.25 U	0.75 U	50.8	55.3
EPTC 3-4 SB 01-02	5	0.75 U	5.47	127	0.328	0.844	16.5	9.37	18.7	3.13	0.024 J	0.25 U	13.8	0.75 U	0.25 U	0.75 U	32.7	40
EPTC-3-4 SB 02-01	0.5	0.75 U	5.74	130	0.536	1.25	21.1	13.7	26.3	8.76	0.0422 J	0.686	18.8	0.75 U	0.25 U	0.75 U	45.1	94
EPTC 3-4 SB 02-02	5	0.75 U	3.53	159	0.689	1.51	29.3	14.2	37.4	7.68	0.0558 J	0.25 U	22.6	0.75 U	0.25 U	0.75 U	51.2	69.5
EPTC 3-4 SB 03-01	0.5	0.75 U	11	121	0.47	1.15	25.9	10.3	20.8	17.4	0.0926	0.0293 U	17.9	0.75 U	0.0515 J	0.75 U	37.3	61.2
EPTC 3-4 SB 03-02	5	0.75 U	7.45	203	0.666	1.94	31.7	15.9	39.7	74.1	0.078 J	0.25 U	43.7	0.75 U	0.25 U	0.75 U	70.6	99.7
EPTC 3-4 SB 03-03	10	0.75 U	2.9	118	0.398	0.872	17.6	11.9	22.6	4.46	0.0241 J	0.25 U	15.8	0.75 U	0.25 U	0.75 U	36.3	46.5
EPTC 3-4 SB 04-01	0.5	0.75 U	3	84.8	0.345	0.833	16.6	7.58	15.6	25.9	0.0493 J	0.0282 U	15.1	0.75 U	0.25 U	0.75 U	31.5	62.6
EPTC 3-4 SB 04-02	5	0.75 U	2.2	145	0.463	1.18	19.9	11.1	23.7	5.56	0.0319 J	0.25 U	20.1	0.75 U	0.25 U	0.75 U	43.9	49.1
EPTC 3-4 SB 05-01	0.5	0.75 U	2.09	120	0.792	1.51	25.1	13.3	25.9	7.88	0.0162 J	0.25 U	19.5	0.75 U	0.25 U	0.75 U	51.1	67.1
EPTC 3-4 SB 05-02	5	0.75 U	0.75 UJ	161	0.634	1.53	27.9	14.4	39.9	6.32	0.0521 J	0.25 U	22.2	0.75 U	0.25 U	0.75 U	42.2	68.4
EPTC 3-4 SB 05-04	5	0.75 U	0.594 U	162	0.659	1.64	27.1	13.7	37.1	9.33	0.0326 J	0.25 U	22.9	0.75 U	0.25 U	0.75 U	44.7	71.4
EPTC 3-4 SB 06-01	0.5	0.75 U	3.7	139	0.51	1.03	20.9	9.86	21.5	11.1	0.0592 J	1.01	19.9	0.75 U	0.25 U	0.75 U	40.8	49.1
EPTC 3-4 SB 06-02	5	0.75 U	2.81	147	0.534	1.36	23.8	12	29.3	31.2	0.0521 J	0.25 U	29.9	0.75 U	0.25 U	0.75 U	44.7	67.1
EPTC 3-4 SB 07-01	0.5	0.75 U	5.37	154	0.504	1.02	21.9	12.3	22.4	10.2	0.211	0.25 U	20.1	0.75 U	0.25 U	0.75 U	43.2	68.4
EPTC 3-4 SB 07-02	5	7.09	10.8	234	2	12.3	23.3	61.1	16.3	30.6	0.0178 J	3.62	2370	31.9	0.25 U	22.2	3430	71.4
EPTC 3-4 SB 07-03	10	0.75 U	34.7	152	0.474	0.999	20.2	10.8	21.8	4.76	0.0472 J	0.25 U	17	0.75 U	0.25 U	0.75 U	40.1	49.4
EPTC 3-4 SB 08-01	0.5	0.75 UJ	17.3	637	0.413	1.18	23.1	8.65	35.7	3420	0.134	0.443	18.2	0.75 U	0.103 J	0.75 UJ	37.2	72.1
EPTC 3-4 SB 08-02	5	0.75 U	4.79	151	0.522	1.07	20.6	10.9	23.4	9.87 J	0.451 J	0.71 J	17.3	0.75 U	0.25 U	0.75 U	41.9	48.9
EPTC 3-4 SB 08-03	10	0.75 U	2.7	77.3	0.34	0.0676 J	17.1	8.33	17.7	3.05	0.0489 J	0.25 U	13.5	6.89	0.25 U	0.75 U	30.8	52.8
EPTC 3-4 SB 08-04	5	0.75 U	5.3	169	0.744	1.49	26.9	15.1	26.8	6.48 J	0.0737 J	0.0602 U	20.8	0.75 U	0.25 U	0.75 U	59.3	48.1
EPTC 3-4 SB 09-01	0.5	0.75 U	2.58 J	73.1	0.338	1.04	15.2	7.9	18.1	42.3 J	0.0378 J	0.25 U	15	0.75 U	0.0577 J	0.75 U	28.9	359
EPTC 3-4 SB 09-02	5	0.75 UJ	5.04	81.1	0.43	1.44	16.7	9.51	18.5	56.3 J	0.0765 J	0.25 U	39.4	0.75 U	0.25 U	0.75 U	113	194J
EPTC 3-4 SB 09-03	10	0.75	5.6	143	0.435	0.248 J	19.4	11.4	21.9	4.56	0.0294 J	0.25 U	18	8.7	0.25 U	075 U	36.8	55.8
EPTC 3-4 SB 09-04	0.5	0.75 U	1.25 J	67.6	0.321	0.842	15.2	7.18	12.9	20 J	0.0322 J	0.25 U	10.8	0.75 U	0.25 UJ	0.75 U	27.9	50.9J
EPTC 3-4 SB 10-01	0.5	0.75 U	1.93 J	33.2 J	0.152 J	0.352 J	5.33 J	3.19 J	6.01 J	2.8 J	0.0223 J	0.132 U	12.3	0.75 U	0.25 UJ	0.75 U	23.9	21.9
EPTC 3-4 SB 10-02	5	0.75 UJ	4.74	122 J	0.429	0.882	17	8.93	19.6	6.84	0.0596 J	0.492	19.3	0.75 U	0.25 U	0.75 U	45	41
EPTC 3-4 SB 10-04	0.5	0.75 U	4.57 J	87.4 J	0.249 J	0.51	10 J	5.37 J	10.5 J	9.04 J	0.0781 J	0.175 J	13	0.75 U	0.0294 J	0.75 U	29.6	29.3
EPTC 3-4 SB 11-01	0.5	0.75 U	8.94	67.7	0.23 J	0.877	18.6	5.96	16.6	18.9	0.0878	0.257	12.8	0.75 U	0.0659 J	0.75 U	29	52.8
EPTC 3-4 SB 11-02	5	0.75 U	1.83	157	0.417	0.993	18.9	8.64	21.3	17.8	0.0345 J	0.25 U	15.9	0.75 U	0.0361 J	0.75 U	31.9	51.2
EPTC 3-4 SB 12-01	0.5	0.75 UJ	6.05	175 J	0.78	1.9	24.7	13.6	29.4	8.21	0.0877	3.93	126	2.51	0.25 U	0.334 J	332	55.4
EPTC 3-4 SB 12-02	5	0.75 U	2.08 J	142	0.539 J	1.35	22.8	12.4	26.4	7.75	0.0562 J	3.54	42.8	9.24 J	0.25 U	0.75 U	54.1	54.4
EPTC 3-4 SB 12-03	10	0.511 J	7.7	149	0.637	0.893	28	12.2	28.2	6.31	0.0305 J	0.25 U	41.2	11.4	U	0.75 U	72.8	68.7
EPTC 3-4 SB 12-04	5	0.75 U	5.37 J	163	0.572 J	1.5	23.9	13.2	29.6	7.99	0.0645 J	3.77	43.2	14.2 J	0.25 U	0.75 U	63.2	54.8
EPTC 3-4 SB 13-01	0.5	0.75 U	21.2	122	0.449	1.36	30.5	9.44	22.3	22.3	0.1	0.25 U	16.9	0.75 U	0.107 J	0.75 U	38.3	72.7
EPTC 3-4 SB 13-02	5	0.75 U	6.91	189	0.669	2	30.6	15.3	40.7	190	0.0907	0.25 U	50	0.75 U	0.25 U	0.75 U	77.3	119
EPTC 3-4 SB 13-03	10	0.213 J	25.8	181	0.614	1.32	28.8	16.7	45.2	6.67	0.0343 J	0.25 U	25	0.75 U	0.25 U	0.75 U	50.7	62.7
Screening Levels																		
NOAA ERLs			8.2			1.2	81		34	46.7	0.15		20.9		1.0			150
PRGs		410	1.6	67,000	1,900	450	450	1,900	41,000	750	310	5,100	20,000	5,100	5,100	67	7,200	100,000
TTLC		500	500	10,000	75	100	2,500	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000
10xSTLC		150	50	1000	7.5	10	50	800	250	50	2	3500	200	10	50	70	240	2500
UCLBackground95		-	5.45	-	-	-	-	-	-	49.79	-	-	42.36	-	-	-	52.95	-

Table 2. Organochlorine Pesticides (µg/kg) Measured in Soils at the LCWA Phase 1 - OTD/Edison Site.

Sample Number	Depth (ft)	4,4'-DDE	4,4'-DDT	Chlordane	Dieldrin
EPTC 3-4 DP 01-01	0.5	5 U	5 U	50 U	5 U
EPTC 3-4 DP 01-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 01-01	0.5	5 U	1.7 J	50 U	5 U
EPTC 3-4 SB 01-02	5	5 U	5 U	50 U	5 U
EPTC-3-4 SB 02-01	0.5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 02-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 03-01	0.5	18	5 U	50 U	5 U
EPTC 3-4 SB 03-02	5	5 U	5 U	50 U	1.8 J
EPTC 3-4 SB 04-01	0.5	2.3 J	4.1 J	50 U	5 U
EPTC 3-4 SB 04-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 05-01	0.5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 05-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 05-04	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 06-01	0.5	5 U	4.4 J	50 U	5 U
EPTC 3-4 SB 06-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 07-01	0.5	510	150	110	5.6
EPTC 3-4 SB 07-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 08-01	0.5	45	100 J	250 U	8.8 J
EPTC 3-4 SB 08-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 08-04	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 09-01	0.5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 09-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 09-04	0.5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 10-01	0.5	5 U	3.2 J	50 U	5 U
EPTC 3-4 SB 10-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 10-04	0.5	3.1 J	5 U	60	5 U
EPTC 3-4 SB 11-01	0.5	27	3.1 J	50 U	5 U
EPTC 3-4 SB 11-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 12-01	0.5	29	37 J	50 U	2.2 J
EPTC 3-4 SB 12-02	5	5 U	5 U	50 U	5 U
EPTC 3-4 SB 12-04	5	7.1	2.1 J	50 U	5 U
EPTC 3-4 SB 13-01	0.5	83	13	50 U	5 U
EPTC 3-4 SB 13-02	5	5 U	5 U	50 U	5 U
NOAA ERLs (ERMs)		2.2 (27)	1.0 (7.0)	0.5 (6.0)	0.02 (8.0)
EPA Region IX Industrial PRGs		7,000	7,000	6,500	110

Shaded Values exceed reporting limits, J=value is considered an estimate, U=analyte was not measurable at the associated limit

3.2. LCWA Phase 1 (Previously Bryant) Parcel

The LCWA Phase 1 (Bryant) parcel is comprised of two separate parcels known as the main parcel and separate parcel. The LCWA Phase 1 main parcel straddles the San Gabriel River Estuary between Westminster Avenue and Alamitos Bay. This parcel is surrounded by the City of Long Beach parcel, Bryant-retained parcel, the Haynes Cooling Channel, and the City of Los Angeles Department of Water and Power (LADWP) parcel. The current LCWA Phase 1 main parcel now includes portions of the previous Upper Bryant area on the western bank of the SGR and the previous Lower Bryant area on the eastern bank of the SGR. The LCWA Phase 1 main parcel corresponds to subareas 26a, 26b, and 27 (Figure 4) in the City of Long Beach Southeast Area Development and Improvement Plan (SEADIP). In the SEADIP, subareas 26a and 26b areas were zoned as a business park with office, commercial, and light industrial uses with designations for wetlands by the developers, while subarea 27 has solely been designated for wetlands restoration (City of Long Beach 2006). Subarea 27 is located between the Haynes Cooling Channel and the San Gabriel River. Zedler Marsh, which was among the first parcels to undergo restoration, is located centrally in this subarea.

Prior to the purchasing this property, the California Coastal Conservancy hired Anchor Environmental LLC (2006) to review all available environmental studies conduct on this parcel in order to better understand potential future liabilities that might be associated with contaminants left on the site as a result of historical property uses. Anchor reviewed the following documents but did not perform any field work.

- Camp Dresser & Mckee Inc., 1991. Environmental Audit, Texaco- Bryant Lease, Seal Beach, CA April 19, 1991
- Camp Dresser & McKee Inc., 1991. Final Phase II Environmental Assessment, Texaco – Bryant Lease, Seal Beach Oilfield, Seal Beach, CA November 15, 1991.
- Earth Technology Corporation. 1988. Hydrologic investigation at the Texaco Bryant Lease Facility, Seal Beach, California, October, 1988.
- Engineering Enterprises, Inc. 1989. Report of Preliminary Subsurface Environmental Assessment, Bryant Property, Long Beach, CA.
- Geomatrix, 1996. Letter providing review comments on the 1995 Texaco Draft Remedial Action Plan for the Bryant Lease, submitted to Kevin Brazil, Rutan & Tucker
- International Technology Corporation, 1988. Phase 1 Environmental Assessment Results and Proposal to perform Phase II assessment of Bryant Property

Previous studies in this region focused on total petroleum hydrocarbons (TPH) as an indicator since TPH was expected to be the most common contaminant associated with the oil and gas recovery activities that have dominated the landscape for decades. In addition, prior investigations also focused on areas believed to be sumps based upon direct knowledge of previous use or aerial photography. Other sites and contaminants were not considered in the early investigations. The CDM (1991) Phase II investigation included limited analysis of metals. They identified several metals (lead, arsenic, vanadium, barium, chromium), BTEX (benzene, toluene, ethylbenzene, and xylene), and polyaromatic hydrocarbons (PAH) in sumps with elevated levels of TPH.

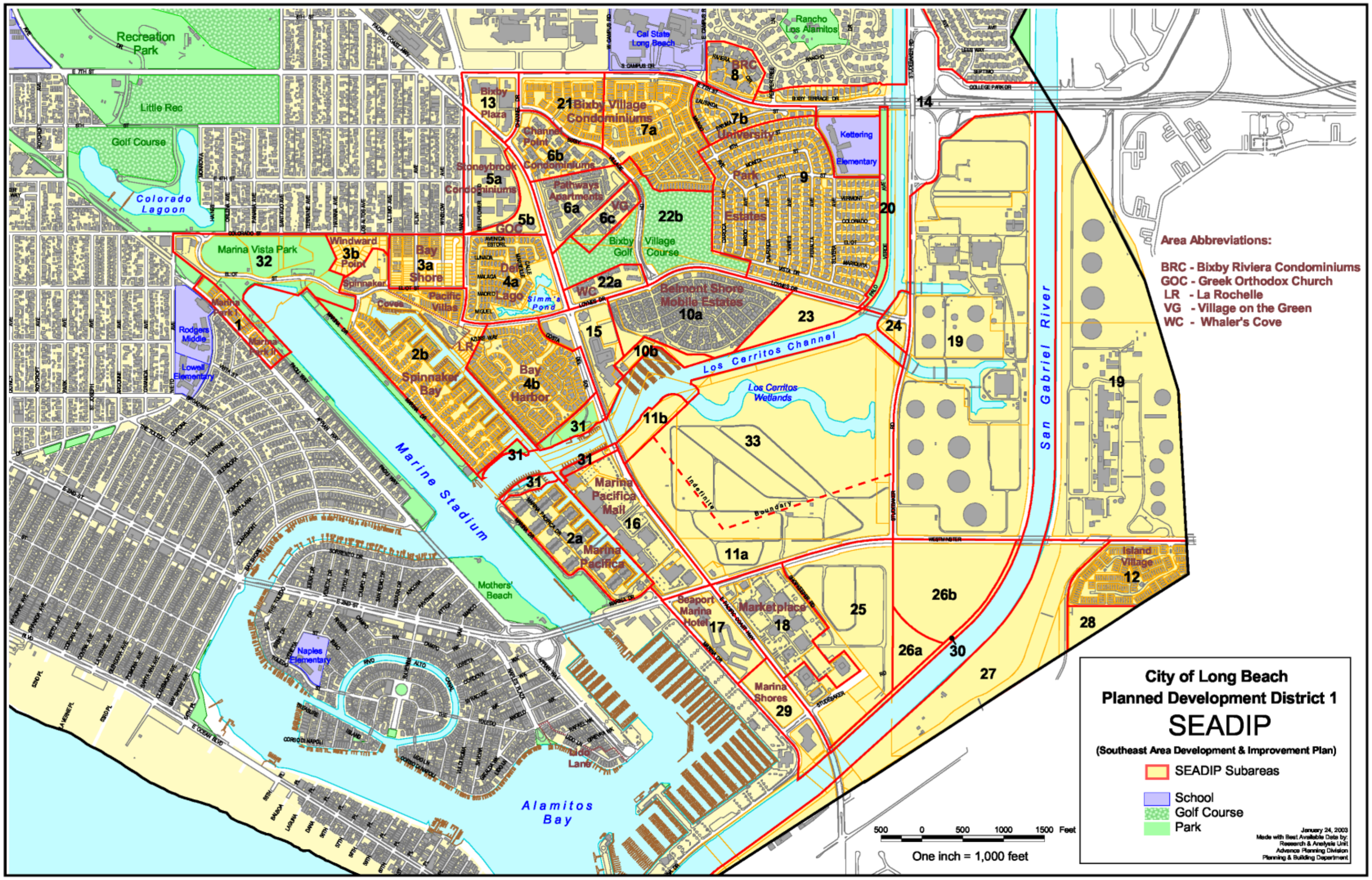
Given prior investigations conducted in the Hellman Ranch property, it was reasonable to assume that pipelines, production wells, gas compressors, or storage tanks were less likely to exhibit extensive contamination. Nevertheless contamination due to industrial uses could exist in these areas as a direct result of oil, drilling muds or in association with the equipment necessary to support the oil field activities. Fairly localized yet significant contamination can occur due to spills in storage areas, broken mercury switches, or from electrical transformers. Assessment of potential contamination in areas not directly suspected as having been used as sumps would require a fairly intensive and extensive effort. Anchor concluded the following:

> TPH concentrations were detected on the property as high as 3,000 mg/kg in the TETC 1988 study and at concentrations up to 189,568 mg/kg in the EEI 1989 study. The California Environmental Screening Level (ESL 2005) for TPH in soil in a residential use area is 500 mg/kg. The PAH carcinogenic compound, Benzo (a) pyrene, was detected at a concentration of 489 µg/kg in one soil boring (EEI 1989). The California Environmental Screening Level (ESL 2005) for Benzo (a) pyrene in soil in a residential use area is 38 µg/kg. Limited analysis of metals, lead, arsenic, vanadium, barium, and chromium in surface soils found concentrations above "background" in several areas in the eastern area of the site. Soluble concentrations of lead were also detected in multiple soil samples from the site at concentrations above the Soluble Threshold Limit Concentration (STLC) listed for lead in CCR Title 22. No soil testing was completed for pesticides and/or PCBs, although the Phase 1 environmental assessment did not identify a former site activity that justified testing of such contaminants.
>
> Boring and trenching logs from previous investigations generally characterized the surface and subsurface soils at the site as SM – sands with some silts. No documentation was found regarding the placement of dredge materials or construction debris on the site. The neighboring Hellmann property was known to have taken dredge materials on area 18 of the site and these dredge materials were generally characterized as silts with some clay. No documented geophysical surveys have been done at the site to identify underground obstacles such as pipes, USTs, or foundations that may affect the characterization of soil contamination.

> In summary, existing soil testing indicates that soil throughout the property has residual TPH concentrations that are greater than promulgated ESLs with a maximum exceedance factor 380 times the appropriate ESL. Limited locations that have soil lead concentrations above the STLs and soil Benzo (a) pyrene concentrations above ESLs.

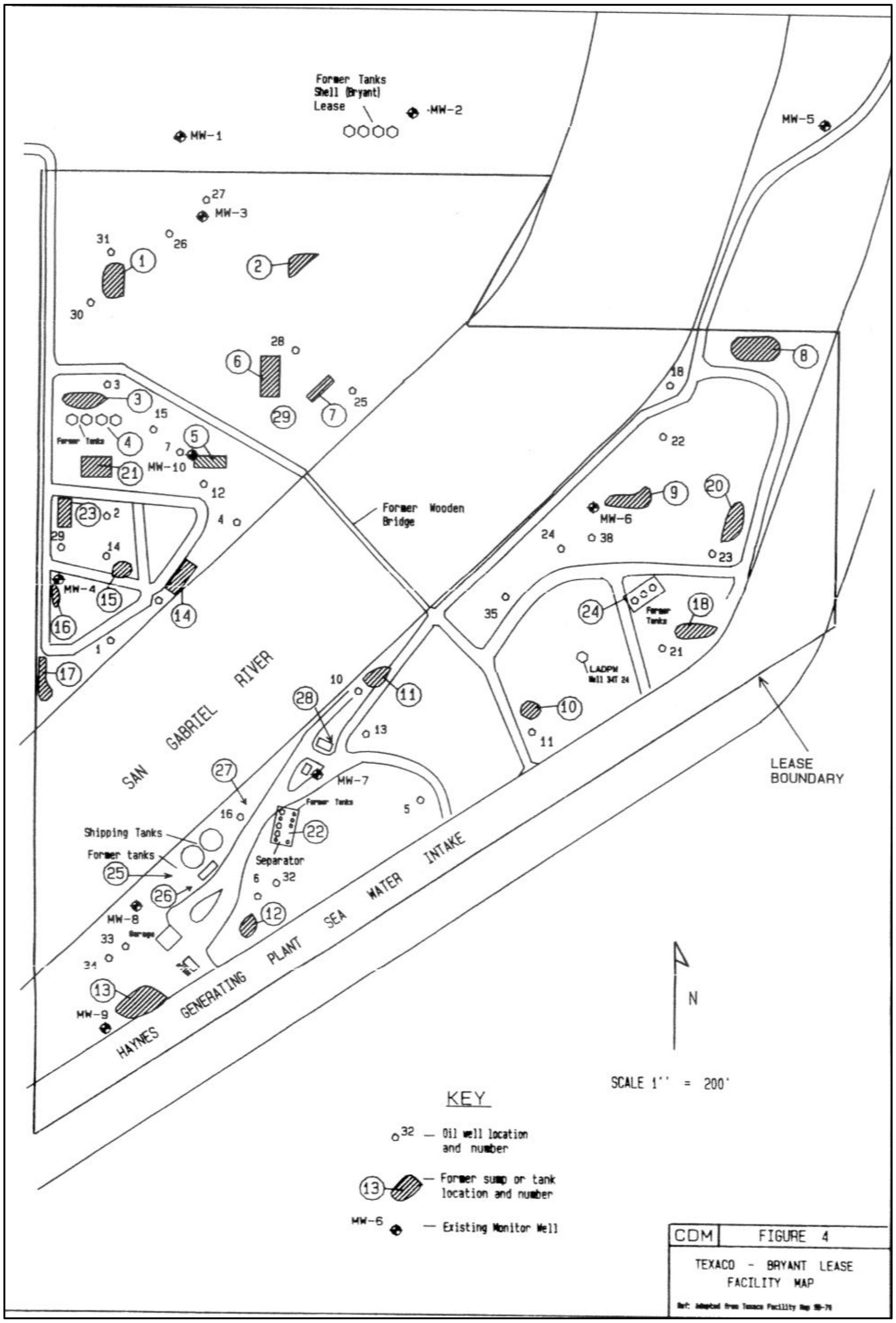
In 2009, three soil cores were taken from within or near the Bryant Parcel (Figure 6) to characterize soils in the upper two meters. One of the sites, 080, was located on the edge of tidal ditch that runs along the western boundary of the Bryant Parcel. The other two sites were both located on the isthmus of land between the San Gabriel River and the Haynes Cooling Water intake. Site 077 was located at the head of Zedler Marsh and Site 078 was located to the south and very close to the Haynes Cooling Water Channel.

Each of the profiles reflected very different characteristics. Soils at Site 077 were dominated by silts at both the surface (0-30 cm) and at depth (65 -200 cm). These were separated by very sandy soil. Site 078 was predominantly sand (70-80%) from the surface down to 1.2 meters. From 1.2 to 2.0 meters, the soil became finer with 55% silt content. Site 080 consisted of sandier soils at the surface and transitioned to higher silt and clay-sized particles below 0.85 meters.



Source: City of Long Beach (2006)

Figure 4. SEADIP Subareas Comprising the LCWA Phase 1 (Bryant) Property (26a, 26b and 27)



Source: CH2MHILL 1991

Figure 5. Sampling Locations in the LCWA Phase 1 (Bryant) Parcel.

Table 3. TRPH (mg/kg) Measured in Soils from the LCWA Phase 1 (Bryant) Parcel.

Site	Location	Description	Horizontal Area (SF)	Depth (Feet)	Volume (CY)	Probable Excavation	TRPH mg/Kg	Comments
Sump 1	NW Sector Texaco Lease, S of #31	Historical Sump	400	4	59	118.5	1176	3 Feet Subsurface
Sump 2	N Central Texaco Lease, 200' SE of #25	Historical Sump	0	0	0	0	<50	Sump Not Found
Sump 3	W. Central Texaco Lease, S of #3	Historical Sump	100	4	15	20	3464	North of Historical Tank Site
4	S and Adjacent to Sump #3	Hist. Tank Site	4000	10	1481	3259	25,600	Max of **81,916 mg/Kg TRPH**, Possible BTEXs, Possible Groundwater Contact
Sump 5	Central Texaco, E of #10	Historical Sump	800	3	89	150	39,400	High TPRH, Near Surface Contamination
Sump 6	Central Texaco, W of #25	Historical Sump	1250	10	463	1020	4527	Deep Contamination, Poorly Defined by Tests
Sump 7	Central Texaco, E of W of #25	Historical Sump	400	4	59	89	12100	Near Surface
Sump 8	N. Isthmus, 100' N of #18	Historical Sump	600	15	333	833	3700	Deep, Potential for Groundwater Contact, Potential BTEXs
Sump 9	N. Isthmus, N of #38	Historical Sump	0	0	0	0	<50	Sump Not Found
Sump 10	Central Isthmus, N of #38	Historical Sump	0	0	0	0	<50	Sump Not Found
Sump 11	Central Isthmus, E of #10	Historical Sump	4200	12	1867	4657	14600	High TPRH, Potential for Groundwater Contact, Potential BTEXs
Sump 12	South Isthmus, S of #8	Historical Sump	11000	10	4074	8963	10800	Possible BTEXs, Potential for Groundwater Contact
Sump 13	South Isthmus, S of #34	Historical Sump	4200	12	1867	4668	6300	Possible Groundwater Contact, Adjacent to Haynes Berm
Sump 14	South Texaco, 100' NE of #1	Historical Sump	2250	12	1000	2250	24300	Possible Groundwater Contact, High TRPH, Possible BTEX
Sump 15	South Isthmus, S of #14	Historical Sump	0	0	0	0	<50	Sump Not Found
Sump 16	South Isthmus, S of NW-8	Historical Sump	400	8	119	178	2400	Debris Associated with Sump
Sump 17	South Isthmus, 120' S of NW-8	Historical Sump	0	0	0	0	<50	Site identified by Dr. Huffman as "Wet", Probably not as Oil Sump
Sump 18	Central Isthmus, NE of #21	Historical Sump	1120	15	622	933	5100	Possible Groundwater Contact, Adjacent to Haynes Berm
19	Shell Bryant Lease, SW MW-2	Hist. Tank Site	200	3	22	25	1477	Old Shell Site, Previously Cleaned, Surficial Contamination Only
Sump 20	Central Isthmus, N of #23	Historical Sump	0	0	0	0	<50	Sump Not Found
Sump 21	Central Texaco, N of #2	Historical Sump	0	0	0	0	<50	Sump Not Found, Described as Tidal Swamp

Highlighting identifies sites where sumps were expected but could not be found.

Table 3. TRPH (mg/kg) measured in Soils from the LCWA Phase 1 (Bryant) Parcel. (Continued)

Site	Location	Description	Horizontal Area (SF)	Depth (Feet)	Volume (CY)	Probable Excavation	TRPH mg/Kg	Comments
Sump 22	Central Isthmus, N of #32	Hist. Tank Site	6000	10	2222	4890	3200	Possible Solvent Contamination, Possible Groundwater Contact
Sump 23	W Central Texaco, N of #29	Historical Sump	400	10	148	326	8200	Possible Groundwater Contact
Sump 24	Central Isthmus, 100’ SE of #24	Hist. Tank Site	900	5	167	250	10600	
25	South Isthmus, SW of #15	Tank Site	5000	10	1852	4074	18200	Possible Groundwater Contact, High TRPH, Possible BTEX
26	South Isthmus, SW of #15	Hist. Tank Site	100	8	30	20	1300	Possible Groundwater Contact
Sump 27	South Isthmus, SW of #16	Historical Sump	0	0	0	0	<50	Sump Not Found
28	Central Isthmus, S of #10	Compressor Site	100	5	19	28	8500	Contaminant Observed Seeping from Test Boring
29	Central Texaco, 100 feet S of #28	Tank Site	0	0	0	0	<50	Possible BTEXs
					16507	36752	10247	Summary of TRPH Only

Source: CH2MHill 1991 Phase II Environmental Site Assessment and the TEPI 1996. Soil Remediation Plan
Highlighting identifies sites where sumps were expected but could not be found.

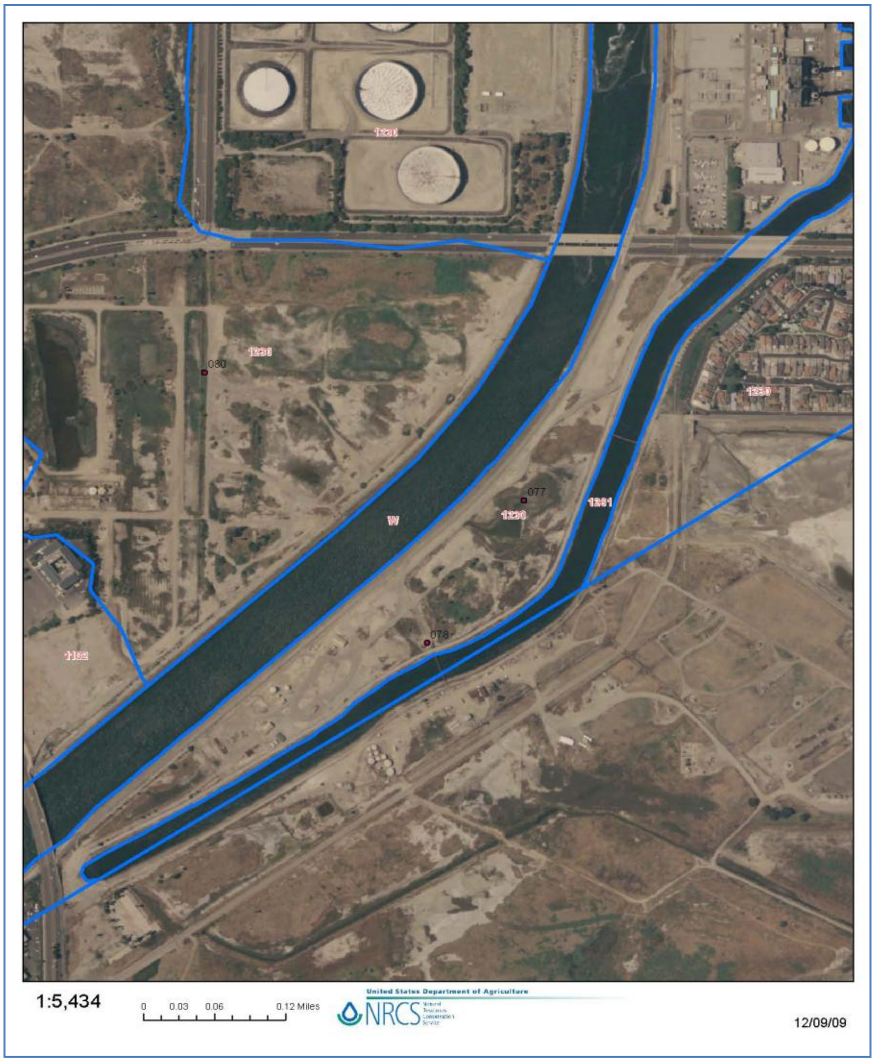


Figure 6. Locations of Three Sites (077, 078 and 080) Used to Profile Soils within the LCWA Phase 1 (Bryant) Parcel.

Table 4. Grain Size Distribution of Soil Profiles at Three Locations in the LCWA Phase 1 (Bryant) Parcel.

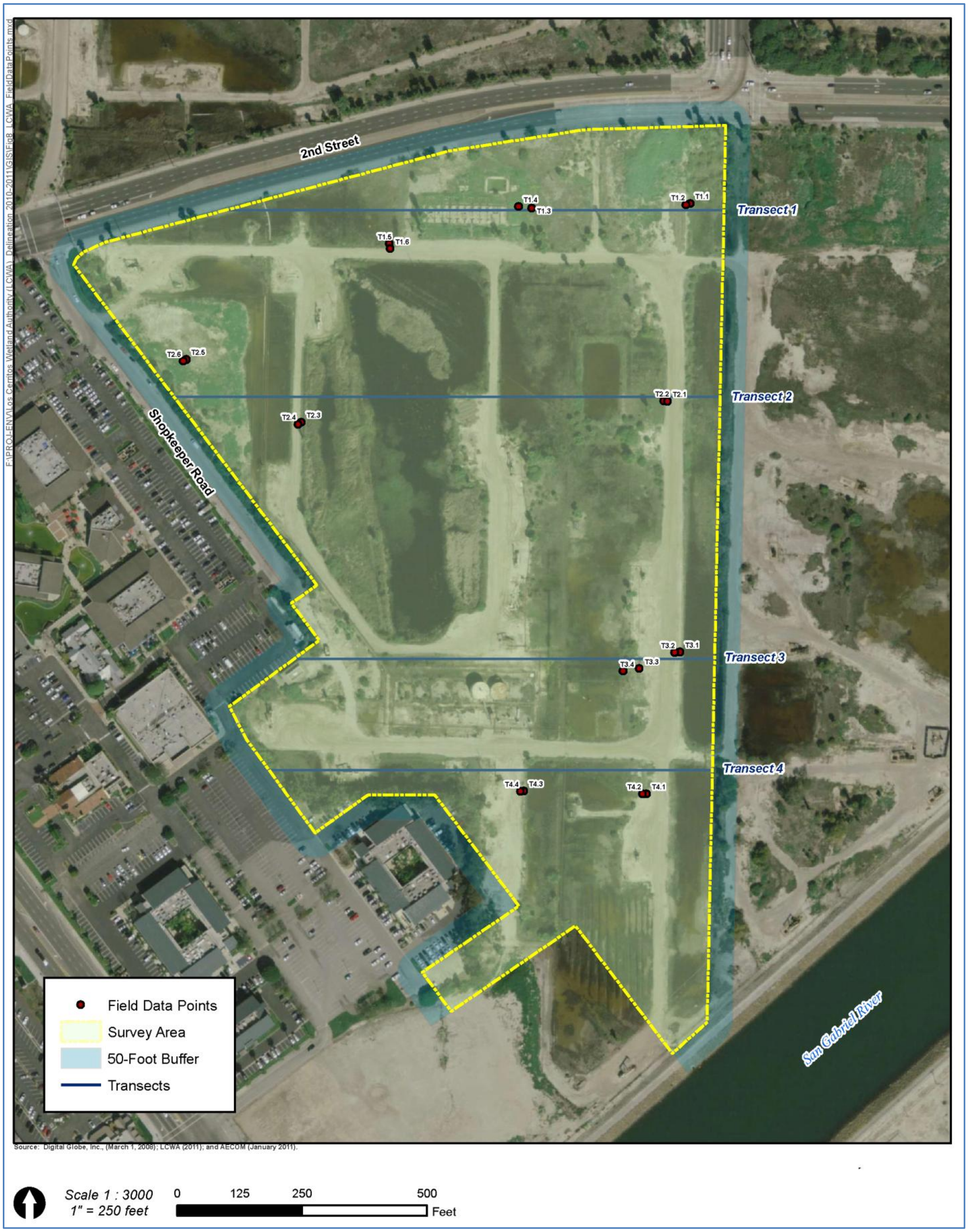
SITE	DEPTH (CM)	SAND %	SILT %	CLAY %
077	0-30	12	64	24
	30-65	78	15	6
	65-200	28	58	14
078	0-3	-	-	-
	3-7	70	27	3
	7-10	70	26	4
	10-15	70	26	4
	15-30	70	26	4
	30-33	-	-	-
	33-80	70	20	10
	80-120	80	15	5
	120-200	30	55	15
080	0-10			
	10-30	60	35	5
	30-50	60	35	5
	50-75	15	50	35
	75-85	55	40	5
	85-120	10	50	40
	120-150	10	50	40

Source: NRCS, 2009; Matthew Balmer

3.3. City of Long Beach (Marketplace Marsh) Parcel

The City of Long Beach (Marketplace Marsh) parcel is located 1 mile east of the Pacific Coast Highway within the city of Long Beach (Figure 7). This property is bound by Westminster Avenue/East 2nd Street to the north, the LCWA Phase 1 (Bryant) Property to the east, Shopkeeper Road to the west, and North Marina Drive/San Gabriel River to the south. This approximately 33.77-acre property consists of two parcels. The first and largest is Los Angeles Assessor's Identification Number (AIN) 7237-020-021, which is a triangular-shaped parcel located south of 2nd Street, east of Shopkeeper Road, and west of the terminus of Studebaker Road. Total acreage of the parcel is approximately 29.38-acre. The smaller parcel, AIN 7237-020-055, is an approximately 4.39-acre rectangular-shaped parcel on the west side of the terminus of Shopkeeper Road approximately 1,000 feet southeast of 2nd Street. (AECOM 2011a).

Information on soil contamination and grain size characteristics for the Marketplace Marsh parcel is extremely limited. No recent data are available to identify the contaminants present in this area, their concentrations and distribution. Grain size information based upon visual assessment of the upper 20 inches of soil was developed as part of the 2011 Jurisdictional Delineation Report (AECOM 2011a). The sampling locations are shown in Figure 7 and a summary of the visual characterization of soil texture at each site is provided in Table 5. Many of the sites show evidence of fill materials such as compacted gravels. Overall, surface soils were considered clay-loams, loams, and sandy-loams. Given the extensive disturbances associated with oil recovery operations, it is unlikely that these soils would be representative of natural conditions.



Source: AECOM 2011

Figure 7. Location of Sites used to Assess Texture of Surface Material within the City of Long Beach (Marketplace Marsh) Parcel.

Table 5. Surface Soil Texture (0-20 inches) Along Transects in the City of Long Beach (Marketplace Marsh) Parcel.

Site/Depth	NAD83 Latitude	NAD83 Longitude	Texture	Comments
T1.1	33.759032	-118.104098		
0-2”			Clay-Loam	Root Zone
2-12”			Clay-Loam	Clay-Loam
12-20”			Clay-Loam	Saturated
T1.2	33.759025	-118.104126		
0-20”			Clay-Loam	Upland Pit adjacent to T1.1
T1.3	33.758991	-118.105140		
0-4”			Clay-Loam	
4-6”			Clay-Loam	Prominent Redox Features
T1.4	33.758998	-118.105228		
0-2”			Loam	
2-12”			Loam	
T1.5	33.758702	-118.106073		
0-12”			Clay-Loam	
T1.6	33.758754	-118.106067		
0-6”			Loam & Gravel	Fill Material
T2.1	33.757947	-118.104227		
0-16”			Gravelly Loam	Compacted Fill
T2.2	33.757944	-118.1042237		
0-20”			Gravelly-Silt	Fill Material
T2.3	33.757972	-118.1053462		
0-1”			Muck	Mucky Material
T2.4	33.757972	-118.1053552		
0-14”			Loam	Compacted Fill, Disturbed road
T2.5	33.758317	-118.107684		
0-20”			Gravelly Loam	Fill Material
T2.6	33.758317	-118.1076851		
0-20”			Gravelly Loam	Fill Material
T3.1	33.756567	-118.104112		
0-20”			Sandy-Loam	
T3.2	33.756564	-118.104148		
0-21”			(no data entry)	Dirt Road with compacted material
T3.3	33.756470	-118.104378		
0-4”			Loamy-Sand	
4-20			Loamy-Sand	
T3.4	33.756456	-118.104484		
0-4			Loamy-Sand	Prominent Redox Features
4-20			(no data entry)	
T4.1	33.755781	-118.1042991		
0-12”			Sandy Gravelly	Compacted Fill
T4.2	33.755781	-118.1043013		
0-18”			Sandy Gravel	Compacted Fill
T4.3	33.755786	-118.105127		
0-20”			Silt	Inundated
T4.4	33.755786	-118.1051314		
0-16”			Loam	Compacted Fill

Source: AECOM 2011. Marketplace Marsh Jurisdictional Delineation Report for Waters of the U.S. and California

3.4. LCWA Phase 2 (Previously Hellman Ranch) Parcel

This parcel is a 100-acres segment of property previously owned by the Hellman Ranch company (Figure 8 and Figure 9) and now called the LCWA Phase 2 property. The property is located near the San Gabriel River (Figure 1). This property has been used for oil production since the mid-1920s. The site included a wide range of infrastructure necessary for drilling and oil production. Oil wells, pipelines, sumps and tank farms have occupied the property. Petroleum and other wastes were released onto the site as a result of these activities. Twelve sumps have been located on the property (Figure 9) and samples taken to determine the general composition and concentration of contaminants.

A landfill is located in the southwestern end of the property. This landfill was used from the 1952 to 1975 (City of Seal Beach 1975) and was intended to receive only clean fill material. The actual extent of the landfill is poorly defined but construction debris (chunks of concrete, asphalt and gravel) has commonly been encountered during excavation of exploratory trenches (Geomatrix, 2001).

Another area located on the northeastern end of the parcel (Area 18) was also known to be used for disposal of petroleum and other wastes. Previous environmental site investigations (Anchor 2004a and b; Geomatrix 2001) identified most soil contamination to be associated with historical sumps and from disposal of bottom sludge from the tank farm. Prior to 2001, site investigations focused primarily on evaluating sumps associated with oil production and the former landfill in the northeast comer of the property, and did not adequately address areas outside of those known to be impacted by oilfield operations. These investigations also focused primarily on the extent and remedial options for Total Petroleum Hydrocarbon (TPH) contamination. Minimal analyses were conducted to identify other contaminants such as metals, volatile organic compounds, and pesticides.

Early and limited analysis of metals indicated that none were elevated to the degree to which material needed to be tested against hazardous waste standards. Several metals, however, frequently exceeded NOAA ERLs. These included cadmium, copper, mercury and nickel (Table 6).

Prior to purchasing the property, the California State Coastal Conservancy hired a consultant to review existing data (Anchor 2004a). Site investigations completely before 2004 were largely limited to sampling soil contamination by petroleum hydrocarbons within known historical sumps and at Area 18 (Figure 9). Area 18 was used to dispose of sediment that was originally dredged to form the intake channel for the Haynes power plant. Field studies also indicated that this site was used for disposal of tank bottom sludge (Anchor 2004b). A subsequent site investigation was designed to address data gaps and provide additional data that would be useful for evaluation of the full range of restoration alternatives. The new testing included an evaluation of soil contamination due to metals, volatile organic compounds, and pesticides in both upland and subtidal regions. Most importantly, detection limits were established at levels appropriate for assessment of potential biological impacts under a range of future restoration alternatives.

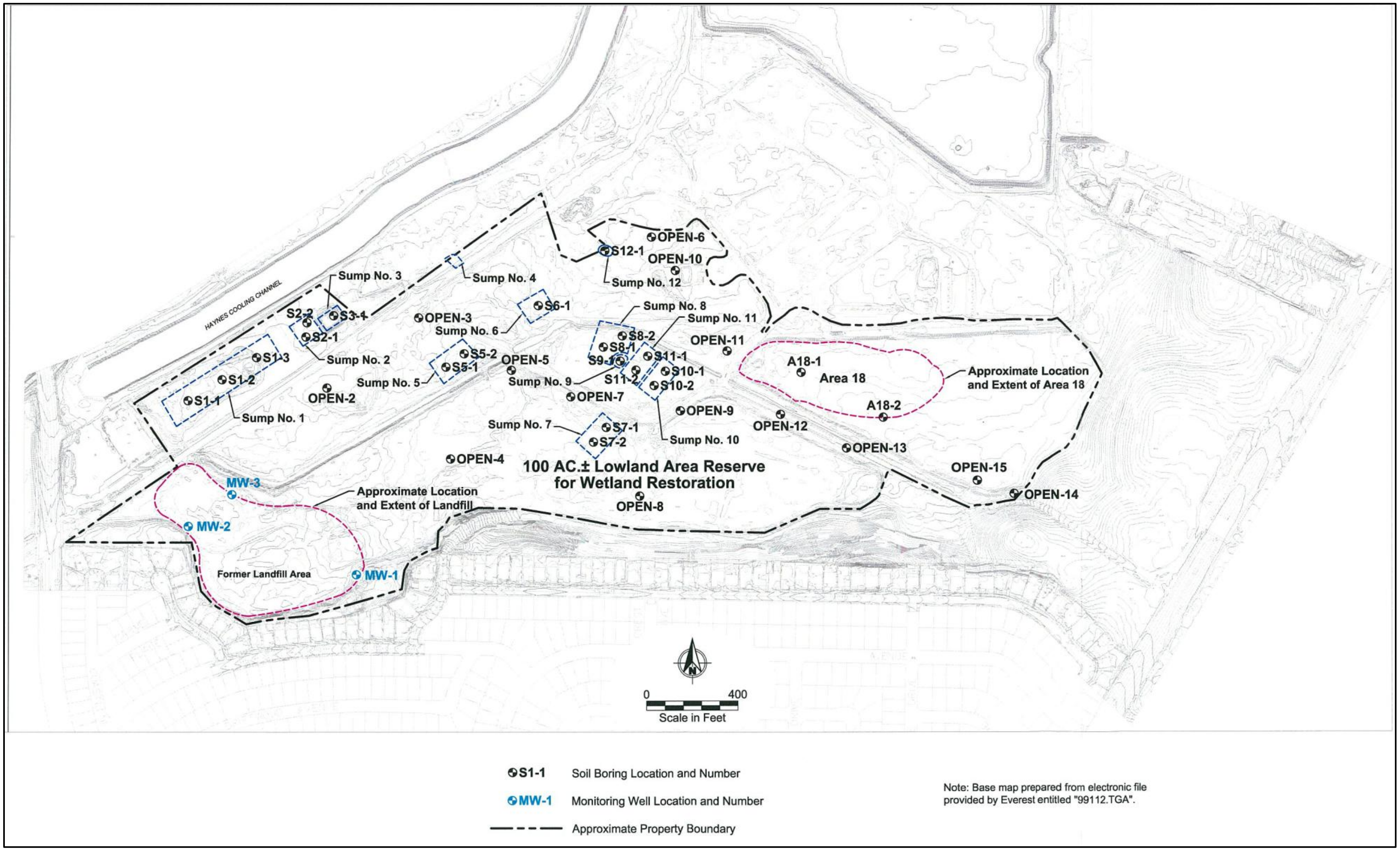
The added sampling and testing activities were designed to:

- Identify chemicals of concern under both wetland creation and upland restoration scenarios.
- Identify both the vertical and lateral extent of potential contamination in soils.
- Identify if contaminants correlate with one another.
- Separate natural background concentrations of chemicals (primarily metals) from concentrations that are related to anthropogenic contamination.

Sampling locations used in this study are shown in Figure 8. Summary statistics are provided for all analytes in Table 7. These data show that TRPH averages 1751 mg/kg at all sampling sites. Both metals and pesticides commonly exceed ERLs used to screen the data. Arsenic, copper, lead, mercury, nickel and zinc all exceed ERLs in at least one case. 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane and dieldrin also were present at levels that warranted further screening.

These data were examined closer to assess statistical outliers for each constituent of concern (Table 8). Outliers were considered to result from anthropogenic sources. Elevated lead concentrations were found to be associated with sumps while other metals were elevated in both sumps and in open areas. In addition, nine out of eleven TRPH values considered to be outliers were associated with sumps.

Tabulation of the outliers by source (closed versus open areas) several trends were evident (Table 9 and Table 10). Lead and PAH exceedences were most commonly associated with sumps. Exceedances of screening levels for other metals were common in both sumps and in the open areas. Lastly, pesticides tend to be associated with surface soils in open areas of the site.



Source: Anchor (2004b)

Figure 8. LCWA Phase 2 (Hellman Ranch) Soil and Groundwater Sampling Sites, 2004.

Figure 9. Sumps and Other Areas of Concern on the LCWA Phase 2 (Hellman Ranch) Parcel

Table 6. Results of Testing of LCWA Phase 2 (Hellman Ranch) Soils by BCL Associates (1987).

				Sample Number										
				34	50	57	72	82	97	155	171	226	264	265
Metal	TTLC mg/kg	Ecological Soil Screening Levels (mg/kg)	Ecological Effects Range Low (ERLs) mg/kg	Area 1-4	Area 5	Area 12	Area 7&8	Area 7&8	Area 14	Areas 15,16,17	Areas 15,16,17	Areas 15,16,17	Area 18	Area 18
Antimony	500	21	NA	5.3	5.96	5.18	3.88	8.02	7.76	7.76	3.62	6.47	3.1	5.69
Arsenic	500	NA	8.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	25.8	<0.5
Beryllium	75	NA	NA	0.2	0.09	0.32	0.49	0.32	0.46	0.24	0.19	0.39	<0.05	<0.05
Cadmium	100	110	1.2	**4.3**	**2.79**	**6.82**	**6.94**	**5.89**	**7.17**	**4.55**	**3.02**	**6.17**	**2.11**	**2.94**
Chromium, total	2500	NA	81	36.7	26.9	43.1	46.9	39.7	51.3	37	24.6	47	13.3	18
Chromium, hex.	500	330	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper	2500	61	34	34	17.3	**47.9**	**42.1**	25.1	**42.6**	27.6	12.6	**34.9**	11.2	12.6
Lead	1000	NA	46.7	19.5	22.1	6.87	<0.5	<0.5	<0.5	<0.5	<0.5	5.13	22	28.5
Mercury	20	NA	0.15	**0.3**	**0.19**	**0.3**	**0.18**	0.07	**0.18**	0.3	**8.76**	**2.88**	**2.05**	**2.26**
Nickel	2000	NA	20.9	**21.5**	14.2	**26.6**	18.6	**22.6**	**30.3**	**26.9**	12.5	**23.2**	**25.3**	**38.2**
Selenium	100	NA	NA	<0.5	<0.5	<0.5	0.073	<0.5	0.69	<0.5	22.9	<0.5	<0.5	<0.5
Silver	500	NA	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	700	NA	NA	20	15	25	25	35	40	30	30	40	20	15
Zinc	5000	120	150	74.8	48.9	136	95.3	113	77.7	55.7	34.2	78.1	24.7	47.5
Barium	1000	NA	NA	251	58.3	129	107	98.7	116	91.1	36	94.6	97.1	676
Cobalt	8000	32	NA	13.2	5.72	17.3	18.1	14.3	16.4	12.4	9.06	17	3.08	7.76
Molybdenum	3500	NA	NA	12	0.87	0.87	0.9	2.03	1.43	0.58	1.05	1.47	2.12	2.9
Vanadium	2400	NA	NA	42	20.5	52.9	60.5	46.3	58.7	36.6	31.8	54.2	13.6	30.5

Bolded values exceeded
ERLs
Source: Anchor and Everest 2003

Table 7. Statistical Summary of Soil Contaminants in the LCWA Phase 2 (Hellman) Parcel.

Contaminant of Concern		Units	Mean Concentration	Minimum Concentration	Maximum Concentration	Ecological Effects Range Medium (ER-Ms)	Ecological Effects Range Low (ER-Ls)
	Solids Percent	mg/kg	82	60.8	99.	NA	NA
	TRPH	mg/kg	1751	ND	68,000	NA	NA
Metals	Arsenic	mg/kg	7.87	0.96	40	70	8.2
	Chromium (Total)	mg/kg	32.1	8.58	57.6	370	81
	Copper	mg/kg	31.3	7.17	65.5	270	34
	Lead	mg/kg	30.1	7.17	65.6	218	46.7
	Mercury	mg/kg	0.18*	ND	0.919	0.71	0.15
	Nickel	mg/kg	24.9	5.78	49.1	51.6	20.9
	Selenium	mg/kg	0.38	ND	1.27	NA	NA
	Silver	mg/kg	0.09	ND	0.23	3.7	1.0
	Thallium	mg/kg	0.24	ND	0.52	NA	NA
	Zinc	mg/kg	94.4	31.2	207	410	150
Pesticides	4,4"-DDD	µg/kg	0.7*	ND	2.8	7.81(a)	2.0
	4,4"-DDE	µg/kg	1.99	ND	42	374(a)	2.2
	4,4"-DDT	µg/kg	1.89	ND	22	4.77(a)	1.0
	Aldrin	µg/kg	NA	ND	ND	NA	NA
	Alpha-BHC	µg/kg	NA	1.8	1.8	NA	NA
	Beta-BHC	µg/kg	NA	ND	ND	NA	NA
	Chlordane	µg/kg	7.19	ND	49	4.79(a)	0.5
	Delta-BHC	µg/kg	NA	ND	ND	NA	NA
	Dieldrin	µg/kg	0.98(b)	2.4	24	4.3(a)	0.02
	Endosulfan I	µg/kg	NA	ND	ND	NA	NA
	Endosulfan II	µg/kg	NA	ND	ND	NA	NA
	Endosulfan Sulfate	µg/kg	NA	ND	ND	NA	NA
	Endrin	µg/kg	NA	ND	ND	NA	NA
	Endrin Aldehyde	µg/kg	NA	ND	ND	NA	NA

a. *Probable Effects Level (PEL) from Smith et al. 1996*
b. *The mean concentration of 0.98 µg/kg was listed in the original table with a minimum concentration of 2.4 µg/kg. The reason for this discrepancy was not identified.*

Table 7. Statistical Summary of Soil Contaminants in the LCWA Phase 2 (Hellman) Parcel. (Continued)

Contaminant of Concern		Units	Mean Concentration	Minimum Concentration	Maximum Concentration	Ecological Effects Range Medium (ER-Ms)	Ecological Effects Range Low (ER-Ls)
Pesticides (continued)	Endrin Ketone	µg/kg	NA	ND	ND	NA	NA
	Gamma-BHC	µg/kg	NA	ND	ND	0.99	NA
	Heptachlor	µg/kg	NA	ND	ND	NA	NA
	Heptachlor Epoxide	µg/kg	NA	1.8	1.8	NA	NA
	Methoxychlor	µg/kg	NA	1.2	1.2	NA	NA
	Toxaphene	µg/kg	NA	ND	ND	NA	NA
Polychlorinated biphenyls (PCBs)	Aroclor-1016	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1221	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1232	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1242	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1248	µg/kg	NA	ND	ND	NA	NA
	Aroclor -1254	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1260	µg/kg	NA	ND	ND	NA	NA
	Aroclor-1262	µg/kg	NA	ND	ND	NA	NA
	Total PCBs	µg/kg	NA	NA	NA	180	22.7
Polycyclic Aromatic Hydrocarbons (PAH) Low Molecular Weight	Acenaphthene	mg/kg	NA	0.059	0.059	0.5	0.016
	Acenaphthylene	mg/kg	NA	ND	ND	0.64	0.044
	Anthracene	mg/kg	NA	0.02	0.02	1.1	0.0853
	Fluorene	mg/kg	0.02	ND	0.53	0.54	0.019
	Naphthalene	mg/kg	0.05	ND	1.4	2.1	0.160
	Phenanthrene	mg/kg	0.04	ND	0.76	1.5	0.240
PAHs High Molecular Weight	Benzo (a) Anthracene	mg/kg	0.013	ND	0.045	1.6	0.261
	Benzo (a) Pyrene	mg/kg	0.01	ND	0.21	1.6	0.43
	Benzo (b) Fluoranthene	mg/kg	0.01	ND	0.052	NA	NA
	Benzo (g ,h.i) Perylene	mg/kg	0.01	ND	0.05	NA	NA
	Benzo (k) Fluoranthene	mg/kg	0.01	ND	0.047	NA	NA
	Chrysene	mg/kg	0.02	ND	0.13	2.8	0.384
	Dibenz (a,h) Anthracene	mg/kg	NA	ND	ND	NA	0.0634
	Fluoranthene	mg/kg	0.02	0.025	0.53	5.1	0.6
	Indeno (1 ,2,3-c,d) Pyrene	mg/kg	0.01	0.022	0.023	NA	NA
	Pyrene	mg/kg	0.04	ND	0.76	2.6	NA

Source: Anchor Environmental (2004b)

Table 8. Identification of Statistical Outliers and the Locations Associated with High Concentrations

Contaminant of Concern	Station	Area	Depth of Sample	Concentration mg/Kg
Arsenic	AHE-OPEN6-2-A	OPEN	SURFACE	31.70
	AHE-A18-1-B	Area 18	SUBSURFACE	40.30
Lead	AHE-S2-1B	Sump 2	SUBSURFACE	93.90
	AHE-S8-1-A	Sump 8	SURFACE	98.20
	AHE-S10-2-C	Sump 10	SUBSURFACE	202.00
	AHE-S5-2-B	Sump 5	SUBSURFACE	240.00
Mercury	AHE-OPEN5-1-B	OPEN	SUBSURFACE	0.17
	AHE-OPEN3-1-B	OPEN	SUBSURFACE	0.19
	AHE-S11-1-B	Sump 11	SUBSURFACE	0.64
	AHE-S11-1-A	Sump 11	SURFACE	0.92
Selenium	AHE-OPEN5-1-B	OPEN	SUBSURFACE	1.14
	AHE-S2-2B	Sump 2	SUBSURFACE	1.27
TRPH	AHE-S5-1-A	Sump 5	SURFACE	430
	AHE-OPEN7-1-A	OPEN	SURFACE	760
	AHE-S9-1-A	Sump 9	SURFACE	1,200
	AHE-S2-1B	Sump 2	SUBSURFACE	1,300
	AHE-OPEN3-1-A	OPEN	SURFACE	1,400
	AHE-S10-2-A	Sump 10	SURFACE	1,600
	AHE-S11-1-A	Sump 11	SURFACE	1,800
	AHE-S3-1A	Sump 3	SURFACE	2,400
	AHE-S8-2-A	Sump 8	SURFACE	3,700
	AHE-S10-2-C	Sump 10	SUBSURFACE	34,000
	AHE-S5-2-B	Sump 5	SUBSURFACE	68,000

Source: Anchor Environmental (2004b)

Table 9. Summary of Soil Contamination Exceeding Screening Levels in Open Areas of the LCWA Phase 2 (Hellman) Parcel.

		Metals (mg/Kg)						Pesticides (µg/kg)					PAHs (mg/Kg)			
		Arsenic	Copper	Lead	Mercury	Nickel	Zinc	4,4'-DDD	4,4'-DDE	4,4'-DDT	Chlordane	Dieldrin	Acenaph-thene	Fluorene	Naph-thalene	Phenan-threne
	ER-L	8.2	34	46.7	0.15	20.9	150	2.0	2.2	1.0	0.5	0.02	0.016	0.019	0.16	0.24
	ER-M	70	270	218	0.71	51.6	410	7.8	374	4.7	4.3	4.3	0.5	0.54	2.1	1.5
Station	SSL		61				120									
Open Area																
AHE-OPEN2-1-A						22.1			6.1	3.7						
AHE-OPEN2-1-B						27.0										
AHE-OPEN3-1-A									42	22	34					
AHE-OPEN3-1-B					0.192	21.8										
AHE-OPEN4-1-A		11.4	57.0			49.1	138									
AHE-OPEN4-1-B		8.41	58.3			40.1	127									
AHE-OPEN5-1-A		15.2	56.0			35.4				2.4						
AHE-OPEN5-1-B		16.3	**65.5**		0.173	42.7	138									
AHE-OPEN6-2-A		31.7	41.6			28.4										
AHE-OPEN7-1-A				60.3		24.3		2.8		1.8						
AHE-OPEN7-1-B		10.4	45.6			31.5										
AHE-OPEN9-1-A									15	13		2.4				
AHE-OPEN10-1-A			45.7			37.6	**177**									
AHE-OPEN10-1-B			44.9			21.0										
AHE-OPEN11-1-A			37.7			28.6		2.7		4.5						
AHE-OPEN11-1-B			46.9			30.4										
AHE-OPEN12-1-A			37.4	61.5		34.2	141			2						
AHE-OPEN12-1-B			36.1			27.2										
AHE-OPEN13-1-A			39.2			35.3	140			2.3						
AHE-OPEN13-1-B			40.6	51.0		37.8	149									
AHE-OPEN14-1-A										5.6						
AHE-OPEN14-1-B		8.99								1.3						
AHE-OPEN15-1-A		11.4	50.2			33.2	123		3	2.7						

NOTES: Blue = Exceeds ERL, Green Exceeds SSL, Green Bold Exceeds SSL and ERL, Red Exceeds ER-M and ER-L

Table 10. Summary of Soil Contamination Exceeding Screening Levels in Closed (Sumps etc.) Areas of the LCWA Phase 2 (Hellman) Parcel.

		Metals (mg/Kg)						Pesticides (µg/kg)					PAHs (mg/Kg)			
		Arsenic	Copper	Lead	Mercury	Nickel	Zinc	4,4'-DDD	4,4'-DDE	4,4'-DDT	Chlordane	Dieldrin	Acenaph-thene	Fluorene	Naph-thalene	Phenan-threne
	ER-L	8.2	34	46.7	0.15	20.9	150	2.0	2.2	1.0	0.5	0.02	0.016	0.019	0.16	0.24
	ER-M	70	270	218	0.71	51.6	410	7.8	374	4.7	4.3	4.3	0.5	0.54	2.1	1.5
Station	SSL		61				120									
Closed Area																
AHE-A18-1-B		40.3	36.0			35.8										
AHE-S1-1A										1.6						
AHE-S1-2A								2.4	19	18	49	24				
AHE-S2-1A		15.1	45.4			30.5										
AHE-S2-1B		10.5	44.6	93.9		29.2										
AHE-S2-2A		13.9	39.0			26.6										
AHE-S2-2B		15.1	58.1			35.5										
AHE-S3-1A		17.0	34.6			24.4	139						0.06	0.13	0.22	0.45
AHE-S5-1-A										1.7						
AHE-S5-2-A			36.2			30.6										
AHE-S5-2-B		15.3	50.4	240		36.5	139							0.23	0.87	0.33
AHE-S6-1						24.4										
AHE-S7-1-B			59.7			35.6	129									
AHE-S7-2-C		15.6	48.2			36.3	120									
AHE-S8-1-A		8.24	39.4	98.2		35.9	126		11	12						
AHE-S8-2-A						23.0	124									
AHE-S8-2-B				66.8												
AHE-S9-1-A				56.7		32.3				1.8						
AHE-S9-1-B		12.6														
AHE-S10-1-A		12.0				26.3										
AHE-S10-1-B		9.59														
AHE-S10-2-A			38.3			37.3	137									
AHE-S10-2-C		10.0	46.6	202		33.6								0.53	1.40	0.86
AHE-S11-1-A		11.6	36.9		0.919	45.4	**207**									
AHE-S11-1-B		10.8			0.636	38.1	**178**									
AHE-S11-2-A			34.3	63.8		32.6	**162**									
AHE-S12-1-B			47.0			33.8										

NOTES: Blue = Exceeds ERL, Green Exceeds SSL, Green Bold Exceeds SSL and ERL, Red Exceeds ER-M and ER-L

4.0 RECONNAISSANCE SURVEY -SOIL CORES AND GRAIN SIZE DATA

Information regarding grain size distributions or texture of soils from the four base project parcels was available from three different sources. These include Jurisdictional Wetland Determination surveys, core logs from previous investigations of contaminants, and deep cores taken for monitoring wells and geological purpose. Due to the different objectives, grain size information was not very comparable. Texture data was reported as part of the recent Jurisdictional Wetland Determination conducted for the State Coastal Conservancy in the Marketplace Marsh (Anchor, 2011). These data were intended to assist in determination of the presence of hydric soils and were limited to the top 20 inches. Similar data are available in other areas but they were not compiled due to the limited value of visual characterizations of surface soils that are known to be highly disturbed and compromised with the addition of fill material. Very little of the historic surface of the wetlands is exposed at the surface. Records suggest that the entire area has been subjected to some degree of fill. Core logs associated with sampling conducted in the Hellman Ranch parcel indicate that soils are predominantly silts and silty-clays with some layers of clay at depth and some sands near the surface.

The soil profiles developed by NRCS staff (Matthew Balmer) at three locations within the Phase 1 (Bryant) parcel were detailed and valuable but were also limited to the top 2.0 meters.

3.5. LCWA Phase 1 (Previously Bryant) Property

Additional soil cores were taken as part of the current study in order to supplement existing data and support assessment of potential reuse. Cores were taken at five locations west of the San Gabriel River in the Phase 1 Bryant Lease (Table 11 and Figure 10). A vibracore sampler with 4" aluminum tubing was used to obtain 10-11.5 foot cores at each site. The soil cores were then logged and subsampled for laboratory measure of particle-size distributions. Three to five soil samples were taken from each core to obtain quantitative information on grain size. Coring logs for each site are attached as Appendix A.

Table 11. Locations (NAD83) of Soil Coring Sites for Grain Size Characterization.

Sampling Point	Latitude	Longitude
A	33.75542	-118.10352
B	33.75696	-118.10154
C	33.75749	-118.10340
D	33.75852	-118.10334
E	33.75842	-118.09999

Figure 10. Coring Sites in the LCWA Phase 1 (Bryant) Parcel.

The results of all 21 ASTM D422-63(2002) soil particle size distribution analyses were plotted on a ternary plot in order to examine general trends within the wetlands (Figure 12). Silts, sandy-silts and clayey-silts dominated the soils at all five coring sites (Figure 10) but most sites contained thin layers of fatty clays with indications of perched water. Moisture increased until passing through the clay layers where drier soils were again encountered. The water table was not evident at any of the sites but soils in the 8-10 foot depth range would collapse into the hole when the core tube was withdrawn.

Petroleum odors were noted at depth in soils from three (A, C, and D) of the five cores (Appendix A-Core Logs). Cores with petroleum odors were all located along the western side of the property. The two cores (B and E) taken closest to the San Gabriel River did not have any perceptible petroleum odors and were generally more distant from existing oil field infrastructure.

Particle-size distributions for each of the 21 soil samples are summarized in Table 12. Figure 13 through Figure 17 provide detailed graphical summaries of the particle size distribution of soil from each core. In addition, the percent sand, silt and clay for each subsample is summarized in a tabular format on the particle size distribution graphics.

Table 12. Particle Size Distributions and Depth-Ranges Associated with Subsamples of Soil from Each Core.

Site	Depth (ft BGS)	% Gravel	% Sand	% Silt	% Clay
A-1	0-3.5	2	23.1	53.1	21.9
A-2	4.75-7.25	5.6	29.3	48.6	16.6
A-3	7.25-8.25	0	21.7	71.8	6.5
A-4	8.25-9.9	0	2.5	77.3	20.2
A-5	9.9-10.0	0	20	68.5	11.5
B-1	1.0-3.25	0	14	61.4	24.6
B-2	5.75-8.0	0	4.8	81.6	13.6
B-3	8.3-10.4	0	28	67.2	4.8
B-4	10.4-11.5	0	1.3	68.2	30.5
C-1	0-3.4	0.8	23.6	51.6	24.8
C-2	3.4-6.9	0	8	70.2	21.8
C-3	6.9-9.0	0	19.3	69.6	11.1
C-4	9.0-10.0	0	3.4	67.5	29.1
C-5	10.0-11.5	0	47	49.2	3.8
D-1	0-2.5	5.1	43.5	37	14.4
D-2	3.25-4.75	0	61.3	34.4	4.3
D-3	5.0-7.25, 7.6-11.0	0	36.8	53	10.2
D-4	7.25-7.6	0	6.4	67.8	25.8
E-1	0-6.6	0	1.8	63.6	34.6
E-2	6.6-8.4	0	4.4	80.9	14.7
E-3	8.6-10	0	35.4	52	12.6

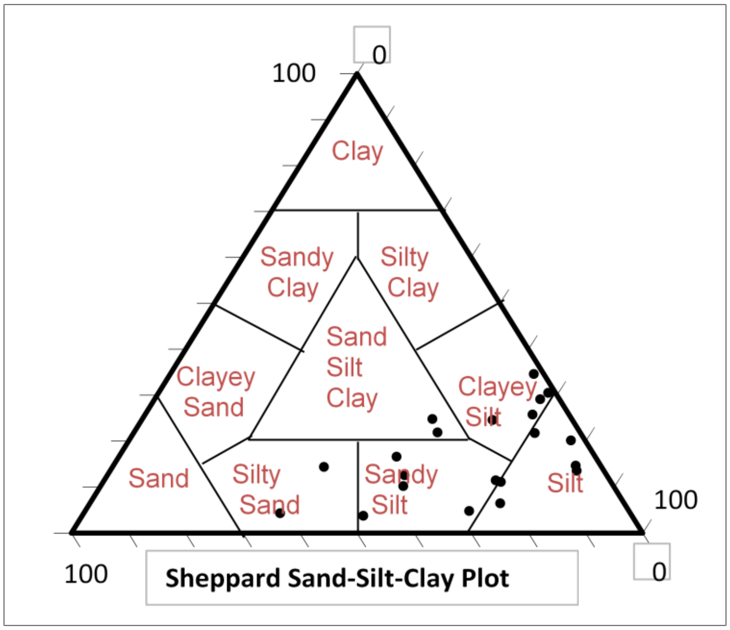
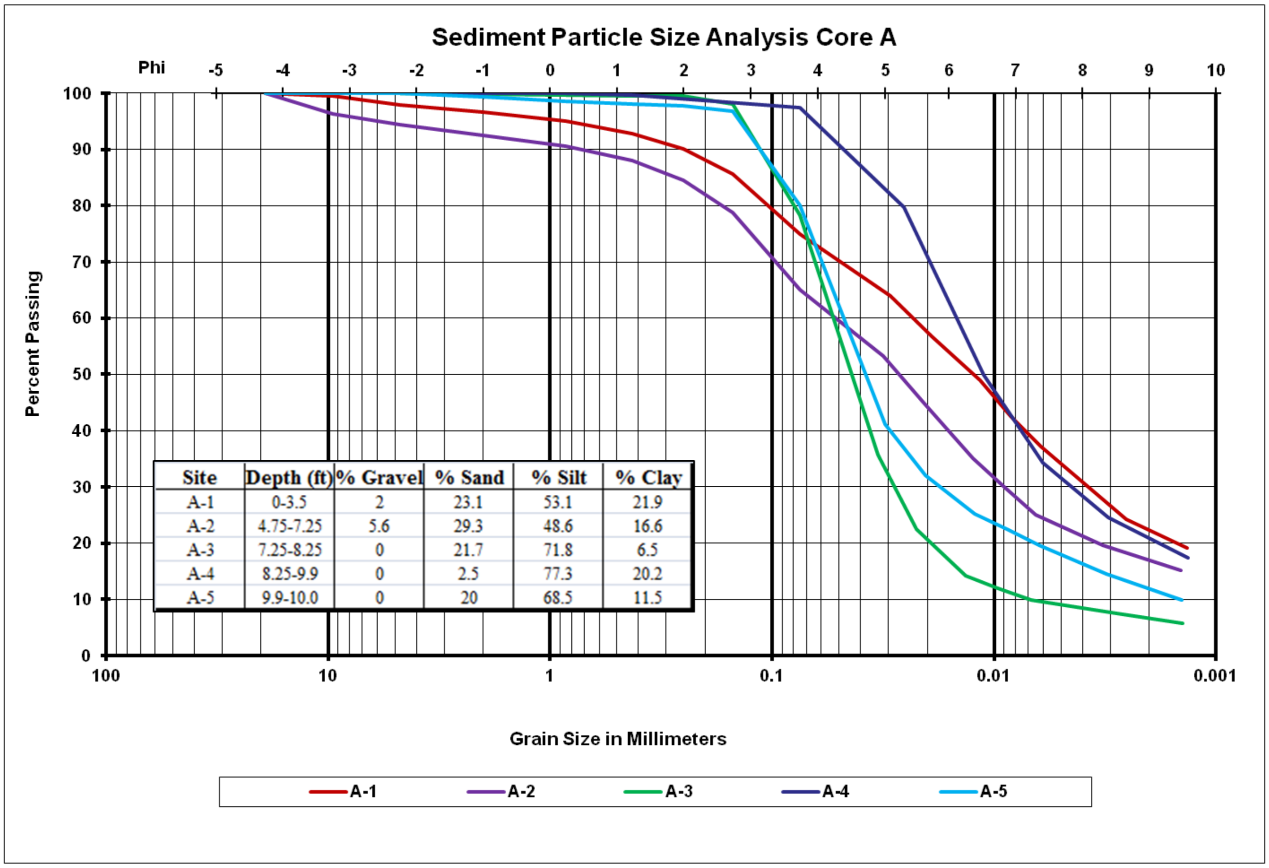


Figure 11. Sheppard Sand-Silt-Clay Plot of all 21 Sediment Samples from the LCWA Phase 1 (BryantParcel.

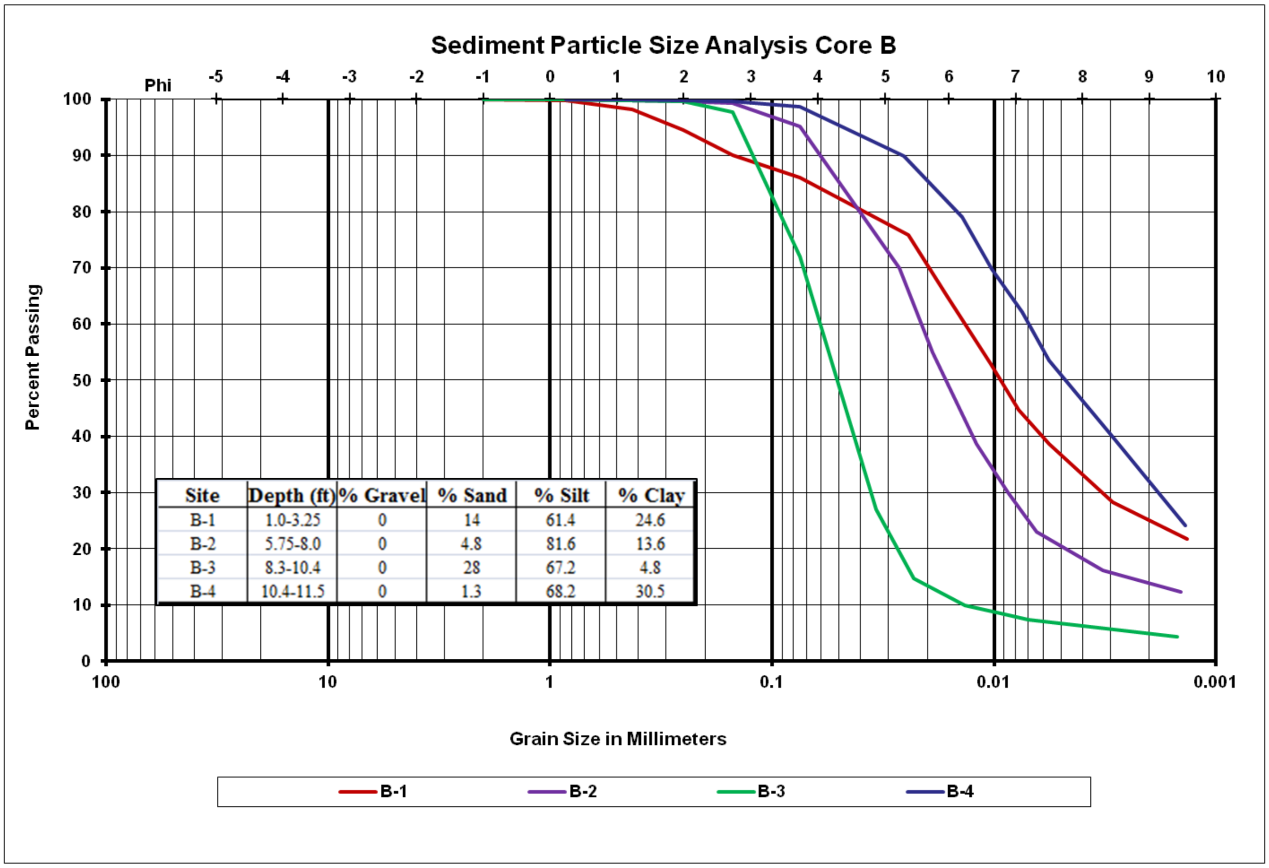
Figure 12. Typical Clay Layer Present in the Site E Soil Profile.- LCWA Phase 1 (Bryant) Parcel.

Note: Top of core is to the left. Clay layer was at depth of 8.5 feet and was 2-3 inches thick.



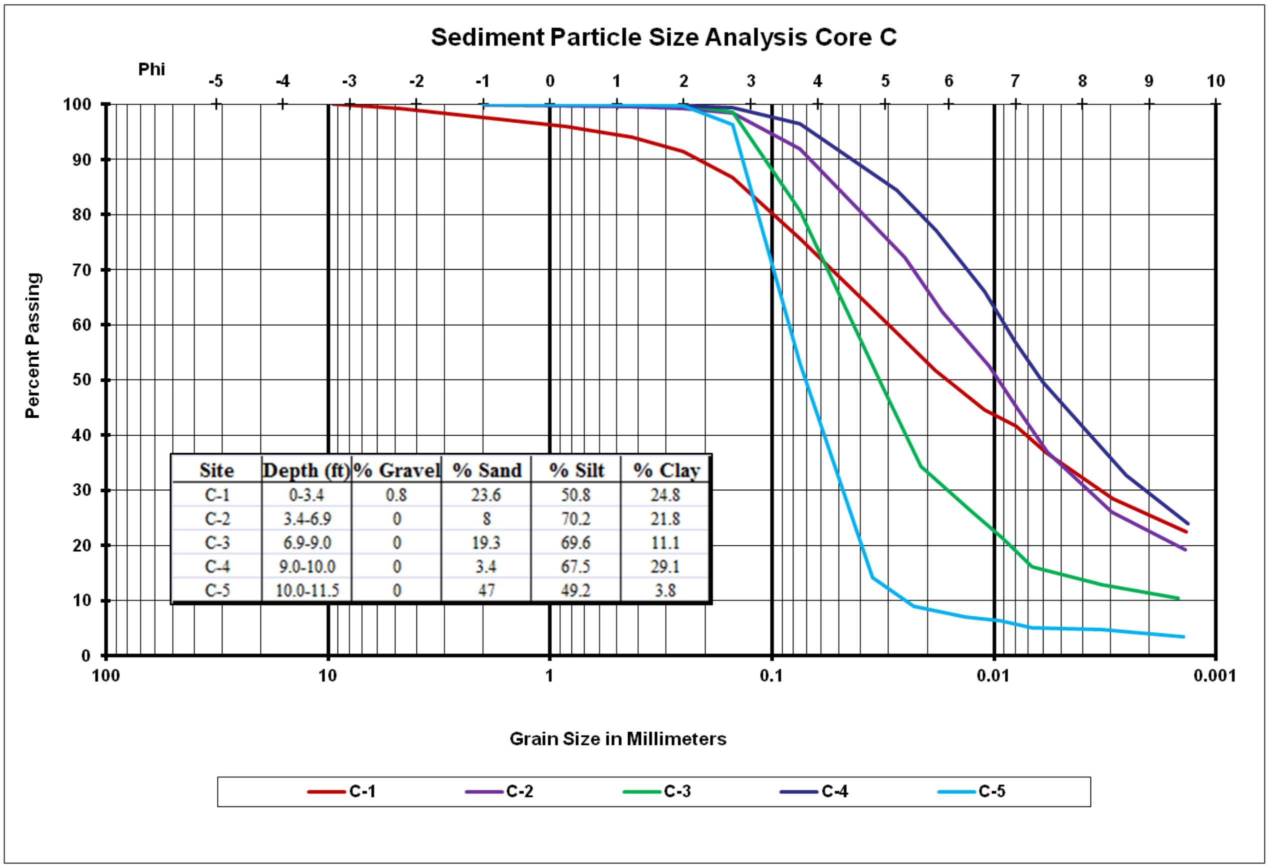
Site	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
A-1	0-3.5	2	23.1	53.1	21.9
A-2	4.75-7.25	5.6	29.3	48.6	16.6
A-3	7.25-8.25	0	21.7	71.8	6.5
A-4	8.25-9.9	0	2.5	77.3	20.2
A-5	9.9-10.0	0	20	68.5	11.5

Figure 13. Particle Size Distribution of Each Individual Sediment Sample from Core A.



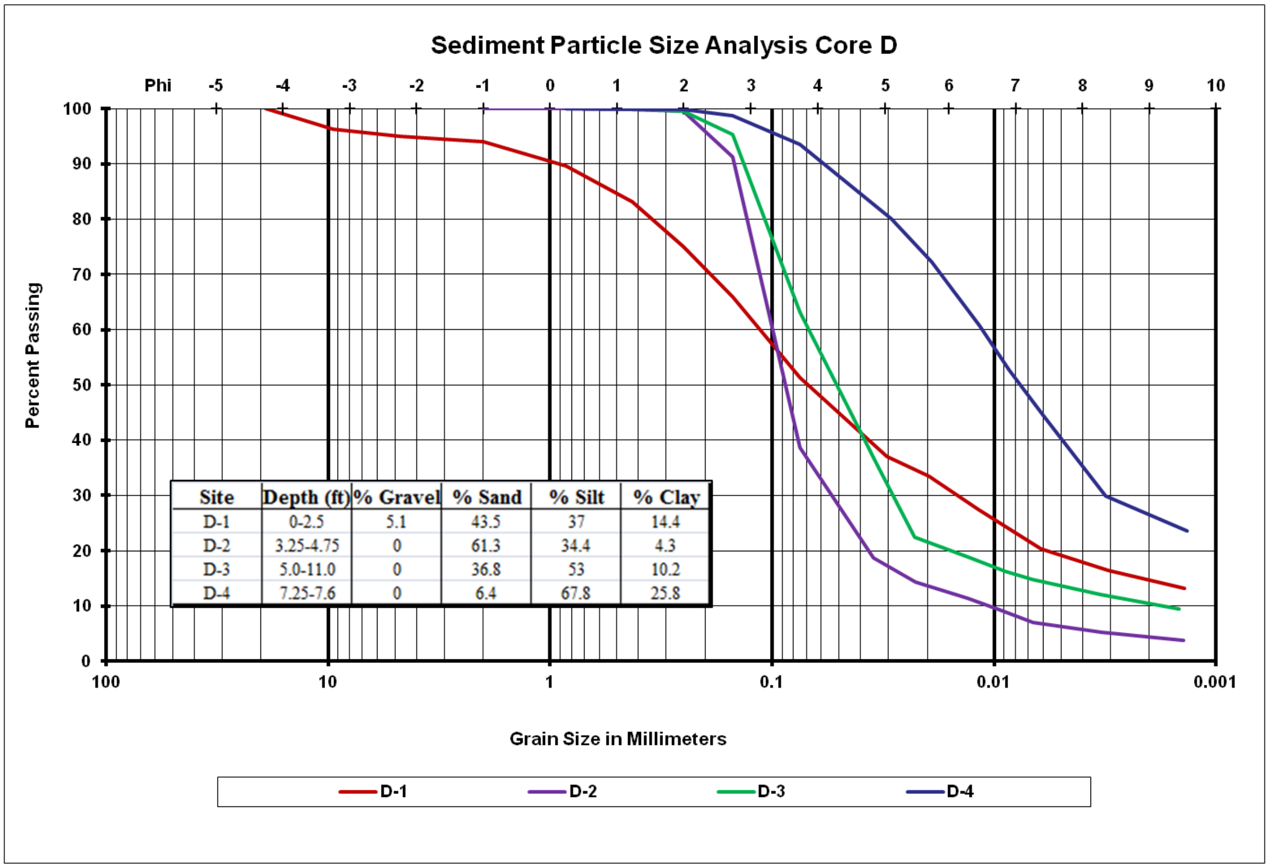
Site	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
B-1	1.0-3.25	0	14	61.4	24.6
B-2	5.75-8.0	0	4.8	81.6	13.6
B-3	8.3-10.4	0	28	67.2	4.8
B-4	10.4-11.5	0	1.3	68.2	30.5

Figure 14. Particle Size Distribution of Each Individual Sediment Sample from Core B.



Site	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
C-1	0-3.4	0.8	23.6	50.8	24.8
C-2	3.4-6.9	0	8	70.2	21.8
C-3	6.9-9.0	0	19.3	69.6	11.1
C-4	9.0-10.0	0	3.4	67.5	29.1
C-5	10.0-11.5	0	47	49.2	3.8

Figure 15. Particle Size Distribution of Each Individual Sediment Sample from Core C.



Site	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
D-1	0-2.5	5.1	43.5	37	14.4
D-2	3.25-4.75	0	61.3	34.4	4.3
D-3	5.0-11.0	0	36.8	53	10.2
D-4	7.25-7.6	0	6.4	67.8	25.8

Figure 16. Particle Size Distribution of Each Individual Sediment Sample from Core D

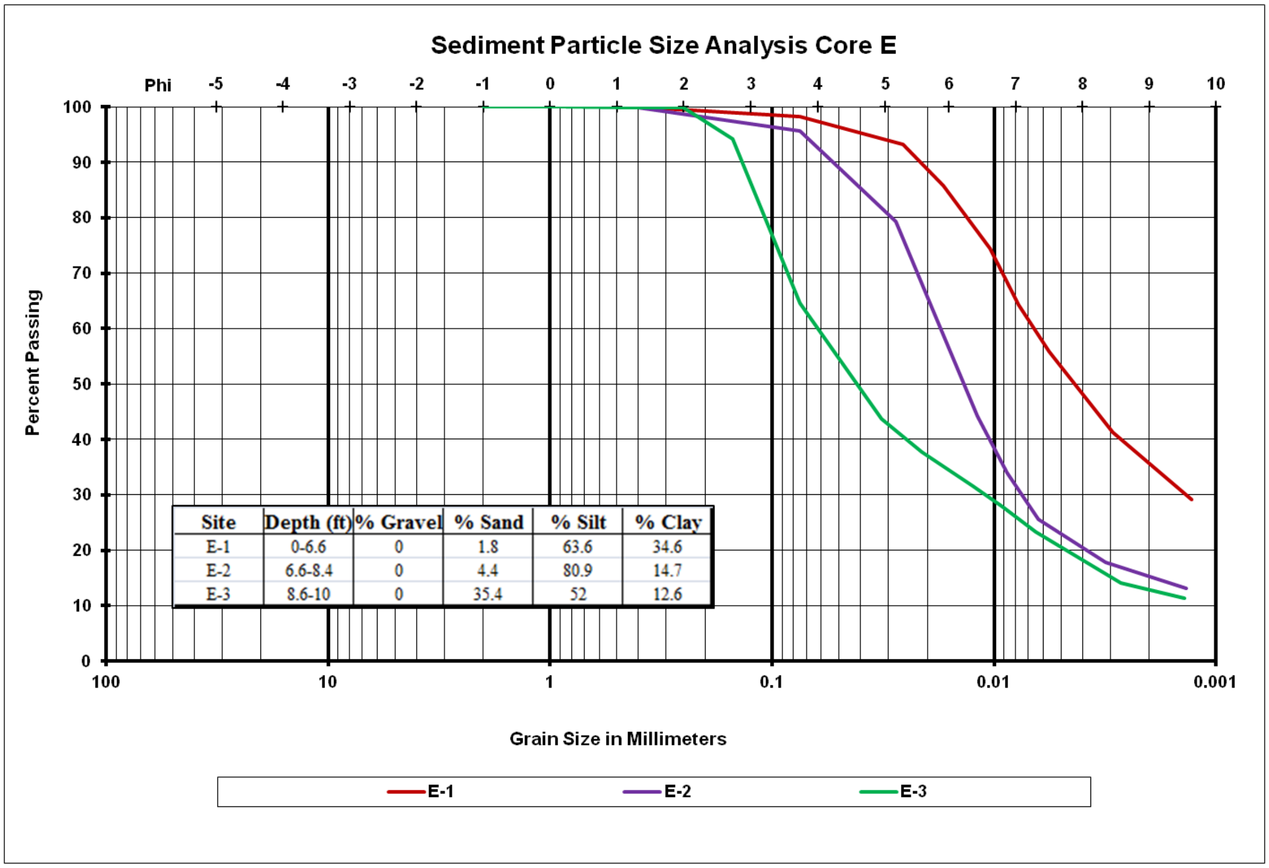


Figure 17. Particle Size Distribution of Each Individual Sediment Sample from Core E.

5.0 DATA GAPS AND RECOMMENDATIONS

The Los Cerritos Wetlands complex has been used for oil exploration and recovery for the past 90 years. In addition, certain areas were used as landfill for disposal of clean construction materials. Other areas such as Area 18 in the LCWA Phase 2 (Hellman Ranch) parcel were used for disposal of dredged material associated with excavation of the cooling water intake channel for the Haynes Power Plant. Oil sludge presumed to be from a nearby tank farm was also disposed at Area 18. Sumps are located throughout the property. The sumps were used for waste products associated with drilling operations.

A large number of investigations have been conducted in the Los Cerritos Wetlands over the past 25 years. The most extensive of these studies were performed on the LCWA Phase 2 (Hellman Ranch) property (Anchor, 2004a; 2004b), the LCWA Phase 1 (former Texaco/Bryant) property (CDM, 1991), and the LCWA Phase 1 (OTD/Edison) parcel (CH2MHILL, 2004). In contrast, no studies were found that assessed potential soil contamination in the City of Long Beach (Marketplace Marsh) property.

All early studies (pre-1990) focused on TRPH and TPH associated with sumps or tank farms. TPH concentrations are highest in sumps and in the vicinity of historic tank farms but are also widespread throughout all parcel where these contaminants have been measured. Average concentrations in most areas ranged from 10,000-20,000 mg/kg, but this reflects a bias towards more measurements being taken in sumps.

Metals have not been emphasized in any of the studies conducted to identify contaminants in LCWA properties. Studies that incorporated analysis of metals indicated that metal concentrations are mostly within the range of typical background concentrations found in California soils. A few metals such as such as arsenic, vanadium, barium and chromium also tend to be elevated in the sumps and are associated with some drilling muds. Anchor (2004b) found that high concentrations of lead, in particular, were strongly correlated with high concentrations of TPH in sumps. One of the earlier studies (BCL, 1989) reported elevated levels (~2 to 9 mg/kg) of mercury at Sites near the Area 18 landfill on the LCWA Phase 2 (Hellman Ranch) parcel.

In most cases, extremely elevated concentrations of one or two metals were reported at a limited number of sites. Sampling densities were not sufficient to identify distinct patterns of association with any particular feature or location. CH2MHILL reported single instances of lead, nickel and vanadium on the OTD/Edison parcel that were 100 times the average concentrations at other sites. Although these could have been clerical or laboratory errors, they did occur at sites that had other issues such as elevated pesticides.

Chlordane compounds, DDT compounds and their derivatives and dieldrin were the most common pesticides found in this region. Although large numbers of analyses have not been conducted, these compounds tended to be most common in surface soil samples. In the LCWA Phase 2 (Hellman Ranch) parcel, these compounds tended to occur along an access road and were not frequently encountered in the sumps. Very high concentrations of DDE, DDT, chlordane and dieldrin were present in surface soils at two sampling points on the OTD/Edison parcel. The associated report suggests that the sampling points were saturated with water at the time of the survey. This may indicate that the sampling points were low spots on the property where water would pond after small rain events. The analytical detection limits used for organochlorine pesticides at the OTD/Edison were quite elevated compared to detection limits used for other analytes of concern. In all cases, the reporting limits for organochlorine compounds were well about the NOAA ERL values. In the case of chlordane, reporting limits were nearly 10 times the NOAA ERM.

Additional grain size data was obtained by conducting a reconnaissance survey at five different sites within the LCWA Phase 1 (Bryant) parcel. Soil texture was assessed for the upper 10 feet at each location. Although many strata were identified at each site, grain size composition consisted primarily of silts, sandy-silts, and clayey-silts. Clays were present in thin layers at most sites. Odors of hydrocarbons were recorded in three of the five soil cores. The three cores with oil odors were all located along the western edge of the parcel. Previous soil cores taken in the LCWA Phase 1 (Bryant) parcel and the LCWA Phase 2 (Hellman Ranch) parcel were found to have similar grain size characteristics.

Data Gaps

No data were available on contaminants on the City of Long Beach (Marketplace Marsh) property or any of the additional 300 acres of property of potential future acquisition. Depending on the specific future restoration plans for the Marketplace Marsh property and future availability of data for the privately-owned properties, Phase I ESA work may be necessary as a first step towards identification of areas that are likely to have been used as sumps or for storage and transport of oil.

Also depending upon the specific future restoration plans, further work may be necessary to: a) assess the extent of metal contamination in the vicinity of the LCWA sites that had elevated concentrations of arsenic, cadmium, lead, mercury, nickel and zinc, and b) delineate the magnitude and extent of elevated concentrations of pesticides contamination in areas away from the sumps. A number of sample concentrations reported were extremely high for metals and, if valid, could be of concern. Spatial coverage was generally not adequate to determine if some of the extreme metal values reported represented a significant source and no sites were revisited to verify the elevated values. Based upon existing data, surface samples will likely be sufficient for delineating the areas for pesticides since they were not detected at depth. A stratified sampling design using composite samples as an initial screen would provide the ability to determine if significant quantities of organochlorine pesticides are present. If any composite sample exceeds pesticide threshold values, archived individual soil samples could be analyzed separately to delineate hot spots within the established stratum.

In addition, a potential future task could be to establish a geospatial database for the entire wetlands that will provide a long-term management tool. Data from the larger studies conducted over the past 10 years should be available in Electronic Data Files (EDFs). If these files could be recovered from the three consultants and placed into a common format, they would provide a starting point for better tracking and identification of problem areas. In the current form, information is extremely difficult to glean out of the hard copy reports and appendices. With data in a basic geospatial database, queries could be used to quickly assess the current status of contaminants in a variety of matrices, determine what analyses have been performed, and screen the data to examine horizontal and vertical distributions and concentrations of contaminants. A geospatial database could also provide a system to store photographic records before, after and during modifications. A geospatial database was developed when the Bolsa Chica wetlands were first being examined to determine the extent of contamination and the effects of different cleanup criteria on soil re-use or disposal.

It should also be noted that a formal Sampling and Analysis Plan and additional comprehensive sampling and test will be done during the future preliminary engineering phase for the specific restoration alternative selected.

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APPENDIX A
Core Logs

LCW-A

KINNETIC LABORATORIES INCORPORATED

LOS CERRITOS WETLANDS - TASK 5 | Long Beach, CA

Project Number		Equipment: Vibracore with Piston	
Crew Leader/Logger	D. Parent/T. Fleming	Ground Elevation	Feet
Date Drilled	11/16/2011	Total Depth of Core	10.0 Feet
Boring Diameter	4 Inches	Total Depth Recovered	Feet
Lat: 33.75558	Long: 118.10343		

Graphic Log	Description	Depth	Sample	Recovery	Composite	Old Marsh	Notes
CL	CLAY WITH SANDTop organic material present at surface, hard-packed dry silts and clays, crumbly brown with gray mottling, low plasticity. One to two inch gravel scattered through layer	1, 2, 3			A1		
CL	SILTY-CLAY with increasing moisture, medium plasticity, dryer material encapsulated by mostly grey clay (approx. 1/2 inch ball) faint oil odor.	4					
CL	SANDY-CLAY soft with medium plasticity						
CL	SANDY-CLAY stiff clay, medium plasticity, olive color						
CL	SANDY-CLAY medium plasticity, grey to olive in color, chunks/balls of concrete throughout the layer	5, 6, 7			A2		
MH	SILT WITH SAND fine texture with slight to no plasiticity, olive color, oil odor	8			A3		
CH	CLAY (MH to CH transition)	9			A4		
CH	CLAY High plasticity, light brown in color, wet						
MH	SILT WITH SAND	10			A5		
		11					

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Kinnetic Laboratories, Inc. Page 1

LCW-B

LOS CERRITOS WETLANDS - TASK 5 | Long Beach, CA

Project Number	Equipment: Vibracore with Piston
Crew Leader/Logger: D. Parent/T. Fleming	Ground Elevation: Feet
Date Drilled: 11/16/2011	Total Depth of Core: 11 Feet
Boring Diameter: 4 Inches	Total Depth Recovered: Feet
Lat: 33.75693 — Long: 118.10149	

Graphic Log	Description	Depth	Sample	Recovery	Composite	Old Marsh	Notes
SM	SILTY-SANDS Some organic material present at surface, light brown turning to olive, 1-inch of hard, oiled roadbed at 0.5 ft.	0–1			B1		
CL	SANDY-CLAY stiff dry with no plasticity, crumbly	1					
CL	SILTY-CLAY stiff dry with low plasticity	2–3			B2		
ML	SILT WITH SAND brown to olive color, moist to wet	4					
CH	CLAY fatty with high plasticity, brown clay with grey mottling	5					
ML	SILT WITH SAND Brown to olive in color, wet with visible water	6–7			B3		
CH	CLAY fatty clay, gray mottled	8					
MH	SILT WITH SAND fine silts and clays, gray in color and wet	9–10			B4		
CH	CLAY fatty clay	11			B5		

Kinnetic Laboratories, Inc. Page 1

LCW-C

LOS CERRITOS WETLANDS - TASK 5 Long Beach, CA

Project Number		Equipment:	Vibracore with Piston
Crew Leader/Logger	D. Parent/T. Fleming	Ground Elevation	Feet
Date Drilled	11/18/2011	Total Depth of Core	11.5 Feet
Boring Diameter	4 Inches	Total Depth Recovered	Feet
Lat: 33.75742	Long: 118.10345		

Graphic Log	Description	Depth	Sample	Recovery	Composite	Old Marsh	Notes
CL	CLAY WITH SAND Dry, stiff silts/clays with 1 to 2 inch gravel, brown to gray in color, crumbly, asphalt or old road bed at 1.0 ft, organic roots present at 2-2.5 feet.	1, 2, 3			C1		
CL	SILTY-CLAY moist silts/clays, olive in color, medium plasticity, soft and inorganic						
CL	SILTY-CLAY drier, soft silts/clays, olive color, stiff to medium plasticity, odor of oil	4					
CL	CLAY medium plasticity, olive color						
CL	SILTY-CLAYstiffer silts/clays, olive in color, dry and gritty with increasing moisture at depth, odor of oil	5, 6			C2		
MH	SILTY-CLAYS wet, grey in color	7, 8			C3		
MH	SILTY-CLAYS wet, color changing to brown	9					
CH	CLAY Brown, moist clay with medium to high plasticity, fatty clay				C4		
MH	SANDY-SILTS gray to brown in color, wet (>50% moisture)	10, 11			C5		

Kinnetic Laboratories, Inc. Page 1

LCW-D

KINNETIC LABORATORIES INCORPORATED

LOS CERRITOS WETLANDS - TASK 5		Long Beach, CA	
Project Number		Equipment:	Vibracore with Piston
Crew Leader/Logger	D. Parent/T. Fleming	Ground Elevation	Feet
Date Drilled	11/18/2011	Total Depth of Core	11 Feet
Boring Diameter	4 Inches	Total Depth Recovered	Feet
Lat: 33.75811	Long: 118.10352		

Graphic Log	Description	Depth	Sample	Recovery	Composite	Old Marsh	Notes
OL	SANDY-CLAYS Top organic material present at surface (roots from pickleweed), brown to gray color	1 2			D1		
SM	SILTY-SANDS stiff, brown to olive color, fine sediment	3					
SM	SILTY-SANDS loose, grey to olive color, low plasticity, increasing moisture at 4.0 feet	4			D2		
ML	SILTwith some clay becoming moist with depth, reddish mottling, low plasticity	5					
MH	SANDY-SILTS with thin (1-inch) layers of fatty clay at 5.1 feet and 6.0 feet fine texture with no plasiticity, olive color, oil odor	6 7					
CH	CLAY fatty clay, olive coloration						
MH	SANDY-SILT grey color, well sorted, contains thin layers of fatty clays	8 9 10 11			D3 (CH layer removed)		

Kinnetic Laboratories, Inc. Page 1

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LCW-E

KINNETIC LABORATORIES INCORPORATED

LOS CERRITOS WETLANDS - TASK 5 | Long Beach, CA

Project Number		Equipment: Vibracore with Piston	
Crew Leader/Logger	D. Parent/T. Fleming	Ground Elevation	Feet
Date Drilled	11/18/2011	Total Depth of Core	10 Feet
Boring Diameter	4 Inches	Total Depth Recovered	Feet
Lat: 33.75804	Long: 118.10006		

Graphic Log	Description	Depth	Sample	Recovery	Composite	Old Marsh	Notes
CL	SILTY-CLAY stiff dry silts and clays, brown to olive, low plasticity. layer of one to two inch gravel with some organic material present at 1.0 foot level, becoming moister towards the bottom of this interval.	1					
CL	SILTY-CLAY brown to olive color, silty clay with medium stiffness, medium plasticity, approx. 1-inch layer of lighter olive silty clay at 3.0 feet.	2, 3			E1		
CL	SILTY-CLAY light in color becoming more olive, medium plasticity, moist material. almost fatty clay (CH)	4					
CL	SILTY-CLAY drier, low plasticity, silty clay	5					
CH	CLAY moist clay with silts, high plasticity, brown to olive in color, fatty	6					
MH	SILTY-CLAY wet, low plasticity, brown to olive in color	7, 8			E2		
CH	CLAY with high plasticity, fatty clay, brown to olive						
MH	SILT fine grained, gray to olive in color, not as wet as above, no plasticity	9			E3		
		10, 11					

Kinnetic Laboratories, Inc. Page 1