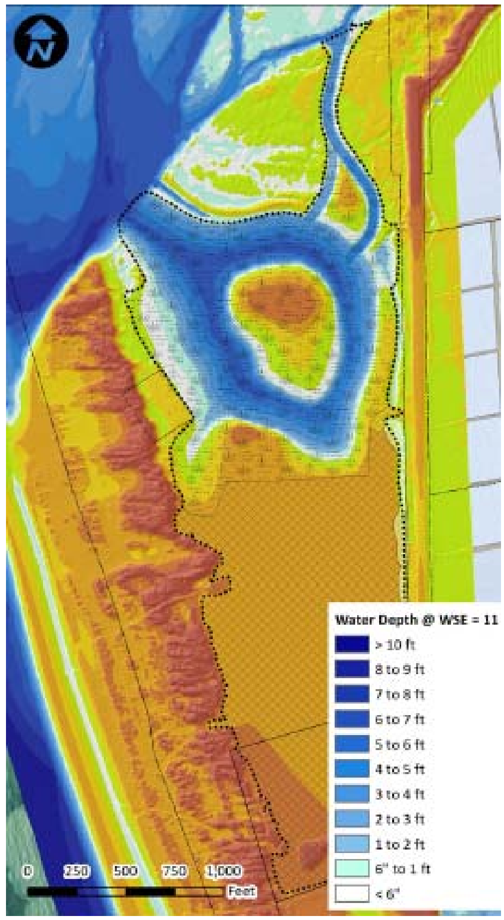
Wishtoyo

VENTURA COASTKEEPER®

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY



California Department of Fish and Wildlife

Fisheries Restoration Grant Program Agreement # P1350015

August 7, 2015

APPENDIX A – HYDRODYNAMIC MODEL DEVELOPMENT

APPENDIX A – HYDRODYNAMIC MODEL DEVELOPMENT TECHNICAL MEMORANDUM

Date:	7/27/2015
To:	Jason Weiner, M.E.M., Wishtoyo Foundation's Ventura Coastkeeper Program
From:	cbec eco engineering - Chris Hammersmark, Dale Meck, John Stofleth, Denise Tu
Project:	Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study - Project # 14-1023
Subject:	Hydrodynamic, Sediment Transport and Circulation Model Development

1 INTRODUCTION

This document was prepared as a technical appendix to support the Santa Clara River Estuary (SCRE) Habitat Restoration and Enhancement Feasibility Study (Feasibility Study). It describes the data sources, assumptions, and technical work done to develop the hydrodynamic, sediment transport, and water quality model simulations used to support initial alternatives development, and subsequent refinement of the Preferred Restoration Concept.

2 MODEL DEVELOPMENT

MIKE 21 FM is a hydrodynamic modeling software package developed by the Danish Hydraulic Institute (DHI) which uses a two-dimensional (2D) depth-averaged approach to solving the Navier-Stokes equations for fluid flow, and is appropriate for simulating flow behavior in oceanic, coastal, and estuarine environments. It uses an unstructured flexible mesh (FM) for the computational grid, which allows the model to include varying resolution within a single model mesh. Modules within the MIKE 21 FM platform utilized in this effort include: 2D hydrodynamic (HD), sediment transport (ST), and circulation (advection/dispersion). Model results provided to the project team for analysis included inundation extents, water depth, flow velocities, bed scour, sediment deposition/erosion, and water temperature. The model was developed using SI units and results were converted to U.S. customary units for reporting.

2.1 MODEL DOMAIN

The model domain extended from the upstream model boundary at Victoria Ave. (approximately 3 miles upstream of the SCRE) to the downstream boundary located approximately 0.5 miles west of the shoreline (Figure A-1). From north to south, the model domain extended from just north of the Ventura

Water Reclamation Facility (VWRF) wildlife ponds to approximately 1 mile south of the edge of the existing campground. As spurious results can sometimes occur at model boundaries (i.e., edge effects), the extents of the model were chosen to provide an adequate amount of buffer space between the area of interest (the estuary) and the location of the model boundaries.

The computational mesh (FM) used in the model varied in resolution with the areas of interest (SCRE, proposed restoration areas) being defined with triangular elements at a higher resolution (5 to 25 m element faces). Areas including the upper river extents and the ocean were defined with triangular elements with lower resolution (15 to 70 m element faces). Project levees (i.e., FEMA certified), non-project levees, agricultural berms, and road embankments within the model domain were identified using the 2014 aerial and the 2009-2011 LIDAR. These features were defined within the model domain as dike structures to ensure that their topographic maxima were represented in the model domain.

Model input parameters referenced the horizontal datum of North American Datum 1983, State Plane Zone 5 (meters), and a vertical datum of NAVD 88 meters.

2.2 BATHYMETRY AND TOPOGRAPHY

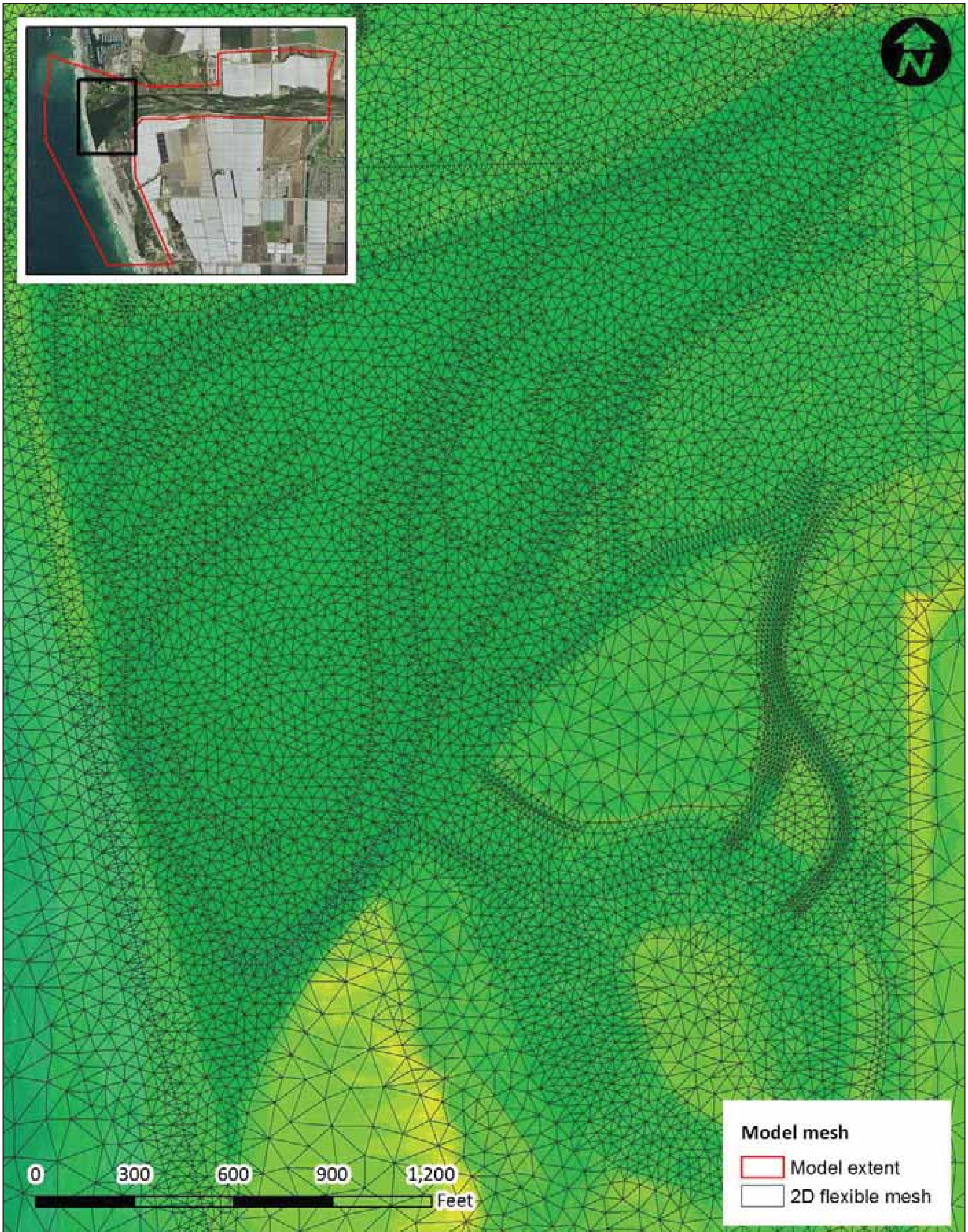
The topography developed for the model reflected the best available data for the site topography and was assembled from the following sources:

- A hydro-flattened bare earth digital elevation model (DEM) of the area from the 2009 - 2011 CA Coastal Conservancy Coastal Lidar Project as available through the Digital Coastal Services Center (DCSC) of the National Oceanic and Atmospheric Administration (NOAA). This dataset provided the elevations and topography for the majority of the site, but did not include the estuary bathymetry below approximately 8.8 ft (NAVD88). It also reflected the coast alignment, and mouth berm geometry as observed in 2009.

- 2012 California State University – Channel Islands (CSUCI) 1-meter horizontal resolution, multi-beam bathymetry collected by the Seafloor Mapping Lab.

- Limited 2014 cbec topographic and bathymetric surveys to update the location and elevation of the mouth berm, to capture the cross-section of the outfall channel, and to confirm the suitability of the past data sources.

Figure A-2 shows the composite topography, and the coverage area for each of the sources listed above. Figure A-3 includes a point by point comparison (difference) between the 2012 CSUCI bathymetry the 2014 data collected by cbec, which confirmed the suitability of the CSUCI dataset.



Source: 2014 NAIP aerial, 2009 NOAA DCSC LiDAR,2012 CSUCI Bathymetry, 2014 cbec survey

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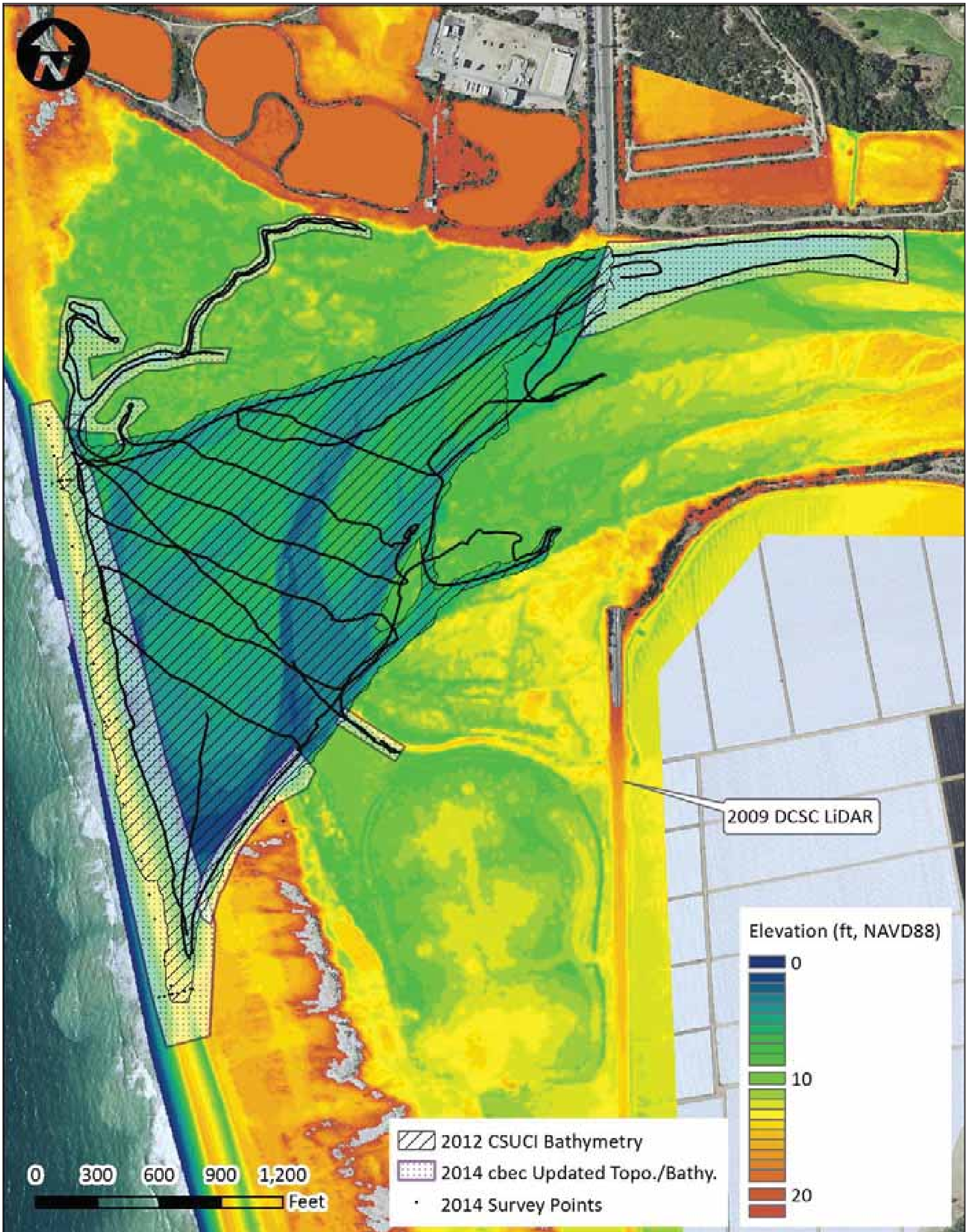
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

MIKE 21 FM model mesh

Project No. 14-1023 | Created By: DT | **Figure A -1**



Source: 2014 NAIP aerial, 2009 NOAA DCSC LiDAR, 2012 CSUCI bathymetry, 2014 cbec survey.	cbec eco engineering	Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study **Fall 2014 bathymetry**
		Project No. 14-1023 / Created By: DM / **Figure A - 2**

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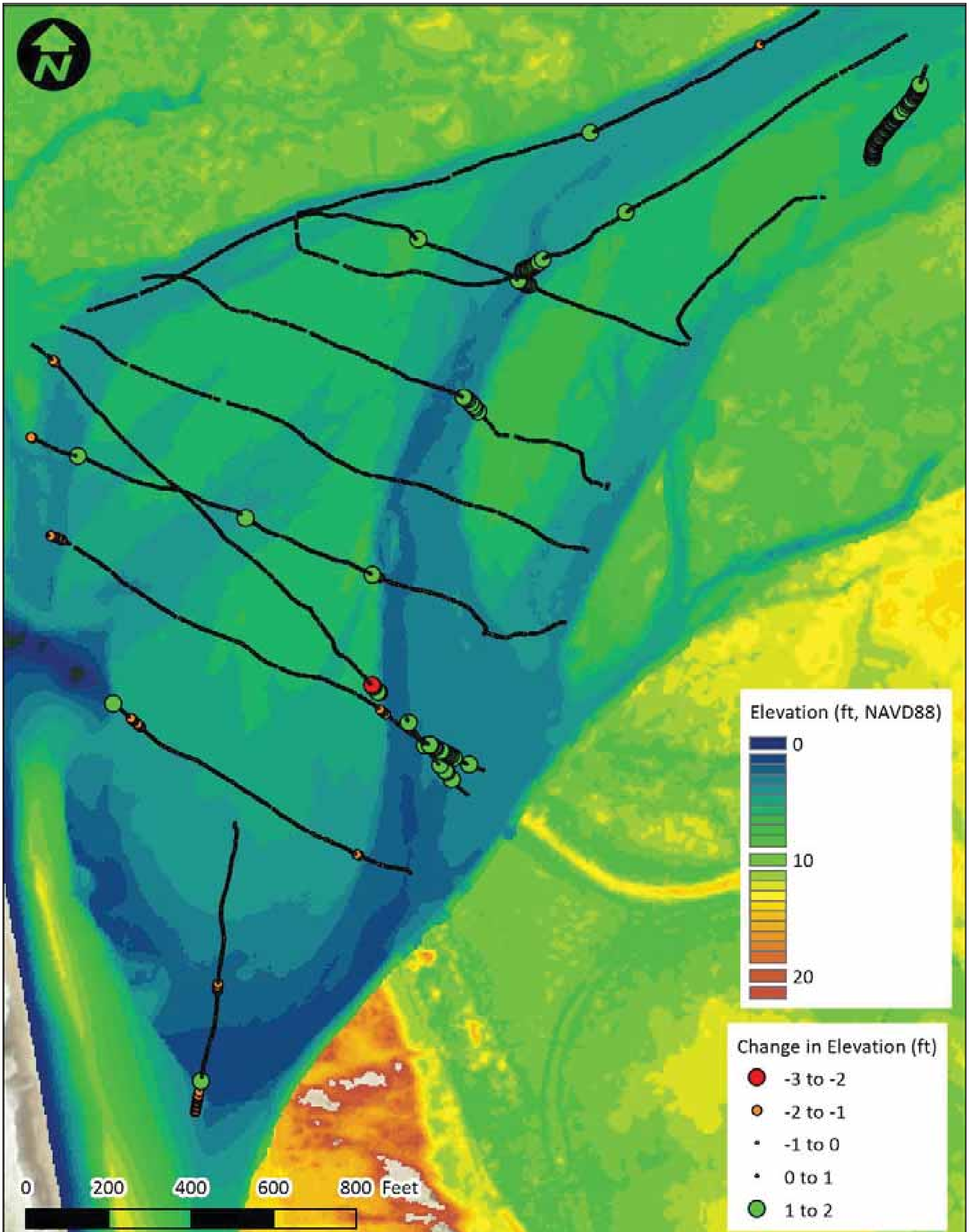


Source:2012 NAIP aerial. 2009 NOAA DCSC LiDAR. 2012 CSUCI bathymetry. 2014 cbec survey	cbec	Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study **Bathymetry comparison**
		Project No. 14-1023 | Created By: DM | **Figure A - 3**

2.3 MODEL SCENARIOS

As discussed in the main body of this Feasibility Study, three separate model scenarios were developed to represent and assess varying states of the SCRE: (1) river runoff during storm events; (2) tidal exchange; and (3) closed-berm circulation. These model scenarios were developed for the existing condition, restoration alternatives with present-day sea levels, and restoration alternatives with a 2-ft increase in mean sea level corresponding to the maximum projected range for 2050 sea levels (NRC 2012). In addition, a modified circulation scenario was included to simulate a 50% reduction in the VWRF effluent discharge flow rate. Due to limitations of the primarily surface water modeling software, additional VWRF discharge reduction scenarios (up to a complete removal of the VWRF effluent) were evaluated using a spreadsheet-based water budget model described in Appendix B. Each model scenario is summarized in Table 1.

3 HYDRODYNAMIC BOUNDARY CONDITIONS

This section describes the development of the hydrodynamic boundary conditions used in the various model scenarios. These boundary conditions included river flow, tidal levels, a wind boundary (which drives circulation and mixing within the estuary in the absence of other major flows), and the hydraulic roughness (the resistance to flow provided by the river bed and vegetation). All boundary conditions were developed with U.S. customary units and with elevations relative to NAVD88 feet, but were converted to SI units for use in the MIKE 21 FM software.

3.1 HYDROLOGY

Upstream boundary conditions were developed using historic water level and flow data collected by the USGS and Ventura County.

Before it was destroyed in the 2005 flood event, the USGS Montalvo gage (#11114000) was located at the Highway 101 Bridge where flow and other water data were measured for the period from 1927-2004. Since 2008, flow data in the SCR is measured at the Ventura County Watershed Protection District (VCWPD) gage #723, which is located a short distance downstream at the Victoria Blvd Bridge, approximately 1.7 miles downstream from the historic Montalvo gage. The 1,600 square mile watershed and the locations of these two gaging stations are shown in Figure A-4. Given the close proximity of these gaging stations, and the lack of significant additional inflows between them, these two gages provide a consistent and relatively continuous record of the flow in the lower SCR since 1927.

A flood frequency analysis was performed using the most recent instantaneous peak flows (2008-2012) from VCWPD gage #723 (Figure A-5) The results were generally consistent with a previous flood frequency analysis (1955-2004)(Stillwater Sciences, 2011. The analysis was performed using the log Pearson Type III flood frequency analysis (USGS Bulletin 17B). The updated flood frequencies for the extended water record of 1955-2012 are shown in Figure A-6 and in Table 2. This updated analysis compares reasonably well with the flood flow frequency analyses in AQUA TERRA (2009) and Stillwater

Sciences (2011). The most recent major flood event occurred in January of 2005, with an estimated peak flow of 136,000 cfs.

Table 1. Model scenario summary

For each alternative (and the existing conditions):				
Model Scenario	**Boundary Conditions**	**Topography**	**Simulation Duration**	**Purpose**
Storm Events HD/ST modules **Modifications** Climate change runs with SLR of 2 ft	• Synthetic 2-yr (12,800 cfs) river hydrograph • 2-yr sediment discharge • Simplified tidal cycle with 2-yr storm surge • Seasonally appropriate hourly wind forcing	• 2-yr breach opening based on survey	• ~6-8 days (storm duration) • Model time step of 5 seconds (HD) and 15 seconds (ST) • High order	• Developed to represent the estuary when a significant precipitation event occurs within the watershed, and the SCR conveys large volumes of flood runoff water and sediment to the SCRE • Evaluate velocities, inundation extents, elevations and sediment trends for a frequent ecologically important flow event (2-yr) and a larger geomorphic event (10-yr)
	• Synthetic 10-yr (86,600 cfs) river hydrograph • 10-yr sediment discharge • Simplified tidal cycle with 10-yr storm surge • Seasonally appropriate hourly wind forcing	• 10-yr breach opening (estimated)		
Tidal Exchange HD/ST modules **Modifications** Climate change runs with SLR of 2 ft	• Monthly average VWRF Flows Synthetic tidal cycle (including neap and spring tides) • Seasonally appropriate hourly wind forcing	• 2-yr breach opening based on survey	• 28 days (full neap/spring tidal cycle) • Model time step of 5 seconds (HD) and 15 seconds (ST) • Lower order faster algorithm	• Developed to represent the SCRE during open berm conditions with periods of tidal flow, VWRF effluent discharge, but without significant river or groundwater inputs • Evaluate velocities and potential sedimentation in restoration area(s)
Bathtub Circulation HD module plus Temperature and Salinity modules **Modifications** Climate change run with SLR of 2 ft and decreased subsurface flow to ocean 50% reduction in VWRF effluent	• Monthly average VWRF effluent discharge & temperatures • Stage dependent loss to ocean (through the mouth berm), • Evaporation calculated though temperature/salinity module with hourly averaged inputs (solar radiation, humidity, air temperature from nearby weather station). • Seasonally appropriate hourly wind forcing • Initial temperature (12°C) • Initial salinity (11ppt)	• Closed berm with location as surveyed in Fall 2014	• 7 months (March thru September) • Model time step of 5 minutes • Lower order, faster algorithm	• Developed to represent the SCRE during extended closed berm conditions with the VWRF as the primary volume source (without river runoff) as currently occurs in the dry summer months. • Evaluate salinity, temperature and wind circulation trends, evaporation and pseudo-equilibrium water levels

Table 2. Flood Frequencies for the lower Santa Clara River for 1955-2012

Return Period, yr	Q_{peak} (cfs)
2	12,800
5	46,800
10	86,600
25	158,600
50	228,800
100	312,500

Using the results of the flood frequency analysis and historic flood events, synthetic storm hydrographs were developed for the upstream boundary condition. These synthetic flood events reduce noise and provide simple, smooth, readily interpretable hydrodynamic results that allow for straightforward comparative evaluations of restoration concepts. The synthetic 2- and 10-year discharge hydrographs (Figure A-7) were created using a Gamma distribution approximation with peak flows at 12,800 and 86,600 cfs respectively. The shape of each synthetic storm hydrograph was fitted to normalized historical storm events (above and below the targeted recurrence intervals) to ensure the duration and volume of the event is reasonably represented.

Storm event scenarios utilized an initial water level corresponding to the recent water levels within the SCRE, but with an open breach based on the expectation that a breach event generally precedes the peak of the hydrograph. Inundation patterns were therefore able to reflect areas that would typically be wetted prior to and following a breach event associated with a storm event.

3.2 TIDE LEVEL

In an effort to develop accurate downstream boundary conditions for the hydrodynamic simulations, historical tidal measurements were obtained from two nearby NOAA tide stations: the Santa Barbara Station (ID: 9411340) established in 1974, and the Santa Monica Station (ID: 9410840) established in 1932 (see Figure A-4). This section describes the average tidal conditions observed at the SCRE and the approaches used to develop tidal boundary conditions for use in the hydrodynamic simulations. Additionally, this section describes the methods used to incorporate appropriate storm surges for the 2- and 10-year recurrence interval, and how sea level rise projections were incorporated.

3.2.1 TIDAL DATUMS

The tides at the SCRE are mixed semidiurnal tides with two low tides (MLW and MLLW), and two high tides per day (MHHW and MHW). Appropriate tidal datums for the SCRE were determined by averaging the values from the two surrounding NOAA tide stations. As shown in Table 3, this yielded a mean tide level (MTL) at the SCRE of 2.65 ft and a mean diurnal range (MHHW - MLLW) of 5.42 ft.

Table 3. Existing conditions tidal datums

Datum, ft (NAVD88*)	Santa Barbara	Santa Monica	Average
MHHW	5.27	5.24	5.26
MHW	4.51	4.50	4.51
MTL	2.68	2.62	2.65
MLW	0.85	0.64	0.75
MLLW	-0.13	-0.19	-0.16

* Station datums were converted to NAVD88. Santa Barbara used 3.29 ft and Santa Monica used 2.63 ft (NOAA, 2014).

3.2.2 SIMPLIFIED TIDE

A simplified tidal cycle was developed for the downstream boundary condition for the 2- and 10-year storm event scenarios. The simplified boundary condition was developed so that interpretation of the storm event scenarios could focus on the hydrodynamic and sediment transport trends associated with large river discharge events. The simplified tidal cycles were created using the HEC 25 tidal constituent equation for a semidiurnal period and were bounded by the MHHW and MLLW (see Figure A-8).

In addition to the typical tide levels, elevated high water levels (storm surges) were incorporated into the downstream boundary conditions of the storm event scenarios using data from NOAA's extreme tide level exceedance probability analysis. For the Santa Monica station, the 50% annual exceedance level (2-year recurrence interval) was 7.19 ft, and the 10% annual exceedance level (10-year recurrence interval) was 7.55 ft (NOAA, 2014).

As exhibited in Figure A-8, the simplified tidal cycle was modified to include these exceedance levels. In an effort to represent the maximum inundation extents expected during a given storm event (worst case scenario), the resulting tidal cycle was shifted in time so that the high tide of the storm surge coincided with the peak of the hydrograph.

3.2.3 HARMONIC TIDES

Though a simplified tidal boundary condition is appropriate in simulating large storm events, when the estuary is overwhelmingly dominated by river flows, the complete tide cycle, including neap and spring tides, was used to represent the downstream boundary for the open berm condition that typically occurs after storm events. As with the storm event boundary conditions, a synthetic harmonic tide cycle was developed to reduce noise, and assist with model interpretation and results comparisons.

The synthetic tidal cycle was created using published harmonic constants for the Santa Monica station (NOAA, 2014) and is shown in Figure A-9.

3.2.4 SEA LEVEL RISE

The downstream boundary conditions (both the simple tidal boundary and the more complete harmonic tidal boundary) were shifted vertically to incorporate sea level rise (SLR) into the model scenarios. SLR projection ranges for the California coast (NRC, 2012) include a rise in mean sea level (MSL) of:

- 0.39 to 2.0 ft by the year 2050 and
- 1.38 to 5.48 ft by the year 2100.
  (increases are relative to the MSL in the year 2000)

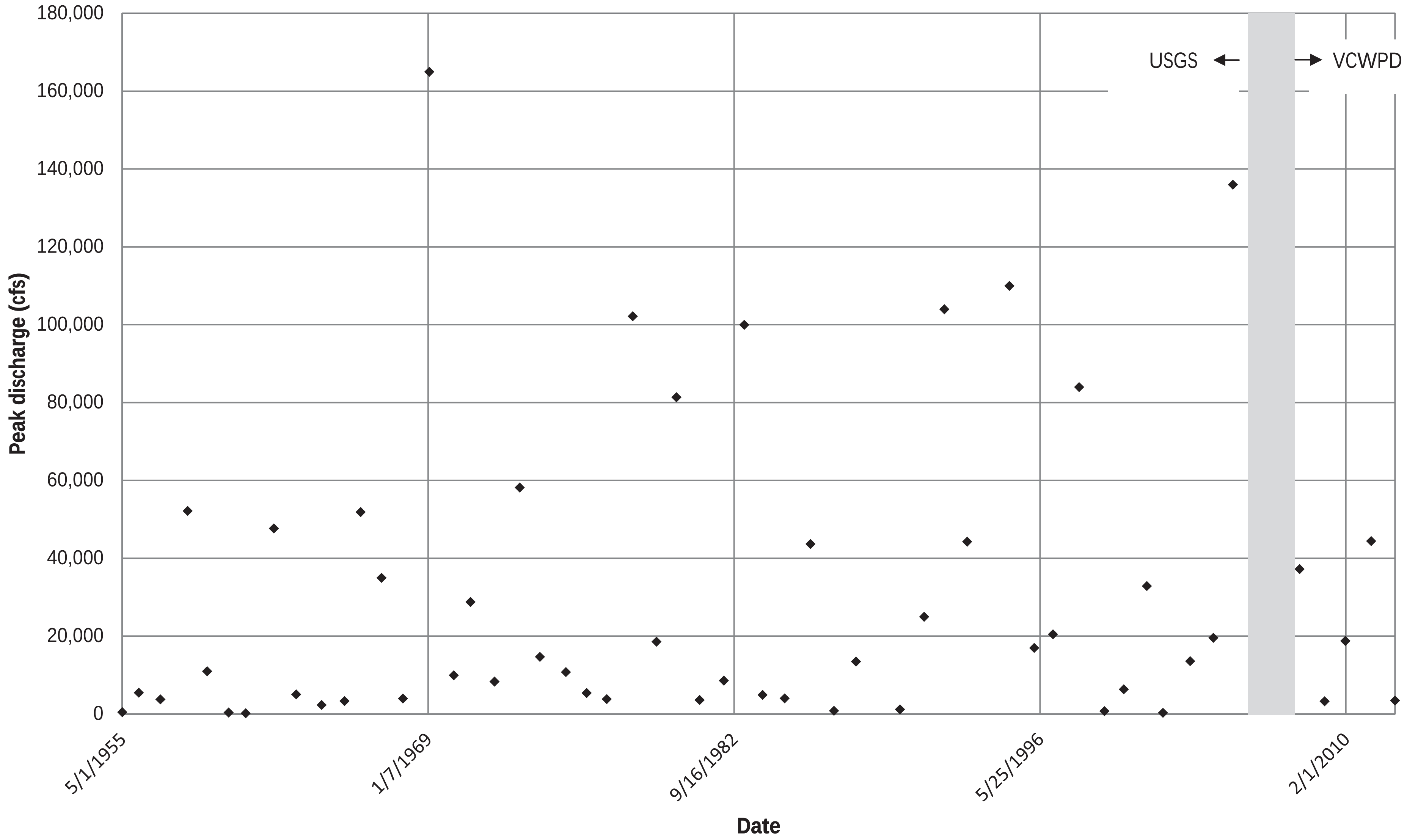
To support the evaluation of the feasibility of the proposed restoration alternatives, the tidal boundary conditions were shifted up by the maximum projected 2050 sea level increase of 2 ft (see Figure A-7 and Figure A-8).

Source: ESRI base aerial.

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Santa Clara River watershed and gaging stations

Project No. 14-1023 | Created By: DT | **Figure A - 4**



Source:USGS gage #11114000 Santa Clara River at Montalvo and VCWPD gage #723 Santa Clara River at Victoria Ave.
Notes: Annual peak discharges for 1955-2012.No data for WY 1989, 2006, 2007. 1995 flow estimated from Flood Protection Report (1995-1996). 2005 flow estimated at VCWPD gage #724.

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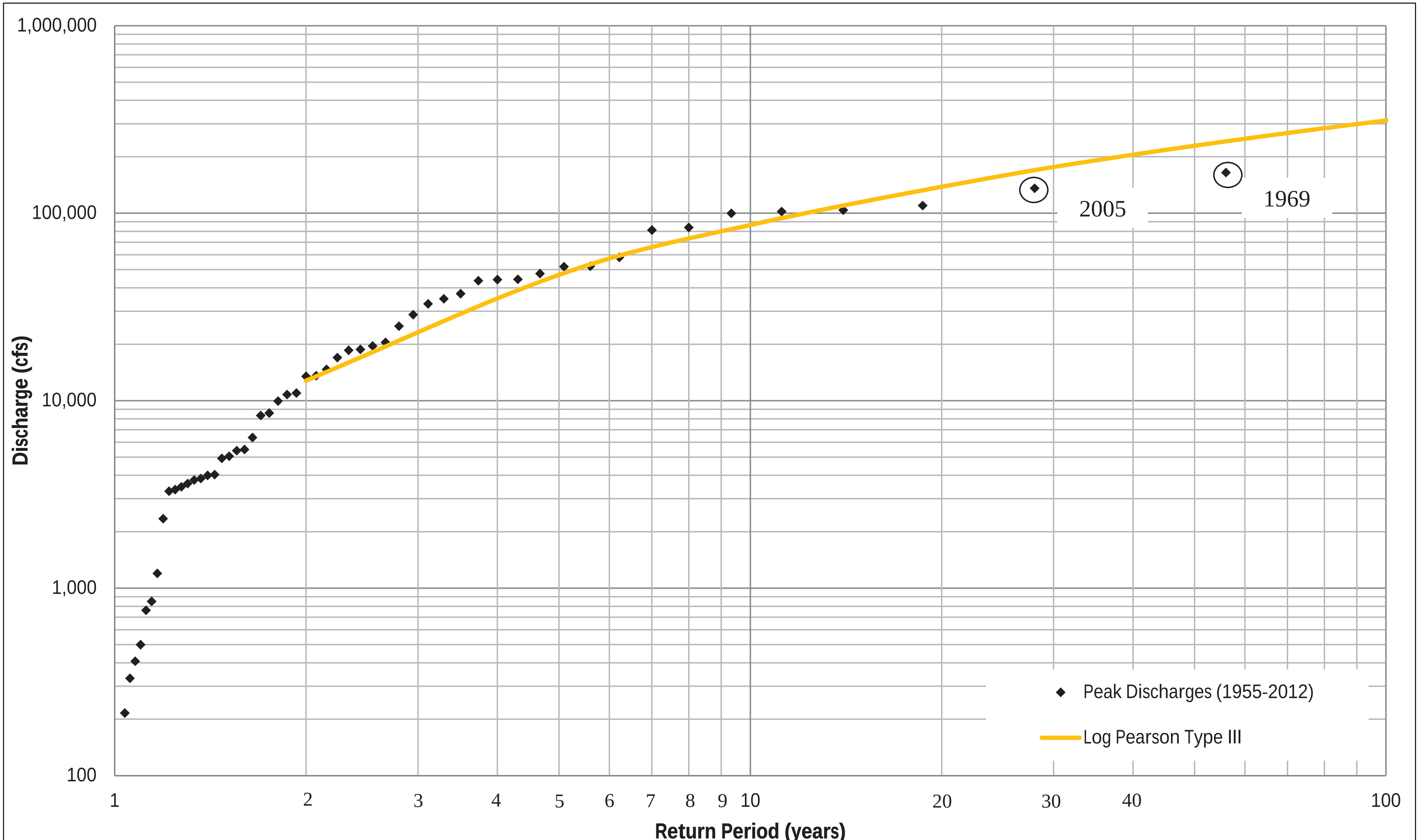
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Santa Clara River annual peak discharges

Project No. 14-1023	Created By: DT	**Figure A - 5**



Source:USGS gage #11114000 Santa Clara River at Montalvo and VCWPD gage #723 Santa Clara River at Victoria Ave. Notes: Annual peak discharges for 1955-2012. No data for WY 1989, 2006, 2007. 1995 flow estimated from Flood Protection Report (1995-1996). 2005 flow estimated from VCWPD gage #724.	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Santa Clara River flood frequency analysis** Project No. 14-1023 | Created By: DT | **Figure A - 6**

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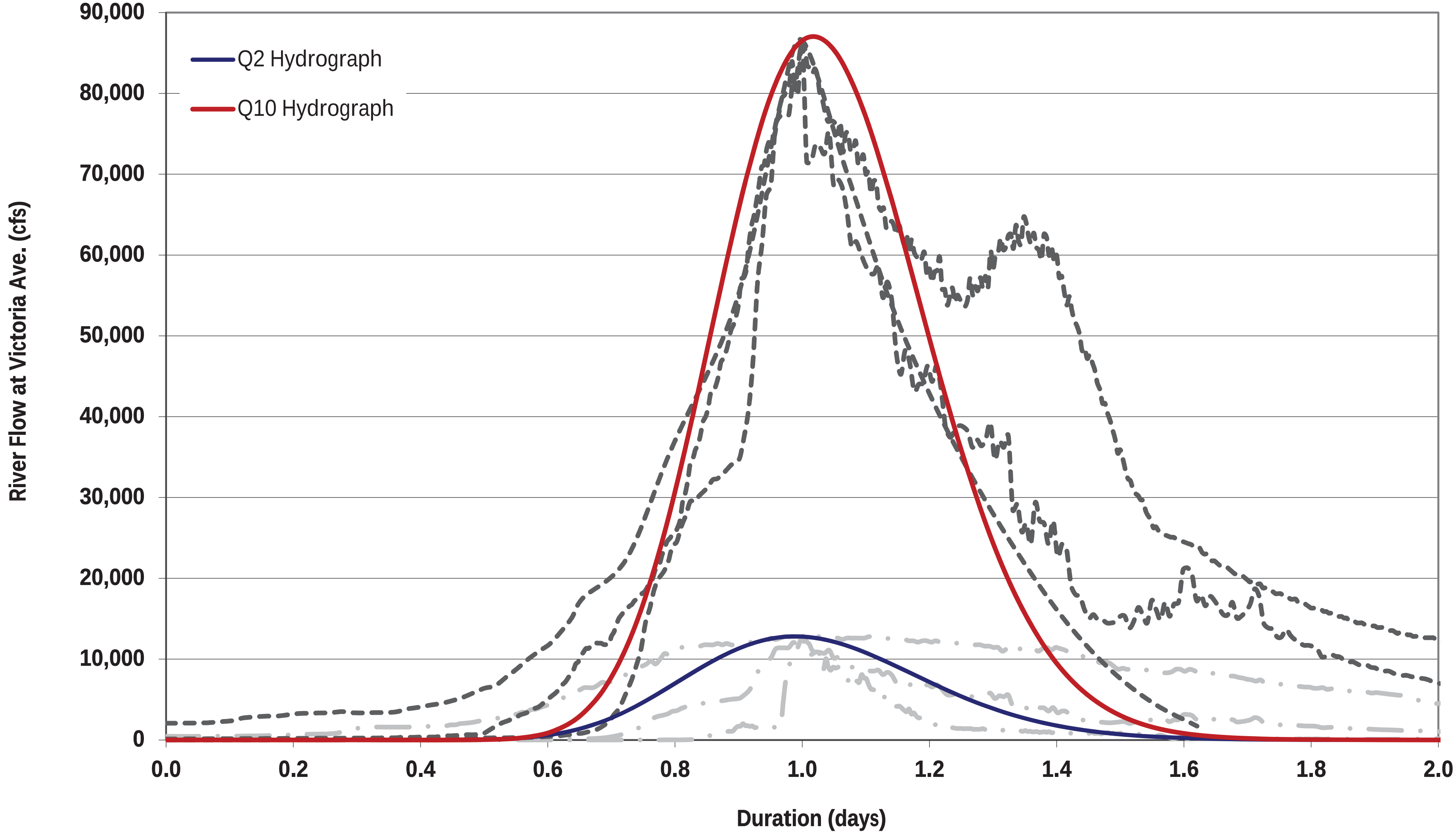

Sources: USGS #11114000 Montalvo gage, VCWPD #723 gage
Notes: Synthetic 2-yr hydrograph designed using storm events (light grey lines) from Jan. 2008 (Q=37,253 cfs), Feb. 2003 (Q=13,600 cfs), Mar. 2011 (Q=6,858 cfs). Synthetic 10-yr hydrograph designed using storm events (dark grey lines) from Feb. 1992 (Q=104,000 cfs), Mar. 2011 (Q=44,439 cfs), Jan. 2008 (Q=37,253 cfs).

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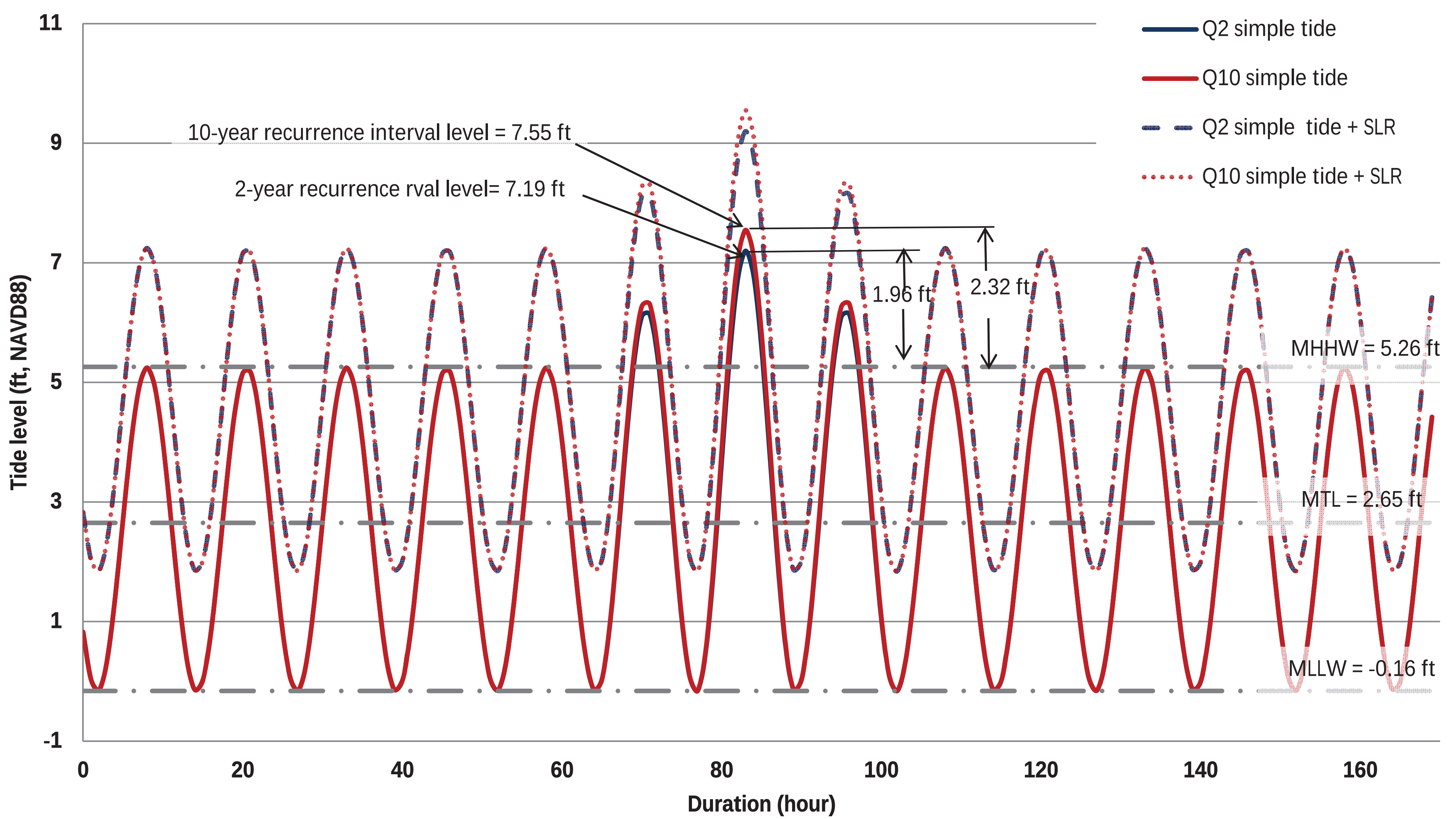
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Synthetic river storm hydrographs

Project No. 14-1023	Created By: DT	**Figure A - 7**



Notes: Storm surges adapted from Santa Clara NOAA tide station extreme tide level exceedence probabilities, SLR = Sea level rise, MHHW = Mean higher high water, MTL = mean tide level, MLLW = Mean lower low water.

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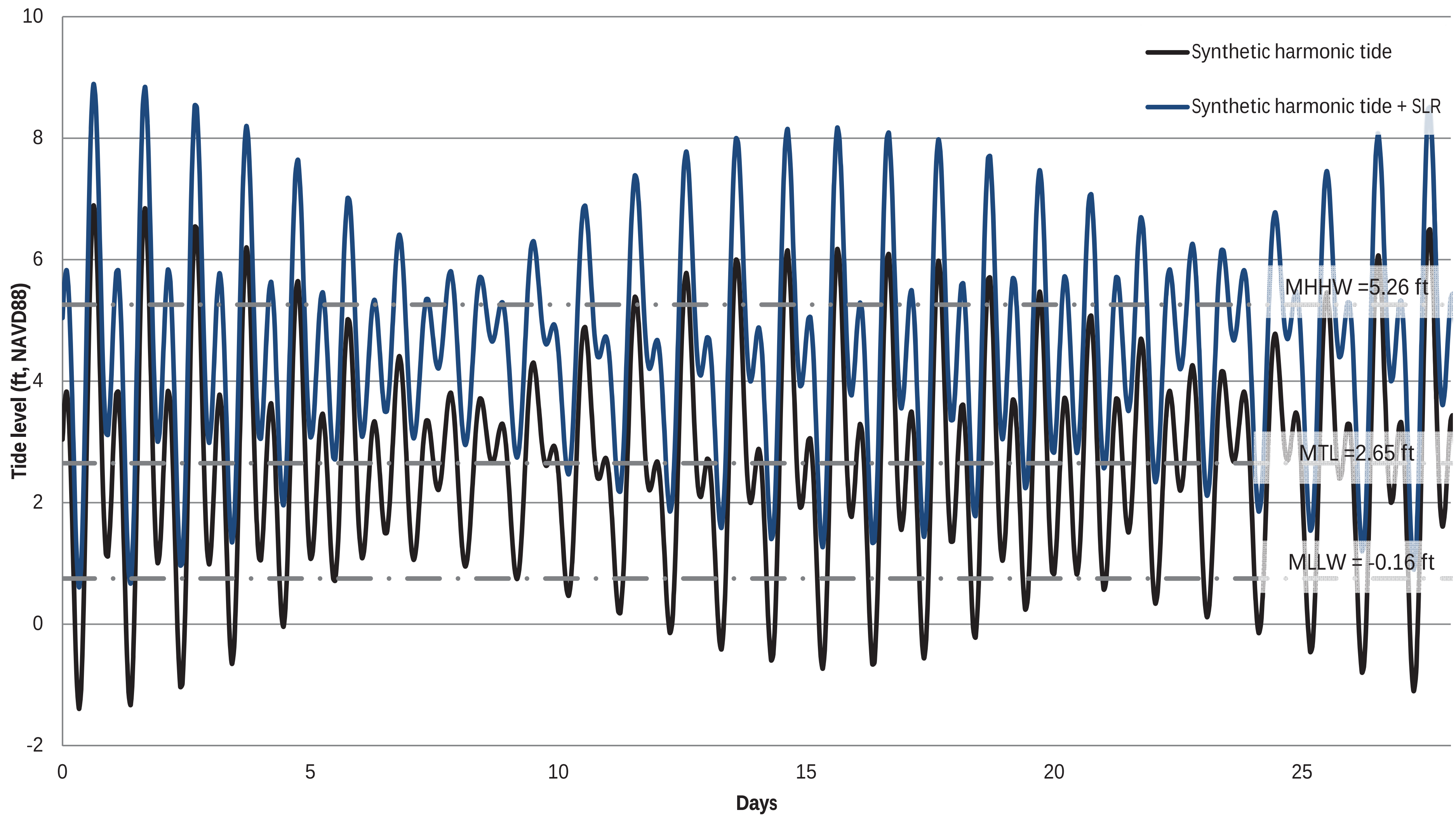
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Simple synthetic tidal cycles with storm surges

Project No. 14-1023	Created By: DT	**Figure A – 8**



Notes: Harmonic tide derived from Santa Monica NOAA tide station published harmonic constants, SLR = Sea level rise, MHHW = Mean higher high water, MTL = mean tide level, MLLW = Mean lower low water.	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Synthetic harmonic tidal cycle**
		Project No. 14-1023 | Created By: DM | **Figure A - 9**

3.3 WIND

In the absence of river runoff or tidal exchange, local winds are the primary driver for water circulation within the SCRE. To incorporate wind into the model simulations, a surface boundary condition was developed from local wind data obtained from the California Irrigation Management Information System (CIMIS) station #156 at Oxnard. This station has been active since October of 2001 and was used to determine typical wind patterns over the 14-year period. In general, onshore breezes from the west dominate in the midmorning to afternoon and are strongest in early afternoon. Northeasterly offshore breezes dominate in the evening and early mornings (Figure A-10-Figure A-13). Seasonally, winds are predominantly westerly onshore winds from March through October with the strongest winds occurring in April, and predominantly north easterly offshore winds occurring from November through February (Figure A-14 and Figure A-15).

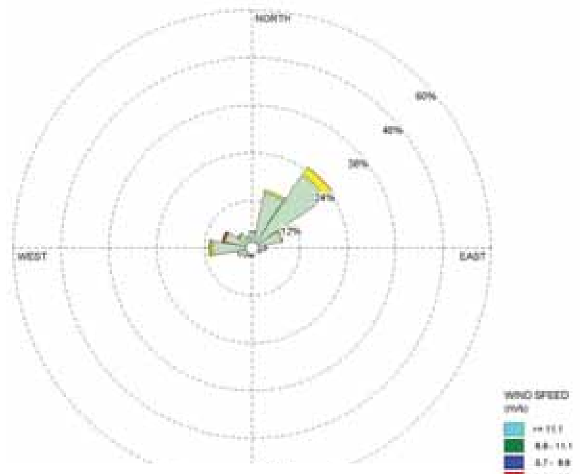
The wind boundary condition was developed as an hourly time series, which included both wind magnitude (speed) and direction. The average speed was determined for each hour of each day for the period of record, while the predominant wind direction was determined for each hour for the period of record. The average wind speed was unique to each hour of each day of the year, but the dominant wind direction was repeated every 24 hours. This approach created a wind boundary condition that encompassed both sub-daily and seasonal changes.

3.4 HYDRAULIC ROUGHNESS

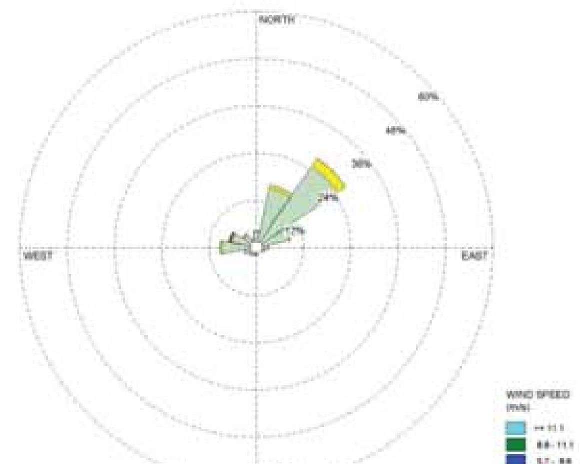
Hydrodynamic models typically use spatially variable hydraulic roughness to represent the way varying channel bed conditions (grain size) and vegetation communities provide resistance to flowing water. Roughness values were used to describe both the type/density of vegetation as well as channel bed forms (boulders, cobbles, and undulations in the bed). Manning's n values are a common formulation for hydraulic roughness with higher values reflecting greater resistance to flow. Manning's n values within the model domain were selected using the vegetation type/density observed during field surveys and previously mapped vegetation types (Stillwater Sciences & URS, 2007; WRA, 2014) in accordance with the traditional hydraulic roughness guidance provided in Chow (1959). Roughness values for the main channel ranged from 0.02 to 0.035, while values for floodplain areas ranged from 0.013 to 0.095 (Table 4). For the preferred alternative, roughness values within the proposed Restoration Area were estimated based on existing condition inundation levels and vegetation communities that persist at different elevations. The proposed Restoration Area roughness values ranged from 0.035 to 0.095. The existing condition hydraulic roughness is shown in Figure A-16 and the Preferred Restoration Concept roughness is shown in Figure A-17.

Table 4. Santa Clara River Estuary modeled Manning's n values

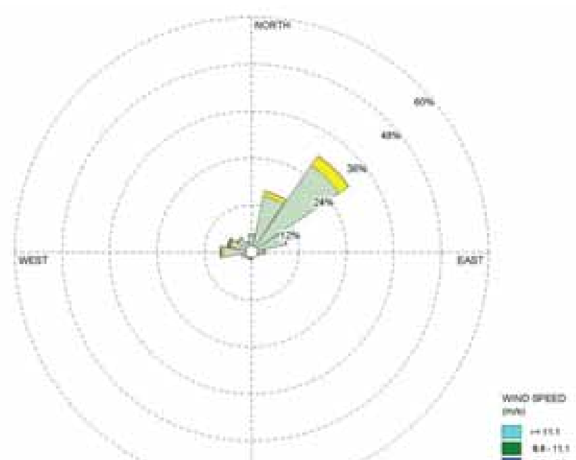
Land Use / Surface Type	Manning's n
Pavement and developed areas	0.013
Deep open water	0.02
Shallow water and bare sand dunes	0.035
Vegetated dunes and marshy wetlands	0.04
Agriculture	0.045
Intermediate vegetation	0.065
Thick riparian vegetation	0.095



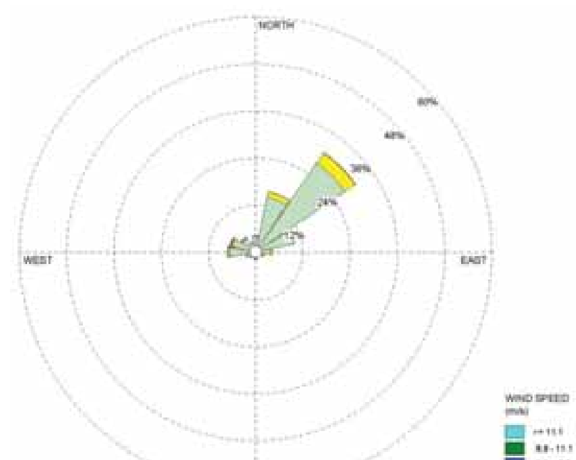
1:00 Hours, Average wind speed= 1.13 m/s



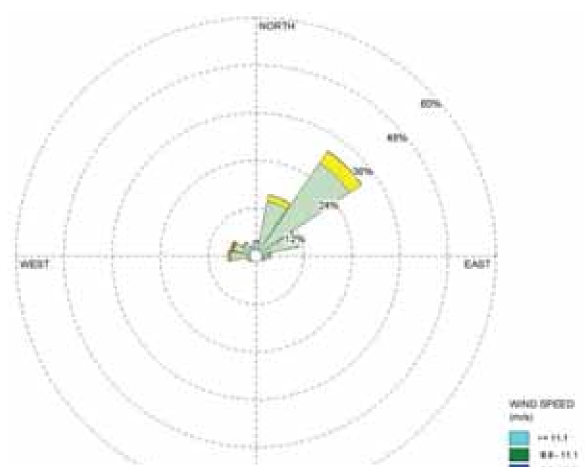
2:00 Hours, Average wind speed= 1.13 m/s



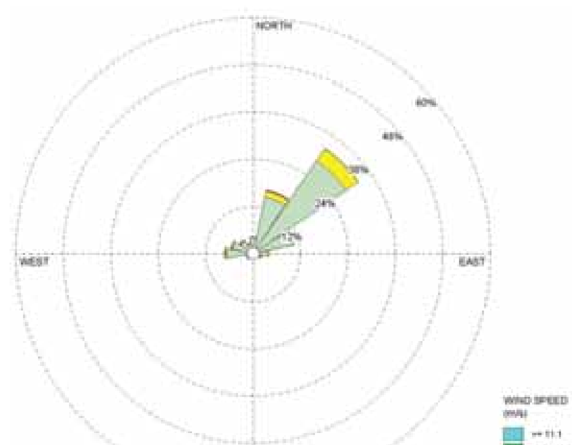
3:00 Hours, Average wind speed= 1.14 m/s



4:00 Hours, Average wind speed= 1.15 m/s

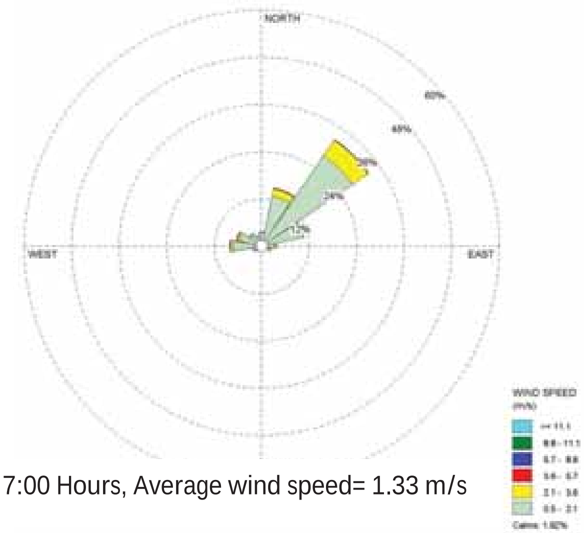


5:00 Hours, Average wind speed= 1.17 m/s

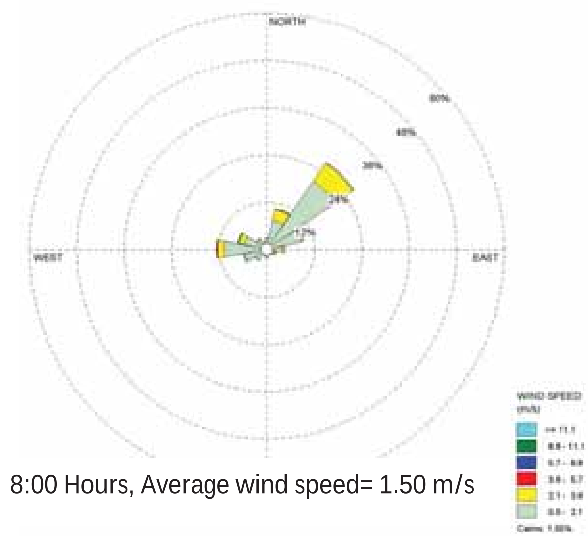


6:00 Hours, Average wind speed= 1.22 m/s

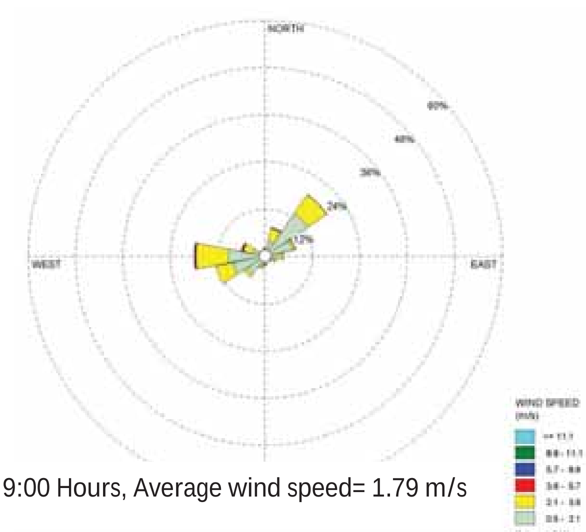
Notes:Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Hourly wind speed and direction, 1:00-6:00 hours**		
		Project No.14-1023	Created By: DT	**Figure A - 10**



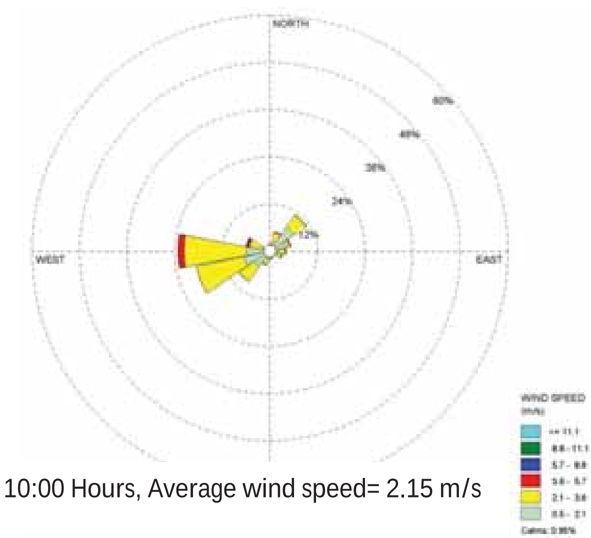
7:00 Hours, Average wind speed= 1.33 m/s



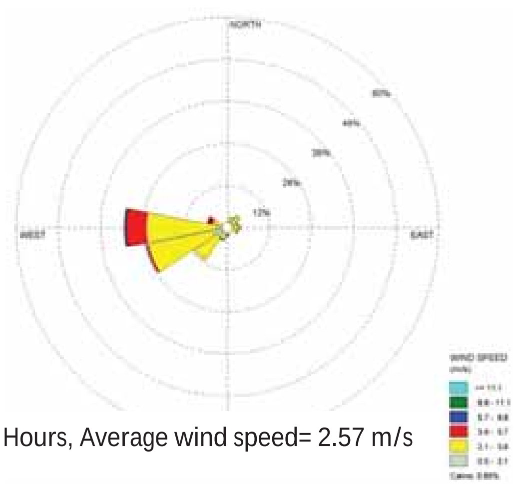
8:00 Hours, Average wind speed= 1.50 m/s



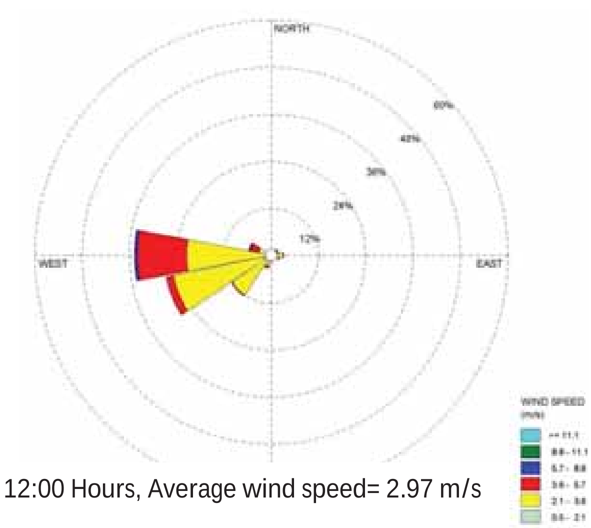
9:00 Hours, Average wind speed= 1.79 m/s



10:00 Hours, Average wind speed= 2.15 m/s



11:00 Hours, Average wind speed= 2.57 m/s



12:00 Hours, Average wind speed= 2.97 m/s

Notes: Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Hourly wind speed and direction, 7:00-12:00 hours**		
		Project No. 14-1023	Created By: DT	**Figure A - 11**

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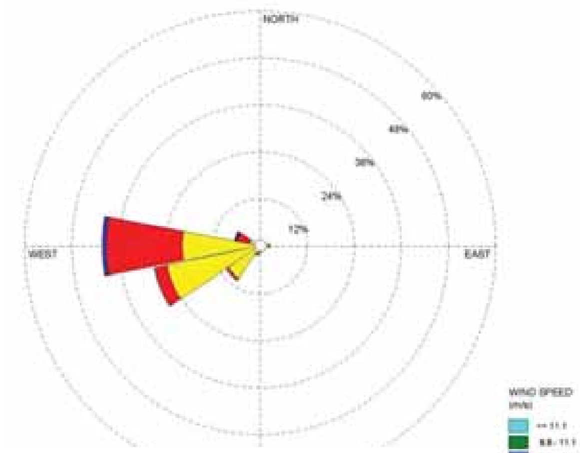
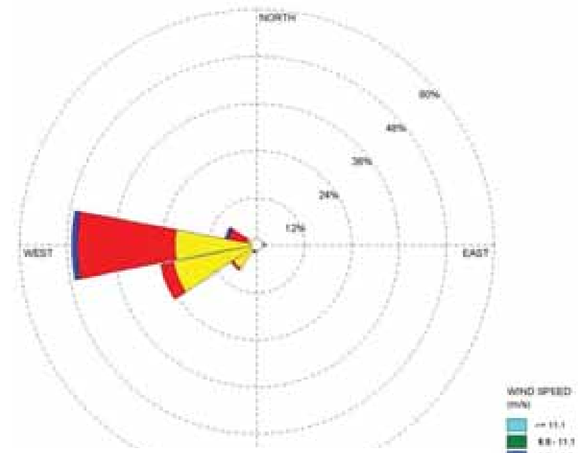
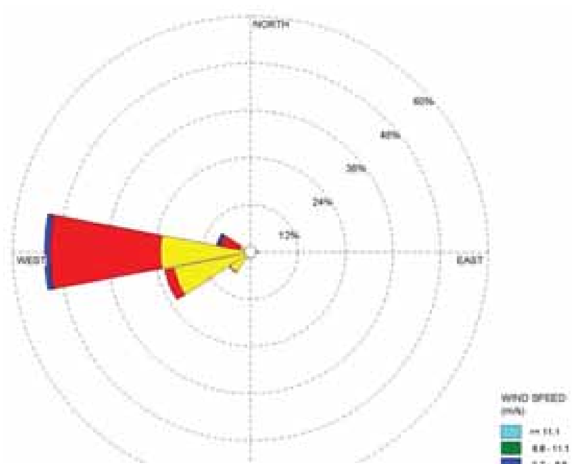


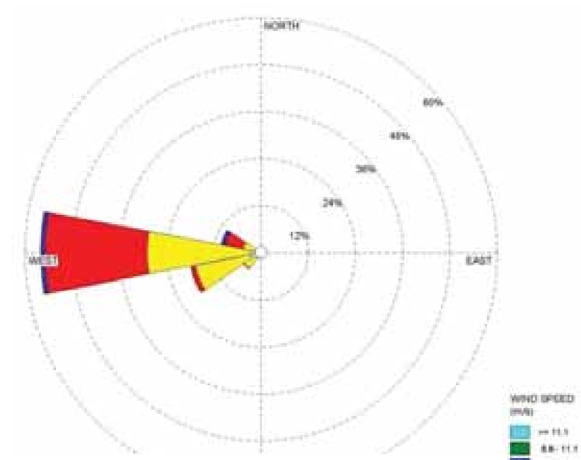
13:00 Hours, Average wind speed= 3.26 m/s



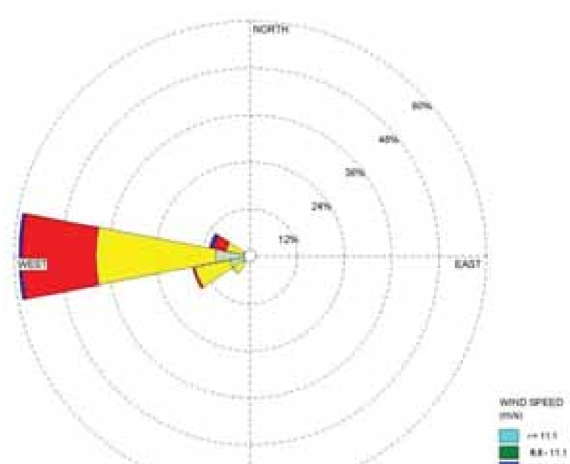
14:00 Hours, Average wind speed= 3.40 m/s



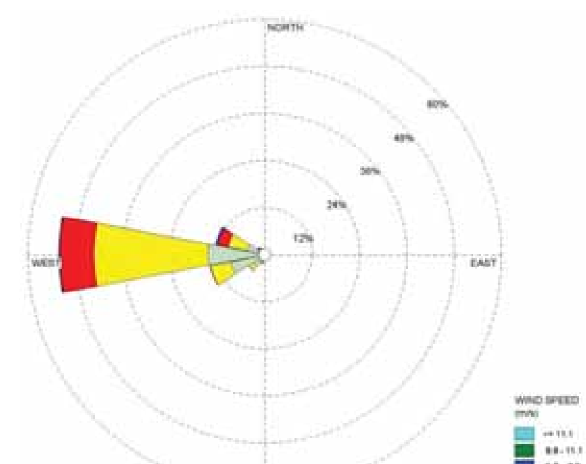
15:00 Hours, Average wind speed= 3.40 m/s



16:00 Hours, Average wind speed= 3.25 m/s



17:00 Hours, Average wind speed= 2.88 m/s



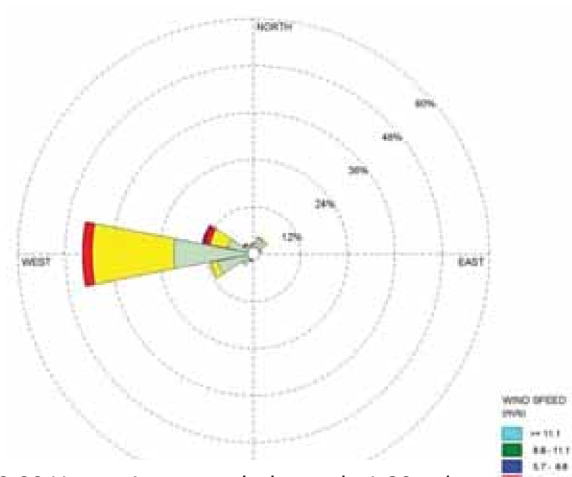
18:00 Hours, Average wind speed= 2.33 m/s

Notes:Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014

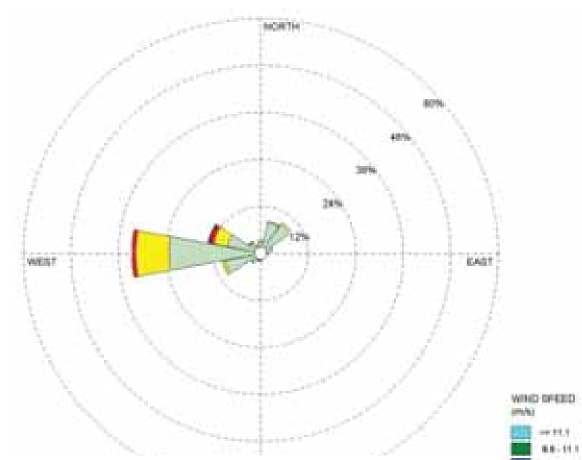
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Hourly wind speed and direction, 13:00-18:00 hours

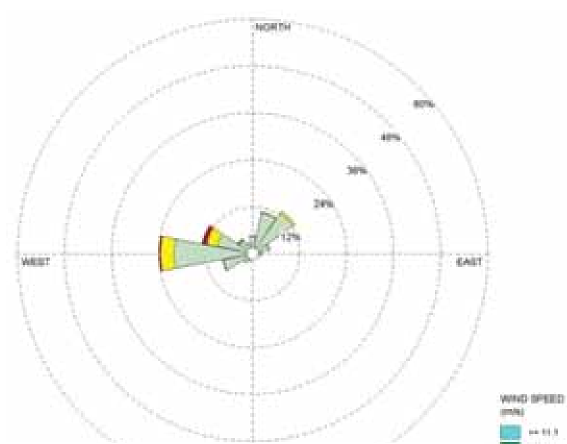
Project No.14-1023 | Created By: DT | **Figure A - 12**



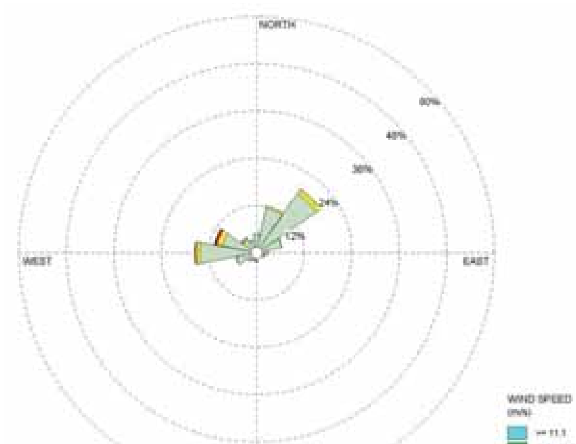
19:00 Hours, Average wind speed= 1.80 m/s



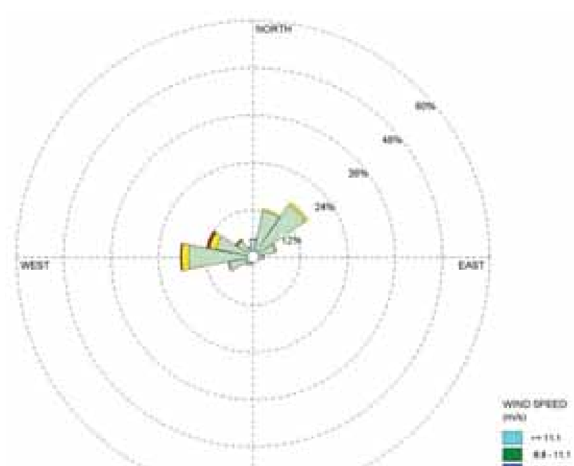
20:00 Hours, Average wind speed= 1.43 m/s



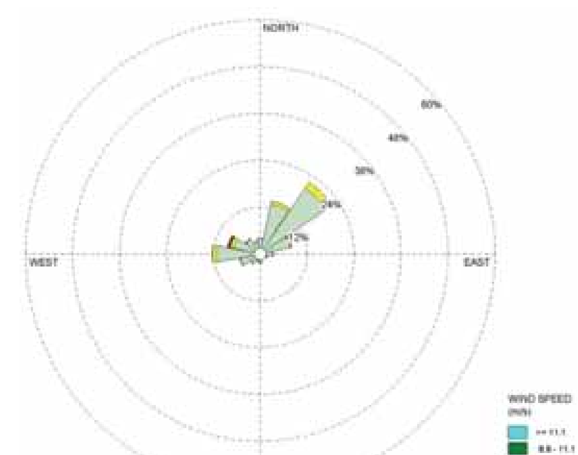
21:00 Hours, Average wind speed= 1.25 m/s



22:00 Hours, Average wind speed= 1.17 m/s

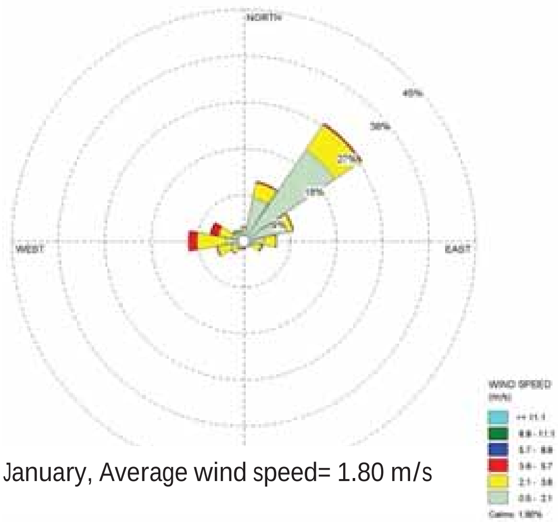


23:00 Hours, Average wind speed= 1.15 m/s

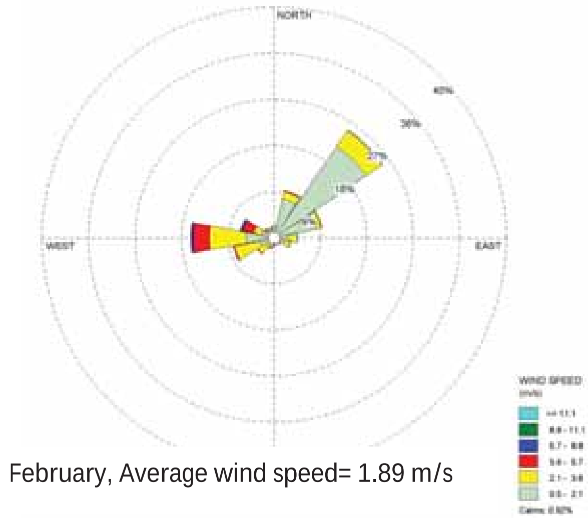


24:00 Hours, Average wind speed= 1.14 m/s

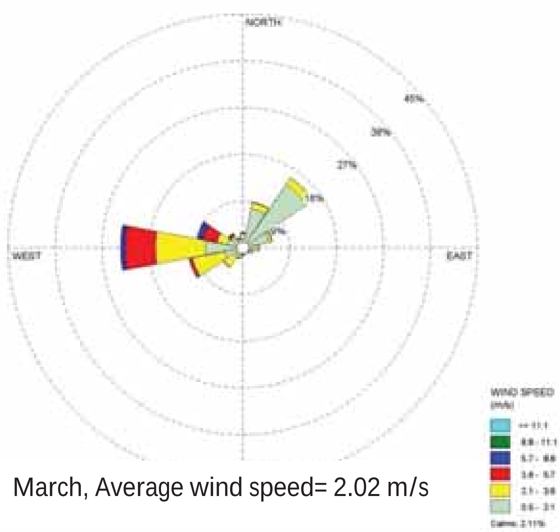
Notes:Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Hourly wind speed and direction, 19:00-24:00 hours** Project No. 14-1023 / Created By: DT / **Figure A - 13**



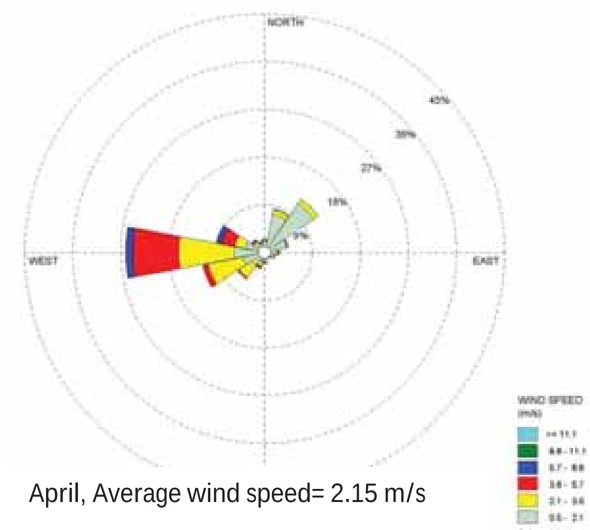
January, Average wind speed= 1.80 m/s



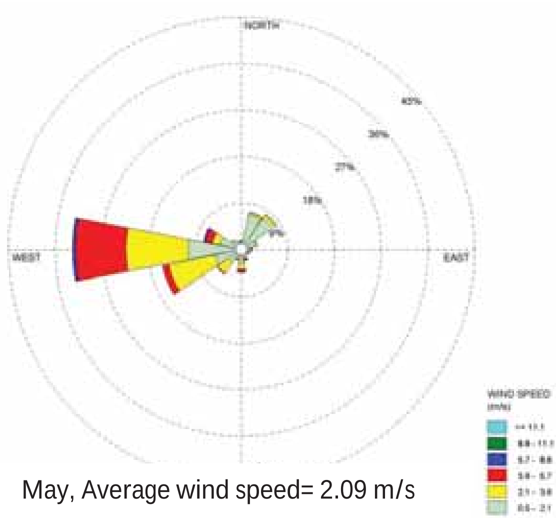
February, Average wind speed= 1.89 m/s



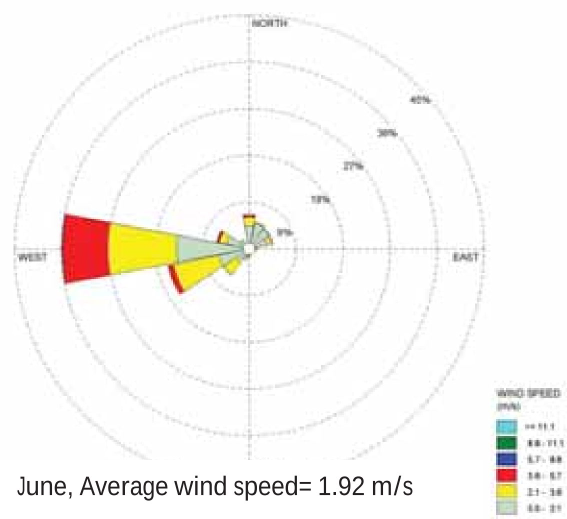
March, Average wind speed= 2.02 m/s



April, Average wind speed= 2.15 m/s



May, Average wind speed= 2.09 m/s



June, Average wind speed= 1.92 m/s

Notes:Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014

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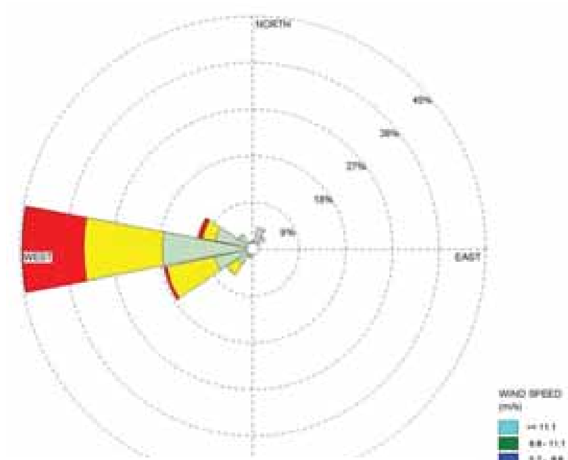
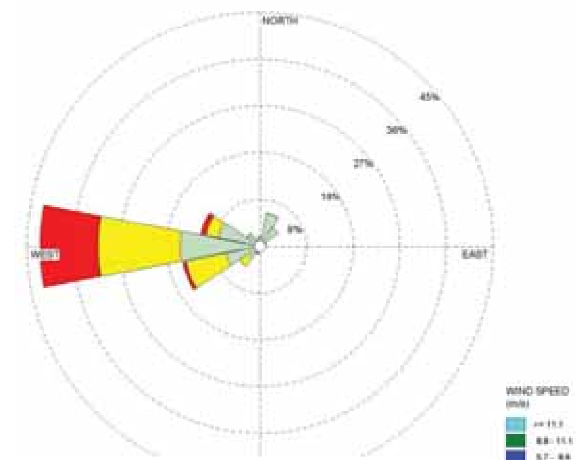
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Monthly wind speed and direction, January-June

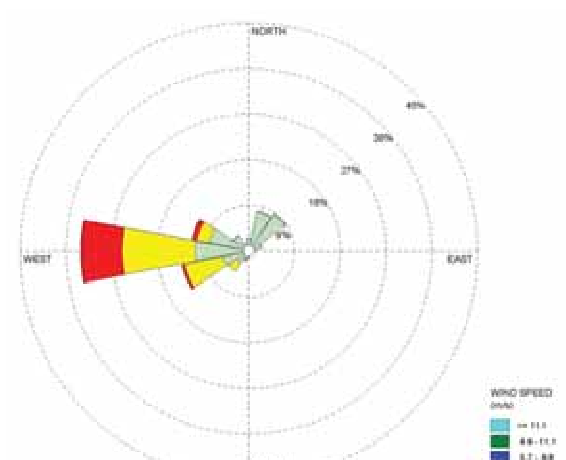
Project No.14-1023 | Created By: DT | **Figure A - 14**



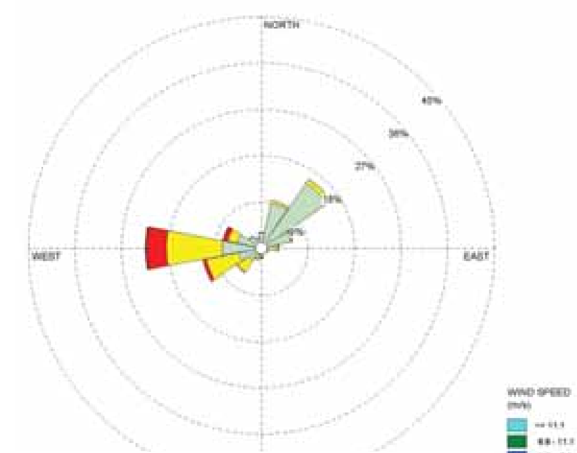
July, Average wind speed= 2.02 m/s



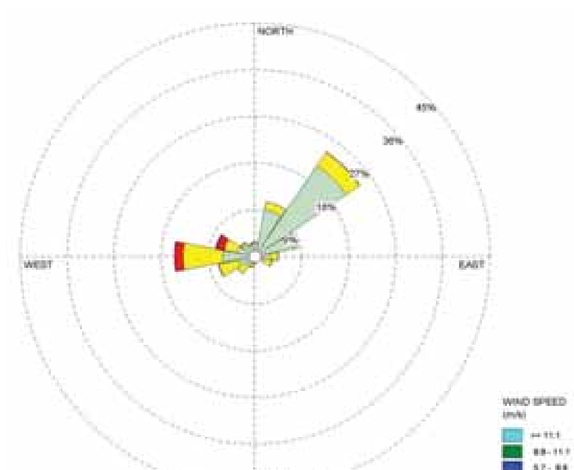
August, Average wind speed= 1.94 m/s



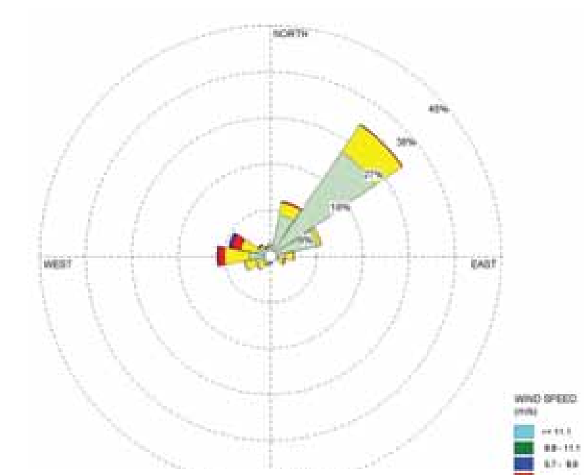
September, Average wind speed= 1.81 m/s



October, Average wind speed= 1.72 m/s

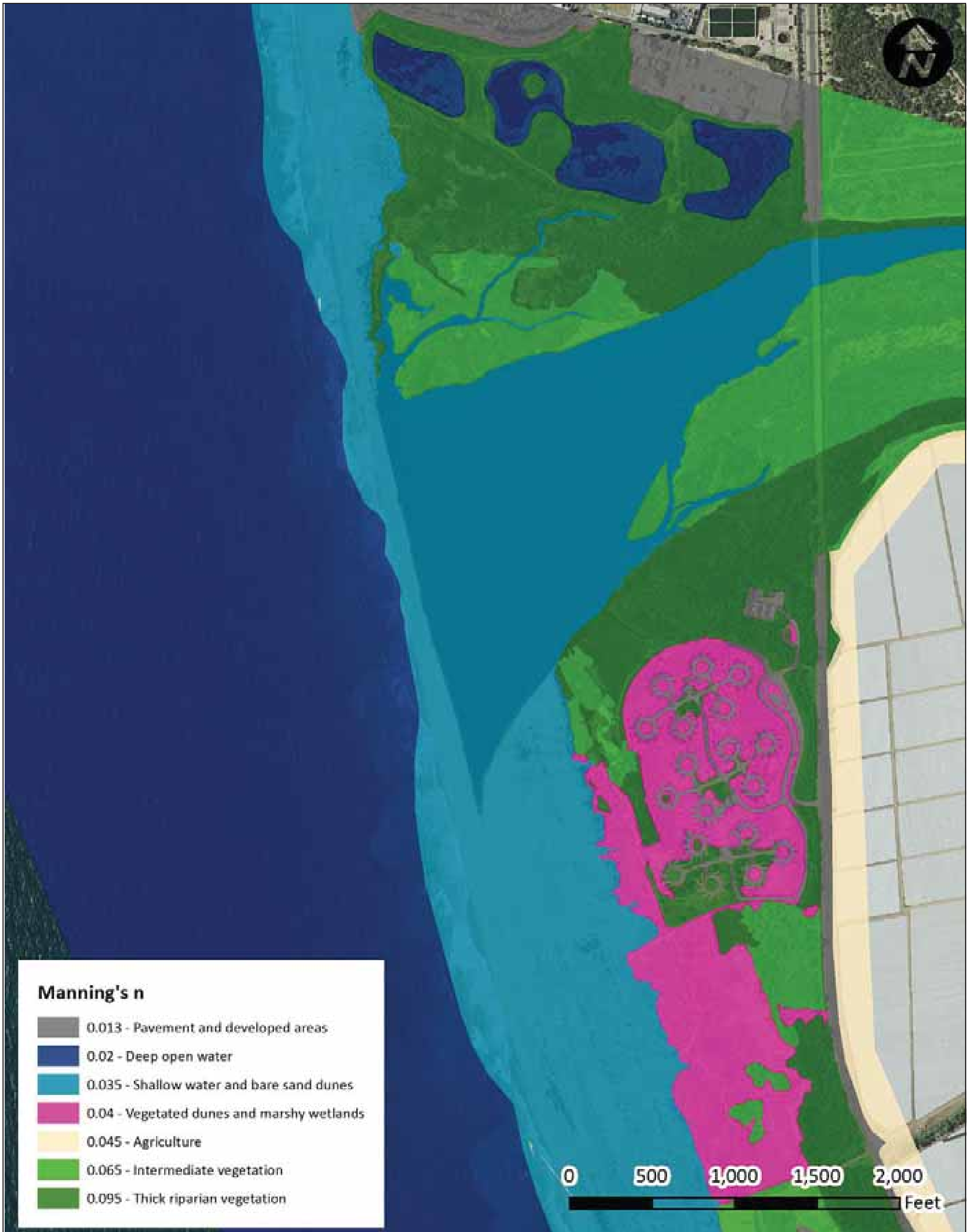


November, Average wind speed= 1.70 m/s

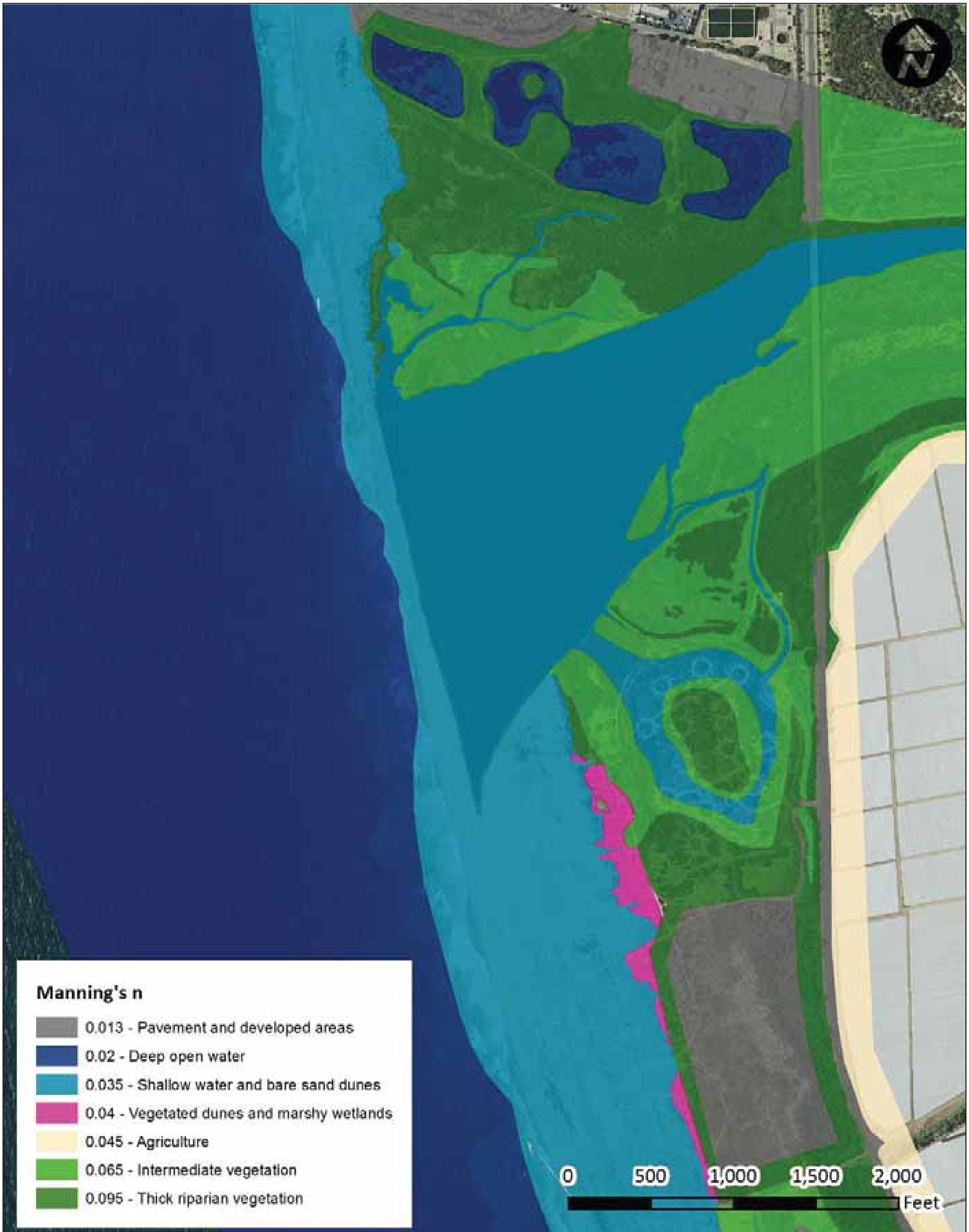


December, Average wind speed= 1.80 m/s

Notes:Wind data from CIMIS station #156: 10/12/2001 to 10/26/2014	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Monthly wind speed and direction, July-December**		
		Project No.14-1023	Created By: DT	**Figure A - 15**



Source: Background aerial - NAIP, 2014.	cbec	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Existing condition roughness**		
		Project No. 14-1023	Created By: DT	**Figure A - 16**



Source: Background aerial - NAIP, 2014.	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Preferred alternative roughness**		
		Project No. 14-1023	Created By: DT	**Figure A - 17**

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6/2/2015

4 SEDIMENT TRANSPORT

This section describes the development of the sediment transport simulations. Model boundary conditions included sediment discharge at the upstream boundary condition (based on the sediment load and hydrology of the SCR), bed material grain size (based on USGS and cbec sediment data), and an estimated bed thickness/erosion limit. A limited set of model simulations, performed with varying breach locations, indicated that overall erosion and depositional trends within the restored estuary are mostly independent of the specific breach location. Given these findings, and to keep comparisons straightforward, modeling efforts utilized a single breach location for the 2- and 10-year flood events. All boundary conditions were developed with U.S. customary units, but were converted to SI units for use in the MIKE 21 FM software.

4.1 SEDIMENT TRANSPORT THEORY

The Engelund-Hansen total load equation was used to simulate sediment transport. This equation was selected through an iterative process by which several transport equations were tested to achieve results that were most similar to observed geomorphic trends within the study reach. The Engelund-Hansen equation was used to simulate the transport of a 0.35 mm grain size, which was selected to represent both the incoming sediment load and bed material throughout the model domain. Grain sizes less than 0.062 mm are classified as washload/fines that do not interact with the bed, and are not considered in the available sediment transport formulas, and therefore, are not represented in the MIKE 21 FM model.

4.2 SEDIMENT TRANSPORT BOUNDARY CONDITIONS

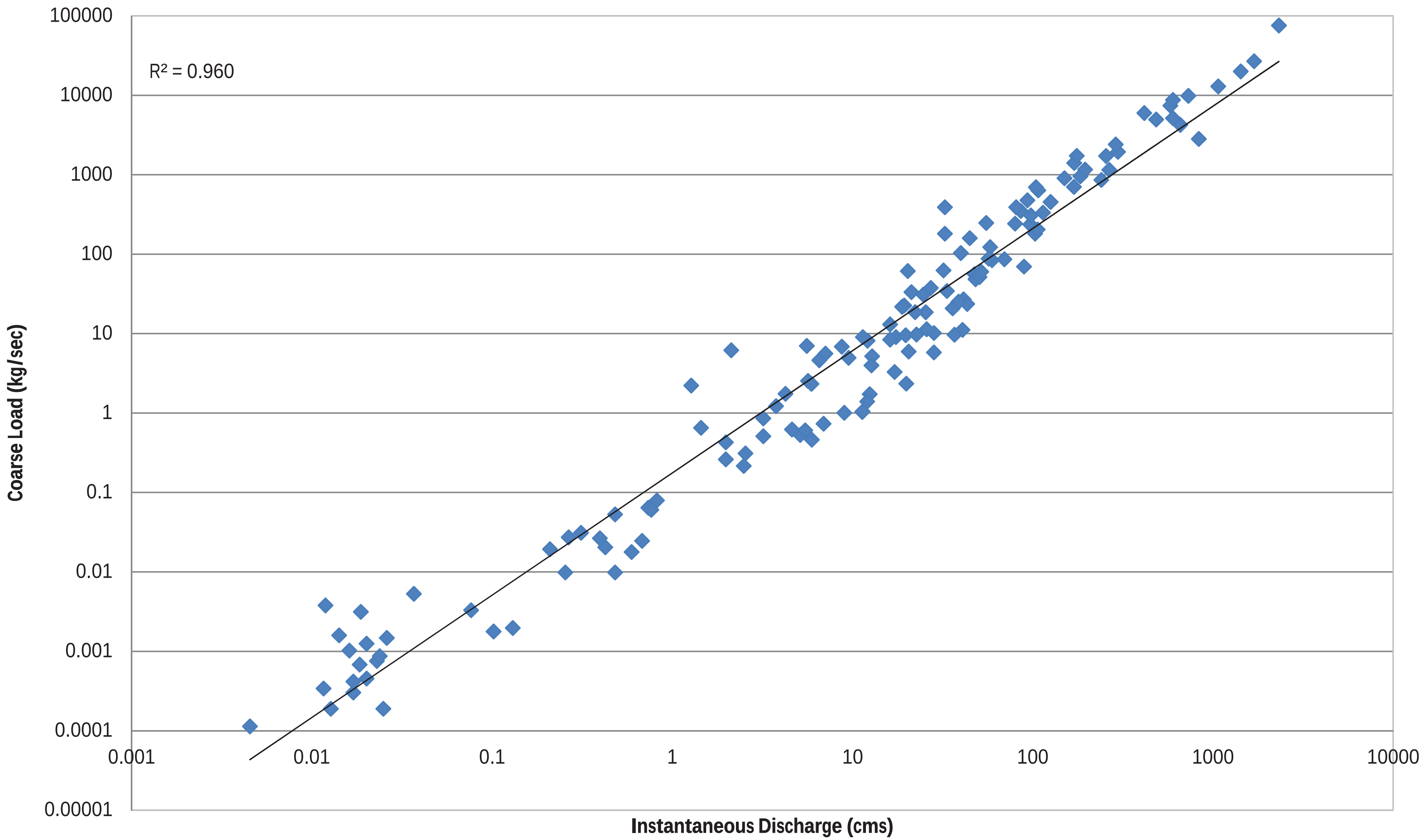
Sediment discharge and flow data collected at the USGS Montalvo gage (#11114000) from 1970 to 1995 facilitated the development of a sediment discharge rating curve, which was used to create the upstream model boundary conditions for the 2- and 10-year events. This rating curve was verified against the suspended sediment rating curve developed by Stillwater Sciences (2011). Based on the findings of Williams (1979) as reported in Stillwater Sciences (2011), bed load discharge was found to be approximately 6% of the suspended sediment load, and the sediment coarse load (bed and suspended load greater than 0.062 mm) is approximately 34% of the total sediment load. These relationships were applied to the suspended sediment rating curve to create a total coarse sediment load rating curve as shown by Figure A-18.

4.2.1 BED MATERIAL, THICKNESS AND REPRESENTATIVE GRAINSIZE

In the fall of 2014, cbec staff collected eight surficial bed sediment samples (Figure A-19) in the estuary and analyzed the particle size distribution associated with the sediment load data from the USGS Montalvo gage (#11114000). The surficial bed sediment was comprised of poorly sorted sand with a relatively narrow particle size distribution. The bed sediment samples were characterized by an average D16 of 0.22 mm, an average D50 of 0.36 mm, and an average D84 of 0.66 mm (Figure A-20). The incoming suspended sediment load (including fines less than 0.062 mm) exhibited an average D50 of 0.2 mm.

Since the MIKE 21 FM model is limited to simulating the transport of a single grain size for both the bed material and the sediment load, it was necessary to develop a representative grain size for these constituents. This was accomplished by averaging D50 of the bed sediment (0.036 mm) with the median grain size of the coarse (> 0.062 mm) suspended load (0.034 mm), which yielded a representative grain size of 0.035 mm.

The active bed material thickness was arbitrarily set at 7 meters (23 feet) for the estuary as this was considered an ample scour limit. Scour depths observed in the simulation results were significantly less than this limit.



Source: USGS Montalvo gage #11114000
Notes: Data from 1970-1995. Coarse load rating curve excludes size fractions less than 0.062mm.

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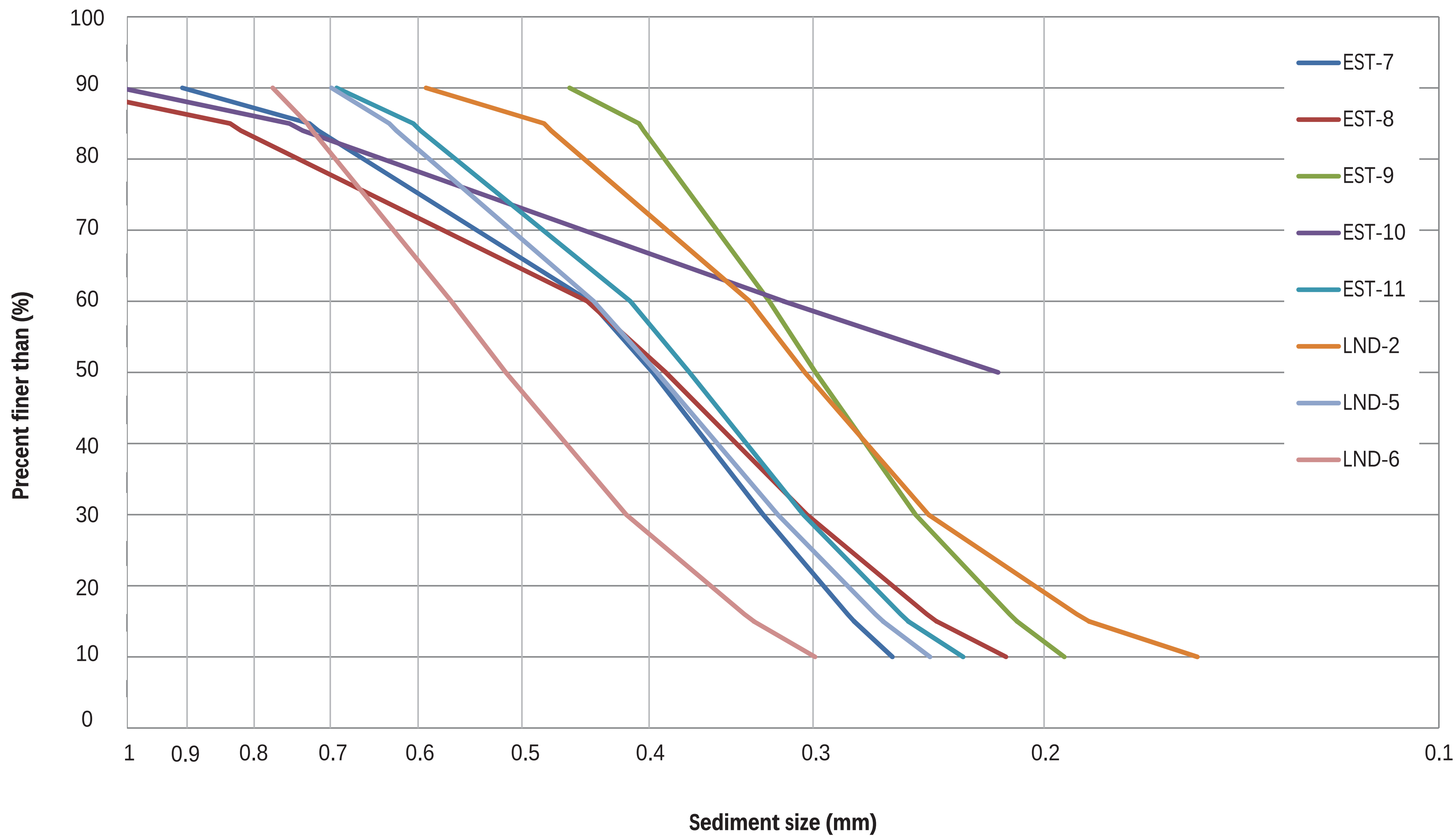
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Coarse load rating curve

Project No. 14-1023	Created By: DT	**Figure A - 18**

Source: 2014 cbec survey	cbec eco engineering	Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study **Estuary sediment sample locations**	
		Project No. 14-1023	Created By: DT	**Figure A - 19**



Source: Blackburn Consulting, 2014	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Estuary sediments - particle size distribution**		
		Project No. 14-1023	Created By: DT	**Figure A - 20**

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6/2/2015

5 WATER QUALITY BOUNDARY CONDITIONS

This section describes the development of the water quality boundary conditions used in the various model simulations. These boundary conditions included initial estuary temperature and salinity, VWRF inflows and temperatures, groundwater inputs and heat exchange parameters (solar radiation, air temperature, and humidity). All boundary conditions were developed with U.S. customary units, but were converted to SI units for use in the MIKE 21 FM software.

5.1 INITIAL ESTUARY CONDITIONS

Water temperature data collected by Stillwater Sciences in 2009-2010 and air temperature data obtained from the CIMIS #156 weather station were used in the selection of the initial estuary water temperature for the model simulations. During open berm conditions, water temperatures range from wintertime lows near 12 ^{o}C to summer time highs near 23 ^{o}C . During closed berm conditions, water temperatures up to 25 ^{o}C were reported (Stillwater Sciences, 2011). An initial water temperature of 12 ^{o}C was ultimately selected as the simulation was initiated at the beginning of March, which typically corresponds to annual average low temperature shortly after berm closure.

Salinity within the estuary is highly variable to ocean exchange and wind mixing during both open and closed berm conditions. Historical samples showed salinity near the estuary mouth ranged from 5-11 ppt depending upon the time since the mouth closure (Stillwater Sciences, 2011). An initial salinity of 11 ppt ultimately selected for initial salinity condition as the simulation was initiated at the beginning of March, which typically corresponds to timeframe shortly after berm closure.

5.2 VWRF DISCHARGE AND TEMPERATURE

Monthly average VWRF effluent discharge for 1984-2010 was derived from Stillwater Sciences (2011) and represented in the model as a point source inflow. Monthly average effluent temperature was derived from VWRF annual reports from 2002-2009 (Table 5).

5.3 SUBSURFACE FLOW THROUGH THE MOUTH BERM

To include a limited characterization of subsurface flows, many of which could not be directly modeled with the MIKE 21FM software, the hydrodynamic model domain was adjusted so that the downstream model boundary was located along the mouth berm. This adjustment allowed for the use of a rating curve to model the subsurface groundwater flow through the berm as a direct function of the water level in the estuary (see Figure A-21). The rating curve for the mouth berm was developed through adaptation of the field data collected by Stillwater Sciences (2010) from 2009 to 2010 coupled with interpretation of the corresponding water balance analysis (Stillwater Sciences, 2011). While the measurements were obtained in a relatively wet year, these relationships were the best available data and, when incorporated into the hydrodynamic model, yielded water level results that were generally consistent observations.

Table 5. Monthly average VWRF effluent discharge and temperature

Month	Discharge (cfs)	Temperature (°C)
January	12.45	17.3
February	13.1	17.8
March	12.3	19.7
April	11.3	21.4
May	10.9	23.0
June	10.7	23.7
July	10.6	24.6
August	10.8	24.5
September	10.9	23.8
October	11.10	21.9
November	11.40	19.6
December	11.30	17.3

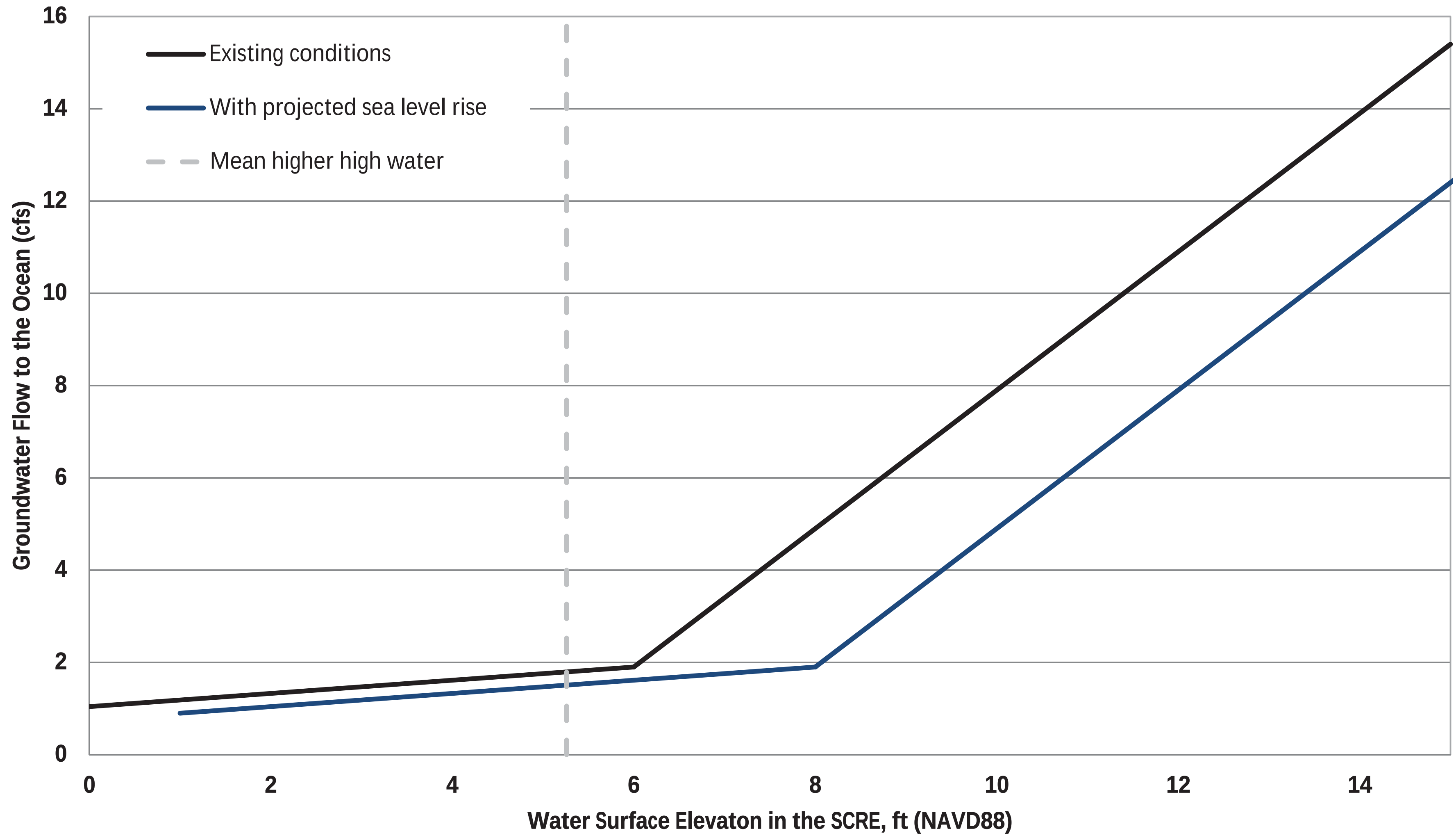
Other groundwater flows (e.g., subsurface flow the VWRF wildlife ponds, ground inflows from upstream, exchange with McGrath lake, etc.) could not be included in the hydrodynamic model, but were more fully were characterized in the spreadsheet-based water balance model developed for the Project (see Appendix B).

5.4 HEAT EXCHANGE PARAMETERS

Heat exchange parameters used in the model included latent heat flux (evaporation), sensible heat (convection), short wave and long wave radiation, and atmospheric conditions (e.g., cloudy, clear).

The latent heat module is based on Dalton's law which calculates loss of energy due to evaporation. Sensible heat equations calculate heat transfer between the water and the atmosphere. For both parameters, default values were selected. The average wind speed of 1.89 m/s was used as the as the critical wind speed.

Solar radiation, air temperature, and humidity data were obtained from the CIMIS (#156) weather station at Oxnard for the period of record: 10/2001 – 10/2014. Hourly time series were created by calculating the average hourly value for each hour of the year over the period of record. Solar radiation was recorded in Watts/m^2 (Figure A-22), air temperature in °C (Figure A-23), and humidity as a percent (Figure A-24). The default value of 70% was used for clarity (where 100% is clear skies).



Notes: Derived from data collected and reported in Stillwater Sciences, 2011	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Circulation model – groundwater flow to ocean**
		Project No. 14-1023 / Created By: DT / **Figure A - 21**

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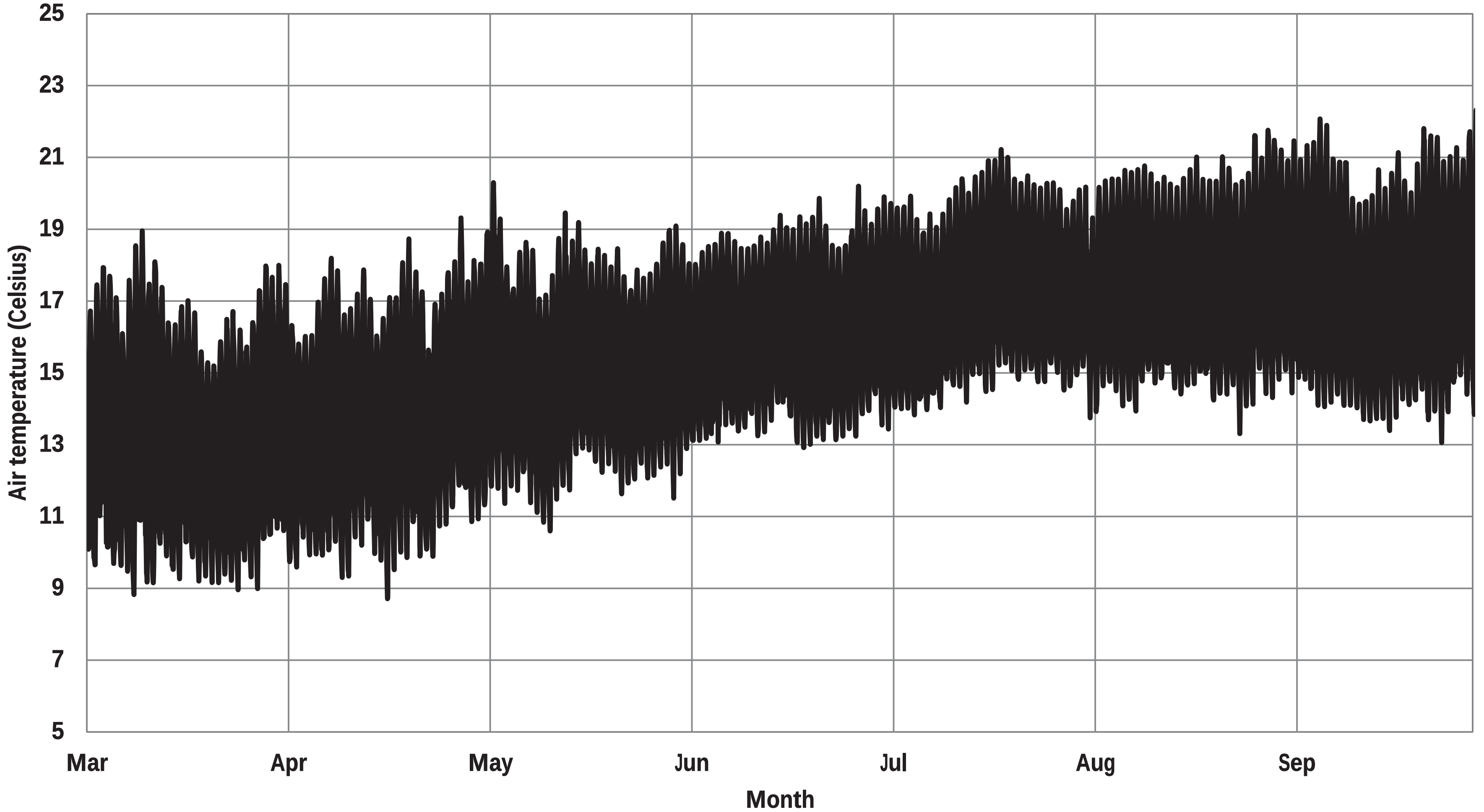
6/2/2015



Source: CIMIS #156 weather station at Oxnard, CA
Notes: Hourly data downloaded for 10/2001 to 1/2015. Graphic shows average air temperature for each hour of each day for March thru September for the period of record.

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Air temperature

Project No. 14-1023 | Created By: DT | **Figure A - 22**

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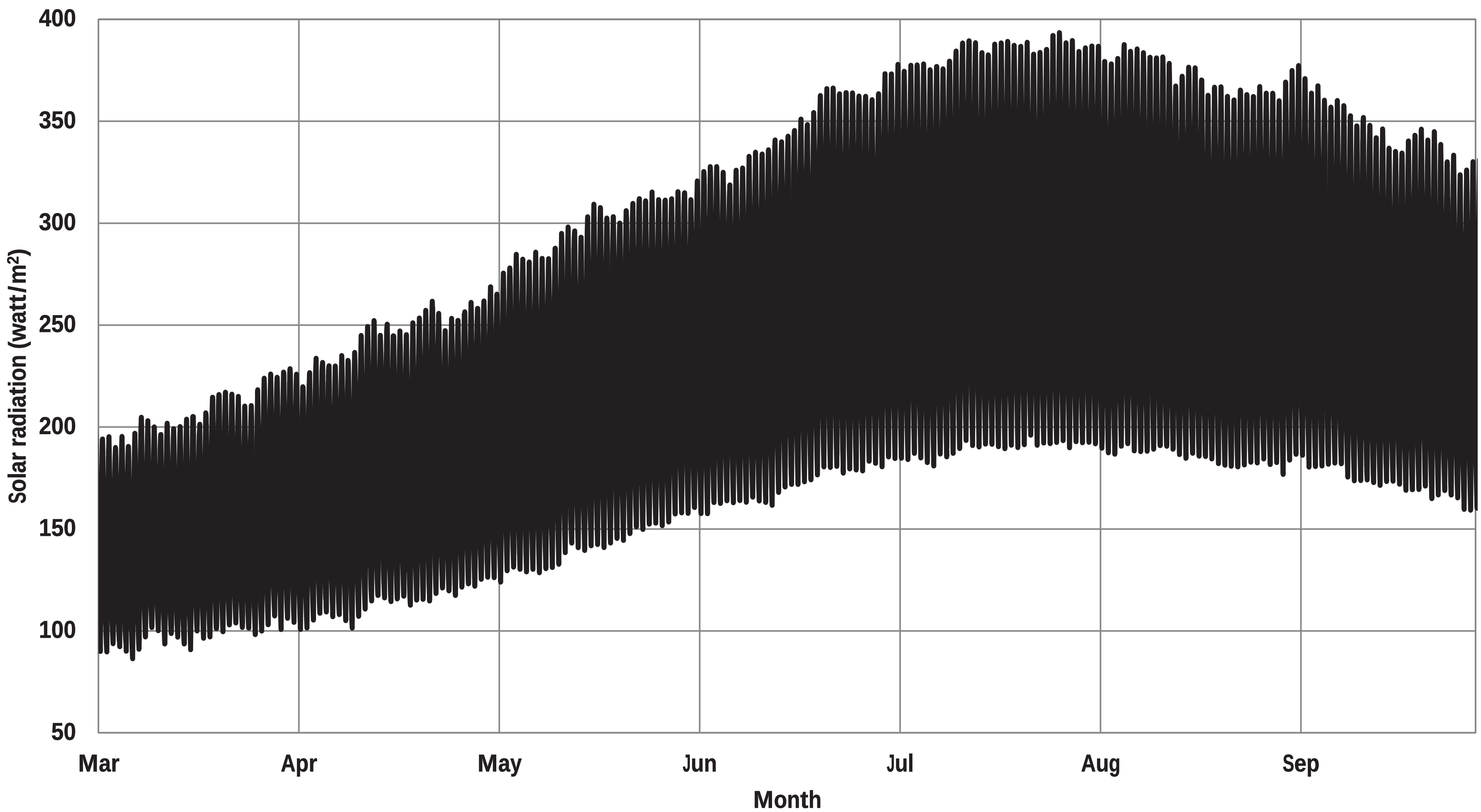
6/2/2015

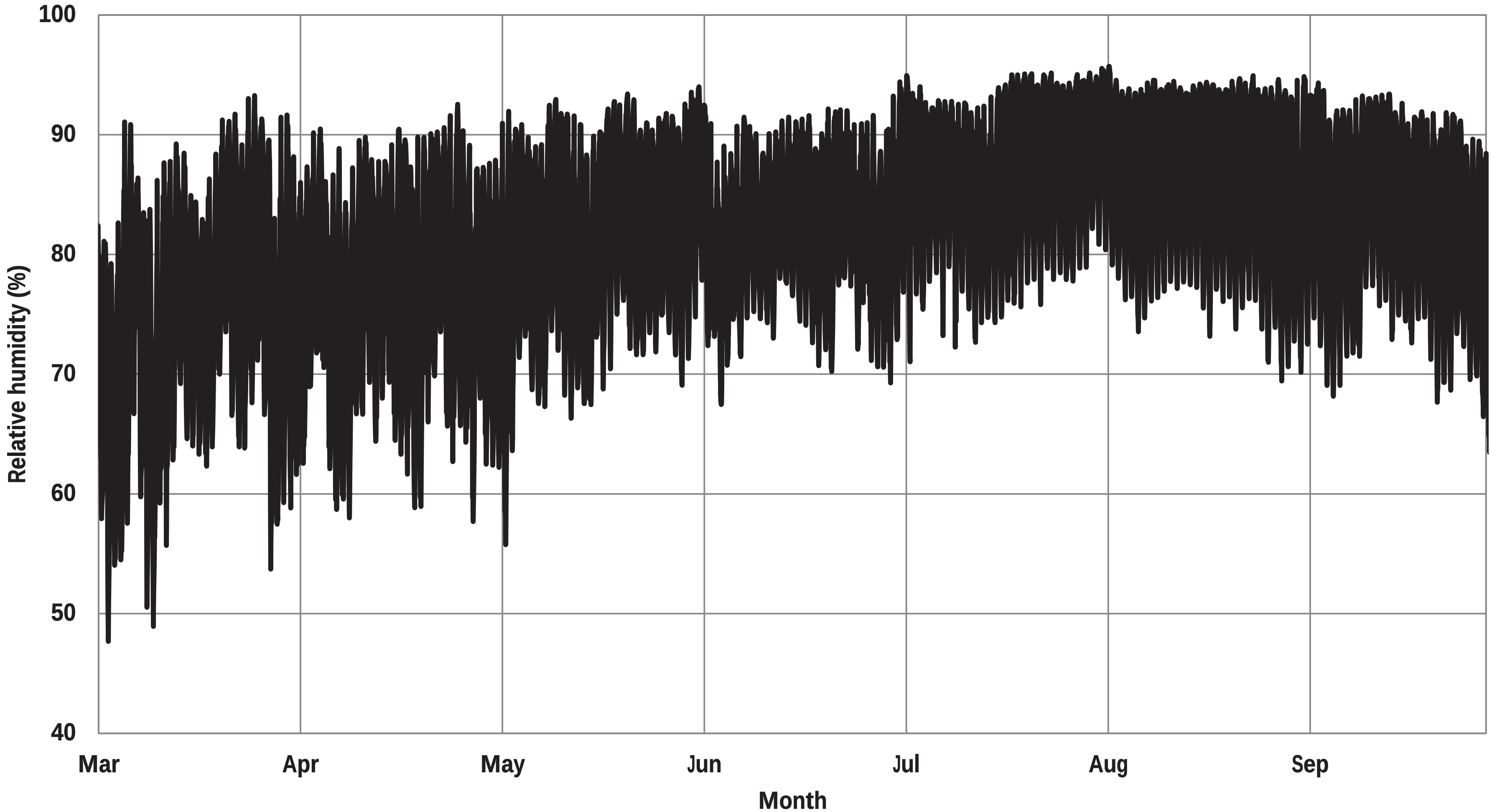


Source: CIMIS #156 weather station at Oxnard, CA
Notes: Hourly data downloaded for 10/2001 to 1/2015. Graphic shows average solar radiation for each hour of each day for March thru September for the period of record.

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Solar radiation

Project No. 14-1023	Created By: DT	**Figure A - 23**



Source: CIMIS #156 weather station at Oxnard, CA
Notes: Hourly data downloaded for 10/2001 to 1/2015. Graphic shows average relative humidity for each hour of each day for March thru September for the period of record.

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Relative humidity

Project No. 14-1023	Created By: DT	**Figure A - 24**

6 MODEL ASSUMPTIONS AND LIMITATIONS

Hydrodynamic, sediment transport, and water quality models are useful tools that aid in the understanding of physical and biological processes, but it is important to recognize the assumptions and limitation of these tools. This section describes the major assumptions and limitations of the analysis conducted for this effort:

- Topography and bathymetry were represented with a discrete triangular mesh. Important linear features such as sloughs, roads, and levees were delineated in GIS and represented in the topographic mesh. Mesh resolution within the SCRE and restoration area ranged from a triangular mesh with a maximum area of 50 to 150 m^2, and were assumed appropriate to the project and site. Model calculations and results were generated at the scale of the mesh resolution and cannot represent finer scale results.
- MIKE 21 FM is a 2D depth-averaged model, meaning depth-dependent variables (e.g. velocity, temperature, concentration, etc.) were characterized by a single average value. Results do not characterize the vertical concentration gradient of sediment or thermal and salinity stratification within the water column.
- The model is limited to 2D flow phenomenon, and does not simulate other three-dimensional (3D) phenomenon such as the vertical and lateral erosion of the mouth berm sands during a breach event.
- The model was not calibrated to observed water levels and scour patterns as appropriate data were not available to support this effort and because the primary objective was a comparative evaluation of restoration alternatives.
- The MIKE 21 FM sediment transport model is a tool for assessing potential geomorphic change; sediment transport results were not intended to be taken as absolute and should be interpreted to imply probable trends (not absolutes) with order-of-magnitude levels of accuracy.
- All sediment transport simulations used the Engelund-Hansen sediment transport equation. This equation was selected through an iterative process by which several transport equations were tested with the model to achieve results that were most similar to patterns of erosion and deposition observed within the study reach.
- The MIKE 21 FM sediment transport model was not calibrated for sediment transport and geomorphic change, as appropriate data were not available to support this type of effort. However, model boundary conditions were based on measured data from the USGS Montalvo gage.
- Modeling results were derived from simplified, depth-averaged, 2D representations of complex, 3D processes.
- The MIKE 21 FM model was limited in simulating the transport of sediment as a single grain size, which prompted the need to represent the bed material and sediment load with a single representative size fraction. The methods for this determination are included in Section 4. Although this was a limitation of the model, the impact was likely not significant as the sediment load and surficial sediments in the estuary are poorly graded with a relatively narrow size distribution.

- Models did not include any considerations for wave action or littoral transport and did not simulate the initial breaching or the subsequent rebuilding of the mouth berm.
- Water quality model results were dependent on the heat exchange input parameters (which were developed based on average conditions). Water temperature data (which was collected at mean depth) indicated that temperatures can fluctuate 2 to 4 ^{o}C in any given day. However simulated water temperature fluctuations were limited to only 1 ^{o}C of variation per day. This disparity is most likely attributed to the depth-averaged nature of the model and the use of averaged input parameters, such as hourly solar radiation obtained from the CIMIS weather station in Oxnard. This weather station was the closest weather station to the SCRE and had the best available data, but may not accurately reflect local conditions at the SCRE.
- Other known limitations pertain to uncertainty related to future climate changes, future upstream developments, and management actions related to the VWRF discharge.
- Groundwater and SCRE stage relationships were developed based on data collected by Stillwater Sciences (2010) during a wet year (2009-2010) and therefore, these relationships may not be appropriate with different climatic or hydrologic conditions. These relationships were the best available data for this analysis and this model.
- Removal or reduction of VWRF effluent flows may allow vegetation encroachment near the existing outfall channel or elsewhere within the SCRE due to lower water levels. The vegetation mapping (hydraulic roughness) used in these simulations does not account for future changes to vegetative conditions.
- The model was developed using present-day relationships observed between water levels and groundwater flows. Variability in future groundwater levels may affect the accuracy of model predictions.

APPENDIX B – WATER BALANCE MODEL

APPENDIX B - WATER BALANCE MODEL TECHNICAL MEMORANDUM

Date:	7/27/2015
To:	Jason Weiner, M.E.M., Wishtoyo Foundation's Ventura Coastkeeper Program
From:	cbec eco engineering - Chris Hammersmark, Dale Meck, John Stofleth, Denise Tu
Project:	Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study - Project # 14-1023
Subject:	Water Balance Model

1 INTRODUCTION

A spreadsheet-based water balance model was initially created to allow for simple scenario modeling to estimate the seasonal water surface levels of the SCRE as a deliverable for a previous pilot feasibility study supported by USFWS Agreement No.: 81440-B-J317 (cbec project #14-1001). To support the Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study (Project), the water balance model was adapted and refined to help inform the development of the Preferred Restoration Concept, to allow for improved groundwater formulations which enabled additional scenarios not appropriate for modeling with the more powerful (but slower and more intensive), two-dimensional (2D) hydrodynamic model (MIKE 21FM) also developed for the Project (see technical Appendix A).

Though the spreadsheet-based water balance model relied on the data and stage/flow relationships developed through a more extensive water balance study previously completed by Stillwater Sciences (2011), the overall approach use for this effort is distinct. Instead of endeavoring to measure all the various inflows and outflows over a specific calendar period, this spreadsheet model used averaged monthly and daily historical data and thus functions as more of an analysis tool than a detailed scientific study.

This technical appendix provides additional technical information related to the refinements made to the water balance model including the addition of improved subsurface rating curves, limited groundwater inflows, and sea level rise (SLR). The objective was to allow for a better understanding of the seasonal trends and hydrologic drivers influencing the estuary water levels. For background on the Project, a description of the Preferred Restoration Concept, and interpretation of key model results, see the main body of the Feasibility Study.

The primary limitation of the MIKE 21FM model, is that the software is designed for surface water flows, not distributed or stage-dependent groundwater flows. While the MIKE 21FM approach is appropriate at the current Ventura Wastewater Reclamation Facility (VWRF) discharge rate (and even with a 50% reduction) because of the relative magnitude of the VWRF discharge volume when compared to other estuary inflows during extended closed-berm conditions, this assumption becomes less valid as further reduction scenarios are considered and groundwater flows would become relatively more important. The City of Ventura's Phase 3 Special Studies are expected to provide additional groundwater data, including seasonal flow patterns and groundwater temperatures, which should be used to refine the water balance model.

This appendix is organized into two sections. Section 2 briefly describes the underlying water balance approach and the formulation of the equations used by the water balance model. Section 3 describes the flow rates and subsurface rating curves developed for the model scenarios. All elevations are given in feet relative to the North American Vertical Datum of 1988 (NAVD88).

2 WATER BALANCE APPROACH

The water balance model assumed zero river inflow (corresponding to extended dry season conditions) and then used a simple conservation of volume approach based on the remaining flows into and out of the estuary on a daily basis:

change in estuary volume = Inflows – Outflows

where *Inflows* includes subsurface flow from the VWRF ponds, VWRF discharge, groundwater flow from McGrath Lake, and groundwater inflow from upstream

and *Outflows* includes subsurface flows to the Pacific Ocean, flows to McGrath Lake, and evaporation

Other inflows and outflows may exist, but were not included (e.g. evapotranspiration, river inflow, etc.). Using hypsometric curves (which relate surface area and estuary volume to water levels) developed for the existing estuary and the grading of the estuary proposed by the Preferred Restoration Concept, the change in estuary volume from one day to the next can then be translated into changes in water surface elevation (which influences the subsurface flow rates) and changes in surface area (which influences the average daily evaporation volumes).

The approach required the assumption of an initial water surface elevation and a finely resolved hypsometric relationship to allow for the use of lookup functions based on potentially small stage and volume changes in any given day. The model did not simulate the actual movement of water within the estuary and therefore did not provide estimates of temperature, water depth, or velocity. The water balance method relied on daily and monthly averages and reflects a very simplified approach to modeling a complicated and changing natural system; results are not predictive and inaccuracies exist.

The water balance model was set up so that input parameters (e.g. sea level rise, groundwater flows, potential VWRF discharge reductions, etc.) could be toggled on or off or depending on the scenario being analyzed. The simplified version of the water balance model included only VWRF discharge, evaporation, and subsurface flow the mouth berm (to more closely match the inputs provided to the hydrodynamic model. The enhanced version of the water balance model also included groundwater exchange with McGrath Lake, subsurface flow from the wildlife ponds, and other groundwater inflows from upstream sources. Seasonal water level trends indicated by the water balance model are generally considered superior to the results provided by MIKE 21FM though the differences between the results were relatively minor.

3 FLOW RATES AND RATING CURVES

This section describes the development of the flow rates and rating curves used in the water balance model and in the various model scenarios. These input parameters included evaporation (based on monthly pan evaporation rates), seasonal VWRF discharge flows (based on monthly averaged data), and estimated groundwater flows (both as flows dependent on the estuary water level and as independent, but seasonally-variable inflows). The flow rates and rating curves were simple, estimated relationships based on the available data and will not typically reflect actual site conditions at any given time. These relationships will change in the future and should only be used to provide general qualitative information related to estuary water levels and the various scenarios built into the model. All water balance model parameters were developed with U.S. customary units.

3.1 EVAPORATION

Monthly average pan evaporation rates were acquired from the Ventura County Watershed Protection district (VCWPD) Hydrologic Data Server (Site #239). Though located several miles inland from the SCRE, the VCWPD site was the best readily available evaporation data. Given the relatively small magnitude of the evaporation compared to VWRF discharge and groundwater fluxes, potential inaccuracies in the evaporation rate because of the coastal site and inland monitoring site were considered relatively inconsequential. Pan evaporation rates were reduced by 30% to approximate open water evaporation rates (Table **1**) based on Linacre, 1994 as reported in Stillwater Sciences (2011). Evaporation at the SCRE will vary from day to day and may be higher or lower than the values used in the water balance model.

Table 1. Monthly average open water evaporation

Month	Evaporation (in/month)
January	2.55
February	2.64
March	3.33
April	3.96
May	4.30
June	4.49
July	4.81
August	4.62
September	3.88
October	3.39
November	2.95
December	2.55

3.2 VWRF DISCHARGE

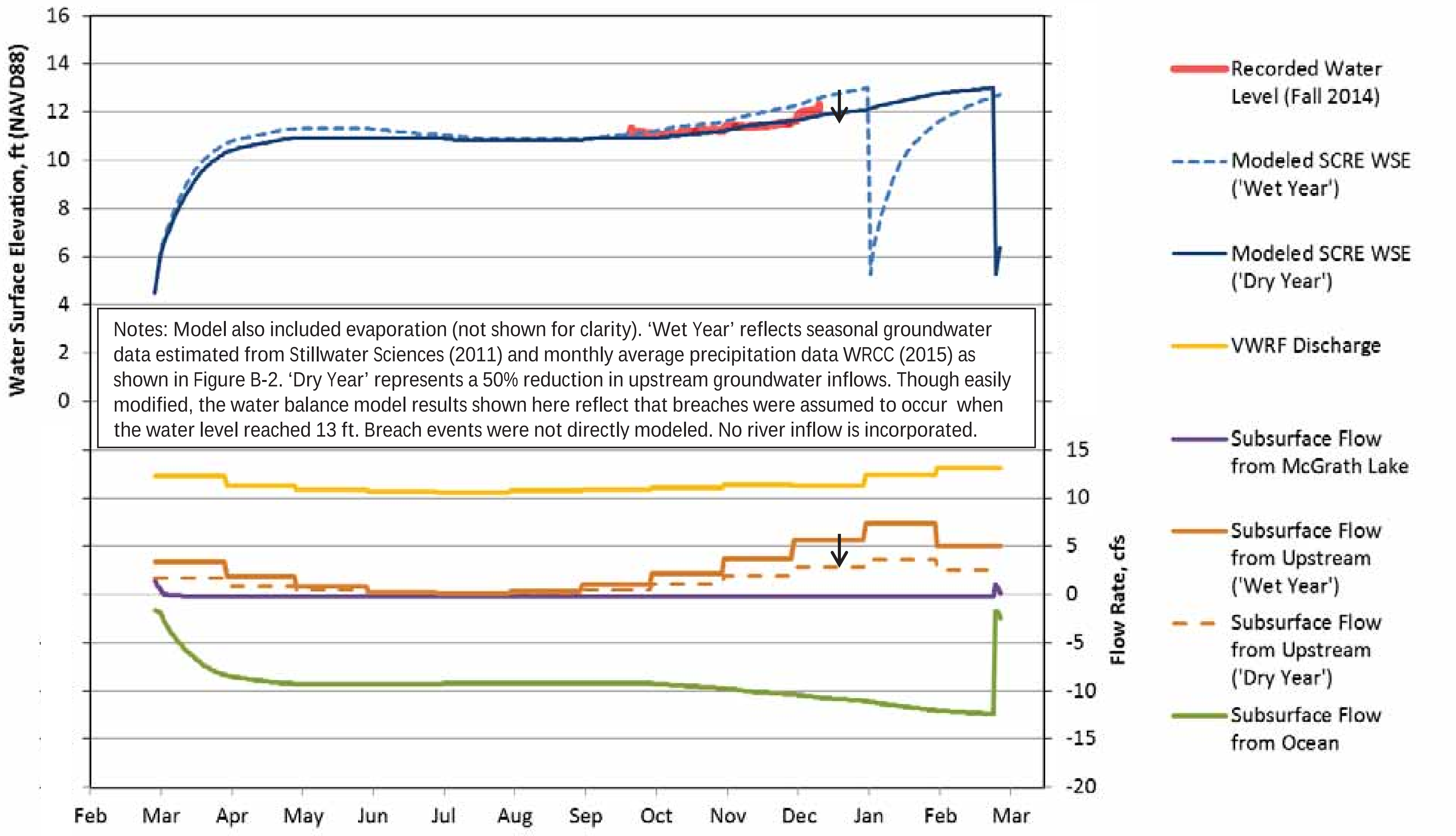
The water balance model used a monthly average, daily mean VWRF effluent discharge (shown in Table 2) which was derived from VWRF discharge records for the period 1984-2010 (Stillwater Sciences, 2011). The model was then modified to allow simulations to explore what water levels might be anticipated with potential reductions in the VWRF discharge rate. This was done by multiplying each monthly value by a specified percentage. To provide bookends and the midpoint of the potential ranges, 0% (current discharge), 50%, and 100% (complete discharge removal) reduction scenarios were considered. As discussed in the Feasibility Study this functionality was intended to allow the Preferred Restoration Concept to be developed to provide enhanced ecological function and improved habitat for a wide range of potential water levels. It does not provide any direct conclusions as to whether one particular discharge reduction value is preferred over another. The 100% discharge reduction scenario corresponds to complete removal of the surface discharge, but includes subsurface flows from the wildlife ponds (see Section 3.3.1). Complete removal of all VWRF discharge (including both surface discharge and the estimated subsurface flows) was determined to be beyond the reasonable use of the water balance model as currently formulated. When groundwater flow patterns are better quantified via the City of Ventura Phase 3 Special Studies, the water balance model could be readily refined.

Table 2. Monthly average VWRF effluent discharge

Month	Existing Discharge (cfs)	50% Reduction Scenario(cfs)
January	12.45	6.23
February	13.1	6.55
March	12.3	6.15
April	11.3	5.65
May	10.9	5.45
June	10.7	5.35
July	10.6	5.30
August	10.8	5.40
September	10.9	5.45
October	11.10	5.55
November	11.40	5.70
December	11.30	5.65

3.3 GROUNDWATER FLOWS

In addition to the subsurface flow through the mouth berm (which was also utilized by the hydrodynamic model, and described in Appendix A), the water balance model was further enhanced to include several additional groundwater flow relationships including subsurface flow from the unlined VWRF wildlife ponds (Section 3.3.1), groundwater flow from upstream sources (Section 3.3.2), and groundwater exchange with McGrath Lake (Section 3.3.3). The seasonal flow patterns and stage-discharge relationships were developed through adaptation of the field data collected by Stillwater Sciences (2010) from 2009 to 2010, coupled with interpretation of the corresponding water balance analysis (Stillwater Sciences, 2011). While the Stillwater Sciences measurements were obtained in a relatively wet year, these relationships were the best data available, and when incorporated into the water balance model, these relationships yielded water level results that were generally consistent with the limited set of recently recorded water levels. In addition, it was observed that decreasing the seasonal groundwater inputs by approximately 50% (which could potentially be considered to account for the drier climatic conditions observed in the past few years) caused the water balance model to even more closely agree with the limited set of recently measured fall water levels as shown in Figure B1. For consistency, all results presented in the Feasibility Study included this reduction. No other calibration of the water balance model was performed and the results are only as valid as the inputs used to create the flow balance. The Phase 3 Special Studies will provide more information on the groundwater flow patterns and should be used to further refine the water balance model to support final designs for the Preferred Restoration Concept.



Sources: Monthly average historical VWRF flows (Stillwater Sciences, 2011). Recorded estuary water levels were measured from September –December in 2014 (cbec, 2015).

cbec

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Water balance model – existing conditions water levels

Project No. 14-1023	Created By: DM	**Figure B - 1**

3.3.1 VWRF WILDLIFE PONDS

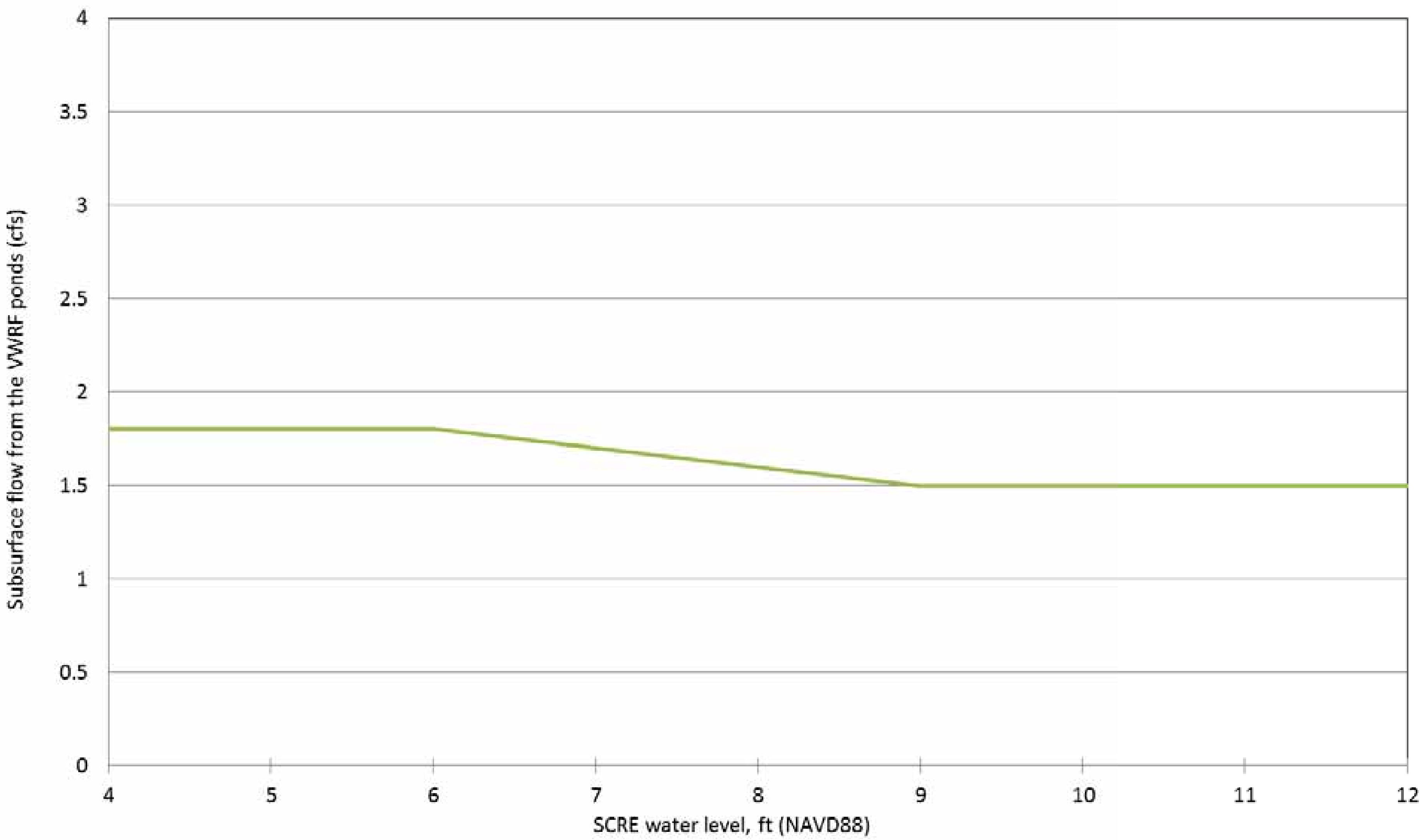
The VWRF wildlife ponds are unlined and subsurface flow through the bottom of the ponds provides a significant source of inflow (with an annual average estimated at approximately 1 million gallons per day) into the SCRE (Stillwater Sciences, 2011). The groundwater flow relationship used for the water balance model was developed based on the hydraulic gradient analysis and flow estimates provided by Stillwater Sciences (2011). The relationship used in the water balance model to relate estuary stage and subsurface inflows from the VWRF wildlife ponds is shown in Figure B2. The relationship transitions from a flow rate of 1.8 cfs to a flow rate of 1.5 cfs as the water level in the SCRE increases from 6 ft to 9 ft (NAVD88). This simple, straightforward approach was consistent with the limited amount of groundwater data available on the wildlife ponds and can be readily revised as additional information on subsurface flows becomes available.

3.3.2 GROUNDWATER FROM UPSTREAM SOURCES

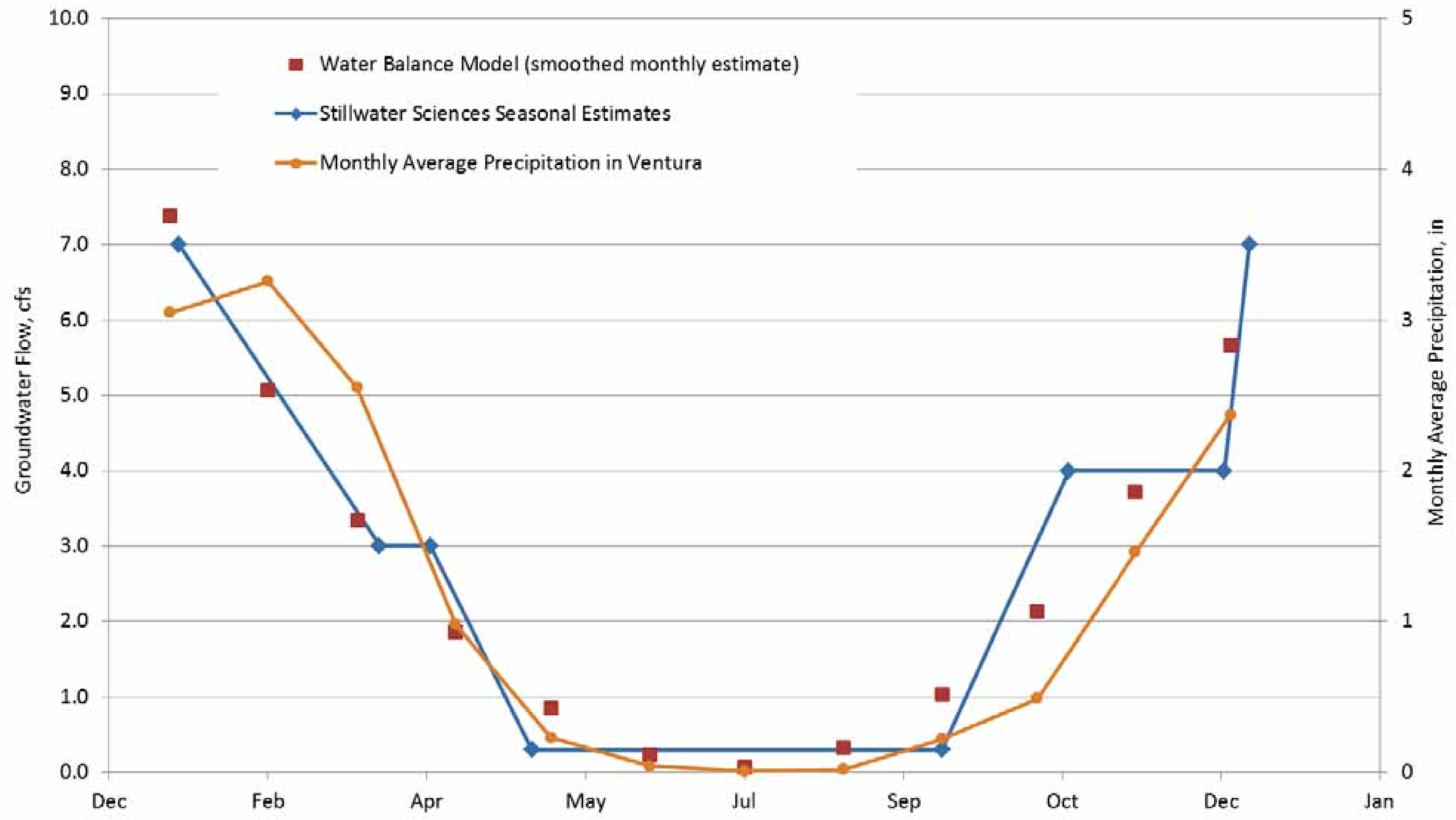
Other sources of groundwater flow into the SCRE include flow from the northern floodplain, agricultural fields to the east, and other unmeasured upwelling along the SCR between Harbor Blvd. and Victoria Ave. While these flow rates and seasonal patterns are poorly characterized, Stillwater Sciences (2011) provided some useful seasonal estimates. To improve on these seasonal estimates, the monthly average groundwater inflows into the SCRE, shown in Figure B3, were also based on the monthly average precipitation observed in the Ventura area (WRCC, 2015). These numbers should be revised as the results of the City of Ventura Phase 3 Groundwater Special Studies become available.

3.3.3 GROUNDWATER EXCHANGE WITH MCGRATH LAKE

The SCRE is also hydraulically connected to McGrath Lake to the south. Groundwater exchange between the SCRE and McGrath Lake has been shown to depend largely on the difference in the water surface elevations (Stillwater Sciences, 2011). As McGrath Lake is generally operated to maintain water elevations around 5.3-6.3 ft (Stillwater Sciences, 2011), the groundwater flow can be reasonably estimated with just the water level in the SCRE. When the SCRE water surface elevation is significantly lower than 6.5 ft (essentially open to the Pacific Ocean), there is a positive gradient from McGrath lake to the SCRE with an estimated flow of approximately 2.7 cfs. Conversely, when the estuary is essentially full (extended closed-berm conditions), a negative gradient forms and flow is away from the SCRE and towards McGrath lake with an average estimated flow of approximately 0.2 cfs (Stillwater Sciences, 2011). To include the groundwater flows between the SCRE and McGrath Lake in the water balance model, these data points were developed into a stepwise-smoothed rating curve (Figure B4).



Sources: Adapted from data presented by Stillwater Sciences, 2011.	cbec eco engineering	*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Subsurface flow from VWRF wildlife ponds**		
		Project No. 14-1023	Created By: DM	**Figure B2**

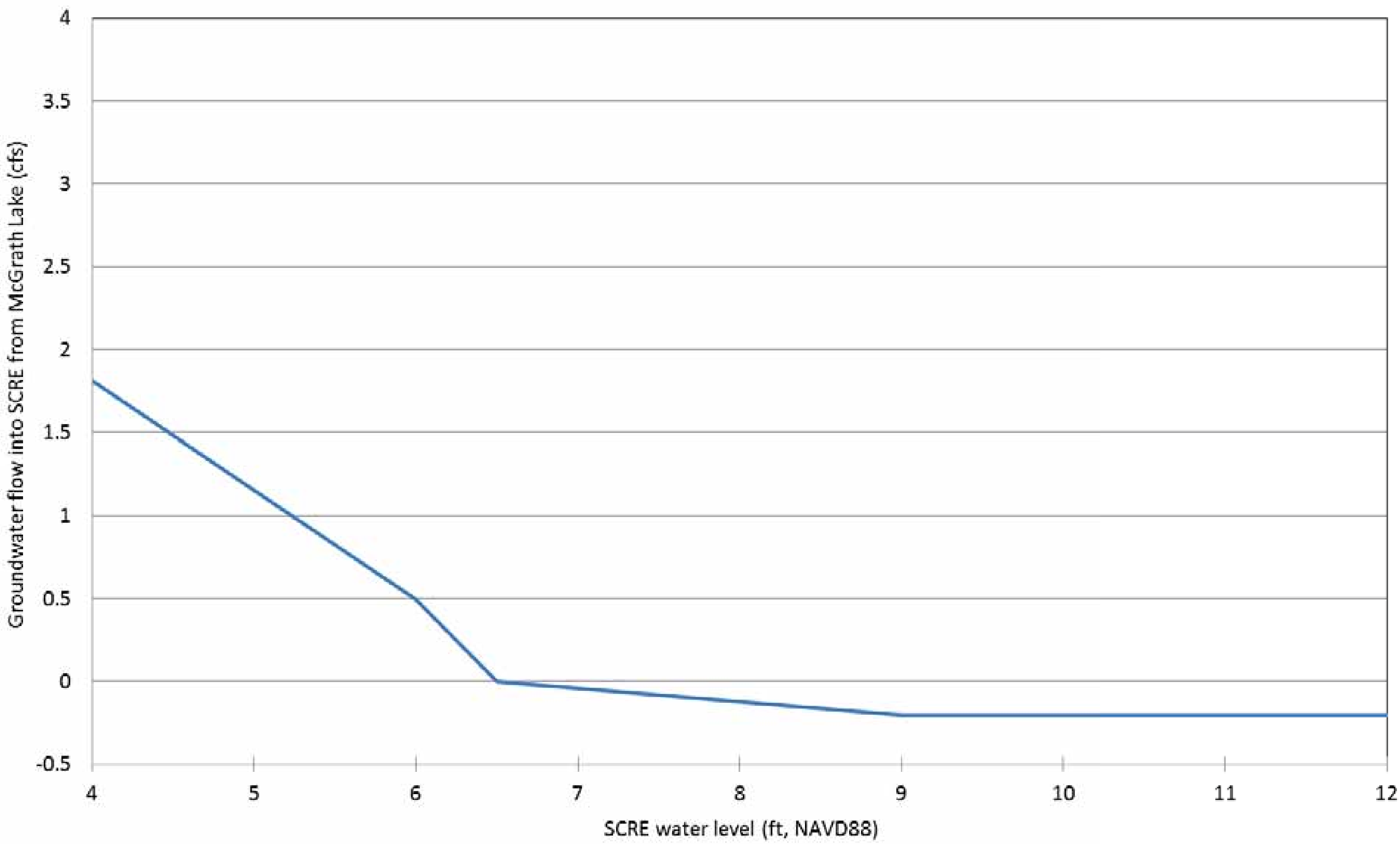


Sources: WRCC, 2015; Stillwater Sciences, 2011.
Notes: Smoothed monthly estimate based on seasonal estimates presented by Stillwater Sciences, 2011. Seasonal pattern estimated from precipitation estimates.

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Groundwater inflows from upstream sources

Project No. 14-1023	Created By: DM	**Figure B3**



Sources: Adapted from data presented by Stillwater Sciences, 2011.		*Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* **Groundwater exchange with McGrath Lake**		
		Project No. 14-1023	Created By: DM	**Figure B4**

APPENDIX C – COMMENTS ON PRELIMINARY ALTERNATIVES

Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Comments to the two preliminary restoration alternatives

As part of Task 1 and Task 2 of this Project, and as a result of the design charrette held in January of 2015, two preliminary restoration alternatives were developed for the portion of the Santa Clara River Estuary located on the California State Parks property associated with McGrath State Beach. These preliminary alternatives, referred to as Alternative 1 and Alternative 2, were then evaluated with a suite of hydrodynamic and water quality model scenarios. The preliminary alternatives and the results of the scenarios were presented to project stakeholders in a meeting held on March 4th, 2015. Written comments to help guide the development of the preferred restoration alternative were requested from the meeting participants. The following agencies and individuals provided written comments (which are included in this appendix):

Heal the Bay
Peter Shellenbarger
Water Resources Manager

Independent Scientific Expert
Professor David Jacobs
UCLA Department of Ecology and Evolutionary Biology

Independent Scientific Expert
Mark Abramson
Senior Watershed Advisor
Santa Monica Bay Restoration Foundation

National Marine Fisheries Service
Stacie Fejtek Smith
Marine Habitat Resource Specialist

National Marine Fisheries Service
Brittany Struck
Natural Resource Management Specialist

The Nature Conservancy
Lily Verdone
Project Director, LA-Ventura Project

The Nature Conservancy
Laura Riege
Restoration Manager, LA-Ventura Project

City of Ventura
Joe McDermott
Assistant General Manager Ventura Water

Tevin Schmitt
CSUCI Undergraduate ESRM Research Assistant
& Wishtoyo/Ventura Coastkeeper Intern

Independent Scientific Expert
Professor Rich Ambrose
UCLA Department of Environmental Health Sciences

Independent Scientific Expert
Professor Sean Anderson
CSU – Channel Islands – Department of Environmental Science and Resource Management

To: Jason Weiner
From: Peter Shellenbarger, Water Resources Manager at Heal the Bay
Re: Santa Clara River Estuary Restoration March 4th Workshop
Date: March 23, 2015

Grain Size

- The Santa Clara River is largest and most "natural" fluvial system in Southern California. Flow modeling only used one grain size (0.35mm or fine/medium sand) for analyses. Santa Clara River is the major source of fines, sand, pebbles, cobbles, etc. in the region. Is the single grain size used in analyses representative of all sediments discharged/flowing through the estuary during flow events? How does flow influence sediment transport in the model? Is it possible to include a variety of grain sizes to capture deposition and scour over a variety of flow scenarios? Different flow conditions are likely to transport a variety of sediment sizes (e.g. fines in water column and larger sands, pebbles, cobbles along the channel bottom). Grain size greatly influences sedimentation, hydraulic roughness, scour, deposition, etc.; thus only using one grain size for a fluvial system of this magnitude may not truly represent all hydraulic conditions influencing Santa Clara River Estuary Habitat Restoration. In addition, during a high flow event when the river mouth is open, coarser material may settle/deposit in estuary while fines may be transported offshore-this is not captured in current modeling. I understand the limitations of models used in analysis, however model results would be more realistic if multiple sediment sizes were incorporated into future modeling.

Estuary Water Inputs/Water Balance

- Groundwater inputs are not incorporated into water balance simulations. Ventura Phase III NPDES studies are currently studying groundwater inputs-this analysis should, if possible, be incorporated into the restoration study. Groundwater inputs may be more prevalent when effluent discharges from Ventura's wildlife ponds decrease or cease. It is unclear if this interaction (e.g. removal of WWTP input) is incorporated into restoration modeling scenarios.

Habitat Restoration Design

- From speaking with a tidywater goby scientist, it was identified that current conditions in the Santa Clara River Estuary are not conducive to support goby habitat. The constant flow of warm water from the wastewater treatment plant harbors not-native organisms, which predate on goby. In addition, goby rely on diurnal changes in temperature in their life-cycle which is not currently present in the estuary. Are these components of goby's life-cycle incorporated into restoration design?

Flow Scenarios

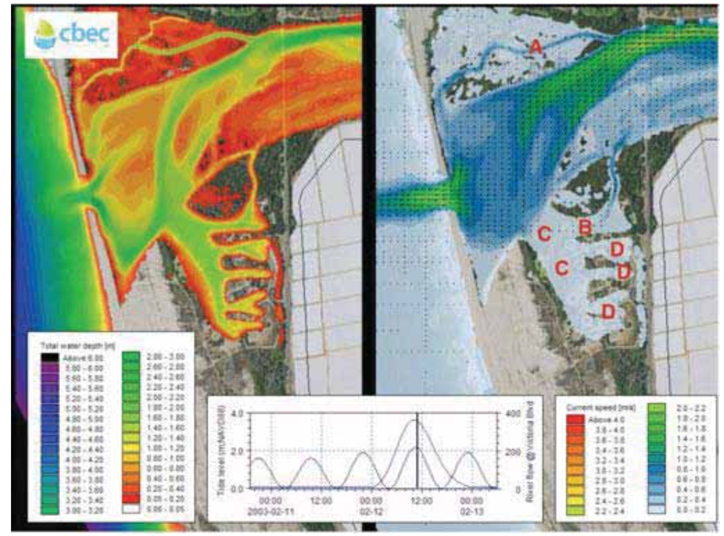
- I do not recall what flow scenarios were included in analyses-I do remember there was only two. I would request that more flow scenarios be included in the study- most notably a zero discharge, two MGD, four MGD, and the current flow.

SCRE - Jacobs Comments 24 March 2015.

A few of the problems and limitations with both designs are illustrated, but comments are ultimately directed towards generating a combined approach (Last Figure). The approach is intended to have fluvial responses that occur through the main loop on the two-year times scale so it is scoured out. But also more of the landscape would be engaged on about the five-year flood repeat scale. This version has a more heterogenous landscape feel such as is envisioned in Alt #1, while expanding scour benefits to a larger area.

The intent is for the landscape to behave evolve and be dynamic and provide habitat benefit until the next big event. Let me know what else I can do—I am happy to discuss with anyone to make this clearer.

Lettering is sequential across the figures.



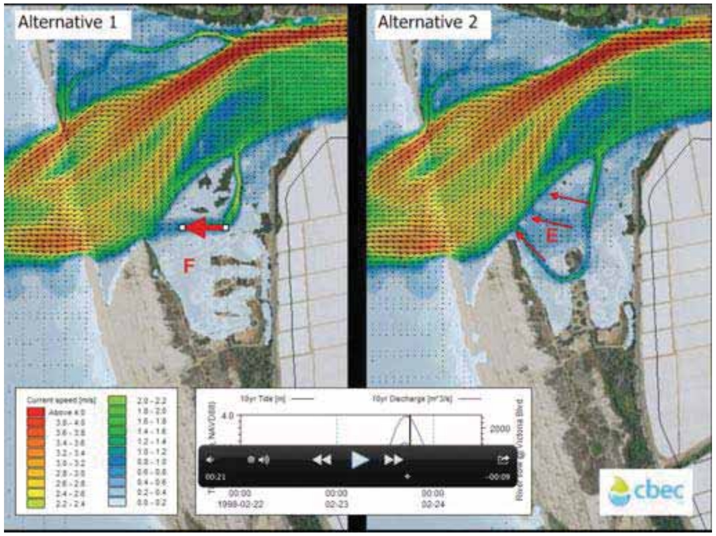
A - Don't worry about modifying the north side -waste of time and money it will accomplish very little in steelhead recovery.

B. Deep channel focuses scour, even in 10 year event. Consequently little of the landscape beyond the channel experiences scour. Thus the environment south of the channel is not likely to rejuvenate or evolve, but tend to stagnate and senesce C&D.

C. Open enbayment area receives little scour- in flood or breach events (Although some with tide near mouth). Fine sediment will accumulate during closure and be reworked into D.

D. Backwater Appendices-Eastern pointed digits, provide some landscape complexity, but will fill with flotsom borne by winds from the west. Flotsom borne downstream during flood, or long shore during open tidal condition will be allowed easy access into these digits due to the large forebay and opening to the lagoon. They receive no scouring and will fill with fine sediments become anoxic & filled with trash, logs and Kelp.

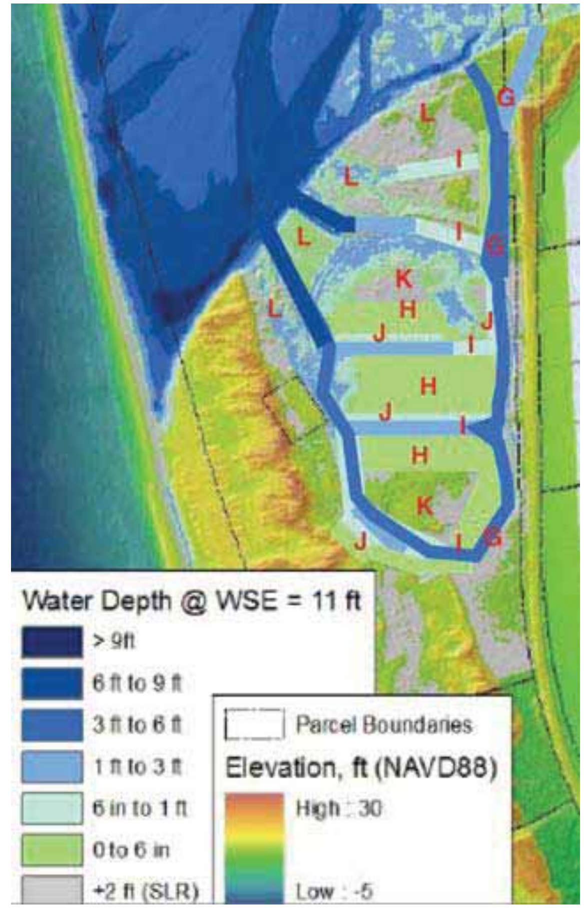
<u>Summary- Fines will accumulate and the landscape will not be dynamic.</u>



E. More of the landscape was involved in scouring flow and flood dynamic in alternative two. Both sheets and multichannel flow are evident in the ten-year event. This will produce a varied and heterogenous landscape. That can be dynamically reset and become part of the broader lagoonal dynamic evident to the north. *We want more of this.*

F. This is distinct from alternatives 1 where scouring flow is concentrated in the single deeper channel and there is no scour south of the channel.

Improving & Combining
The benefit might be greater if a still larger area could be engaged in the intermittent high flows. A design that allow for a complex suite of channels and isolated patches of exposrure at various water depths is shown below. It is somewhat analogous too, but slightly higher in average elevation than, the currently dynamic lagoonal area to the north.



G. Relative to previous alternatives -- intake of the main loop moved further upstream and widened, two channel intakes shown, to increase flow into system. Main loop channel moved further to the east, and extended a bit further to the south.

H. Perhaps slightly more fill can to be removed from the campground area - so that the lower surface becomes more engaged in an intermediate/five-year flow event.

I. Ideally there would be more shallow channels between the intake channel and the outflow, such that the system could at least initially behave as a manifold such that flows can be induced in all the channels (they have somewhat similar resistance based on distance from source & slightly different intake/spillover elevation at high flow, but only the deeper channels would be really active at low flow). Deeper channel is the most southerly one so the flows to be driven all the way through the more southern part of the system. Channels are deeper but not wide as they enter the current lagoon/estuary such that flow is constrained and current wetland habitat is not unduly disrupted (L). Happy to discuss this more,

J. Channel edges need to be softened in a few places to integrated with the landscape and allow fish in and out of the system during flooding.

K. Low Islands

L. Although channels are cut through the existing wetted areas are not removed.

Construction may be facilitated by digging some of the channels by removing berms, roadways or other features that would be desirable to remove anyway.

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VENTURA WATER

www.venturawater.net

March 23, 2015

Jason Weiner
General Counsel, Water Initiative Director
Wishtoyo Foundation
3875-A Telegraph Road, #423
Ventura, CA 93003

SUBJECT: Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study

Dear Jason,

The City of Ventura (City) appreciates the efforts of the Wishtoyo Foundation's Ventura Coastkeeper program, its Consultants and Technical Advisory Committee members, along with Agency partners California State Parks and the California Department of Fish and Wildlife to develop the preferred concept for the above subject feasibility study. The City appreciates the opportunity to provide comments on the preliminary restoration alternatives presented at the March 4, 2015 meeting and understands your request related to which aspects of each of the two alternatives presented at that meeting are desirable and which would be discarded or improved to benefit the habitat of the species present in the estuary. However, we would like to reiterate our concern that the information presented at both the March 4th and January 12, 2015 meetings, is insufficient to compare with previous work conducted by the City as part of our Santa Clara River Estuary Special Studies to ascertain that there is no conflict between the underlying modeling assumptions used to inform this feasibility study with the findings of the City's Special Studies.

At the January 12th "Design Charrette" workshop, your Consultants stated that the *Habitat Restoration and Enhancement Feasibility Study* would not focus upon flow modifications or water quality conditions beyond those affected by the proposed enhancements at the McGrath State Beach campground site. At the March 4th meeting it appears from the modeling results presented that specific flow reduction scenarios from the City of Ventura Reclamation Facility (VWRF) were being evaluated. As you are aware, the City is currently undertaking additional monitoring and modeling to determine the maximum ecologically protective diversion volume from the Estuary. For this reason, we believe it is premature to presume particular diversion scenarios or their ecological effects at this time and believe the feasibility study should focus upon current conditions until the City's Special Studies are complete.

Our additional concerns specific to the alternatives presented include:

- The proposed side channel on the Northside of the estuary, as an element of the restoration to provide additional habitat for lagoon rearing steelhead or tidewater goby has the potential to impact the discharge channel of the Ventura Water Reclamation Facility. The City has concerns about interfering with the mixing conditions in the outfall channel and how the outfall channel could be impacted by sediment routing along the side channel. Migration of the side channel could possibly impact the integrity of the levee on the north side of the estuary which protects the City's wastewater facilities from the Santa Clara River. The City would prefer that the north side of the estuary remain unaltered.

- To expand on our comments regarding the Special Studies, a more thorough explanation of data and assumptions used in modeling flooding and breaching under various discharge scenarios and other conditions would be helpful. It may be more beneficial to evaluate a range of breaching elevations at the estuary berm to assess flooding risks of the alternatives presented.

- In the simulations of future water temperatures, a more through explanation of temperature data used in developing these results would also be useful. Understanding that estimated water depths and vegetation amounts all have the potential to affect water temperatures, the results should best be taken as qualitative indicators of future change under the alternatives and scenarios presented.

- The required excavation and fill issues are not addressed in terms of potential permitting of the future project. It would be useful to explore the feasibility of these activities in what already appears to be potential jurisdictional wetland habitat under the Clean Water Act.

- The relocation of the campground is implied but not shown in either alternative. Do these alternatives include moving the existing campground facilities? What are the proposed campground facilities and occupancies under the two alternatives?

The earth fill and campground relocation aspects of the two proposed alternatives are primary considerations that will eventually need to be included in the CEQA process along with other affected resource areas should the alternatives discussed move forward. Thank you again for giving us the opportunity to participate and comment on the restoration and habitat feasibility study and if you should have any questions please contact Gina Dorrington at (805) 677-4131.

Sincerely,

Joe McDermott
Assistant General Manager Ventura Water

Cc: Shana Epstein, General Manager Ventura Water
Gina Dorrington, Wastewater Utility Manager
Karen Wain, Management Analyst

SCRE TAC Comments Mark Abramson

General Comments

I recommend combining or hybridizing the designs that came out of the design charette. I still prefer a sluice channel larger complex system with some modifications.

I think the consensus of the working group and the TAC was that existing higher quality habitats for example the riparian band along Harbor blvd be expanded and enhanced during the restoration process and that other habitat types be avoided as much as possible. There was strong sentiment from the group that Arundo Donax be removed along the western side of the estuary and that area enhanced with riparian and wetland vegetation. There was also wide spread support to remove ice plant and enhance the entire sand dune complex. The restoration of the sand dune element is particularly important as future sea level rise and larger storm surges are predicted in the future.

It is also recommended that the existing entry to the site be completely removed and relocated from the existing location closer to the gas company property to the east very near the gas company road. This will allow form maximum enhancement of the riparian drainage area that parallels Harbor blvd.

Finally, the Santa Clara river Estuary suffers from too much fresh water and nutrient inputs from the treatment plant. It is recommended that discharges from the treatment plant be eliminated and those flows be used for irrigation purposes. This would also eliminate the need for the upstream diversion which should also be eliminated in the future.. This would restore a more natural water regime in the system and would likely lead to less water quantity and elevated salinity. It would still support tidewater goby but may prove more difficult for the non-native/invasive aquatic species that are prevalent in the estuary today.

Area 1- I would like to see the north eastern stream channel (Area 1 in the attached drawing) enter the complex a bit higher up then was proposed in the charette. I believe the channel should be relatively steep > 1% slope to enhance drainage and scour. Additionally, the Area 1 channel meander and widths could be manipulated to create certain habitat types in certain areas for example channel narrowing and larger substrate will create riffle habitats when the stream is flowing. I would also recommend the placement of woody debris anchored with large boulders to create certain habitat features within the Area 1 channel and especially where this channel meets the main channel. Proper placement of these woody debris features can help maintain the opening and anchor specific plunge pool habitat features within the Area 1 channel.

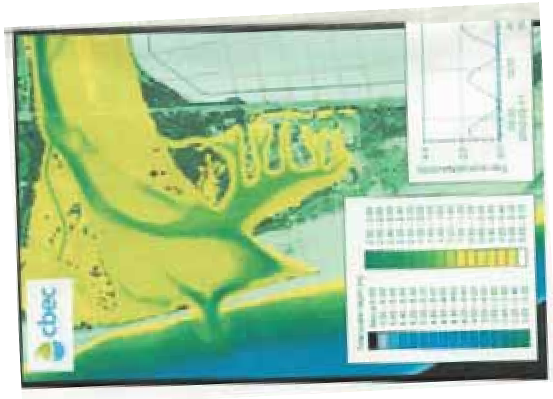
Area 2 and 3 Area 2 is the northern finger (tributary) and Area 3 is the southern finger of the proposed slough area. It is recommended that we slightly tweak the alignment from that proposed in the design charette to accommodate two tributaries (fingers) instead of the five finger charette configuration. The alignment is slightly tweaked to the north more facing the tide while still aligned to prevailing wind directions. This configuration allows for long uninterrupted wind areas that will enhance mixing and water movement during a closed condition. It is also recommended that these fingers have some slope ranging 0.5% - 1% at the back of the channels to encourage periodic scour during open conditions. It is also recommended that a shelf be designed into the very rear of the fingers that would become connected during a closed condition but not during most tidal conditions (` 6.5 -7' elevation). This will allow for two separate fingers during tidal conditions that will generate maximum scour and will be connected during prolonged closed conditions to remove dead end channels, minimize debris collection, and wind driven circulation.

The slough areas 2 and 3 should have micro-habitat as part of the design including depressions and elevated areas. Avoid completely smooth grading design (build in roughness). It is recommended that channel shape be broad and gradually shallow sloping. Allow for areas to be shallowly flooded as water levels increase during different water elevations.

Area 4- Is considered an island with a mix of brackish marsh and riparian vegetation. It offers locations where woody debris can be anchored for the Area 1 channel and should be designed to **not** interrupt but to enhance wind fetch in the Area 2 and 3 channels. Portions of the island should be available during high closed conditions.

Area 5- Is a second partial island that becomes a true island during closed conditions when water elevations exceed the shelf height of ~6.5-7 foot water elevations (or the appropriate elevation to ensure that two tributaries are available under most all tidal conditions. The islands are situated to take advantage of and even enhance prevailing winds to maximize wind driven circulation. Portions of this island should be available during high closed conditions.

Area 6- North western channel entrance. I do believe Area 6 channel has merit and could provide habitat for steelhead. I think this channel should follow the alignment and meander of the past historic channel visualized on the maps. I would recommend that the design utilize woody debris elements to stabilize the opening and certain areas within the channel itself. It is recommended that the area 6 channel be created with some slope 1% or greater towards the opening and flattening out to no less than .5% near the ocean. Recommend playing with widths and meander to create certain habitat types riffles and pools. The Area 6 work should also include removal of Arundo donax and restoration of riparian vegetation in that area.


cbec


Shelf @ ELEVATION
6.5' - 7'

Comments from Stacie Fejtek Smith

Considerations for Analysis

A few thoughts on the overall analysis. 2-D, 3-D hydrodynamic models coupled with sediment transport bed evolution modeling are valuable tools for ascertaining the most appropriate estuary bathymetry. Alternatively, one could build a physical model of the system to develop and test various bathymetric configurations. Long term hydraulic and sediment transport processes ultimately determine the extent to which various locations will fill up with sediment and/or remain free of sediment deposition. Circulation patterns also play an important role in determining water particle residence time that will in turn affect temperatures. These processes are further complicated by tidal influences and hydrologic variability. To the extent possible, it would be best to work with the natural tendencies of the river and its sediment transport processes to develop an appropriate design, rather than to propose a design and have the hydraulic flow field and sediment transport processes react to those changes in estuary bathymetry. Essentially, the estuary bathymetry will be a very important factor in determining the hydraulic flow patterns, which will then drive many of the other estuary processes. Selection of the appropriate model (a 1-D model in this case is not likely capture the spatial complexity typically found in an estuary with fingers, etc.), mesh refinement, calibration and validation of any model will also be very important in this situation.

Overall Design

Of the two design alternatives developed, Alternative 1 seems to provide the most ecologically relevant design by significantly increasing acreage of tidal slough/marsh and edge habitat, increasing tidal exchange, and lower water temperatures within the area currently occupied by the campground. An increased tidal exchange provides both benefits for steelhead transitions to salt water as well as a potential reduction of invasive freshwater species that currently reside in the estuary. Alternative 2 appears overly simplistic; lacks habitat complexity, will still be vulnerable to overbank flows, and is connected to agricultural overflow channel (during flooding) adjacent to Harbor Blvd. Connection to the agricultural channel may increase pyrethroid insecticides exposure which may reduce fecundity in female steelhead trout (Forsgren et al. 2013[i]). Alternative 2 is similar to the existing conditions in that it still exhibits warm shallow water in the inundated area of existing campground therefore providing little support for moving forward with Alternative 2. Comments regarding Alternative 1 should be taken into consideration for improvement in development of the preferred alternative.

Both design alternatives still utilize the existing campground entrance. Utilizing the existing entrance after moving the campground will put the road that accesses the entire campground at risk (especially under Alternative 1). Additionally the close proximity of the road to the newly establish estuarine habitat and channels poses a threat to water quality. Increased runoff, containing both organic and inorganic pollutants, poses a considerable risk to young steelhead trout migrating out to sea (Hughes et al. 2014[ii], Anderson et al. 2014[iii]). Consideration for placement of an alternative entry point, possibly a shared entrance with the southern neighbor, could provide the most protection of water quality and ensured access to the campground.

During the design consideration the possibility of relocation of the campground to areas outside the current parcel boundaries should be considered. In southern California the planning process for coastal estuaries can and has lasted decades. While there are current constraints on the area which the campground can be relocated to today the opportunity to consider the potential benefits of further relocation should be incorporated into the design process. As is, neither alternative explicitly states the location of the campground, but rather just a potential area for placement of project excavated material to be relocated. Some sort of “no campground” alternative should be considered with variation of sediment placement.

Consideration and Suggested Improvements for Alternative #1

The creation of the northern “high velocity fluvial side-channel” (hereafter the side-channel) appears to offer direct benefits to steelhead, but there are some factors which should be considered in the design. The side-channel could offer steelhead the possibility of velocity refuge under a 10 year storm or breach event. Despite the conclusion the “neither alternative exhibits significant scour/deposition or bed level changes” the side-channel mouth bed level appears to increase after the 10 year storm event. If a berm develops or it functions as a catch/debris basin at the mouth of the side-channel it would become inaccessible or require maintenance to stay open. Post project maintenance requirements should be avoided if possible. The northern portion of the estuary where the proposed side-channel would be is relatively intact “scrub-shrub wetland” habitat. Efforts undertaken in areas with productive/intact habitat must have clearly identified goals to provide rational that justifies the impact to the area.

Alternative 1 increases subtidal habitat which is important refugia of steelhead during summer (low flow and/or high temperature) conditions. Sea-level rise (SLR) will continue to reduce estuarine habitat through inundation and displacement, changing the amount and complexity of habitat available in estuaries (Flitcroft et. al. 2013[iv]). Southern California coastal estuary restorations have artificially increased the extent of subtidal habitat (Stein et al. 2014[v]). Past southern California restorations have considered depth in planning, but not the evolution of substrate in the balance of sediment surface and hydrologic forcing. Providing for future transgression by using gradual slopes will allow for natural SLR transgression of marsh habitats providing an increase in habitat types that will be represented under future SLR scenarios (Fejtek et. al. 2014[vi]). Subtidal habitat is likely to naturally increase with SLR within SCRE, but SLR effects may be reduced if VWRF flows are reduced. The analysis of alternatives provided did not incorporate SLR and the effects of reduced flows from VWRF modeled together. As discussed during the question/answer portion on March 4th, SLR may cancel out the reduced flows from VWRF. This combination would have the greatest influence on the year round water temperatures and depth of the proposed side-channel in Alternative 1.

The size and number of finger channels in Alternative 1 should be considered further. Alternative 1 currently has 5 finger channels that based on the scale appear to be about 50+ ft. wide. These finger channels seem very large as compared to other southern California systems (although I was unable to find a reference to support this). By having such large deep channels the amount of sediment to be excavated almost doubles (as compared to Alt. 2) along with it the potential cost of the restoration. The value of excavation (besides increasing subtidal habitat) is of course the ability to use the excavated material to raise the level of the campground to avoid future flooding. Alternative 1 raises the campground so much that it is higher than Harbor Blvd. It is unnecessary to raise the campground higher than Harbor Blvd because the campground would essentially become an island with no access if Harbor Blvd. was flooded. Reducing the width (20-30ft) and number of finger channels (from 5 to 3) would reduce the amount of sediment to be excavated to a more intermediate level (somewhere between Alt. 1 and Alt 2).

The orientation of the finger channels is another point to be considered. During the discussion at the end of the March 4th meeting the idea of flipping the fingers from an East/West orientation to a North/South was discussed (see attached sketch). Dropping the fluvial side channel loop would increase the size of the potential nesting island. The fingers would then extend from the lower portion of the loop. Notice I increased the sinuosity and tapering of finger channels as well.

Stacie Fejtek Smith

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Comments/Questions from Brittany Struck:

"Figure #" refer to the SCRE_March4th_Meeting_Figures.pdf and "Slide #" refer to the SCRE_March4th_presentation.pdf

- Does the simulation of ecological storm flow and geomorphic events incorporate upstream river discharge that the estuary receives; keeping in mind this river system is highly regulated through water diversions on the mainstem and on major tributaries to the mainstem (e.g., Piru Creek)?
- Duration of habitat/channel connectivity is an important factor for rearing steelhead especially during the dry season including how long critical depths will be maintained, for example, the duration of 1ft depths (and greater) throughout the restoration area.
- For Figure 6 (circulation scenario), can the model incorporate regulated, upstream river discharge into the estuary?
- What would estuary conditions appear to be under Alternative 1, open-mouth scenario, for the summer season? Further, can the model capture a hypothetical summer breach and display how a summer breach would influence water depth and water temperature?
- Please provide the rationale for using a single grain size evaluation. Is the 0.35 mm tied to a biologically meaningful criterion for steelhead? A more complex sediment model may be required to better understand where sediment is likely to move/settle out under low flow conditions and high flow conditions while the estuary is open and closed.
- Under the listed uncertainties, "upstream developments" is included. Does this mean land/infrastructure development or potential water development (increase in water diversions, increase in irrigation for agriculture, use of groundwater, etc.)?
- Explain in a more detailed manner, why there is an initial reduction in estuary water levels for the month of April (slide 33).
- (slide 35) For Location A, show the maximum daily water temperature from November through February for a collection of hydrologically-classified Dry Years and Wet Years.
- (slide 46) Provide the maximum daily water temperature trend with a 50% VWRF flow reduction for Location A.
- (slide 47) Is it possible to model how temperature would change from incoming flows from the mainstem (upstream river discharge that is received by the estuary)?

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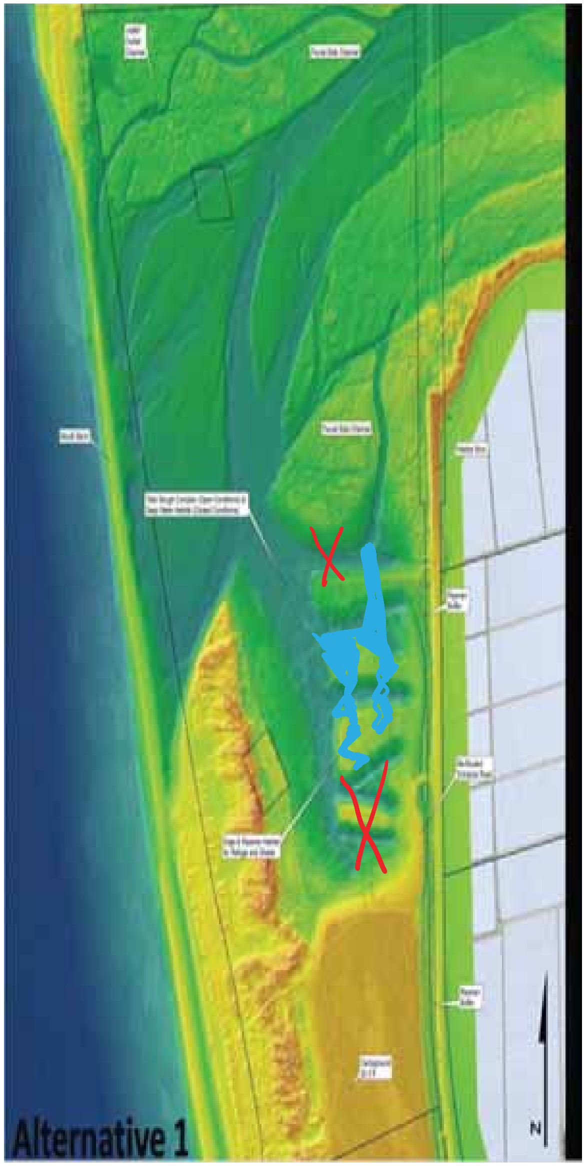
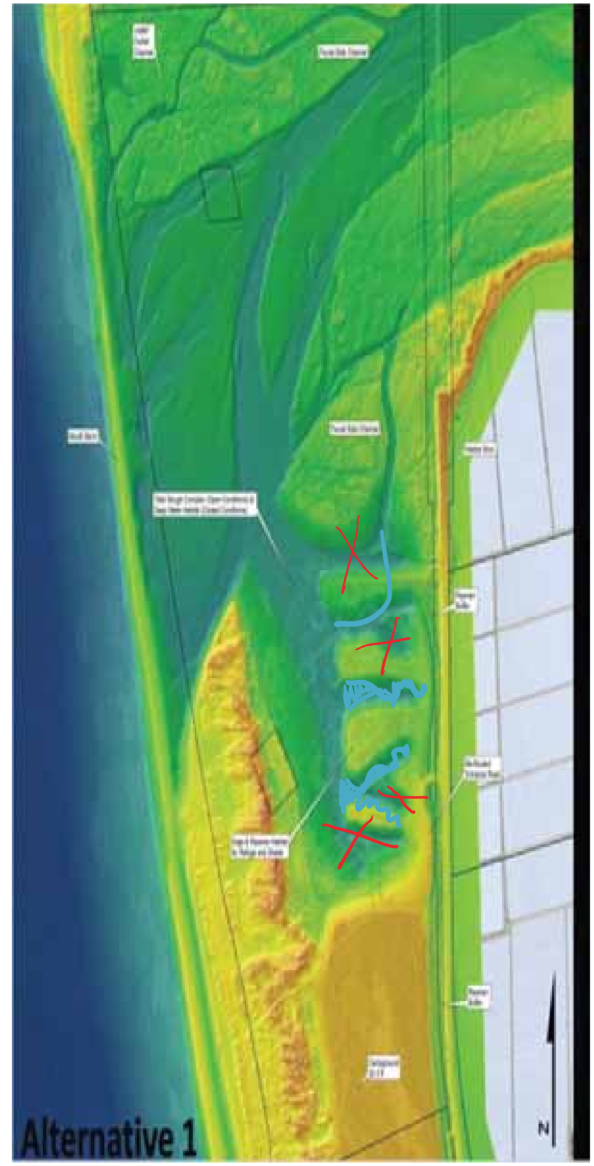
[i] Forsgren, K. L., N. Riar, and D. Schlenk. 2013. The effects of the pyrethroid insecticide, bifenthrin, on steroid hormone levels and gonadal development of steelhead (Oncorhynchus mykiss) under hypersaline conditions. General and Comparative Endocrinology 186:101–107.
[ii] Hughes, B. B., M. D. Levey, J. A. Brown, M. C. Fountain, A. B. Carlisle, S. Y. Litvin, C. M. Greene, W. N. Heady and M. G. Gleason. 2014. Nursery Functions of U.S. West Coast Estuaries: The State of Knowledge for Juveniles of Focal Invertebrate and Fish Species. The Nature Conservancy, Arlington, VA. 168pp.
Can be found at:
file:///C:/Users/stacie.smith/Documents/SH%20Background%20Info/TNC%20Nursery%20functions%20of%20west%20coast%20estuaries.pdf
[iii] Anderson, B., B. Phillips, J. Hunt, K. Siegler, J. Voorhees, K. Smalling, K. Kuivila, M. Hamilton, J. A. Ranasinghe, and R. Tjeerdema. 2014. Impacts of pesticides in a Central California estuary. Environmental Monitoring and Assessment 186:1801–1814.
[iv] Flitcroft, R., K. Burnett, and K. Christiansen. 2013. A simple model that identifies potential effects of sealevel rise on estuarine and estuary-ecotone habitat locations for salmonids in Oregon, USA. Environmental Management 52:196–208.
[v] Stein, E., K. Cayce. M. Salomon, D. Bram, D. De Mello, R. Grossinger, S. Dark, 2014. Wetlands of the Southern California Coast – Historical Extent and Change Over Time. Technical Report 826. Southern California Coastal Water Research Project, Costa Mesa, CA
Can be found at: http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/826_WetlandsHistory.pdf
[vi] Fejtek, S., Gold, M., MacDonald, G., Jacobs, D., Ambrose, R. 2014. Best Management Practices for Southern California Coastal Wetland Restoration and Management in the Face of Climate Change. University of California Los Angeles, Institute of the Environment and Sustainability
Can be found at: http://escholarship.org/uc/item/3zx2j5br

Consider flipping the fingers from a East/West orientation to a North/South. Dropping the fluvial side channel loop increasing the size of the potential nesting island and then have the fingers extend from the lower portion of the loop. Notice increased tapering and sinuosity if the finger channels. Red X =remove





Reduce number of finger channels and width. Increase sinuosity and tapering remaining fingers. Red X = remove

The Nature Conservancy
Protecting nature. Preserving life.

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March 20, 2015

Jason Weiner
Ventura Coastkeeper

RE: Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study: Preferred Restoration Concept Comments

Dear Jason,

Thank you for the opportunity to comment on the Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study. The Nature Conservancy recognizes the value estuaries play in the steelhead life cycle. The scientific literature documents that lagoon-rearing juveniles have increased ocean survival resulting from increased growth in the productive estuarine habitat. Estuaries/lagoons also provide a transition zone where smolts can acclimate to increasing salinity before entering the ocean. This habitat is likely to become even more important in Southern California as we likely enter a period of longer and more frequent droughts and warmer ocean temperatures.

We reviewed the March 4th meeting presentation materials, the brief description of the alternatives and the model animations. Based on these materials we have the following comments:

- Presentation Slide 7 shows that Alternative 2 does not appreciably change the acreage of habitat that is less than 3 feet in depth, nor does it appreciably increase the amount of deeper habitat. Alternative 1 will decrease the amount of shallow habitat (less than 1 foot depth) and increase the amount of deeper habitat (greater than 3 feet depth). In the southern California steelhead recovery plan, the National Marine Fisheries Service lists one of the estuarine primary constituent elements (PCE) as "connected shallow water areas and wetlands to conceal and shelter juveniles." It would be helpful in the alternatives evaluation to quantify how much of this connectedness between "shallow water" areas and wetlands would be created, rather than focusing on depth alone.
- Both alternatives require significant engineering and build out (see presentation slide 48 for excavation quantities). Alternative 1, with the southern tidal slough area and finger channels, appears to be the least natural of the alternatives. Based on the high sediment load in the Santa Clara River, and as experienced at Ventura Harbor and Ventura Keys, both alternatives may require maintenance/dredging to maintain the channel depths and contours. Slide 41's evaluation of the effects of sea level rise indicates sediment scour would be decreased, resulting in increased sediment accumulation. Large storms are likely to reset bathymetric conditions within the estuary. Dredging and maintenance activities will be costly and will disturb instream habitat, potentially resulting in take of listed species and adverse modification of critical habitat.
- Both alternatives state that the new channels will allow juvenile steelhead to find a refuge in the estuary during high flow events, rather than being swept out to the ocean. It would help in the alternatives analysis to quantify this benefit. At the current level of design, the proposed channel in Alternative 2 does not have very many meanders or instream structure that would slow velocity and provide velocity shadows for juvenile steelhead or tidewater gobies. The velocity model for Alternative 2 in both storm scenarios shows only a small decrease in velocity in the side channel as compared to the main flow from the SCR. Alternative 1 does not appear to provide a velocity benefit as compared to the existing conditions.
- Both the Alternative 1 southern fluvial side channel and the Alternative 2, U-shaped channel are described as being deep enough to discourage vegetation growth (>9 feet deep) under typical closed mouth conditions; however neither the bathymetry maps for the alternatives nor the models of water depth during storm events or circulation with a closed mouth indicate these channels will be more than 9 feet deep at any time. The tidal exchange model indicates Alternative 1 will provide an increase in tidal sough/marsh habitat, which is unlikely to be vegetation free. Based on the integration of the modelling results, are these channels expected to remain vegetation-free?
- While the depth modeling in the circulation animations (i.e. "closed mouth" conditions) at maximum fullness is consistent with the depths depicted on the bathymetric maps, the depth modeling in the velocity/storm event animations (i.e. "open mouth" conditions) shows that the newly created habitat for both models is rarely greater than 0.5 meters deep. The tidal exchange model indicates that Alternative 1 may lengthen the duration of the "open mouth" condition, resulting in lower depths more of the time. If one of the decision criteria between the alternatives is water depth and the acreage of connectedness to wetland habitat, it would be helpful to quantify how many days the estuary is expected to be in a "closed mouth" condition, an "open mouth" condition and an intermediate or "filling" condition when water depths are expected to be less than the full "closed mouth" condition.
- Alternative 1's southern tidal fingers form dead ends that can strand fish during breaching events or trap fish potentially resulting in fish kills as seen in recent years at the Ventura Keys and other southern California harbors with dead end channels.
- Both alternatives reference increased habitat benefits due to additional woody vegetation at the water's edge. It would help the alternatives analysis to understand the impacts of storm surges, inundation, scour and erosion on the development and maintenance of mature woody vegetation, allowing quantification of this benefit to steelhead habitat.
- It is not clear how the northern fluvial side channel in Alternative 1 will limit or discourage homeless/transient use. Clean, relatively deep channels are more likely to attract homeless use by providing a source of relatively clean water for bathing and drinking.
- The alternatives analysis provides a limited evaluation of the effects of sea level rise and coastal hazards in the evaluation. The Coastal Resilience Program (www.coastalresilience.org) developed a fine-scale model of the impacts of coastal hazards for Ventura County, including the Santa Clara River Estuary (http://maps.coastalresilience.org/ventura/#), modeling factors such as storm surge, erosion, wave run-up, and river and flood inundation under various sea level scenarios. We recommend this model be incorporated into the alternatives analysis.
- Particularly vulnerable, the estuary experiences localized flooding during large storm and tide events now. Based on Coastal Resilience Ventura model results, the majority of McGrath State Park is at risk of becoming permanently inundated (both tidal and flood inundation) by the year 2030 due to increasing sea level rise, storm surges and erosion.

The Nature Conservancy prefers a low impact, minimal interference approach to restoration of the Santa Clara River Estuary. We recommend restoration design be low maintenance, naturally resilient to the current and future flood and drought regimes found in Ventura County and incorporate the results of Ventura County-specific climate change models.

Sincerely,

Lily Verdone
Project Director, LA-Ventura Project

Laura Riege
Restoration Manager, LA-Ventura Project

Tevin Schmitt

3/25/15

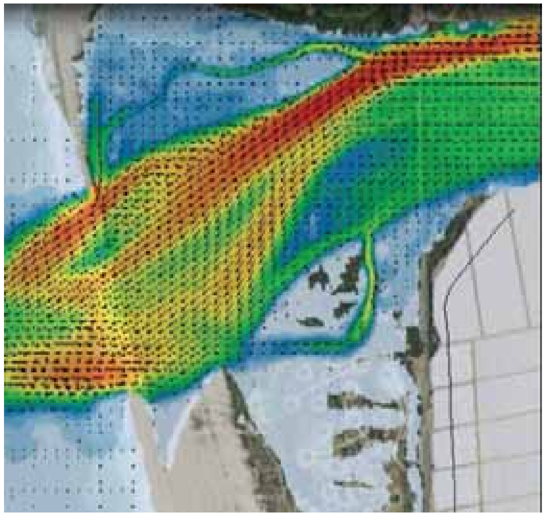
CSUCI Undergraduate ESRM Research Assistant

Wishtoyo Intern

Comments on Preferred SCRE Design Alternative 1

In looking over the animations for projected 10 year storm events, it is my opinion that the northern fluvial channel will not provide refuge for juvenile steelhead when the river's water velocity is increased. The highest velocity water is expected to flow along the river bank in which the channel is proposed to be built. The river waters just south of the high velocity stream seem to have similar, if not identical velocity to the fluvial channel. A more natural reaction for a steelhead at this time would be to swim into the southern part of the river rather than aiming for a relatively small fluvial channel that has similar velocity.

I propose that the northern fluvial channel not be built if this alternative is chosen. The building of this channel would require unnecessary funding and environmental assessments that would use up time and money that could go towards strengthening the viability of the rest of the project.



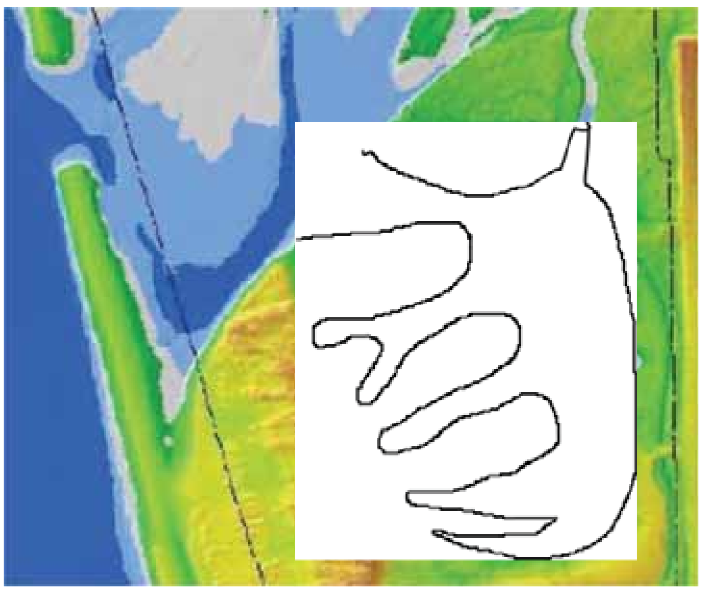
Santa Clara River Estuary Restoration Alternatives

Richard Ambrose
Comments

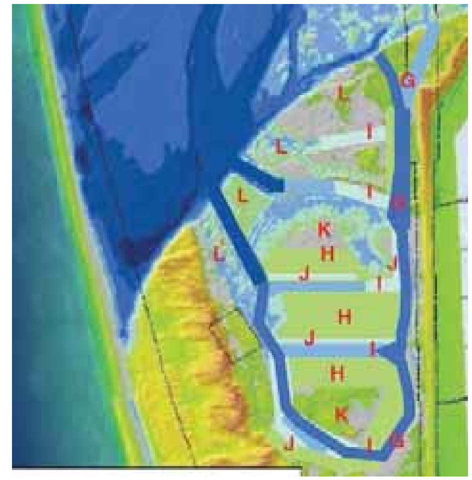
Between Alternatives 1 and 2, I prefer Alternative 1 because it provides more aquatic habitat. It also has the potential for providing a greater diversity of habitats, both during open and closed mouth conditions. And if the "peninsulas" between the channels are vegetated with riparian vegetation, this could be especially good habitat for steelhead.

One concern with Alternative 2 is that the eastern end of the channels ("fingers") could become stagnant and accumulate fine sediments, leading to anoxic conditions and habitat that is not suitable for most species, including tidewater goby and steelhead. This is reminiscent of the conditions at Malibu Lagoon, and considerable effort was spent deciding how to remedy the problem there. I think it would not be as bad as at Malibu, largely because the fingers are oriented along the prevailing wind direction, thus water that "piled up" during the day would circulate back to the main body when the wind speeds relaxed at night. Nonetheless, I think a different design could reduce this problem.

One possibility is to "reverse" the glove direction. I've traced a rough outline over the Alternative 1 figure. With this configuration, the prevailing winds would push water (and fine sediment) out of the fingers and into the deeper main body. Another advantage is that the high-flow channel connecting to the main lagoon on the north would divert higher flow over the whole restored area instead of concentrating flow along a narrow area of the restored area.



Dave Jacobs has presented an alternative design which would also spread the higher flow from the north channel over a larger area of the restoration site, and would also minimize the accumulation of fine sediments at the ends of "finger" channels. I like many features of this design. By keeping the channel on the east side of the project site (channel G) narrow, higher velocities could be maintained over a larger portion of the restoration than with my "reversed glove" design. Another advantage is that a series of islands would be created, which could provide some degree of protection from predators for nesting birds.



The main feature that I prefer in my "reversed glove" design over Dave's is the greater aquatic habitat area. I think if we are going to go to all the trouble and expense of restoring this area, we should try to maximize the area that would be suitable for aquatic species, especially tidewater goby and steelhead. Of course, Dave's design might be modified to expand the aquatic habitat – though you would have to be careful not to lose the advantage of higher flows in a restricted channel during major flood events.

I have one other concern about Dave's design. There are a few channels that connect the east and west peripheral channels. I think that water circulation during tidal periods might be "confused" in those channels, possibly leading to unexpected results. We had this problem with the original restoration at Malibu Lagoon, and although it wasn't as severe a problem as the dead-end channels, I'm still slightly concerned about it.

On balance, though, I think either of these designs would solve the main problems I see with Alternatives 1 and 2. My design maintains the main advantages of Alternative 1, including more aquatic habitat, a higher diversity of habitat, potential for good habitat for steelhead (especially if the peninsulas were covered with riparian trees), and the potential for keeping the mouth open a bit longer, while having a lower chance of fine sediment accumulation and hypoxia in the finger channels.

APPENDIX D – FEMA/NFIP – FIRM FOR PROJECT SITE

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later.

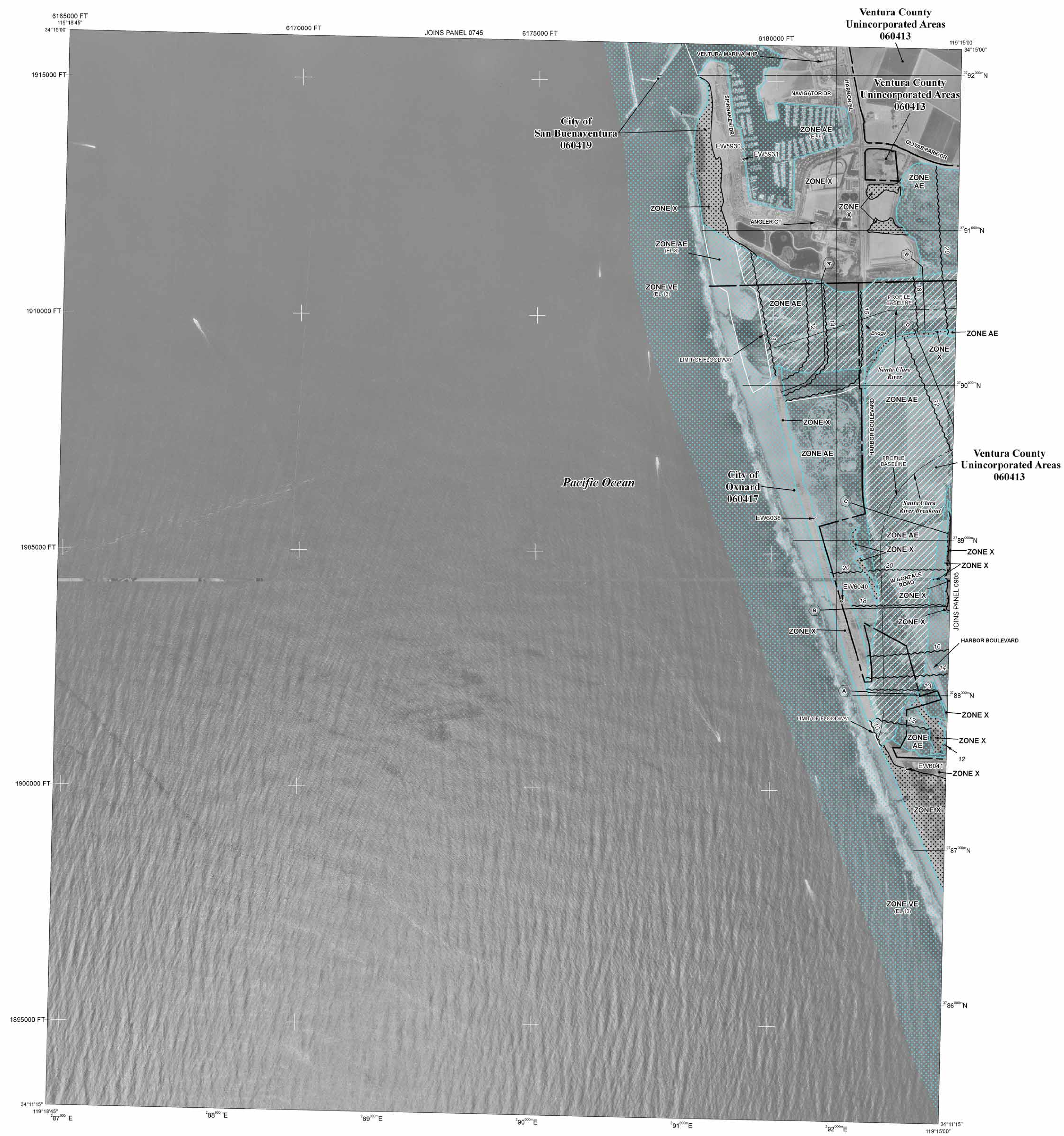
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to confirm to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.mcs.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 11
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone V (FIPSZONE 0405), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
January 20, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0885E

FIRM

FLOOD INSURANCE RATE MAP

VENTURA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 885 OF 1275
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
OXNARD, CITY OF	060417	0885	E
SAN BUENAVENTURA, CITY OF	060419	0885	E
VENTURA COUNTY	060413	0885	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06111C0885E

EFFECTIVE DATE
JANUARY 20, 2010

Federal Emergency Management Agency

APPENDIX E – STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

STORMWATER POLLUTION PREVENTION PLAN

for
McGrath State Beach
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study
California State Parks

RISK LEVEL 1

Legally Responsible Person [LRP]:
LRP Name to Be Determined

Prepared for:
Wishtoyo Foundation and Wishtoyo Foundation's Ventura Coastkeeper Program

Project Address:
McGrath State Beach
2211 Harbor Blvd.
Oxnard, CA 93030

SWPPP Prepared by:
WRA, Inc.
2169 E Francisco Blvd., Suite G
San Rafael, California 94901
Megan Stromberg, QSD

With assistance from cbec, inc. eco-engineering

SWPPP Preparation Date
July 2015

Table of Contents

Section 1 SWPPP Requirements

1.1 INTRODUCTION

Given the preliminary nature of this Stormwater Pollution Prevention Plan (SWPPP), and in order to keep this document to a manageable length, supporting background text describing the Preferred Restoration Concept and the aims of the Santa Clara River Estuary (SCRE) Habitat Restoration and Enhancement Feasibility Study (Project) are not included. As this SWPPP is finalized, additional supporting text for each section may be readily transferred as necessary from the Feasibility Study (cbec et al., July 2015), the Existing Conditions Technical Report (cbec et al., January 2015), and the future basis of design reports which should be prepared in conjunction with the final design of the Preferred Restoration Concept.

This preliminary Stormwater Pollution Prevention Plan (SWPPP) is designed to comply with California's General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (General Permit) Order No. 2009-0009-DWQ as amended by Order No. 2010-0014-DWQ (NPDES No. CAS000002) issued by the State Water Resources Control Board (State Water Board). This SWPPP has been prepared following the SWPPP Template provided on the California Stormwater Quality Association Stormwater *Best Management Practice Handbook Portal: Construction* (CASQA, 2010). In accordance with the General Permit, Section XIV, this SWPPP is designed to address the following:

- Pollutants and their sources, including sources of sediment associated with construction, construction site erosion and other activities associated with construction activity are controlled;
- Where not otherwise required to be under a Regional Water Quality Control Board (Regional Water Board) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard;

Calculations will be provided in the final SWPPP.

1.2 PERMIT REGISTRATION DOCUMENTS

Required Permit Registration Documents (PRDs) shall be submitted to the State Water Board via the Stormwater Multi Application and Report Tracking System (SMARTS) by the Legally Responsible Person (LRP), or authorized personnel (i.e., Approved Signatory) under the direction of the LRP. The project-specific PRDs include:

1. Notice of Intent (NOI);
2. Risk Assessment (Construction Site Sediment and Receiving Water Risk Determination);
3. Site Map;
4. Annual Fee;
5. Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal); and
6. SWPPP.

A copy of the submitted PRDs will be provided in the final SWPPP along with the Waste Discharge Identification (WDID) confirmation.

Additional PRDs may be required depending on the construction type and location.

1.3 SWPPP AVAILABILITY AND IMPLEMENTATION

The discharger shall make the SWPPP available at the construction site during working hours (see Section 7.5 of CSMP for working hours) while construction is occurring and shall be made available upon request by a State or Municipal inspector. When the original SWPPP is retained by a crewmember in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing will be left with the field crew and the original SWPPP shall be made available via a request by radio/telephone. (CGP Section XIV.C)

The SWPPP shall be implemented concurrently with the start of ground disturbing activities.

1.4 SWPPP AMENDMENTS

The SWPPP should be revised when:

- If there is a General Permit violation.
- When there is a reduction or increase in total disturbed acreage (General Permit Section II Part C).
- BMPs do not meet the objectives of reducing or eliminating pollutants in stormwater discharges.

Additionally, the SWPPP shall be amended when:

- There is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4);
- When there is a change in the project duration that changes the project's risk level; or

- When deemed necessary by the QSD. The QSD has determined that the changes listed in Table 1.1 can be field determined by the QSP. All other changes shall be made by the QSD as formal amendments to the SWPPP.

The following items shall be included in each amendment:

- Who requested the amendment;
- The location of proposed change;
- The reason for change;
- The original BMP proposed, if any; and
- The new BMP proposed.

Amendments shall be logged at the front of the SWPPP and certified. The SWPPP text shall be revised replaced, and/or hand annotated as necessary to properly convey the amendment. SWPPP amendments must be made by a QSD. The following changes have been designated by the QSD as "to be field determined" and constitute minor changes that the QSP may implement based on field conditions.

Table 1.1 List of Changes to be Field Determined

Candidate changes for field location or determination by QSP(1)	Check changes that can be field located or field determined by QSP
Increase quantity of an Erosion or Sediment Control Measure	✓
Relocate/Add stockpiles or stored materials	✓
Relocate or add toilets	✓
Relocate vehicle storage and/or fueling locations	✓
Relocate areas for waste storage	✓
Relocate water storage and/or water transfer location	✓
Changes to access points (entrance/exits)	✓
Change type of Erosion or Sediment Control Measure	✓
Changes to location of erosion or sediment control	✓
Minor changes to schedule or phases	✓
Changes in construction materials	✓
(1) Any field changes not identified for field location or field determination by QSP must be approved by QSD	

1.5 RETENTION OF RECORDS

Paper or electronic records of documents required by this SWPPP shall be retained for a minimum of three years from the date generated or date submitted, whichever is later, for the following items:

- NONE

These records shall be available at the Site until construction is complete. Records assisting in the determination of compliance with the General Permit shall be made available within a reasonable time, to the Regional Water Board, State Water Board or U.S. Environmental Protection Agency (EPA) upon request. Requests by the Regional Water Board for retention of records for a period longer than three years shall be adhered to.

1.6 REQUIRED NON-COMPLIANCE REPORTING

If a discharge violation occurs the QSP shall immediately notify the LRP and the LRP shall file a violation report electronically to the Regional Water Board within 30 days of identification of non-compliance using SMARTS. Corrective measures will be implemented immediately following the discharge or written notice of non-compliance from the Regional Water Board. Discharges and corrective actions will be documented on the NAL/NEL Exceedance Site Evaluation Report Form in CSMP Attachment 3 "Example Forms."

The report to the LRP and to the Regional Water Board will contain the following items:

- The date, time, location, nature of operation and type of unauthorized discharge.
- The cause or nature of the notice or order.
- The control measures (BMPs) deployed before the discharge event, or prior to receiving notice or order.

The date of deployment and type of control measures (BMPs) deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.

To date, there are no additional Regional Water Board requirements.

The Regional Water Quality Control Board jurisdiction is Los Angeles RWQCB (4).

1.7 ANNUAL REPORT

The General Permit requires that permittees prepare, certify, and electronically submit an Annual Report no later than September 1st of each year. Reporting requirements are identified in Section XVI of the General Permit. Annual reports will be filed in SMARTS and in accordance with information required by the on-line forms.

1.8 CHANGES TO PERMIT COVERAGE

The General Permit allows for the reduction or increase of the total acreage covered under the General Permit when: a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs shall be filed electronically within 30 days of a reduction or increase in total disturbed area if a change in permit covered acreage is to be sought. The SWPPP shall be modified appropriately, shall be logged at the front of the SWPPP and certified. Updated PRDs submitted electronically via SMARTS will be provided in the final SWPPP.

1.9 NOTICE OF TERMINATION

A Notice of Termination (NOT) must be submitted electronically by the LRP via SMARTS to terminate coverage under the General Permit. The NOT must include a final Site Map and representative photographs of the project site that demonstrate final stabilization has been achieved. The NOT shall be submitted within 90 days of completion of construction. The Regional Water Board will consider a construction site complete when the conditions of the General Permit, Section II.D have been met.

Section 2 Project Information

2.1 PROJECT AND SITE DESCRIPTION

2.1.1 Site Description

Please refer to:
Feasibility Study – Section 1-2 (cbec et al., 2015)
Existing Conditions Technical Report (cbec et al., 2015)

2.1.2 Existing Conditions

Please refer to:
Feasibility Study – Section 1-2 (cbec et al., 2015)
Existing Conditions Technical Report (cbec et al., 2015)

2.1.3 Existing Drainage

Please refer to:
Feasibility Study – Section 1-2 (cbec et al., 2015)
Existing Conditions Technical Report (cbec et al., 2015)

Stormwater is conveyed through surface runoff and some underground culverts within the site. Stormwater discharges, from the site, are considered direct discharges, as defined by the State Water Board into the Pacific Ocean. The existing site topography is shown in Figure 2 and Appendix F of the Feasibility Study.

More detailed drainage patterns, and stormwater conveyance systems will be provided in the final SWPPP.

2.1.4 Geology and Groundwater

Please refer to:
Feasibility Study – Section 1-2 (cbec et al., 2015)
Existing Conditions Technical Report (cbec et al., 2015)

2.1.5 Project Description

Please refer to:
Feasibility Study – Section 4 and Appendix F (cbec et al., 2015)

2.1.6 Developed Condition

Post construction, surface drainage will remain directed to the proposed estuary as surface flow through stormwater conveyance systems and sheet flow. Post construction drainage patterns and conveyance systems are shown in Appendix F of the Feasibility Study (Sheets C-1.2 through C-1.8).

Table 2.1 Construction Site Estimates

Construction site area	42	acres
Percent impervious before construction	19	%
Runoff coefficient before construction	0.38	
Percent impervious after construction	>1	%
Runoff coefficient after construction	0.25	

2.2 PERMITS AND GOVERNING DOCUMENTS

In addition to the General Permit, the following documents have been taken into account while preparing this SWPPP

- Regional Water Board requirements (Los Angeles RWQCB (4)
- Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study
- Basin Plan requirements
- Contract Documents
- Air Quality Regulations and Permits
- Federal Endangered Species Act
- National Historic Preservation Act/Requirements of the State Historic Preservation Office
- State of California Endangered Species Act

The following permits will be required for this project but have not been prepared to date:

- Clean Water Act Section 401 Water Quality Certifications and 404 Permits
- CA Department of Fish and Game 1602 Streambed Alteration Agreement

2.3 STORMWATER RUN-ON FROM OFFSITE AREAS

The General Permit requires that temporary BMPs be implemented to direct offsite run-on away from disturbed areas through the use of runoff controls. The following BMPs will be implemented: silt fence, fiber rolls (wattles) and hydro-seeding. Temporary water diversions of run-on from Harbor Blvd. may also be implemented. These BMPs will be located as shown on site map. The off-site drainage areas and associated stormwater conveyance facilities have not been developed for this preliminary SWPPP. BMPs are shown in Appendix F of the Feasibility Study (Sheets C1.2-C1.8).

2.4 CONSTRUCTION SITE SEDIMENT AND RECEIVING WATER RISK DETERMINATION

A construction site risk assessment has been performed for the project and the resultant risk level is Risk Level 1.

The risk level was determined through the use of the rainfall erosivity waiver fact sheet to determine R, the GIS method to determine K, LS. The risk level is based on project duration, location, proximity to impaired receiving waters and soil conditions. A copy of the Risk Level determination is included at the end of this report.
Table 2.2 and Table 2.3 summarize the sediment and receiving water risk factors and document the sources of information used to derive the factors.

Table 2.2 Summary of Sediment Risk

<table>
<tr><th>RUSLE Factor</th><th>Value</th><th colspan="2">Method for establishing value</th></tr>
<tr><td>R</td><td>83.7</td><td colspan="2">Construction Rainfall Erosivity Waiver Fact Sheet</td></tr>
<tr><td>K</td><td>0.1</td><td colspan="2">Google Earth File “RUSLE_K_Factor_Google.kml”</td></tr>
<tr><td>LS</td><td>0.28</td><td colspan="2">Google Earth File “RUSLE_LS_Factor_Google.kml”</td></tr>
<tr><td colspan="3">Total Predicted Sediment Loss (tons/acre)</td><td>2.34</td></tr>
<tr><td colspan="3">Overall Sediment Risk
Low Sediment Risk < 15 tons/ acre
Medium Sediment Risk >= 15 and < 75 tons/acre
High Sediment Risk >= 75 tons/acre</td><td>☒ Low
☐ Medium
☐ High</td></tr>
</table>

Runoff from the project site discharges into the Santa Clara River Estuary.

Table 2.3 Summary of Receiving Water Risk

Receiving Water Name	303(d) Listed for Sediment Related Pollutant(1)	TMDL for Sediment Related Pollutant(1)	Beneficial Uses of COLD, SPAWN, and MIGRATORY(1)
Santa Clara River Estuary	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Overall Receiving Water Risk			☒ **Low** ☐ **High**
(1) If yes is selected for any option the Receiving Water Risk is High			

Risk Level 1 sites are subject to the narrative effluent limitations specified in the General Permit. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures, and best management practices. This SWPPP has been prepared to address Risk Level 1 requirements (General Permit Attachment C).

2.5 CONSTRUCTION SCHEDULE

The site sediment risk was determined based on a hypothetical construction taking place between July 1 and June 20 of the following year. These dates were selected just to assist in the preparation of this draft SWPPP. No estimated construction dates have been determined. Modification or extension of the schedule (start and end dates) may affect risk determination and permit requirements. The LRP shall contact the QSD if the schedule changes during construction to address potential impact to the SWPPP. The estimated schedule will be prepared at a later date and is not included in this SWPPP.

This SWPPP does not cover the grading proposed south of the Restoration Area in the proposed Mixed Use Area.

2.6 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES

A Pollutant Source Assessment shall be prepared to identify all potential pollutants during construction, a preliminary Source assessment is provided below.

Table 2.4 includes a list of construction activities and associated materials that are anticipated to be used onsite. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the Best Management Practices for the project. Location of anticipated pollutants and associated BMPs are shown in Appendix F of the Feasibility Study (Sheets C1.2-C1.8)..

For sampling requirements for non-visible pollutants associated with construction activity please refer to Section 7.7.1. For a full and complete list of onsite pollutants, refer to the Material Safety Data Sheets (MSDS), which are retained onsite at the construction trailer.

Table 2.4 POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

General Work Activity/ Products With Potential Stormwater Pollutants	**Specific Work Activity/Products With Potential Stormwater Pollutants**	**Pollutant Categories**
Adhesives	• Adhesives, glues, resins, epoxy synthetics, PVC cement • Caulks, sealers, putty, sealing agents and • Coal tars (naphtha, pitch)	Oil and Grease, Synthetic Organics[1]
Asphalt paving/curbs	• Hot and cold mix asphalt	Oil and Grease
Cleaners	• Polishes (metal, ceramic, tile) • Etching agents • Cleaners, ammonia, lye, caustic sodas, bleaching agents and chromate salts	Metals, Synthetic Organics
Liquid waste	• Wash waters • Irrigation line testing/flushing	Metals, Synthetic Organics
Painting	• Paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding	Metals, Synthetic Organics
Planting / Vegetation Management	• Vegetation control (pesticides/herbicides) • Planting • Plant maintenance • Vegetation removal	Nutrients, Metals, Synthetic Organics
Removal of existing structures	• Demolition of asphalt, concrete, masonry, framing, roofing, metal structures.	Metals, Oil and Grease, Synthetic Organics
Sanitary waste	• Portable toilets • Disturbance of existing sewer lines.	Nutrients
Soil preparation/amendments	• Use of soil additives/amendments	Nutrients
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Utility line testing and flushing	• Hydrostatic test water • Pipe flushing	Synthetic Organics
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease
[1] Synthetic Organics are defined in Table 1.2 of the CASQA *Stormwater BMP Handbook Portal: Construction* as adhesives, cleaners, sealants, solvents, etc. These are generally categorized as VOCs or SVOCs.		

2.7 IDENTIFICATION OF NON-STORMWATER DISCHARGES

Non-stormwater discharges consist of discharges which do not originate from precipitation events. The General Permit provides allowances for specified non-stormwater discharges that do not cause erosion or carry other pollutants.

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the General Permit and listed in the SWPPP, or authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges that are authorized from this project site include the following:

- None

However, the project is likely to require a dewatering permit from the Los Angeles Region Regional Water Board for discharges of groundwater from construction to surface waters or to land.

Management of these authorized non-stormwater discharges will be provided for in subsequent drafts of the SWPPP.

Activities at this site that may result in unauthorized non-stormwater discharges include:

- Staging Area – small fueling activities, minor equipment maintenance, sanitary facilities, building materials, solvents, adhesives, paving materials, aggregates, paints, trash.
- Construction Activity – paving, curb/gutter installation, concrete pouring

Steps will be taken, including the implementation of appropriate BMPs, to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated on-site.

Discharges of construction materials and wastes, such as fuel or paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff, are also prohibited.

2.8 REQUIRED SITE MAP INFORMATION

The construction project's Site Map(s) show the project location, surface water boundaries, geographic features, construction site perimeter and general topography and other requirements identified in Attachment B of the General Permit. Table 2.5 identifies Map or Sheet Nos. where required elements are illustrated.

Table 2.5 Required Map Information

Included on Map/Plan Sheet No. (1)	Required Element
Fig 1	The project's surrounding area (vicinity)
Sheets C1.2-C1.8	Site layout

Table 2.5 Required Map Information

Included on Map/Plan Sheet No. (1)	Required Element
Sheets C1.2-C1.8	Construction site boundaries
See Note 2	Drainage areas
See Note 2	Discharge locations
See Note 2	Sampling locations
Sheets C1.2-C1.8	Areas of soil disturbance (temporary or permanent)
Sheets C1.2-C1.8	Active areas of soil disturbance (cut or fill)
Sheets C1.2-C1.8	Locations of runoff BMPs
Sheets C1.2-C1.8	Locations of erosion control BMPs
Sheets C1.2-C1.8	Locations of sediment control BMPs
N/A	ATS location (if applicable)
Sheets C1.2-C1.8	Locations of sensitive habitats, watercourses, or other features which are not to be disturbed
N/A	Locations of all post construction BMPs
See Note 2	Waste storage areas
See Note 2	Vehicle storage areas
See Note 2	Material storage areas
Sheets C1.2-C1.8	Entrance and Exits
See Note 2	Fueling Locations

Notes: (1) Indicate maps or drawings that information is included on (e.g., Vicinity Map, Site Map, Drainage Plans, Grading Plans, Progress Maps, etc.) (2) This is a preliminary SWPPP. These items are not provided in this version of the SWPPP because final design has not been completed.

Section 3 Best Management Practices

3.1 SCHEDULE FOR BMP IMPLEMENTATION

All grading and earthwork is anticipated to occur in a single phase. All work near the Santa Clara River, the only drainage on the project site, will occur during the seasonal work windows established by the project permits, and all specified BMP's will be in place to protect the river prior to the start of grading activities.

Table 3.1 BMP Implementation Schedule

	BMP	Implementation	Duration
Erosion Control	EC-1, Scheduling	Prior to Construction	Entirety of Project
	EC-2, Preservation of Existing Vegetation	Start of Construction	Entirety of Project
	EC-4 Hydroseed	End of Construction	Post- Project
	EC-3 Hydromulch	End of Construction	Post- Project
Sediment Control	SE-1 Silt Fence	Prior to Construction	Entirety of Project
	SE-5 Fiber Rolls	During/End of Grading	Post-Project
Tracking Control	TC-1 Stabilized Construction Entrance and Exit	Prior to Construction	Entirety of Project
	SE-7 Street Sweeping	During Construction	Entirety of Project
Wind Erosion	WE-1, Wind Erosion Control	Start of Construction	Entirety of Project

3.2 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls are required by the General Permit to provide effective reduction or elimination of sediment related pollutants in stormwater discharges and authorized non-stormwater discharges from the Site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

3.2.1 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

This construction project will implement the following practices to provide effective temporary and final erosion control during construction:

1. Preserve existing vegetation where required and when feasible.
2. The area of soil disturbing operations shall be controlled such that the Contractor is able to implement erosion control BMPs quickly and effectively.
3. Stabilize non-active areas within 14 days of cessation of construction activities or sooner if stipulated by local requirements.
4. Control erosion in concentrated flow paths by applying erosion control blankets, check dams, erosion control seeding or alternate methods.
5. Prior to the completion of construction, apply permanent erosion control to remaining disturbed soil areas.

Sufficient erosion control materials shall be maintained onsite to allow implementation in conformance with this SWPPP.

The following temporary erosion control BMP selection table indicates the BMPs that shall be implemented to control erosion on the construction site. Fact Sheets for temporary erosion control BMPs will be provided in the final SWPPP.

Table 3.2 Temporary Erosion Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP Used		If not used, state reason
			YES	NO	
EC-1	Scheduling	✓	x		
EC-2	Preservation of Existing Vegetation	✓	x		
EC-3	Hydraulic Mulch	✓[2]	x		
EC-4	Hydroseed	✓[2]	x		
EC-5	Soil Binders	✓[2]		x	Hydroseed\mulch is adequate/preferred
EC-6	Straw Mulch	✓[2]		x	Hydroseed\mulch is adequate/preferred
EC-7	Geotextiles and Mats	✓[2]		x	Slopes are gentle, Hydroseed is adequate/preferred
EC-8	Wood Mulching	✓[2]		x	Hydroseed\mulch is adequate/preferred
EC-9	Earth Dike and Drainage Swales	✓[3]		x	Not necessary for site slopes
EC-10	Velocity Dissipation Devices			x	Project does not involve culverts
EC-11	Slope Drains			x	Slopes are gentle
EC-12	Stream Bank Stabilization			x	Not required per engineered hydraulic model
EC-14	Compost Blankets	✓[2]		x	Hydroseed is adequate/preferred
EC-15	Soil Preparation-Roughening		x		
EC-16	Non-Vegetated Stabilization	✓[2]		x	Hydroseed is adequate/preferred
WE-1	Wind Erosion Control	✓	x		
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project shall be determined by the QSD.
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.
[3] Run-on from offsite shall be directed away from all disturbed areas, diversion of offsite flows may require design/analysis by a licensed civil engineer and/or additional environmental permitting

These temporary erosion control BMPs shall be implemented in conformance with the following guidelines and as outlined in the BMP Factsheets that will be provided in the final SWPPP. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Scheduling

Preliminary scheduling assumes that mass grading will be performed during the dry season. Hydroseed/mulch and post-construction BMPs will be installed by the end of October.

Preservation of Existing Vegetation

Because of sensitive site vegetation, a biologist will oversee construction activities to ensure that existing vegetation is preserved to the maximum extent possible.

Hydroseed

Hydroseed/mulch will be applied to all disturbed areas that are not going to be paved or stabilized with permanent paving.

Wind Erosion Control

Dust control will be applied to all disturbed areas until hydromulch or other permanent stabilization is applied.

3.2.2 Sediment Controls

Sediment controls are temporary or permanent structural measures that are intended to complement the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water.

The following sediment control BMP selection table indicates the BMPs that shall be implemented to control sediment on the construction site. Fact Sheets for temporary sediment control BMPs will be provided in the final SWPPP.

Table 3.3 Temporary Sediment Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
SE-1	Silt Fence	✓[2] [3]	**x**		
SE-2	Sediment Basin			x	Fiber rolls and silt fence provide adequate protection
SE-3	Sediment Trap			x	Fiber rolls and silt fence provide adequate protection
SE-4	Check Dams			x	Fiber rolls and silt fence provide adequate protection
SE-5	Fiber Rolls	✓[2][3]	x		
SE-6	Gravel Bag Berm	✓[3]		x	Fiber rolls and silt fence provide adequate protection
SE-7	Street Sweeping	✓	x		
SE-8	Sandbag Barrier			x	Fiber rolls and silt fence provide adequate protection
SE-9	Straw Bale Barrier			x	Fiber rolls and silt fence provide adequate protection
SE-10	Storm Drain Inlet Protection	✓ RL2&3	x		No storm drains
SE-11	ATS			x	Fiber rolls and silt fence provide adequate protection
SE-12	Temporary Silt Dike			x	Fiber rolls and silt fence provide adequate protection
SE-13	Compost Sock and Berm	✓[3]		x	Fiber rolls and silt fence provide adequate protection
SE-14	Biofilter Bags	✓[3]		x	Fiber rolls and silt fence provide adequate protection
TC-1	Stabilized Construction Entrance and Exit	✓	x		
TC-2	Stabilized Construction Roadway		x		
TC-3	Entrance Outlet Tire Wash			x	Stabilized construction entrance/exit & sweeping is adequate
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project shall be determined by the QSD
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements
[3]Risk Level 2 &3 shall provide linear sediment control along toe of slope, face of slope, and at the grade breaks of exposed slope

These temporary sediment control BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets will be provided in the final SWPPP. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Silt Fence

Silt fence will be installed at continuously along areas of the perimeter that are downslope of the project.

Fiber Rolls

Fiber rolls will be installed at the toe of slope, at appropriate intervals and at grade breaks, as necessary.

Street Sweeping

Street sweeping will be provided at the entrance and on Harbor Blvd. and elsewhere as needed.

Storm Drain Inlet Protection

Storm drain inlets on Harbor Blvd will be protected.

Stabilized Construction Entrance and Exit

A stabilized construction entrance will be provided during mass grading and prior to the road paving on the site entrance/exit road.

Stabilized Construction Roadway

A stabilized construction roadway will be provided during mass grading and prior to the road paving on the site entrance/exit road.

3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT

3.3.1 Non-Stormwater Controls

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the General Permit, are prohibited. Non-stormwater discharges for which a separate NPDES permit is required by the local Regional Water Board are prohibited unless coverage under the separate NPDES permit has been obtained for the discharge. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.7 of this SWPPP.

The following non-stormwater control BMP selection table indicates the BMPs that shall be implemented to control sediment on the construction site. Fact Sheets for temporary non-stormwater control BMPs will be provided in the final SWPPP.

Table 3.4 Temporary Non-Stormwater BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
NS-1	Water Conservation Practices	✓	✓		
NS-2	Dewatering Operation		✓		
NS-3	Paving and Grinding Operation		✓		
NS-4	Temporary Stream Crossing			✓	Not applicable to the project
NS-5	Clear Water Diversion		✓		
NS-6	Illicit Connection- Illegal Discharge Connection	✓		✓	Not applicable to the project
NS-7	Potable Water Irrigation Discharge Detection		✓		
NS-8	Vehicle and Equipment Cleaning	✓		✓	Will not be allowed on-site
NS-9	Vehicle and Equipment Fueling	✓	✓		
NS-10	Vehicle and Equipment Maintenance	✓		✓	Will not be allowed on-site
NS-11	Pile Driving Operation			✓	Not applicable to the project
NS-12	Concrete Curing			✓	Not applicable to the project
NS-13	Concrete Finishing			✓	Not applicable to the project
NS-14	Material and Equipment Use Over Water			✓	Not applicable to the project
NS-15	Demolition Removal Adjacent to Water		✓		
NS-16	Temporary Batch Plants			✓	Not applicable to the project
Alternate BMPs Used:			**If used, state reason:**		

[1] Applicability to a specific project shall be determined by the QSD

Non-stormwater BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets that will be provided in the final SWPPP. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Water Conservation Practices

Water use will be minimized to the maximum extent practical.

Dewatering Operation

Dewatering methods will be determined in subsequent design.

Paving and Grinding Operation

Paving will be scheduled for the dry season and will have appropriate BMPs described in NS-3.

Clear Water Diversion

Water diversion methods, if needed will be determined in subsequent design.

Potable Water Irrigation Discharge Detection

Irrigation leaks will trigger an automatic shut-off.

Vehicle and Equipment Fueling

Fueling location and BMPs will be determined in subsequent design.

3.3.2 Materials Management and Waste Management

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing and using construction materials to prevent the release of those materials into stormwater discharges. The amount and type of construction materials to be utilized at the Site will depend upon the type of construction and the length of the construction period. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consist of implementing procedural and structural BMPs for handling, storing and ensuring proper disposal of wastes to prevent the release of those wastes into stormwater discharges.

Materials and waste management pollution control BMPs shall be implemented to minimize stormwater contact with construction materials, wastes and service areas; and to prevent materials and wastes from being discharged off-site. The primary mechanisms for stormwater contact that shall be addressed include:

- Direct contact with precipitation
- Contact with stormwater run-on and runoff
- Wind dispersion of loose materials
- Direct discharge to the storm drain system through spills or dumping

- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

A list of construction activities is provided in Section 2.6. The following Materials and Waste Management BMP selection table indicates the BMPs that shall be implemented to handle materials and control construction site wastes associated with these construction activities. Fact Sheets for Materials and Waste Management BMPs will be provided in the final SWPPP.

Table 3.5 Temporary Materials Management BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
WM-01	Material Delivery and Storage	✓	x		
WM-02	Material Use	✓	x		
WM-03	Stockpile Management	✓	x		
WM-04	Spill Prevention and Control	✓	x		
WM-05	Solid Waste Management	✓	x		
WM-06	Hazardous Waste Management	✓	x		
WM-07	Contaminated Soil Management			x	No Contaminated soil on site
WM-08	Concrete Waste Management	✓	x		
WM-09	Sanitary-Septic Waste Management	✓	x		
WM-10	Liquid Waste Management		x		
Alternate BMPs Used:				**If used, state reason:**	
[1] Applicability to a specific project shall be determined by the QSD.					

Material management BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Material Delivery and Storage

Material delivery and storage will be limited to the dry season and will take place in designated staging areas to be determined in subsequent design.

Material Use

Material Use will follow recommended BMPs in WM-2.

Stockpile Management

Stockpiles will be controlled as recommended in WM-3.

Spill Prevention and Control

Spill prevention will be controlled as recommended in WM-4.

Solid Waste Management

Waste Management will be controlled as recommended in WM-5.

Hazardous Waste Management

Hazardous Waste Management will be controlled as recommended in WM-6.

Contaminated Soil Management

Contaminated Soil will be controlled as recommended in WM-7.

Concrete Waste Management

Concrete Waste Management will be controlled as recommended in WM-8.

Sanitary-Septic Waste Management

Sanitary Septic will be controlled as recommended in WM-9.

Liquid Waste Management

Liquid Waste Management will be controlled as recommended in WM-10.

3.4 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

This site is located in an area subject to a Phase I or Phase II Municipal Separate Storm Sewer System (MS4) permit approved Stormwater Management Plan. ☒ Yes ☐ No

The following source control post construction BMPs to comply with General Permit Section XIII.B and local requirements have been identified for the site:

- None

Section 4 BMP Inspection and Maintenance

4.1 BMP INSPECTION AND MAINTENANCE

The General Permit requires routine weekly inspections of BMPs, along with inspections before, during, and after qualifying rain events. A BMP inspection checklist must be filled out for inspections and maintained on-site with the SWPPP. The inspection checklist includes the necessary information covered in Section 7.6. A blank inspection checklist will be provided in the final SWPPP. Completed checklists shall be kept in CSMP.

BMPs shall be maintained regularly to ensure proper and effective functionality. If necessary, corrective actions shall be implemented within 72 hours of identified deficiencies and associated amendments to the SWPPP shall be prepared by the QSD.

Specific details for maintenance, inspection, and repair of Construction Site BMPs can be found in the BMP Factsheets.

Section 5 Training

The following text should be modified accordingly

To promote stormwater management awareness specific for this project, periodic training of job-site personnel shall be included as part of routine project meetings (e.g. daily/weekly tailgate safety meetings), or task specific trainings as needed.

The QSP shall be responsible for providing this information at the meetings, and subsequently completing training logs, which identifies the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting. Tasks may be delegated to trained employees by the QSP provided adequate supervision and oversight is provided. Training shall correspond to the specific task delegated including: SWPPP implementation; BMP inspection and maintenance; and record keeping.

Section 6 Responsible Parties and Operators

6.1 RESPONSIBLE PARTIES

Approved Signatory(ies) who are responsible for SWPPP implementation and have authority to sign permit-related documents are listed below. Written authorizations from the LRP for these individuals will be provided in the final SWPPP. The Approved Signatory(ies) assigned to this project are:

Name	Title	Phone Number
Rep for Cal. State Parks to be determined		

QSPs identified for the project will be provided in the final SWPPP. The QSP shall have primary responsibility and significant authority for the implementation, maintenance and inspection/monitoring of SWPPP requirements. The QSP will be available at all times throughout the duration of the project. Duties of the QSP include but are not limited to:

- Implementing all elements of the General Permit/ SWPPP, including but not limited to:
  - Ensuring all BMPs are implemented, inspected, and properly maintained;
  - Performing non-stormwater and stormwater visual observations and inspections;
  - Performing non-stormwater and storm sampling and analysis, as required;
  - Performing routine inspections and observations;
  - Implementing non-stormwater management, and materials and waste management activities such as: monitoring discharges; general Site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than stormwater are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.;
- The QSP may delegate these inspections and activities to an appropriately trained employee, but shall ensure adequacy and adequate deployment.
- Ensuring elimination of unauthorized discharges.
- The QSPs shall be assigned authority by the LRP to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate with the Contractor(s) to assure all of the necessary corrections/repairs are made immediately and that the project complies with the SWPPP, the General Permit and approved plans at all times.
- Notifying the LRP or Authorized Signatory immediately of off-site discharges or other non-compliance events.

6.2 CONTRACTOR LIST

Contractor

Name: TO BE DETERMINED

Title:

Company:

Address:

Phone Number:

Number (24/7):

Section 7 Construction Site Monitoring Program (CSMP)

7.1 Purpose

This Construction Site Monitoring Program (CSMP) was developed to address the following objectives:

1. To demonstrate that the site is in compliance with the Discharge Prohibitions of the Construction General Permit;
2. To determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives;
3. To determine whether immediate corrective actions, additional Best Management Practices (BMP) implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges;
4. To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

7.2 Applicability of Permit Requirements

This project has been determined to be a Risk Level 1 project. The General Permit identifies the following types of monitoring as being applicable for a Risk Level 1 project.

Risk Level 1

- Visual inspections of Best Management Practices (BMPs);
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for non-visible pollutants when applicable; and
- Sampling and analysis of construction site runoff as required by the Regional Water Board when applicable.

7.3. Weather and Rain Event Tracking

Visual monitoring and inspections requirements of the General Permit are triggered by a qualifying rain event. The General Permit defines a qualifying rain event as any event that produces ½ inch of precipitation. A minimum of 48 hours of dry weather will be used to distinguish between separate qualifying storm events.

7.3.1 Weather Tracking

The QSP should daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the weather forecasts. These forecasts can be obtained at http://www.srh.noaa.gov/. Weather reports should be printed and maintained with the SWPPP in CSMP Attachment 1 "Weather Reports".

7.3.2 Rain Gauges

The QSP shall install a rain gauge on the project site. Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

The rain gauge shall be read daily during normal site scheduled hours. The rain gauge should be read at approximately the same time every day and the date and time of each reading recorded. Log rain gauge readings in CSMP Attachment 1 "Weather Records". Follow the rain gauge instructions to obtain accurate measurements.

Once the rain gauge reading has been recorded, accumulated rain shall be emptied and the gauge reset.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge is located at the River Ridge Golf Course located at 2401 W Vineyard Ave, Oxnard, CA 93036 with a Latitude of 34 deg. 14 min N and a Longitude of 119 deg. 12 min W and an Elevation of 48 ft.

7.4 Monitoring Locations

Monitoring locations will be provided in the final SWPPP. Monitoring locations are described in the Sections 7.6 and 7.7.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP amended. Temporary changes that result in a one-time additional sampling location do not require a SWPPP amendment.

7.5 Safety and Monitoring Exemptions

Safety practices for sample collection will be in accordance with the Contractor's Health and Safety Plan (to be determined). A summary of the safety requirements that apply to sampling personnel will be provided in subsequent designs.

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions:

- During dangerous weather conditions such as flooding and electrical storms.
- Outside of scheduled site business hours.

Scheduled site business hours are to be determined in subsequent design.

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above then the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation shall be filed in CSMP Attachment 2 “Monitoring Records”.

7.6 Visual Monitoring

Visual monitoring includes observations and inspections. Inspections of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Visual observations of the site are required to observe storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.

Table 7.1 identifies the required frequency of visual observations and inspections. Inspections and observations will be conducted at the locations identified in Section 7.6.3.

Table 7.1 Summary of Visual Monitoring and Inspections

Type of Inspection	Frequency
Routine Inspections	
BMP Inspections	Weekly[1]
BMP Inspections – Tracking Control	Daily
BMP Inspections – Silt Fence, Fiber Roll, etc.	Weekly
Non-Stormwater Discharge Observations	Quarterly during daylight hours, weekly during dewatering
Rain Event Triggered Inspections	
Site Inspections Prior to a Qualifying Event	Within 48 hours of a qualifying event [2]
BMP Inspections During an Extended Storm Event	Every 24-hour period of a rainevent[2]
Site Inspections Following a Qualifying Event	Within 48 hours of a qualifying event[2]

[1] Most BMPs must be inspected weekly; those identified below must be inspected more frequently.

[2] Inspections are only required during scheduled site operating hours. Note however, these inspections are required daily regardless of the amount of precipitation.

7.6.1 Routine Observations and Inspections

Routine site inspections and visual monitoring are necessary to ensure that the project is in compliance with the requirements of the Construction General Permit.

7.6.1.1 Routine BMP Inspections

Inspections of BMPs are conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

7.6.1.2 Non-Stormwater Discharge Observations

Each drainage area will be inspected for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Inspections will record:

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized);
- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.); and
- Source of discharge.

7.6.2 Rain-Event Triggered Observations and Inspections

Visual observations of the site and inspections of BMPs are required prior to a qualifying rain event; following a qualifying rain event, and every 24-hour period during a qualifying rain event. Pre-rain inspections will be conducted after consulting NOAA and determining that a precipitation event with a 50% or greater probability of precipitation has been predicted.

7.6.2.1 Visual Observations Prior to a Forecasted Qualifying Rain Event

Within 48-hours prior to a qualifying event a stormwater visual monitoring site inspection will include observations of the following locations:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- BMPs to identify if they have been properly implemented;
- Any stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.

Consistent with guidance from the State Water Resources Control Board, pre-rain BMP inspections and visual monitoring will be triggered by a NOAA forecast that indicates a probability of precipitation of 50% or more in the project area.

7.6.2.2 BMP Inspections During an Extended Storm Event

During an extended rain event BMP inspections will be conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

If the construction site is not accessible during the rain event, the visual inspections shall be performed at all relevant outfalls, discharge points, downstream locations. The inspections should record any projected maintenance activities.

7.6.2.2 Visual Observations Following a Qualifying Rain Event

Within 48 hours following a qualifying rain event (0.5 inches of rain) a stormwater visual monitoring site inspection is required to observe:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- BMPs to identify if they have been properly designed, implemented, and effective;
- Need for additional BMPs;
- Any stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard; and
- Discharge of stored or contained rain water.

7.6.3 Visual Monitoring Procedures

Visual monitoring shall be conducted by the QSP or staff trained by and under the supervision of the QSP.

The name(s) and contact number(s) of the site visual monitoring personnel will be listed below and their training qualifications will be provided in the final SWPPP.

Assigned inspector:	Contact phone:
Alternate inspector:	Contact phone:

Stormwater observations shall be documented on the *Visual Inspection Field Log Sheet* (see CSMP Attachment 3 “Example Forms”). BMP inspections shall be documented on the site specific BMP inspection checklist. Any photographs used to document observations will be referenced on stormwater site inspection report and maintained with the Monitoring Records in Attachment 2.

The QSP shall within 2 days of the inspection submit copies of the completed inspection report to the QSD.

The completed reports will be kept in CSMP Attachment 2 “Monitoring Records”.

7.6.4 Visual Monitoring Follow-Up and Reporting

Correction of deficiencies identified by the observations or inspections, including required repairs or maintenance of BMPs, shall be initiated and completed as soon as possible.

If identified deficiencies require design changes, including additional BMPs, the implementation of changes will be initiated within 72 hours of identification and be completed as soon as possible. When design changes to BMPs are required, the SWPPP shall be amended to reflect the changes.

Deficiencies identified in site inspection reports and correction of deficiencies will be tracked on the *Inspection Field Log Sheet* or *BMP Inspection Report* and shall be submitted to the QSP and shall be kept in CSMP Attachment 2 “Monitoring Records”.

The QSP shall within 14 days of the inspection submit copies of the completed *Inspection Field Log Sheet* or *BMP Inspection Report* with the corrective actions to the Owner's Representative..

Results of visual monitoring must be summarized and reported in the Annual Report.

7.6.5 Visual Monitoring Locations

The inspections and observations identified in Sections 7.6.1 and 7.6.2 will be conducted at the locations to be determined in subsequent design.

BMP locations are shown in Appendix F of the Feasibility Study (Sheets C1.2-C1.8).

There are a to be determined drainage number of drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) will be provided in the final SWPPP.

There are a number to be determined of discharge location(s) on the project site. Site stormwater discharge location(s) will be provided in the final SWPPP.

7.7 Water Quality Sampling and Analysis

7.7.1 Sampling and Analysis Plan for Non-Visible Pollutants

A Pollutant Source Assessment shall be prepared to identify all potential pollutants during construction. The assessment shall include the Material Safety Data Sheets (MSDS) for all potential non-visible pollutants and an analysis method for potential pollutants on the site. The assessment shall also identify the minimum sample volume, sample containers, sample preservation, reporting limit, and maximum holding time for each pollutant.

The Pollutant Source Assessment shall be submitted to the QSD and shall be kept in CSMP Attachment 5 "Supplemental Information". The Pollutant Source Assessment shall be updated as necessary to include any additional potential pollutants brought to the site.

Sampling for non-visible pollutants will be conducted when (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

The following construction materials, wastes, or activities, as identified in Section 2.6, are potential sources of non-visible pollutants to stormwater discharges from the project. Storage, use, and operational locations will be provided in the final SWPPP.

- Wash waters
- Irrigation line testing/flushing
- Utility line testing and flushing
- Vegetation control (herbicides)

The following soil amendments have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil and will be used on the project site. Locations of soil amendment application will be provided in the final SWPPP.

- To Be Determined but may include Sulfur Coated Urea and/or Gypsum

7.7.1.1 Sampling Schedule

Samples for the potential non-visible pollutant(s) and a sufficiently large unaffected background sample shall be collected during the first two hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during the site's scheduled hours and shall be collected regardless of the time of year and phase of the construction.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during site inspections conducted prior to or during a rain event.

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents stormwater contact and runoff from the storage area.
- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- A construction activity, including but not limited to those in Section 2.6, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Stormwater runoff from an area contaminated by historical usage of the site has been observed to combine with stormwater runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

7.7.1.2 Sampling Locations

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use; accessibility for sampling, and personnel safety. Planned non-visible pollutant sampling locations will be provided in the final SWPPP.

Sampling location(s) on the project site and the contractor's yard will be identified in subsequent design phases for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Sampling location(s) will be identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. The location(s) will be selected such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

7.7.1.3 Monitoring Preparation

Non-visible pollutant samples will be collected by one of the following parties:

Contractor	☐ Yes	☐ No
Consultant	☐ Yes	☐ No
Laboratory	☐ Yes	☐ No

7.7.1.4 Analytical Constituents

Table 7.3 lists the specific sources and types of potential non-visible pollutants on the project site and the water quality indicator constituent(s) for that pollutant.

Table 7.3 Potential Non-Visible Pollutants and Water Quality Indicator Constituents

Pollutant Source	Pollutant	Water Quality Indicator Constituent
Gypsum	Base	pH
Herbicides	TBD	TBD
Sulfur coated urea	Sulfate	Sulfate
Vegetation stockpiles	BOD	BOD
Portable toilets	BOD, Fecal Coliform	BOD, Total/Fecal Coliform
Asphalt Work	VOC	VOCs
Vehicle Use	Batteries	Sulfuric acid; Pb, pH

7.7.1.5 Sample Collection

Samples of discharge will be collected at the designated non-visible pollutant sampling locations to be determined in subsequent design phases or in the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Grab samples shall be collected and preserved in accordance with the methods identified in the Table, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants" provided in Section 7.7.1.6. Only the QSP, or personnel trained in water quality sampling under the direction of the QSP shall collect samples.

Sample collection and handling requirements are described in Section 7.7.7.

7.7.1.6 Sample Analysis

Samples shall be analyzed using the analytical methods and a laboratory to be determined in subsequent design phases..

7.7.1.7 Data Evaluation and Reporting

The QSP shall complete an evaluation of the water quality sample analytical results.

Runoff/downgradient results shall be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

The General Permit prohibits the storm water discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the Regional Water Board and other agencies as required by 40 C.F.R. §§ 117.3 and 302.4.

Results of non-visible pollutant monitoring shall be reported in the Annual Report.

7.7.2 Sampling and Analysis Plan for pH and Turbidity

Sampling and analysis of runoff for pH and turbidity is not required for Risk Level 1 projects.

7.7.3 Additional Monitoring Following an NEL Exceedance

This project is not subject to NELs.

7.7.4 Sampling and Analysis Plan for Non-Stormwater Discharges

This project is not subject to the non-stormwater sampling and analysis requirements of the General Permit because it is a Risk Level 1 project.

7.7.5 Sampling and Analysis Plan for Other Pollutants

The Regional Water Board has not specified monitoring for additional pollutants.

7.7.6 Training of Sampling Personnel

Sampling personnel shall be trained to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring program (SWAMP) 2008 Quality Assurance Program Plan (QAPrP). Training records of designated contractor sampling personnel will be provided in the final SWPPP.

7.7.7 Sample Collection and Handling

7.7.7.1 Sample Collection

Samples shall be collected at the designated sampling locations shown on the Site Maps and listed in the preceding sections. Samples shall be collected, maintained and shipped in accordance with the SWAMP 2008 Quality Assurance Program Plan (QAPrP).

Grab samples shall be collected and preserved in accordance with the methods identified in preceding sections.

To maintain sample integrity and prevent cross-contamination, sample collection personnel shall follow the protocols below.

- Collect samples (for laboratory analysis) only in analytical laboratory-provided sample containers;
- Wear clean, powder-free nitrile gloves when collecting samples;
- Change gloves whenever something not known to be clean has been touched;
- Change gloves between sites;
- Decontaminate all equipment (e.g. bucket, tubing) prior to sample collection using a trisodium phosphate water wash, distilled water rinse, and final rinse with distilled water. (Dispose of wash and rinse water appropriately, i.e., do not discharge to storm drain or receiving water). Do not decontaminate laboratory provided sample containers;
- Do not smoke during sampling events;
- Never sample near a running vehicle;
- Do not park vehicles in the immediate sample collection area (even non-running vehicles);
- Do not eat or drink during sample collection; and
- Do not breathe, sneeze, or cough in the direction of an open sample container.

The most important aspect of grab sampling is to collect a sample that represents the entire runoff stream. Typically, samples are collected by dipping the collection container in the runoff flow paths and streams as noted below.

i. For small streams and flow paths, simply dip the bottle facing upstream until full.
ii. For larger stream that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle. Once again making sure that the opening of the bottle is facing upstream as to avoid any contamination by the sampler.
iii. For larger streams that cannot be safely waded, pole-samplers may be needed to safely access the representative flow.
iv. Avoid collecting samples from ponded, sluggish or stagnant water.
v. Avoid collecting samples directly downstream from a bridge as the samples can be affected by the bridge structure or runoff from the road surface.

Note, that depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the stream, but filled indirectly from the collection container.

7.7.7.2 Sample Handling

Turbidity and pH measurements must be conducted immediately. Do not store turbidity or pH samples for later measurement.

Samples for laboratory analysis must be handled as follows. Immediately following sample collection:

- Cap sample containers;
- Complete sample container labels;
- Sealed containers in a re-sealable storage bag;
- Place sample containers into an ice-chilled cooler;
- Document sample information on the *Effluent Sampling Field Log Sheet*; and
- Complete the CoC.

All samples for laboratory analysis must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Place samples to be shipped inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless required sooner by the analytical laboratory).

7.7.7.3 Sample Documentation Procedures

All original data documented on sample bottle identification labels, *Effluent Sampling Field Log Sheet*, and CoCs shall be recorded using waterproof ink. These shall be considered accountable documents. If an error is made on an accountable document, the individual shall make corrections by lining through the error and entering the correct information. The erroneous information shall not be obliterated. All corrections shall be initialed and dated.

Duplicate samples shall be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples shall be identified in the Effluent Sampling Field Log Sheet.

Sample documentation procedures include the following:

<u>Sample Bottle Identification Labels:</u> Sampling personnel shall attach an identification label to each sample bottle. Sample identification shall uniquely identify each sample location.

<u>Field Log Sheets:</u> Sampling personnel shall complete the *Effluent Sampling Field Log Sheet* and *Receiving Water Sampling Field Log Sheet* for each sampling event, as appropriate.

<u>Chain of Custody:</u> Sampling personnel shall complete the CoC for each sampling event for which samples are collected for laboratory analysis. The sampler will sign the CoC when the sample(s) is turned over to the testing laboratory or courier.

7.8 Active Treatment System Monitoring

An Active Treatment System (ATS) will be deployed on the site?

☐ Yes ☒ No

This project does not require a project specific Sampling and Analysis Plan for an ATS because deployment of an ATS is not planned.

7.9 Bioassessment Monitoring

This project is not subject to bioassessment monitoring because it is not a Risk Level 3 project.

7.10 Watershed Monitoring Option

This project is not participating in a watershed monitoring option.

7.11 Quality Assurance and Quality Control

An effective Quality Assurance and Quality Control (QA/QC) plan shall be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- CoCs;
- QA/QC Samples; and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

7.11.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. Sampling information to be included in the field log include the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and types of samples that were collected. Field observations should be noted in the field log for any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity should also be recorded in the field log. A Visual Inspection Field Log, and an Effluent Sampling Field Log Sheet are included in CSMP Attachment 3 “Example Forms”.

7.11.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. As discussed in Section 7.7.7, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

7.11.3 Chain of Custody

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples;
- Use of CoC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in CSMP Attachment 3 “Example Forms”.

7.11.4 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. The types of QA/QC will be determined in subsequent design for this project and may include:

☐ Field Duplicates at a frequency of 1 duplicate minimum per sampling event (Required for all sampling plans with field measurements or laboratory analysis)

☐ Equipment Blanks

☐ Field Blanks

☐ Travel Blanks

7.11.4.1 Field Duplicates

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples shall be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected shall be randomly selected from the discharge locations. Duplicate samples shall be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples shall not influence any evaluations or conclusion.

7.11.4.2 Equipment Blanks

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks are typically collected when:

- New equipment is used;
- Equipment that has been cleaned after use at a contaminated site;
- Equipment that is not dedicated for surface water sampling is used; or
- Whenever a new lot of filters is used when sampling metals.

7.11.4.3 Field Blanks

Field blanks assess potential sample contamination levels that occur during field sampling activities. De-ioninzed water field blanks are taken to the field, transferred to the appropriate container, and treated the same as the corresponding sample type during the course of a sampling event.

7.11.4.4 Travel Blanks

Travel blanks assess the potential for cross-contamination of volatile constituents between sample containers during shipment from the field to the laboratory. De-ioninzed water blanks are taken along for the trip and held unopened in the same cooler with the VOC samples.

7.11.5 Data Verification

After results are received from the analytical laboratory, the QSP shall verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification shall include:

- Check the CoC and laboratory reports.
  Make sure all requested analyses were performed and all samples are accounted for in the reports.
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.
  Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. The QSP should especially note data that is an order of magnitude or more different than similar locations, or is inconsistent with previous data from the same location.
- Check laboratory QA/QC results.
  EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. These data are typically reported along with the sample results. The QSP shall evaluate the reported QA/QC data to check for contamination (method, field, and equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.
- Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate.
  Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.

Field data including inspections and observations must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification shall include:

- Check field logs to make sure all required measurements were completed and appropriately documented;
- Check reported values that appear out of the typical range or inconsistent;
  Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling; verify equipment calibrations;
- Review observations noted on the field logs; and
- Review notations of any errors and actions taken to correct the equipment or recording errors.

7.12 Records Retention

All records of stormwater monitoring information and copies of reports (including Annual Reports) must be retained for a period of at least three years from date of submittal or longer if required by the Regional Water Board.

Results of visual monitoring, field measurements, and laboratory analyses must be kept in the SWPPP along with CoCs, and other documentation related to the monitoring.

Records are to be kept onsite while construction is ongoing. Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation;
- The individual(s) who performed the inspections, sampling, visual observation, and/or field measurements;
- The date and approximate time of field measurements and laboratory analyses;
- The individual(s) who performed the laboratory analyses;
- A summary of all analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;
- QA/QC records and results;
- Calibration records;
- Visual observation and sample collection exemption records;
  The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections

Rain Gauge Log Sheet				
Construction Site Name:				
WDID #:				
Date (mm/dd/yy)	Time (24-hr)	Initials	Rainfall Depth (Inches)	Notes:

Risk Level 1, 2, 3 ***Visual Inspection Field Log Sheet***						
Date and Time of Inspection:				Report Date:		
Inspection Type:	☐ Weekly	☐ Before predicted rain	☐ During rain event	☐ Following qualifying rain event	☐ Contained stormwater release	☐ Quarterly non-stormwater
Site Information						
Construction Site Name:						
Construction stage and completed activities:					Approximate area of exposed site:	
Weather and Observations						
Date Rain Predicted to Occur:				Predicted % chance of rain:		
Estimate storm beginning: ____________ (date and time)		Estimate storm duration:_______ (hours)		Estimate time since last storm: _______ (days or hours)	Rain gauge reading:_______ (inches)	
Observations: If yes identify location						
Odors	Yes ☐	No ☐				
Floating material	Yes ☐	No ☐				
Suspended Material	Yes ☐	No ☐				
Sheen	Yes ☐	No ☐				
Discolorations	Yes ☐	No ☐				
Turbidity	Yes ☐	No ☐				
Site Inspections						
Outfalls or BMPs Evaluated			**Deficiencies Noted**			
(add additional sheets or attached detailed BMP Inspection Checklists)						
Photos Taken:	Yes ☐	No ☐	Photo Reference IDs:			
Corrective Actions Identified (note if SWPPP/REAP change is needed)						
Inspector Information						
Inspector Name:				Inspector Title:		
Signature:					Date:	

Risk Level 2 ***Effluent Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Additional Sampling Notes:
Time End:

Risk Level 3 Effluent Sampling Field Log Sheets				
Construction Site Name:			Date:	Time Start:
Sampler:				
Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant	☐ Post NEL Exceedance
Field Meter Calibration				
pH Meter ID No./Desc.: Calibration Date/Time:			Turbidity Meter ID No./Desc.: Calibration Date/Time:	

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected			
Discharge Location Description	SSC	Other (specify)	Time

Additional Sampling Notes:
Time End:

Risk Level 3 ***Receiving Water Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Receiving Water Description and Observations			
Receiving Water Name/ID:			
Observations:			
Odors	Yes ☐ No ☐		
Floating material	Yes ☐ No ☐		
Suspended Material	Yes ☐ No ☐		
Sheen	Yes ☐ No ☐		
Discolorations	Yes ☐ No ☐		
Turbidity	Yes ☐ No ☐		
Field Meter Calibration			
pH Meter ID No./Desc.: Calibration Date/Time:		Turbidity Meter ID No./Desc.: Calibration Date/Time:	
Field pH and Turbidity Measurements and SSC Grab Sample			
Upstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		
Downstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		
Additional Sampling Notes:			
Time End:			

NAL or NEL Exceedance Evaluation Summary Report	Page __ of __
Project Name	
Project WDID	
Project Location	
Date of Exceedance	
Type of Exceedance	NAL Daily Average ☐ pH ☐ Turbidity NEL Daily Average ☐ pH ☐ Turbidity ☐ Other (specify) ________________
Measurement or Analytical Method	☐ Field meter (Sensitivity: _________) ☐ Lab method (specify) __________ (Reporting Limit: _____) (MDL: ______________)
Calculated Daily Average	☐ pH _ pH units ☐ Turbidity __ NTU
Rain Gauge Measurement	______ inches
Compliance Storm Event	______ inches (5-year, 24-hour event)
Visual Observations on Day of Exceedance	

NAL or NEL Exceedance Evaluation Summary Report	Page __ of __
Description of BMPs in Place at Time of Event	
Initial Assessment of Cause	
Corrective Actions Taken (deployed after exceedance)	
Additional Corrective Actions Proposed	
Report Completed By	____________________ **(Print Name, Title)**
Signature	____________________

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

							REQUESTED ANALYSIS				Notes:
DESTINATION LAB: ATTN: **ADDRESS:** **Office Phone:** **Cell Phone:**											
SAMPLED BY:											
Contact:											
Project Name											
Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container #**	**Container Type**	**Container Pres.**					

SENDER COMMENTS:	**RELINQUISHED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:
LABORATORY COMMENTS:	**RECEIVED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:

Section 8 References

CASQA 2009, *Stormwater BMP Handbook Portal: Construction*, November 2009, www.casqa.org

cbec, WRA, and Podlech, M. (2015) Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study, July 2015.

State Water Resources Control Board (2009). Order 2009-0009-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing Activities. Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

State Water Resources Control Board (2010). Order 2010-0014-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing Activities. Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Risk Level Determination

Sediment Risk

R x K x LS = tons/acre of Project

(83.7) x (0.1) x(0.28) = 2.34

Where R: is 83.7 as determined by

The number 25 was discovered through the “Erosivity Index Zone_WGSProjected” per KML File available from the State Water Board at ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/ and viewed in Google Earth. Table 1. (Erosivity Index Table) revealed the number 25. Looking at row 25 with an estimated project duration of one year (Jan. through Dec.) we get 0.93 (93%) EI as a percentage.

The number 90 was then extrapolated from being within the zone between 100 and 80 per “Isoerodent R Value” per Google Map File “RUSLE_R_Isoerodent.kml” file as viewed in Google Earth. The equation used was then used:

Index Zone x EI x **#years=R** therefore, **90 x .93 x 1 = 83.7**

Where K: Is 0.1 per “K Factor” per Google Map File “RUSLE_K_Factor_Google.kml” File as viewed in Google Earth

Where LS: Is 0.28 per “LS Final Update” per Google Map File “RUSLE_LS_Factor_Google.kml” File as viewed in Google Earth

If Tons per project is:

Low sediment Risk: <15 tons/acre

Medium Risk: _> 15 and <75 tons/acre

High Risk: _> 75 tons/acre

Our site is projected to have 2.34 tons/acre falling in the low end of the “Low Sediment Risk.”

Receiving Water Body Risk

Our site has a **Low Receiving Water Body Risk Level** per the KML file available from the State Water Board at:

ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/ and viewed in Google Earth.

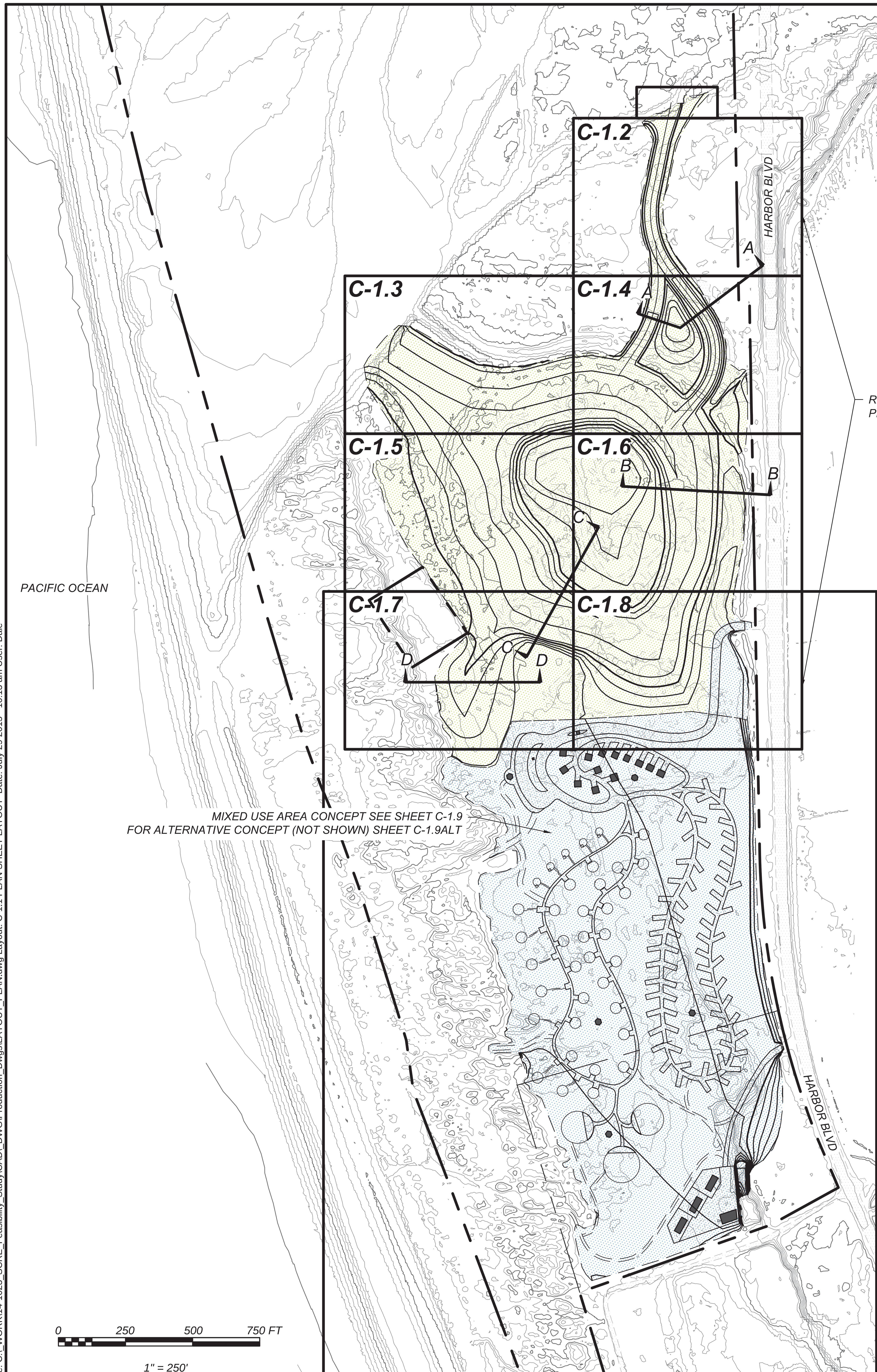
Final Risk Level

Low Sediment Risk

Low Receiving Water Body Risk

This project is a Risk 1 Level Project.

APPENDIX F – PLAN SET

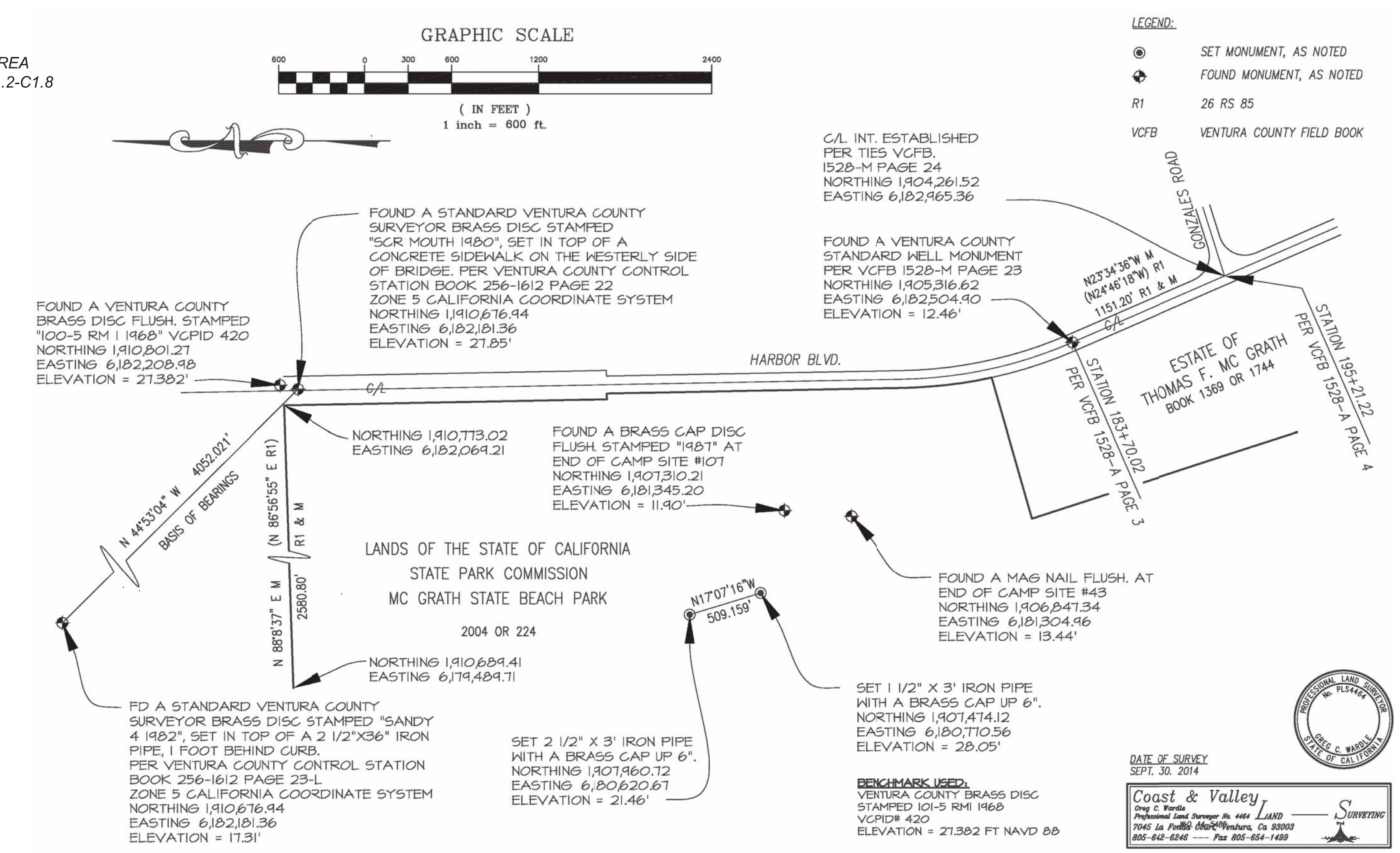


CIVIL SHEET LIST

Sheet Number	Sheet Title
C-1.1	PLAN SHEET LAYOUT
C-1.2	GRADING & EROSION CONTROL PLAN
C-1.3	GRADING & EROSION CONTROL PLAN
C-1.4	GRADING & EROSION CONTROL PLAN
C-1.5	GRADING & EROSION CONTROL PLAN
C-1.6	GRADING & EROSION CONTROL PLAN
C-1.7	GRADING & EROSION CONTROL PLAN
C-1.8	GRADING & EROSION CONTROL PLAN
C-1.9	MIXED USE AREA CONCEPT
C-1.9ALT	MIXED USE AREA ALTERNATIVE CONCEPT
C-1.10	PROPOSED FACILITIES TYPICAL FLOOR PLANS
C-2.1	FLUVIAL SIDE CHANNEL PROFILE
C-2.2	TYPICAL RESTORATION SECTIONS

LANDSCAPE SHEET LIST

Sheet Number	Sheet Title
L-1.1	PLANTING PLAN SHEET LAYOUT & TYPICALS
L-1.2	PLANTING PLAN
L-1.3	PLANTING PLAN
L-1.4	PLANTING PLAN
L-1.5	PLANTING PLAN
L-1.6	PLANTING PLAN
L-1.7	PLANTING PLAN
L-1.8	PLANTING PLAN
L-2.1	IRRIGATION PLAN



GENERAL NOTES:

1. PROPERTY LINE SHOWN IS APPROXIMATE. SOURCE: VENTURA COUNTY GIS.
2. EASEMENTS AND UTILITIES NOT SHOWN ON PLANS.
3. TOPOGRAPHY SHOWN ADAPTED FROM RECENT 2009 LIDAR AND LIMITED BATHYMETRICAL SURVEY (2012, 2014). ELEVATED VEGETATION RETURNS POSSIBLE IN THICKLY VEGETATED AREAS. CONTOURS NOT FIELD VERIFIED.
4. RESTORATION CONCEPT AT 30% LEVEL ONLY. NOT FOR CONSTRUCTION OR PERMITTING.
5. LINEWORK REPRESENTING EXISTING FEATURES (ASPHALT, BUILDINGS, ETC.) IS FOR REFERENCE ONLY. LINEWORK WAS BASED ON INTERPRETATION OF AERIAL IMAGERY AND WAS NOT SURVEYED. NOT FOR ESTIMATING DEMOLITION COSTS.
6. ADDITIONAL TEMPORARY (DURING CONSTRUCTION) AND POST-CONSTRUCTION BEST MANAGEMENT PRACTICES (BMP'S) ARE NECESSARY BEYOND THOSE SHOWN ON THIS SHEET. FINAL EROSION AND SEDIMENT CONTROL PLANS WILL DEPEND ON FINAL DESIGN DETAILS AND CONSTRUCTION PHASING. ADDITIONAL SLOPE PROTECTION BLANKETS MAY BE REQUIRED (AT A RANGE OF ELEVATIONS) FOR WIND WAVE AND/OR TIDE PROTECTION WHILE SLOPE VEGETATION BECOMES ESTABLISHED.
7. FINAL EROSION CONTROL PLANS WILL NEED TO INDICATE:
   - WASTE STORAGE AREAS
   - VEHICLE STORAGE AREAS
   - MATERIAL STORAGE AREAS
   - TEMPORARY SOIL STORAGE , HANDLING, AND DEWATERING
   - FUELING LOCATIONS
   - DRAINAGE AREAS
   - DISCHARGE LOCATIONS
   - SAMPLING LOCATIONS
   - LOCATIONS OF POST CONSTRUCTION BMPS (AS NEEDED)

APPROXIMATE INTERNAL PARCEL BOUNDARY
APPROXIMATE PROPERTY LINE
GRADING LIMITS
RESTORATION AREA
MIXED USE AREA
B B RESTORATION SECTION LOCATION SEE SHEET C-2.2

CALIFORNIA STATE PARKS SINCE 1864

cbec eco engineering

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

CALIFORNIA STATE FIRE MARSHAL- APPROVED

Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #

Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

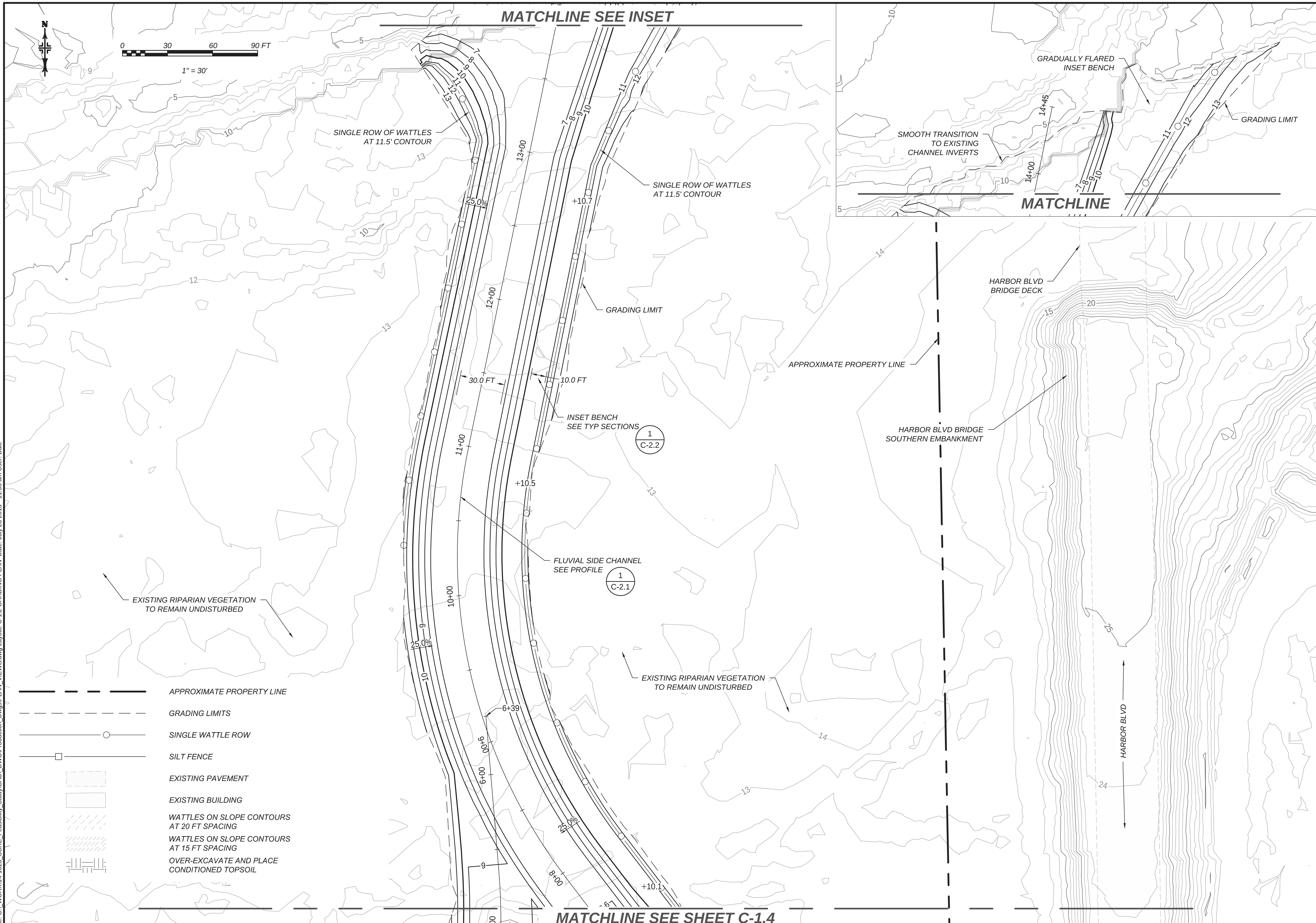
DESIGNED:	DM
DRAWN:	DM/RR
CHECKED:	CH
DATE:	7-27-2015

REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLAN SHEET LAYOUT

SHEET NO.
C-1.1
1 OF 22



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CALIFORNIA STATE PARKS SINCE 1864

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30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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DRAWN:	DM/RR
CHECKED:	CH
DATE:	7-27-2015

△	REVISIONS	DATE

MCGRATH STATE BEACH

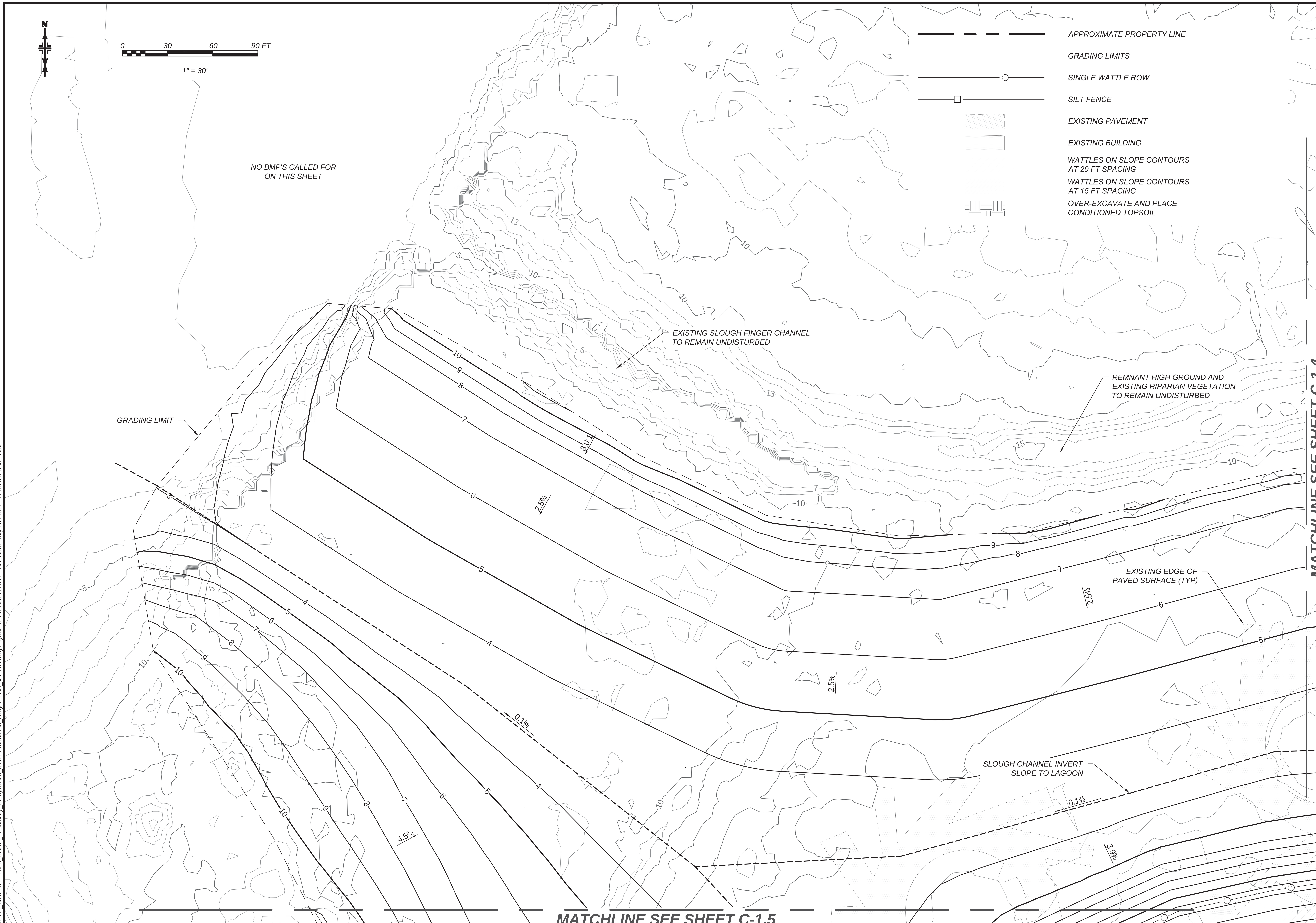
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

GRADING & EROSION CONTROL PLAN

SHEET NO.

C-1.2

2 OF 22



File: C:_WORK\14-1023_SCRE_Feasibility_Study\CAD_DWG\Production_Dwgs\PLAN_VIEWS.dwg Layout: C-1.3 GRADING PLAN Date: July 28 2015 - 11:03 am User: Dale

CALIFORNIA STATE PARKS SINCE 1864 ®

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30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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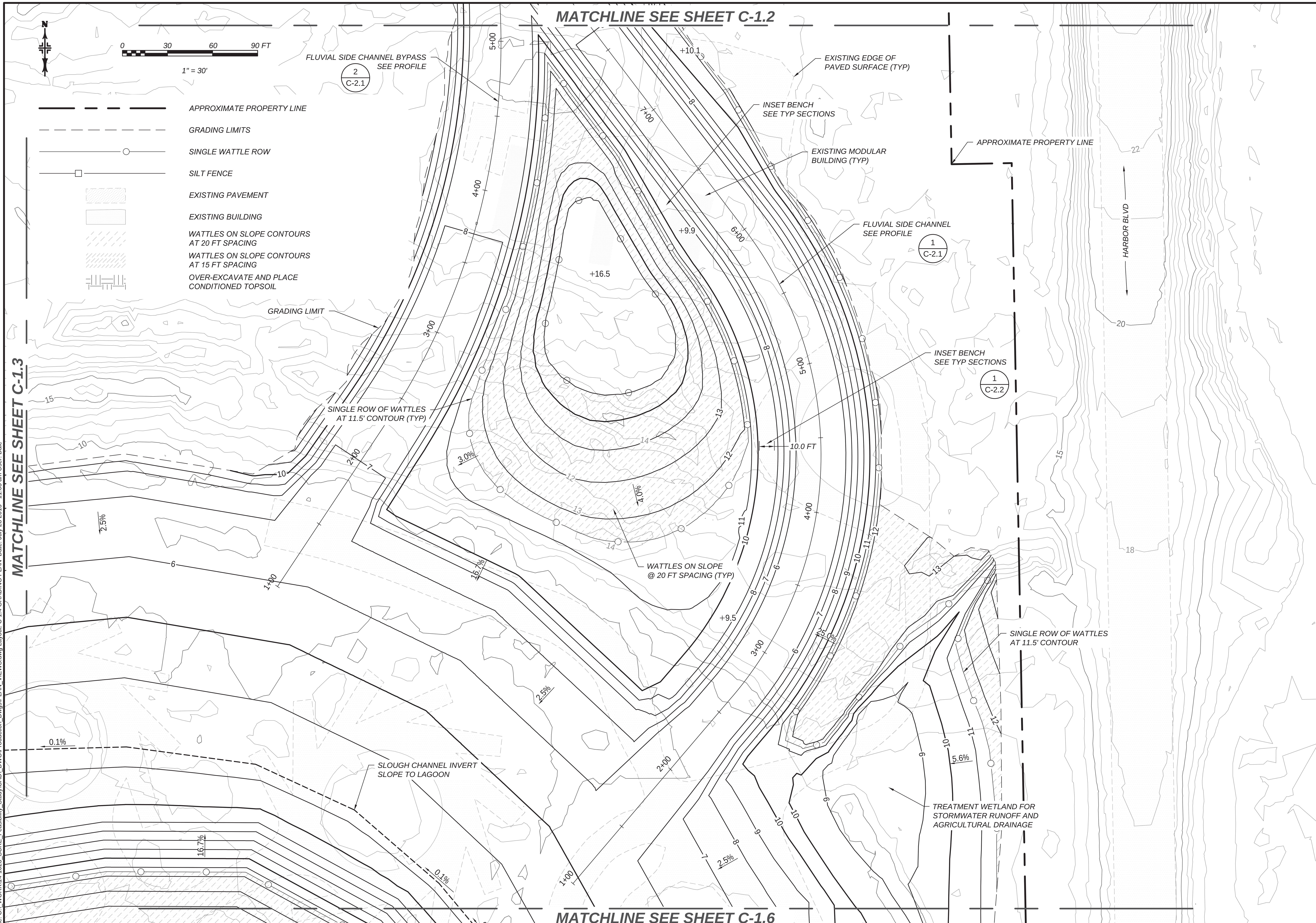
DESIGNED:	DM
DRAWN:	DM/RR
CHECKED:	CH
DATE:	7-27-2015

	REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

GRADING & EROSION CONTROL PLAN

SHEET NO.
C-1.3
3 OF 22



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DESIGNED:	DM
DRAWN:	DM/RR
CHECKED:	CH
DATE:	7-27-2015

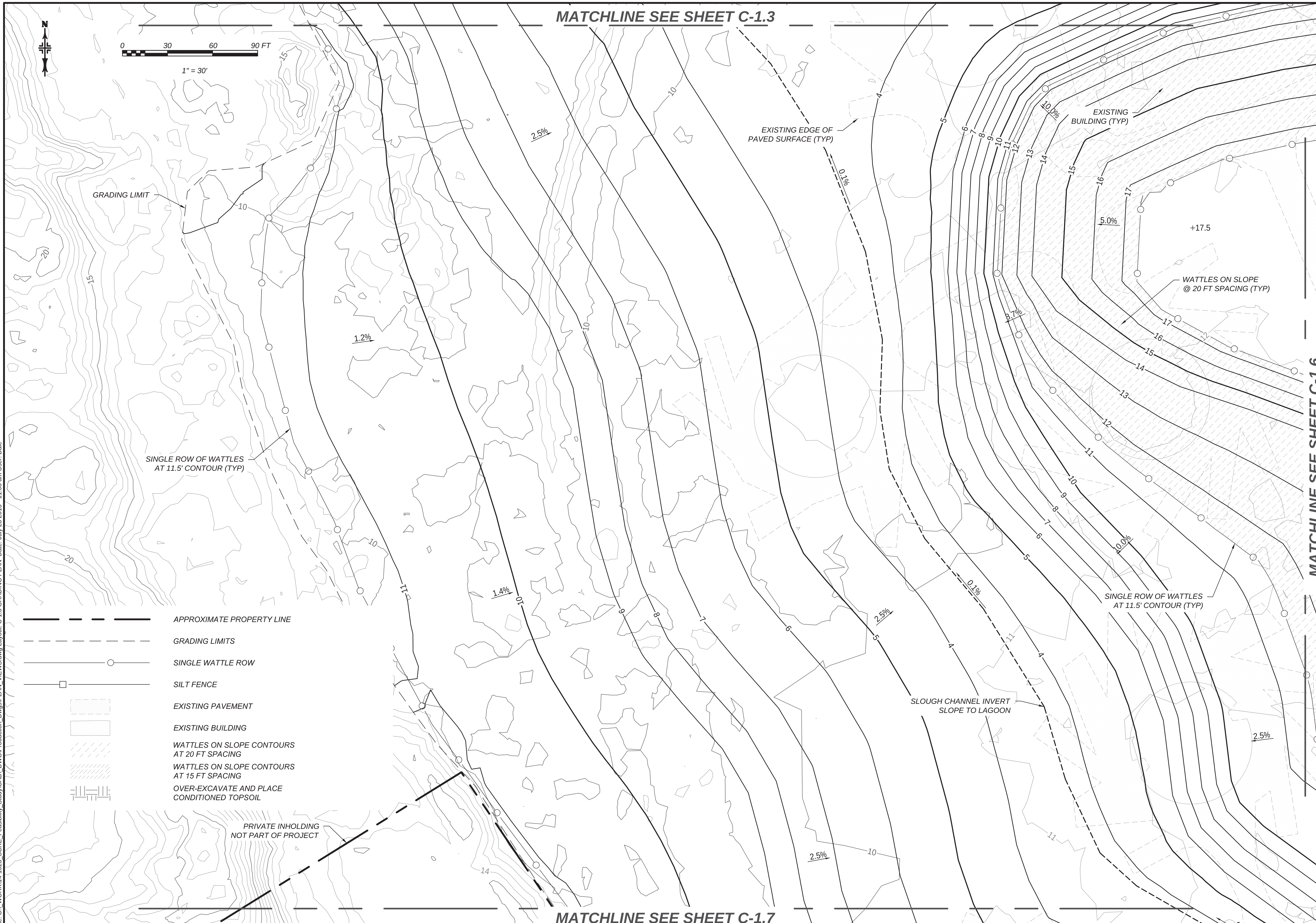
	REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

GRADING & EROSION CONTROL PLAN

SHEET NO.

C-1.4



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DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION

CERTIFICATION #

Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

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DRAWN:	DM/RR
CHECKED:	CH
DATE:	7-27-2015

REVISIONS	DATE

MCGRATH STATE BEACH

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

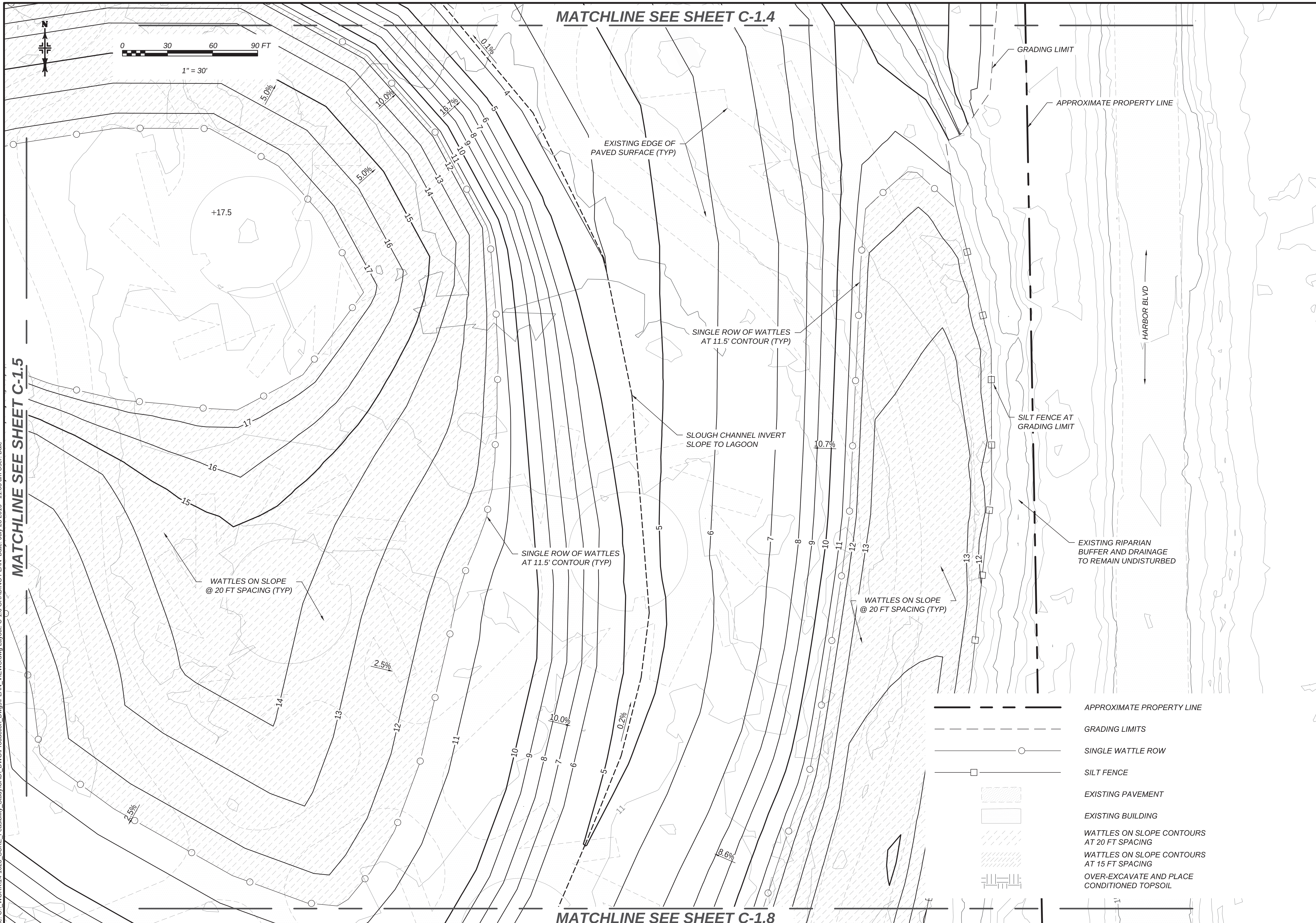
GRADING & EROSION CONTROL PLAN

SHEET NO.

C-1.5

5 OF 22

File: C:_WORK\14-1023_SCRE_Feasibility_Study\CAD_DWG\Production_Dwgs\PLAN_VIEWS.dwg Layout: C-1.5 GRADING PLAN Date: July 28 2015 - 11:03 am User: Dale



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CALIFORNIA STATE PARKS SINCE 1864

cbec eco engineering

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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	REVISIONS	DATE

MCGRATH STATE BEACH

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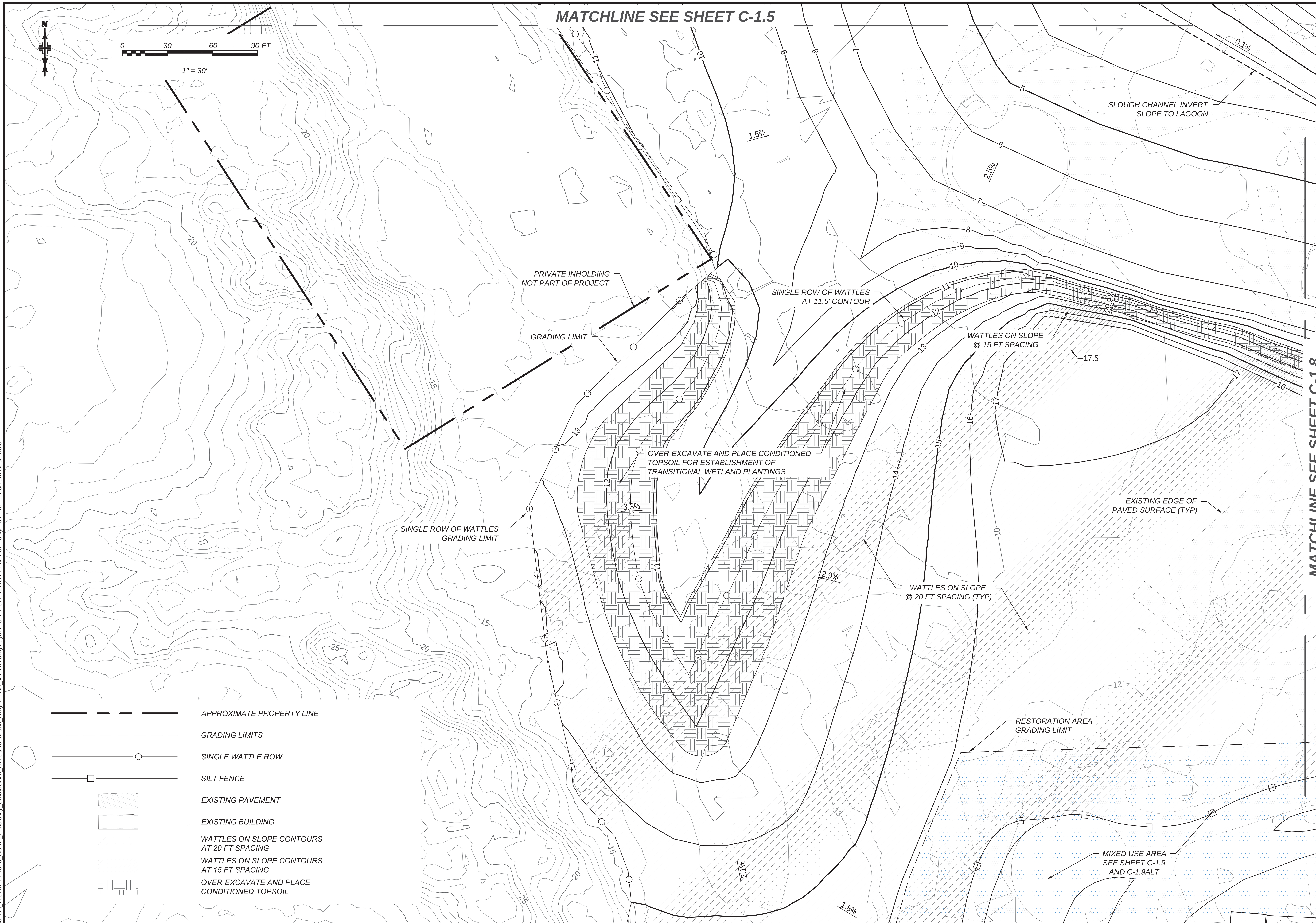
GRADING & EROSION CONTROL PLAN

SHEET NO.

C-1.6

6 OF 22



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DATE:	7-27-2015

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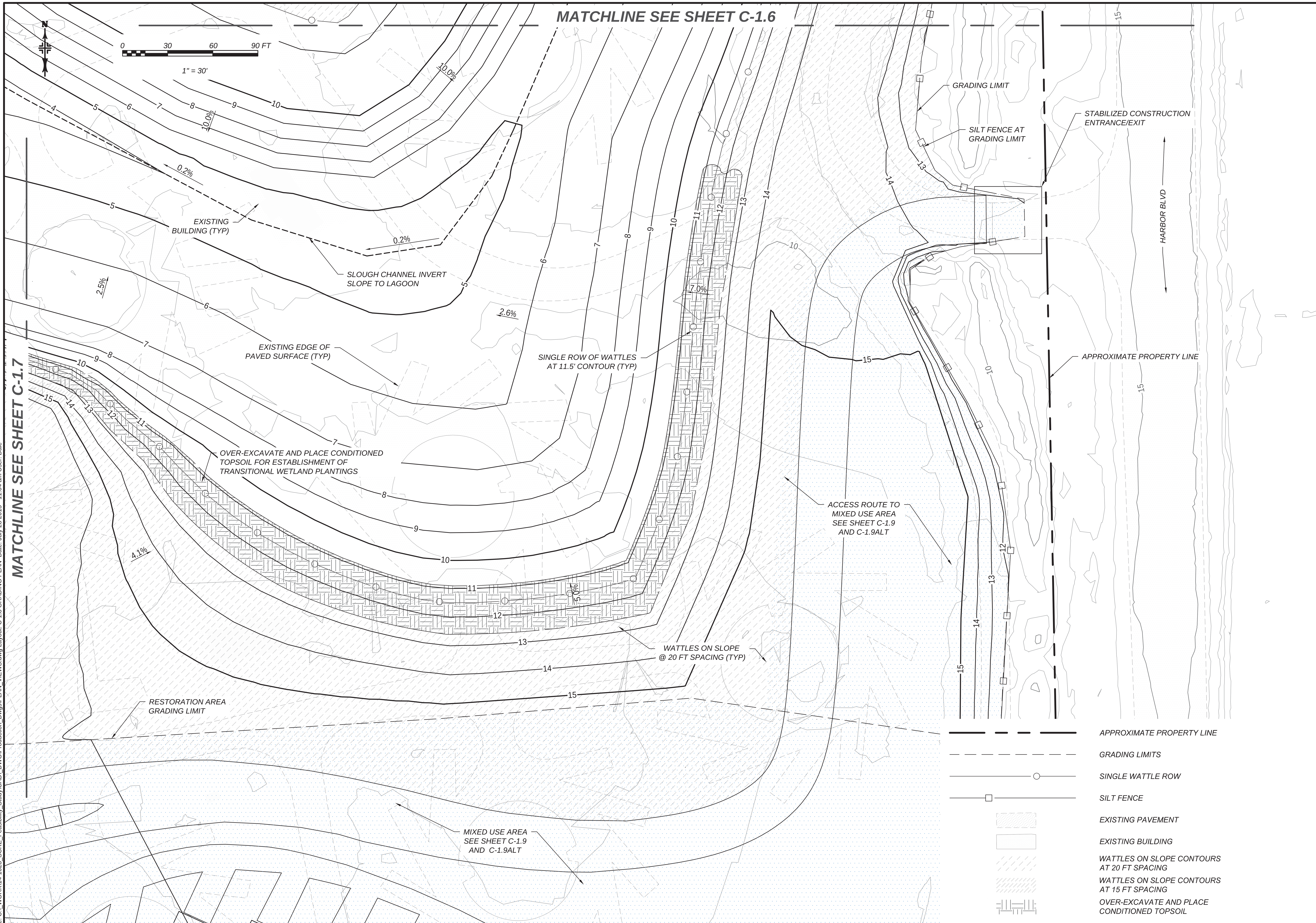
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

GRADING & EROSION CONTROL PLAN

SHEET NO.

C-1.7



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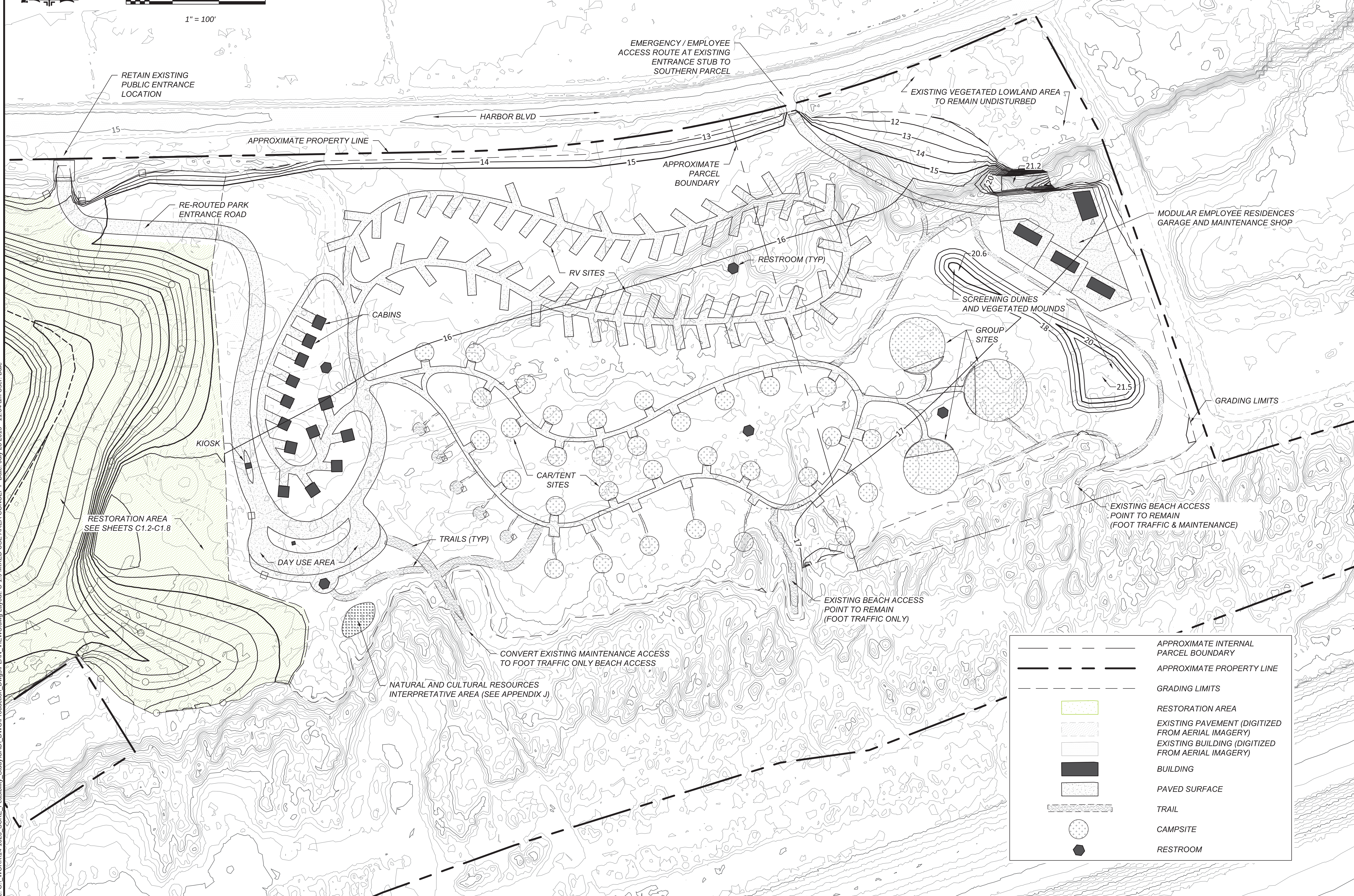
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

GRADING & EROSION CONTROL PLAN

SHEET NO.
C-1.8
8 OF 22

THIS SHEET REFLECTS THE FIRST PRELIMINARY DESIGN AND CAMPGROUND LAYOUT DEVELOPED FOR THE MIXED USE AREA. AN ALTERNATIVE DESIGN FOR THE CAMPGROUND LAYOUT IS INCLUDED ON PLAN SHEET C-1.9ALT. FINAL DESIGN OF THE PREFERRED RESTORATION CONCEPT MAY INCORPORATE COMPONENTS FROM BOTH ALTERNATIVES AND MAY ALSO BE USED TO REFINE PLANS FOR THE RESTORATION AREA.



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DATE:	7-27-2015

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MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

MIXED USE AREA CONCEPT

SHEET NO.
C-1.9
9 OF 22

File: C:_WORK\14-1023_SCRE_Feasibility_Study\CAD_DWG\Production_Dwgs\PLAN_VIEWS.dwg Layout: C-1.9 MIXED USE AREA CONCEPT Date: July 28 2015 - 11:04 am User: Dale

THIS SHEET REFLECTS AN ALTERNATE LAYOUT FOR THE MIXED USE AREA. THE MIXED USE AREA CONCEPT DEVELOPED IN CONJUNCTION WITH THE PREFERRED RESTORATION CONCEPT IS SHOWN ON SHEET C-1.9. FINAL DESIGN OF THE PREFERRED RESTORATION CONCEPT MAY INCORPORATE COMPONENTS FROM BOTH ALTERNATIVES AND MAY ALSO BE USED TO REFINE PLANS FOR THE RESTORATION AREA.

File: L:\16-CAD-CCD-910\McGrath—567\Campground Relocation\Xref\CIVIL\McGrath Sheet C-9A.dwg Layout: C-9A Date: July 14 2015 - 10:19 am User: mobi

CALIFORNIA STATE PARKS SINCE 1864

ACQUISITION & DEVELOPMENT DIVISION
One Capitol Mall
Sacramento, CA
95814-3229

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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△	REVISIONS	DATE

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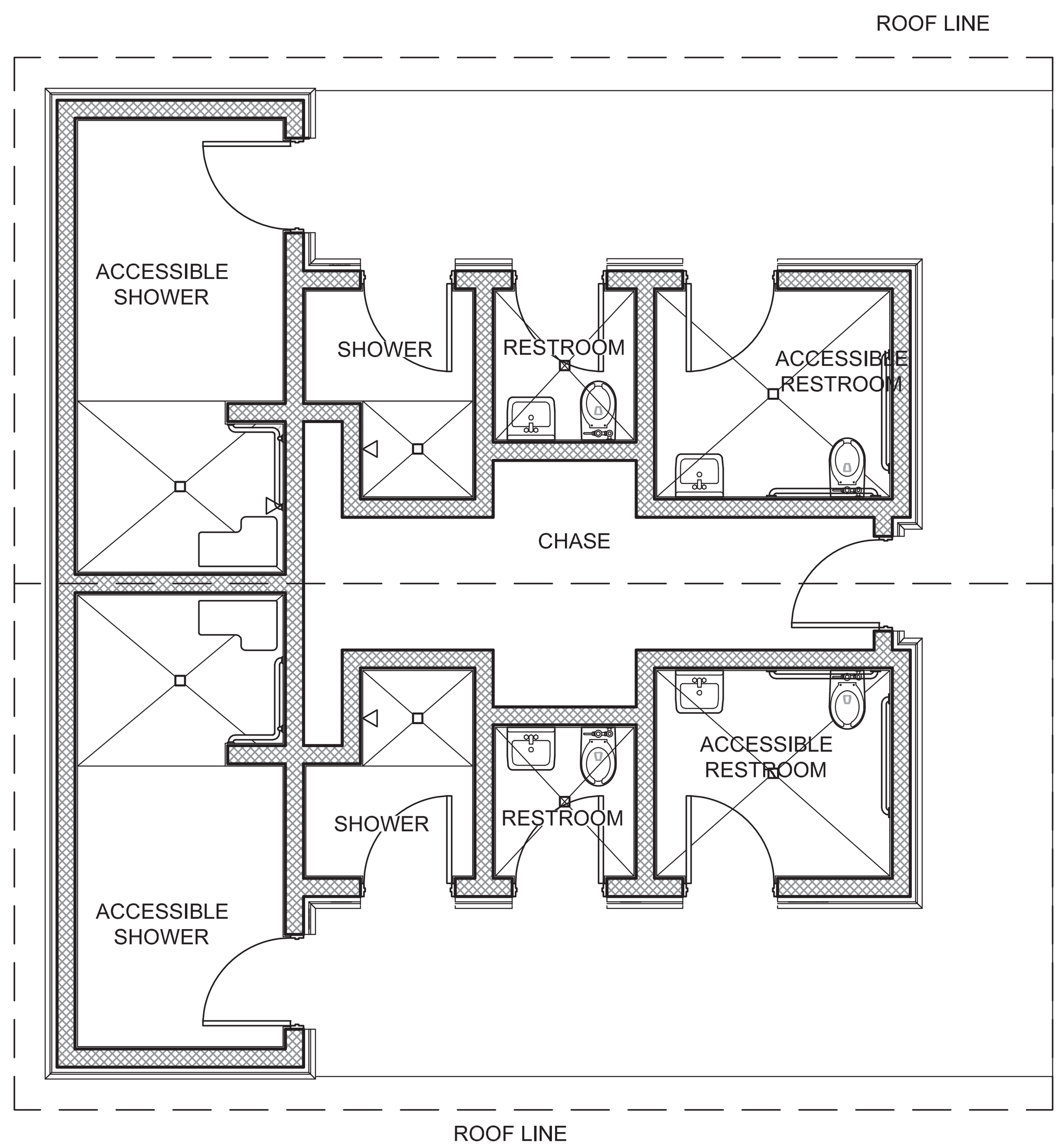
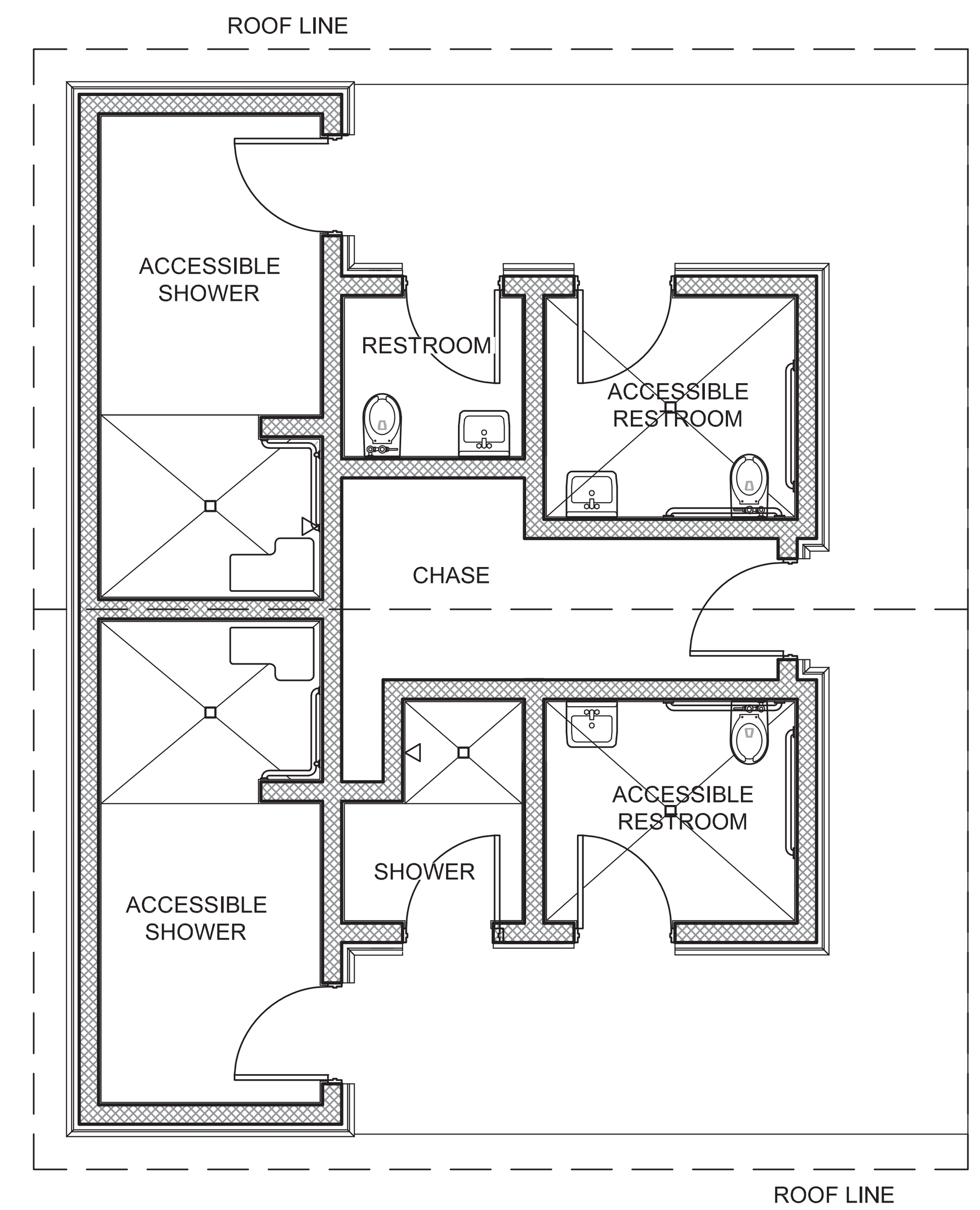
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

CAMPGROUND SITE PLAN

SHEET NO.
C-1.9Alt
10 OF 22



1 COMBO BLUIDING FLOOR PLAN (4) SHOWERS (4) RESTROOMS
SCALE@22X34 3/16"=1'-0"



2 COMBO BLUIDING FLOOR PLAN (3) SHOWERS (3) RESTROOMS
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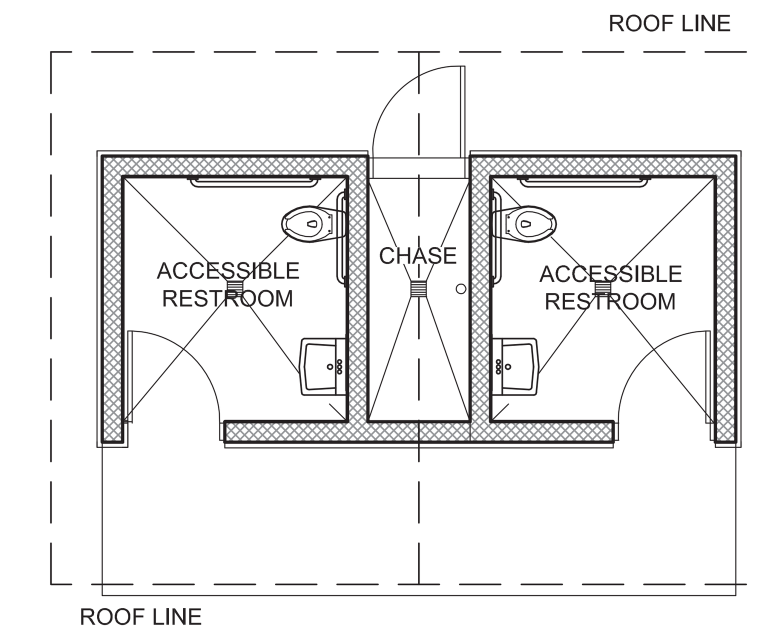

3 DAY USE RESTROOM
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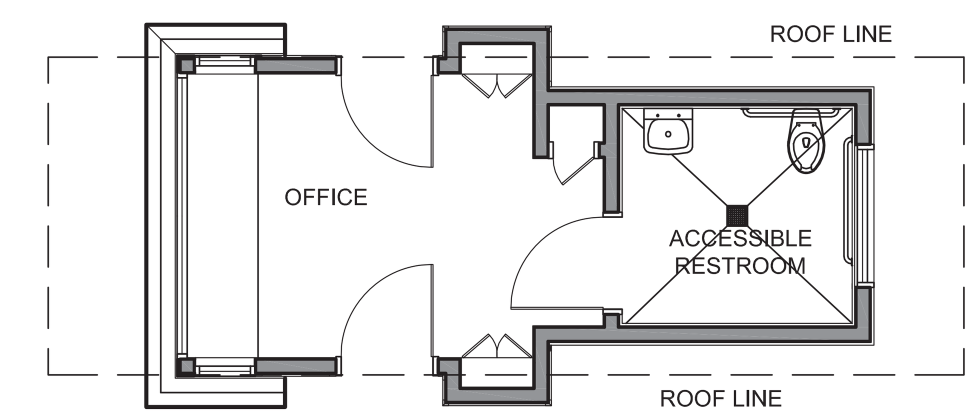
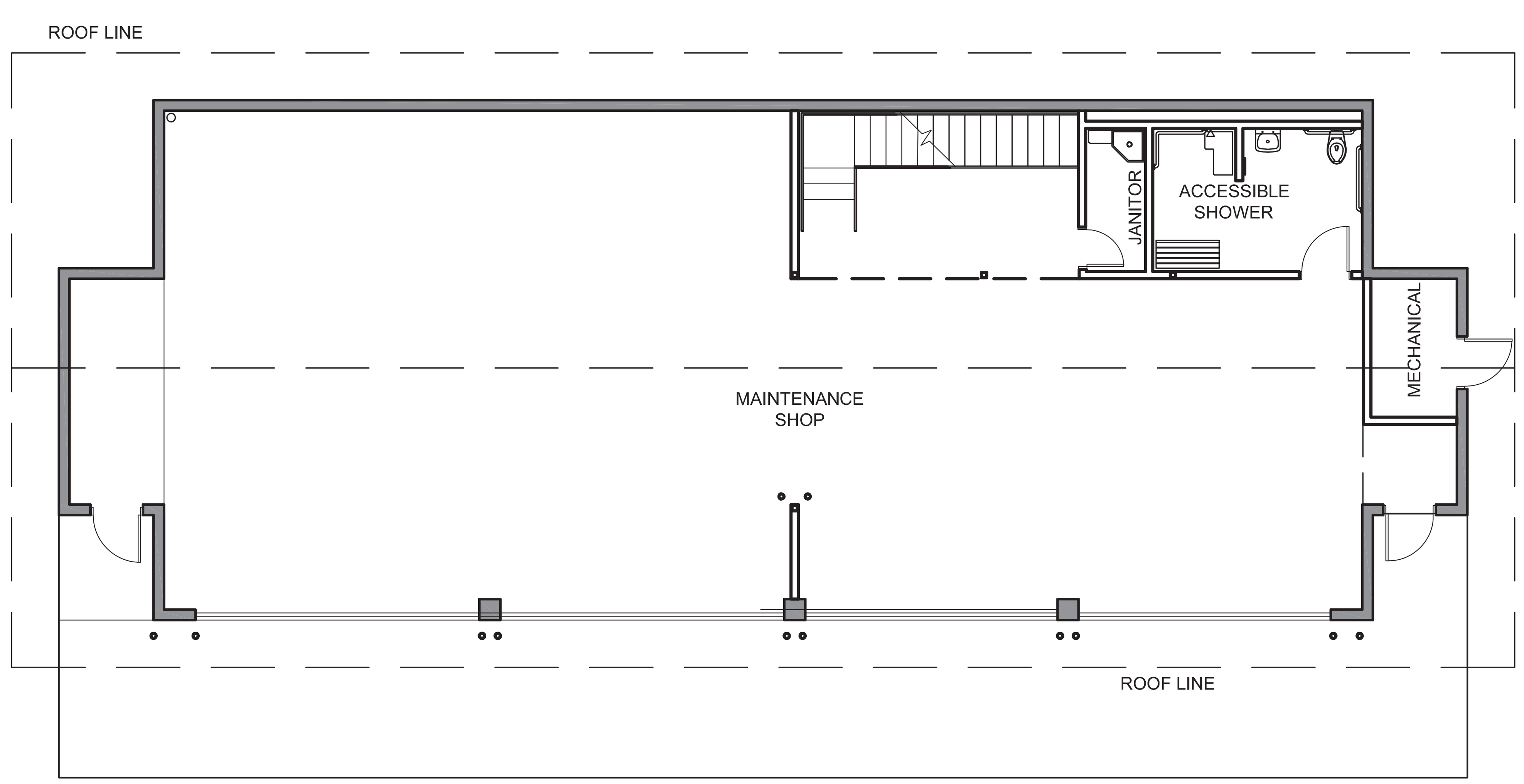


4 KIOSK
SCALE@22X34 3/16"=1'-0"



5 MAINTENANCE SHOP
SCALE@22X34 1/8"=1'-0"

Minimum Overnight Campground Design For Unisex Facilities

Campsites	Persons	Toilets	Lavatories	Showers
1-15 Campsites	Up to 60 Persons	2 Toilets	2 Lavatories	2 Showers
16-22 Campsites	Up to 88 Persons	3 Toilets	3 Lavatories	3 Showers
23-30 Campsites	Up to 120 Persons	4 Toilets	4 Lavatories	4 Showers
31-37 Campsites	Up to 148 Persons	5 Toilets	5 Lavatories	5 Showers
38-45 Campsites	Up to 180 Persons	6 Toilets	6 Lavatories	6Showers

GENERAL DESIGN REQUIREMENTS

- TOILET FACILITIES SHALL NOT BE FURTHER THAN 400 FEET FROM LOT OR CAMPSITE. CPC TABLE 4-4, NOTE 3
- FIRE HYDRANT LOCATIONS AND DISTRIBUTION: APPENDIX C

C101.1 Scope Exception:
[SFM]GROUP B, S-2 AND U OCCUPANCY HAVING A FLOOR ARES NOT EXCEEDING 1,000 SQUARE FOOT., PRIMARILY CONSTRUCTED OF NONCOMBUSTIBLE EXTERIOR WALLS WITH WOOD OR STEEL ROOF FRAMING, HAVING CLASS A ROOF ASSEMBLY, WITH USE LIMITED TO THE FOLLOWING OF SIMILAR USES:

1. CALIFORNIA STATE PARKS BUILDINGS OF AN ACCESSORY NATURE(RESTROOM)

File: L:\16-CAD-CCD-910\McGrath--567\Campground Relocation\Xref\CIVIL\McGrath Sheet C-1.9B.dwg Layout: Layout1 Date: July 14 2015 - 10:21 am User: rrobi

CALIFORNIA STATE PARKS SINCE 1864 ®
ACQUISITION & DEVELOPMENT DIVISION
One Capitol Mall
Sacramento, CA
95814-3229

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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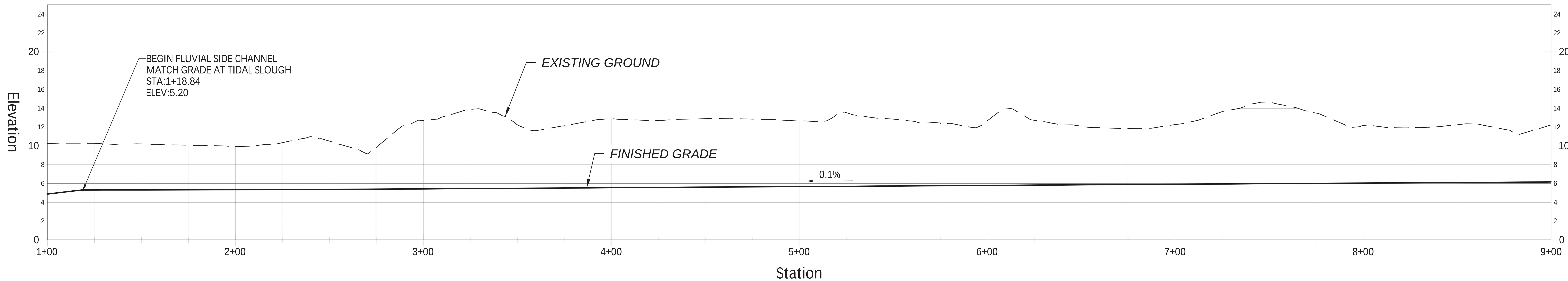
DATE: 7/27/2015

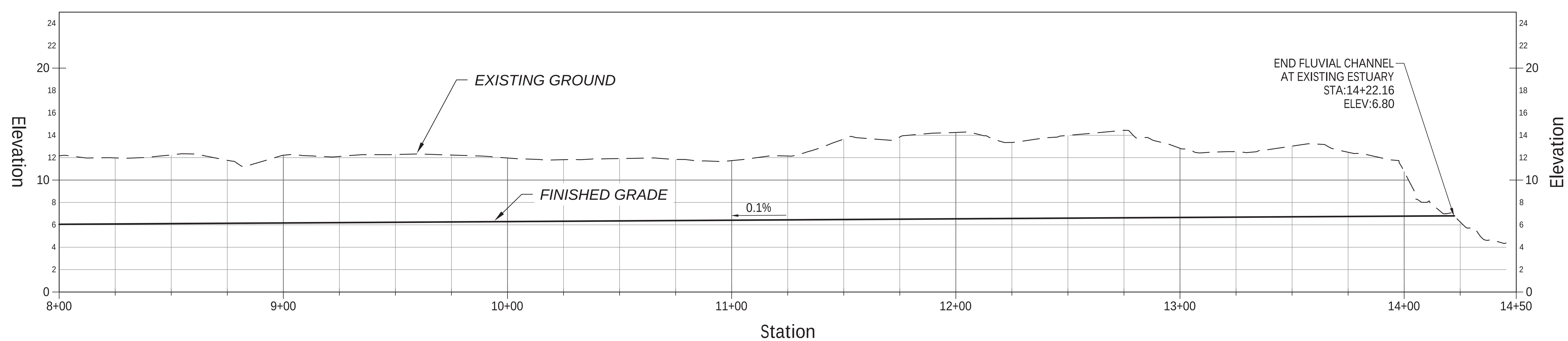
	REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION
AND ENHANCEMENT FEASIBILITY STUDY

PROPOSED FACILITIES TYPICAL FLOOR PLANS

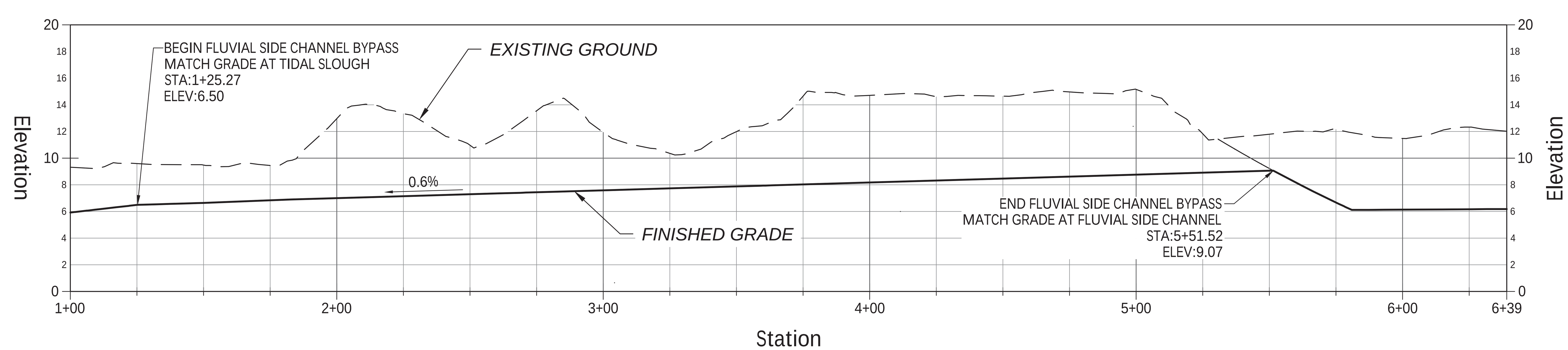
SHEET NO.
C-1.10
11 OF 22





1 FLUVIAL SIDE CHANNEL PROFILE

SCALE@22X34 H: 1"=30' V: 1"=6'



2 FLUVIAL SIDE CHANNEL BYPASS PROFILE

SCALE@22X34 H: 1"=30' V: 1"=6'

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SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

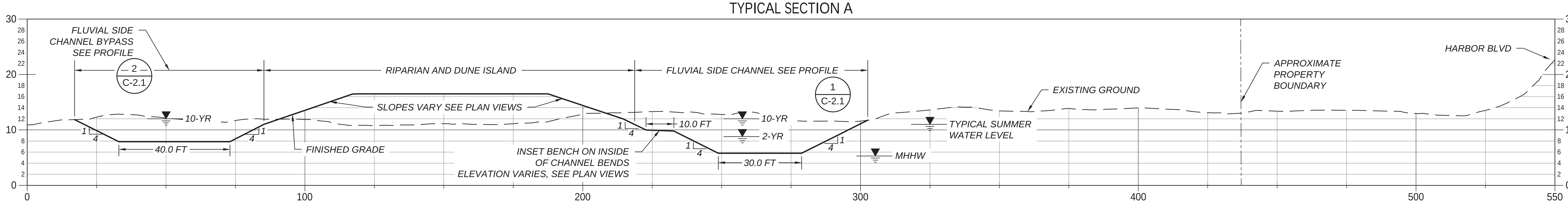
FLUVIAL SIDE CHANNEL PROFILE

SHEET NO.

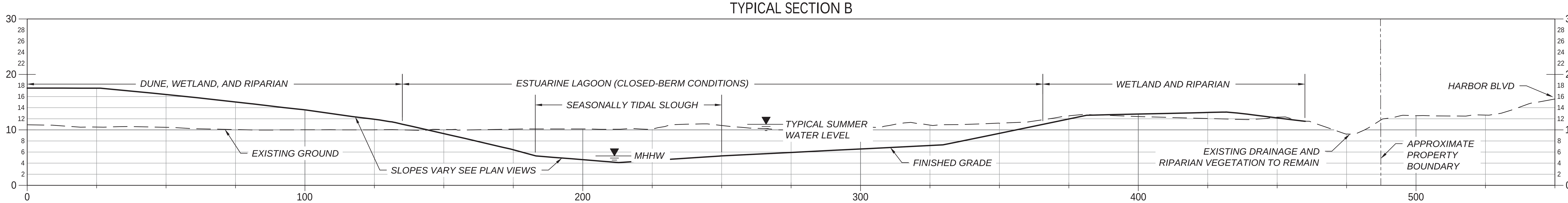
C-2.1

12 OF 22

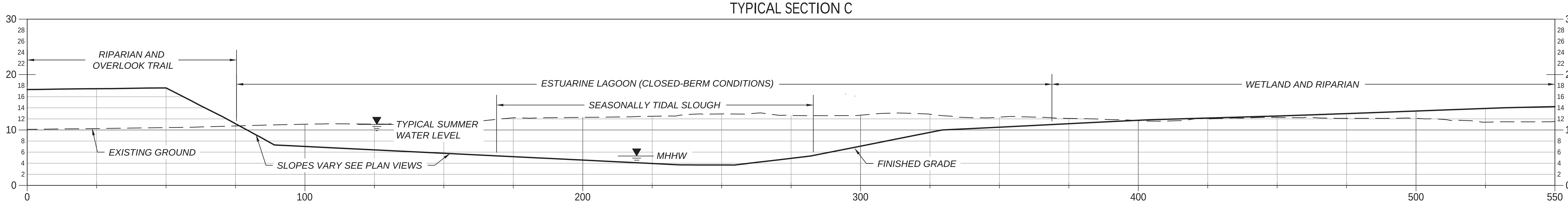
TYPICAL SECTION A



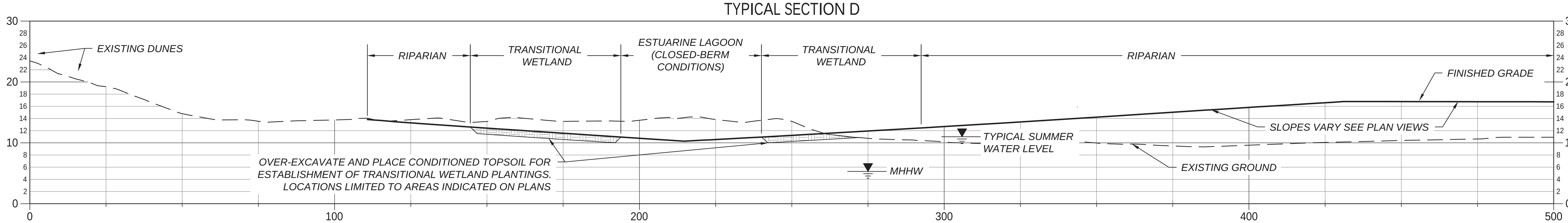
TYPICAL SECTION B



TYPICAL SECTION C



TYPICAL SECTION D



1 TYPICAL SECTIONS

SCALE@22X34 H: 1"=20' V: 1"=10'

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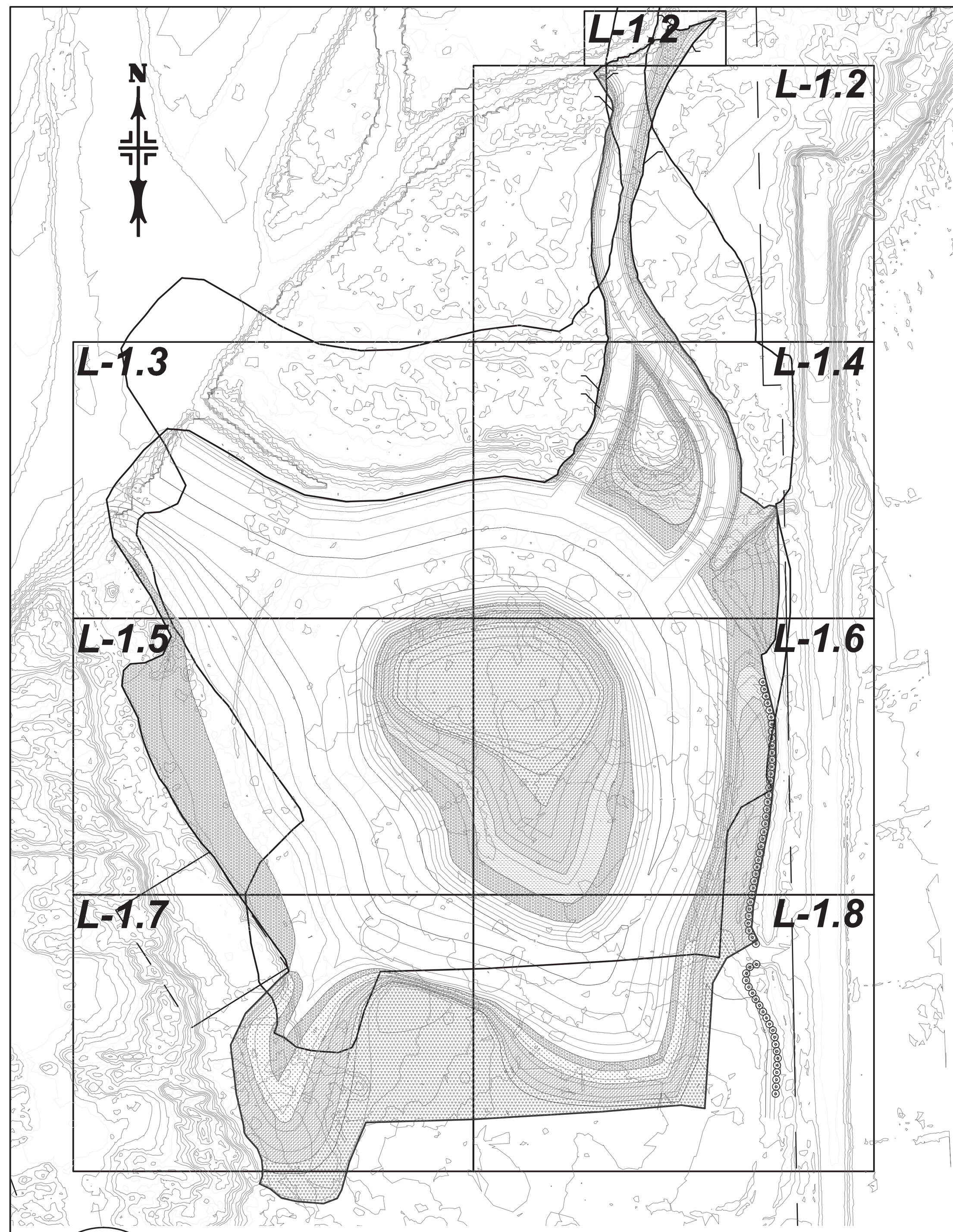
TYPICAL RESTORATION SECTIONS

SHEET NO.

C-2.2

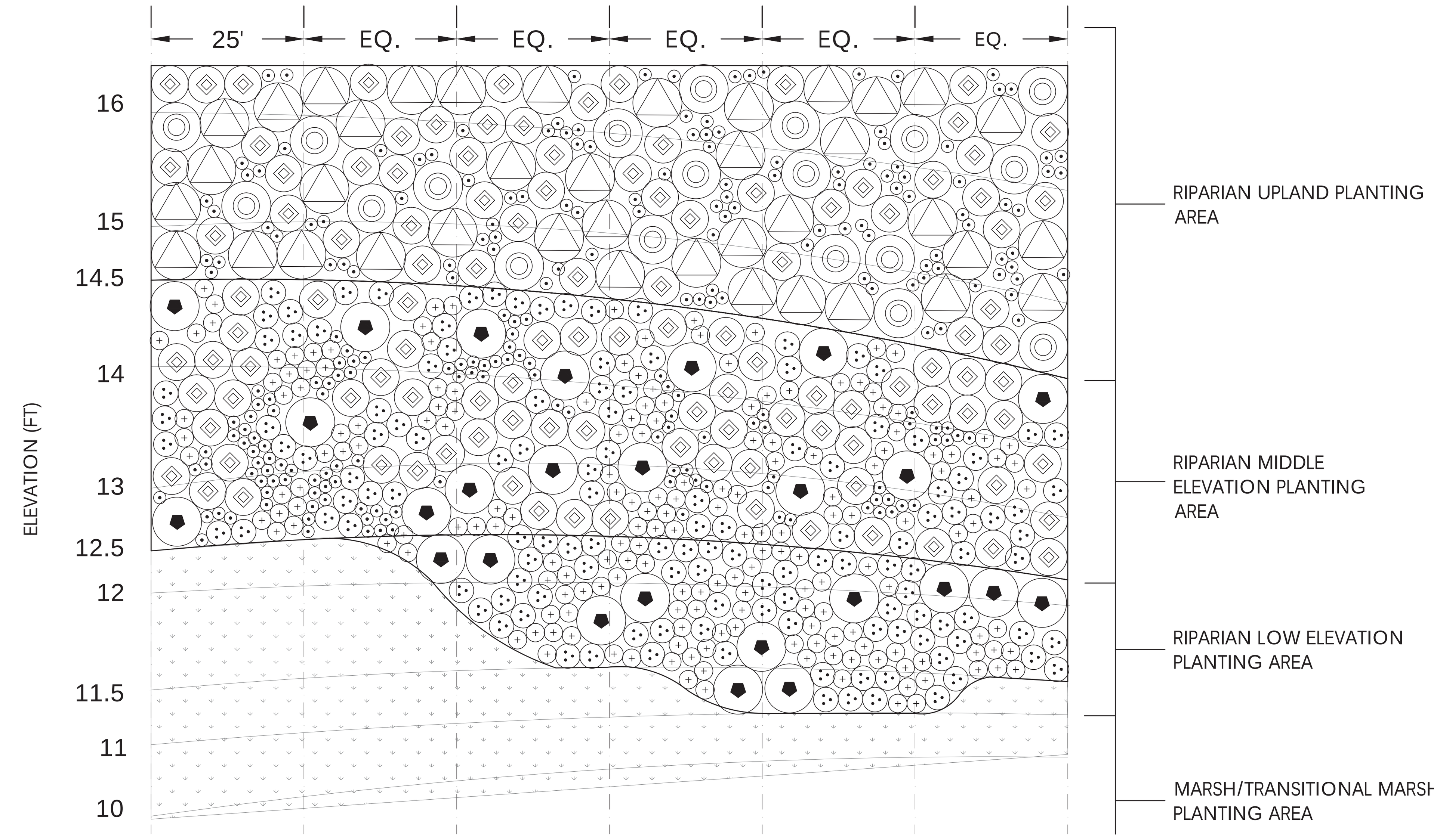
13 OF 22

File: C:_WORK\14-1023_SCRE_Feasibility_Study\CAD_DWG\Production_Dwgs\PROFILES.dwg Layout: C-2.2 TYPICAL RESTORATION SECTIONS Date: July 28 2015 - 11:04 am User: Dale



1 PLAN SHEET LAYOUT

1" = 300'



NOTES:
1. MINIMUM ELEVATION OF RIPARIAN PLANTING AREAS VARIES. SEE SITE PLANTING PLAN.
2. SEE DETAILS 2 AND 3 FOR TYPICAL MARSH AND TRANSITIONAL MARSH PLANTING PLANS.

4 RIPARIAN UPLAND, MIDDLE, AND LOWER TYPICAL PLANTING

1" = 20'

PLANT LEGEND - RIPARIAN UPLAND

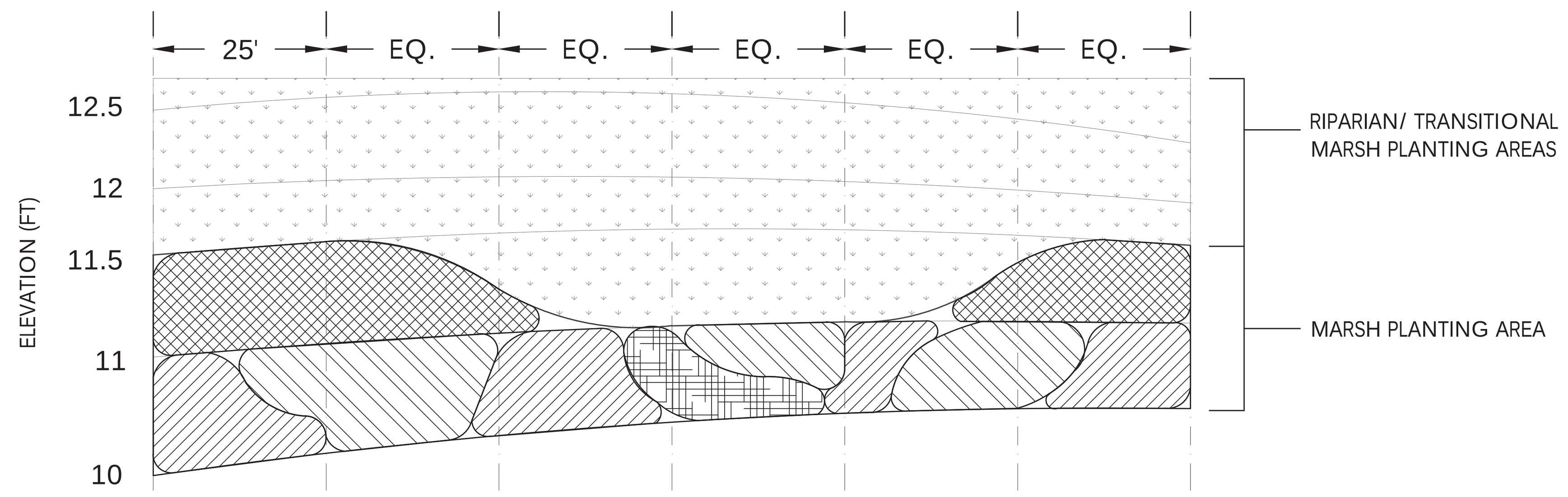
SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	ON CENTER SPACING (FEET)
ATR LEN	*ATRIPLEX LENTIFORMIS*	BIG SALTBUSH	1 GAL	8
BAC SAL	*BACCHARIS SALICIFOLIA*	MULE FAT	1 GAL	6
ART DOU	*ARTEMISIA DOUGLASIANA*	MUGWORT	1 GAL	2
SAL EXI	*SALIX EXIGUA*	NARROWLEAF WILLOW	16" DEEPOT	8

PLANT LEGEND - RIPARIAN MIDDLE

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	SPACING (FEET)
ART DOU	*ARTEMISIA DOUGLASIANA*	MUGWORT	1 GAL	2
BAC GLU	*BACCHARIS GLUTINOSA*	MARSH BACCHARIS	1 GAL	4
BAC SAL	*BACCHARIS SALICIFOLIA*	MULE FAT	1 GAL	6
SAL LAS	*SALIX LASIOLEPIS*	ARROYO WILLOW	CUTTINGS	3
SAL LAS	*SALIX LASIOLEPIS*	ARROYO WILLOW	16" DEEPOT	8

PLANT LEGEND - RIPARIAN LOW

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	SPACING (FEET)
BAC GLU	*BACCHARIS GLUTINOSA*	MARSH BACCHARIS	1 GAL	4
SAL LAS	*SALIX LASIOLEPIS*	ARROYO WILLOW	CUTTINGS	3
SAL LAS	*SALIX LASIOLEPIS*	ARROYO WILLOW	16" DEEPOT	8



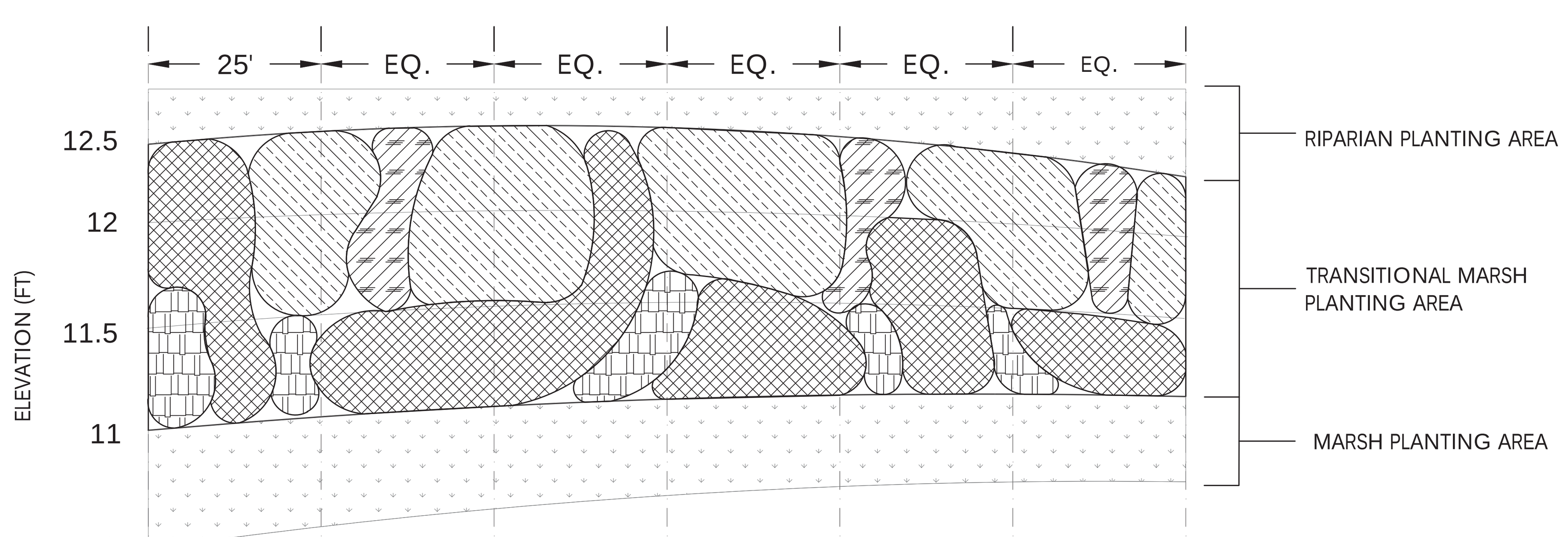
NOTES:
1. MINIMUM ELEVATION OF RIPARIAN PLANTING AREAS VARIES. SEE SITE PLANTING PLAN.
2. SEE DETAILS 3 AND 4 FOR TYPICAL TRANSITIONAL MARSH AND RIPARIAN PLANTING PLANS.

2 MARSH TYPICAL PLANTING

1" = 20'

PLANT LEGEND - MARSH

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	ON-CENTER SPACING (FEET)	ELEVATION RANGE
ANE CAL	*ANEMOPSIS CALIFORNICA*	YERBA MANSA	PLUG	2	10.5 TO 11.0 FEET
BOL MAR	*BOLBOSCHOENUS*	ALKALI BULRUSH	PLUG/ 1 GAL	2	10.0 TO 11.0 FEET
DIS SPI	*DISTICHLIS SPICATA*	SALTGRASS	PLUG	2	11.0 TO 12.5 FEET
SCH CAL	*SCHOENOPLECTUS ACUTUS*	HARDSTEM BULRUSH	PLUG/ 1 GAL	2	10.0 TO 11.0 FEET



NOTES:
1. MINIMUM ELEVATION OF RIPARIAN PLANTING AREAS VARIES. SEE SITE PLANTING PLAN.
2. SEE DETAILS 2 AND 4 FOR TYPICAL MARSH AND RIPARIAN PLANTING PLANS.

3 TRANSITIONAL MARSH TYPICAL PLANTING

1" = 20'

PLANT LEGEND - TRANSITIONAL MARSH

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	ON-CENTER SPACING (FEET)	ELEVATION RANGE
DIS SPI	*DISTICHLIS SPICATA*	SALTGRASS	PLUG	2	11.0 TO 12.5 FEET
FRA SAL	*FRANKENIA SALINA*	ALKALI HEATH	PLUG	3	11.5 TO 12.5 FEET
JAU CAR	*JAUMEA CARNOSA*	MARSH JAUMEA	PLUG	3	11.5 TO 12.0 FEET
SAL PAC	*SALICORNIA PACIFICA*	PICKLEWEED	PLUG	2	11.0 TO 12.0 FEET

PLANT QUANTITIES - RIPARIAN UPLAND

SYMBOL	AREA (SQ. FEET)	AREA (ACRES)	ATR LEN	BAC SAL	ART DOU	SAL EXI	TOTAL
U-1	133,437	3.06	417	1,112	2,669	876	5,074
U-2	107,244	2.46	335	894	2,145	704	4,078
TOTAL	240,681	5.53	752	2,006	4,814	1,580	9,152

PLANT QUANTITIES - RIPARIAN MIDDLE

SYMBOL	(SQ. FEET)	(ACRES)	ART DOU	BAC GLU	BAC SAL	SAL LAS	SAL LAS	TOTAL
R-1	12,934	0.30	259	162	144	244	30	839
R-2	71,487	1.64	1,430	894	794	1,350	168	4,636
R-3	117,753	2.70	2,355	1,472	1,308	2,224	276	7,635
TOTAL	202,173	4.64	4,044	2,528	2,246	3,818	474	13,110

PLANT QUANTITIES - RIPARIAN LOWER

SYMBOL	AREA (SQ. FEET)	AREA (ACRES)	BAC GLU	SAL LAS	SAL LAS	TOTAL
L-1	9,252	0.21	231	308	43	582
L-2	38,048	0.87	951	1,268	178	2,397
L-3	12,868	0.30	322	429	60	811
L-4	11,003	0.25	275	367	52	694
TOTAL	71,171	1.63	1,779	2,372	333	4,484

PLANT QUANTITIES - MARSH

SYMBOL	AREA (SQ. FEET)	AREA (ACRES)	ANE CAL	BOL MAR	DIS SPI	SCH CAL	TOTAL
M1	14,781	0.34	185	1,478	554	1,478	3,695
M2	48,262	1.11	603	4,826	1,810	4,826	12,065
M3	77,426	1.78	968	7,743	2,903	7,743	19,357
M4	5,684	0.13	71	568	213	568	1,420
M5	76,128	1.75	952	7,613	2,855	7,613	19,033
TOTAL	222,280	5.10	2,779	22,228	8,335	22,228	55,570

PLANT QUANTITIES - TRANSITIONAL MARSH

SYMBOL	AREA (SQ. FEET)	AREA (ACRES)	DIS SPI	FRA SAL	JAU CAR	SAL PAC	TOTAL
T1	14,781	0.34	1,478	657	164	370	2,669
TOTAL	14,781	0.34	1,478	657	164	370	2,669

CALIFORNIA STATE PARKS SINCE 1864

wra ENVIRONMENTAL CONSULTANTS

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

CALIFORNIA STATE FIRE MARSHAL- APPROVED

Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION CERTIFICATION #

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DRAWN:	MS/CS
CHECKED:	MS/MJ
DATE:	7-27-2015

REVISIONS DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY
PLANTING PLAN SHEET LAYOUT & TYPICALS

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SHEET NO.
L-1.1
14 OF 22

File: L:\Acad 2000 Files\18000\18106-2\dwg\concept\L1-planting plans.dwg Layout: L-1.1 Date: July 28 2015 - 9:51 am User: mstromberg

CALIFORNIA STATE PARKS SINCE 1864

wra ENVIRONMENTAL CONSULTANTS

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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	REVISIONS	DATE

MCGRATH STATE BEACH

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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SHEET NO.

L-1.2

15 OF 22

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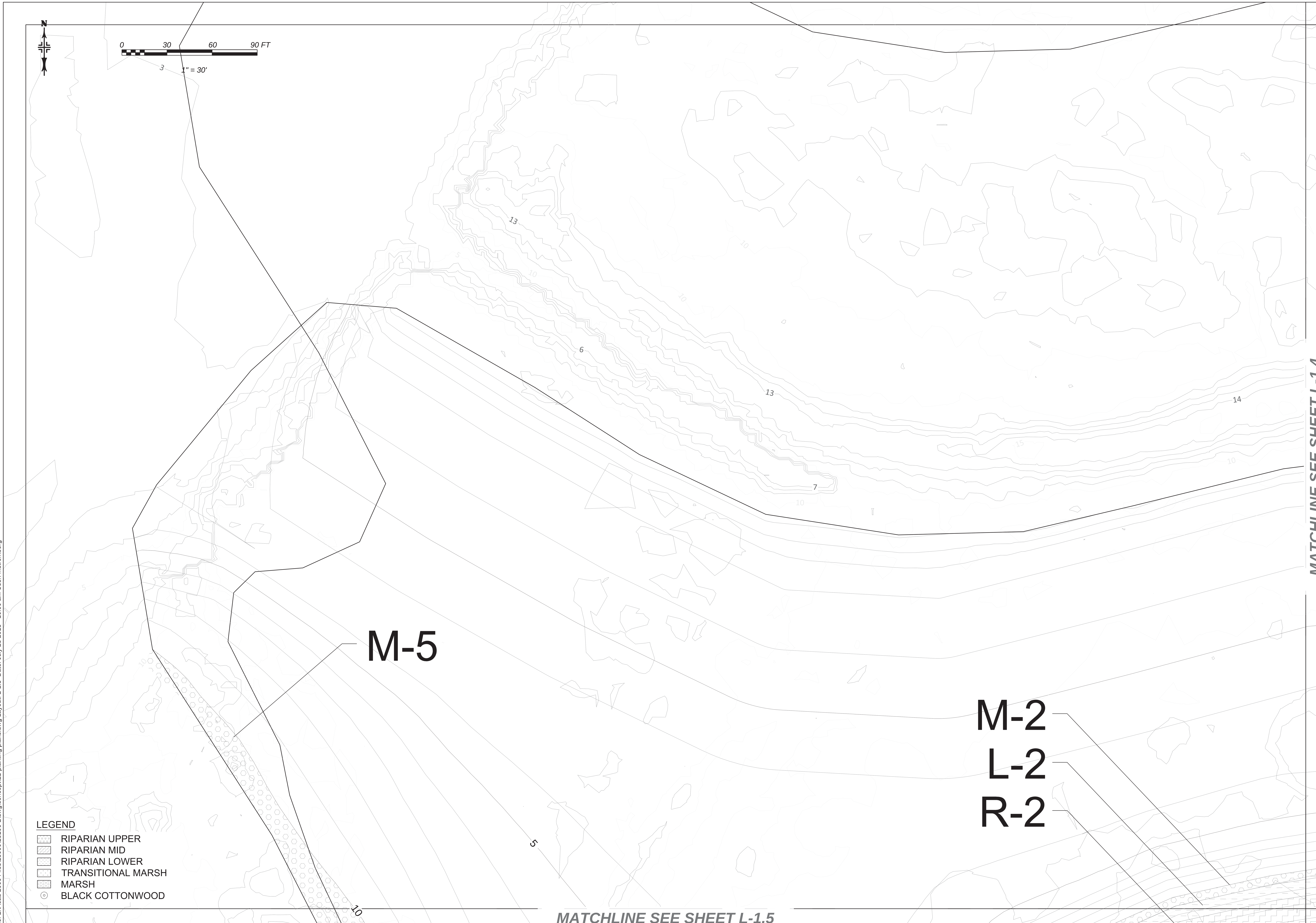

CALIFORNIA STATE PARKS SINCE 1864

wra ENVIRONMENTAL CONSULTANTS

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

CALIFORNIA STATE FIRE MARSHAL- APPROVED

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SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

SHEET NO.
L-1.3

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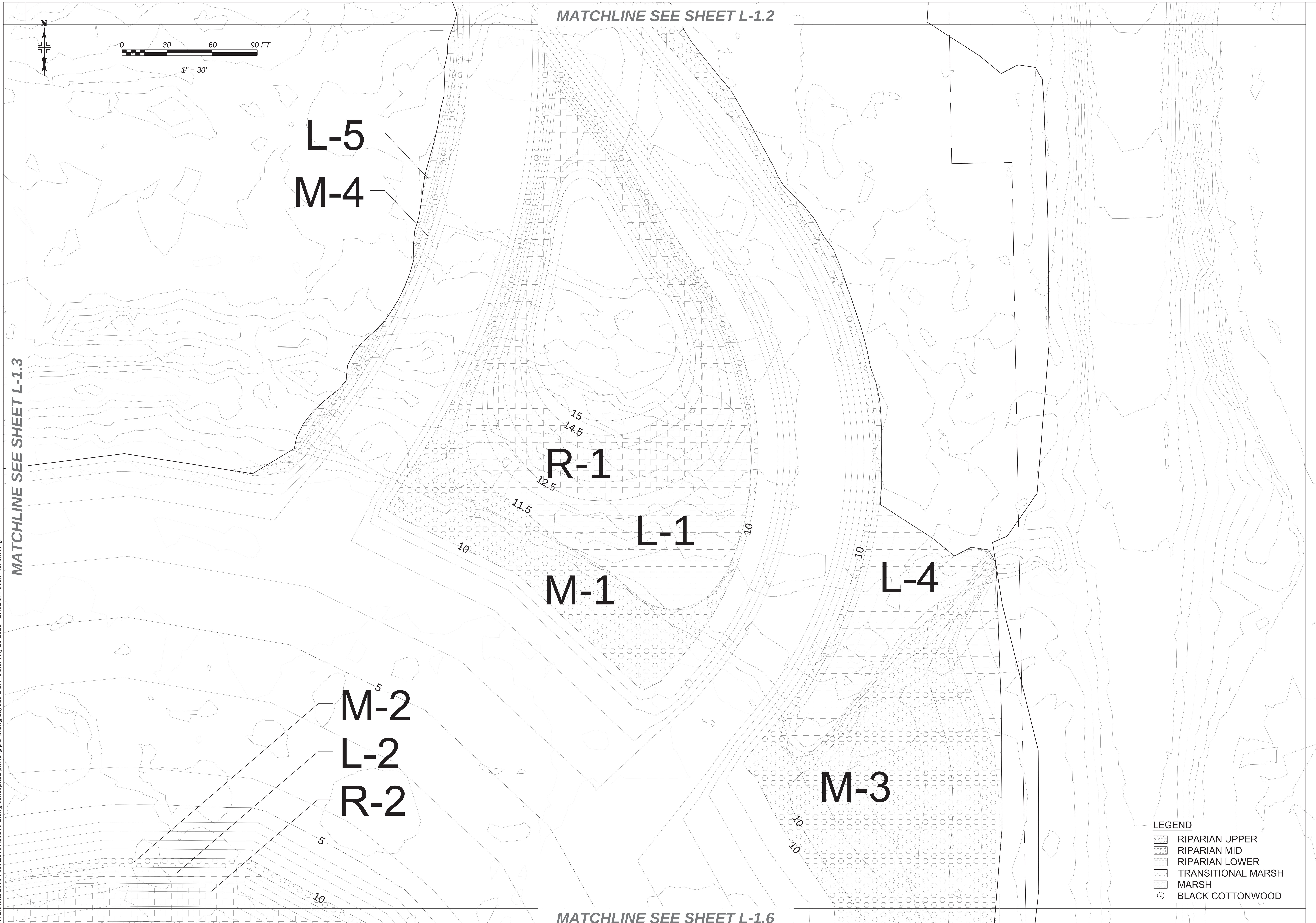

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30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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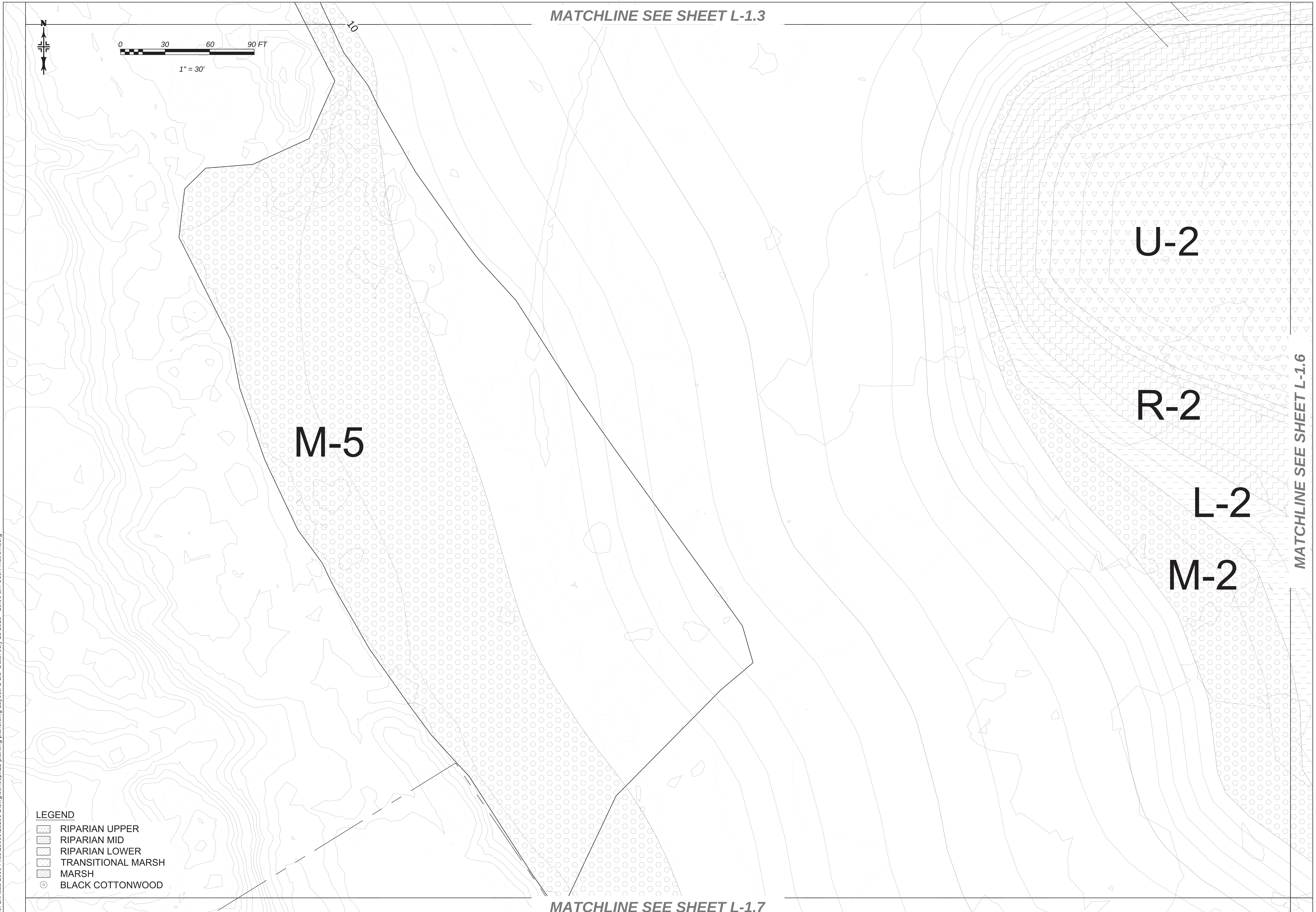
SHEET NO.

L-1.4

17 OF 22



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DATE:	7-27-2015

REVISIONS	DATE

MCGRATH STATE BEACH

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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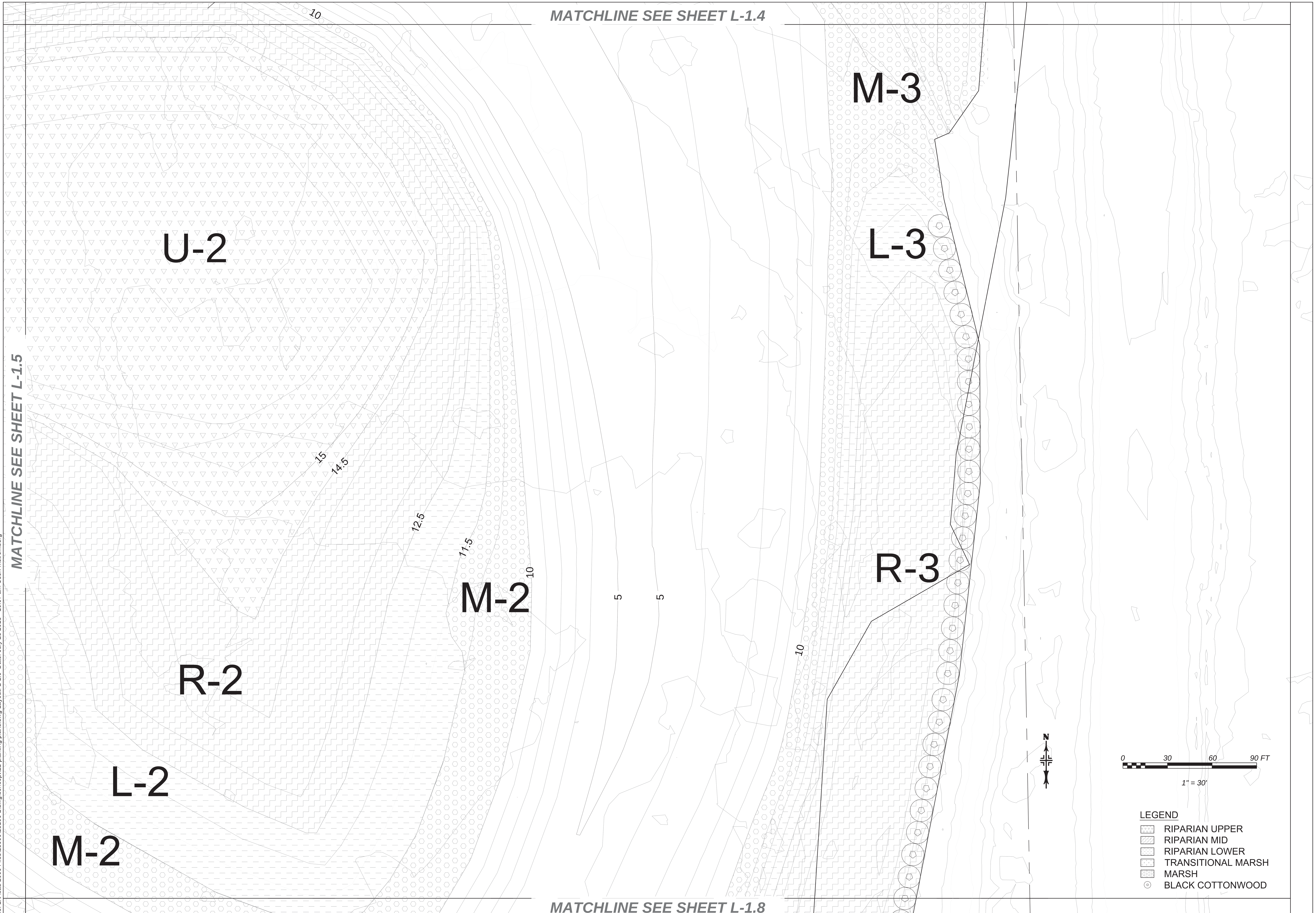
SHEET NO.

L-1.5

18 OF 22



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DATE:	7-27-2015

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MCGRATH STATE BEACH

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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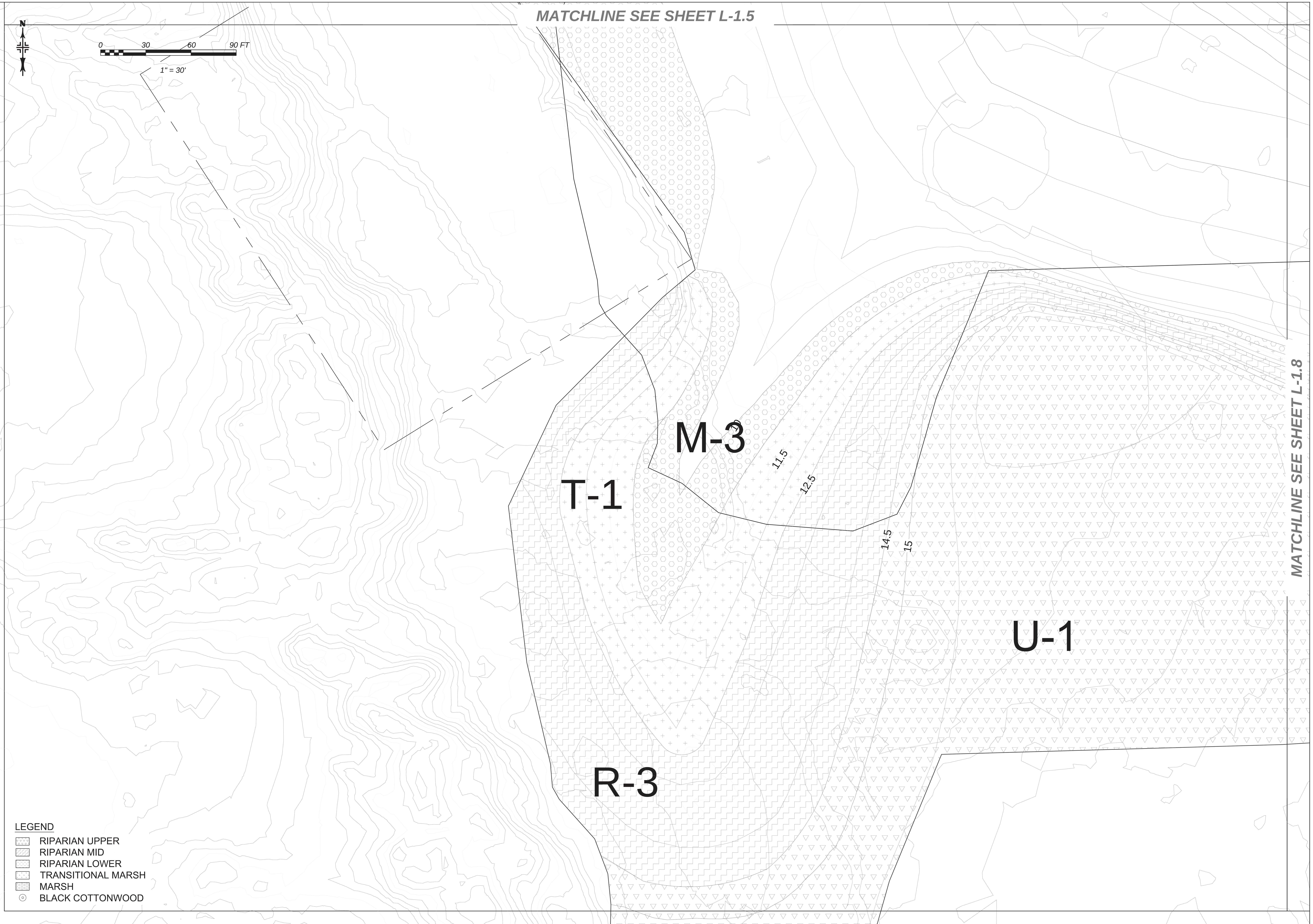
SHEET NO.

L-1.6



CALIFORNIA STATE PARKS SINCE 1864

wra ENVIRONMENTAL CONSULTANTS

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

CALIFORNIA STATE FIRE MARSHAL- APPROVED

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REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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SHEET NO.

L-1.7

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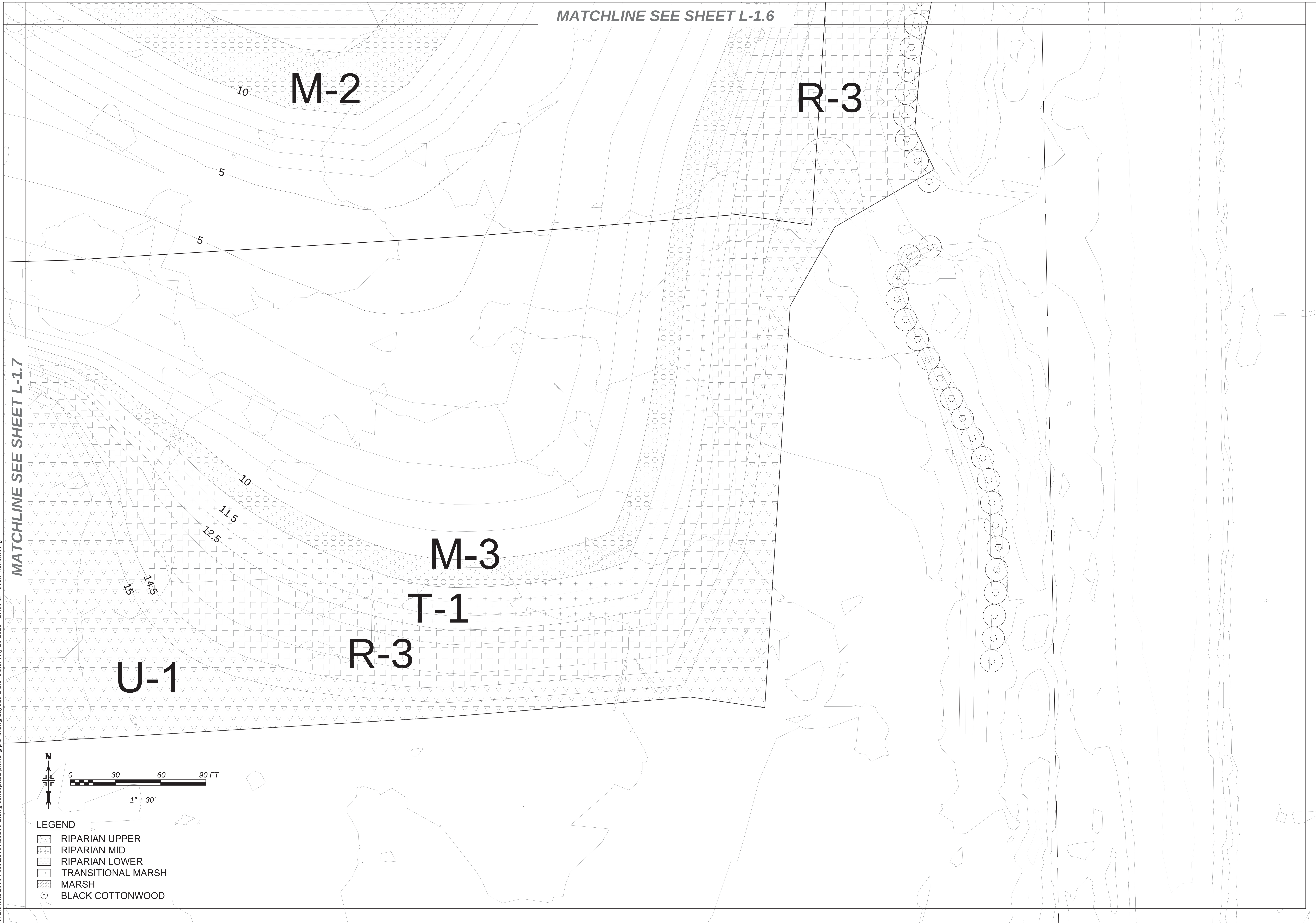

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CALIFORNIA STATE PARKS SINCE 1864 ®

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ENVIRONMENTAL CONSULTANTS

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

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ACCESSIBILITY SECTION
CERTIFICATION #

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REVISIONS	DATE

MCGRATH STATE BEACH
SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

PLANTING PLAN

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SHEET NO.

L-1.8

LEGEND

- RIPARIAN UPPER
- RIPARIAN MID
- RIPARIAN LOWER
- TRANSITIONAL MARSH
- MARSH
- BLACK COTTONWOOD
- MAINLINE (2-INCH PVC)
- SPRAY ZONE (11.18 AC)

0 100 200 300 FT

1" = 100'

NOTES:

1. SPRAY IRRIGATION SHALL BE PROVIDED FOR TRANSITIONAL MARSH, AND RIPARIAN ZONES ABOVE ELEVATION 13.
2. MAINLINE PIPE SIZES SUBJECT TO CHANGE BASED ON FINAL DESIGN.
3. ALL MAINLINES SHALL BE BURIED AT LEAST 18' BELOW FINISHED GRADE ELEVATIONS INCLUDING THE CROSSING TO THE ISLAND. LATERAL LINES (NOT SHOWN) MAY BE BUILT ON GRADE.
4. TOTAL MAXIMUM MONTHLY IRRIGATION DEMAND IS ESTIMATED TO BE 422,700 GALLONS IN jULY. TOTAL WATER USAGE FOR 1 YEAR IS ESTIMATED TO BE 2.4 M GALLONS.

30% FEASIBILITY LEVEL CONCEPT

(NOT FOR CONSTRUCTION)

CALIFORNIA STATE FIRE MARSHAL- APPROVED

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CERTIFICATION #

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MCGRATH STATE BEACH

SANTA CLARA RIVER ESTUARY HABITAT RESTORATION AND ENHANCEMENT FEASIBILITY STUDY

IRRIGATION PLAN

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SHEET NO.

L-2.1

22 OF 22

APPENDIX G – SEDIMENT SAMPLING

A number of surface and subsurface sediment samples were collected and analyzed to support this Feasibility Study:

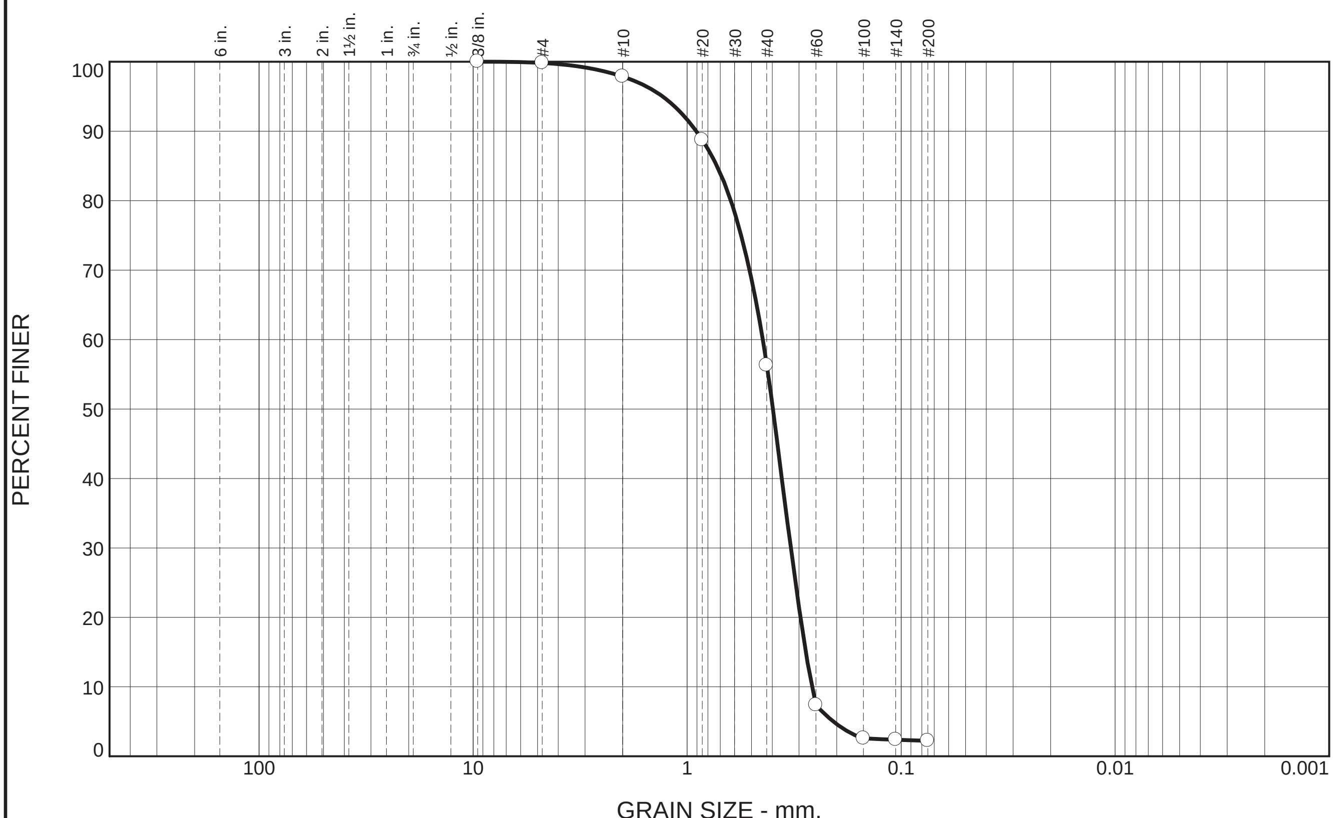
- To support sediment transport simulation modeling, a set of surficial land and estuarine (dredged) sediment samples were collected by cbec and subsequently analyzed by Blackburn Consulting to determine typical particle sizes and distributions. These results are included in this appendix for future reference.

- To inform the feasibility of the Preferred Restoration Concept, a limited set of composite subsurface samples were collected via hand auger by Oakridge Geoscience, Inc. and analyzed for grainsize and maximum dry density.

- The composite subsurface soil samples collected were also provided to American Scientific Laboratories, LLC to be analyzed for metals (EPA 6010B & 7470A), organochlorine pesticides and polychlorinated biphenyls (EPA 608), and oil and grease (EPA 1664). Both the geotechnical results and the analytical results are included in this appendix for future reference.

- To inform the planting plan, nine sediment samples were collected from representative locations within the Project Area and subsequently analyzed by Soil & Plant Laboratory, Inc. horticultural suitability, fertility, and physical characteristics.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.9	41.6	54.1	2.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.8		
#10	97.9		
#20	88.7		
#40	56.3		
#60	7.4		
#100	2.6		
#140	2.4		
#200	2.2		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9074 D_{85}= 0.7260 D_{60}= 0.4439
D_{50}= 0.3974 D_{30}= 0.3274 D_{15}= 0.2791
D_{10}= 0.2610 C_u= 1.70 C_c= 0.92

Classification

USCS= SP AASHTO=

Remarks

Sample Number: EST-7

Date: 10/17/2014

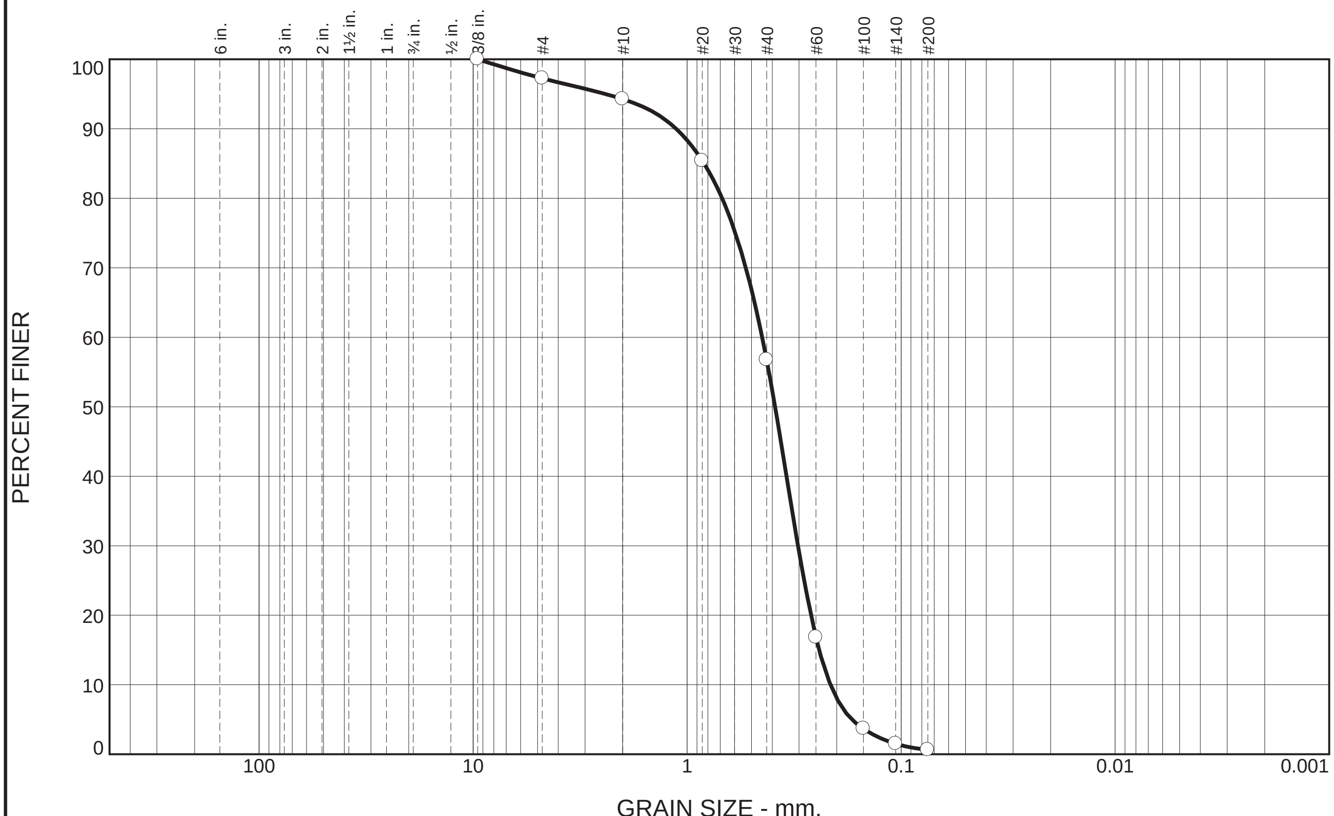
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	2.9	37.6	56.1	0.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	97.2		
#10	94.3		
#20	85.4		
#40	56.7		
#60	16.8		
#100	3.7		
#140	1.5		
#200	0.6		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.1265 D_{85}= 0.8344 D_{60}= 0.4459
D_{50}= 0.3884 D_{30}= 0.3032 D_{15}= 0.2415
D_{10}= 0.2138 C_u= 2.09 C_c= 0.96

Classification

USCS= SP AASHTO=

Remarks

Sample Number: EST-8

Date: 10/17/2014

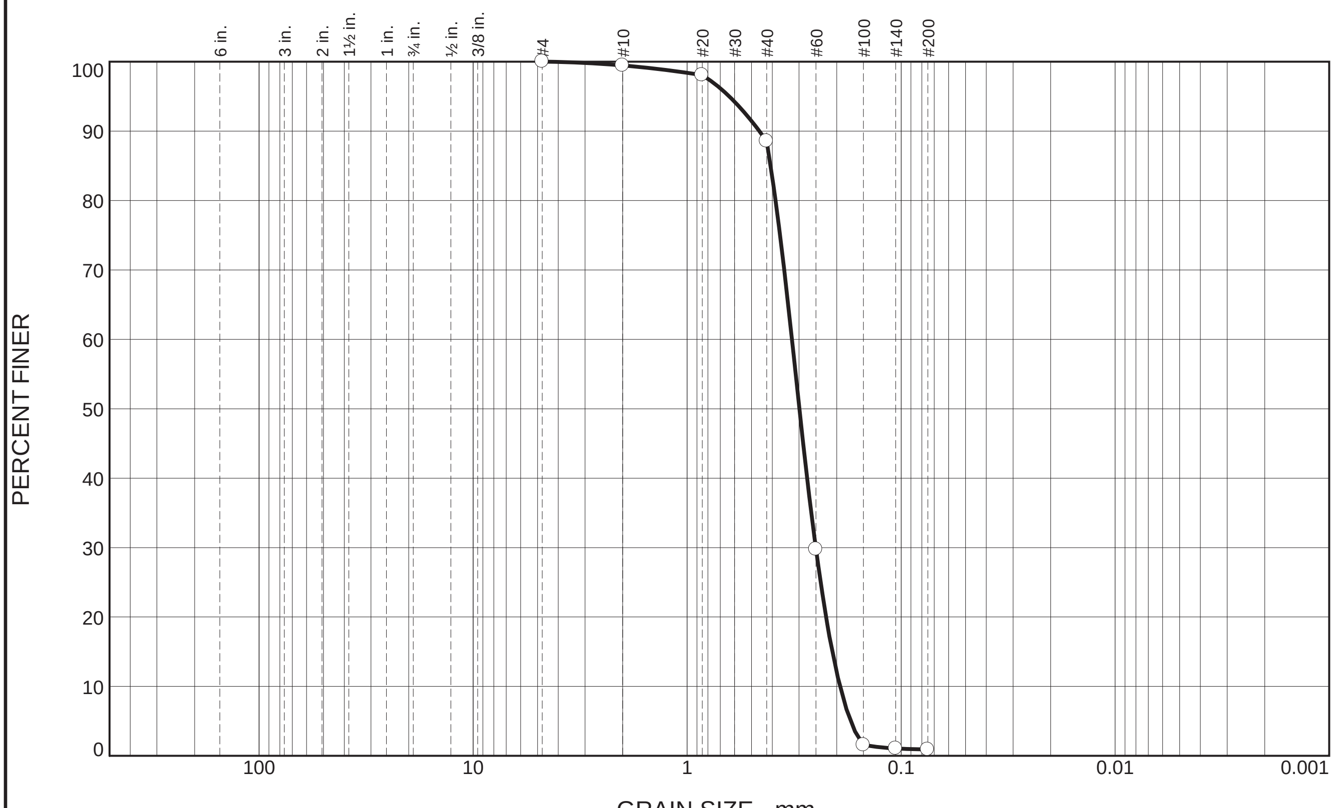
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	11.0	87.6	0.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.5		
#20	98.1		
#40	88.5		
#60	29.7		
#100	1.6		
#140	1.0		
#200	0.9		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4599 D_{85}= 0.4072 D_{60}= 0.3239
D_{50}= 0.2986 D_{30}= 0.2506 D_{15}= 0.2097
D_{10}= 0.1930 C_u= 1.68 C_c= 1.00

Classification

USCS= SP AASHTO=

Remarks

Sample Number: EST-9

Date: 10/17/2014

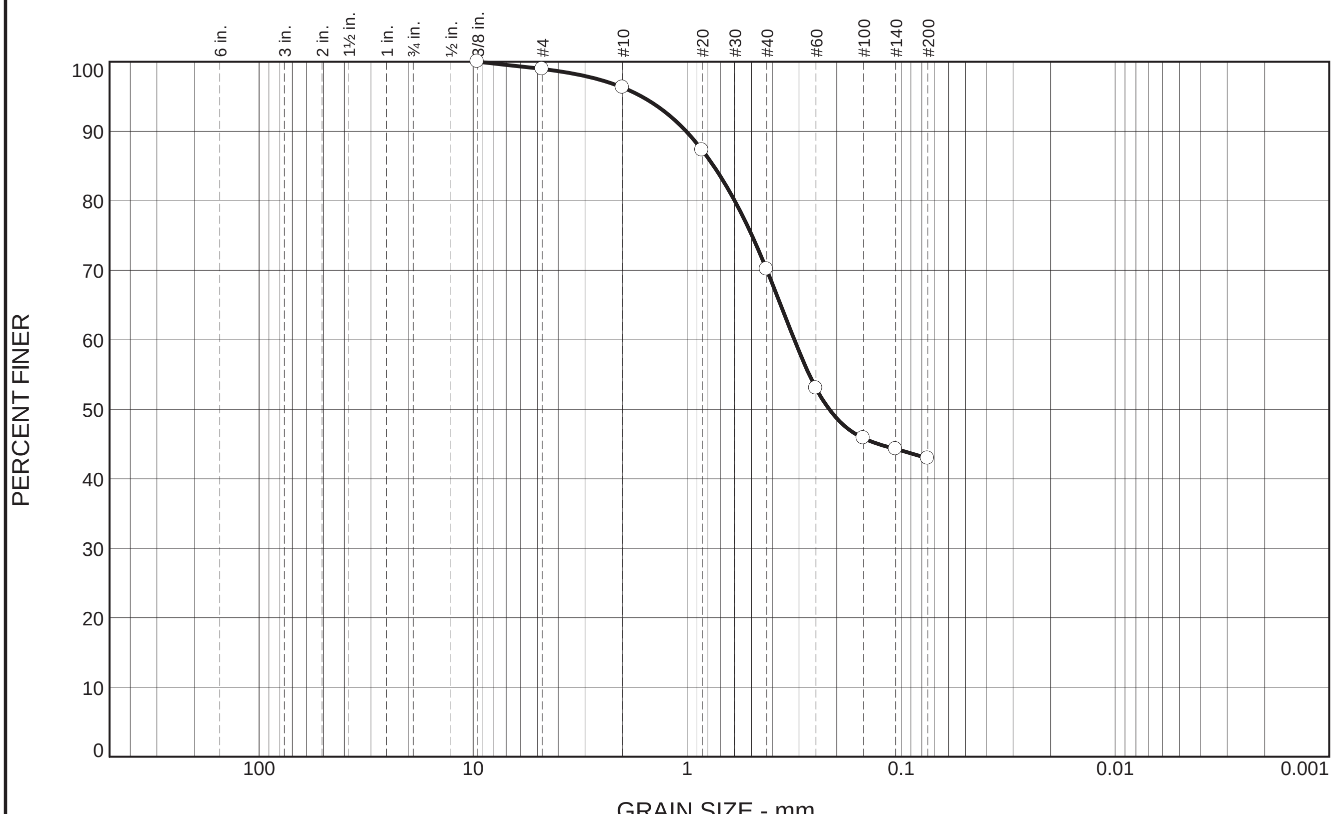
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	2.6	26.2	27.2	42.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	98.9		
#10	96.3		
#20	87.3		
#40	70.1		
#60	53.0		
#100	45.8		
#140	44.3		
#200	42.9		

* (no specification provided)

Material Description

SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.0119 D_{85}= 0.7521 D_{60}= 0.3159
D_{50}= 0.2168 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: EST-10

Date: 10/17/2014

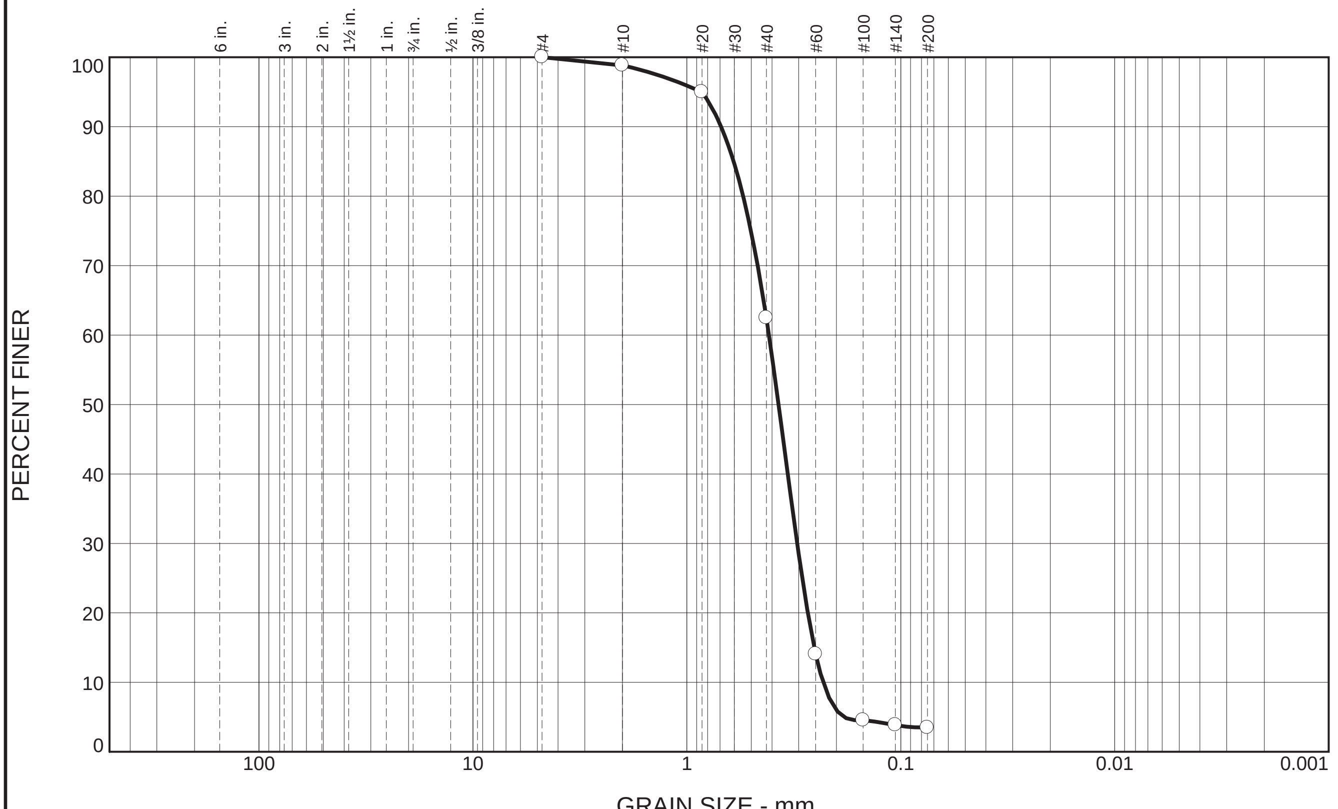
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.2	36.3	59.0	3.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.8		
#20	95.0		
#40	62.5		
#60	14.1		
#100	4.5		
#140	3.8		
#200	3.5		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6921 D_{85}= 0.6050 D_{60}= 0.4134
D_{50}= 0.3726 D_{30}= 0.3051 D_{15}= 0.2538
D_{10}= 0.2305 C_u= 1.79 C_c= 0.98

Classification

USCS= SP AASHTO=

Remarks

Sample Number: EST-11

Date: 10/17/2014

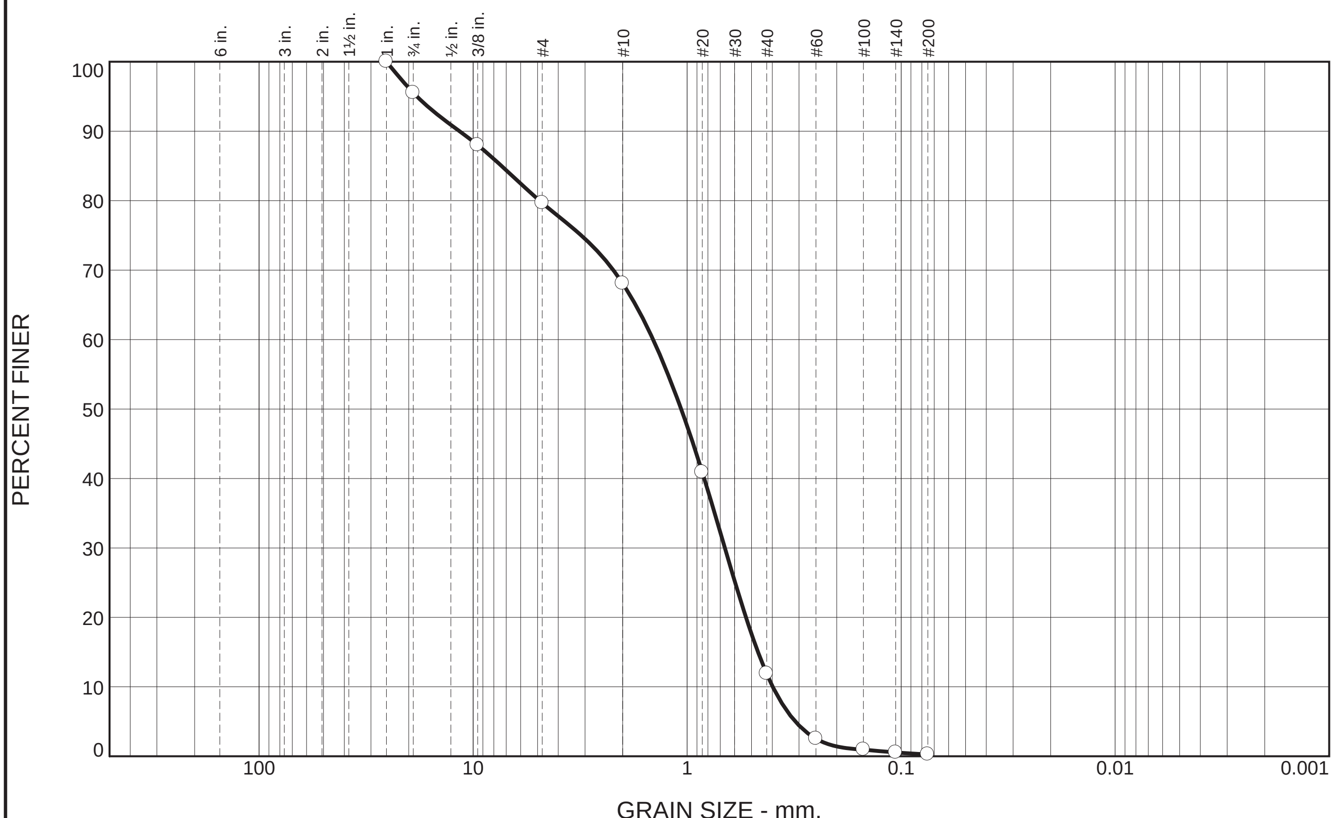
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.5	15.8	11.6	56.2	11.6	0.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	95.5		
3/8"	88.0		
#4	79.7		
#10	68.1		
#20	40.9		
#40	11.9		
#60	2.5		
#100	1.0		
#140	0.6		
#200	0.3		

* (no specification provided)

Material Description

Poorly-graded SAND with GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.5806 D_{85}= 7.3671 D_{60}= 1.4424
D_{50}= 1.0666 D_{30}= 0.6664 D_{15}= 0.4663
D_{10}= 0.3978 C_u= 3.63 C_c= 0.77

Classification

USCS= SP AASHTO=

Remarks

Sample Number: EST-12

Date: 10/17/2014

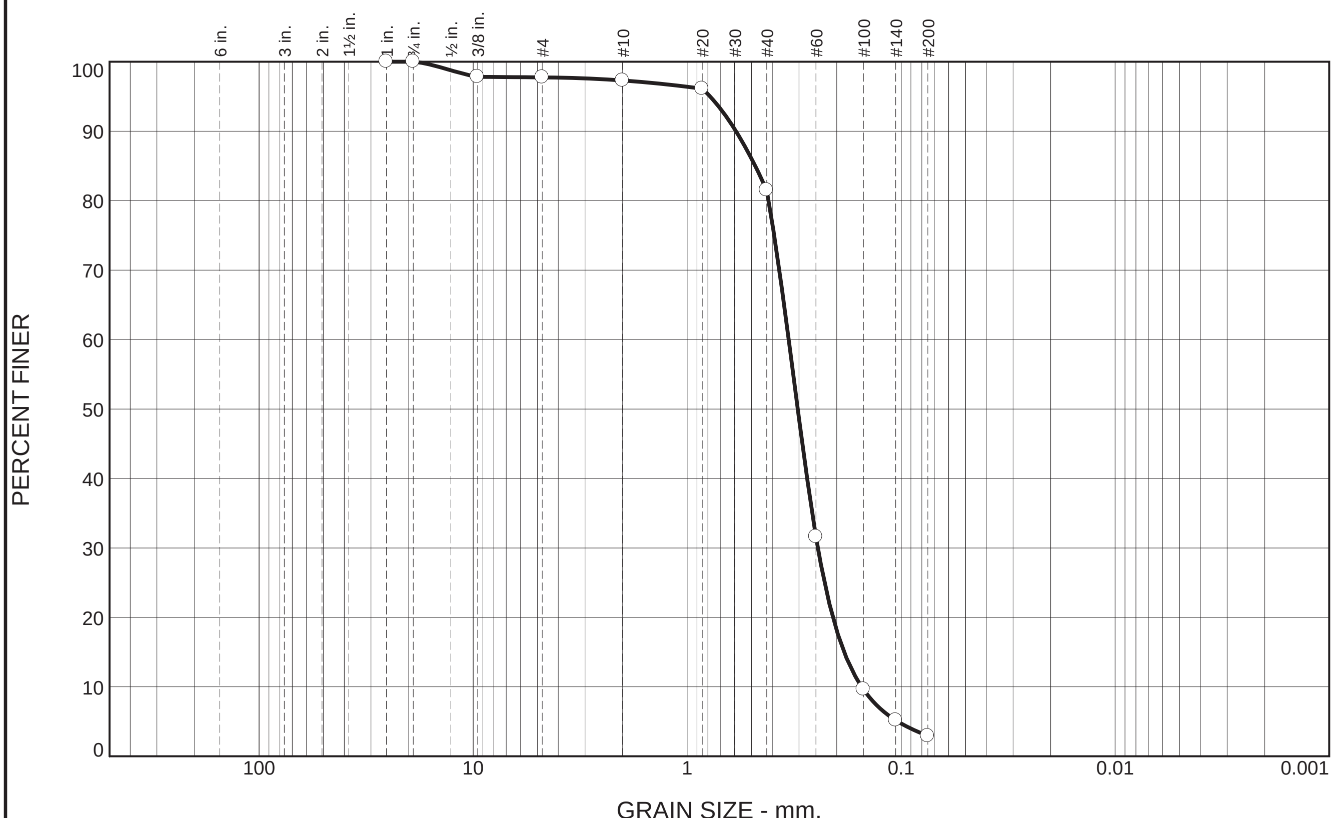
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.3	0.4	15.8	78.6	2.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	100.0		
3/8"	97.8		
#4	97.7		
#10	97.3		
#20	96.1		
#40	81.5		
#60	31.6		
#100	9.6		
#140	5.2		
#200	2.9		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5916 D_{85}= 0.4809 D_{60}= 0.3353
D_{50}= 0.3043 D_{30}= 0.2449 D_{15}= 0.1848
D_{10}= 0.1528 C_u= 2.19 C_c= 1.17

Classification

USCS= SP AASHTO=

Remarks

Sample Number: LND-2

Date: 10/17/2014

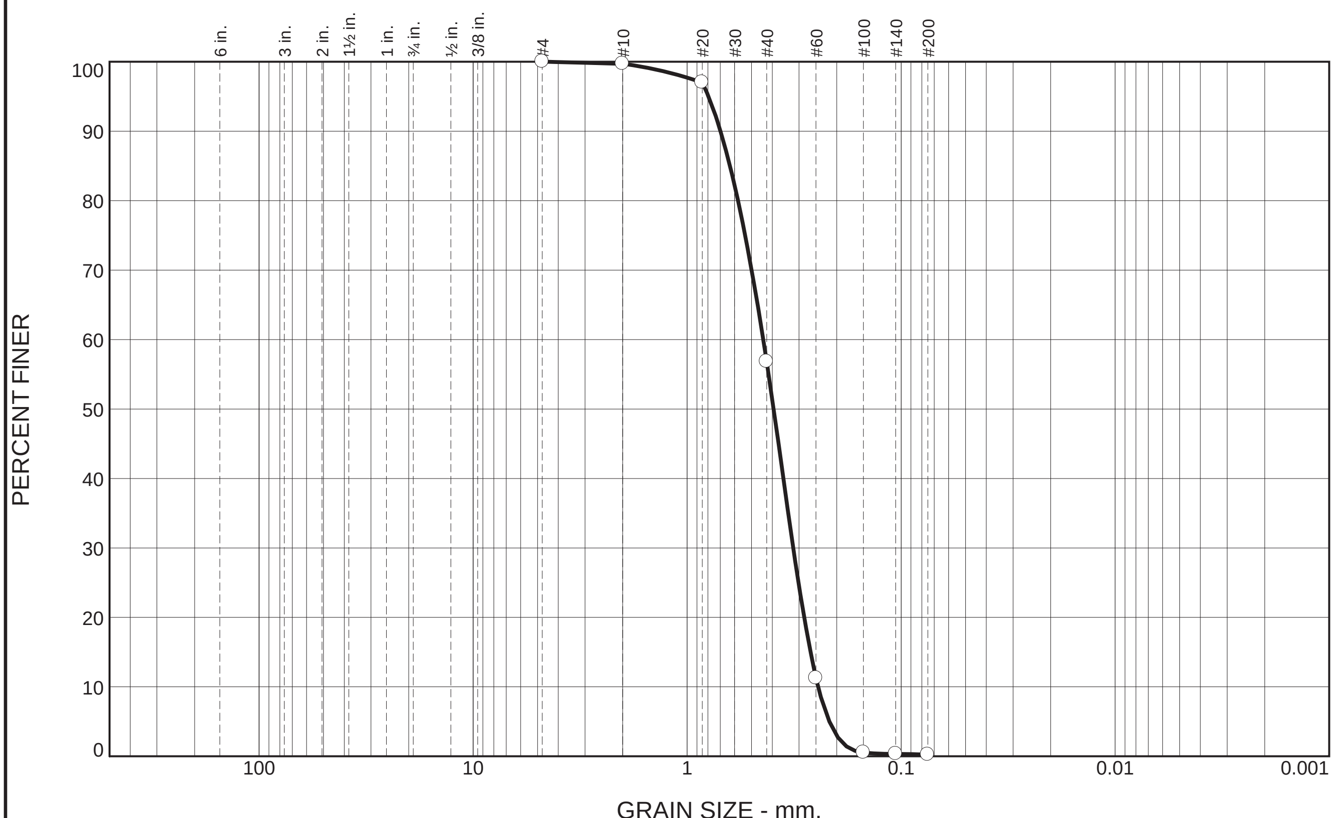
Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	42.9	56.5	0.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	97.0		
#40	56.8		
#60	11.3		
#100	0.6		
#140	0.3		
#200	0.3		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6985 D_{85}= 0.6310 D_{60}= 0.4408
D_{50}= 0.3945 D_{30}= 0.3191 D_{15}= 0.2653
D_{10}= 0.2443 C_u= 1.80 C_c= 0.95

Classification

USCS= SP AASHTO=

Remarks

Sample Number: LND-5

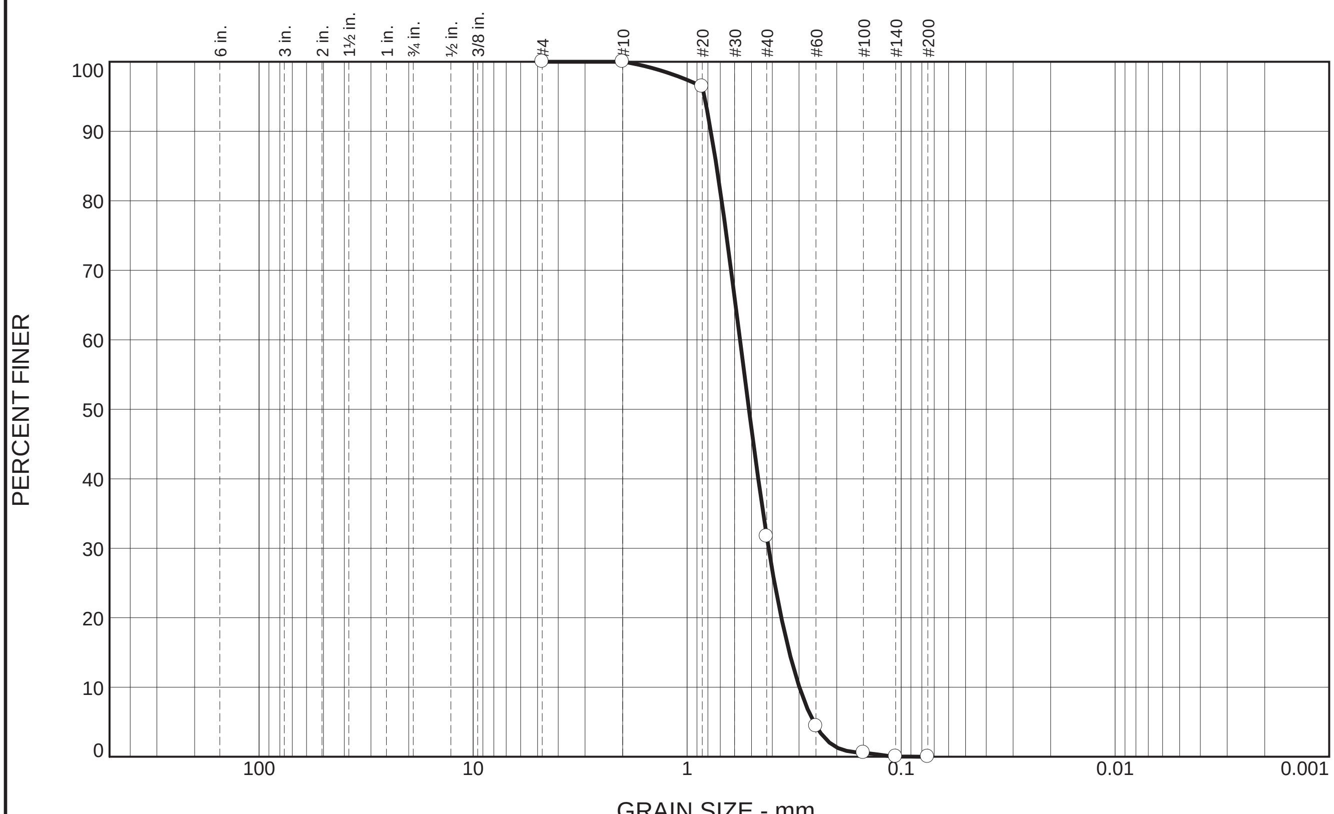
Date:

Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing
Project No: 2134 x **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	68.3	31.7	0.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	96.4		
#40	31.7		
#60	4.4		
#100	0.6		
#140	0.0		
#200	0.0		

* (no specification provided)

Material Description

Poorly-graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7744 D_{85}= 0.7288 D_{60}= 0.5660
D_{50}= 0.5143 D_{30}= 0.4163 D_{15}= 0.3328
D_{10}= 0.2989 C_u= 1.89 C_c= 1.02

Classification

USCS= SP AASHTO=

Remarks

Sample Number: LND-6

Date: 10/17/2014

Blackburn Consulting

W. Sacramento, CA

Client: CBEC, Inc.
Project: CBEC Lab Testing

Project No: 2134 x **Figure**

1098 Deseo Avenue
Camarillo, California 93010
www.Oakridgegeo.com
805-368-7765

April 17, 2015
Project No. 008.001

CBEC Inc.
2544 Industrial Blvd.
West Sacramento, California 95691

Attention: Mr. Dale Meck, EIT

Subject: Summary of Geotechnical Sampling and Testing Services, McGrath State Beach Park Restoration Project, Ventura County, California

Dear Mr. Meck:

Oakridge Geoscience, Inc. (OGI) is pleased to provide this letter summarizing the geotechnical services performed for the McGrath State Beach Park restoration project. The scope of services consisted of field exploration, soil sampling, geotechnical laboratory testing, and data transmittal performed in general accordance with our proposal dated February 19 2015.

WORK PERFORMED

Field Exploration

Field exploration consisted of advancing three hand-auger drill holes on April 9, 2015 to refusal near the locations requested by CBEC on the attached site plan. The actual exploration locations are approximate and were based on visual site observations and conditions. Locations A and C, located within the campground area, were advanced to refusal due to caving soil below groundwater at depths of about 7 feet. Location B, located near the western-most residence within the maintenance area, encountered refusal to hand-augering on the first attempt at a depth of about 2 feet in granular base-type fill material containing gravel and cobbles likely placed to create an elevated fill pad for the maintenance facility. In an effort to penetrate the base materials, the location was moved about 25 feet southeast in an area that is about 2 feet lower in elevation than the original location. At that location, the hand-auger penetrated the gravel and cobbles and was advanced to refusal in caving soil materials below the groundwater at a depth of about 5 feet. The drill hole logs are included as Plates A-1 through A-3 and the findings are summarized in Table 1 below.

Prior to the field exploration, we met with Ms. Alexis Frangis with the State Parks Department for site access to mark the testing locations for Underground Service Alert coordination and for subsequent field exploration.

Laboratory Testing

Bulk composite samples were collected for geotechnical laboratory testing and for environmental testing as the hand-auger holes were advanced.

Geotechnical Testing. The requested geotechnical laboratory testing consisted of performing grainsize determinations and maximum density tests on composite samples collected at each location in general accordance with ASTM D422 and ASTM D1557, respectively. The results of the geotechnical tests are included as Plates B-1 through B-6 and are summarized in Table 1 below.

Environmental Testing. Samples were collected from the composited materials excavated from each location for environmental testing performed by American Scientific Laboratories (ASL) under contract to CBEC. ASL provided the sample bottles/containers, insulated shipping carton, and the chain-of-custody forms prior to field exploration. After collection, the samples were kept chilled in the insulated carton and released to ASL with accompanying COC documentation on April 10, 2015. Environmental analyses reportedly consisted of tests for metals (EPA 6010B & 7470A), organochlorine pesticides and PCB's (EPA 608), and oil and grease (EPA 1664). ASL will provide the results of the environmental analyses to CBEC.

SUMMARY OF FINDINGS

The earth materials encountered by the hand-auger drill holes consisted of artificial fill materials overlying alluvial sediments as indicated on the drill hole logs and summarized below. Depths to groundwater ranged from about 2 to 2.7 feet below the ground surface at the locations explored; however, standing water was observed at many locations within the McGrath State Park campground facility.

Table 1. Summary of Encountered Conditions

Location	Earth Materials and Approx. Depth (ft)	Approx. Total Depth (ft)	Approx. Depth of Ground-water (ft)	Percent Passing No. 200 Sieve (%)	Optimum Moisture Content (%)	Maximum Density (pcf)
Loc. A[1]	0-1.5' – Artificial Fill; clay underlain by sandy silt/silty fine sand 1.5'-7' – Alluvium; Sandy silt and silty fine sand underlain by sand	7	2.1	30	13	112
Loc. B[1, 2]	0-2.3' – Artificial Fill; clayey sand with gravel and cobbles 2.3'-5.2' – Alluvium; clayey to silty fine sand underlain by sand	5.2	2.7	14	10	118
Loc. C[1]	0-2.5' – Artificial Fill; clayey sand and sand with silt 2.5'-7' – Alluvium; silty fine sand/fine sandy silt underlain by sand, underlain by clay	7	2	16	11	124

[1] Refusal to hand-augering due to caving soil materials.

[2] Refusal to hand-augering due to gravel and cobbles.

CLOSURE

We appreciate the opportunity to provide geotechnical services to CBEC, Inc. for the McGrath State Beach Park restoration project. Please call the undersigned if you have any questions on the information presented herein.

Sincerely,

OAKRIDGE GEOSCIENCE, INC.

Lori E. Prentice, CEG
President

Attachments: Exploration Location Plan by CBEC, Inc.
Plates A-1 through A-3 – Log of Drill Holes
Plates B-1 through B-3 – Grainsize Curves
Plates B-4 through B-6 – Compaction Curves

Harbor Blvd.
Location B
To depth of 10.0 ft
SP Coords:
6181507
1908492
Loc. B
(approx)
Location A
To depth of 7.0 ft
SP Coords:
6181361
1907988
Location C
To depth of 8.0 ft
SP Coords:
6181115
1907574
McGrath State Beach and Campground
0
250
500
1,000 Feet
N

LOG OF HAND AUGER LOCATION A

LOCATION: See Location Map

SURFACE ELEVATION: FEET (ref. MSL datum)

DEPTH (FEET)	SAMPLE NUMBER	BLOW COUNT	MATERIAL DESCRIPTION
			ARTIFICIAL FILL(af)
	A1		CLAY (CL) moderate brown, moist to wet, with fine sand and organics
		(1')	Sandy SILT (ML)/Silty fine SAND (SM): moderate yellowish brown, moist, with clay, slightly micaceous
2		(1.5')	ALLUVIUM (Qal)
	S1 (bulk)		Sandy SILT (ML): moderate yellowish brown mottled with light gray and orangish brown, moist, slightly micaceous
		(3.3')	Silty fine SAND (SM): moderate gray, mottled with orangish brown, wet, slightly micaceous, wi h scattered organics
4	A2		- dark gray with minor orangish mottling, below 4.2'
		(5.3')	- clayey sand, with common organics, slight organic odor, at 5'
6	S2 (bulk)		Medium SAND (SP): moderate gray, wet
		(7')	
8			NOTE: Hole caved to 6.6' after sampling; refusal to hand auger due to caving conditions.
10			
12			
14			
16			
18			

COMPLETION DEPTH (FT)	7
DEPTH TO WATER (FT):	2.1
LOGGED BY:	Lprentice
CHECKED BY:	Cprentice
EXCAVATION METHOD:	Hand auger
CONTRACTOR:	Oakridge Geo.
EXCAVATION DATE:	4/9/15
BACKFILL	Soil

Note:
The log and data presented herein are a simplification of actual subsurface conditions encountered at the time of exploration at the specific location explored. Subsurface conditions may differ at other locations and at this location

LOG OF HAND AUGER LOCATION B

LOCATION: See Location Map

SURFACE ELEVATION: FEET (ref. MSL datum)

DEPTH (FEET)	ELEVATION (FEET)	MATERIAL SYMBOL	SAMPLE NUMBER	BLOW COUNT	MATERIAL DESCRIPTION	TV or PP
					ARTIFICIAL FILL(af)	
			B1		Clayey SAND (SC): moderate yellowish brown, damp, with gravel and angular rock fragments to about 4" diameter, angular asphalt fragments to about 1.75" length, rounded to subrounded cobbles to about 8" diameter	
2				(2.3')	ALLUVIUM (Qal)?	
				(2.7')	Silty Fine SAND (SM): dark gray, damp, with fine roots	
			S1 (Bulk)	(3')	ALLUVIUM (Qal)	
4					Clayey to Silty Fine SAND (SC-SM): moderate brown with gray and orangish brown mottling, increasing moisture content with depth	
			B2		Medium SAND (SP): moderate gray, wet	
				(5.2')	- caving below 3.5'	
6						
					NOTE: Hand auger refusal on cobbles at 2' on first attempt. Moved location about 25' southeast to an area about 2' lower in elevation. Refusal to hand auger at second location at about 5.2' due to caving conditions.	
8						
10						
12						
14						
16						
18						

COMPLETION DEPTH (FT) 5.2
DEPTH TO WATER (FT): 2.7

Note:
The log and data presented herein are a simplification of actual subsurface conditions encountered at the time of exploration at the specific location explored. Subsurface conditions may differ at other locations and at this location with the passage of time.

LOGGED BY:	Lprentice
CHECKED BY:	Cprentice
EXCAVATION METHOD:	Hand auger
CONTRACTOR:	Oakridge Geo.
EXCAVATION DATE:	4/9/15
BACKFILL	Soil

CBEC, INC.
MCGRATH STATE BEACH RESTORATION PROJECT

LOG OF HAND AUGER LOCATION C

DEPTH (FEET)	ELEVATION (FEET)	MATERIAL SYMBOL	SAMPLE NUMBER	BLOW COUNT	LOCATION: See Location Map SURFACE ELEVATION: FEET (ref. MSL datum) MATERIAL DESCRIPTION	TV or PP
			S1 (Bulk)		ARTIFICIAL FILL(af)	
					Clayey SAND (SC): dark brown, moist, with abundant root and organics in upper 4"	
				(1.3')	ARTIFICIAL FILL (af)/ALLUVIUM (Qal)?	
2			C1		SAND with Silt (SP-SM): loose, moderate brown, wet	
				(2.5')	ALLUVIUM (Qal)	
					Silty Fine SAND (SM)/Fine Sandy SILT (ML): grayish brown, wet, with orangish mot ling, and with caliche stain, micaceous	
4					- wi h increasing orangish mottling, below 3'	
			C2			
6				(5.8')		
				(6.2')	Medium SAND (SP): light gray, wet, loose	
				(7')	CLAY (CL/CH): olive gray, wet, with silt, slightly micaceous	
8					NOTE: Hole caved to 5' after sampling; refusal to hand auger due to caving conditions.	
10						
12						
14						
16						
18						

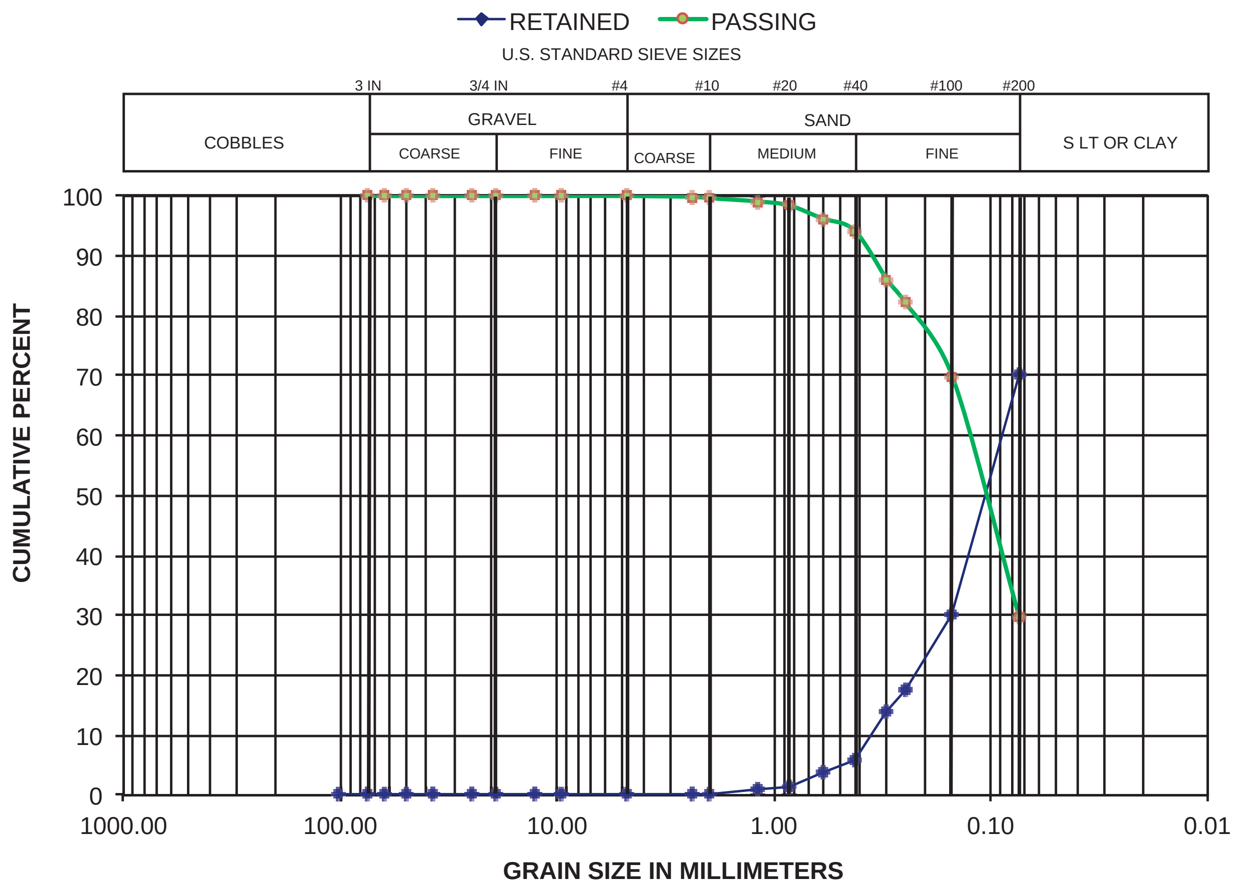
COMPLETION DEPTH (FT)	7
DEPTH TO WATER (FT):	2

Note:
The log and data presented herein are a simplification of actual subsurface conditions encountered at the time of exploration at the specific location explored. Subsurface conditions may differ at other locations and at this location with the passage of time.

LOGGED BY:	Lprentice
CHECKED BY:	Cprentice
EXCAVATION METHOD:	Hand auger
CONTRACTOR:	Oakridge Geo.
EXCAVATION DATE:	4/9/15
BACKFILL	Soil

CBEC, INC.
MCGRATH STATE BEACH RESTORATION PROJECT

GRADATION CURVE

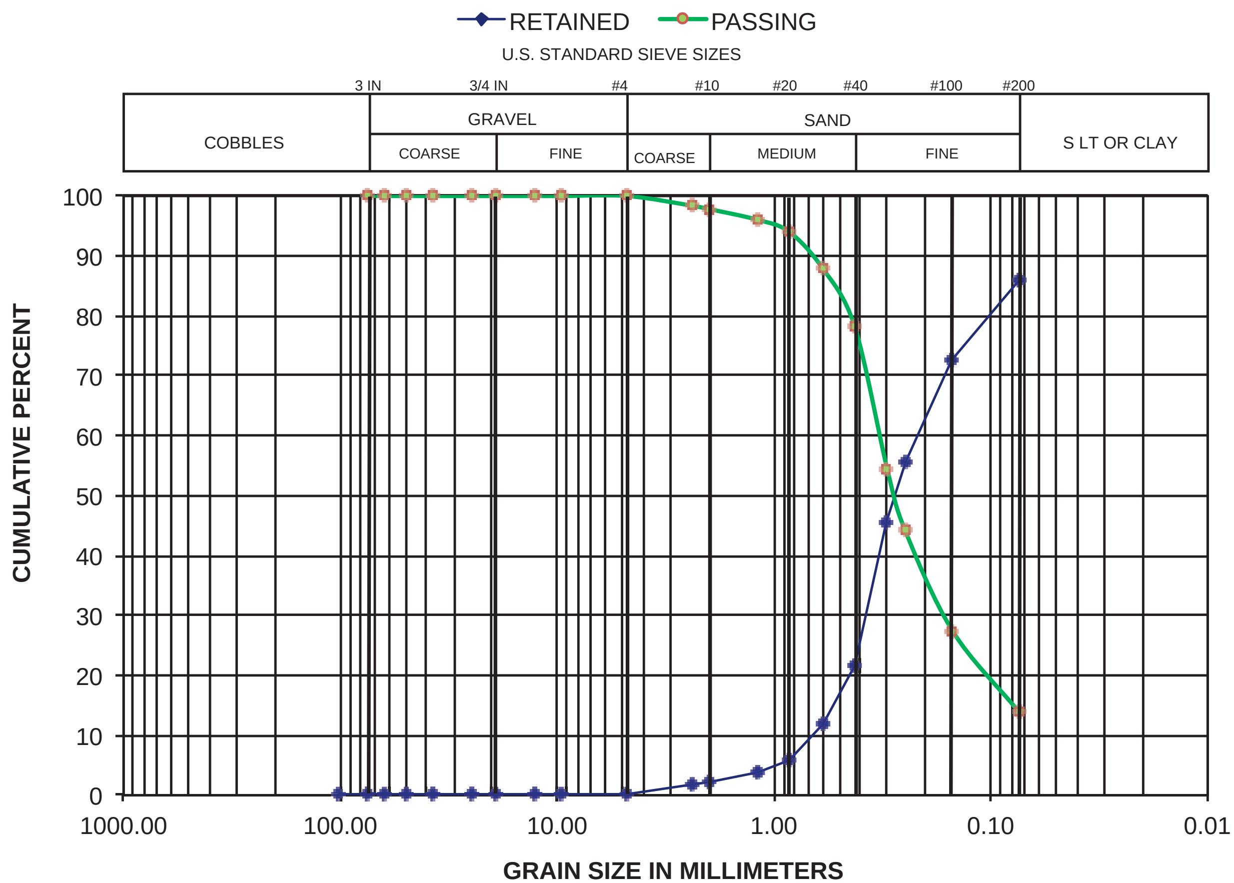


PROJECT NO.	SAMPLE I.D.	Cc	Cu	SO L CLASS FICATION
008.001	Location A; S1 0-5' Composite			Silty to Clayey SAND (SM/SC)

PLATE B-1

Oakridge Geoscience, Inc.   www.Oakridgegeo.com

GRADATION CURVE



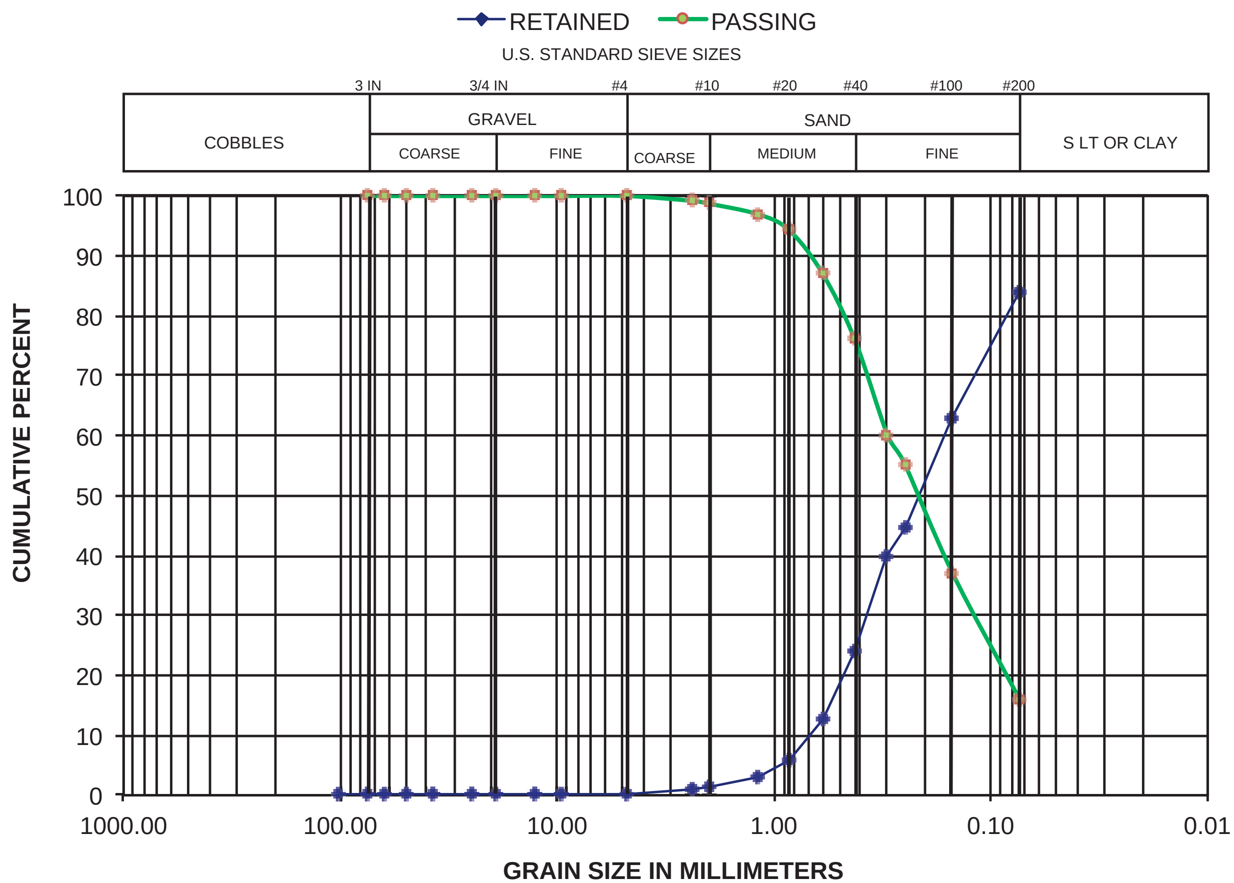
PROJECT NO.	SAMPLE I.D.	Cc	Cu	SO L CLASS FICATION
008.001	Location B; S1 0-5' Composite			Silty to Clayey SAND (SM/SC)

Oakridge Geoscience, Inc.

www.Oakridgegeo.com

PLATE B-2

GRADATION CURVE



PROJECT NO.	SAMPLE I.D.	Cc	Cu	SO L CLASS FICATION
008.001	Location C; S1 0-5.8' Composite			Silty to Clayey SAND (SM/SC)

PLATE B-3

PROCTOR COMPACTION

Test Method: ASTM D1557

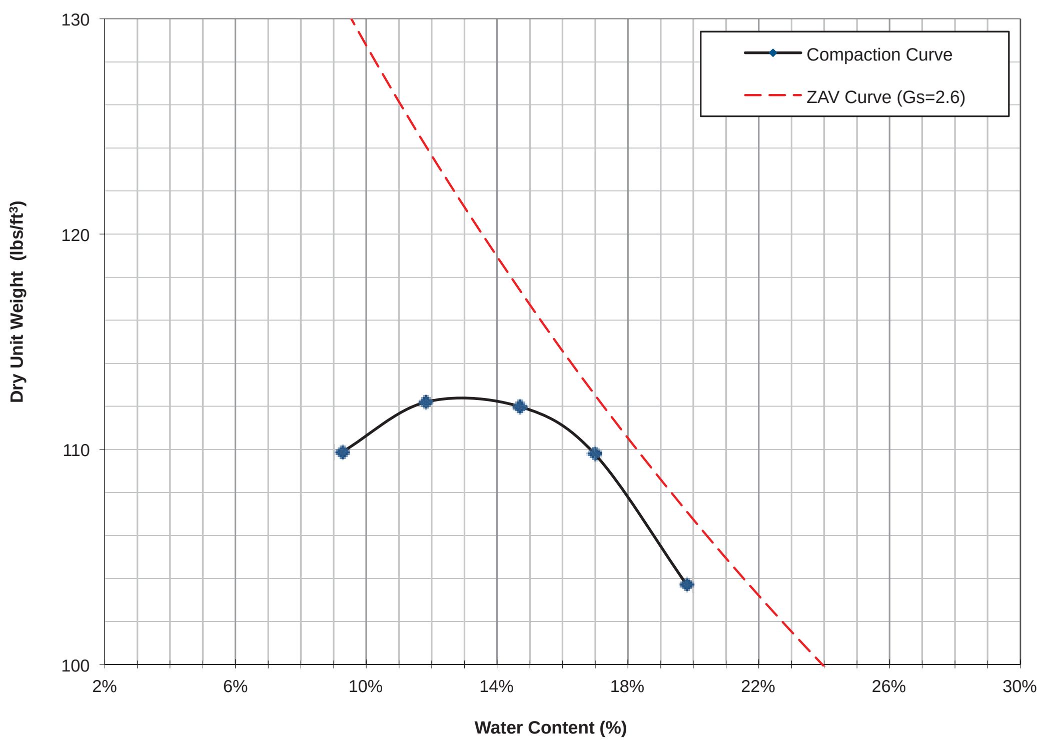
Project Name	McGrath State Beach Restor.	Project No.	008.001
Tested By	C Prentice	Testing Date	4/14/15

SPECIMEN ID AND CLASSIFICATION					
Boring No.	Loc A	Sample No.	S1	Depth (ft)	0-5'
Soil Description					

EQUIPMENT AND PROCEDURE					
Test Method (D698/D1557)	D1557	Ram. Mass (g)	4530	# of Lifts	5
Mold Volume (cm^3)	943	Mold Mass(g)	2050	Blows/ Lift	25

DENSITY AND MOISTURE MEASUREMENTS					
Mass of Soil + Mold (g)	3946.3	3991.7	3991.7	3928.2	3864.7
Dish ID	A1	A2	A3	A4	B1
Mass of Dish (g)	6.34	6.35	6.34	6.38	44.48
Mass of Moist Soil + Dish (g)	285.1	292.2	388.8	341.9	409.3
Mass of Dry Soil + Dish (g)	255.6	255.6	333.3	286.5	378.4

RESULTS					
Water Content	11.8%	14.7%	17.0%	19.8%	9.3%
Dry Density (Mg/m^3)	1.798	1.795	1.760	1.662	1.761
Dry Unit Weight (lbs/ft^3)	112.2	112.0	109.8	103.7	109.9
Lab Max. Dry Density (Mg/m^3)	1.795		Optimum Water Content (%)		13%
Lab Max. Dry Unit Wt. (lbs/ft^3)	112				



PROCTOR COMPACTION

Test Method: ASTM D1557

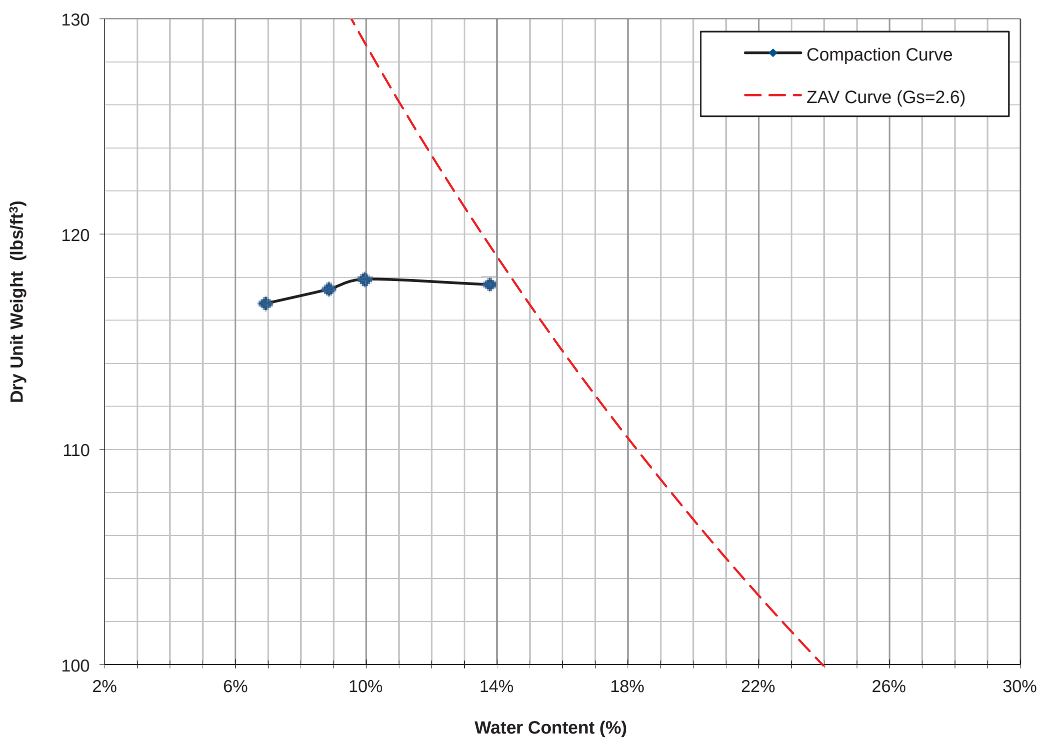
Project Name	McGrath State Beach Restor.	Project No.	008.001
Tested By	C Prentice	Testing Date	4/14/15

SPECIMEN ID AND CLASSIFICATION					
Boring No.	Loc B	Sample No.	S1	Depth (ft)	0-5'
Soil Description					

EQUIPMENT AND PROCEDURE					
Test Method (D698/D1557)	D1557	Ram. Mass (g)	4530	# of Lifts	5
Mold Volume (cm^3)	943	Mold Mass(g)	2050	Blows/ Lift	25

DENSITY AND MOISTURE MEASUREMENTS					
Mass of Soil + Mold (g)	3982.6	3937.2	4073.3	4009.8	
Dish ID	A6	A7	A8	B2	
Mass of Dish (g)	6.42	6.39	6.35	44.48	
Mass of Moist Soil + Dish (g)	345.9	332.5	328.0	505.8	
Mass of Dry Soil + Dish (g)	318.3	311.5	289.1	464.0	

RESULTS					
Water Content	8.9%	6.9%	13.8%	10.0%	
Dry Density (Mg/m^3)	1.882	1.871	1.886	1.889	
Dry Unit Weight (lbs/ft^3)	117.4	116.8	117.7	117.9	
Lab Max. Dry Density (Mg/m^3)	1.891		Optimum Water Content (%)		10%
Lab Max. Dry Unit Wt. (lbs/ft^3)	118				



PROCTOR COMPACTION

Test Method: ASTM D1557

Project Name	McGrath State Beach Restor.	Project No.	008.001
Tested By	C Prentice	Testing Date	4/14/15

SPECIMEN ID AND CLASSIFICATION

Boring No.	Loc C	Sample No.	S1	Depth (ft)	0-5.5'
Soil Description					

EQUIPMENT AND PROCEDURE

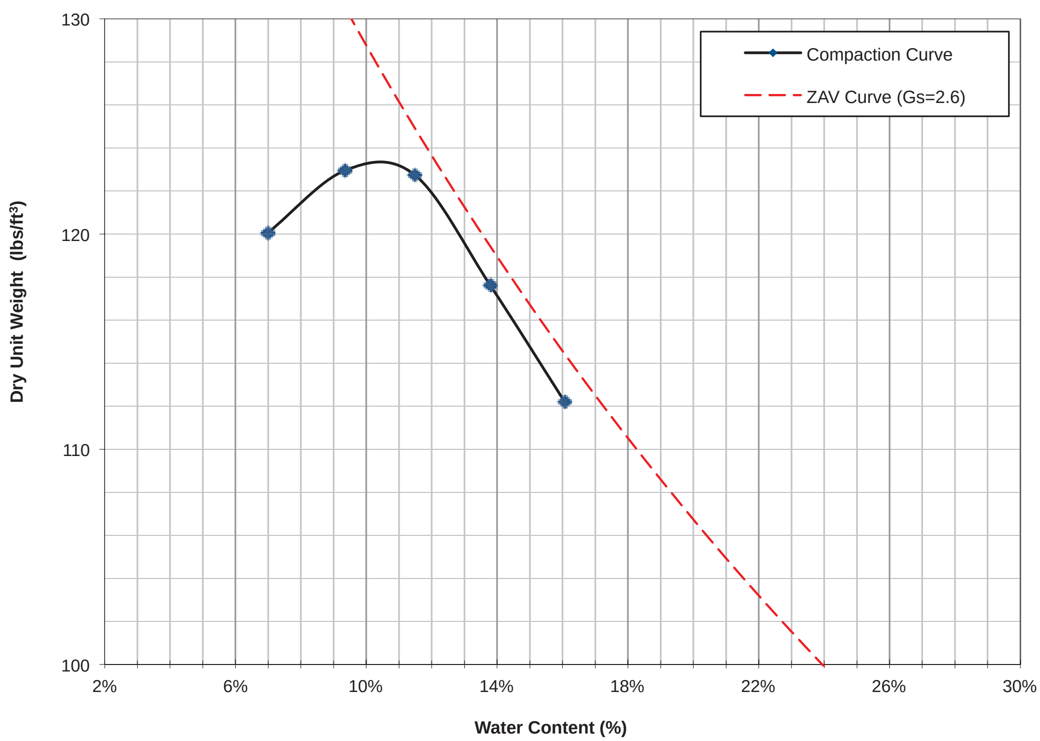
Test Method (D698/D1557)	D1557	Ram. Mass (g)	4530	# of Lifts	5
Mold Volume (cm^3)	943	Mold Mass(g)	2050	Blows/ Lift	25

DENSITY AND MOISTURE MEASUREMENTS

Mass of Soil + Mold (g)	3991.7	4082.4	4118.7	4073.3	4018.9
Dish ID	B1	B2	B3	B4	B5
Mass of Dish (g)	44.45	44.48	44.40	44.43	44.55
Mass of Moist Soil + Dish (g)	391.6	443.1	525.2	529.8	464.4
Mass of Dry Soil + Dish (g)	369.0	409.0	475.7	471.0	406.3

RESULTS

Water Content	7.0%	9.3%	11.5%	13.8%	16.1%
Dry Density (Mg/m^3)	1.924	1.970	1.967	1.885	1.798
Dry Unit Weight (lbs/ft^3)	120.1	123.0	122.7	117.6	
Lab Max. Dry Density (Mg/m^3)	1.987		Optimum Water Content (%)		11%
Lab Max. Dry Unit Wt. (lbs/ft^3)	124				



AMERICAN SCIENTIFIC LABORATORIES, LLC
Environmental Testing Services
2520 N. San Fernando Rd., Los Angeles, CA 90065 Tel: (323) 223-9700 Fax: (323) 223-9500

Ordered By

cbec
2544 Industrial Blvd.
W. Sacramento, CA 95691-

Number of Pages	7
Date Received	04/10/2015
Date Reported	04/17/2015

Telephone (970)903-8297
Attn Dale Meck

Job Number	Ordered	Client
64178	04/10/2015	CBEC

Project ID:
Project Name: McGrath St. Beach
Site: Harbor Blvd.
Oxnard, CA

Enclosed are the results of analyses on 3 samples analyzed as specified on attached chain of custody.

Wendy Lu
Organics Supervisor

AMERICAN SCIENTIFIC LABORATORIES, LLC
Environmental Testing Services
2520 N. San Fernando Road, LA, CA 90065 Tel: (323) 223-9700 • Fax: (323) 223-9500

Page ____ Of ____

COC# No 71134 GLOBAL ID ____ E REPORT: ☐ PDF ☐ EDF ☐ EDD ASL JOB# 64178

CHAIN OF CUSTODY RECORD

Company: Cbec		Report To: Dale Meck	
Address: 2544 Industrial Blvd West Sacramento, CA 95691	Project Name: McGrath St Beach	Address:	
	Site Address: Harbor Blvd Oxnard, CA	Invoice To: Cbec	
Telephone: 916-668-5244 Fax:		Address:	
Special Instruction:	Project ID:		
E-mail: dmeck@cbecoeng.com	Project Manager: Dale Meck	P.O.#:	

ANALYSIS REQUESTED: Metals (6010B/7471A); PCBs and Pesticides (608); Oil & Grease (1664)

ITEM	Lab ID (LAB USE ONLY)	Sample ID	Date	Time	Container #	Container Type	Matrix	Preservation	Metals (6010B/7471A)	PCBs and Pesticides (608)	Oil & Grease (1664)	Remarks
		C1 @ 2'	4/9/15	235p		Glass	Soil					
	330878	C2 @ 5'	4/9/15	245p		Glass	Soil		x	x	x	
		A1 @ 1'	4/9/15	325p		Glass	Soil					
	330879	A2 @ 4'	4/9/15	335p		Glass	Soil		x	x	x	
		B1 @ 1.5'	4/9/15	435p		Glass	Soil					
	330880	B2 @ 5'	4/9/15	450p		Glass	Soil		x	x	x	

Collected By: Lori Prentice	Date 4/9/15	Time 450p	Relinquished By:	Date	Time
Relinquished By:	Date	Time	Received For Laboratory: alex	Date 4-10-15	Time 11:00
Received By:	Date	Time	Condition of Sample:		

TAT: ☐ Normal ☐ Rush

White - Report, Yellow - Laboratory, Pink - Client

ANALYTICAL RESULTS

Ordered By

cbec
2544 Industrial Blvd.
W. Sacramento, CA 95691-

Site

Harbor Blvd.
Oxnard, CA

Telephone: (970)903-8297
Attn: Dale Meck

Page: **2**

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 1664, Revision A, Oil and Grease (HEM)

QC Batch No: 041315-1

Our Lab I.D.		**330878**	**330879**	**330880**		
Client Sample I.D.		C2@5'	A2@4'	B2@5'		
Date Sampled		04/09/2015	04/09/2015	04/09/2015		
Date Prepared		04/13/2015	04/13/2015	04/13/2015		
Preparation Method						
Date Analyzed		04/13/2015	04/13/2015	04/13/2015		
Matrix		Soil	Soil	Soil		
Units		mg/Kg	mg/Kg	mg/Kg		
Dilution Factor		1	1	1		
Analytes	**PQL**	**Results**	**Results**	**Results**		
Conventionals						
Oil and Grease	20.0	66.0	32.0	40.0		

QUALITY CONTROL REPORT

QC Batch No: 041315-1

Analytes	LCS % REC	LCS DUP % REC	LCS RPD % REC	LCS/LCSD % Limit	LCS RPD % Limit					
Conventionals										
Oil and Grease	88	89	<1	80-120	<20					

AMERICAN SCIENTIFIC LABORATORIES, LLC
Environmental Testing Services
2520 N. San Fernando Rd., Los Angeles, CA 90065 Tel: (323) 223-9700 Fax: (323) 223-9500

ANALYTICAL RESULTS

Ordered By

cbec
2544 Industrial Blvd.
W. Sacramento, CA 95691-

Site

Harbor Blvd.
Oxnard, CA

Telephone: (970)903-8297
Attn: Dale Meck

Page: **3**

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 6010B/7471A, CCR Title 22 Metals (TTLC)

QC Batch No: 041415-2

Our Lab I.D.		**330878**	**330879**	**330880**		
Client Sample I.D.		C2@5'	A2@4'	B2@5'		
Date Sampled		04/09/2015	04/09/2015	04/09/2015		
Date Prepared		04/14/2015	04/14/2015	04/14/2015		
Preparation Method						
Date Analyzed		04/15/2015	04/15/2015	04/15/2015		
Matrix		Soil	Soil	Soil		
Units		mg/Kg	mg/Kg	mg/Kg		
Dilution Factor		1	1	1		
Analytes	**PQL**	**Results**	**Results**	**Results**		
AA Metals						
Mercury	0.0500	ND	0.420	ND		
ICP Metals						
Antimony	0.500	ND	ND	ND		
Arsenic	0.250	2.15	1.75	0.906		
Barium	0.500	93.0	99.4	43.8		
Beryllium	0.500	ND	ND	ND		
Cadmium	0.500	0.856	0.754	ND		
Chromium	0.500	11.4	12.1	4.25		
Cobalt	0.500	4.56	5.00	1.55		
Copper	0.500	9.50	8.70	3.11		
Lead	0.250	3.50	3.09	2.46		
Molybdenum	0.500	0.967	ND	ND		
Nickel	0.500	11.2	11.6	4.13		
Selenium	0.500	ND	ND	ND		
Silver	0.500	ND	ND	ND		
Thallium	0.500	ND	ND	ND		
Vanadium	0.500	19.9	20.0	8.17		
Zinc	0.500	32.7	32.3	10.8		

QUALITY CONTROL REPORT

QC Batch No: 041415-2

Analytes	LCS % REC	LCS/LCSD % Limit								
AA Metals										
Mercury	88	80-120								
ICP Metals										
Antimony	99	80-120								
Arsenic	107	80-120								

American Scientific Laboratories, LLC
Environmental Testing Services
2520 N. San Fernando Rd., Los Angeles, CA 90065 Tel: (323) 223-9700 Fax: (323) 223-9500

ANALYTICAL RESULTS

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 6010B/7471A, CCR Title 22 Metals (TTLC)

QUALITY CONTROL REPORT

QC Batch No: 041415-2

Analytes	LCS % REC	LCS/LCSD % Limit								
ICP Metals										
Barium	115	80-120								
Beryllium	110	80-120								
Cadmium	103	80-120								
Chromium	103	80-120								
Cobalt	106	80-120								
Copper	107	80-120								
Lead	106	80-120								
Molybdenum	102	80-120								
Nickel	104	80-120								
Selenium	102	80-120								
Silver	101	80-120								
Thallium	109	80-120								
Vanadium	105	80-120								
Zinc	107	80-120								

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ANALYTICAL RESULTS

Ordered By

cbec
2544 Industrial Blvd.
W. Sacramento, CA 95691-

Site

Harbor Blvd.
Oxnard, CA

Telephone: (970)903-8297
Attn: Dale Meck

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 8081A, Organochlorine Pesticides

QC Batch No: 041615-1

Our Lab I.D.		**330878**	**330879**	**330880**		
Client Sample I.D.		C2@5'	A2@4'	B2@5'		
Date Sampled		04/09/2015	04/09/2015	04/09/2015		
Date Prepared		04/16/2015	04/16/2015	04/16/2015		
Preparation Method						
Date Analyzed		04/16/2015	04/16/2015	04/16/2015		
Matrix		Soil	Soil	Soil		
Units		ug/kg	ug/kg	ug/kg		
Dilution Factor		1	1	1		
Analytes	**PQL**	**Results**	**Results**	**Results**		
Aldrin	2.00	ND	ND	ND		
alpha-Hexachlorocyclohexane (Alpha-BHC)	2.00	ND	ND	ND		
Beta-Hexachlorocyclohexane (Beta-BHC)	2.00	ND	ND	ND		
Gamma-Chlordane	2.00	ND	ND	ND		
alpha-Chlordane	2.00	ND	ND	ND		
4,4'-DDD (DDD)	4.00	ND	ND	ND		
4,4'-DDE (DDE)	4.00	ND	ND	ND		
4,4'-DDT (DDT)	4.00	ND	ND	ND		
delta-Hexachlorocyclohexane (Delta-BHC)	2.00	ND	ND	ND		
Dieldrin	4.00	ND	ND	ND		
Endosulfan 1	2.00	ND	ND	ND		
Endosulfan 11	4.00	ND	ND	ND		
Endosulfan sulfate	4.00	ND	ND	ND		
Endrin	4.00	ND	ND	ND		
Endrin aldehyde	4.00	ND	ND	ND		
Endrin ketone	4.00	ND	ND	ND		
gamma-Hexachlorocyclohexane (Gamma-BHC, Lindane)	2.00	ND	ND	ND		
Heptachlor	2.00	ND	ND	ND		
Heptachlor epoxide	2.00	ND	ND	ND		
Methoxychlor	4.00	ND	ND	ND		
Toxaphene	170	ND	ND	ND		
Chlordane, Total	170	ND	ND	ND		

Our Lab I.D.		**330878**	**330879**	**330880**		
Surrogates	% Rec.Limit	% Rec.	% Rec.	% Rec.		
Surrogate Percent Recovery						
Decachlorobiphenyl	43-169	92	95	100		

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ANALYTICAL RESULTS

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 8081A, Organochlorine Pesticides

QUALITY CONTROL REPORT

QC Batch No: 041615-1

Analytes	LCS % REC	LCS DUP % REC	LCS RPD % REC	LCS/LCSD % Limit	LCS RPD % Limit					
Aldrin	75	70	6.9	42-122	<30					
4,4'-DDT (DDT)	96	87	9.8	25-160	<30					
Dieldrin	72	70	2.8	36-146	<30					
Endrin	79	72	9.3	30-147	<30					
gamma-Hexachlorocyclohexane (Gamma-BHC, Lindane)	71	74	4.1	32-127	<30					
Heptachlor	70	69	1.4	34-111	<30					

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ANALYTICAL RESULTS

Ordered By

cbec
2544 Industrial Blvd.
W. Sacramento, CA 95691-

Telephone: (970)903-8297
Attn: Dale Meck

Site

Harbor Blvd.
Oxnard, CA

Project Name: McGrath St. Beach

ASL Job Number	Submitted	Client
64178	04/10/2015	CBEC

Method: 8082, Polychlorinated Biphenyls(PCBs) by Gas Chromatography

QC Batch No: 041615-1

Our Lab I.D.		330878	330879	330880		
Client Sample I.D.		C2@5'	A2@4'	B2@5'		
Date Sampled		04/09/2015	04/09/2015	04/09/2015		
Date Prepared		04/16/2015	04/16/2015	04/16/2015		
Preparation Method						
Date Analyzed		04/16/2015	04/16/2015	04/16/2015		
Matrix		Soil	Soil	Soil		
Units		ug/kg	ug/kg	ug/kg		
Dilution Factor		1	1	1		
Analytes	**PQL**	**Results**	**Results**	**Results**		
Aroclor-1016 (PCB-1016)	33.0	ND	ND	ND		
Aroclor-1221 (PCB-1221)	67.0	ND	ND	ND		
Aroclor-1232 (PCB-1232)	33.0	ND	ND	ND		
Aroclor-1242 (PCB-1242)	33.0	ND	ND	ND		
Aroclor-1248 (PCB-1248)	33.0	ND	ND	ND		
Aroclor-1254 (PCB-1254)	33.0	ND	ND	ND		
Aroclor-1260 (PCB-1260)	33.0	ND	ND	ND		

Our Lab I.D.		330878	330879	330880		
Surrogates	**% Rec.Limit**	**% Rec.**	**% Rec.**	**% Rec.**		
Surrogate Percent Recovery						
Decachlorobiphenyl	43-169	92	95	100		

QUALITY CONTROL REPORT

QC Batch No: 041615-1

Analytes	LCS % REC	LCS DUP % REC	LCS RPD % REC	LCS/LCSD % Limit	LCS RPD % Limit					
Aroclor-1260 (PCB-1260)	81	89	9.4	39-150	<30					

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San Jose Office
May 4, 2015
Report 15-113-0001

WRA Environmental
2169-G E. Francisco Blvd.
San Rafael, CA 94901

Attn: Megan Stromberg

RE: Santa Clara River Estuary, Ventura/Oxnard

Background

Nine samples were received on April 23, 2015 identified as representing site soil taken from an area that is scheduled for marsh and riparian plant revegetation. The samples were analyzed for horticultural suitability, fertility, and physical characteristics. The results of the analyses are attached.

Analytical Results

The reaction of the soil ranges from slightly acidic at a pH of 6.7 in sample 1A to moderately alkaline at a pH of 8.2 in sample 5B. These are predominantly within the range preferred by most plants, including the plants on the provided list. The pHs of 7.9 in samples 1B and 3A and 8.2 in sample 5B may be at the upper end of the preferred range for some of the specified plants so this should be taken into account when installing plants in these areas.

Salinity (ECe) and sodium are elevated and likely to cause marginal and tip burning on all but the most salt tolerant of plants in all but sample 2A and 4B. Boron is also quite elevated in all but samples 2A, 4A and 4B and many plants are likely to be affected by its presence. The sodium adsorption ratio (SAR) shows sodium inadequately balanced by soluble calcium and magnesium in in all but samples 2A and 4B. This imbalance can significantly affect soil structure quality, and decrease the rate at which water infiltrates this soil.

The texture of the soil ranges from loam in samples 1A, 5A and 5B, to silt loam in sample 1B, loamy sand in samples 2A and 4B, and sandy loam in 3A and 3B according to the USDA Soil Classification system. Organic matter content is ranges from low at 1.0% dry weight in sample 4B to moderate at 4.3% dry weight in sample 1A.

In terms of soil fertility, nitrogen is low in all nine samples and phosphorus is low or fair. All of the other nutrients are sufficient for native plant nutrition. A slow-release nitrogen fertilizer is recommended along with a composted greenwaste amendment.

Comments

Concern was expressed as to whether it is worth salvaging the upper A layers of soil or if the B layer would suffice for growing marsh and riparian plants. The main issues with this soil are the elevated sodium and boron content and to a lesser degree total salts. The soil in samples 1B, 3A, 3B, 5A and 5B is considered “Saline-Sodic” due to the elevated salts and sodium. The soil in samples 1B, 3A and 3B should only be used for installation of plants that are known to tolerate saline-sodic soils. Based on the provided plant list these would include the known halophytes Frankenia, Distichlis, Salicornia and Jaumea.

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WRA Environmental
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It is recommended to avoid using the soil from sample areas 5A and 5B if at all possible, due to the **extremely elevated** salinity, sodium and boron and SAR unless some documentation can be found indicating that any of the chosen plants would be able to survive these conditions.

If it is possible to apply gypsum and perform leaching irrigations, it may be feasible to use the soil in samples 1A, 4A and 4B for some of the less salt-tolerant plantings. Samples 1A and 4A have over 50% silt plus clay present so it may be difficult to leach these areas sufficiently. Sample 4B would be suitable for moderately salt-tolerant plants such as the Baccharis and Populus. If it is desired to improve these areas gypsum recommendations are provided below. If these areas are inundated with the fresher water as noted in the initial email that may also be helpful depending on the amount of fresher water coming in. If this is not the case and it is possible to do any leaching in these areas, that would be beneficial.

Sample 2A has no significant chemistry or texture issues and it is highly recommend that you salvage the soil in this area for planting use. This would be suitable for plants with limited salt tolerance data such as the Salix.

To Prepare for Mass Planting:
Drainage of the root zone should be improved by first loosening the top 10 inches of any undisturbed or compacted soil. The following materials should then be evenly spread and thoroughly blended with the top 6 inches of soil to form a homogenous layer:

Material	Amount / 1000 Square Feet	Area
Composted Greenwaste	2-3 cubic yards	1A, 2A, 4A, 4B
Sulfur-coated Urea (43-0-0)	4 pounds	1A, 2A, 4A, 4B
Gypsum	50 pounds	1A
Gypsum	20 pounds	4A

*The rate may change based on the analysis of the chosen organic amendment. This rate is based on 270 bs. of dry weight of organic matter per cubic yard of amendment.

To Prepare Backfill For Trees and Shrubs:
- Excavate planting pits at least twice as wide as the diameter of the rootball.
- Soil immediately below the root ball should be left undisturbed to provide support but the sides and the bottom around the side should be cultivated to improve porosity and dusted with gypsum in 1A and 4A.
- The top of the rootball should be at or slightly above final grade.
- The top 12 inches of backfill around the sides of the rootball of trees and shrubs may consist of the above amended soil or may be prepared as follows:

4-5 parts	Site Soil
1 part	Composted Greenwaste*

Uniformly blended with:

Material	Amount / Cubic Yard	Area
Sulfur-coated Urea (43-0-0)	1/4 pound	1A, 2A, 4A, 4B
Gypsum	2 1/2 pounds	1A
Gypsum	1 pound	4A

Backfill below 12 inches required for 24 inch box or larger material should not contain the urea or composted greenwaste but should still contain the gypsum at the recommended rates.

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You may consider additional sampling in the existing riparian and marsh areas to determine more specifically exactly what conditions the existing plants are thriving in for comparison purposes. That may be more efficient than attempting to significantly amend or leach such a diverse variety of soils.

If we can be of any further assistance, please feel free to contact us.

Annmarie Lucchesi
Emailed 5 Pages: stromberg@wra-ca.com

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Project : Santa Clara River Estuary
Ventura/Oxnard
Job# 18106-2
PO# 18106-2-T2.3

COMPREHENSIVE SOIL ANALYSIS

Report No : **15-113-0001**
Purchase Order : 18106-2-T2.3
Date Recd : 04/23/2015
Date Printed : 04/28/2015

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
1A 4-10"	29	6.7	8.0	7	8	13	473	1914	603	4.4	3.7	12	235	4.3	24298
	155	None		0.3		0.4	2.3	0.8	1.8	2.2	0.5	0.7	3.1		
1B 14-18"	25	7.9	8.4	2	3	7	366	981	463	3.2	1.2	16	118	1.6	24299
	91	None		0.1		0.3	2.3	0.6	2.2	2.7	0.3	1.6	2.6		
2A 4-10"	17	7.5	1.1	2	2	12	143	733	162	1.6	1.5	5	26	1.5	24300
	55	None		0.1		0.6	1.3	0.8	1.3	2.2	0.6	0.7	1.0		
3A 4-10"	21	7.9	15.8	1	4	9	302	663	394	3.1	2.6	32	169	2.5	24301
	66	None		0.1		0.4	2.3	0.6	2.6	3.7	0.8	4.5	5.3		
3B 14-18"	16	7.8	11.6	1	1	6	204	575	259	2.4	1.2	29	83	1.4	24302
	44	Low		0.1		0.3	2.2	0.8	2.5	4.3	0.6	5.9	3.9		
4A 4-10"	24	7.3	6.3	3	5	11	511	1613	325	3.4	3.9	7	83	4.2	24303
	111	None		0.2		0.4	3.1	0.9	1.3	2.4	0.7	0.6	1.5		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
28.7	19.0	51.2	1.9	1.87	53.6	10.5	0.1	0.2	0.4	7.0	33	37.8	21.7	Loam	24298
21.6	19.4	63.0	1.5	1.19	62.9	13.9	0.1	0	0.2	2.0	32.2	53.8	11.7	Silt Loam	24299
3.1	2.1	7.0	0.4	0.30	5.4	4.3	0.3	0.4	3.5	41.5	42.1	5.0	7.8	Loamy Sand	24300
28.1	32.2	150.0	2.6	2.48	94.9	27.3	0.6	3.3	4.3	11.2	46.6	25.0	12.8	Sandy Loam	24301
31.3	24.8	68.7	1.8	1.59	74.3	13.0	0.6	1.8	3.1	12.6	58.4	19.0	6.8	Sandy Loam	24302
29.0	13.9	36.2	2.6	0.44	49.5	7.8	0	0.4	1.2	1.6	35.6	51.8	9.7	Silt Loam	24303

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Igni ion.

* LOW , SUFFICIENT , HIGH

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Project : Santa Clara River Estuary
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Job# 18106-2
PO# 18106-2-T2.3

COMPREHENSIVE SOIL ANALYSIS

Report No : **15-113-0001**
Purchase Order : 18106-2-T2.3
Date Recd : 04/23/2015
Date Printed : 04/28/2015

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
4B 14-18"	15	7.3	4.6	1	1	5	147	778	154	1.8	1.1	4	23	1.0	24304
	48	Low		0.1		0.3	1.6	1.0	1.4	2.9	0.5	0.8	1.0		
5A 4-10"	25	7.6	32.6	10	5	15	382	955	659	4.3	3.7	10	132	2.7	24305
	97	Low		0.3		0.5	2.3	0.6	3.0	3.4	0.8	0.9	2.8		
5B 14-18"	20	8.2	30.4	4	2	6	266	684	497	2.2	1.3	6	39	1.3	24306
	75	None		0.2		0.3	2.1	0.5	2.9	2.3	0.3	0.7	1.1		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
25.8	11.6	22.2	0.8	0.48	42.2	5.1	0.8	3.2	2.4	5.8	72.9	13.0	5.8	Loamy Sand	24304
38.9	70.1	346.0	3.0	9.66	152.0	46.9	0.5	0.7	1.0	3.2	36.2	39.8	19.7	Loam	24305
32.7	63.9	345.0	1.9	9.84	186.0	49.6	0	0	0	1.0	39.4	49.8	9.7	Loam	24306

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Igni ion.

* LOW , SUFFICIENT , HIGH

APPENDIX H – CULTURAL, ARCHAEOLOGICAL, AND PALEONTOLOGICAL RESOURCES STUDY

Cultural, Archaeological, and Paleontological Resources at McGrath State Beach

by Chester King

June 25, 2015

Prepared by Topanga Anthropological Consultants
PO Box 826, Topanga CA 90290
Telephone (310) 455-2981

Prepared for Wishtoyo Foundation and
Wishtoyo Foundation's Ventura Coastkeeper Program
3875-A Telegraph Road, #423
Ventura, California 93003

Project located on Oxnard USGS Quadrangle
Key words: archaeological, geoarchaeology, canine forensics, soil auger.

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Cultural, Archaeological, and Paleontological Resources at McGrath State Beach

by Chester King

MANAGEMENT SUMMARY- ABSTRACT

This study is part of a Santa Clara River Estuary Habitat Restoration & Enhancement Feasibility Study. The study was conducted to inventory archaeological resources and identify areas of sensitivity in the areas of an existing and proposed campground. Study of maps, air photographs, and geological knowledge indicate the present ground surface includes historic stream deposits and areas of disturbed sand deposits. Surface observations have not detected evidence of archaeological sites.

Excavation of auger holes revealed the presence of buried soils that may contain archaeological deposits. The Chumash occupants of the closest village east of the beach obtained fish from the beach and the wetlands also provided plant and animals used as food. Buried archaeological campsite deposits have been identified in similar coastal areas. Monitoring is recommended to identify archaeological sites if undisturbed soils over 160 years old are disturbed.

The Institute for Canine Forensics (ICF) conducted walkovers with dogs trained to smell human remains to locate possible human burials. No evidence of human burials was found

Plants and animals significant to Chumash society are present and it is recommended they be protected or transplanted to assure their propagation.

Existing information indicates soil deposits in the project area are less than 6000 years old and paleontological fossils are not expected. Sea mammal remains may be encountered in the area of the existing campground.

Photographs, notes and records associated with this study are on file at Topanga Anthropological Consultants and Wishtoyo Foundation.

UNDERTAKING INFORMATION/ INTRODUCTION

This study was conducted to inventory cultural, archaeological, and paleontological resources that might be impacted by earth moving activities associated with associated with the estuary restoration and campground relocation project at McGrath State Beach at McGrath State Beach. The study was conducted to provide guidance concerning preservation of cultural sites. Areas studied included an existing campground and an area to its south that might be the site of a new campground. These areas are referred to as the project area. This report was prepared under a subcontract between Wishtoyo Foundation and Topanga Anthropological Consultants (Project Number: Wishtoyo_SCRE_001). It was produced to satisfy an agreement between Wishtoyo Foundation and the California Department of Fish and Wildlife as part of Fisheries Restoration Grant Program Agreement P1350015.

On December 17, 2015 Chester King of Topanga Anthropological Consultants ordered a record search for the project area from the South Central Coastal Archaeological Information Center. The record search was completed on January 6, 2015.

Fieldwork was conducted on February 19 and 20, 2015. The fieldwork included a search by the Institute for Canine Forensics for possible burials, a survey of exposed soil surfaces, and study of soil sampled with a hand auger.

The property studied is owned and managed by the California Department of Parks and Recreation. Figure 1 indicates the location of the project.

SETTING

McGrath State Beach is located on the coast between the cities of Ventura and Oxnard in Ventura County. It is bounded on the north by the Santa Clara River, on the east by Harbor Boulevard, on the south by the Southern California Edison Mandalay Generating Plant, and on the west by the Pacific Ocean.

Background concerning cultural resources including plant and animal foods used by Native people in the area is given in King and Parsons (2011).

NATURAL

The project area is located south of the mouth of the Santa Clara River and includes wetlands, sand dunes and river terrace deposits. Figures 1-2 indicate the project location. The project area is located on the western edge of the Oxnard Plain. The plain was created by sediments deposited by the Santa Clara River. At different times, the river flowed in different channels and discharged at Mugu, Ormond Beach, and Hueneme. The present channel is the furthest north. Appendix 2 by Parsons provides additional background concerning geology.

The State Beach attracts more than 200 species of birds including white-tailed kites, marsh and red-tailed hawks, owls, and herons. The project area also provides habitat for weasels. muskrats, skunks, jackrabbits, opossum, squirrels, mice, tortoises, and gopher snakes.

The State Beach contains many plants native to the wetlands and sand dunes. There are several different types of vegetation and habitat. The project area includes relatively distinct differences in vegetation cover indicated in Figure 2. The existing campground contains roadways,

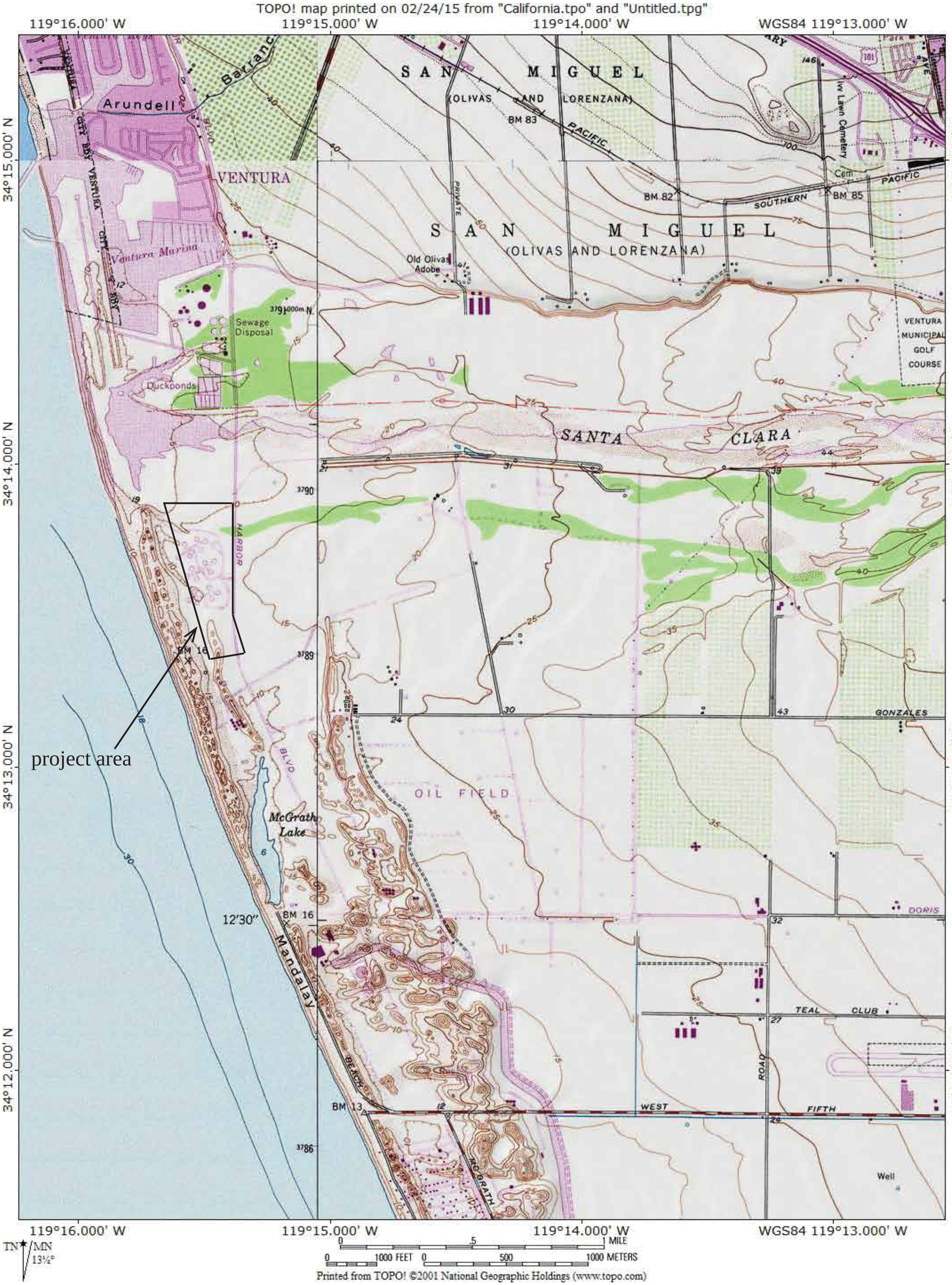

Figure 1: Location of project on USGS 7.5' Quadrangle

Figure 2. Project area map used by Canine Forensics team. Search area C1 lies between the leeward side of the dunes separating it from areas C3 and C3 and Harbor Boulevard. Area C1 is heavily wooded. Search areas C2 and C3 are between the sand dunes along the coast and the second band of dunes and are covered with iceplant and other low growing vegetation. The cultural resource, archaeological and paleontological surface survey covered the same areas.

Figure 3. Wooded area west of Harbor Boulevard and east of sand dunes.

Figure 5. Sandy terrace at auger boring site.

Figure 4. Wooded area west of Harbor Boulevard and east of sand dunes.

Figure 6. View south of western part of proposed campground.

Figure 7. View southeast of western part of proposed campground from dune next to coast.

lawns, and planted non-native trees as well as native plants associated with salt marshes.

The area of the proposed campground is inland from the sand dunes adjacent to the beach and is separated by a row of sand dunes. The area between these dunes and Harbor Boulevard is heavily wooded with *Myoporum laetum* and willow trees and poison oak vines (Figures 3 and 4). Trails and the remains of camps have created areas of open ground in this area. The dunes to the west (Figure 5) and the area west of the dunes (Figures 6 and 7) contain mostly low growing vegetation. In both areas, vegetation covered much of the ground surface.

CULTURAL

Native American archaeological sites are present on the Oxmard Plain. Chumash lived at several sites on the Oxnard Plain at the time they were recruited into San Buenaventura Mission.

HISTORIC NATIVE SETTLEMENTS ON AND ADJACENT TO THE OXNARD PLAIN

Table 1 and Figure 8 on the following pages provide information concerning the recruitment and location of settlements in the vicinity of the Oxnard Plain at the time of the Spanish conquest.

KASUNALMU

Kasunalmu is the closest settlement to McGrath State Beach that was recorded in the registers of San Buenaventura Mission. It was the second settlement identified with the Santa Clara River at San Buenaventura Mission. Alexander Taylor in the *California Farmer* noted: The rancherias near the mission of San Buenaventura were ... Casunalmo, at Rafael Gonzalez' rancho. Fernando Librado told John Harrington, a linguist and ethnologist who collected placename information from Chumash consultants in the early part of the 20th century,: kasunalmu is the name of the rancho de Juan Gonzales (center of Oxnard district) less than a mile west [north] of Oxnard, on west side of the Savier's road [Oxnard Blvd.] leading from El Rio to Oxnard. Simplicio Pico also told Harrington it was Gonzalez's place.

At Ventura, baptisms V1b 193, 397 and 525 identify Casunalmu with Santa Clara [In references to books of San Buenaventura mission, abbreviations are V= San Buenaventura Mission, following 1 or 2 = 1st and 2nd books, b=baptism and the number is the number of the entry].

A 1912 map of the Rio School District indicates that J. Gonzales owned two parcels on both sides of Gonzales Road approximately 1/4 mile west of Oxnard Boulevard (Alexander 1912: 31). The land owned by Gonzales is on the crest of an area of high ground that is over 75 feet above sea level and is the highest landform in the area.

Kasunalmu means 'sending place', in Ventureño Chumash (Applegate 1975:33).

Most recorded kinship ties with Kasunalmu are with Sisolop and Cayeguas. V1b 232 was mother of V1b 172, the father was V1b 155 of Somes who died before his child was born. V1b 427 was son of V1b 850 of Sisolop and V1b 1378 of Sisolop. V1b 428 was also a daughter of V1b 1378 of Sisolop. V1b 485 was daughter of V2b 90 and V2b 79 both of Cayeguas. V1b 528 had a father from Mugu and a mother of Casunalmu. V1b 528 was son of V1b 1796 of Sisolop and V1b 1738 of Cayeguas.

This was probably the Santa Clara River village described by Font on February 23, 1776 when following present Route 101 from Thousand Oaks to Ventura.

> The camp is somewhat lacking in firewood and the river is very miry and bad when it rises, but it was now low. Near it there was a fairly large village whose Indians had fish, because it is near the sea; and on the river there were many geese, ducks, cranes, and other fowl. We saw in the plain a large drove of antelopes which, as soon as they saw us, fled like the wind, looking like a cloud skimming along the earth [Bolton 1931:247].

The fish may have been taken from the shores off of McGrath State Beach. The village was approximately 4 miles to the east and it is probable that people from the village camped at the beach in the vicinity of McGrath State Beach while fishing and gathering plant resources.

KANAPUTEQNON

There were two settlements identified with the Santa Clara River at San Buenaventura Mission. Kanapueteqnon was the first recruited and was closest to the Mission. John Harrington did not find consultants who knew the location of Kanapueteqnon. He noted that José Juan Olivas approved the reconstructed word kanaputeĸnon but did not know the place. Baptism number 27 says the rancheria of Queneputcon was about two leagues from the Mission. Fifteen people were baptized from the settlement between 1783 and 1785. Kanapueteqnon was the only settlement completely recruited into the Mission before 1788. Several entries identify the settlement with the Santa Clara River. A baptism of a native of Rincon, located at the northwest corner of Ventura County, reads:

> At the rancheria of Santa Clara located along the river called by this name at the place called Canaputegnon, I baptized a child. Her father is Alsacucaguit [V1b 1385 of Sisolop] and her mother, Alsayiguia daughter of Puliayta of Sucu ò San Matheo [Rincon Creek], is a sister of Susui capitan of said rancheria.

Year	1782	1783	1784	1785	1786	1787	1788	1789	1790	1791	1792	1793	1794	1795	1796	1797	1798	1799	1800	1801	1802	1803	1804	1805	1806	1807	1808	1809	1810	1811	1812	1813	1814	1818	1824	Total
Canapuetegon		10	2	3																																15
Alcui			1	4	2	3	2																													12
Cachantac						1		1																												2
Casunalmu				1	3	1	2	3	3				2																							15
Sisolop		10	23	14	13	33	24	11	4	13	6	10	7	24	19	5	4	3	5	22	19	23	1	1												294
Lalimanuc				1	2	1	6	3	5	7	1			2																						28
Somes		1	3	12	6	23	14	15	9	9	7	3	3	11	59	2	1	1		4	16	2	9				1									211
Matilija						13	12	5	1	4	3	4	2	7	113	2	4		1	17	13	5	4	5	5	3	2		7			2				234
Sisulcuy							1					2			1	1		1		2	3					1	3									15
Aujai						2	2						2	1	1	1	1		1	11	9	1	2	4	2	13	6									59
Mupu							1	2	2	6	1	3	4	2	1	1			1	7	22	1	1	6	1	18	19								1	100
Quimishag																						9			1		1		1					1		13
Sisa						1	1		1	3		1		2			1			7	19	1	1	7	2	10	13	1	2							73
Calleguas												2	2	2	1		1			7	11	22	13	5	9	5	7	18	15		1			1		122
Mugu				1			2	1	1	5	5	2	4	3	3		4		2	2	20	25	10	5	16	47	20	4	4				1			187
Sapue							1	4		2		2					1		1	2	5	9	1	2	20	1	2	6	3							62
Sumuahuahua																						2	3	1	42			4								52
Lisichi						1	2	2	2		1	1					1					9	1		2	7	8	9	10							56
Alalehue	1							1													2	1		2	1	1	11									20
Secpe										1										2	6		1		1	3	35	3				2				54

Table 1: Recruitment by Ventura Mission from Chumash Villages in the Vicinity of the Oxnard Plain. The villages are listed in the sequence of recruitment of over 50% from the settlement at the mission. The settlements closest to the mission are at the begining of the list [except Sisolop which was closest but was recruited from over an extended period of time] and those most distant at the end of the list. Most setlements were recruited by 1810 and later baptisms are of people married into more distant settlements and people who have lived at the mission as catacumenos for several years before converting.

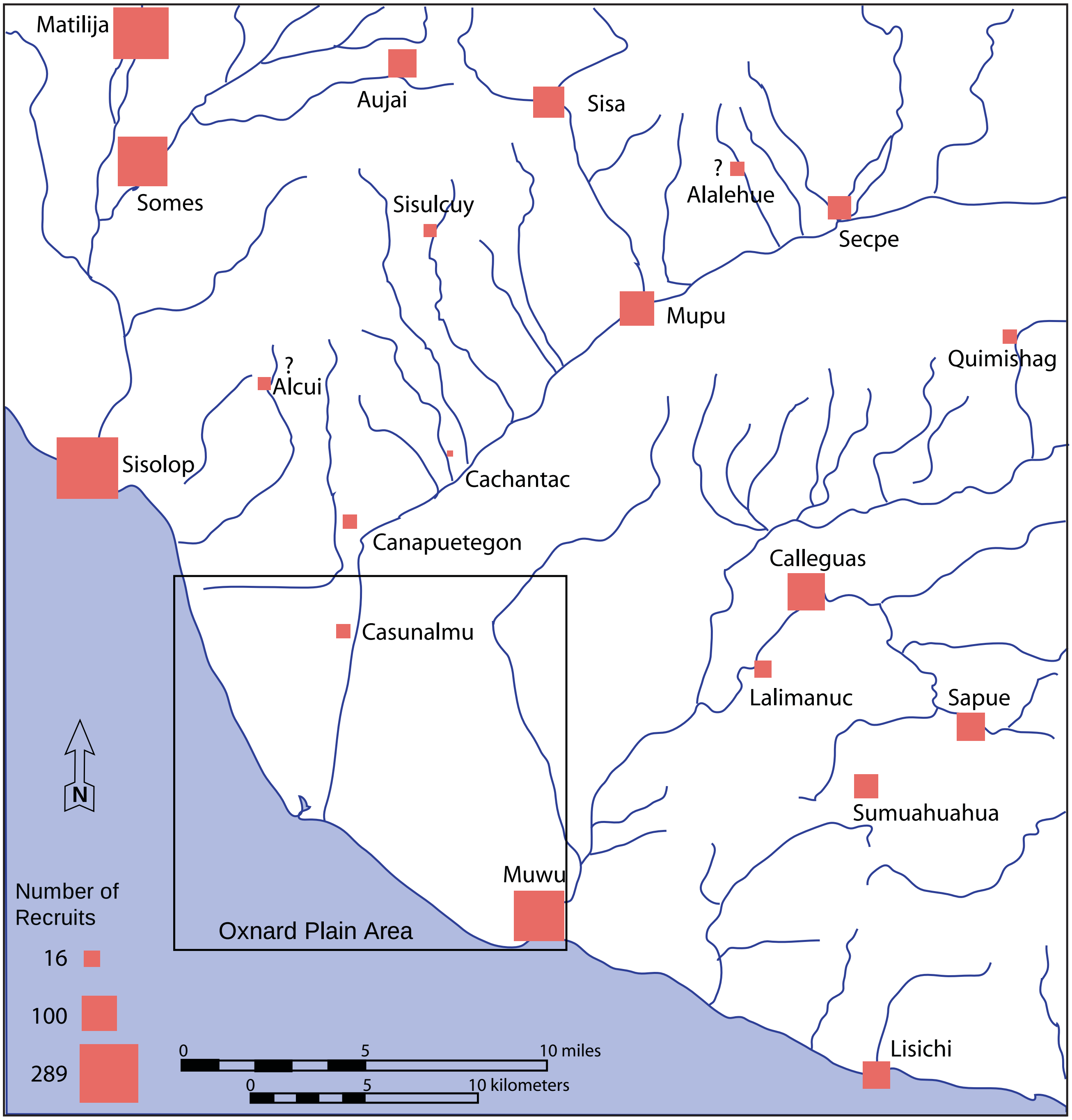

Figure 8: Chumash Villages Recruited at Ventura Mission from the Vicinity of the Oxnard Plain. This map only indicates settlements at time of recruitment. Many other sites were occupied both after secularization and before the mission was founded.

Most recorded kinship ties were with the town of Sisolop at Ventura. V1b 142 of Kanapueteqnon was the mother of V1b 137 of Sisolop and sister of V1b 31 of Kanapueteqnon who was the wife of V1b 35 of Sisolop. V1b 22 of Kanapueteqnon was a daughter of Vb 889 of Sisolop. V1b 64 of Kanapueteqnon was husband of V1b 65 of Sisolop

This site was probably near Montalvo where Some historical accounts suggest the river flowed towards Hueneme as recently as around and before 1800 (San Francisco Estuary Institute 2011). This would have been the closest place to Ventura and is consistent with the early recruitment of the settlement. Montalvo is approximately six miles from the Mission. A location near Montalvo is consistent with the reading of two leagues in the San Buenaventura registers. In the 1930s, Richard Van Valkenburgh recorded archaeological sites in the Montalvo area.

OTHER SMALL SETTLEMENTS

Alcui was also a small settlement with very strong ties to Sisolop. In one case the margin entry of a baptism reads Alcui but the text reads Sisolop (V1b 81).

Sisulcui was another small settlement. It had close ties to the settlement of Somes.

Lalimanuc was a small settlement with very strong ties to Calleguas. It appears that some small settlements with strong ties to large nearby settlements were recorded as separate settlements in the early records of Ventura Mission.

Over time, recruitment was from longer distances and larger areas. When they began recruiting from more distant settlements, it appears missionaries stopped recording small settlements with strong ties to larger settlements as separate settlements and grouped them together with the larger settlements. More detailed recording of geographic detail close to missions is found in the books of many California missions. Muwu is a good example of a regional name being used to include recruits from different settlements.

RESEARCH DESIGN

The survey and records search was conducted for management purposes. The goal of fieldwork was to identify archaeological sites or areas that might contain sites or other cultural resources that might be disturbed by the project so they could be avoided.

METHODS

RECORD SEARCH

The South Central Coastal Archaeological Information Center at Fullerton maintains records of archaeological studies and records for recorded sites in Ventura County. The Information Center staff conducted a record search and provided copies of documents prepared for environmental studies and other studies that are inventoried on maps at the center. The search area included the project area and the area within a mile of the park. The records search the indicated no recorded sites are present in the search area. The inventoried studies provide information concerning the scope and results of archaeological studies in the area. The report of the record search and list of documents concerning studies within a mile of the project area is included as Appendix 1.

CANINE FORENSICS

The Institute for Canine Forensics (ICF) conducted walkovers with dogs trained to smell human remains to locate possible human burials. Their procedures are described in Appendix 3.

WALKING SURVEY

Areas where patches of soil were visible were searched for evidence of Chumash cultural resources, archeological sites, and paleontological resources. Chester King and Sergio Valuenzuela walked the project area on February 19, 2015. Areas with visible surfaces were visited and King continued to make surface observations on February 20.

GEOARCHAEOLOGY AND SOIL AUGERING

Soil auger borings were excavated to discover the depths and composition of soil deposits. On February 20, 2015, Chester King excavated auger holes and Jeff Parsons took notes concerning soils encountered. Sergio Valuenzuela and Mati Waya observed. Parson’s report is included as Appendix 2.

Jeff A. Parsons, is an earth scientist specializing in archaeology in California for over 30 years. He has expertise in coastal, sand dune, and alluvial settings. He has previously conducted a study related to the history of the Oxnard plain, in the vicinity of Ormond Beach. He conducted research to reconstruct the history of landforms in the project area through study of topographic maps, soil maps, aerial photographs, historical maps, offshore maps and geologic information. His procedures are described in Appendix 2.

REPORT OF FINDINGS

RECORD SEARCH

The record search identified one archaeological survey that covered the entire McGrath State Beach. It was conducted in 1985. This study also included an study of the plants at McGrath State Beach that were used by the Chumash.

On the 1985 survey,:

> Three individuals, spaced 15 to 20 m apart, walked approximately 75 percent of the unit. The marshy area along the southern bank of the Santa Clara River was not surveyed. Neither was the northeastern corner of the unit. This area is heavily overgrown with willow (*Salix* sp.), poison oak (*Toxicodendron divirsiloba*), and other shrubs and grasses. All of the foot trails in this riparian environment were examined on foot.
>
> Except for the marshy area around McGrath Lake, the ground visibility was good. It was impossible to see the ground through the thick growth of tules and grasses near the lake. However, it is doubtful that there are any cultural remains near the lake [Hines 1986:9].

The 1985 survey concluded:

> There is no evidence to indicate that the unit was occupied by Native Americans. The location of the unit within the flood plain of the Santa Clara River probably explains the lack of prehistoric sites. However, there are a number of plants found within the unit that were known to have been used by the Chumash (Appendix A). In all likelihood the inhabitants from nearby villages probably used the plant resources found at or near the mouth of the Santa Clara River [Hines 1986:9].

The 1985 survey located an historic oil test shaft site:

> The remains of an oil test shaft (Mobile Oil Corp., McGrath No. 1) drilled as part of the West Montalvo Oil and Gas field was found on the east side of the sand dunes, approximately 200 m southeast of the lagoon at the mouth of the Santa Clara River. The well was drilled to a depth of 7625 feet, but abandoned in 1935 when no oil was found. Information on the well is found in file API No. 111-00746, California Department of Conservation, Division of Oil and Gas, Ojai, California (personal communication, Bill Winkler, 1986). The remains consisted of a square concrete slab that measured approximately 20 ft on a side [Hines 1986:8].

The survey of plants used by the Chumash identified two plants that were important to the Chumash that are no longer frequently found because of habitat destruction and invasive competitors.

> The existence of a now-rare stand of *Juncus acutus* should be specifically protected with judicious collecting permitted to contemporary Chumash people and others interested in the study of traditional basketry. Further suggestions made by Jan Timbrook include: (1) preservation of a "spectacular stand of yerba mansa, *Ameopsis Californica,*' and, (2) development of a nature trail oriented to Chumash ethno-botany to heighten visitor appreciation of how the area looked to prehistoric peoples [Hines 1986:10].

Other studies that involved survey of areas within the State Beach boundaries. A survey was conducted by Steve Horne of an oil pipeline corridor along Harbor Boulevard. Survey transects were walked on both sides of the highway (Horne 1980: 3.0-30 VN 236). A proposed dredging disposal site west of the existing campground was surveyed by Bradley Sturm in 1985 (VN 1733). In 2008, a survey was conducted by James Schmidt of Compass

Figure 9. Sergio Valuenzuela, Mati Waiya, and Jeff Parsons at site of auger boring.

Rose for an emergency road grading project associated with power poles in the northern part of the project area (VN 2754). In 2012 a survey for repair of the force sewer main in parts of the existing campground was conducted by Brendon Greenaway of State Parks (VN 3138). No archaeological sites were identified during the studies.

Studies adjacent to the State Beach include surveys of the fields east of Harbor Boulevard. A survey of the field on the east side of Harbor Boulevard was conducted by Joe Simon of W&S. He walked transects 20 meters apart (VN 2011). An earlier survey by RMW Paleo Associates also used transects 20 meters apart and covered the southern part of the same area (VN 989). No archaeological sites were identified during the studies.

FIELD STUDIES

On February 19, 2015, Chester King and Sergio Valuenzuela walked the project area and inspected areas of visible ground surface. No evidence of archaeological sites was observed.

On February 20, 2015, Chester King excavated auger holes and Jeff Parsons took notes concerning soils that were encountered. Sergio Valuenzuela and Mati Waiya assisted and observed. No evidence of archaeological sites was observed. Parsons has analyzed the soils data and integrated it with information from historic air photos, maps, and information concerning the recent geology of the area. Parsons' study is attached as Appendix 2. The analysis enables identification of areas with buried surfaces (a surface once forming the ground surface but now buried beneath more recent sediments) where any potential cultural resources, created or deposited during the time period when the buried surface formed the ground surface, would not be evident to a surface survey. If the area is expected to have been being used intensely during the time the surface was the ground, and cultural remains being deposited, then the buried surface have a significant sensitivity for cultural remains. On the other hand, if this is a little utilized area, then there is low sensitivity.

On February 19 and 20, 2015, the Canine Forensics team conducted a survey of the project area There were four dogs and human companions. Both the existing and proposed campground areas were searched. The study is attached as Appendix 3. Maps of areas surveyed can be found in Appendix 3 pages 5 and 18. The team concluded:

> Using trained dogs that specialize in the location of old burials adds a unique layer of detection that can be used, combined with other techniques, to determine if burials are present. Our dogs did not detect any human remains at this location. There is always the possibility that burials could be in locations the dogs did not have access to or had gotten too deep in shifting sands for detection (Appendix 3:6).

Areas the dogs could not access included areas of thick vegetation, pavement, and existing structures.

DISCUSSION/ INTERPRETATION

POTENTIAL FOR ARCHAEOLOGICAL SITES

The site of Kasunalmu and other archaeological sites on the Oxnard plain are apparently located on old natural levees of the Santa Clara River and were adjacent to the river or sloughs associated with the river.

South of the project area was the place of Wene'mu ('resting place' Hueneme). Wene'mu was apparently a settlement in 1542 when the Cabrillo expedition visited the area. The extant record of the Cabrillo voyage records the place of Quelqueme (probably a misreading of Guelgueme = English Welweme). It is listed second in a list that begins with Mugu and continues listing settlements extending west in sequence past Santa Barbara. Recent archaeological finds indicate a permanent settlement was at Hueneme at the time of Cabrillo's visit. It is possible that the Santa Clara River flowed through the Hueneme area in 1542 and was a source of fresh water.

The people of Kasunalmu and/or Wene'mu used plant and animal resources present in the project area and probably fished from the adjacent beach and may have fished and hunted at the lagoon or lakes in the area. The area is a significant distance from these known settlements. If activities in the area lasted more than a day, overnight campsites were probably used to avoid spending excessive amounts of time (2-3 hours per day) and energy traveling.

Natural landforms of the project area consist of sandy coastal sedimentary deposits and alluvial floodplain deposits less than 6,000 years old, and are contemporary with the development of Chumash society. Parsons identifies two paralic terraces in the project area, the Seacliff and the McGrath terraces (Appendix 2). Cultural deposits may be present at locations on the terraces that were suitable for use as Chumash campsites. Both terraces contain sediments with buried surfaces (a surface, formerly the ground surface, now buried in the subsurface by more recent sedimentary deposits). Prehistoric cultural sites and resources potentially associated with these buried surfaces can't be identified by observation of the modern ground surface and are best observed in the walls of trenches or archaeological excavations.

Eastern portions of the project area are located on the Seacliff Terrace. A widespread buried surface at 4 feet depth (about 9 feet elevation) occurs in this terrace. Its age is uncertain but likely in the range of 2,000-5,000 years old. Upper portions of the Seacliff Terrace consist of more recent river quietwater floodplain deposits (after a large flood recedes, the terrace is covered by a layer of silty clay mud; over time and subsequent floods the terrace surface aggrades vertically). The buried surface also occurs beneath twentieth century alluvium in the area of the existing campground. There the buried surface may be scoured by high energy scour channels and filled during nineteenth and twentieth century floods. Figure 10 indicates the presence of old scour channels in the campground area in 1855.

Western portions of the project area are located on the McGrath Terrace. Recent dunes cover much of its surface. Augers penetrated 3-4 feet thick dune sands overlying beach and backbeach marsh deposits. Coalescing dunes built most of the terrace and, over time, raised its elevation

Figure 10. Project area superimposed over 1855 Coast and Geodetic Survey Map. Note scour channels in the area of the existing campground.

to over 15 feet height. During this period, many temporary landsurfaces were created and partially buried as sand moved and accumulated. Age of these sandy deposits is uncertain, but probably over 200 years old and less than 2,000 years old. Sandy areas are of particular interest for economic seed-producing fields, and dunes provide good refuges from the coastal breezes during daytime activities of fishing, hunting and field-tending. Cultural deposits are often rapidly buried in dunes, and coastal sandy areas are among the most likely places to encounter buried cultural sites in California.

Much of the surface soil in the south part of the project area was recently disturbed. Twentieth century disturbance is most evident in areas of the former oil field in the southern portion of the study area. Oil field development, 1948-1970, included two oil wells and a pipeline. Due to potential health and safety hazard, much of this area was avoided during subsurface augering, yet two augers carefully located indicate much of the area is underlain by disturbed soils (soils excavated, transported and re-deposited by heavy construction equipment) up to 4 feet thick. The disturbance may be related to remediation activity. The pipeline went north beneath the future campground, crosses the river and joins the pipe corridor along Harbor Boulevard (presumably to Ventura area refineries). Above ground portions of these oil field facilities appear to be abandoned and removed by 1972. In general, the surface of the sandy McGrath Terrace was heavily graded to create level areas during the mid-twentieth century. In the eastern portion of the project area between the dunes and Harbor Boulevard, there is little historical disturbance outside a pipeline corridor. Grain fields were plowed in the twenties, but the area was isolated by the construction of Harbor Boulevard about 1958. Forests slowly took over the area in the last fifty years.

TYPES OF SITES FOUND IN SIMILAR SITUATIONS

South of the project at Mandalay Beach archaeological surveys recorded an archaeological site (CA-VEN-667) recognized by the presence of shell and unweathered shell fragments. Similar deposits may be present in deposits of the McGrath terrace. The site was described:

> This site is a buried deposit situated in eroded sand dunes.... Since the site is buried, the extent, nature, integrity, and information potential of the deposit cannot be adequately assessed. The observed deposit consists of distinct strata of ashy sand with charcoal and unweathered shell. No artifacts or other evidence of culture were observed. There is some question about the cultural origin of the deposit. Holman and Chavez, who originally observed the site in 1976, termed it a "'possible archaeological site' with 'midden-like' strata" (1976:7-8). We concur; the ashy deposits may be either cultural or natural in origin. Dune fires have characterized the coastal environment since the Pleistocene and leave deposits much like those observed here (Johnston 1977). However, an unconfirmed report of a burial removed from the site area ... was received from Mr. Eugene Stafford of the Board of Commissioners of Port Hueneme Historical Museum. On the basis of his report, this deposit is classified as an archaeological site [Horne 1980: 3.0-30 VN 236].

Remediation efforts at the Guadalupe Oil Field along the shoreline of the Santa Maria River Lagoon resulted in the discovery buried sites in deposits similar to those found on the McGrath terrace. Sites were often identified as thin bands of shell, bones and chipped stone artifacts in excavation sidewalls with unweathered shell being predominant and being the main indicator of presence of site deposits. The Dusty Lee Site (SL0-2594) that measured approximately five meters square, was excavated using controlled archaeological techniques. Gibson and Parsons concluded:

> A detailed analysis produced a spatial pattern of cultural materials that were likely deposited in a very short period of time even perhaps a single day around circa A.D. 1480.
>
> Results indicate the cultural site was located on a small dune contemporary with an ancient lagoon shoreline associated with the 10 feet elevation peat at the end of the 15th century or beginning of the 16th century. Shell and fish remains at Feature 1 are located in a thin coarse sand layer representing sand ripples filling a trough-like flute eroded into the dune. These landscapes changed during the 16th century, probably in response to world climate change, and the ancient shoreline became emergent and covered by new dunes during the 16th-17th centuries, before renewed stability allowed soil (the pre-1950 soil) to form during the 17th-18th centuries. Archaeological deposits at SL0-2594 lack formation of anthropic soils, or midden; suggesting the heap of shell and fish remains are an isolated feature not associated with a village or camp deposit [Gibson and Parsons 2010:3].

It is anticipated that sites in the area of the McGrath terrace may be less than 20 feet (6 meters) in diameter and probably are only thin zones with shells that can be best observed by vigilant observers.

NATURAL RESOURCES IMPORTANT TO TRADITIONAL CHUMASH CULTURE

Natural resources important to the Chumash include plants and animals used as food, construction materials, or medicine. The 1985 study of the State Beach identified *Juncus acutus* which was used for the construction of baskets and *Ameopsis Californica* used as a medicinal herb as important plants whose range has greatly decreased as a result of loss of habitat and competition with non-native plants (Hines 1986:10).

MANAGEMENT CONSIDERATIONS

The 1986 State Parks report concluded:

> Since there is no evidence of cultural remains other than the concrete base of the 1935 exploratory shaft, there should be no adverse cultural ipact to development of the campground. Considering the position of the park on the flood plain at the mouth of the Santa Clara River. It seems posstble that early occupation sites may have been covered with silt and yet be intact. Should any evidence of early occupation be found during digging, the Cultural Resources Division should be contacted [Hines 1986:10].

This study has focused on identifying soils most likely to contain intact buried sites. Soils disturbed or deposited since 1850 are not expected to contain significant unidentified sites. Disturbance of these most recent soils should not require monitoring. Older soils and dunes may contain buried site deposits. If these older (in most cases buried) soils will be disturbed by project construction, monitoring by an archaeologist with training and experience that demonstrates ability to identify buried small archaeological deposits is recommended.

The project alternatives both involve excavation of soil from the area of the existing campground and placement of the excavated soil in the area of the proposed campground. The alternatives differ in the amounts of soil moved. Nineteenth and twentieth century river floodplain deposits are about four feet thick and overly the Seacliff Terrace in much of the existing campground. Early aerial photographs indicate this area was covered by high energy floodplain deposits during large floods and is characterized by scour channels and sediment deposition during waning periods of the flood. Mechanical excavations greater than 3 feet deep in the existing campground area may disturb terrace soils. Grading plans should be evaluated to determine the potential to of excavations in the campground to disturb intact soils of the Seacliff and the McGrath terraces.

Placement of fill and development of a new campground has potential to disturb old soils if extensive grading is conducted to prepare the area for fill or if trenches are excavated into buried soils for sewer and other utilities. Presumably a greater amount of fill will reduce the depth of penetration of trenches into old intact soils.

It is recommended that final development plans be reviewed by an archaeologist with experience identifying impacts of development projects to identify places where intact soils greater than 165 years old might be disturbed and monitoring should be required. Excavation of additional auger holes may be necessary to identify old soil surfaces to determine the depths at which site deposits might be encountered.

Excavations in older soils should be monitored by an archaeologist or geoarchaeologist with experience identifying sites that leave relatively little evidence. If evidence of archaeological deposits is observed, excavations should stop in the vicinity of the discovery. Discovered deposits should be evaluated by archaeologists and Chumash representatives. Sites discovered should be avoided and recorded to protect them from future disturbance.

Native plants important to the Chumash that are no longer frequently found should be preserved. *Anemopsis californica* is included in the planting palette recommended for the restoration area. The restoration area will provide habitat for both *Juncus acutus* and *Anemopsis californica*.. Preservation of native plants important to the Chumash and the habitat of the plants should be a goal of the estuary restoration program.

Existing information indicates soil deposits in the project area are less than 6000 years old and paleontological fossils are not expected. Sea mammal remains may be encountered in the area of the existing campground. Discoveries should be reported to the California Department of Fish and Game to determine disposition.

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Appendix 1. Record Search

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California Historical Resources Information System
Orange, Los Angeles, and Ventura Counties

1/6/2015 Records Search File No.: 14653.

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P.O. Box 826
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Re: Santa Clara River, Ventura County

The South Central Coastal Information Center received your records search request for the project area referenced above, located on the Oxnard, CA USGS 7.5' quadrangle. The following reflects the results of the records search for the project area and a 1-mile radius:

As indicated on the data request form, the locations of reports and resources are provided in the following format: ☒ custom GIS maps ☐ shape files

Resources within project area: 0	None
Resources within 1-mile radius: 1	56-152738
Reports within project area: 5	VN236, VN1475, VN1733, VN2978, VN3138
Reports within 1-mile radius: 11	SEE ATTACHED LIST

Resource Database Printout (list): ☐ enclosed ☒ not requested ☐ nothing listed

Resource Database Printout (details): ☐ enclosed ☒ not requested ☐ nothing listed

Resource Digital Database (spreadsheet): ☐ enclosed ☒ not requested ☐ nothing listed

Report Database Printout (list): ☒ enclosed ☐ not requested ☐ nothing listed

Report Database Printout (details): ☐ enclosed ☒ not requested ☐ nothing listed

Report Digital Database (spreadsheet): ☐ enclosed ☒ not requested ☐ nothing listed

Resource Record Copies: ☒ enclosed ☐ not requested ☐ nothing listed

Report Copies: ☐ enclosed ☐ not requested ☐ nothing listed

OHP Historic Properties Directory: ☒ enclosed ☐ not requested ☐ nothing listed

Archaeological Determinations of Eligibility: ☐ enclosed ☐ not requested ☐ nothing listed

Historical Maps: ☒ enclosed ☐ not requested ☐ nothing listed

Ethnographic Information: ☒ not available at SCCIC

Historical Literature: ☒ not available at SCCIC

GLO and/or Rancho Plat Maps: ☒ not available at SCCIC

Caltrans Bridge Survey: ☒ not available at SCCIC; please go to
http://www.dot.ca.gov/hq/structur/strmaint/historic.htm

Shipwreck Inventory: ☒ not available at SCCIC; please go to
http://shipwrecks.slc.ca.gov/ShipwrecksDatabase/Shipwrecks_Database.asp

Soil Survey Maps: (see below) ☒ not available at SCCIC; please go to
http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Please forward a copy of any resulting reports from this project to the office as soon as possible. Due to the sensitive nature of archaeological site location data, we ask that you do not include resource location maps and resource location descriptions in your report if the report is for public distribution. If you have any questions regarding the results presented herein, please contact the office at the phone number listed above.

The provision of CHRIS Data via this records search response does not in any way constitute public disclosure of records otherwise exempt from disclosure under the California Public Records Act or any other law, including, but not limited to, records related to archeological site information maintained by or on behalf of, or in the possession of, the State of California, Department of Parks and Recreation, State Historic Preservation Officer, Office of Historic Preservation, or the State Historical Resources Commission.

Due to processing delays and other factors, not all of the historical resource reports and resource records that have been submitted to the Office of Historic Preservation are available via this records search. Additional information may be available through the federal, state, and local agencies that produced or paid for historical resource management work in the search area. Additionally, Native American tribes have historical resource information not in the CHRIS Inventory, and you should contact the California Native American Heritage Commission for information on local/regional tribal contacts.

Should you require any additional information for the above referenced project, reference the record search number listed above when making inquiries. Requests made after initial invoicing will result in the preparation of a separate invoice.

Thank you for using the California Historical Resources Information System,

Lindsey Noyes
Lead Staff Researcher

Enclosures:

(X) Custom Maps – 3 pdf pages

(X) Report Database Printout (list) – 2 pdf pages

(X) Resource Record Copies – (list) 4 pdf pages

(X) Report Copies – (list) 1,072 pdf pages

(X) OHP Historic Properties Directory – 1 pdf page

(X) National Register Status Codes – 1 pdf page

(X) Historical Maps – 2 pdf pages

(X) Invoice #14653.

Report List

Santa Clara River in Ventura County

Report No.	Other IDs	Year	Author(s)	Title	Affiliation	Resources
VN-00219		1979	Lopez, Robert	An Archaeological Reconnaissance of the Area Involved in the Lusk Homes General Plan Amendment, City of San Buenaventura, Ventura County, California		
VN-00236		1980	Horne, Stephen	Final Report: Onshore Cultural Resources Assessment, Union Oil Company Platform Gina and Platform Gilda Project Federal Lease Ocs P-0202 and P-0216, Offshore Southern California	Dames & Moore/Stephen Horne	56-000553, 56-000662, 56-000663, 56-000664, 56-000665, 56-000666, 56-000667, 56-001234, 56-120002, 56-120003
VN-00398		1981	Wlodarski, Robert J.	Archaeological Monitoring Report for the Proposed Location of an 8 Montalvo Pipeline, Along Harbor Boulevard, Ventura County, California	Historical, Environmental, Archaeological, Research, Team	
VN-00711		1988	MacFarlane, Heather	Technical Synthesis Report Underwater Archaeological Survey Near Ventura Harbor, California	MacFarlane Archaeological Consultants	
VN-00961		1991	Lopez, Robert	An Archaeological Reconnaissance for Cup-4656 on One Acre Within the 112.25 Acre Charles McGrath Ranch, 5011 West Gonzales Road, Oxnard, Ventura County, California.		
VN-00982		1991	Singer, Clay A. and John E. Atwood	Cultural Resources Survey and Impact Assessment for the Bristol Relief Sewer Phases Two and Three, in the City of Ventura, Ventura County, California.	C.A. Singer & Associates, Inc.	56-000031, 56-000815
VN-00989		1990	Bissell, Ronald M.	Cultural Resources Reconnaissance of Four Possible Sites for the California State University, Ventura Campus in Oxnard and Ventura, Ventura County, California	RMW Paleo Associates, Inc.	56-000665
VN-01347		1995	Wlodarski, Robert J.	A Phase 1 Archaeological Study for 1 Acre of Land (c.u.p. 4656), East of Harbor, West of Victoria, North of Gonzales, and South of the Santa Clara River, City of Oxnard, Ventura County, California	Historical, Environmental, Archaeological, Research, Team	
VN-01475		1986	Hines, Philip and Timbrook, Jan	Cultral Resource Survey for Mcgrath State Beach	State Archaeologist	
VN-01509		1985	Sturm, Bradley L.	Ventura Marina Dredging Project	Army Corps of Engineers, Los Angeles District	
VN-01733		1985		Ventura Marina Dredging Project	Army Corps of Engineers, Los Angeles District	

Report List

Santa Clara River in Ventura County

Report No.	Other IDs	Year	Author(s)	Title	Affiliation	Resources
VN-02011		2000	Unknown	Phase I Archaeological Survey for the Coastal Zone/soil Transfer Program Study Area, Coastal Berry Ranch, Ventura County, California	W&S Consultants	
VN-02754		2008	Schmidt, James J.	SCE Mandalay-San Miguel 66 kV Emergency Road Grading Project, Ventura County, California	Compass Rose Archaeological, Inc.	
VN-02974		1987	Pierson, Larry, Shiner, Gerald, and Slater, Richard	California Outer Continental Shelf, Archaeological Resource Study: Morro Bay to Mexican Border, Final Report	PS Associates	
VN-02978		2004	Sharpe, Jim and Durio, Lori	Groundwater Recovery Enhancement and Treatment (GREAT) Program, Cultural Resources Inventory Report	CH2MHill	56-000506, 56-000662, 56-000664, 56-000665, 56-000666, 56-000726, 56-000789, 56-000918, 56-100060, 56-152779, 56-152780, 56-152781, 56-152782, 56-152783, 56-152784
VN-03138		2012	Greenway, Brendon	McGrath State Beach -- Sewer Force Main and Sewer Lift Station Replacement and Wet Well Conversion	Dept of Parks and Recreation	

Appendix 2

Jeff A. Parsons
Geo-archaeology
earth science for Archaeologists since 1984

30 April 2015

GEOMORPHOLOGY STUDY ON HISTORICAL AND PREHISTORIC LANDSCAPE CHANGE AT THE MCGRATH STATE BEACH CAMPGROUND, VENTURA COUNTY

Prepared for:
Topanga Archaeological Consultants
P.O. Box 826
Topanga, CA 90290

Abstract

Historical landscape changes, Holocene age shoreline changes and potential for paleontological resources have been identified for the McGrath State Beach Campground Relocation Project through the evaluation of historical maps and aerial photographs, geomorphology, and geological review. Landforms in the study area include portions of the Santa Clara River floodplain and lagoon shoreline (vicinity of existing campground), recent dunes, the McGrath Terrace (age uncertain; 200-2,000 years-old?), and the Seacliff terrace (c.2,000-5,800 years-old). Both of the terraces are paralic terraces and found in the vicinity of the proposed new campground. The Cultural Resource Investigation Auger Program revealed the sandy nature of the McGrath terrace and the alluvial nature of the Seacliff Terrace. A widespread Buried Surface is identified at four feet depth in the Seacliff Terrace. Sandy coastal areas such as the McGrath Terrace have a strong potential for buried surfaces and cultural resources. Coastal areas are sensitive for cultural resources due to the use of coastal areas for hunting, fishing, and gathering edible seeds, as well as, the attractiveness and spirituality of shores. Extensive desirable resources are found around lagoon shores. Due to the Late Holocene age for these coastal sedimentary deposits, paleontological resources are considered non-existent.

This report discusses historical changes and includes an appendix on 1950-1970 West Montalvo Oil Field facilities in the project area. Geomorphology sections discuss McGrath Coast landform development using models for Sediment-Dominated Coast when the Santa Clara River flows towards McGrath, and Wave-Dominated Coast when the river flows towards the Hueneme/Ormond Coast. Results of the auger program revealing subsurface details are discussed; auger logs are included as an appendix.

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phone/fax: 805-237-9002

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Figures

1.0 Purpose of Study

Wishtoyo Foundation entered into Grant Agreement Number P1350015 with the California Department of Fish and Wildlife to work in partnership with the California Department of Parks and Recreation for 1• the Santa Clara River Estuary Steelhead Habitat Restoration and Enhancement Plan, and 2• the McGrath State Beach Campground Relocation. Wishtoyo Foundation subcontracted with Topanga Anthropological Consultants to perform a cultural resource Phase 1 study to ascertain the presence/absence of significant cultural resources in the project impact areas (Fig. 1). Topanga Anthropological Consultants contracted with Jeff A. Parsons, a geoarchaeologist, to conduct research, and prepare this report to reconstruct the history of landforms in the project area, evaluate the natural setting for the potential for buried cultural sites, determine the nature and extent of twentieth century disturbance, and discuss the potential for paleontological resources within the project site.

Fig. 1: McGrath Campground Project Area, the upper blue box is the project boundary for the Santa Clara River Estuary Steelhead Habitat Restoration and Enhancement Plan (existing campground area), and the lower blue box is the project boundary for the McGrath State Beach Campground Relocation (new campground area).

It is convenient in the field to refer three distinct areas:

- northern section of the project area consisting of the existing campground and northern portions of the McGrath Terrace,
- central section of the project area consisting of the northern half of the campground relocation area where most proposed development is to occur, and
- southern section of the project area consisting of areas in the former oil field that lie in the southern half of the campground relocation area.

2.0 Methods of Investigation

Landforms were reconstructed using historical maps and aerial photographs. Both the McGrath Coast and Pierpont Bay were examined for this study. Aerial photographs courtesy the University of California Santa Barbara Map and Imagery Library were studied for the following years:

1927: Flight ID# C104, Frame Nos. C15	
1929: Flight ID# C563, Frame Nos. B4, B6, B9	years since last image: 2 (1928 flood)
1945: Flight ID# C9800, Frame Nos. 3-329	years since last image: 16 (1938 flood)
1947: Flight ID# GS-EM, Frame Nos. 1-72, 7-71	years since last image: 2
1953: Flight ID# AXI-1952, Frame Nos. 4K-82	years since last image: 6 (oil field)
1959: Flight ID# AXI-1959, Frame Nos. 12W-7, 12W-8	years since last image: 6
1963: Flight ID# HA-SH, Frame Nos. 96, 98	years since last image: 4 (erosion)
1965: Flight ID# AXI-1965, Frame Nos. 2ff-28	years since last image: 2
1970: Flight ID# HB-RT, Frame Nos. 201	years since last image: 5 (1969 flood)

Additional aerial obliques and photographs available at www.Californiacoastline.org were examined for the following years:

1972	years since last image: 2 (oil activity mostly abandoned)
1979	years since last image: 7
1987	years since last image: 8
1993	years since last image: 6 (last with oil field property fence standing)
2005	years since last image: 8 (2005 flood)
2010	years since last image: 5

Aerial photograph interpretation has many limitations and as such is somewhat speculative unless ground-truthing can be accomplished. Things on aerial photographs are not always what they seem. Each aerial photograph is a time capsule of activities, but many activities can occur in intervening years between aerial photographs (2-16 years between images; average: 5.2 years) and not be evident. Within these limitations, study of historical aerial photographs is a good approach to recreating historical landscapes of the twentieth century. Historical US Coast Survey maps for 1855 and 1870 were consulted. Changes to twentieth century dunes were evaluated, the river floodplain delineated, and coastal terraces mapped. Also important in historical aerial photographs are changes in land-use in the project area, notably the construction and operation of oil wells and a buried petroleum pipeline in the early (1947-1970) development of the West Montalvo Oil Field. These facilities appear abandoned after 1970. Remediation work, if any, is uncertain at this time.

Geomorphological analysis of coastal landforms in the vicinity of the project area was also accomplished in order to reconstruct the Late Holocene geohistory of the coastline. Natural landscape features are today often obscured by twentieth century land modifications and disturbance. Genesis and evolution of paralic landforms are poorly understood. This study is limited to theoretical models unsupported by hard landform dating or study of internal sedimentary features. Geology of the coastal deposits was reviewed to evaluate the potential for paleontological resources.

3.0 Project Site Historical

Historical landscape changes affecting the region of the project site include shoreline changes, changes in the river valley from floods and reclamation, development of the West Montalvo Oil Field, construction of Harbor Boulevard and the existing campground.

Historical shorelines

Putman 1942 used US Coast and Geodetic Maps (1855: T-683 to 1933: T-4684 and -4617) to suggest the shoreline aggraded and moved seaward from 1855-1933 (78 year period). Putman 1942 measured about 300 feet change at Pierpont Bay, while, at McGrath Beach during this time, his map comparison shows a move seaward of the shoreline of about 100 feet. Construction of Port Hueneme in 1938-40 resulted in some beach accretion along Mandalay Beach from sand impounded behind the port jetties. Matilija Dam was constructed on Ventura River in 1948, capturing and storing stream sediment and leading to a loss of sediment to the shoreline (almost half of the Ventura River annual sediment output). As a result, from 1948-1959 the shoreline at Pierpont Bay retreated about 300 feet (Griggs and Savoy 1975; Griggs, Patch and Savoy 2005). Sand supplement and the construction of groins along the beach in 1962-67 helped stabilize the beach at Pierpont Bay. Additional beach erosion in 1969-1973 resulted in damage to beachfront houses along Mandalay Beach. This erosion has been attributed to either delayed erosion from the loss of Ventura River sediment, or as effects of the 1969 flood. Also in the sixties a number of coastal developments occurred, including the Channel Islands Harbor built in 1961 and the Ventura Marina built in 1963 (heavily damaged when river diverted through marina in 1969 floods, and the marina was rebuilt in 1971 with an offshore detached breakwater) (Turhollow 1975). These coastal structures helped stabilize the beach.

At McGrath Beach (Fig. 2), aerial photographs from 1927 and 1929 indicate the shore is similar to the mapped 1933 shoreline. Pierpont Bay contains a distinctive line, or curve, in early twentieth century aerial photographs (1927, 1929) in front of the first belt of dunes and dune vegetation approximating the location and shape of the mapped 1855 shoreline. This beach line can be followed downcoast beneath dunes as far as Arundell Barranca, and again at McGrath where it is buried by dunes behind the 1927-9 beach. The shoreline continues to move oceanward, being over a hundred feet wider in the 1945-47 aerial photographs. However, beach erosion associated with dam construction on the Ventura River and a dry climatic period pushed the beach at McGrath back by 1970 to its approximate position in 1929. Although the 1969 flood created a new bulging shoreline in front of the lagoon, the beach in front of McGrath doesn’t begin aggrading until the later seventies as longshore drift begins to move sand in front of the lagoon downcoast. Since then the shoreline has continue to aggrade, and has moved oceanward about 500 feet during 1970-2005 (35 year period). A similar sediment pulse occurred after the 2005 flood when the river mouth, jetting out from the levees, eroded its bank and pushed the beach in front of northern McGrath outward nearly 600 feet. Five years later, the bulge is gone, but all of McGrath Beach had moved oceanward over 100 feet.

The beach zone contains examples of sedimentary systems that build paralic terraces. After a large flood, the coast is pushed out by the sediment pulse into a bulging shoreline, after which sand is moved downcoast by longshore drift in the pursuing years. An "estuary arm" may become "trapped" on the back beach, such as was constructed after the 2005 floods (visible in Fig. 2). Estuarine systems introduce fine-grained stream deposits and estuary deposits into otherwise sandy beach and dune deposits. Wide beaches provide sand for dunes. Dune deposits buttress against earlier dune belts and slowly merge with them. Thus the dunes now cover, or bury, the location of the 1929 and 1855 shorelines, and may be constructing a new paralic terrace of historical age. However, with rising sea-level, the fate of these coastal terraces may be in question.

All historical shorelines are located west of the project area in the modern beach zone, and the project area was not directly threatened by twentieth century beach erosion or changes.

Fig. 2: Location of Historical Shorelines at McGrath Beach
(1929 and 1970 shorelines about the same; 1855 shoreline estimated)

Character of the Santa Clara River Valley

Southern California's largest sediment discharging river, the Santa Clara River, now reaches the coast at McGrath. Its historical character is described in San Francisco Estuary Institute (2011). At past times, however, the river has also flowed, from about the Highway 101 Bridge/El Rio area, towards the Hueneme/Ormond Coast, but little is currently known about the timing or ages of past river channel changes.

Only one channel leads to the McGrath Coast, the modern one. It is incised into an older plain and has a relatively short, steep and straight channel characterizing through-flow of sediment to the coast (Fig. 3). Surrounding plains have soils characterized as Mollisols (Pico and Sorrento soils) typically formed in sediment weathering about 2,000-6,000 years or more (see regional soil chronostratigraphies, Keller et al 1981; Rockwell, Keller and Dembroff 1985; Harden, Sarna-Wojcicki and Dembroff 1986; McFadden 1988). Topographic contours indicate the plains north of the river were created as alluvial fans built by small streams crossing the Ventura Fault Zone, while plains south of the river were created as alluvial deposits of the river. Soils formed on the floodplain deposits adjacent the modern river and coastal terraces on the McGrath Coast are less developed Entisols (Mocho, Camarillo and Hueneme soils) that are younger (<2,000 years) than the older surrounding surfaces of the plain.

Contrastingly, several paleo-channels of the Santa Clara River have been mapped flowing toward the Hueneme/Ormond Coast (Clahan 2003; San Francisco Estuary Institute 2011), the most recent reaching toward Bard's Bubbling Springs. These channels are relatively long, low gradient and sinuous, meander across the plain, and are characteristic of overflowing (during floods) rivers widely inundating the plain and depositing its sediment on land, aggrading its surface. Some historical accounts suggest the river flowed towards Hueneme as recently as around and before 1800 (San Francisco Estuary Institute 2011). Because the outer edge of this plain forms the shoreline and interacts with the ocean, the river deposits forming the Oxnard Plain are a delta-fan deposit. Deposits of the Oxnard Plain associated with the paleo-channels are known as the "perched aquifer" and have young soils (Camarillo and Hueneme soils).

Twentieth century changes have greatly altered the river channel. Historical recreations indicate the natural channel to have been about 1,500 feet wide with a floodplain about a mile wide. Since 1938 the river bottomlands have been increasingly reclaimed for agricultural fields and protected by levees that today greatly restrict the river channel and its character.

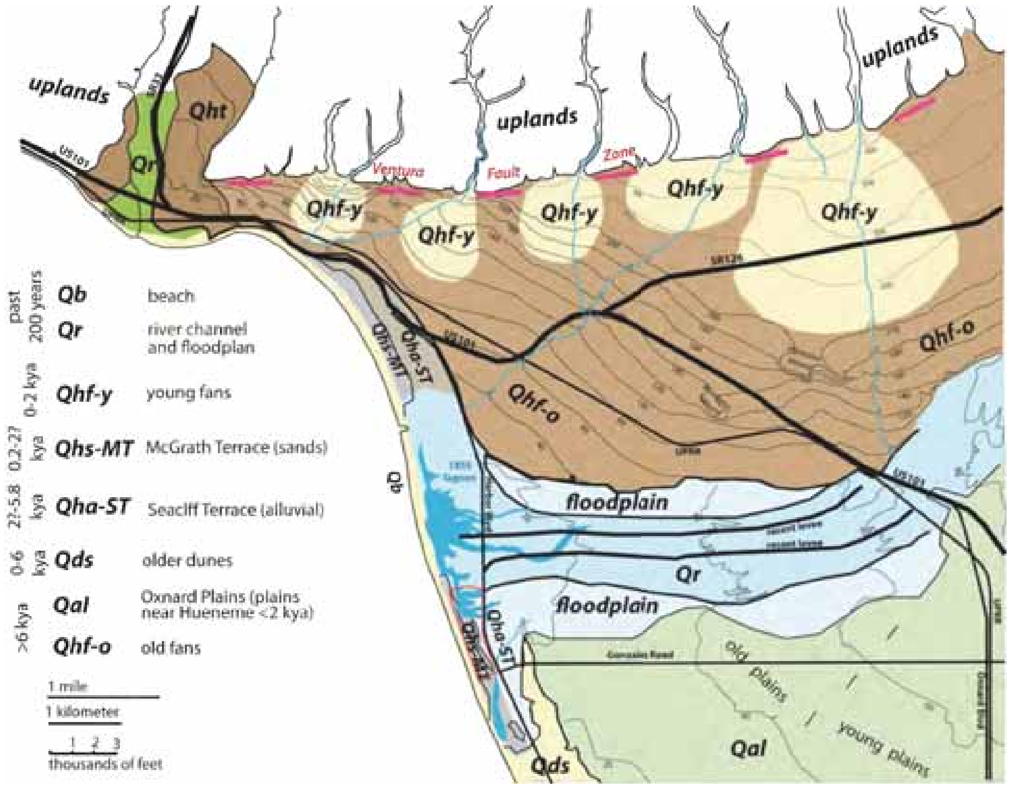

Fig. 3: Geosetting of the McGrath Coast

Within the project area (Fig. 4), the twentieth century floodway bank forms the northern boundary of the existing campground. North of this bank (blue area in Fig. 4) the riverbed has been greatly scoured and its streambed represents sediment in transition. Also shown is the 1938 flood line bordering areas affected by channel overbank flows strong enough to create scour channels, deposit sediment, and create visual scrolls on early aerial photographs, and weaker flows in quietwater flooding areas lacking scour and having thin silty clayey mud deposits (eastern portion of campground relocation area).

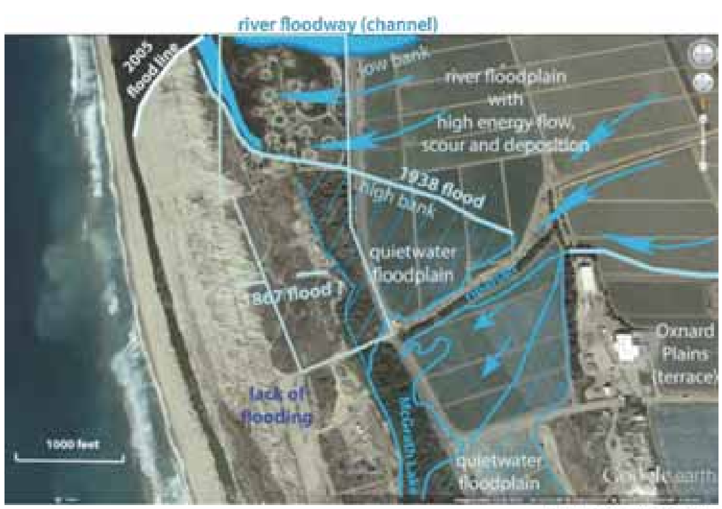

Fig. 4: Details of Early Twentieth Century River Floodplain and Inundation

Historical Land Use

Early twentieth century land-use indicates the dunes and dune-covered terrace were in a natural state, while areas to the east were reclaimed for grain fields. Agriculture spread during the 1920's on the lands between Oxnard and the sea, while concurrently, there were early attempts at canalizing the river between levees, and reclamation of adjacent floodplain lands for agriculture. By the 1927 aerial photograph, property lines and windbreaks are already apparent in the river floodplain. In the 1929 aerial photograph, after the 1928 San Francisquito Dam failure and flood, the beginnings of field production are appearing, and drainage canals lead from the river floodplain to McGrath Lake; however, only fields east of the 6,000 year-old shoreline (see below) are in actual use for anything besides grain fields.

The first artificial levees along the river appear in the 1947 aerial photograph. Grain production appears to cover the eastern portion of the project area in the 1945, 1947 and 1953 aerial photographs, however the dune-covered terrace is un-utilized and in a natural state, presumably due to its sandy surface rendering it unfit for agriculture. Construction of Harbor Boulevard (appears in 1959 aerial photograph) cut off the seaward portions of the grain fields, and they were abandoned. Larger engineered levees also appear in the fifties and sixties, and constrict the river channel upriver of Harbor Boulevard Bridge. Since construction of the campground in 1962-1963, the strip of land between the coastal dunes and Harbor Boulevard has become overgrown with a 40 acre arroyo willow thicket (to the south), a small cottonwood forest, and a 4.9 acre myoporum grove (to the north near campground) (cbec, WRA, and Podlech 2015). A levee partially protecting the campground was removed in the 1990's (or perhaps the 2005 flood), leading to inundation of the campground during high lagoon stands.

Significant disturbance in the project area was created by oil field development associated with the West Montalvo Oil Field during 1950-1970. Little is known of these activities. An extensive aerial photograph study of the former oil field facilities was accomplished for this study and is included as Appendix A. Two wells, a pipeline, associated sumps, and other activities were identified. All activity appears to have been abandoned after 1970. The extent of remediation efforts is unknown. The identified areas of oil field activity were located on a hazard map that was used during the auger program to avoid areas of potential unanticipated finds of affected soils. Auger results indicate the area of the former oil field activity contains disturbed soils up to 4 feet thick, but affected soils were not encountered. Evidence for remediation activity was seen. See Appendix A for details.

4.0 McGrath Coast Geomorphology

Major elements of the McGrath Coast are the Santa Clara River, Ventura River and the eastern Santa Barbara Channel Coastal Sedimentary Cell. Sediments and deposits created by these elements are of Holocene age (past 10,000 years). Holocene sediments underlying the McGrath Coast are 80 m (200 ft) thick, and subsurface structures such as the Oak Ridge Fault, Montalvo Fault and Montalvo Anticline do not affect the overlying Holocene deposits along the coast (Fisher et al 2005) (i.e., coastal deposits and landforms are not broken by faulting or deformed by tectonic stresses).

Within the Santa Barbara Channel Cell, dominant longshore sediment transport is southeasterly towards Hueneme. Although some contribution comes from the Rincon Coast, most of the coastal sediments are delivered to the McGrath Coast (Fig. 5) by the Ventura River (270,000 tons per year mean annual river suspended sediment flux, or about 100,000 cubic yards per year) and the Santa Clara River, (3,100,000 tons per year mean annual river suspended sediment flux, or about 1.2 million cubic yards per year), two of coastal California's greatest sediment dischargers. Much of the sediment is moved during flood events. The largest twentieth century event was the 1969 flood. Forty-eight million tons of sediment were discharged in a few days by the Santa Clara River. This has its effect on the shoreline, which instead of following a simple log-spiral like form from Ventura to McGrath State Beach, is broken by a protruding fan-shaped coast around the rivermouth resulting from the river's sediment discharge. About 40% of the suspended sediment is sandy or larger. These sandy materials are mostly deposited nearshore at the beginning of the evolution of hyperpycnal flows in the coastal waters, and are later available for longshore drift to cast it downcoast along beaches and dune accumulations. Clay and silt are moved by wave-supported gravity flows and deposited in the offshore sediment prism that is over 30 m thick and sequesters 12 km^3 of sediment, about a third of the total post-glacial sediment on the coastal shelf between Point Concepcion and Point Dana and distinguishing the McGrath Coast as the most sediment laden coastal stretch in southern California (Sommerfield, Lee and Normack, 2009). At Hueneme, much of the longshore drift is lost to the Hueneme Submarine Canyon, and a portion continues into the Ormond Coast.

Given the tremendous discharge of the Santa Clara River, the location of its mouth, whether on the McGrath Coast or on the Hueneme/Ormond Coast, is of great significance to the character of the coast at McGrath State Beach through time. When the river flows towards McGrath, the McGrath Coast is sediment-dominated. Alternatively, when the river flows towards the Hueneme/Ormond Coast, the McGrath Coast becomes wave-dominated.

Harbor Boulevard at Pierpont Bay follows the curve of cliffs that get lower towards the south. The line of cliffs is followed south of the Santa Clara River by a line of large dunes or sand hills (vicinity of Gonzales Road). The cliffs and dunes are an ancient shoreline at a time when waves eroded away the pre-existing coastal plain. It is thought that the cliffs formed at the end of the great rise in sea-level during the Early

Holocene at about 6,000 years ago (maximum sea-stand about a meter above today's in Fairbridge Pacific Sea Level Curve; end of fast sea-level rise bringing sea level to within a meter of modern in Curray Sea Level Curve). This must have been a time when the Santa Clara River flowed towards the Hueneme/Ormond Coast as the cliff line is a simple log-spiral curve from the headland at Ventura to McGrath State Beach representing a wave-dominated coast. Coastal processes have constructed more recent terraces oceanward of the 6,000 year-old shoreline to make the coast we know today. Such landforms are known as "paralic" terraces (from the Greek "paralia," "seacoast"). Details of these processes and the genesis of these landforms are poorly studied or understood at this time.

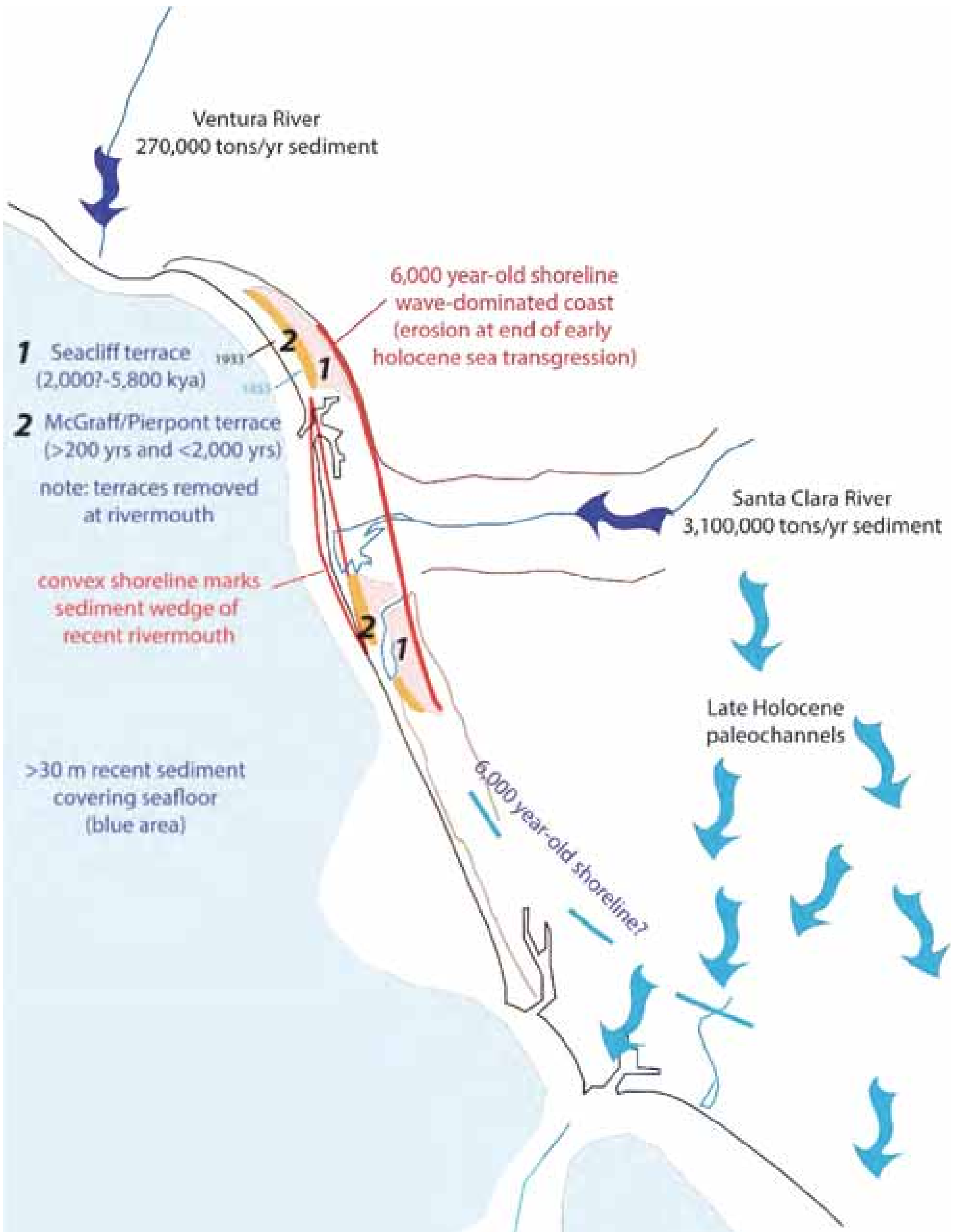

Fig. 5: Sketch of Geomorphology Elements of the McGrath Coast

Seacliff Terrace

Pierpont Bay has an extensive back beach area at 10-20 feet elevation roughly between Pierpont Boulevard and Harbor Boulevard recently identified as a portion of the Seacliff Terrace (Tan, Jones and Clathan 2003). An unusual Holocene age coastal terrace, the Seacliff Terrace was identified and named by Putman 1942 along the Rincon Coast in western Ventura County; good descriptions are in Harden et al 1986. Along the Rincon coast the terrace lies on an uplifted marine wave-cut bedrock platform. Terrace deposits contain both marine/beach and alluvial/colluvial deposits. Uplift along this few miles of coast is about 5 m/ky, an extremely fast uplift related to tectonic activity of Red Mountain Fault and Ventura Avenue Anticline. Closer to the fault the terrace gets higher, and southeastward toward Ventura it gets lower as the uplift rate declines. Uplifted shoreline ages were assigned by a combination of radiocarbon dating and calculated uplift rate (if a terrace RC dated 2,000 years old is 10 feet high, then an undated terrace 20 feet high might be 4,000 years old), from which the Sea Cliff Terrace has been assigned an age range of 1,800-5,800 years before present. Lower terraces closer to today's shoreline are younger, higher terraces further inland are older. Terrace deposits are thin (5-10 feet). Terrace deposits consist of mostly beach sands 6-10 feet thick, with some alluvial/colluvial (clay and silt, rocky) deposits in back beach areas, lots of eolian dust, and, the older they get the more they contain soil organic matter - dark color in upper 2 feet or so. But mostly there is a lack of much soil development. Soils showing well developed surface soils and subsoil horizons (Pico and Mocho soils, US Soil Survey) are generally over 2,000 years old (weathering age).

Portions of the Seacliff Terrace behind Pierpont Bay, however, are different. Uplift rates along the beaches here are negligible (no uplift), and the terrace here hasn't been formed on a wave-cut bedrock platform, but was instead constructed by coastal sedimentary processes on coastal sediments, and preserved by coastal aggradation. Southerly portions of the Seacliff Terrace also appear inland of McGrath State Beach and McGrath Lake (Fig. 6); however, in this area the terrace has been covered by more recent estuarine deposits (Clahan 2003). At the McGrath Coast, the Seacliff Terrace is about 1,500-2,000 feet wide.

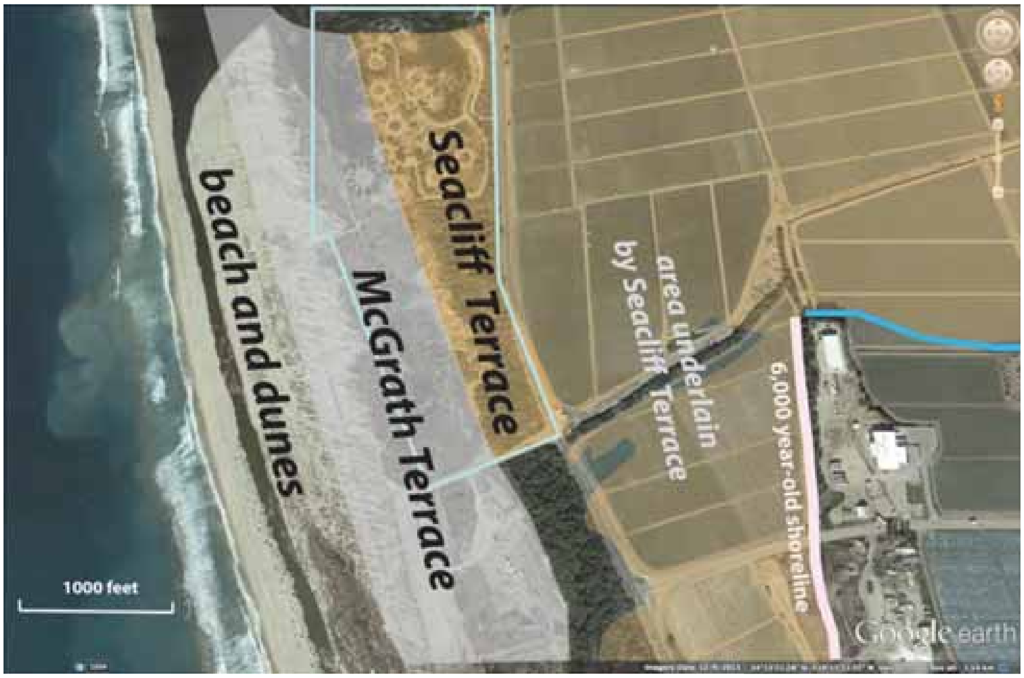

Fig. 6: Coastal Terraces on the McGrath Coast

McGrath Terrace

Fronting the Seacliff Terrace at Pierpont Bay is a dune belt upon which the community of Pierpont Bay has been constructed (between beach and Pierpont Boulevard), and which also has a terrace-like form. This sandy terrace is found behind the beach at the McGrath Coast, too. In the McGrath area (Fig. 6), the terrace surface is flat and sandy, about 800 feet wide and 12-15 feet elevation. Recent dunes lie on top of the terrace. The terrace appears to divert floodwaters of the Santa Clara River around it, and hasn't been inundated by twentieth century floods. The terrace deflected the floodwaters northward into the lagoon or southward into McGrath Lake. As the nineteenth and twentieth century shorelines are all oceanward of this terrace, the terrace is thought to be an earlier coastal landform older than 200 years old. Its leading edge in the Pierpont-McGrath State Beach areas is likely wave eroded, but is now buried beneath recent dunes formed behind the nineteenth and twentieth century beaches. Throughout the twentieth century, the McGrath Terrace formed a promontory northward into the river lagoon, but about 700 feet of this promontory was completely lopped off and removed by floodwaters in 2005.

The extent to which floods have inundated or eroded the surface of the McGrath Terrace is uncertain. It appears the terrace once extended northward even further than it did in 2005, and has been eroded episodically by the river in the past hundred years. Twentieth century aerial photographs indicate twentieth century floods inundated the existing campground area creating scour channels and areas of deposition, and also covered the Seacliff Terrace in the project area with quietwater muddy deposits, until reclaimed behind levees in the fifties and sixties. Inundations did not reach the McGrath

Terrace. However, variances in the dune belt on the McGrath Terrace may indicate past times of the terrace being swept by floods. The three geographic sections of the project area roughly correspond to changes in dune cover. In the southern section dunes cover the entire terrace, while in the central section there are two dune belts (one at ocean edge, one at contact with Seacliff Terrace) but in the middle the terrace is at ground surface. In the northern section, there is only a narrow dune belt at the ocean edge of the terrace. Perhaps large floods of the past swept the terrace surface and removed dunes, with the most extensive flood sweeping across the central section of the project area. Each flood may have re-set the dune clock with new dunes behind the beach being generated constantly. In this view, we can speculate the largest historical flood in 1867 might have swept through the central section and the later 1884 flood swept the northern section, and thus, the dunes in the northern section are a little over 100 years old, the central section dunes go back 140 years (to after 1867), and dunes in the southern section go back over 150 years ago; however, we caution this is somewhat speculative.

In aerial photographs from 1927 to 2010 (83 year period) the inland dune belt in the central section, together with the eastern (inland) edge of the dunes in the southern section, do not appear to have substantially moved eastward, as though fixed in place at the McGrath and Seacliff Terrace contact (dunes bury contact), while the narrow dune belt in the northern section has extended over a hundred feet from dune movement. Between 1950 and 1970, a good portion of the central section dunes were removed by grading or excavation, and today the terrace surface is mostly flat where once there were low dunes.

Both the Seacliff and the McGrath Terrace are broken by the mouth and lagoon of the Santa Clara River, and also to have been incised by the channel leading to McGrath Lake. Both terraces disappear into the dunes south of McGrath Lake and are missing behind Mandalay Beach. Except where broken by the rivermouth, the terraces are coastal features corresponding to the thickest portions of the offshore sediment prism. Paralic terraces represent coastal aggradation of the past 6,000 years on the sediment laden McGrath Coast.

Most of the sediment on the McGrath Coast is and has been delivered there by the Santa Clara River, yet the river has also episodically flowed towards Hueneme and the Ormond Coast, and the McGrath Coast beaches supported by only the Ventura River. Good dating of coastal and alluvial landforms is currently lacking so that we do not know how often the river flowed to the McGrath Coast, or how long each episode lasted.

Additional information concerning the terraces was obtained in the auger program described in the following section. Details of the terrace subsurfaces and clues to their formation were revealed during our study.

5.0 Results of Auger Program

Little is known about subsurface conditions in the McGrath Campground Relocation Project area. Due to the high potential for buried surfaces in coastal sandy and alluvial deposits, and the likelihood of cultural sites in the coastal and estuarine shore settings, an auger program was designed to reveal some of the character of subsurface deposits. On February 20, 2015, a two person crew (Chester King and Jeff Parsons) along with two Native American observers (Sergio Valuenzuela and Mati Waya) excavated and described eleven (11) hand auger excavations in the project area. One hand auger, HA-1, was located where the canine forensic team identified a spot of mild interest.

An 8 cm (3.25in) diameter hand auger was used to excavate in 10-15 cm lifts. Most auger excavations penetrated to 240-270 cm (8-9 ft) depth, but auger excavations in the existing campground (northern section) and portions of the central section of the project area encountered a high, or perched water table at 120 cm (4 ft) depth, and saturated sands prevented further penetration (HA-4, HA-5, HA-7, HA-8 and HA-9). Locations were recorded with a field GPS unit (longitude-latitude) and plotted on a digital elevation map. Elevations at each auger are estimated from the map plot and water table correlation.

Auger Boring Logs with a map of auger locations, auger logs, descriptions and interpretations, are presented in Appendix B. Auger boring logs are arranged in three cross-sections (west to east in southern section and central section of project area, south to north in northern section) in Fig. 7. Note the scale in Fig. 7 is elevation above mean sea-level. Augers penetrated four landforms that underlie the McGrath State Beach landscape: dunes, river alluvium, sandy McGrath Terrace, and floodplain/estuarine Seacliff Terrace.

Dunes: Auger HA-1 was located at a spot identified by the canine forensic team as of mild interest, and it was the only auger to penetrate a recent dune. This spot was located near the top of a sand dune remnant at about 20 feet elevation in the southern section of the project area. Recent dune sand is 2.0 m (6.5 ft) thick, consists of pale brown medium and coarse sand, and overlies sandy deposits of the Seacliff Terrace. Most of the windward portion of this dune was removed during mid-twentieth century grading.

River Alluvium: Augers HA-8 and HA-9 penetrated 1.1-1.2 m (3-3.5 ft) thick recent river alluvium overlying the buried surface of the Seacliff Terrace, and Auger HA-7 penetrated 50 cm (20 in) thick recent river alluvium overlying a thin beach deposit and the buried sandy deposits of the McGrath Terrace. Alluvium is dark brown to dark yellowish brown sandy loam that is slightly sticky and plastic. Typically, flood waters first scour areas, and then, in waning stages of the flood, alluvium is deposited over the erosional surface. River alluvium in the existing campground area (augers HA-8 and HA-9) correlates with twentieth century flood deposits before 1940. Early aerial photographs have prominent scrolls in this area indicating scour channels and alluvial deposition during flood events. A prominent floodplain bank is evident in early aerial photographs before 1940. It runs approximately through the circles for Camps 39-48, Camps 49-58, and then eastwardly along the campground roadway leading out from these circles (south of Camps 1-10 circle) at the edge of the existing myoporum grove. Auger HA-7 is south (on top) of the bank; its shallower alluvium may represent earlier flooding inundation, scour and alluvium deposition, perhaps a nineteenth century flooding event.

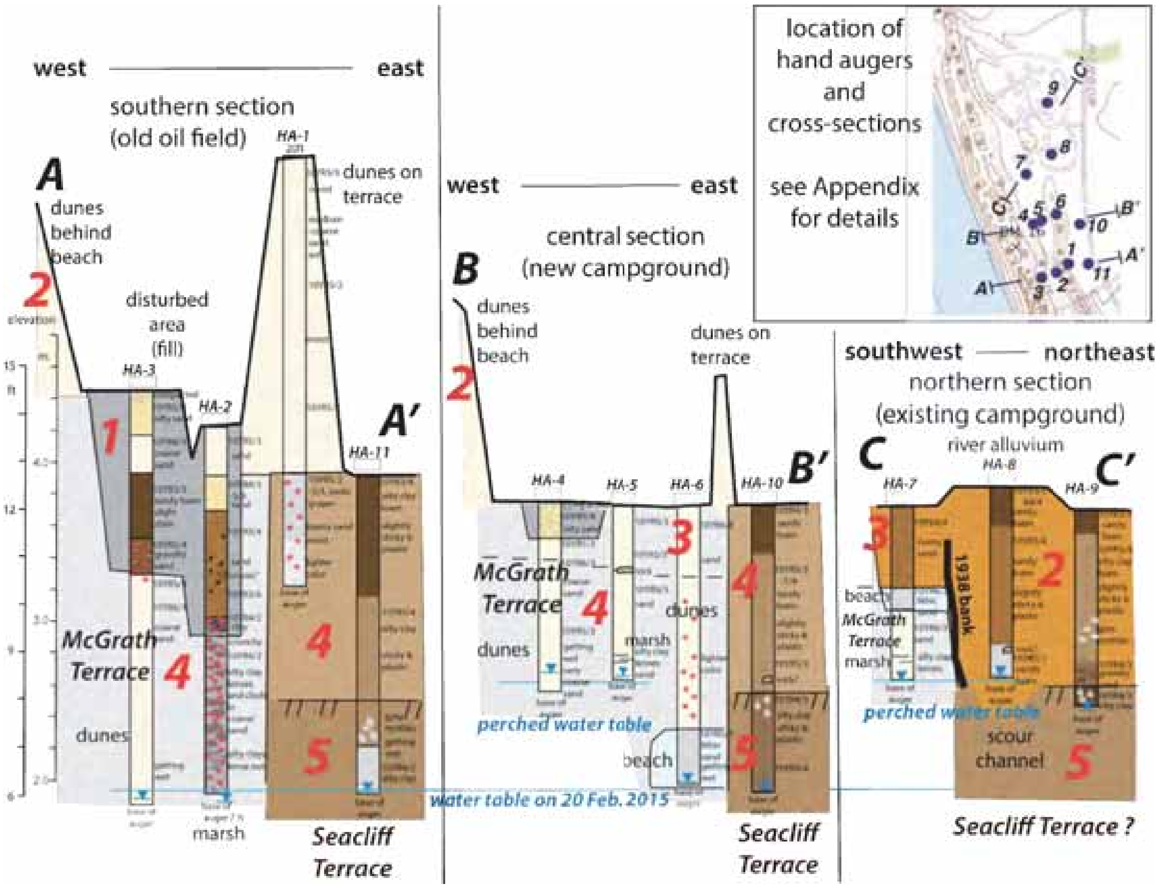

Fig. 7: Three Interpretive Cross-sections of Auger Results at McGrath State Beach Campground; red numbers refer to time-stratigraphic layers:

1- recent disturbance (oil field)
2- twentieth century flood deposits
3- nineteenth century (?) flood deposits and sandy deposits on McGrath Terrace
4- McGrath Terrace and Upper Seacliff Terrace est. 200-2,000 years ago
5- (Lower) Seacliff Terrace c. 2,000-5,8000 years ago

McGrath Terrace: Sandy sediments of the McGrath Terrace were penetrated at depth in Auger HA-7 (northern section), throughout in Augers HA-4, HA-5 and HA-6 in the central section, and at depth beneath disturbed soils in Augers HA-2 and HA-3 in the southern section. Most of the terrace consists of pale brown medium and coarse sand similar to recent dune sand interpreted to be ancient dune deposits. Two augers, HA-5 and HA-7, encountered lenses of dark grayish brown silty clays at 90-100 cm (3-3.2 ft) depth interpreted to be thin marsh deposits deposited in a narrow channel along the back beach. In the southern section, Auger HA-2 encountered thicker lenses or beds of dark grayish brown silty clays interspersed with sandy layers for about a meter (3 ft) below 1.3 m (4.25 ft) depth. Finally, Auger HA-6 penetrated 1.4 m (4.7 ft) of pale brown sand before encountering a "lithic sand" (sand contains high proportion of dark colored mafic lithic grains). Such sands are unusual deposits and most prevalent on beaches where the back-and-forth washing of waves sorts heavy mafic grains from lighter weight and colored (felsic) grains, creating beds of lithic sand; thus this layer is interpreted to be an ancient beach.

Beach deposits in Auger HA-6 are the oldest sediments of the McGrath Terrace and likely lie at the base of a low wave-cut cliff cut into the Seacliff Terrace. The age of the beach is likely similar to the age of the buried Seacliff Terrace deposits, perhaps 2,000-3,000 years old (age uncertain). Internal features of the McGrath Terrace suggest the terrace was first a beach, then the beach was covered by sandy deposits in which a marsh evolved (beach zone moves oceanward), and finally dunes (accumulating off beach to west) covered the lower terrace deposits and gradually build-up the terrace surface until it had greater elevation than the river floodplain. Sand appears to have been first trapped by the wave-cut lip of the Seacliff Terrace and fixed in place, afterward building up vertically (aggrading the terrace surface) but not moving inland. Floodplain deposits on the Seacliff Terrace appear to abut the dunes, and inland moving dunes may have been kept in check by removal by floodwaters.

Three augers in the central section, HA-4, HA-5 and HA-6 have a change at about 40 cm (16 in) depth. At HA-4, the surface is disturbed for 25 cm (10 in) and the underlying sands may be altered due to this, however, intact grayish brown sand gives way to pale brown sand at 40 cm (16 in) depth, while at Auger HA-5 the beachrock (flat rounded elliptical rock typical of beach erosion) accompanied a similar color change at 40 cm (16 in), and in Auger HA-6 sand below 40 cm (16 in) depth contained few iron oxide linings. These subtle changes correspond with the river alluvium in the upper portion of Auger HA-7 and could be related. Floodwaters may have swept the terrace surface and slightly eroded it but not to the extent of scour and fill at Auger HA-7. This relationship may suggest the central portion of the terrace was swept by a nineteenth century flood and the upper 40 cm (16 in) of the terrace sediments are only 100-140 years old, and the overlying recent dunes even younger (about 100 years old). Erosion of the terraces by the nineteenth century Santa Clara River indicates the McGrath Terrace is over 200 years old (established before river changes circa 1800).

Seacliff Terrace: Two augers, HA-10 and HA-11 were located on the Seacliff Terrace near Harbor Boulevard and entirely penetrated deposits of the Seacliff Terrace, while two other augers, HA-1 and HA-9, encountered Seacliff Terrace deposits beneath more recent dune and alluvium deposits. The Seacliff Terrace consists of alluvium deposits and contains two distinct strata. In the upper 1.2-1.4 m (4-4.6 ft), augers penetrated a brown to dark yellowish brown silty clay loam that was slightly sticky and plastic, representing recent quietwater floodplain deposits. This area of the Seacliff Terrace is a marginal and relatively high elevation portion of the river floodplain, and was inundated during large floods by slow moving water lacking scour power leaving behind a thin muddy layer after the flood. Repeated inundations slowly aggraded the terrace surface.

Lower portions of the Seacliff Terrace include a prominent buried surface at 120 cm (4.0 ft) depth (about 9 feet elevation) beneath which is dark brown silty clays that are strongly sticky and plastic. These soil materials are similar to those found out on the Oxnard Plains. Their origin is likely as a former river floodplain that was abandoned (drop in river level-turned floodplain into terrace) and then exposed as a land surface for 2,000-3,000 years and incorporated eolian dust to become heavy silty clay soil.

6.0 Synopsis of McGrath Coastal Evolution

Based on coastal geomorphology and the results of the auger program at McGrath Campground, we can reconstruct parts of the genesis and evolution of this coast. Major elements are the sediment laden coastal area with a large sediment prism offshore, continual sediment input to beaches from the Ventura River, and episodic sediment input from the Santa Clara River. Large sediment flows from the river create a sediment-dominated coastline. When the river flowed towards the Hueneme/Ormond Coast, the McGrath Coast became a wave-dominated coastline.

Fig. 8a&b illustrate how the river and coast might change. In Fig. 8a, the Santa Clara River flows to the McGrath Coast (today; sediment-dominated coast) in a wide floodway bordered by a large floodplain, the coast has a bulging sediment prism, and beaches are wide. However, when the river flows towards the Hueneme/Ormond Coast (Fig. 8b), the character of the McGrath Coast changes to a wave dominated setting. River flow in the (modern) river valley is replaced by the discharge of nearby creeks, and the valley becomes underfit. It is likely that even in floods that under these conditions only the modern floodway would be inundated, and the surrounding floodplain emerges as a terrace. Likewise, the lagoon would be more restricted in size. The coastal bulge created by river sediment erodes away, and the shoreline in the Pierpont-McGrath State Beach area takes on the form of a shallow log-spiral, with the beach eroded back into the pre-existing dunes.

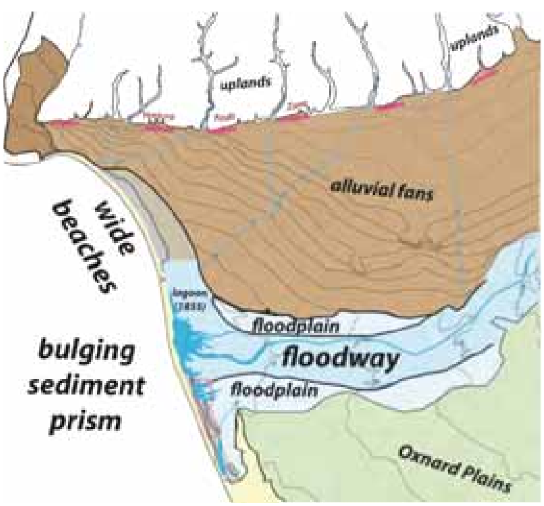

Fig. 8a: sediment-dominated coast (today) with wide beaches, wide river floodway and floodplain, large lagoon, and bulging shoreline;

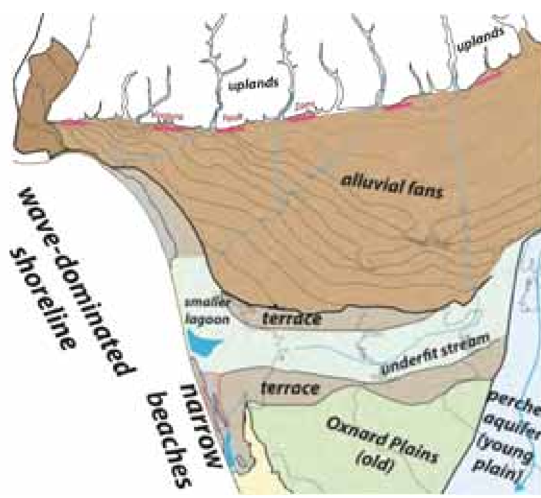

Fig. 8b: wave-dominated coast when river flows towards Hueneme leaving valley with underfit stream, terraces (above flooding), reduced lagoon, and wave-dominated shoreline.

Fig. 9 consists of cartoon cross-sections through the McGrath Coast to show its evolution over the past 6,000 years in seven stages.

In Stage 1 the Early Holocene sea-level is lower and the shoreline further west. As sea-level reaches it's maximum height following the Early Holocene period of fast sea-level rise (Stage 2), while the river flows towards the Ormond Coast, waves erode back the pre-existing plains into a line of cliffs behind Pierpont Bay and lower cliffs behind McGrath State Beach.

In Stage 3, the river has returned to the McGrath Coast and built up a new floodplain incised into the older sediments of the Oxnard Plains.

In Stage 4, the river returns flowing toward the Hueneme/Ormond Coast, and the river floodplain at McGrath State Beach becomes a terrace as river flow lessens and water is lower. The terrace is long-lived and receives large amounts of eolian dust to give it a silty clay character. Along the shoreline, now wave-dominated, the oceanward edge of the alluvial terrace is eroded back into a line nearly parallel the 6,000 cliffs yet further oceanward due to coastal aggradation. The age of this second wave-dominated period is uncertain, but may correlate with a possible small sea-level rise around 2,000-2,500 years ago.

Stage 5 repeats the cycle, with the river returning to the McGrath Coast making for a sediment-dominated period of beach and dune aggradation. Quietwater flooding affects the surface of the Seacliff Terrace.

In Stage 6, the river flows away again, and the coast becomes wave-dominated, causing the now thick accumulation of dunes in front of the Seacliff Terrace to begin eroding back to a line parallel again to the 6,000 year-old cliffs, removing beach sources of sand from dunes, which then erode beneath rainfall until the new McGrath Terrace has a level surface.

In Stage 7, the past 200 years since about 1800, the river returns to the McGrath Coast, and the beach and dunes aggrade further west, while recent dunes begin to cover the surface of the McGrath Terrace.

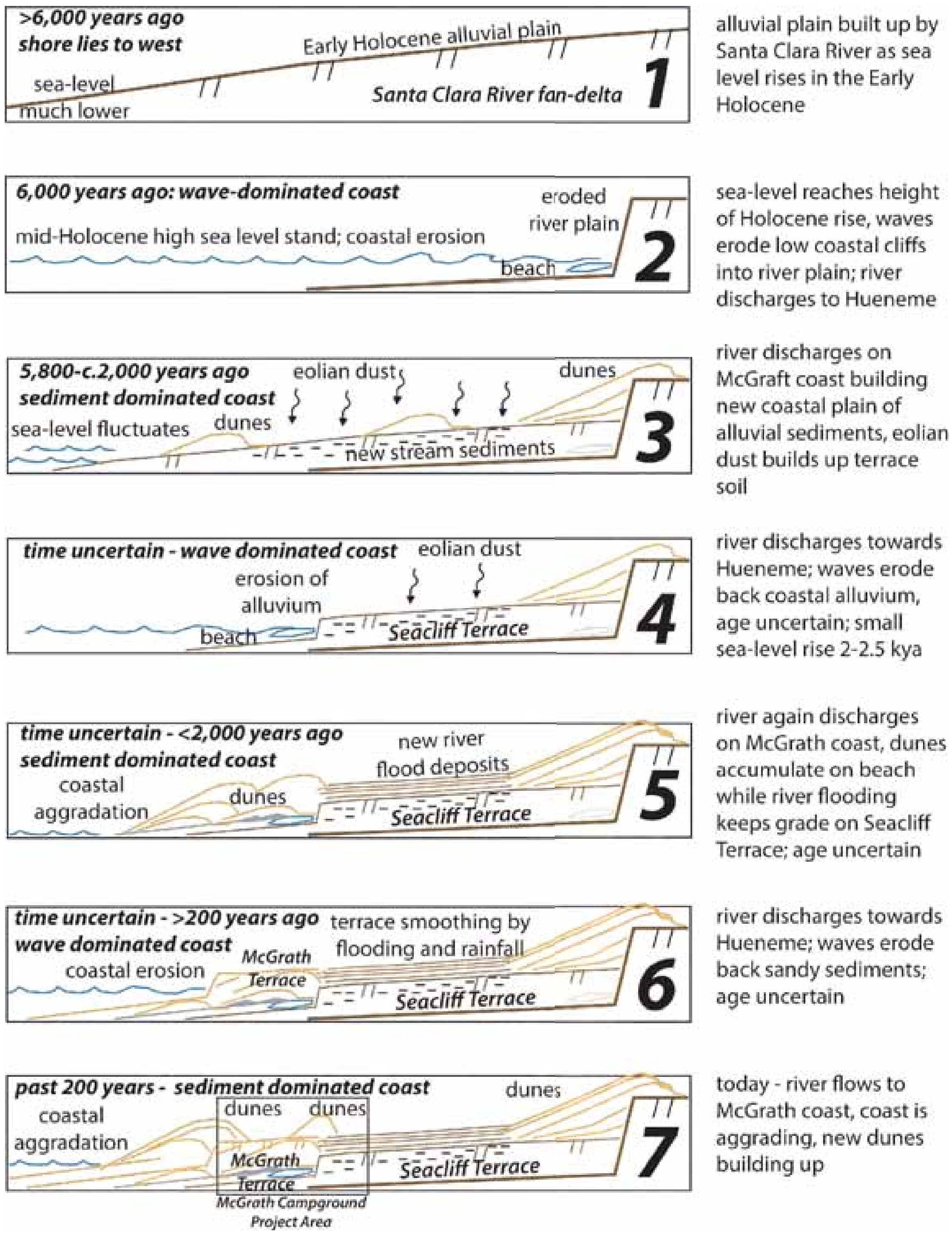

Fig. 9: seven step coastal evolution during Late Holocene

7.0 Presence of Buried and Potential Buried Surfaces

Sandy coastal areas generally have the strongest potential for the presence of buried surfaces in subsurface deposits. At McGrath Campground there are several possibilities for buried surfaces.

Most prominent in the augers is the widespread buried surface of the lower Seacliff Terrace at about 9 feet elevation (about 1.2 m or 4 ft depth). There is a strong likelihood that this buried surface extends beneath the river floodplain for a great length towards El Rio. Underlying the buried surface are river alluvium (flood deposits) created after the Santa Clara River first eroded its modern channel into the 6,000 year old cliff-ed shoreline of the Pierpont-McGrath Coast, likely soon after the cliffs were created or about 5,500-5,800 years ago. The surface of the floodplain deposits represents a long-lived (several thousand years) landform in the river valley and became a terrace (above flooding levels) during times when the river flowed toward the Hueneme/Ormond Coast, and local river levels were lower. The surface was extent for 2,000-3,000 years after river flooding had subsided and the surface exposed to eolian dust deposition, so creating a sticky and plastic fine grained soil in the now buried surface that is similar to soils on the older portions of the Oxnard Plains.

Short-lived surfaces have also been constructed and then buried in the dune deposits in the McGrath Terrace. We give these terrace deposits a preliminary age range of 200-2,000 years old. Dunes are often scenes of shoreline activities, for instance, a protected spot to gather, sort and clean a day’s catch, or work on tools; are good hunting areas; and provide habitat for plants that produce edible seeds.

Similar short-lived, buried surfaces might exist in the recent dunes behind the beach and on top of the McGrath Terrace. These recent dunes, however, are thought to be only about 200 years old, and therefore too young to contain potential prehistoric surfaces of concern. They may, however, bury or obscure older deposits on top of the McGrath Terrace surface.

Finally, although most of the river floodway and portions of its historical floodplain, such as beneath the existing campground, are scenes of scour and deposition of recent alluvium during large floods, more marginal or higher portions of the floodplain, such as in the eastern project area near Harbor Boulevard, quietwater flooding is more likely to bury and preserve pre-existing landsurfaces than to scour it away.

8.0 Paleontology

Paleontology is the study of life in past geologic times based on fossil remains, other indications of once living plant and animal life, their context and relationship with modern life and environment, and the chronology of earth's history. This section discusses the potential for paleontological resources to be encountered in the study area, and concludes that, due to the young age (<6,000 years old and younger) of soil and sediment, paleontological resources are unlikely to occur within the project footprint.

Of strong interest to paleontologists are fossils of land mammals and birds, fossil shells, and fossil marine mammals. Microfossils are not considered a resource as they are common in the rocks in which they occur, while fossils represent significant and unusual finds. Fossil remains are considered important if they are well preserved, identifiable, good type specimens, age diagnostic, useful in paleoenvironmental reconstruction, represent rare or endemic taxa, represent a diverse assemblage, and/or represent associated marine and non-marine taxa (Ventura County Initial Study Assessment Guidelines 2006). Such remains are protected under an assortment of Federal, State and local policies and programs. Significant statutes include (for Federal lands) the Antiquities Act of 1906, Federal-Aid Highway Act of 1935, National Historic Preservation Act of 1966, Section 4(f) of the Department of Transportation Act of 1966, National Environmental Policy Act of 1969; and (for State lands) California Environmental Quality Act, California Coastal Act, Public Resources Code Section 5097.5, and California Code of Regulations Sections 4307 and 4309. The McGrath Campground study area is a part of lands owned by the California Department of Parks and Recreation. DPR treats paleontological remains within the provisions of CEQA, with DPR Natural Heritage Section of the Resource Protection Division providing guidance to individual park units. State guidelines suggest in cases of paleontological finds the preparation of a Paleontological Identification Report, Paleontological Evaluation Report, a Paleontological Mitigation Plan and Report, and Paleontological Stewardship Summary.

In Ventura County, projects are evaluated for Thresholds of Significance for Paleontological Resources through review of paleontology and geology reports, and comparison to the county database of paleontological finds and their geologic rock formations. McGrath State Beach is located on very recent sedimentary landforms. Late Holocene coastal terraces are not specifically evaluated in the Ventura County Initial Study Assessment due to their young age; sediments at McGrath State Beach are thought to be less than 6,000 years old. This time period is less than the rate at which remains are fossilized, and thus fossils are unlikely to be encountered. Additionally, fossils represent ancient forms of life, while life forms of the past 6,000 years are essentially modern. Thus the potential for paleontological remains at McGrath State Beach are considered nonexistent. *Paleontological resources are unlikely to exist in this project footprint.*

Although paleontological specimens are unlikely to be encountered, much of the sediment at McGrath State Beach was deposited in the estuary of the Santa Clara River. Estuaries are prime areas for the remains of creatures to be deposited and covered by sediment (Muller 1979). Marine mammals are known to enter estuaries, become disoriented and trapped, leading to death and burial in estuarine sediments. There is a possibility that remains of recent creatures will be encountered in the subsurface, particularly in the area of the existing campground where the 1855 Coast Survey map indicates there were extent several arms of the estuary that seem likely “dead ends” for disoriented animals. Likewise, large terrestrial animals can be caught by floods and their remains end up in the estuary deposited with river sediment.

Should unexpected discoveries be made during this project, construction activities should be halted in the vicinity of the remains, a paleontological consultant notified and a site evaluation conducted as necessary to assess the site and determine further mitigation measures, as appropriate. Such mitigation measures may include, but are not limited to, placing the area in a protected open space easement or Restrictive Covenant, excavation monitoring to allow any fossil remains to be identified, preserved and protected by qualified individuals. Reports of activities must be filed, and the Ventura County Paleontological Data Base should be updated with the find. Paleontologists should meet minimum qualifications of education (B.S. degree in paleontology, geology or related discipline), minimum of 5 years experience performing paleontological, geological or related studies, evidence of experience in local and regional vertebrate and invertebrate paleontology (fossil collection, curation and reporting), and be a member of a professional society.

In conclusion, paleontological finds are not expected in the study area due to the recent age of the underlying sediments, but there is a low potential for buried remains of modern creatures in estuarine sediments beneath the existing campground.

9.0 Suggestions for Future Research

Theoretical models of coastal development have been utilized to evaluate the landforms at McGrath Campground. Models often change as new information comes in. Most conspicuous of research needs is the definitive dating of landforms, and the creation of a chronology for river changes (McGrath State Beach versus Hueneme/Ormond Coast) during the Late Holocene.

Excavations or boreholes that encounter materials such as shell, wood, or organic matter dateable by radiocarbon techniques could provide valuable dating of sediments. With an open face (archaeological units or trenches) the collection of samples for OSL (Optically Stimulated Luminescence) could be attempted. Prehistoric cultural deposits may have dateable artifacts.

Provenience of beach sands might be definable by the differences in sediment types and ages provided by the Ventura River versus the Santa Clara River. During times the Santa Clara River flows towards McGrath State Beach, the local beaches and dunes would be supported by the tremendous flows of that river; while, when the Santa Clara River flowed towards the Hueneme/Ormond Coast, beaches on the McGrath Coast might be supported by sediment of the Ventura River spread downcoast by longshore drift. Significant differences in each river's sediment are suggested by differences in geology underlying the two watersheds. Ventura River drains watershed underlain by mostly sedimentary rocks of Cenozoic age (past 67 million years). Much larger Santa Clara River has a watershed draining both these kinds of rocks as well as much older granitic and metamorphic rocks of the Alamo Mountain, Sierra Pelona and San Gabriel Mountains area. These differences make possible the use of heavy mineral analysis, detrital zircon analysis and other new techniques to indicate when sediment layers have been deposited during times of (Santa Clara River) sediment-dominated coastal sediments, or during times of wave-dominated coastal sediments (Ventura River sediment dominant).

Such dating of landforms is important to efforts to date and understand prehistoric cultural deposits that may be encountered along this coast.

10.0 Summary

This study set out to:
- reconstruct the history of landforms in the project area;
- evaluate the natural setting for the potential for buried cultural sites;
- determine the nature and extent of twentieth century disturbance; and
- discuss the potential for paleontological resources within the project site.

Summary points include:

- historical shorelines all lie to west of project area (project area not threatened by twentieth century beach erosion);

- energetic floodwaters (scour channels, sediment deposition) inundated the area of the existing campground, quietwater floodplain deposits cover the Seacliff Terrace, and the McGrath Terrace appears mostly free of flooding;

- strongest historical disturbance is in portions of former oil field;

- natural landforms are paralic terraces formed during the past 6,000 years;

- auger program results help define the sandy character of the McGrath Terrace, the alluvial character and buried surface of the Seacliff Terrace, as well as, recent alluvium and the buried Seacliff Terrace at the existing campground area;

- McGrath Coast character is determined by whether river flows towards the McGrath Coast resulting in a sediment-dominated shoreline, or towards the Hueneme/Ormond Coast resulting in a wave-dominated shoreline;

- age estimates (ages uncertain from lack of hard dated landforms, and reliance on theoretical models and relationships):
  - dunes and river deposits: <200 years
  - McGrath Terrace and upper Seacliff Terrace deposits: somewhere between 200-2,000 years old (multiple ages within time span)
  - Seacliff Terrace 2,000?-5,8000 years old
  - age of buried Seacliff surface: perhaps about 2,000-5,000 years old.

Conclusions:

• natural landforms and sediments are paralic terraces <6,000 years old (alluvial Seacliff Terrace and younger, sandy McGrath Terrace), nineteenth and twentieth century river floodplain deposits, and recent beach and dunes.

• an extensive Buried Surface is present at 4 ft depth under the Seacliff Terrace;

• potential short-term Buried Surfaces can exist in the sandy dune deposits of the McGrath Terrace or within the quietwater floodplain deposits on the Seacliff Terrace;

• Buried Surfaces in sandy areas of the McGrath Terrace may be culturally sensitive due to the general uses (fishing, hunting, economic seed-producing fields), attractiveness and spirituality of coastal areas; nearness of lagoon shores may also render the buried Seacliff Terrace surface sensitive as well, for periods when the buried surface was a terrace land surface adjacent the lagoon and river valley;

• Paleontological Resources are not expected in the project area due to the recent age of the sediments underlying lands (<6,000 years old; too young for fossils); there is some potential for finding in the subsurface recent animal remains such as whales, sea lions and other sea animals who were stranded in the lagoon, or remains of terrestrial mammals washed in during floods - the most sensitive area for these is the area of the existing campground where historical scour channels and flood deposits occur.

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Appendix 2

Appendix A

Cultural Resource Investigation McGrath Campground Relocation

Aerial Photograph Study of Abandoned Oil Field Facilities In a Portion of the West Montalvo Oil Field

Introduction

According to the West Montalvo Oil Field Well Map (web source) there was once located two petroleum production wells in the southern portion of the project area. Potential deposits of crude oil ("free product") and refined products are a potential safety and health hazard. Little is known of the oil field activities in the project area. Significant effort was made, therefore, to study historical aerial photographs of the early oil field in the project area. Results of the study are used to construct a Map of Potential Hazardous Areas (Fig. A1), and these areas were mostly avoided for the cultural resource auger program to avoid any unanticipated discoveries of affected soil.

West Montalvo Oil Field

McGrath #1 was the first exploratory well on the beach. In was constructed in 1935 by Mobil Oil Corporation on the east side of the dunes behind the beach and about 200 m southeast of the lagoon (located west of northern study area; now marked by a twenty foot-to-a-side concrete footing). Drilled to 7,625 feet depth, it did not produce and was abandoned in 1935. West Montalvo Oil Field was subsequently discovered by Standard Oil Company of California (later Chevron) in 1947 while exploring for oil reservoirs associated with the Montalvo Anticline (Yerkes, Wagner and Yenne 1969; Wikipedia.org). Since its discovery, West Montalvo has produced over 43 million barrels of oil and 43 billion cubic feet of gas; about 2.2 million barrels of recoverable oil remain. Oil accumulations discovered early at over 9,000 feet depth occur within the easterly plunging anticline in mostly Pliocene age sands of the Pico Formation. In 1951 the Colonia Pool was discovered at 11,500-14,000 feet depth. Offshore areas of the field in the Tideland Pool, discovered in 1963 at 12,500-14,850 feet depth in the Sespe Formation, were reached with directional drilling. West Montalvo is the first dry gas field of commercial importance in Ventura County. Several enhanced recovery projects have been used including gas injection 1956-68, waterflooding since 1963, gas injection in the Colonia Pool 1964-71 and waterflooding since 1960, and more recently water injection and possibly fracturing. Produced oil supplies the Mandalay Generating Station via an oil and gas separator service, and also supplies the Oxnard Refinery. A regional oil pipeline runs north south along Harbor Boulevard past the project site. Chevron sold the oil field in 1990 to Bush Oil Company, Taft. Ownership passed in 1992 to Berry Petroleum, then Venoco in 2007, and was sold in August 2014 to Occidental Petroleum.

Aerial Photograph Study

Only a small portion of the West Montalvo Oil Field existed on the project site with facilities covering the southern 1,000 feet of the parcel. Well maps indicate two wells were located in this area. Facilities within the project area, however, such as oil wells, pump stations, pipes, valves and tanks were removed before 1970, and the property was transferred to State Parks sometime between 1993 and 2005. Aerial photographs available from the UCSB Map and Imagery Library were examined to reveal the nature and extent of oil field activities during 1947-1970. Additional aerial photographs and obliques available at www.Californiacoastline.org for 1972, 1979, 1987, 1993, 2005, 2008 and 2010 were also examined.

Aerial photographs from 1929 (pre-development), 1945, 1947, 1953, 1959, 1963, 1965 and 1970 indicate oil field development work began around 1950, although a previous buried pipeline (appears first in 1945 aerial) ran along the beach (oceanward of study area) (pipe continues south down Mandalay Beach, and runs north of Santa Clara river along future Pierpont Boulevard right-of-way; most likely a WW2 products pipeline from refineries near Ventura to Port Hueneme). A single well (Well A on hazard map) appears in operation in 1953. Extensive areas have been graded, an access road and circulation roadway, and an area near the first well has been isolated by an embankment or dike complex; a small sump may exist. Some grading has occurred south of the first well, and some operations are occurring (circular area) at the edge of development (circular area operation located south of study area).

Much development occurred during the fifties. By 1959, a buried pipeline appears to connect the well area with facilities (refineries) north of the Santa Clara River (pipe right-of-way runs beneath existing campground), and the pipeline may terminate near what appears to be an engineered square-shaped sump. The first well is gone in 1959 and the area appears graded by a bulldozer; and the small sump area appears spread out by a dozer (presumably the worse of the sump was removed?). A larger pad area has been graded to the south of the first well where a second well (Well B on hazard map) was likely located, but it too is now gone. It has an associated area that appears to be a sump in a topographical low spot. Nearby are several small structures. Perhaps these may be associated with gas injection facilities? More development occurs south of the study area where it appears the majority of operations are moving.

In the 1963 aerial photograph most oil field operations within the study area appear abandoned, the structures removed and the area graded with a bulldozer. Portions of the pipe right-of-way to the north and its associated square sump are still evident, yet it appears most oil field activity has now moved south of the study area. In the 1965 aerial photograph, except for the square sump, the portion of the oil field in the study area appears to be returning to a natural state, while the campground has been constructed on top of the buried pipeline right-of-way to the north. The pipeline may or may not have been removed (lack of surface indications to determine).

The area is freshly graded and a new buried pipeline leading offshore from the locality of the second well is evident in the 1970 aerial photograph. A small sump in a topographical low spot may be evident at the pipe junction. The square sump is highly visible. The new offshore buried pipeline was likely drilled horizontally from the second well location during the Tidelands Pool development in the mid-sixties. There is also some sort of activity in the southeastern corner of the study area along Harbor Boulevard where a short access road off the highway leads to what looks like a circular footing. By 1972 aerial photographs suggest most oil field activity in the study area has ceased, although the status of any buried pipelines is uncertain. Certainly some of the pipe right-of-ways are evident. However, the area appears to have only been partially maintained for use for storage (look like piles of sheetpile), while the rest of the disturbed area appears to be reverting to a natural state with accumulating sands and vegetation. The square sump appears elongated as though it has “ponded” in a larger area. The square sump has mostly disappeared by 1979, although square-ish like patches of vegetation are still evident in 1987 and 1993 aerial photographs. Lands in the study area look fairly natural after the Millennia. Sometime between 1993 and 2005 the fence at the northern edge of the original oil field is removed, likely the time period the parcel was purchased by California Department of State Parks.

A note on oil field geology. The existing oil field access road along the southern boundary of the study area approximately overlies the axis of the Montalvo Anticline, a geologic structure of deformed older rock units (Pleistocene to Oligocene; rocks of the Ventura Geologic Basin), as it runs out to sea. The north flank of the anticline is cut off by the McGrath Fault, which runs out to sea approximately a thousand feet north of the oil field access road. Thus the first two beach wells reached into the northern flank of the anticline, while later drilling moving southward beyond the project area reached into the southern flank of the anticline where the larger oil accumulations occur, and over which the oil field developed. These underground structures were poorly or inaccurately located in the fifties, and even as late as the eighties on geologic maps. It appears that as better subsurface mapping was accomplished that interest was lost in the northern flank of the anticline and any operations there abandoned.

A note on potential hazards. Activities associated with development of the West Montalvo Oil Field occurred in the study area between about 1950 and 1972. During that period two wells were drilled and operated for a short time, a buried pipeline to (presumably) refineries to the north constructed, along with access roads, graded areas, construction and demolition of embankments/dikes, and possible sumps. At this time the process of abandonment and any remediation work for these mid-twentieth century facilities is uncertain. Thus, until it can be proven otherwise, a “worst-case scenario” is assumed for this project that implies the possibility of encountering ***in certain areas*** affected soils during subsurface exposure (augering, shovel pits, or trenching). These hazards might not exist (due to good remediation), might involve slightly affected soils (those possibly containing trace amounts of affected material yet below regulatory concern), to strongly affected soils (those containing remnants of subsurface sumps or plumes from leaks in, or spills from pipes, valves and equipment, or from oil field operations involving cleaning out pipes). A hazard map was assembled using this information. One option is to avoid these areas during subsurface work (hand augering).

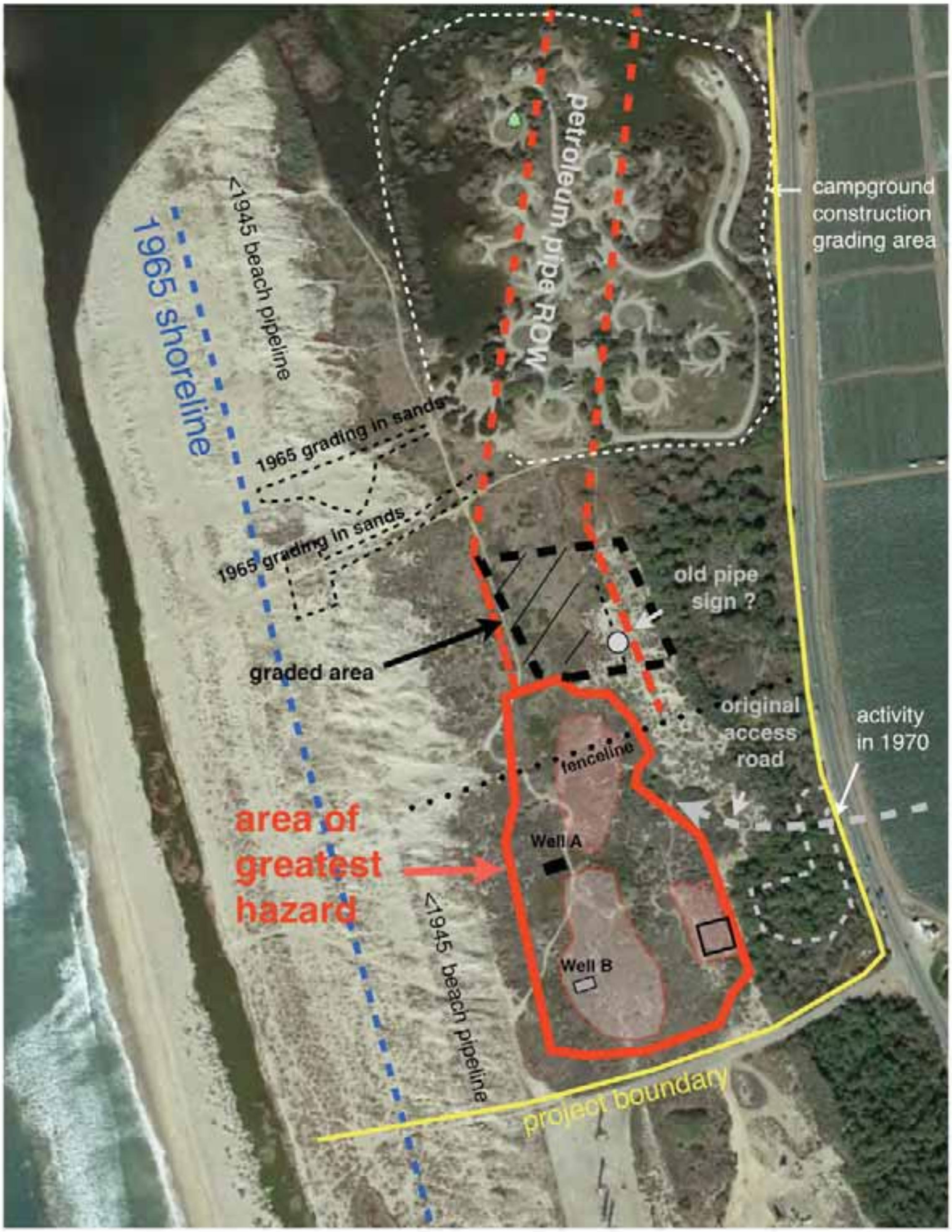


Fig. A1: Map of Potentially Hazardous Areas of Former Oil Field and Suspected Affected Areas (areas in red)

State of Disturbed Areas During Fieldwork

During the single day of fieldwork a preliminary feel for extent of twentieth century disturbances was considered. Most of the disturbance occurs in the southern section of the project area in the former oil field areas. Areas where aerial photographs may indicate the two wells, associated sumps or spreading out of sumps, and the square sump were avoided (see Hazard Map). In general the McGrath Terrace surface is strongly disturbed by grading and land modification. On the surface are several piles of concrete and pipe debris, but most of the area appears fairly cleaned up of oil field infrastructure. Near Auger HA-1 were some backdirt piles consisting of tarry sand. These may represent areas where sumps were spread out onto the sand and left to harden, and remediation attempts have removed these and stored them into the backdirt piles. Two augers in the area of disturbance, HA-2 and HA-3, penetrated 4 feet of disturbed soil. These soil materials appear to have been placed over a surface graded into pre-existing dune and sandy terrace soils, earth materials mixed and re-deposited to rebuild the ground surface. Auger HA-2 encountered soil with “chunkies” between 0.5-1.2 m (2-4 ft) depth; chunkies are small globules and chunks of crude oil remnants. Likely there was affected soils in the area and they were bulldozed out, the remaining soil retaining small chunkies. Also in this auger at depth in natural sand and marsh-like silty clay layers, there was a large amount of iron oxide linings. Such linings may result from the oxidation of organic matter in the silty clay layers, but iron oxide stained sands also often mark areas immediately outlying affected areas like sumps (Cole 1994; Antonellini, Aydin and Orr 1999; Yong 2001; Chiou 2002). They are formed in an area of a continuous wetting-phase (groundwater submersion) when iron in the hydrocarbon-saturated sands that have a negative redox potential (*Eh*) and is in reduced form $Fe(OH)_2$, are transported in solution by advective flow or diffusion to the oxidizing environment of the hydrocarbon-free sands where *Eh* is positive, Fe^{2+} is oxidized and precipitated as the stable authigenic mineral $Fe(OH)_3$. Iron oxides at auger HA-2 may indicate the presence close by in the past of a sump.

Observations during the auger program suggest some remediation actions have occurred in portions of the former oil field in the project area. Evidence for affected soils was not encountered during augering, and sediments and groundwater brought up in the auger lacked any sign of discoloration or smell associated with affected soils. The auger program did not find evidence for any significant existing affected soils in the specific locations we augered.

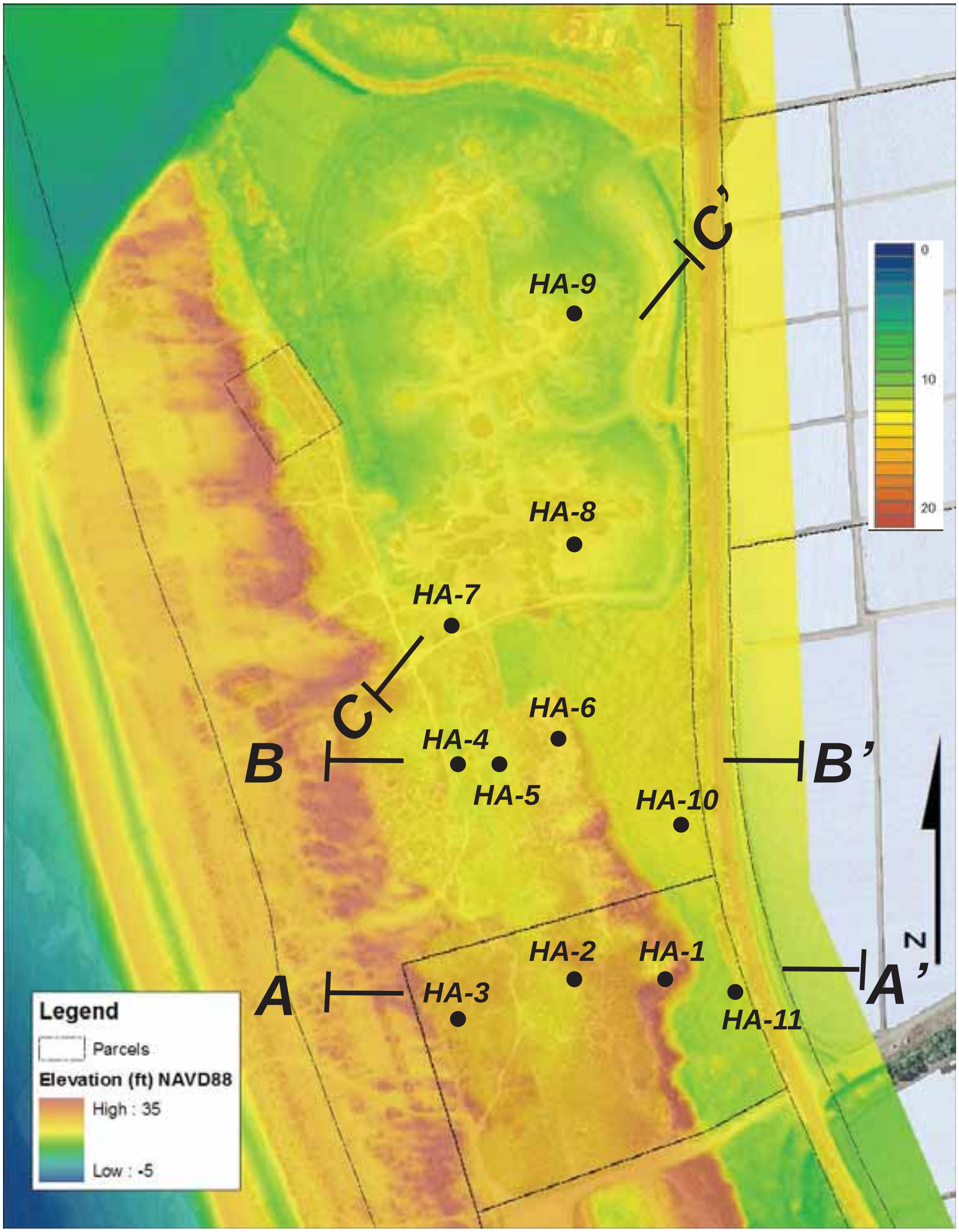
Appendix 2

Appendix B

Cultural Resource Investigation
McGrath Campground Auger Program

Auger Boring Logs

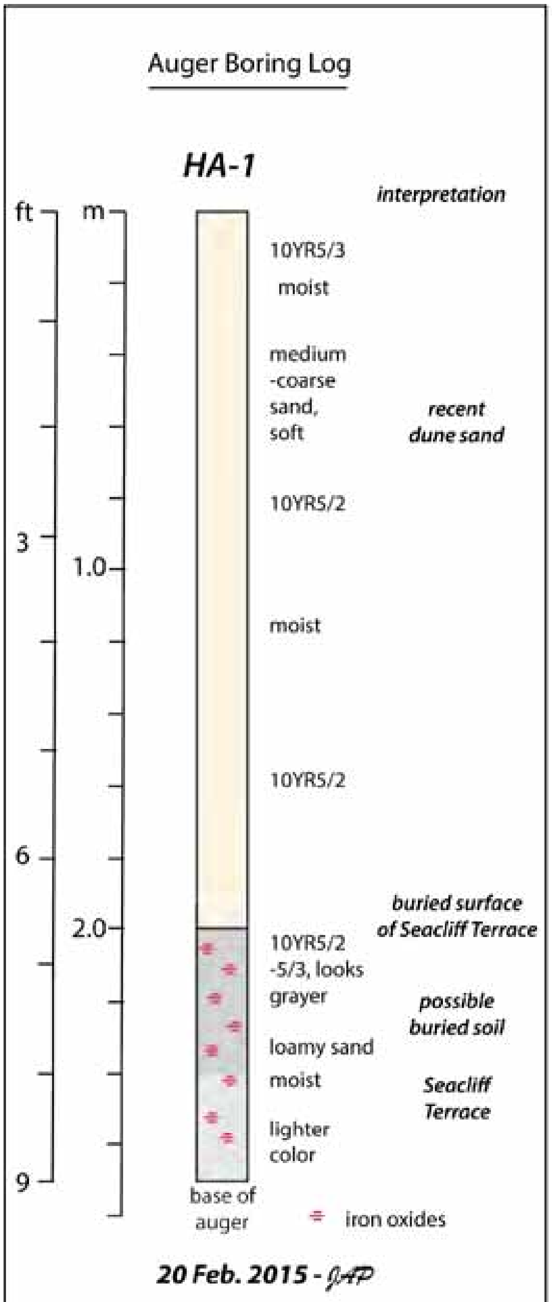
Augers HA-1 through Ha-11



digital elevation map courtesy Dale Meck, cbec, Inc and Eco Engineering

B-1: Digital Elevation Map Showing Auger Locations and Cross-sections

Cultural Resources Investigation
McGrath Campground Auger Program



n/a

photo view towards -

GPS Location: 34° 13′ 21″N 119° 15′ 25″W (est.)

elevation: 20 feet

Setting: canine response location
located on top of dune in inland dune belt
overlying McGrath/Seacliff Terrace contact
in southern section of project area

Description: auger penetrated 2.0 m (6.5 ft) of recent dune and continued for 75 cm (over 2 ft) into the underlying terrace consisting of grayish brown to brown loamy sand with iron oxide linings; an upper dark zone about 40 cm (16 in) thick may suggest a buried soil.

Interpretation: 2.0 m (6.5 ft) thick recent dune overlying bured Seacliff Terrace containing an old soil.

B-2: Auger Boring Log for Auger HA-1

Cultural Resources Investigation
McGrath Campground Auger Program

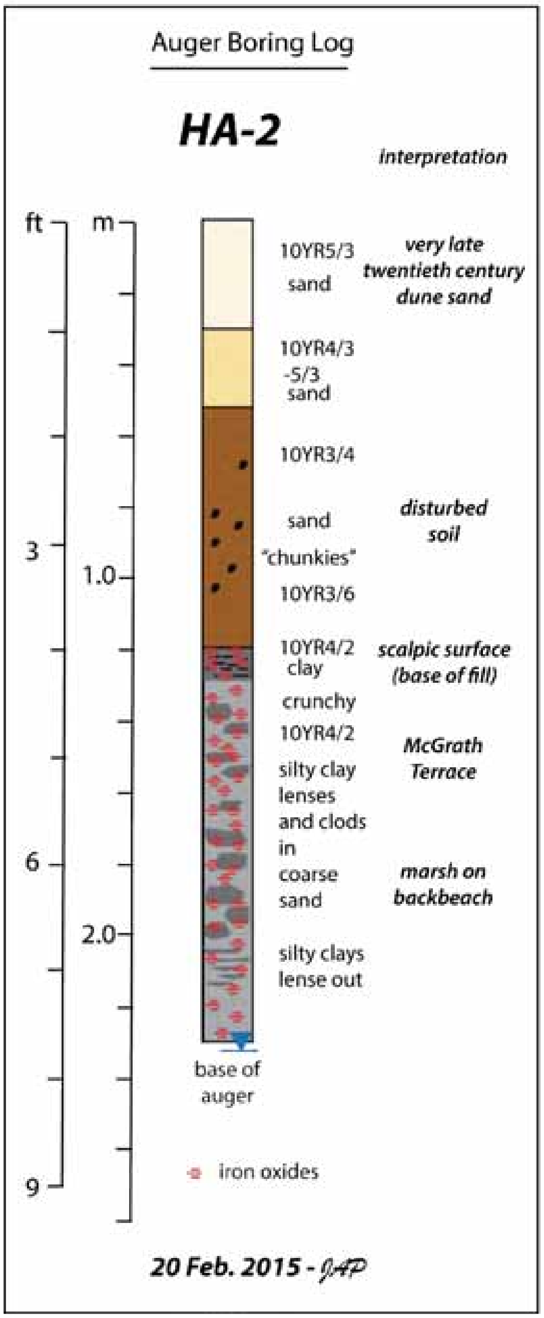


photo view towards southeast

GPS Location: 34° 13′ 20″ N 119° 15′ 27″ W

elevation: 14 feet

Setting: southern section of project area on McGrath Terrace east side; surface covered by dune sand and slopes gently to west; near suspected pipe corridor.

Description: auger penetrated 25 cm (10 in) of dune sand overlying disturbed soil about 1m (3 ft) containing small "chunkies" (5 cm/0.25 in) with a scalpic surface at 1.15 m (3.75 ft) depth overlying intact dark grayish brown sand and lenses or thin layers of silty clay; silty clays lense out below 2.20 m (7.25 ft) depth; intact soil contains iron oxides.

Interpretation: 1.15 m (3.75 ft) thick very recent sands and twentieth century disturbed soils overlying marshy and sandy sediments of the McGrath Terrace.

B-3: Auger Boring Log for Auger HA-2

Cultural Resources Investigation
McGrath Campground Auger Program

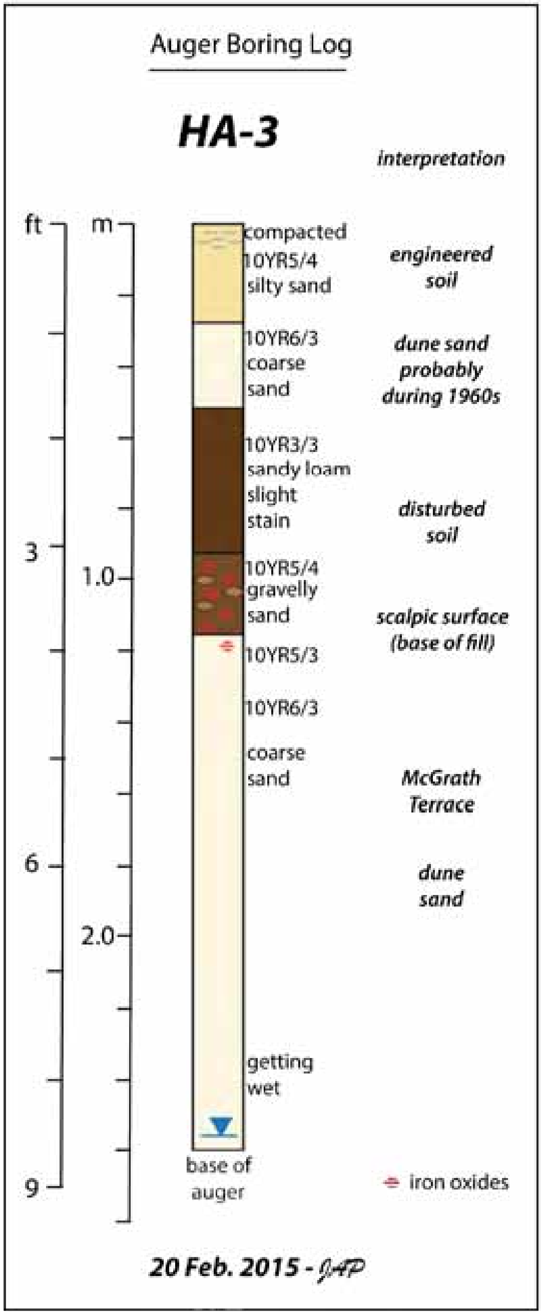


photo view towards north

GPS Location: 34° 13′ 19″ N 119° 15′ 32″ W

estimated elevation: 15 feet

Setting: southern section of project area on McGrath Terrace westside; surface is an old flat graded surface from the former oil field.

Description: auger penetrated 1.15 m (3.75 ft) of disturbed soil before penetrating into intact dune sand of the McGrath Terrace.

Interpretation: 1.15 m (3.75 ft) thick twentieth century disturbed soils overlying sandy sediments of the McGrath Terrace.

B-4: Auger Boring Log for Auger HA-3

Cultural Resources Investigation
McGrath Campground Auger Program

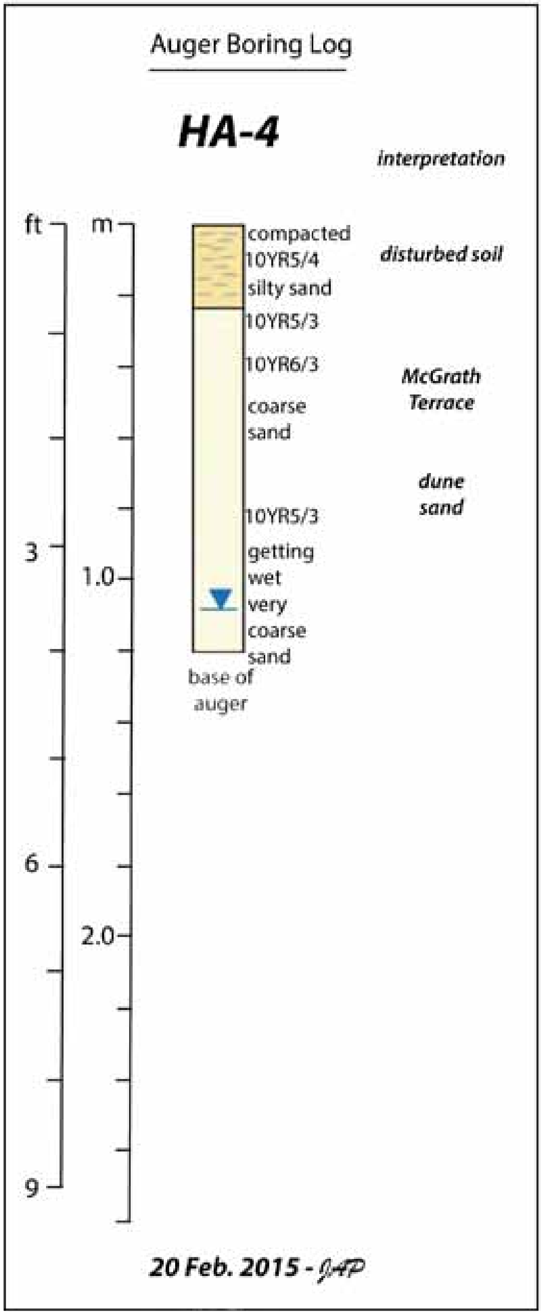


photo view towards west

GPS Location: 34° 13′ 26″ N 119° 15′ 32″ W

estimated elevation: 12 feet

Setting: central section of project area on McGrath Terrace central-west side; sandy surface with low vegetation.

Description: after penetrating 25 cm (10 in) through disturbed soil auger continued into intact pale brown dune sand of the McGrath Terrace. Perched water table at about 1.20 m (4 ft) below surface and saturated sands prevented further penetration.

Interpretation: 1.19 m (3.67 ft) thick twentieth sandy sediments of the McGrath Terrace.

B-5: Auger Boring Log for Auger HA-4

Cultural Resources Investigation
McGrath Campground Auger Program

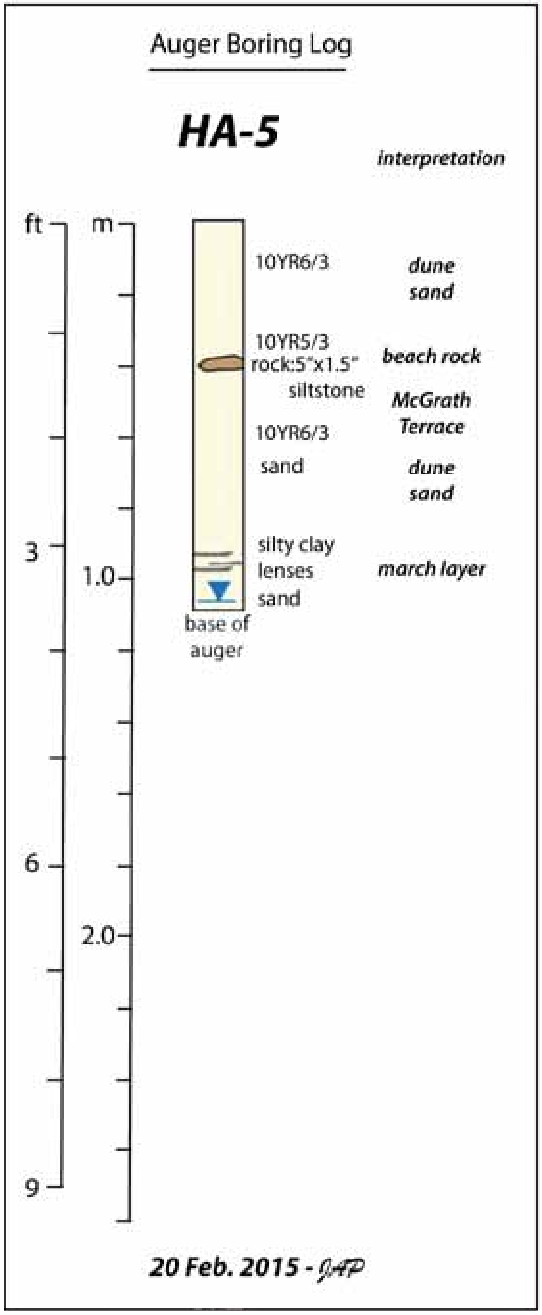


photo view towards north

GPS Location: 34° 13′ 26″ N 119° 15′ 31″ W

estimated elevation: 12 feet

Setting: central section of project area on McGrath Terrace ; sandy surface with low vegetation.

Description: auger penetrated about 1.10 m (3.67 ft) of dune sand of the McGrath Terrace. A rock about 40 cm (16 in) depth has the shape of beachrock. At 95-100 cm (3.0-3.25 ft) depth are some thin dark grayish brown silty clay lenses. Pershed water table and saturated sand prevented penetration beyond 1.10 cm (3.67 ft) depth.

Interpretation: 1.19 m (3.67 ft) thick sandy sediments of the McGrath Terrace.. Beachrock may indicate a period of wave erosion. Silty clay lenses at 95-100 cm (3.0-3.25 ft) are thin marsh sediment.

B-6: Auger Boring Log for Auger HA-5

Cultural Resources Investigation
McGrath Campground Auger Program

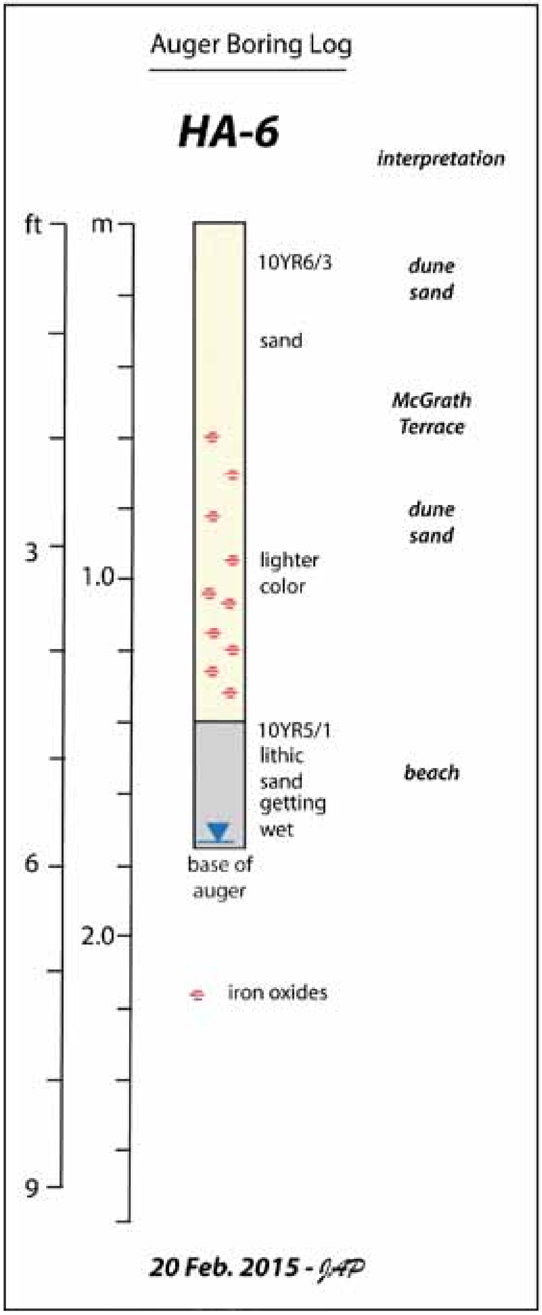


photo view towards south

GPS Location: 34° 13′ 27″ N 119° 15′ 28″ W

estimated elevation: 12 feet

Setting: central section of project area on McGrath Terrace east side; sandy surface with low vegetation; most dune sand originally overlying terrace has been graded away.

Description: auger penetrated about 1.40 m (4.55 ft) of pale brown dune sand of the McGrath Terrace. and then encountered a gray lithic sand (sand contains high proportion of dark colored mafic lithic grains).

Interpretation: 1.40 m (4.55 ft) thick sandy sediments of the McGrath Terrace. Lithic sand below 1.40 m (4.55 ft) depth is an ancient beach.

B-7: Auger Boring Log for Auger HA-6

Cultural Resources Investigation
McGrath Campground Auger Program

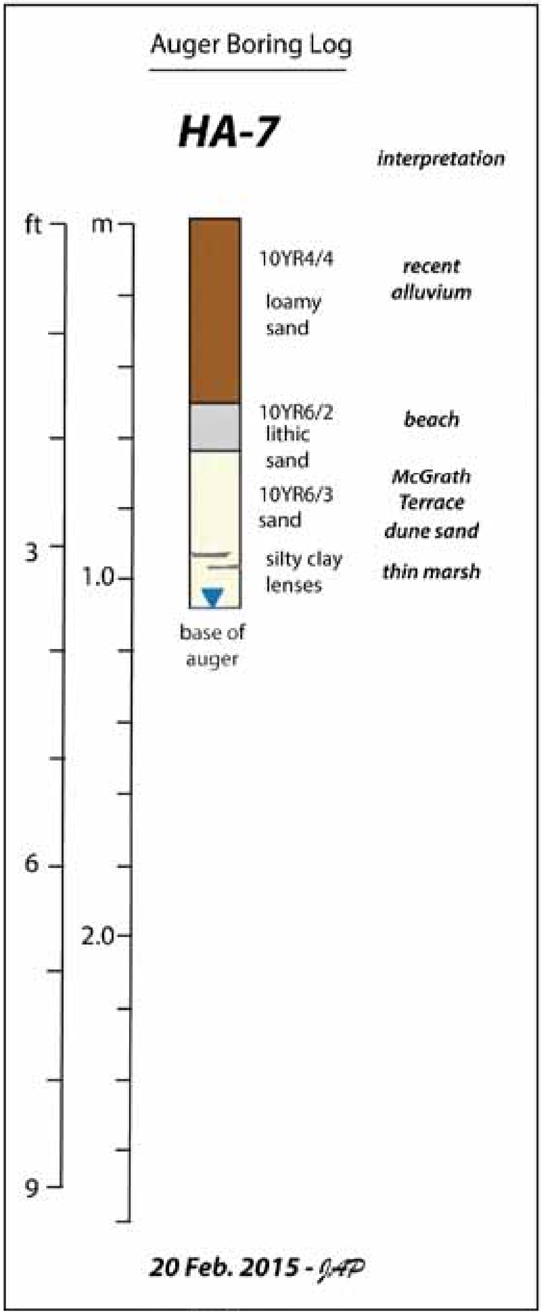


photo view towards northeast

GPS Location: 34° 13′ 30″ N 119° 15′ 32″ W

estimated elevation: 12 feet

Setting: northern section of project area at locality of proposed Chumash House; along 1920-1938 riverbank.

Description: auger penetrated about 50 cm (1.67 ft) of dark yellowish brown alluvium and a 20 cm thick (8 in) thick light brownish gray lithic sand, before continuing into sandy sediments of the McGrath Terrace. At 95-100 cm (3,0-3,25 ft) are some thin dark grrayish brown silty clay lenses. Perched water table and saturated sand prevented further penetration.

Interpretation: 50 cm (1.67 ft) thick alluvium and a 20 cm (8 in) thick beach deposit pverly sandy sediments of the McGrath Terrace.. Silty clay lenses at 85-100 cm (3.0-3.25 ft) depth are thin marsh deposits.

B-8: Auger Boring Log for Auger HA-7

Cultural Resources Investigation
McGrath Campground Auger Program

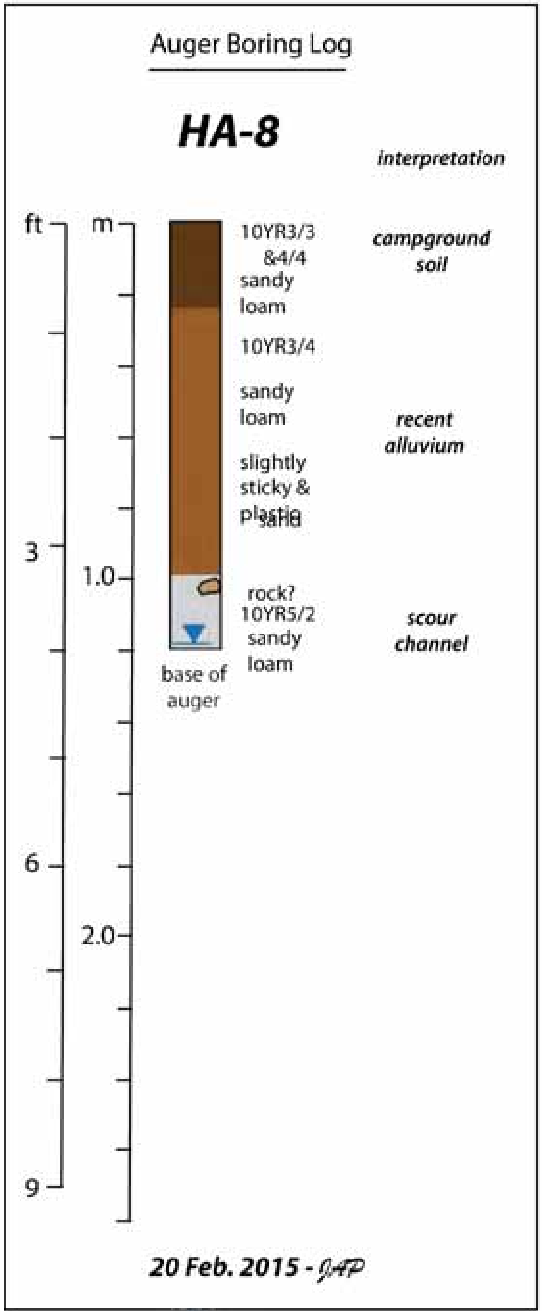


photo view towards east

GPS Location: 34° 13′ 33″ N 119° 15′ 27″ W

estimated elevation: 13 feet

Setting: northern section of project area and inside the Camp 1-10 circle. Graded area.

Description: auger penetrated about 1 m (3.0 ft) of dark brown sandy loam alluvium and a 20 cm thick (8 in) grayish brown sandy loam alluvium. Perched water table and saturated sand prevented further penetration.

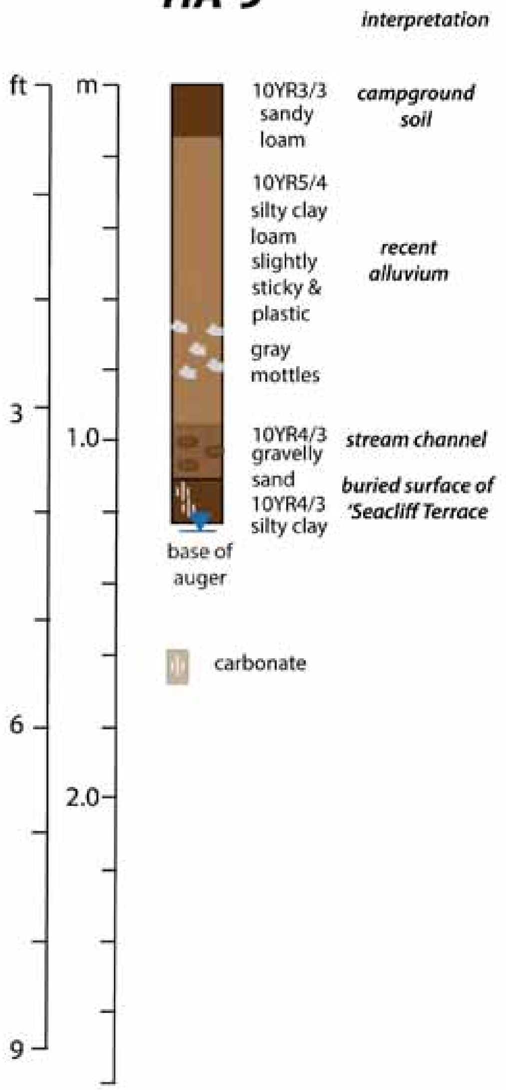
Interpretation: 1 m (3.0 ft) of recent stream alluvium overlies 20 cm thick (8 in) reent alluvium filling a scour channel.

B-9: Auger Boring Log for Auger HA-8

Cultural Resources Investigation
McGrath Campground Auger Program

Auger Boring Log

HA-9



20 Feb. 2015 - JAP

photo view towards west

GPS Location: 34° 14′ 07″ N 119° 15′ 26″ W

estimated elevation: 12 feet

Setting: northern section of project area and iadjacent Camp 78. Graded area. Low yet lush vegetation.

Description: auger penetrated about 15 cm (6 in) of dark brown sandy loam underlying graded area before continuing through about 80 cm (2.67 ft) of dark yellowixh brown silty clay loam contsining some grayish mottles (7at 0-80 cm [2.3-2.6 ft depth), and some gravelly sand before encountering the top of a brown silty clay with carbonate in its upper 10 cm.

Interpretation: 1 m (3.0 ft) of recent stream alluvium overlies 20 cm thick (8 in) reent gravelly channel deposit, and then the buried surface of the Seaclliff Terrace.

B-10: Auger Boring Log for Auger HA-9

Cultural Resources Investigation
McGrath Campground Auger Program

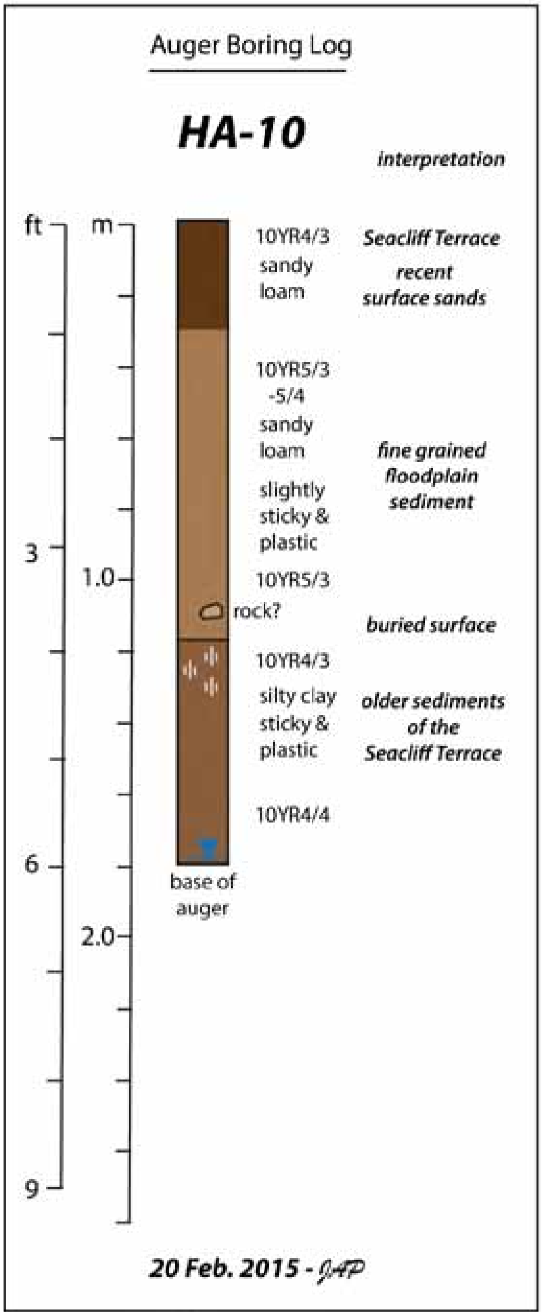


photo view towards east, Harbor Blvd in background

GPS Location: 34° 13′ 26″ N 119° 15′ 21″ W

estimated elevation: 12 feet

Setting: central section of project area near Harbor Boulevard on Seacliff Terrace; clearing in wooded area.

Description: auger penetrated a 30 cm (1.0 ft) thick brown sandy loam overlying a 90 cm (3.0 ft) thick brown to yellowish brown sandy loam, before encountering a dark brown silty clay with a zone at the top about 10-15 cm (4-6 in) thick of carbonate.

Interpretation: 1.20 m (4.0 ft) thick recent floodplain alluvium buried surface and older sediments of the Seaclliff Terrace.

B-11: Auger Boring Log for Auger HA-10

Cultural Resources Investigation
McGrath Campground Auger Program

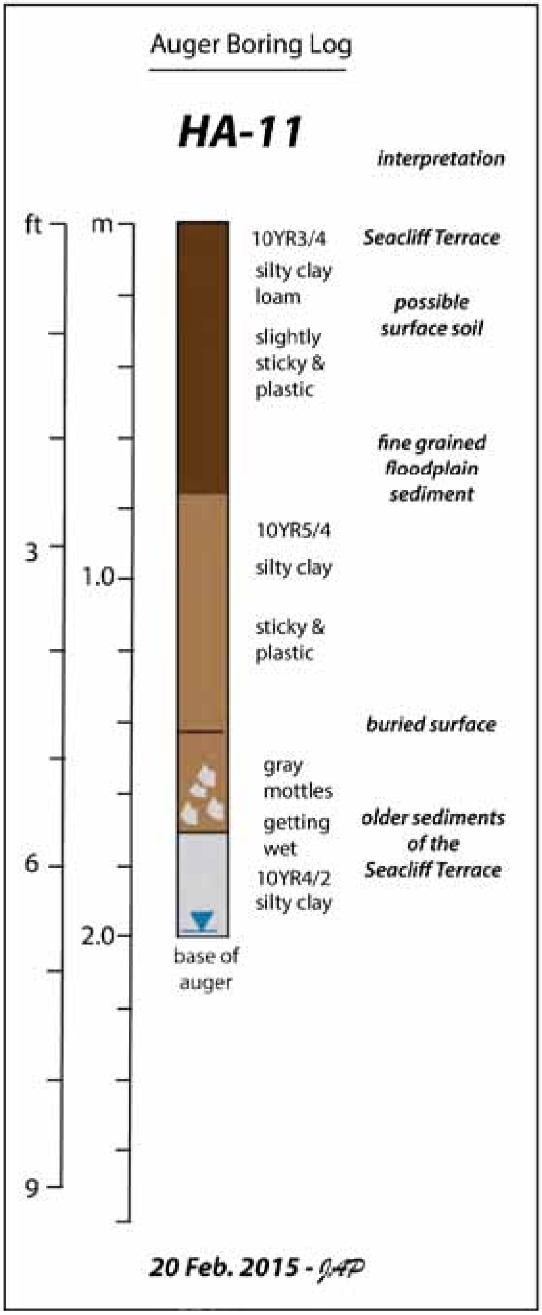


photo view towards east, Harbor Blvd in background

GPS Location: 34° 13' 20"N 119° 15' 21"W

estimated elevation: 13 feet

Setting: southern section of project area near Harbor Boulevard on Seacliff Terrace; clearing in wooded area.

Description: auger penetrated a 75 cm (2.5 ft) thick dark yellowish brown silty clay loam overlying a 65 cm (2.0 ft) thick yellowish brown silty clay, before encountering a mottled zone and a dark grayish brown heavy silty clay.

Interpretation: 1.40 m (4.6 ft) thick recent floodplain alluvium with a buried surface at 1.4 m (4.6 ft) depth and older sediments of the Seacliff Terrace.

B-12: Auger Boring Log for Auger HA-11

END OF AUGER BORING LOG

Appendix 3

McGrath State Beach, California State Parks

February 18 & 19, 2015

Report Prepared for:
Chester King
Topanga Anthropological Consultants

Institute for Canine Forensics
P.O. Box 620699
Woodside, CA 94062
www.K9Forensics.org

This report contains confidential archaeological information about the location of human burials, it should not be provided to third parties without the permission of the Institute for Canine Forensics.

Table of Contents

Executive Summary
Introduction
The Institute for Canine Forensics (ICF) is a 501(c)(3) non-profit corporation established in 1998. The ICF is dedicated to training and certifying Historical Human Remains Detection (HHRD) dogs. HHRD dogs have unique and specialized training to teach them to locate, and alert on, the scent of human remains in an archaeological context. Our dogs provide a non-invasive layering "tool" to assist in the location of historic and prehistoric burial sites.

Over the years the ICF has contracted with many federal, state and local agencies and cultural resource management firms to provide them with non-invasive assistance in locating historic and prehistoric human remains, both inhumations and cremations. Some of our clients include:

- US Army Corps of Engineers, Engineering Research Development Center, Construction Engineering Research Laboratory. Worked with author Carey Baxter, Archaeologist, on a study to Determine the Effectiveness of Historic Human Remains Detection Dogs – her paper is to be published in 2015
- US Army – Hawai'i, Schofield Barracks, Dr. Laurie Lucking, Cultural Resources Mgr.: ICF participated in a JPAC-sponsored study in Hawai'i where our dogs correctly identified a site where known ancient Hawaiian burials had been discovered during construction many years ago. Still awaiting the paper.
- Plumas National Forest, Feather River Ranger District
- US Army Corps Research Lab / Ft. Leavenworth KS
- US Department of Veterans Affairs, Palo Alto Health Systems
- Bureau of Land Management
- University of California San Diego, Lynn H. Gamble, Ph.D.
  CA-SDI-860 - Dr. Gamble tested the ICF canines on a known (cremated remains) cemetery that had been excavated in 1966 by Delbert True. The handlers were unaware of the location of the cemetery. Dr. Gamble states that the ICF canines were "highly successful in the identification of the cemetery area …"
- California State Parks: Bodie, where graves found by the dogs were corroborated by park rangers; North Coast Redwoods; Central Valley; and, Jedediah Smith, where the dogs located and alerted on a Native American burial known only to park management.
- California Department of Transportation (CalTrans), Districts 1, 9 and others
- PAR Environmental Services, Inc., Sacramento, CA
- ASM Affiliates, Carlsbad, CA
- For a more in-depth list of our clients, please see Addendum B

In addition, some of our handlers work as a resource to the Santa Clara County CA Office of the Sheriff, and other law enforcement agencies in the State of California, on cold cases involving locating the remains of suspected murder victims. Notable is the Shermantine-Herzog case in 2012 where our handlers located the remains of two murder victims, 15 years after their death.

Summary of our Findings

ICF surveyed the areas shown on the map below using our historical human remains detection dogs looking for possible Native burials. Although most of the areas were flat or had small dunes, most of the areas had very thick foliage or dense ground cover. This along with shifting sands can make for difficult search conditions as burials can get buried deeper and/or become exposed or scattered. We had very good weather conditions for our dogs, but we gave very low rating of the percent of terrain accessible to the dog in each area (see individual search areas for details). Dogs are most likely to detect old burials if they can physically cover the area by placing their nose close to the surface of the ground.

Each search area was covered by at least 2 dog teams, except for areas A, B1 west side, B2 northwest side and C1. Each area was searched at different time of the day and with a search strategy based on the current conditions and the search style of the dog. There was only one location where one dog gave an alert and that the handler gave a it 3 rating (scent pool). No other alerts or areas of interest were detected by our dogs.

Conclusion

Using trained dogs that specialize in the location of old burials adds a unique layer of detection that can be used, combined with other techniques, to determine if burials are present. Our dogs did not detect any human remains at this location. There is always the possibility that burials could be in locations the dogs did not have access to or had gotten too deep in shifting sands for detection.

Project Information

Date	February 18 & 19, 2015
Project Name	McGrath State Beach
Client	Chester King Topanga Anthropological Consultants P.O. box 826 Topanga, CA 90290
Other Agencies or Interested Parties:	Jason A. Weiner General Counsel, Water Initiative Director Wishtoyo Foundation 3875-A Telegraph Road, #423 Ventura, CA 93003 Office: (805) 658-1120 Cell: (805) 823-3301 Fax: (805) 258- 5107 jweiner.venturacoastkeeper@wishtoyo.org www.wishtoyo.org Mati Waiya Executive Director Wishtoyo Chumash Village 33904 Pacific Coast Highway Malibu, CA 90265 Office: 424.644.0088 Cell: 805.794.1248 matiwaiya@wishtoyo.org www.wishtoyo.org Nathaniel Cox Senior Environmental Scientist Channel Coast District 911 San Pedro Street Ventura, CA 93001 805-648-8194 Nat.Cox@parks.ca.gov Jeff A Parsons Geoarchaeology geoarch@hughes.net 805-237-9002 8248 Plane View Place Paso Robles, CA 53446

	Alexis Frangis Environmental Scientist afrangis@parks.ca.gov Work: 805-585-1582 Cell: 805-207-9469 911 San Pedro Street Ventura, CA 93001	
ICF Personnel Responding	Name	Assignment
	Adela Morris & Jasper	Dog handler, Project Manager
	Lynne Engelbert & Piper	Dog handler
	Lynne Angeloro & Berkeley	Dog handler
	Barbara Pence	Field Coordinator
Pertinent History	The McGrath beach campgrounds have been closed for several years as the area keeps getting flooded. The proposed plan is to move the campgrounds to area C on our map and to return the old campground to a natural state. There are no known village sites or native burials in the area. A survey is being done to make sure there are no cultural areas or burials in the proposed campground area.	
Handler ID	Alert waypoints are given using the handler initials and their waypoint number. Search boundaries waypoints use the letters of the search area. AM = Adela Morris LE = Lynne Engelbert LA = Lynne Angeloro	

Weather	Weather on 2/19/15 was overcast in the morning turning to sunny by early afternoon. Air temperature ranged from 59°F to 68°F. Ground temperature ranged from 64°F to 84°F. Wind ranged from 0-2 from the NW in the morning to 3-6 from the NW. On 2/20/15 the morning was overcast turning to sunny in the early afternoon. Air temperature ranged from 62°F to 70°F. Ground temperature ranged from 64°F to 89°F. Wind was 2-5 from the NE.

General Information:

The following information is important to the individuals reading this report. For more detailed information, please refer to **Addendum A**, at the end of this document, which details the **ICF Practices and Procedures**. These Practices and Procedures address the following subjects in more detail:

- General information About the Dogs
- Search Strategy
- Percent of Accessible Terrain
- Alert Quality Key
- Dog Working Conditions
- Dog Training And Certification
- Scent Travel
- Reports

Percentage of Terrain Accessible to the Dogs

While reading this report it is important to remember the following:

- The percent of terrain accessible to the dogs is different at each site.
- The percent of terrain accessible affects the amount of area that can be covered by the dogs.

Alerts

Our dogs are specifically trained to detect the scent of human remains. Once they have detected the scent of human remains, they are taught to give a trained "**alert**". The alert is either a sit or down at the strongest source of the scent they have located. For more detailed information on alerts, see Addendum A.

Alert Quality Key

The handlers use a 1-3 designation to rate the alerts the dogs give at each at location. This is based on each handler's experience and their dog's behavior when they work burials and perform their trained alerts. For more detailed information on alerts, see Addendum A.

1. **Strongly Committed**: The dog immediately identifies and alerts at a specific location.
2. **Committed**: The dog took time to locate and alert at the strongest source of scent.
3. **Scent Pool**: The dogs are getting scent but are unable to locate the exact source. Scent pools may be the result of disturbed, scattered or fragmentary remains; or, they may be created by wind and/or moving water. It could be scent remaining in the soil where a

burial was located but where physical remains are no longer identifiable.

Recording Alerts

Once a dog alerts to the scent of human remains, the handler uses a pin flag to mark the location and a GPS position is taken. Each handler uses a distinctive flag color (see table below for this project). We flag the dogs' alerts so the client can use a more accurate measuring device to get coordinates of the alerts should they so choose. Alert waypoints are given using the handler initials and their GPS waypoint number. Search areas or perimeter boundary waypoints use the letters and waypoint number of the GPS that took them.

Handler ID & Flag colors	AM = Adela Morris / Jasper, blue flags LE = Lynne Engelbert / Piper, florescent green flags LA = Lynne Angeloro / Berkeley, florescent orange flags

We use the Garmin 60CSx GPS, which gives us approximately 3-9 meter accuracy in optimal conditions. We use the standard WGS 84 geodetic datum settings on our GPSs, we use UTM unless the client has another preference.

Search Strategy

The various search modes used in this project are:

- Free
- Hasty
- Detailed Search
- Fine Grid

See Addendum A for more detailed information

Search Areas: A

Vegetation & Description	Area A consisted of multiple residences and outbuildings that were accessible via an asphalt road. The parking areas were asphalt and/or gravel. One residence was enclosed in a six-foot wood fence. There was a fenced storage yard that was locked. The areas inside the fences were not searched. On the road before the residences there was a trailer / motorhome dump station loop with two stalls. In the middle of the loop was a green grass lawn. Due to thick, impenetrable vegetation similar to area C1, searching was limited to areas next to asphalt road/parking areas, the dump loop and areas around the unfenced residences. The asphalt was not searched.
Percent of terrain accessible to the dog	We estimate this search area was between 40% to 50% accessible to the dogs. 
Search Strategy	Free search of accessible areas. GPS tracks in orange.

Search Areas: B - 1

Vegetation & Description	The North camping areas were bordered by the flooded areas. Camping spots numbered from 117-174. Myoporum shrubs and small trees (invasive imported plant), ice plant and crab grass, as well as other invasive plants have taken over much of the landscape. Native pickle weed covers much of the ground. There were paved roads and hard packed gravel areas.
Percent of terrain accessible to the dog **Jasper searching in B-1**	We estimate this search area was between 50% to 60% accessible to the dogs. 

Lynne E. and Piper	
Search Strategy	Dog handlers used a free search trying to cover areas that were accessible to the dogs. Flooded areas, paved roads and packed gravel roads and areas where vegetation was too thick to penetrate were not searched. Please see Addendum A for the full description of Search Strategies.

Search Areas: B-2

Vegetation & Description	The center camping areas was bordered by B-1 and B-3. Camping spots numbered from 59 - 116 Myoporum shrubs and small trees (invasive imported plant), ice plant and crab grass, as well as other invasive plants have taken over much of the landscape. Native pickle weed covers much of the ground. There were paved roads and hard packed gravel areas.
Percent of terrain accessible to the dog	We estimate this search area was between 50% to 60% accessible to the dogs.
Search Strategy	Dog handlers used a free search trying to cover areas that were accessible to

	the dogs. Flooded areas, paved roads and packed gravel roads and areas where vegetation was too thick to penetrate were not searched. Please see Addendum A for the full description of Search Strategies.

Search Areas: B- 3

Vegetation & Description	The North camping areas were bordered by flooded areas. Camping spots numbered from 1-58 Myoporum shrubs and small trees (invasive imported plant), ice plant and crab grass, as well as other invasive plants have taken over much of the landscape. Native pickle weed covers much of the ground. There were paved roads and hard packed gravel areas.
Percent of terrain accessible to the dog	We estimate this search area was between 50% to 60% accessible to the dogs. 
Search Strategy	Dog handlers used a free search trying to cover areas that were accessible to the dogs. Flooded areas, paved roads and packed gravel roads and areas where vegetation was too thick to penetrate were not searched. Please see Addendum A for the full description of Search Strategies.

Search Areas: C-1

Vegetation & Description	Very dense brush and trees mostly invasive specieas, tamarix , Cotton wood, poison oak, coyote brush and ice plant. The only accessible areas to search were game paths and old homeless encampments. This area is included in the proposed new camp area.
Percent of terrain accessible to the dog **Jasper on the boundary of C-1 and C-2**	We estimate this search area was between .5% to 5% accessible to the dogs. This area was only covered by a single team due to impeneratable vegetation and dense poison oak. 
Search Strategy	Dog handlers used a perimeter and grid search of this area. Please see Addendum A for the full description of Search Strategies.

Search Area: C-2

Vegetation & Description	Sand dunes mostly covered with ice plant and some areas very thick ice plant, prickly pear, cholla cactus and coyote brush This area is included in the proposed new camp area.

Percent of terrain accessible to the dog **Jasper searching in C-2**	We estimate this search area was between 30% and 60% accessible to the dogs. 
Search Strategy	Dog handlers used a perimeter and grid search of this area. Please see Addendum A for the full description of Search Strategies.

Search Area: C-3

Vegetation & Description	Sand dunes mostly covered with ice plant and some areas very thick ice plant, prickly pear, cholla cactusand coyote brush. This area is included in the proposed new camp area.
Percent of terrain accessible to the dog **Lynne A. and Berkeley in area C-3**	We estimate this search area was between 50% and 75% accessible to the dogs.

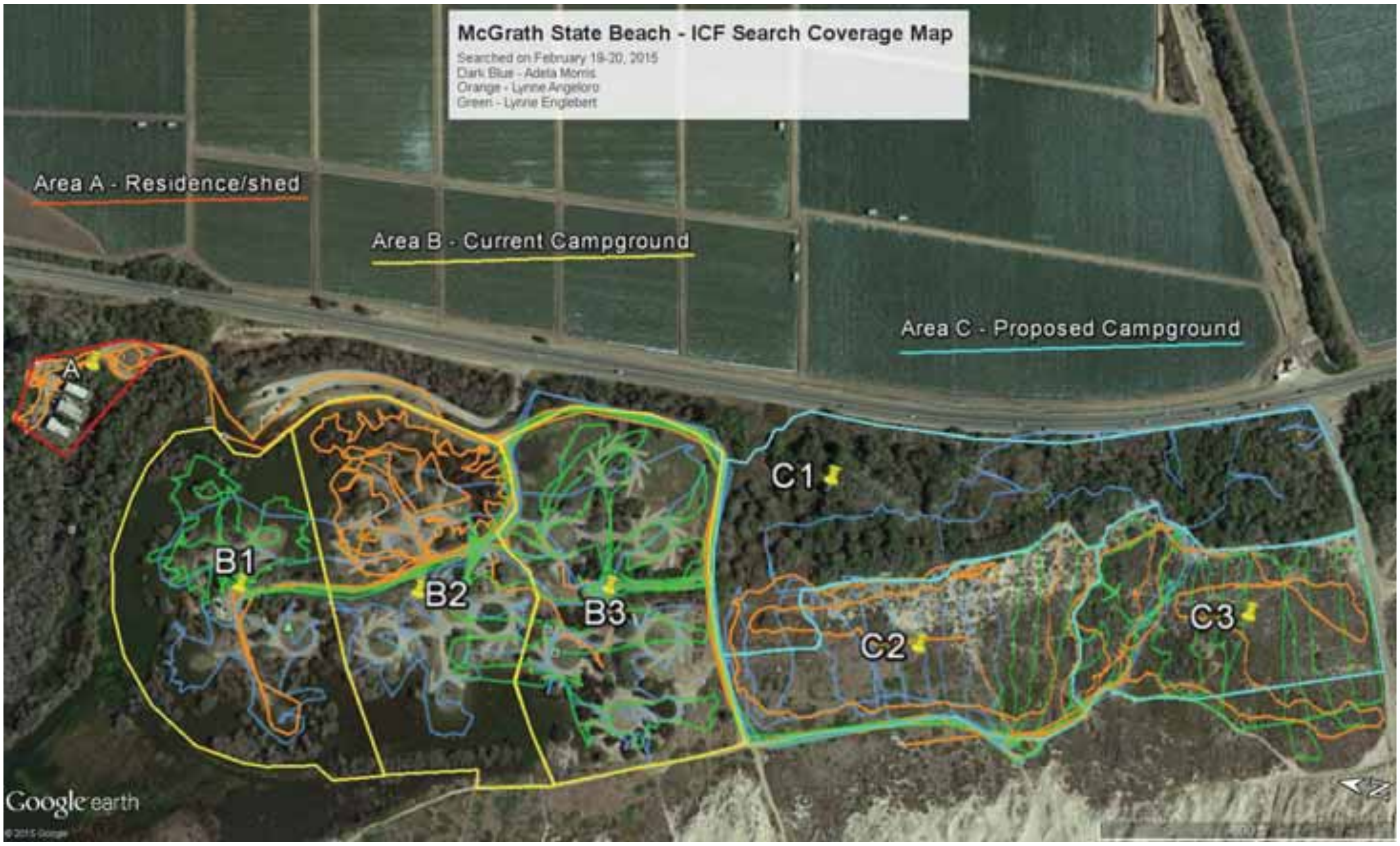
	
Search Strategy	Dog handlers used a perimeter and grid search of this area. Please see Addendum A for the full description of Search Strategies.

Handler/Dog	Way-point #	GPS Coordinates, UTM	Alert Quality	Comments
LA &Berkeley	LA001	11S 292133 3789069	3	Scent pool, scattered type of alert where the dog has a difficult time pinpointing one location.

Coverage Map

The map below show the GPS tracks for each handler. It should be noted that the tracks are made by the handler and the actual coverage by the dog is much larger as the dog ranges while searching.
Blue = Adela
Orange = Lynne A
Green = Lynne E

Client Report continued



Handler Biographies

Adela Morris	**Historical Human Remains Detection Specialist** **Instructor: Human Remains Detection** Adela has been involved in human remains detection with her dogs since 1986 and has deployed her dogs on hundreds of searches specializing on cold cases, crime scenes and historical burials. She is the founder of the Institute for Canine Forensics, a nonprofit organization for the advancement of research and education for the use of canines in the gathering of forensic evidence. Adela is also the founder of the Canine Specialized Search Team, a volunteer resource for Santa Clara County Sheriff's Office. Adela is an evaluator and instructor for Human Remains Detection, Canine Decontamination and Canine First Aid. She has served as an expert witness. Jasper is her 6th certified detection dog. **Canine:** Rhea **Historical Human Remains Detection Dog** **DOB**: September 6, 2003 **Breed**: Border Collie, Red and White **Certifications**: Historical Human Remains Detection; re-certified every year since initial certification in 2004 California State Cadaver: Initial certification in 2007, currently retired **Canine:** Jasper **Historical Human Remains Detection Dog** **DOB**: January 1, 2011 **Breed**: Border Collie, Tri Blue Merle **Certification:** Historical Human Remains Detection; re-certified every year since initial certification in 2012

Client Report continued

Lynne Angeloro	**Historical Human Remains Detection Specialist** Lynne and her canine partner Berkeley are working certified with the Institute for Canine Forensics. She has been a member of ICF since June 2008. She has been certified with three dogs in that time and has raised and trained Berkeley in HHRD for ICF. Lynne is an evaluator for Historical Human Remains Detection, and is the Vice President of ICF. **Canine:** Berkeley **Historic Human Remains Detection Dog** **DOB:** October 2, 2009 **Breed:** Border Collie, Red & White **Certification:** Historical Human Remains Detection; re-certified every year since initial certification in 2011

Lynne Engelbert	**Historical Human Remains Detection Specialist** **Instructor: Human Remains Detection, Disaster Search** Lynne has over 20 years of detection dog training and handling experience and is a member of the Institute for Canine Forensics. Lynne and Piper, her young border collie, are certified as a Historical Human Remains Detection team. Lynne serves as an evaluator for Human Remains, Historical Human Remains Detection and FEMA disaster search dogs. Lynne and her former search partner Lucy (1991-2006) became a CA OES certified Cadaver Team in January 1999 with several major finds in their career. She is also a certified Canine Search Specialist with the FEMA and CalEMA with her disaster search dog, Sweep. Lynne is an instructor for Human Remains Detection, disaster search and canine decontamination. She also works with local and federal law enforcement agencies in doing maintenance training with narcotics, explosives and arson detection dogs. **Canine:** Piper **Historical Human Remains Detection Dog** **DOB:** April 15, 2010 **Breed:** Border Collie, Black & White **Certifications:** Historical Human Remains Detection; recertified every year since initial certification in 2012

Client Report continued

Barbara Pence	**Historical Human Remains Detection Specialist** Barbara has been involved with Human Remains Detection Dogs since 2011. Prior to that, she was a certified Project Manager at IBM for 13 years then returned to school at the University of Art where she earned her BFA in 2008. Since graduating, Barbara has divided her time between making art and training her dog. Barbara has served as the field coordinator and project manager on multple ICF projects. She is also in the process of certifying with Eros who has been a certified HHRD dog with another handler for several years. **Canine:** Bailey **Historical Human Remains Detection Dog** **DOB:** January 22, 2009 **Breed:** Yellow Labrador retriever **Certification:** Historical Human Remains Detection: 2013 **Canine:** Eros **DOB:** March 26, 2007 **Breed:** Border Collie, Tri Red and White **Certification:** Eros has been previously certified in historic Human Remains Detection with another handler. He is now going through the process of certification with Barbara.

Addendum A

Using Historical Human Remains Detection Dogs
Practices and Procedures

The Institute for Canine Forensics (ICF) is a 501(c)(3) non-profit corporation established in 1998. ICF is the only group in the world dedicated to training and certifying Historical Human Remains Detection (HHRD) dogs. HHRD dogs have unique and specialized training to teach them to locate historic and prehistoric human remains. We work closely with archaeologists and anthropologists to ensure our training and methods are consistent with current standards of practice. This document describes some basic requirements clients need to know to ensure their project would be enhanced by using HHRD dogs. For more information on the Institute for Canine Forensics, including articles, advisory board, past projects and testimonials you can go to our web page at: www.K9Forensic.org or www.HHRDD.org.

This document will address the following subjects:
- General information about the dogs
- Search strategy
- Alert Quality Key
- Dog working conditions
- Dog training and certification
- Scent travel
- Percentage of Accessible Terrain
- Reports provided

General Information about the Dogs

Each handler owns their own dog and is responsible for their dog’s training, health and wellbeing. Along with scent training, the dogs are taught obedience and socialized to other animals and humans. Most of our dogs have flown all over the country and, in some cases, internationally. They fly in-cabin with us under the umbrella of service and working dogs. We use a variety of dogs, but all are working breeds, usually from working lines. Typical breeds we use include Labradors, German Shepherds, Australian Shepherds, Border Collies, Golden Retrievers, as well as some mixed breeds.

Our dogs are trained to perform an alert when they detect the scent of human remains. The alert is either a sit or down at the strongest source of the scent they have located. At times it is not physically possible to alert near the source due to vegetation or other obstacles, so the dog tries to communicate that they have scent but are unable to get to the source. Since the dogs can only communicate in limited ways, the handler must interpret their actions. We do this by observing the dog's actions and comparing it to past experiences working known graves or human bones. For example, when we observe the dogs with their heads up, sampling the air after we ask them to indicate the location, we interpret this action as the scent being airborne and an exact location cannot be pinpointed. Dogs have varying abilities and scent thresholds.

Search Strategy

Archaeologists use a wide range of multidisciplinary techniques to locate historic and prehistoric sites. Many times they combine techniques such as oral history, historical records, remote sensing like metal detectors and GPR and physical remains to help locate sites. Historical Human Remains Detection dogs are another type of remote sensing. Their unique ability to detect and recognize the scent of human remains makes them a tool that can aid archaeologists as well as a tool to combine with other more traditional techniques. Using scientific methodologies archaeologists can build predictive models to help determine the possibilities for unknown burials in a given location. HHRD dogs can be used to add layers to a predictive model.

Each project is unique, as is each search area. An initial strategy is defined based on information given to us by the client during the negotiation phase. This is re-evaluated once we arrive at the search site and may be adjusted to fit current conditions. The terrain, weather and amount of time we have to search the designated areas dictate the search mode we will use.

These search modes are:

- **Free:** This style of search lets the dog choose the area it wants to search and is not as controlled as a grid search. It can be useful when speed is needed but it is more difficult to keep track of the areas the dog has searched. The benefit of this search mode is if the dog has scent they will gravitate to that location and work it first.
- **Hasty:** A hasty search entails a quick search that covers a larger area in a faster time. This usually means larger grid spacing and less coverage of a search area.
- **Detailed Search:** A detailed search will cover a search area with a finer grid. The dog usually stays closer to the handler and works more slowly. This search pattern is designed to find single human burials. A typical grid pattern would be about 3 meters. We will often use this type of search in cemeteries to locate multiple burials. A Detailed Search should cover about 2 acres per hour.
- **Fine Grid Search:** A fine grid search is used to search for single bones and teeth. It typically uses a grid of about 1 meter and often is searched with a cross-grid to get better coverage and probability of detection. The dog can easily miss these weak scent sources; the miss can be caused by as simple a thing as breathing out when they pass over the scent source. We use multiple passes over the grid pattern to improve the probability that the dog will get the scent on one of the passes. This type of search is used in the dog's certification exam in which they have to find both single old bones and teeth. We do not use it very often in the field because we are usually not asked to search for individual

bones and teeth. A Find Grid Search covers about ¼ acre per hour. It is tiring on the dog and they usually need a rest break after covering their ¼ acre.

The search location is broken down into multiple, manageable areas. GPS coordinates are taken of the boundaries and handlers are assigned to each area.

Each area is usually searched by at least 2 dogs in order to get the best coverage. When possible, we use different colored flags for each dog and mark each flag with the team's identification, waypoint number and other important information. Single-flagged alerts are given the same creditability as multiple-flagged alerts.

Each area is usually searched by at least 2 dogs in order to get the best coverage. The dogs work at different times during the day with different weather conditions and for varying lengths of time. Each handler chooses the best search strategy based on the weather conditions, terrain and their dog. Typical search patterns include searching boundaries followed by gridding in 2 directions. Grid spacing depends on terrain, soil conditions and what we are looking for. Using multiple dogs to cover an area increases the probability of detection.

Some projects dictate that we use a blind approach where alerts from the dogs are not flagged, only recorded by the initial handler. A second team then works the same area without knowing what the previous team has done. A monitor may observe each team to make sure any areas in question are searched. This strategy is used when more scientific information is desired.

Some projects have time constraints where we need to find potential burials quickly and do not have a need for a blind study. The first team searching the area will flag any alerts and record GPS UTM coordinates.

In past projects, native monitors and/or archeologists have located areas they deem significant due to their knowledge of the terrain, topography, and presence of artifacts or features that were used in historic or prehistoric burial practices. The handler/dogs are given a narrowed down area to search but are not told exactly where these features are. This eliminates the potential to cue or guide the dogs to a specific object or location.

Percent of Accessible Terrain

The percent of accessible terrain is estimated by how much of the search area the dogs can get access to the surface of the ground. Scent can be trapped in plants above the burial. Brush, thick grasses, downed trees, etc. can make it very difficult for the dogs to cover some areas. Dry grasses like foxtails, needle grass, rip gut, wild rye and wild oats can be very dangerous to the dogs as they propagate by seed pods that have one-way barbs. These seeds can attach to the animals fur and can lodge in the dog's nose, eyes, ears or skin, sometimes requiring surgical removal.

Client Report continued

Dense grass above four (4) inches in height can degrade the Probability of Detection (POD) for the dogs. Grass above one (1) foot in height has a significant degradation in POD. The taller grasses, and other groundcover, trap scent in a localized area and the dog must pass directly above that area, with their nose at ground level, in order to catch the scent. It is recommended that tall grass be cut a week before a search. If that isn't possible, a shorter time interval than a week is preferable over searching in tall grass. Ideally it is recommended that the cut grass be removed if it leaves large, thick clumps, which can result in trapping the scent between the clumps and the ground and not allowing it to rise.

It is important to note that there is a difference in the Percent of Accessible Terrain and the amount of area covered by a dog. The area covered is dependent on the terrain, ground and weather conditions, search mode and the amount of time allotted to work an area. The more dogs that are worked in a specific area, the greater the area covered and the higher the Probability of Detection.

Alert Quality Key

The handlers use 1-3 designation to rate the alerts the dogs give at each location. This is based on each handler's experience and their dog's behavior when they work burials and perform their trained alerts.

1. **Strongly Committed**: The dog immediately identifies and alerts at a specific location.
2. **Committed**: The dog took time to locate and alert at the strongest source of scent.
3. **Scent Pool**: The dogs are getting scent but are unable to locate the exact source. Scent pools may be the result of disturbed, scattered or fragmentary remains; or, they may be created by wind and/or moving water. It could be scent remaining in the soil where a burial was located but where physical remains are no longer identifiable.

The alert quality key has been developed over several years by observing the dogs' typical reaction to different kinds of known locations of remains, for example scattered remains from a burial or intact burial at a cemetery. The dog is taught a specific alert / indication when they locate the imprinted scent. They are taught to get as close as they can to the strongest scent. In some cases the strongest scent location may be a crack in the ground or a rodent hole next to the burial. In the case of *scent pools*, there may not be a "source" in the area for the dogs to give a definitive alert on; however, their body language will indicate that they are getting diffused scent in the area.

Multiple flags in close proximity do not necessarily mean more than one grave but most likely are because each dog chooses a different location to alert on at a single grave. Each burial may be anywhere between 3ft to over 5ft in length. Multiple flags in close proximity can also mean the burial has been scattered by ground dwelling rodents, roots, or earth moving equipment.

When a body has decomposed in the ground the “grave soil” contains the scent that the dogs recognize as human remains. Alerts on disturbed, “scattered” burials can be grave soil, or actual remains (bones/teeth).

One of the most difficult sources for the dogs to locate by scent is surface bone in a desert environment where it has been bleached and deteriorated due to sun and other elements. Bone or other human remains (scent) are protected when they are buried in soil. Winter conditions make long term exposed bone somewhat easier to locate as the moisture brings out the scent.

Dog Working Conditions

Our dogs are living creatures and subject to weather, especially heat. Cool, moist conditions are best. The best conditions are not always possible due to the season or location of the project. We have adopted some standard working practices to help ensure the dogs are safe and we get the best possible results. Our dogs are athletes and our training program builds their endurance to extend the duration of time they can work. Each project has its unique set of circumstances.

A basic list of guidelines we subscribe to follows:

- The dogs’ workday varies from 4 to 6 hours per day, depending on weather and conditions. A workday is not the same as “nose time”. Nose time is the amount of time the dog is actively working.
- The dogs can cover anywhere from 2 to 10 acres per workday depending on what they are looking for, the weather, the terrain and the search strategy used.
- Our dogs typically work 3 days on and 1 day off.
- We stop working dogs when the ground temperature reaches 100°F, or the dogs internal body temperature reaches 104°F.
- Weather and ground temperatures play a critical role in the dogs’ ability to locate scent. We monitor ground temperatures as this directly affects the availability of scent. Hot weather conditions, especially ground temperatures 85°F and higher appear to decrease the scent available to the dog.
- In general ground temperatures below 85°F work best for locating burials. The higher the ground temperature, the lower the probability of detection. Ideal ground temperatures are between 40°F and 85°F. The most desirable conditions are mist and light rain. Heavy rain is difficult to work in for both the handler and the dog. Standing water or flooded conditions may make it more difficult to pinpoint a burial as it can block scent or move it around.
- The safety of our dogs always comes first. For example, we do not work deserts at night in the summer due to the presence of rattlesnakes. At some locations we work the dogs on a long line for their safety.
- Each handler has their own personal protection equipment (PPE) including a hard hat, high visibility vest for themselves and a high visibility vest for the dog.

Training and Certification

We start training our dogs as soon as we get them and do not stop until they retire. We meet or exceed best practice standards for similar detection dogs in the industry. Typically, we train detection work 3 days and 1 day of obedience and or drive work per week. Best practice for the industry states that a canine shall complete a minimum of sixteen (16) hours of training per month. Most of our dogs train 40 or more hours a month. We train in all types of weather conditions and terrains, including buildings, urban and wilderness. Although our dogs have no difficulty locating human remains in the stages of decomposition, their training is focused on bones and burials that are no longer in the active stages of decomposing.

Additionally, our dogs are:

- not cross-trained for other scent disciplines
- socialized to many different situations, people and places
- trained to alert as close as possible to the strongest scent available. An alert is either a sit or down at the point of discovery.
- taught to preserve scent sources and are not allowed to dig or mouth potential remains
- routinely train with flags so they learn that flags in their search area are insignificant and do not necessarily relate to an alert by another dog

We track our training sessions in a database that includes nose time, location of trainings, weather, and whether problems were worked blind or known.

To become certified, the dog/handler team must complete pre-certification signoffs of specific criteria and have obtained required search equipment to demonstrate the team is ready for certification. Certification and re-certification tests are set up and run by a team of two pre-approved evaluators, one is from the team and one is an outside evaluator. They have specific criteria they follow when preparing and running a test. The evaluators have a checklist of test scoring criteria that must be met to pass. The certifying team must have an efficacy score between 75% and 100% to pass. Once a team is certified, the team must re-certify every year.

Scent Travel

Human remains scent (vapor) travels away from the decomposing body or skeleton by way of diffusion, or vapor transport. Scent will follow the path of least resistance and can flow by means of water movement, animal or insect activity, and plant or root activity. Burrowing animals, such as rodents, as well as some insects like ants, create channels in the soil that can allow the release of scent to the surface.

Dogs can only detect what is available in the air. Water molecules compete with vapor molecules for binding sites. Water physically displaces odor molecules thus causing human remains scent to appear to be stronger, or pool, at vegetation or moist soil. Humidity is higher in and around photosynthesizing vegetation because it is transpiring. As vegetation transpires, it releases water into the atmosphere and bumps the odor molecules off of whatever they are bound to, making odor in the air more available to a dog's nose.

It is important to note that the dogs do not necessarily alert directly over a burial. Disturbance of the land, be it man-made, rodent and/or insect activity or the natural movement of the earth, including floods or landslides, can spread the scent over the area. The soil in which the body has decomposed retains the human signature that the dogs are trained to recognize and alert on. Disturbed burials will often create larger scent pools, making pinpointing by the dogs more difficult. However, even after years of disturbance and movement, the dogs can still detect, and alert, in reasonably close proximity to a burial.

Bones that have been on the surface for extended periods of time will deteriorate, losing most of their scent, especially in areas with direct sunlight and hot conditions. Environmental conditions that break down scent include sunlight, heat and wind. Intact, undisturbed graves have more scent available than do disturbed graves or bones.

Accuracy
The ICF canine accuracy at finding graves has been measured in only a few unmarked historical cemeteries. In these measurements, the position of the canine alerts is compared to the position of the center of the grave. Results show that the standard deviation of the canine alert position is about 2 meters as compared to geophysical positions taken at the same cemeteries. No excavation was done at any of these graves. These same tests also showed that the dogs cannot accurately discriminate between burials immediately adjacent to each other.

Reports
We produce a final report on each project for the client. The report generally contains the following information:

- UTM coordinates of all dog alerts using a Garmin 60CSx, which has an approximate 3-9 meter range of accuracy
- UTM coordinates for the boundaries of the areas searched
- Alert interpretation, comments and observations
- Weather
- Handlers' Biographies
- Summary of our findings

Addendum B

Comprehensive Client List

Over the years the ICF has contracted with many federal, state and local agencies and cultural resource management firms to provide them with assistance in locating historic and prehistoric human remains, both inhumations and cremations.

Our clients include:

Federal

- US Army Corps of Engineers, Engineering Research Development Center, Construction Engineering Research Laboratory. Worked with author Carey Baxter, Archaeologist, on a study to Determine the Effectiveness of Historic Human Remains Detection Dogs – her paper is to be published in 2015
- US Army – Hawai'i, Schofield Barracks, Dr. Laurie Lucking, Cultural Resources Mgr.: ICF participated in a JPAC-sponsored study in Hawai'i where our dogs correctly identified a site where known ancient Hawaiian burials had been discovered during construction many years ago. Still awaiting the paper.
- Plumas National Forest, Feather River Ranger District
- US Army Corps Research Lab / Ft. Leavenworth KS
- US Department of Veterans Affairs, Palo Alto Health Systems
- Bureau of Land Management

State Level

- University of California San Diego, Lynn H. Gamble, Ph. D
  CA-SDI-860 - Dr. Gamble tested the ICF canines on a known (cremated remains) cemetery that had been excavated in 1966 by Delbert True. Dr. Gamble states that the ICF canines were "highly successful in the identification of the cemetery area …"
- California State Parks: Bodie, where graves found by the dogs were corroborated by park rangers; North Coast Redwoods; Central Valley; and, Jedediah Smith, where the dogs located and alerted on a Native American burial known only to park management.
- California Department of Transportation (CalTrans), Districts 1, 9 and others
- City of Port Angeles, WA, predictive model for Tse-whit-zan, to protect the Lower Elwha Klallam tribe prehistoric burials

Local Level

- City of Fort Bragg, CA
- City of Riverside, CA
- Camp Atterbury and Muscatatuck Urban Training Center, Indiana
- Indiana Department of Homeland Security SAR

- Sacramento (CA) Area Flood Control Agency

International
- Equipo Peruano de Antropologia Forense (EPAF), project in Peru

Native American
- Native Village of Tyonek, AK: President Alfred Goozmer
- Kwaaymii, Laguna Band of Indians, CA: Carman Lucas, Native American Monitor, tested teams on burials on her ancestral land
- Greg Castro, Salinan, CA
- Salinan tribe, CA-MNT-2296
- Me-wuk, Tuolumne Economic Development Authority
- Mutsun/Ohlone, CA: Ann Marie Sayers, Most Likely Descendent
- Manzanita Band of the Kumeyaay Nation, Ocotillo Valley, CA
- Yocha Dehe Wintun Nation, CA
- Tolowa tribe, CA

Cultural Resource Management
- Native American Rights Fund, Boulder, CO
- Rosenfeld Consultant Services, Homer, AK
- PAR Environmental Services, Inc., Sacramento, CA
- ASM Affiliates, Carlsbad, CA
- Pacific Legacy, Inc., Berkeley, CA
- Far Western Anthropological Research Group, Inc., Davis, CA
- Tetra Tech, Inc., Pasadena, CA
- Thomas F. King, PhD, LLC

Other Organizations
- Desert Research Institute, Reno, NV
- La Senora Research Institute, Santa Monica, CA
- LDS Church, Willie and Martin Handcart Parties, Hawn's Mill Massacre
- Santa Clara University, Santa Clara, CA
- Applied Earthworks, CA
- Mission San Antonio de Padua, CA
- Silverado Power, San Francisco, CA
- Santa Barbara Presidio (CA)

APPENDIX I – COMMENTS/RESPONSES ON DRAFT FEASIBILITY STUDY

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June 30, 2015

Jason Weiner
General Counsel, Water Initiative Director
Wishtoyo Foundation
3875-A Telegraph Road, #423
Ventura, CA 93003

SUBJECT: Draft Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study – June 2015

Dear Jason,

1-0

The City of Ventura (City) appreciates the opportunity to review the *Draft Habitat Restoration and Enhancement Feasibility Study, June 2015* (Feasibility Study), as undertaken by the Wishtoyo Foundation's Ventura CoastKeeper (VCK) program, its consultants and Technical Advisory Committee members, along with California State Parks, the California Department of Fish and Wildlife, the U.S. Fish and Wildlife Service, and the McGrath Lake Trustee Council. The City is generally supportive of the proposed restoration and enhancement efforts, as the City has a long history of environmental stewardship and is fully committed to ensuring the continued protection of the Santa Clara River Estuary (Estuary) and its resources. The City acknowledges the extensive effort put into developing the Feasibility Study, which outlines an approach for expanding the habitat of the Estuary for the benefit of special status species, including the Southern California Steelhead (steelhead). The City agrees that expansion and restoration of State Park lands (in particular, removal of Arundo) would benefit steelhead, as well as other special status species, including the federally listed tidewater goby, the federally listed snowy plover, and the federally and state listed California least tern, and would also improve recreational opportunities. Furthermore, this finding is consistent with findings from the City's ongoing Santa Clara River Estuary Special Studies (Special Studies), which have found that a greater wetted surface area in the Estuary provides additional habitat and recreational benefits.

However, the City has several concerns regarding the scope of the Feasibility Study, and potential misinformation derived therefrom. As more specifically discussed below, the City is primarily concerned that the Feasibility Study will significantly interfere with the ongoing Special Studies, in which VCK is an active participant. Furthermore, certain statements in the Feasibility Study could be interpreted as requiring the City to fund a portion of the restoration activities contemplated by the study. Finally, the Feasibility Study contains technical conclusions that are inaccurate. In addition to the brief discussion below, the City has attached a chart (Exhibit A) setting forth specific comments on these items, as well as a few questions that the City has regarding certain aspects of the Feasibility Study.

First, the City is concerned that the conclusions in the Feasibility Study could undermine the important ongoing efforts of the Special Studies. As VCK is well aware, the March 30, 2012

1-7

Tertiary Treated Flows Consent Decree and Stipulated Dismissal (Consent Decree) and the City's 2013 National Pollutant Discharge Elimination System (NPDES) permit require the Special Studies to be undertaken in the Estuary. Indeed, VCK collaborated and agreed upon the City's approved Phase 3 workplan to determine the maximum ecologically protective diversion volume from the Estuary. In short, these studies are of critical importance in determining if, and to what extent, the City's wastewater discharges will be reduced in the future. As such, the City believes it is premature to presume particular diversion scenarios or their ecological effects at this time. Specifically, the City is concerned by the Feasibility Study's use of a 50% reduction in discharge rate in the analyses of the Preferred Restoration Concept. *See* Section 5.2.5, 5.4, Appendices A and B. The City believes this approach provides misinformation that may negatively impact future decision-making by permitting agencies and stakeholders. It is insufficient to state that the effort "was not intended to determine if a particular amount of effluent is needed to sustain the native or endangered species within the estuary." *See* Section 5.2.5. The information presented is materially misleading, and may undermine the conclusions and analyses undertaken as part of the Special Studies. Furthermore, any modeling data derived from these scenarios is misrepresentative of the facts, as the scenarios are not scientifically supported, and ignore potential impacts on species and other resources in the Estuary. Accordingly, the City requests that the draft feasibility study be revised to focus only on current conditions or conditions recommended as part of the Species Studies, until such time as these studies are complete. Other concerns are also set forth in Exhibit A, attached.

1-2

Second, the City is concerned that certain statements in the Feasibility Study could contribute to a conclusion that the City is, in part or in full, legally or equitably responsible for the funding associated with the restoration activities contemplated by the study, including the removal and relocation of the campground. For example, the Feasibility Study's Executive Summary states that the campground "has often been closed to the public because of shallow flooding caused by elevated water levels in the estuary." And other sections of the study, (*see, e.g.,* p. 11), suggest that the City's treated wastewater discharge is responsible for the elevated water levels. These statements, taken together, could be interpreted as evidence that the City is responsible, either equitably or legally, for remedying the flooding of the campground. The City has invested significant funds into studying the health of the Estuary and investigating options for reusing the effluent consistent with the terms of the Consent Decree. The City has also raised rates in preparation for the significant capital investments needed to implement additional reuse. However, the City is unwilling to allow the Feasibility Study to improperly impose liability on the City for costs that are not the City's responsibility. Thus, the City requests that these statements, and the others identified in Exhibit A, be revised to clarify that many factors contribute to the flooding of the campground.

Finally, the City has identified several technical conclusions in the Feasibility Study that appear inaccurate. For example, page 11 of the Feasibility Study states: "The VWRF effluent can cause high water levels within the SCRE during the summer and fall months, and increase the likelihood that the mouth berm can be overtopped and/or breached (Stillwater Sciences, 2011)." This statement is incorrect. All of the breaches observed since 2008 have been caused either by wet weather events or by human activity. The City requests that this statement, and the others set forth in Exhibit A, be revised for accuracy.

The City believes that the issues set forth above, as well as those in the attached chart, can be resolved in a collaborative and efficient manner. The City continues to be committed to the reuse of water, the health of the Estuary, and to completing the Special Studies, a process started several years ago.

9243415.v1

If you should have any questions please contact me at (805) 652-4518.

Sincerely,

Shana Epstein
General Manager Ventura Water

cc: Joe McDermott, Assistant General Manager Ventura Water
Gina Dorrington, Wastewater Utility Manager
Karen Waln, Management Analyst

Exhibit A: Specific Comments on Draft Feasibility Study

EXHIBIT A

Specific Comments on Draft Feasibility Study

	No.	Reference	Comment
1-1	1.	Executive Summary, page i, paragraph 1	The Executive Summary implies a lack of habitat and recreation in the existing Estuary system. It should be noted that the Estuary, including the campground area, supports numerous special status species and includes critical habitat for several of the species. As such, please revise this section to add that the Estuary is occupied by numerous species listed for protection under the State and Federal Endangered Species Acts, including the federally listed tidewater goby, the federally listed snowy plover, and the federally and state listed California least tern. Further, the Estuary has been designated as critical habitat for the Southern California Steelhead, the tidewater goby, and the snowy plover under the ESA.
1-2	2.	Executive Summary, page i, paragraph 2	This paragraph states that the campground "has often been closed to the public because of shallow flooding caused by elevated water levels in the estuary." This conclusion is not supported by the evidence. Much evidence indicates that flooding occurred historically, absent any "elevated levels" of water in the estuary. The City is concerned that this statement could be used to impose liability or to make the City legally or equitably responsible for moving the campground, which is extremely expensive and would divert much-needed resources from the City. We recommend deletion. The paragraph should simply state that the campground has been closed due to flooding.
1-3	3.	Executive Summary, page i, paragraph 2	This paragraph should explain that the areas south of the Santa Clara River were documented as wetlands under historical conditions, long before creation of the campground. In fact, a levee was constructed (construction began in 1961) to protect the campground from elevated water levels in the Estuary. The recent failure of the levee (damaged in 1998 and destroyed in 2005) has allowed this area to revert to a wetland habitat no longer usable as a campground. That is, the levee failure is the primary reason for the increase in flooding-related closures of the campground.
1-4	4.	Executive Summary, page i, paragraph 2	This paragraph states that the campground area currently provides poor-quality steelhead habitat and degraded water quality. This needs to be clarified. Although flooding of the campground has allowed this area to revert to wetland habitat, it should be noted that this area does not currently provide steelhead habitat.
1-5	5.	Executive Summary, pages i-iii; section 1.1, page 1; section 4.1, page 26	Several sections state that the Preferred Restoration Concept includes restoration of 42 acres, yet other sections describe only 15 to 35 acres of restoration. These should be made consistent throughout the document.

1-5	6.	Executive Summary, page ii, paragraph 4; section 1.1, page 1	How big is the Mixed Use Area, and how does it compare in size to the Restoration Area? How expansive is the new proposed campground as compared to the Restoration Area? Please clarify the existing and proposed areas of habitat, campground, and "mixed-use."
1-6	7.	Executive Summary, page ii, paragraph 4; section 1.1, page 1; section 4, page 26	Section 4 states that the Mixed Use and Restoration Areas are discussed separately for "accounting and logistical purposes." Similarly, Section 1 states that analyses regarding the areas were "separately funded, but coordinated." As such, it is unclear why the two areas are considered mutually-enabling. Please explain.
1-1	8.	Executive Summary, page iii, paragraph 2	Please provide further details regarding how the Preferred Restoration Concept will specifically benefit the listed species in the Estuary.
1-7	9.	Executive Summary, page iii, paragraph 3 (Next Steps)	This section should explain that, at this time, it is unclear whether the Preferred Restoration Concept will be consistent with the maximum ecologically protective diversion volume, and related infrastructure alternatives, that result from the Special Studies, as required by the Consent Decree and the City's current NPDES permit. It should also explain that final design decisions cannot be made until the Special Studies are completed.
1-4	10.	Executive Summary, page iii, paragraph 3 (Next Steps); section 1.3, page 3	This section states that the site provides "poor-quality steelhead habitat." This needs to be clarified. That is, the flooding of the campground does not degrade the condition of the habitat in the adjacent estuary, which is designated as critical habitat for the steelhead. Furthermore, characterization of the campground as "habitat" appears premature. Given the site flooding history and plant community, the low lying areas are likely jurisdictional wetlands providing associated habitat functions unrelated to steelhead. Please describe how the project helps the campground provide better habitat for steelhead. *See also* section 1.3, paragraph 3 (stating flooding creates "poor-quality steelhead habitat").
1-2	11.	Section 1.2, page 2	This paragraph states that "higher water levels in the estuary have caused more frequent flooding." This is not supported by the evidence. Please revise to state: "in recent years, more frequent flooding (caused by a combination of factors, as described above) has caused campground closures."
1-4	12.	Section 1.2, page 2; section 2.8, page 20	Other than attributions of flooding to man-made unseasonal breaching, there is no evidence that flooding of the campground is degrading habitat conditions in the Estuary. Separate from steelhead focused assessments, recent visual inspection of the campground suggests very high rates of habitat use by marsh and lagoon associated shorebirds. This would suggest that the recent campground closure has expanded wetland habitat for these species, potentially including endangered western snowy plover and California least tern.
1-16	13.	Section 1.4, page 5	Please revise this section as follows: "(LARWQCB, 2008). <u>The enhancement finding supporting the City of Ventura NPDES permit was questioned in 2008.</u>"
	14.	Section 1.4, page 5	Please revise this section as follows: "Definitive conclusions have yet to be made, but there is agreement on performing additional focused studies. <u>Such studies are mandated by the City's current NPDES Permit.</u>"
	15.	Section 1.4, page 5	Please revise this section as follows: "...related to the health of the estuary as it pertains to the VWRF effluent discharge <u>or legal responsibility for costs of implementation</u>."
1-4	16.	Section 2, page 8	Please revise this section as follows: "...these sections generally <u>relate to the 42-acre Restoration Area within the current campground, not the Estuary itself</u>, and focus on the deficiencies of the existing conditions..."
1-16	17.	Section 2.3, page 10	Please revise this section as follows: "...(sea level rise and <u>potential</u> VWRF discharge reductions)..."
1-8	18.	Section 2.3, page 10	This section states: "The current flooding on the campground is not associated with the 2-year and 10-year runoff events. Rather, these events tend to alleviate the flooding associated with closed-berm conditions by breaching the mouth berm." Contrary to these statements, available evidence shows that flooding in the area is a historical problem, in part caused by large storm events. *See, e.g.*, McGrath State Beach General Plan, p. 10 (1979) (The flood hazard at and near McGrath State Beach is quite high, due to the closeness of the Santa Clara River and the low-lying nature of the terrain. Damaging floods can occur when winter storms bring widespread rain for several consecutive days."). Thus, the two statements should be deleted.
1-2	19.	Section 2.3, page 11	This section states: "The VWRF effluent can cause high water levels within the SCRE during the summer and fall months, and increase the likelihood that the mouth berm can be overtopped and/or breached (Stillwater Sciences, 2011)." This is misleading because all of the breaches observed since 2008 have been caused either by wet weather events or by human activity. Please revise for accuracy.
1-7	20.	Section 2.3, page 11	This section states: "...requires that the City of Ventura reclaim 50 to 100% of the VWRF effluent by 2025...." This is inaccurate, and suggests that the City is required to reduce discharges by a minimum of 50%, regardless of regulatory, technical and financial constraints. This is not consistent with the Consent Decree. Accordingly, please revise this sentence to state: ""...requires that the City of Ventura reclaim <u>up to</u> 100% of the VWRF effluent by 2025...." Note that the same revision also needs to be made in the January 2015 Existing Conditions Technical Report (*see* section 3.4).

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1-9	21.	Section 2.3, page 11	This section states: "...the VWRF discharge rate directly and significantly influences the water levels within the SCRE during extended closed-berm conditions...." This is inaccurate and should be revised and qualified. The 2011 Stillwater report indicated that filling and breach dynamics are influenced by a wide range of factors, many of which change on a variety of time scales. For example, it has been suggested that the extended berm face that developed in the Estuary lagoon following the 2005 flood has reduced the frequency of natural breaching and allowed higher Estuary levels to be attained for the same inflows. Notably, this is confirmed by the final paragraph on page 11.
1-10	22.	Section 2.3, page 11	Please revise the first paragraph on this page to clarify that the City's discharges do not solely determine water levels in the Estuary. As discussed above, water levels in the Estuary are determined by a wide range of factors, such as inter-annual variations in other Estuary inflows, changes in bathymetry, berm morphology and other factors described in the 2011 Stillwater report. For example, absent the City's discharges, groundwater and riverine inflows may fill the Estuary to the same level under some conditions. In addition, groundwater nutrient levels in some locations along the lower Santa Clara River near the Estuary are well in excess of those in the City's effluent.
1-7	23.	Section 2.3, page 11	The paragraph describing the Consent Decree should be revised to clarify that (1) the Consent Decree does not specify a minimum flow diversion and (2) states "an amount up to 100%" can be diverted if the proper technical evaluation and permitting efforts support the findings. The 50% diversion is a planning goal, not a scientifically supported flow reduction. Therefore, it is important to consider a range of diversion options until the Phase 3 studies and associated permitting has been completed.
1-11	24.	Section 2.4, page 13	This section implies that the City's discharge is responsible for water quality issues in the Estuary. While the City does not disagree that the City's discharges contribute a majority of flows to the Estuary during summer, the quality of the surrounding shallow groundwater has only been partially characterized to date. It is likely that a confluence of circumstances, including stagnate water and heat with little mixing, causes water quality issues. It is premature to assume that the City is responsible for water quality conditions in the summer until the Special Studies are complete.

1-12	25.	Section 2.4, page 14	Vegetation in the restoration area will likely provide some temperature benefits from shading and high rates of evapotranspiration within the wetland area. At the same time, it is recognized that living plants and decomposing plant litter in natural and managed wetland settings are associated with reduced oxygen levels within the water column of the wetland areas. However, without tidal exchange under an open berm condition, neither the existing wetland habitats in the flooded campground or the areas proposed for wetland restoration would be expected to appreciably influence water temperature or dissolved oxygen (DO) levels in the larger Estuary lagoon. With the berm open, the large tidal exchanges with cooler ocean waters would also limit any potentially adverse effects from low DO waters arriving in the Estuary lagoon from these wetland areas.
1-4	26.	Section 2.8, footnote 4	This footnote should be deleted. Water drains very quickly during a breach, rapidly mixing Estuary water with well-oxygenated ocean water during the breach and each subsequent tidal cycle. That is, without tidal exchange under an open berm condition these areas would not appreciably influence water quality in the larger Estuary lagoon. With the berm open, the large tidal exchanges with ocean water would be expected to reduce the influence of wetland lagoon exchanges. In short, there is no evidence that open berm conditions are unsuitable, or that breach events degrade water quality in the Estuary. Note that these conclusions should also be deleted from the January 2015 Existing Conditions Technical Report (*see* section 4).
1-13	27.	Section 3.1, bullet 2	A "reduced tendency towards out of season breaching" does not follow from increasing the Estuary volume. Please delete this phrase.
1-7	28.	Section 5.2.5, page 36; section 5.4, pages 38-39; Appendices A and B	The City is very concerned by the use of the 50% reduction discharge rate. This is not a scientifically supported flow reduction, and is materially misleading. The 50% diversion scenario also does not adequately represent a range of potential diversion levels in the future. The Feasibility Study should only take into account current conditions and the reductions recommended as part of the Special Studies.
1-14	29.	Section 5.2.5, page 36; section 5.4, pages 38-39; Appendices A and B	The City has invested in years of data collection and studies of the Estuary. Much of this information has been relied upon in the Feasibility Study. However, because conclusions drawn in 2011 were determined by stakeholders (including VCK) to be insufficiently determinative, Phase 3 data collection is scheduled to be conducted throughout 2015 as well as 2016. Therefore, it is premature to be making conclusions regarding water diversion, water quality, and habitat conditions prior to the conclusion of the City's ongoing Phase 3 study, which is to be completed by January 1, 2018.

1-15	30.	Section 5.4, page 38; Appendix B	Although the Appendix B modeling draws upon an updated lagoon bathymetry, there is a 2-foot discrepancy in the predicted water levels for a zero discharge scenario when compared to the predictions from the 2011 Special Studies. Because the Appendix B Water Balance relies upon 2011 parameter estimates being re-evaluated by the current Phase 3 studies, the use of these model predictions is unwarranted. The City recommends the proposed restoration elevations for the campground areas use existing documented high water marks during recent years with an additional margin to accommodate anticipated sea level rise.
1-16	31.	Section 8.2, page 59	Please revise the "Environmental Permitting" section to state that a permit under section 2081 of the California Endangered Species Act will likely also be required.
1-15 & 1-7	32.	Appendix A	The City has no comments at this time regarding modeling assumptions and limitations for the storm flow and closed berm scenarios evaluated. In the closed berm scenario, however, the City has a number of concerns regarding modeling assumptions and assumptions of future flow reductions that have not yet been developed under the Special Studies.
	33.	Appendix B	The Water Balance Tool relies upon data and estimates developed in the 2011 Stillwater study. The City is concerned that simplifying assumptions and selectively using prior data may lead to differing conclusions regarding equilibrium water levels. The City believes it is premature to assume particular diversion scenarios or their effects until the Special Studies are complete.
	34.	Appendix B	There is a 2-foot discrepancy between the prior (2011) Water Balance and the Water Balance contained in the Feasibility Study report under a zero-discharge scenario. This difference makes a large impact on estimated useable habitat for special status species. Given that the report makes use of 2011 parameter estimates that are currently being re-evaluated as part of the Phase 3 studies, the City believes it is premature to rely on these estimates until the Phase 3 studies are complete.

Heal the Bay

To: Jason Weiner, General Counsel/Water Initiative Director, Wishtoyo Foundation

From: Peter Shellenbarger, Water Resources Manager, Heal the Bay

Date: June 23, 2015

Subject: Santa Clara River Estuary Restoration Draft Feasibility Study and Preferred Restoration Concept Comments

2-1

On behalf of Heal the Bay, I would like to thank Wishtoyo Foundation and Wishtoyo Foundation's Ventura Coastkeeper Program for giving us the opportunity to provide comment on the Santa Clara River Estuary Restoration Draft Feasibility Study and Preferred Restoration Concept document. The health and vitality of the Santa Clara River Estuary is important to support it many beneficial uses, including the estuaries ability to support rare, threatened, and/or endangered species.

In review, it appears hydrodynamic modeling only occurred for current and 50% reduction of effluent flows from the Ventura Water Reclamation Facility (VWRF). At this time, future discharge volume from VWRF is unclear – wastewater flow reduction could be more or less than 50%. Because of this, Heal the Bay believe that hydrodynamic analysis should be expanded to include additional VWRF discharge scenarios. This could include 100% reduction (0 MGD), roughly 10% reduction (1 MGD), roughly 20% reduction (2 MGD), and roughly 40% reduction (4 MGD). In addition, we believe that additional temperature modeling using the above mentioned VWRF flow discharge scenarios may also be warranted. We feel the Feasibility Study and Preferred Restoration Concept document should assess and address all possible discharge scenarios that may occur in the future. These discharge scenarios need to be directly comparable with each other to best inform decision making.

On page 105 of the draft report (Figure 24), it shows water surface elevations for closed-berm conditions using both the MIKE 21FM and the Water Balance Model. Given complexities and outputs of each model differ significantly, it would be interesting to compare water surface elevation outputs when the same VWRF % flow reduction is used. For example, adding a Preferred Alternative + VWRF 50% flow reduction using the Water Balance Model scenario to Figure 24. This may help to identify if using Water Balance Model outputs in place of MIKE 21FM outputs is appropriate for the study. Figure 24 could also be expanded to include additional wastewater flow reduction scenario (referenced above) to more clearly model future conditions that may occur in the Santa Clara River Estuary if/when VWRF discharges volume changes.

---------- Forwarded message ----------
From: **Laura Riege** <lriege@tnc.org>
Date: Mon, Jun 22, 2015 at 10:54 AM
Subject: RE: Santa Clara River Estuary Restoration: June 2 - June 23 Comment Period on Draft Feasibility Study & Preferred Restoration Concept
To: Jason Weiner <jweiner.venturacoastkeeper@wishtoyo.org>
Cc: Lily Verdone <lverdone@tnc.org>

3-1

Hello Jason,

TNC reviewed the Draft Feasibility Study and Preferred Restoration Concept. The revised design in the Preferred Concept addresses TNC's previous concerns. It looks good. Nice work!

Going forward, please add my name to the project mailing list.

Sincerely,

Laura

Please consider the environment before printing this email

Laura Riege
LA/Ventura Restoration Manager

lriege@tnc.org
(805) 290-4778 (Phone)
(805) 750-9662 (Mobile)
(805) 648-6885 (Fax)

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532 E. Main St., Suite 200
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Comments on
Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study
June 2, 2015 Draft

Richard F. Ambrose
June 23, 2015

I have reviewed the June 2, 2015 draft of the Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study. I have made many specific comments on the pdf file, but in this review I provide some overview comments about the report.

4-1

But first, I want to start with a comment about the process. I really appreciated the thoughtful, inclusive process for developing the restoration concepts and preferred restoration design. I have been involved with restoration plans for Ormond Beach, Mugu Lagoon, Malibu Lagoon, Ballona Lagoon, San Dieguito Lagoon, and the South San Diego Bay Salt Ponds/Otay River Estuary, and this was one of the best implemented planning processes I have experienced. There was ample opportunity for stakeholders and technical experts to brainstorm about possible restoration alternatives and provide input into the conceptual design as it developed and was analyzed. I also appreciate how responsive the project team was to the various suggestions they received. Although obviously not all suggestions could be incorporated (I still really like my “reverse glove” design proposed in earlier comments I made!), the final preferred design was a well-considered, balanced synthesis of everybody’s comments.

As for the substance of the report, as just mentioned I feel that the preferred design is a very good design to accomplish the main goals of the restoration project. The design accurately reflects the discussions about the issues that had to be addressed in the restoration as well as proposed solutions during the planning process. As noted in the report, it is impossible to achieve all of the objectives desired for the site, but the proposed project design will achieve the major project objectives while accommodating the sorts of uncertainty that is inevitable at the site. I have a few minor questions or suggestions about the design (sometimes why a particular feature was included and sometimes about how a feature might change, both illustrated by comments on page 28), but no major objections or concerns.

4-2

One possible design addition would be to add more seasonal marsh to the design. Looking at the habitat area changes (Table 4), the most concerning habitat loss is to seasonal wetlands. These habitats can provide important wetland functions and could potentially be incorporated into the project area with little addition cost.

4-3

One technical question I have about the design concerns the side channels (p. 27). The text states that steelhead would find a velocity refuge in these channels, but I’m not sure that is true. I wondered on page 27 when I first read that, and examining the velocity figures it also made me wonder if these channels really would be perceived as having lower velocity. So I think this section needs to be re-thought and perhaps revised.

The report itself was very well written. It was comprehensive, well organized, and easy to understand. There were a number of places where I thought more explanation would be warranted, and I have identified these in the pdf file. Most of these occurred in the description of

4-4

the preferred restoration design. For example, some features of the design are mentioned but there is no context for why that particular feature was chosen or the rationale for a particular characteristic. One example is the description of the two separate slough channels (page 28); it would be useful to have an explanation for why this design element was included and what function or purpose it is expected to serve. Another example is the two lobed-marsh habitats, which are not explained (page 29). An example not related to the description of the restoration design is the assertion that sea level rise is anticipated to generate an equivalent increase in the elevation of the mouth berm (p. 13). This is a critical feature for understanding how the system will function in the future, so there should be more discussion about the mechanism behind it.

4-5

There are some minor errors (e.g., values for SCRE in Table 1 are not averages of Santa Monica and Santa Barbara, and the reference to Section 5.2 on page 31) and various editorial suggestions to correct errors or clarify different points. I have some minor suggestions for changes to some figures to improve their clarity (see Figure 13). There are some places where an additional figure (such as what the project would look like with a 100% reduction in VWRF discharge, page 38) or table (such as the list of special status plant species, page 49) might be useful. Overall, though, the report was very clear and well written, especially for such a long report.

And finally, thank you for highlighting my report with Stacie Fejteck on BMPs for southern California coastal wetland restoration projects!

UNIVERSITY OF CALIFORNIA, LOS ANGELES UCLA

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23 June 2015

Jason A. Weiner
General Counsel, Water Initiative Director
Wishtoyo Foundation
3875-A Telegraph Road, #423
Ventura, CA 93003

Dear Jason:

5-1

I am providing comment to the *Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study* draft of 2 June as requested.

The restoration as presented is quite appealing and should be effective. There are number of aspects to the restoration that will provide significant benefits. Removal of paving and infrastructure associated with a campground on its own is obviously of critical importance in restoring wetland functions.

5-2

Laudatory treatment of the dynamism of the system -The reintroduction of a fluvial channel into the restoration area provides for the possibility of dynamic resetting of the landscape, which is important given the nature of the historic variation that existed to this region of fluvial interaction with the coast. In addition it should be noted that one hopes that the landscape will dynamically evolve rearranging on its own, especially if a larger flow events should occur. Unlike most restorations the dynamism of the Santa Clara system and the ultimate impacts of the wide range of hydrologic processes were encorporated in the design process and thinking. This is unusual and laudatory. Settings such as this are not static but are constantly undergoing succession from the last events of various repeat times from years to decades or centuries. It is important that as the restoration goes forward that this perspective not be lost.

It follows that large investments should not be made to create particulare landscape features that may well be eliminated by the next large flood. It may be worth bearing this in mind for any features infrastructure designed to accommodate the public such as floating walkways or portable infrastructure. These were discussed early in the design process, and can be revisted as designs are finalised to determine if these options are cost effective.

5-3

Need to integrate with actions outside the restoration area regarding steelhead and tidewater goby - Much of the design effort is directed towards the endangered steelhead and also the tidewater goby. In this regard the water emanating from the treatment plant is a two edged sword. Fish need water, and the water levels in the lagoon would undoubtedly be much lower without this source. However, the water is simply too warm. This has clear negative implications for steelhead. It also has indirect negative implications for tidewater gobies as it creates a setting which is highly conducive to invasive species. In my view issues with temperature far exceed any other issues concerning the quality of the water, at least at the current time. My recommendation would be to simply move the outflow a distance upstream such that it would have time to cool prior to entering the lagoon. In doing so it's probably important that there's only a small reduction in flow such that water levels in the lagoon do not drop precipitously during the dominant closed state of the system. Without this kind of ancillary effort habitat improvements within the restoration area can only have a limited beneficial impact on stealhead or the tidewater goby. However, in combination with such actions the impact could be quite large.

Assuming current water conditions in the lagoon are to be maintained, other solutions to the fish issues might be possible, but would likely require more active management or explicit attention to generating species-specific refuges. Bodies of water semi-isolated from the lagoon could be enhanced to maintain significantly cooler temperatures for steelhead, or to exclude exotics in the case of tidewater gobies. In terms of generating a lower temperature refuge the riparian channel may serve some of this function and care can be taken to enhance shading or cooling in this area. Generating an environment that excludes invasives may also be far more practical than it appears. For example, an area near the McGrath Lake outfall, or within the restoration area, could be maintained separate from the lagoon, by a small berm such that an invasive-free area for tidewater gobies could be maintained, fish could then be released to the lagoon following breaching or extirpation.

5-4

Potential for greater integration with the regional environmental and floral history-
The restoration planning process was presented with a highly modified landscape. It was substantially separated from its historic conditions in the 19th century by campground and oil field development, as well as this physical separation by Harbor Boulevard and alteration of the immediate environment to the East for agriculture. Thus, our focus naturally gravitated to the lagoon and they immediate wetland processes, and potential fisheries benefits. However, it may be worth taking a moment to consider the historic conditions at the site in the context of the broader changes of the Santa Clara Delta /Oxnard Plain system. The purpose would be to see if additional restoration opportunities exist either relative to the conditions that existed on the footprint of the restoration historically or more broadly in this area.

5-4 The Santa Clara Delta /Oxnard Plain coastal system broadly provided a range of habitats which are largely gone today. These habitats resulted from distributary channels that interacted with the coastal duneline over previous decades centuries and millennia. This yielded a set of vernal pooled features, small lagoons and alkali meadows behind the dune line. The restoration site itself had some lower flat features that were interpretted by Beller as salt or alkali flat, distributory fluvial features in various stages of succession as well as some areas that likely permitted seasonal pooling. The site was not particularly wooded although wooded areas occur adjacent to it inland. One interesting aspect is that the vegaetation mapped as scrub forest in the current conditions presentation in the draft contains a lot of trees well over a foot in (and even 2 feet) in diameter -- so a lot of it is pretty well developed, as distinct from the 19th century conditions. It is important to note, that as planned, and with the proposed plantings, the restoration is likely to continue this trend towards more woody vegetation in around the lagoon and in the restoration area.

With the above in mind, it might be worthwhile to consider the possibility of setting aside particular areas devoted to enhancing alkali open flat, or meadow habitat, for preserving some of the local flora of the region. In the same vein, the planting effort could try to incorporate a larger suite of the rare species in the area some of which are associated with the unique alkali rich history of much of the Oxnard Plain.

Sincerely,

David K. Jacobs
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djacobs@ucla.edu

310 206-7885, 310 995-7885

Hey Jason and Dale

6-1 I don't really have any substantial comments on the plan. I think you guys did a great job bringing together all the input from the TAC and I really like the final design. I believe this is a modest restoration that will accomplish the goals set forth and has a good chance to improve the estuary. I would just like to mention the following items for further study and consideration as plans move forward which are essentially the same as what was mentioned in previous comments:

1. In the long term reduce or preferably eliminate discharges from the wastewater treatment facility into the estuary.
2. In the short term reduce elevated temperatures from wastewater discharges into estuary.
3. Fine tune channel configuration, slopes and alignment during final engineering to maximize closed condition circulation by wind and open condition tidal flushing.
4. Look for opportunities to incorporate rare or endangered vegetation into final design.
5. Carefully consider temporary irrigation for lower wetland areas to ensure that wetland plants can grow and that soil salinity is not too great for plant growth.
6. Enhance existing dune areas.
7. Mechanically remove Arundo donax preferably prior to restoration activities.

I want to reiterate that you both did a great job integrating all the stakeholder needs into the project.

Sincerely,

Mark Abramson
Senior Watershed Advisor
Santa Monica Bay Restoration Foundation
1 LMU Drive
Pereira Annex MS: 8160
Los Angeles, CA 90045
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Comments on the June 2015 Draft Santa Clara River Estuary
Habitat Restoration and Enhancement Feasibility Study

July 12, 2015

Sean Anderson, Ph.D.

Sean.Anderson@csuci.edu

7-1

I have reviewed the June 2, 2015 draft of the Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study and associated technical appendices. This draft is quite thorough and clearly comprehensive enough to move us into the next phase of the restoration planning for the SCRE. I found the report to be well written and quite articulate in many areas that are often poorly communicated in such technical documents.

The preferred restoration design is a **solid design** for a southern California estuary in this setting and affords us a good opportunity to accomplish our stated primary goals of the restoration project. We have discussed and debated several aspects of details of this design and noted the possible tradeoffs of various alternatives over the past months and I found the hydrological modeling and other "what if" explorations to be sound.

7-2

In my opinion, the biggest drivers of the ultimate success of this restoration will be the future hydrology of the site, external to the estuary proper. These include three factors that are likely to change over the coming decades (in order of their potential influence upon the success of this SCRE restoration):

1. Sea level rise/coastal inundation
2. Altered inflows from the VWRF
3. Altered subsurface flows from McGrath/upland regions

My biggest concern centers around coastal sea level rise and the associated impact this would have on breaching dynamics and hydrologic head at the mouth of the estuary. While the exact rate of sea level rise and the critical inundation points are as of yet unknown, we well know the long-term trajectory of this littoral system. Open or more open mouth conditions and greater wrack deposition in across the estuary (chiefly from *Arundo*) spurred by a changed coastal environment would greatly alter the flows in the SCRE. In addition, the likelihood of more frequent major storms (as happened in

7-2

1997, 2005, *etc.*) combined with lower net precipitation across our region suggest a high probability that we will see and increased frequency of discrete storm events capable of re-contouring the topography and bathymetry of the SCRE (most clearly documented pre- and post-2005). Given this more dynamic world we are entering, any single proposed restoration design would be incapable of perfectly anticipating the "needs" of the estuary over the coming decades. I think we need to acknowledge this a bit more explicitly in the report summary/overview.

The uncertainty about future hydrological drivers is key, but should not be interpreted as an excuse to simply do nothing. The estuary will evolve in the face of these changed hydrologic conditions, but that doesn't mean that we cannot improve the ecological functioning of this system now and into the near future with this preferred alternative. The proposed alternative does a good job balancing tradeoffs in the face of this uncertainty and has a good chance of materially improving the biotic and abiotic conditions in the SCRE. Given this uncertainty, there is not much value in an expanded suite of hydrodynamic "what if" scenarios. Rather than focus on trying to design the theoretically optimal estuary, this report properly says "here is a reasonable option." I would like to see a slightly greater emphasis on the necessity of adaptive management and a willingness to tolerate an evolving system. This preferred alternative is properly viewed as a **good starting point for a revitalized SCRE**.

7-3

There appear to be several implicit assumptions/motivations built around alternatives that are not well articulated in parts of this draft. These seem to mostly stem from the desire to improve steelhead habitat. But given the high likelihood this system will evolve, it is hard for me get too worried or put too much stake in the tradeoffs of some of finer/more detailed elements. As is so often the case in restoration ecology, I think we are best served by topographic heterogeneity. I don't think we necessarily need a justification for heterogeneity in the design outside of the general principal that with increased uncertainty, increased diversity of restoration elements will more likely lead to a well-functioning system (eventually).

7-1

Lastly, I think it is critical to emphasize that the preferred alternative would be a **massive improvement over our existing conditions**. Regardless of how this system will evolve, SCRE functioning at the moment is poor for both human and non-human users of this system. As State Parks has found, a poorly functioning system serves the needs of no one. This preferred alternative would make a vast improvement in every aspect of this system.

Responses to comments received on the (draft) Feasibility Study

Comment Letter No. 1 – City of San Buenaventura (Ventura)

1-0	Stakeholder input was a frequent and important component of this Project. The statement of support for the restoration project and the detailed and thoughtful comments provided by the City of Ventura are greatly appreciated. Though some disagreements exist over the phrasing of particular statements within the Feasibility Study (most of which have limited impact on the feasibility of the Preferred Restoration Concept), it is clear the City will continue to be an important collaborative partner as the broader community and the landowner continue to work towards improving the critical habitat provided by the SCRE. Comments are addressed individually or as a group as appropriate.
1-1	In addition to the southern California steelhead (a focal species for this Project), many other special-status wildlife, fish, and invertebrate species have been documented (or have the potential to occur) within the vicinity of the SCRE including: tidewater goby, California least tern, and Western snowy plover. These other species are also anticipated to benefit with the construction of the Preferred Restoration Concept (see Section 4, 5, & 6). The executive summary has been expanded to reflect the other special status species listed above. To keep the document concise, a more detailed description of the numerous special status species documented, or potentially occurring, within the Project Area is included in the Existing Conditions Technical Report.
1-2	This Project was set up to explore the feasibility of creating expanded, enhanced, and restored habitat for the endangered southern California steelhead (and other native species) by relocating a campground that has been regularly closed in recent years. Water levels in the SCRE have recently been observed as high as 12 ft (NAVD88) during closed-berm conditions (generally higher than previously observed to be sustainable (Stillwater Sciences, 2011) for long periods of time). The Feasibility Study (this report) was carefully worded to avoid providing detailed explanations for the source of the flooding and to refrain entirely from suggesting that responsibility falls on any particular party. These are decidedly outside the scope of the Project and it is clear that the VWRF is not the sole determinant of water levels in the SCRE (Stillwater Sciences, 2011; cbec et al., 2015). As requested, the report has been carefully revised to make it clear that a variety of other factors (beyond the VWRF discharge) influence the water levels in the SCRE including groundwater flows, river runoff, berm dynamics, climate, etc. However, there is ample evidence to support the politic statement that "the campground has often been closed to the public because of shallow flooding caused by elevated water levels in the estuary" which specifically avoids mentioning the VWRF or any causative reason for the flooding. It should be noted that the Amended Final Estuary Subwatershed Study, prepared for the City of Ventura as part the Special Studies, indicated that "elevated SCRE water levels associated with VWRF discharge may cause flooding of McGrath Sate Beach campgrounds under closed-mouth conditions" (Stillwater Sciences, 2011. Page 211, see also Page 4). Similarly, the Subwatershed Study also noted that "During closed-mouth, low-river flow conditions, the constant VWRF discharge can cause the SCRE inflow volume to exceed outflow, thereby raising the SCRE water-surface above the mouth berm and initiating the formation and subsequent scouring of the mouth channel" ... "further, higher water levels in the SCRE may be contributing to increased potential for unseasonal breaches due to multiple causal mechanisms during summer and fall months." (Stillwater Sciences, 2011. page 48 and page 193) As noted above, efforts were made to include only pragmatic statements in this Feasibility Study that support the Preferred Restoration Concept. Where deemed appropriate, citations have been added for scientific support.
1-3	Figure 4, referenced in the first paragraph of the executive summary, shows the historical habitat mapping for the site. The campground and the VWRF were both historically part of the expansive estuarine ecosystem that included unrestrained channels, marshes, and riparian habitats at the terminus of the SCR. However, many changes within the estuary and watershed have substantially changed the hydrology of the SCR and the SCRE including the VWRF discharge and extensive levee construction on the north bank of the estuary and on both sides of the river upstream of Harbor Blvd. The text also specifically acknowledges the long history of flooding (Section 1.2). This is indeed a major motivation for the Project. The main body of the report text has been expanded to note that destruction of the earthen levee "has increased the susceptibility of the campground to surface flooding from the estuary." This is distinctly different from concluding that the destruction of the levee is the primary reason for the current flooding of the campground.

1-4	When flooded, the campground is part of the estuary and is accessible to both native and invasive aquatic species within the estuary. As an extensive study has not been completed to determine the impacts the flooded campground has on the overall estuary habitat, it is premature to state that the shallow flooding of the campground does not degrade the condition of the habitat in the adjacent estuary. Rather, it seems likely that the poor water quality of the water within the campground (when flooded) does have adverse effects on the overall habitat quality of the estuary for steelhead and other native protected species, particularly at the beginning of a breach event before tidal exchange begins. The text has been clarified to reflect that "the shallow flooding of the campground is likely worsening the short-term water quality and habitat suitability of the southern and western portion of the main SCRE lagoon when breach events occur and the stagnant, warm, low dissolved oxygen water of the campground is allowed to drain northward into the main estuary and out through the breach. While the draining of the estuary can occur quickly following a breach event (i.e. in a matter of hours), these are crucial stages in steelhead migration into and out of the SCR and water quality considerations at these times may influence smolt survivability and may have consequences for juvenile steelhead rearing in the estuary." It has been further noted that "once tidal exchange is established, water quality conditions in the estuary generally improve due to the influx of cooler, well-oxygenated ocean water". The report has also been clarified to reflect that when the campground is not inundated it does not provide steelhead habitat. Section 2.8 has also been expanded to note that while the flooded campground may be frequented by a number of protected shorebird species (e.g. the western snowy plover, the California least tern) it is of limited quality and it is expected that use of the site by these protected species would be enhanced with the Preferred Restoration Concept.
1-5	The restoration acreages within the report have been clarified. As now stated in the text, the original intent of the Project was to consider 15 to 35 acres, but as preliminary campground and restoration design concepts evolved, it became clear that additional restoration acreage (up to approximately 42 acres) may be possible and desirable. The Preferred Restoration Concept includes the 42-acre Restoration Area and the 43-acre Mixed Use Area.
1-6	The Mixed Use Area and the Restoration Area are considered mutually enabling as it is considered unlikely that either portion would be acceptable to the majority of stakeholders as a standalone project.
1-7	Given the dynamic nature of the SCRE and the uncertainty in the future hydrologic conditions (sea level rise, climate change, potential VWRF discharge reductions, changes to upstream diversions, etc.), the Preferred Restoration Concept was designed to provide enhanced ecological functions and suitable habitat for the focal native and endangered species at a wide range of estuary water levels while also maintaining (and improving) public recreational opportunities at the coast. This Project, the Preferred Restoration Concept, and this Feasibility Study do not advocate for any specific VWRF discharge or reduction or whether there is any specific "maximum ecologically protective diversion volume" and only mention the Consent Decree as it supports the need to evaluate a potential change in the VWRF discharge. It is standard practice to consider potential scenarios that may affect the feasibility and performance of a restoration design. The range of potential VWRF discharge rates is bounded by the 0% (existing) and 100% reduction scenarios. The 50% discharge scenario was added as the midpoint to help more fully characterize the potential water levels in the estuary not as any particular recommended level. However, as the comment indicated, as the design of the Preferred Restoration Concept moves past the 30% level, it will be necessary to review additional information made available by the City of Ventura's Phase 3 Special Studies. These points have been clarified in the report, figures, and also reiterated in the executive summary. The paragraph that mentions the Consent Decree has been revised in coordination with the City of Ventura.
1-8	While the 2-year and 10-year events are known to pose flood risks to the campground (the scenario modeling performed for this Project also suggest this, see Figure 20 and Figure 23), the inundation of the campground expected for these events is of short duration (less than a few days). Section 2.3 has been clarified to state that it is the persistent flooding of the campground that is not associated with runoff events. Section 1.2 notes the long history of flooding at the site and the increased flood risk that resulted from the destruction of the earthen levee. (see also Response 1-3).
1-9	There is ample scientific evidence to support the statement that the "VWRF discharge rate directly and significantly influences the water level within the SCRE during extended closed-berm conditions" (see Stillwater Sciences, 2011. pg 184) The section has been revised to further clarify that other factors (e.g. berm height, length, and groundwater inflows) also influence water levels in the estuary. The extended berm face created by the 2005 flood event has not been observed for many years. All other conditions unchanged, a longer berm face (such as that observed in 2005) would generally lower equilibrium water levels in the SCRE because of increased subsurface flow through the berm (Stillwater Sciences, 2011).
1-10	See also response 1-2. The water balance analysis performed in the Subwatershed Study also indicated that absent the VWRF flows, water levels within the SCRE would be lower (i.e. the water level would not reach the same level with just groundwater inflows) (Stillwater Sciences, 2011, pg 188). The section was revised to more clearly note that the VWRF discharge rate does not solely determine the water level in the estuary.

1-11	Section 2.4 provides a short summary of the water quality conditions in the SCRE as they pertain to the feasibility of the Preferred Restoration Concept. A more detailed description of the water quality observations and data records for the SCRE was included in the Existing Conditions Technical Report which relied heavily on the data analyzed in the Subwatershed Study (Stillwater Sciences, 2011) and an independent review of the report (Ambrose and Anderson, 2011). The text was revised to more clearly state that many factors influence water quality with the SCRE. As the quality and seasonal nature of the groundwater inflows into the estuary would become relatively more important with a VWRF discharge reduction, it is anticipated that the City of Ventura's Phase 3 Special Studies will provide additional information useful to refining the Preferred Restoration Concept as it moves beyond the 30% design level.
1-12	The comment appears to be consistent with the text of the Feasibility Study.
1-13	The subject bullet is part of a list of considerations identified by the Project Team, not claims associated with the Preferred Restoration Concept. It has been revised to clarify that increasing the volume of the estuary has the potential to reduce the frequency of unseasonal breaching though it is unclear how appreciable the affect will be. As described in the Subwatershed Study (Stillwater Sciences, 2011) and the ECTR, the hypsometric relationship (the stage/volume relationship) of the estuary has changed significantly over the years (in recent years, post construction of the levees and Ventura Harbor, this has generally been in response to large storm events). This relationship directly influences the water level in the estuary and therefore affects the likelihood the breach could be overtopped by subsequent inflows to the estuary. Given the unpredictability of storm events and the future hypsometric relationship of the SCRE, the magnitude of the potential decrease in the breaching frequency is therefore impossible to quantify. While the Preferred Restoration Concept does increase the volume of the estuary, no efforts were taken to estimate whether this would have appreciable changes in the breach events.
1-14	The commitment to the SCRE demonstrated by the City of Ventura is recognized. City of Ventura participation in this Project is also greatly appreciated and has influenced a number of design changes (e.g. the Preferred Restoration Concept does not include any grading or modifications on the north side of the SCRE). The Special Studies and the City of Ventura records related to the mouth berm and the estuary are valuable datasets that have helped many different agencies understand the dynamic nature of the estuary and the different ways the estuary can function (in addition to supporting the work done to prepare the ECTR, this Feasibility Study, and the Preferred Restoration Concept). As requested by the comment, the Feasibility Study does not make any conclusions regarding a potential VWRF discharge diversion. Considering the critical nature of the SCRE as habitat for endangered steelhead and other native species, and given that restoration projects often take several years, it is definitely not premature to begin developing feasibility-level concepts to address the current status of the campground (which is providing poor quality steelhead and native/endangered species habitat and reduced public recreation opportunities). Rather, currently available data supports the restoration design which was specifically developed to provide improved conditions for a wide variety of water levels. As is noted in the report, additional scientific studies (specifically the Special Studies), as completed and made available, should be considered by the restoration design team in order to refine the restoration concept as necessary.
1-15	Given the dynamic nature of the SCRE and the anticipated, but uncertain, hydrologic changes (sea level rise and potential VWRF discharge reductions, etc.), the Preferred Restoration Concept was designed to provide improved function over the existing conditions for a wide range of estuary water levels. As noted in the comment, discrepancies between the various water balance models are likely due to different hypsometric relationships (anticipated to keep changing), but may also be due to differences in other inputs. For example, the models likely use different seasonal riverine and groundwater inflow assumptions (it is unclear what flows were used for the water balance used in the Subwatershed Study). Appendix B now provides additional details related to the methods and assumptions used for the water balance model used for this Project. As suggested by the comments, the Phase 3 Special Studies will provide more information on groundwater flows which can be used to further refine the water balance model and the Preferred Restoration Concept.
1-16	As requested, the text has been revised to clarify.

Comment Letter No. 2 – Heal the Bay

2-1	Thank you for your comments, your participation in this Project, and the work you do to keep southern California's coastal waters and watersheds safe, healthy, and clean. This Project was set up to explore the feasibility of creating expanded, enhanced, and restored habitat for the endangered southern California steelhead (and other native species). As indicated by the comment, the dynamic nature of the SCRE and the uncertainty in the future hydrologic conditions (sea level rise, climate change, and potential VWRF discharge reductions), necessarily requires that the Preferred Restoration Concept be designed to

	provide enhanced ecological functions and suitable habitat for the focal native and endangered species at a wide range of estuary water levels. This Project, the Preferred Restoration Concept, and this Feasibility Study were not intended to advocate for any specific VWRF discharge or reduction or whether there is any specific "maximum ecologically protective diversion volume." (See also response 1-7) It is important to note that seasonal variations are observed in the monthly mean VWRF discharge rate. These patterns were also incorporated into the hydrodynamic model (see Appendix A) and the water balance model (see Appendix B) and were not modified for the full range of reduction scenarios considered (i.e. monthly discharge rates were just scaled by percentages corresponding to 0%, 50% and 100%). To help address the comment, Figure 24 has been substantially revised and now also includes additional labels (in million gallons per day) to show which approximate (annually averaged) VWRF discharge rate was used for each simulation. As also clarified in the report and, the hydrodynamic modeling was performed using only a simple set of assumptions for groundwater inflows and is considered relatively ill-suited for analyzing the SCRE for reductions in the VWRF discharge rate beyond 50%. The water balance model was created to better capture groundwater flows into and out of the SCRE and provides superior water level results. Figure 24 has been revised to show just the water balance model simulation results for clarity. Estuary water level trends for other VWRF discharge scenarios can be estimated using Figure 24 by interpolating between the results shown.

Comment Letter No. 3 – The Nature Conservancy

3-1	Comment noted and greatly appreciated. Thank you for working with us on this Project to improve and refine previous restoration concepts for the SCRE, and for your ongoing efforts to protect the SCR and the Ventura/Oxnard coast by striving for an appropriate balance between people and nature.

Comment Letter No. 4 – Independent Technical Adviser: Prof. Rich Ambrose

4-1	Thank you for your thoughtful comments (both in your letter and as directly provided within the draft copy of the report text). Your participation in the Project, as an independent technical adviser, proved very valuable. Thank you for the restoration insights and the extensive experience related to restoration planning which you contributed to this Project.
4-2	Comment noted. Additional seasonal wetlands could be considered as the design of the Preferred Restoration Concept is refined and additional studies are completed. However, it should be noted that the area currently mapped as seasonal wetland is disconnected from the estuary and is associated with a portion of the site previously disturbed by oil exploration and related site grading.
4-3	The text has been clarified to reflect that, during river runoff events, the fluvial side channel and the fluvial side channel bypass provide *access* to the low velocity areas of the Restoration Area. The 2-year and 10-year hydrodynamic simulations (Figure 17 and Figure 21) indicate that though velocities within the fluvial channels are still significant (up to 3 fps for the 2-year and up to 7 fps for the 10-year), they are consistently lower than in the main estuary (7 to 10+ fps), and provide 'off-ramp' type access to the calmer waters of the slough channels (generally less than 3 fps).
4-4	Comments noted. Additional detail has been provided for the design features. Similarly, additional rationale (and more citations) have been provided to support the claim that sea level rise is anticipated to increase the elevation of the mouth berm (e.g. see also SCOR, 1991).
4-5	Thank you for your detailed and careful review. Many editorial changes were made to the report because of the thorough review you provided. Table 1 has been revised. Draft table values were not erroneous, but reflected the wrong number of significant digits. For clarity, Figure 24 has been substantially revised to reflect the water level predictions provided by the water balance model (superior to those provide by the hydrodynamic model) and also now includes a simulation reflecting a 100% discharge in the VWRF surface discharge rate. To keep the report to a manageable length, the full list of special status species is reserved for the Existing Conditions Technical Report.

Comment Letter No. 5 – Independent Technical Adviser: Prof. David Jacobs

5-1	Thank you for your participation in the Project and for the detailed comment letter. As an independent technical adviser, you provided a distinctly unique and creative restoration perspective that helped create vibrant and imaginative design concepts. Your experience and technical expertise served the Project well.
5-2	Thank you for reiterating the dynamic nature of the SCRE. As commented, the potential for both natural and human-related changes to the physical and hydrologic nature of the estuary should continue to guide the refinement of the Preferred Restoration Concept.
5-3	This comment provides a number of additional interesting and creative ideas for invasive species management and

	reducing estuary water temperatures. Though some of these ideas are beyond the scope of the Project, these are useful suggestions that should be evaluated further by the design team and the larger community as the restoration plans for the SCRE are refined. As suggested by the comment, the Preferred Restoration Concept is not anticipated to provide significant temperature relief within the main lagoon area of the SCRE. However, the Preferred Restoration Concept may provide up to a 2 °C reduction in the water temperatures observed within the water of the inundated campground. Increased shading through riparian vegetation (once established) is also anticipated to provide some additional water temperature benefits.
5-4	In response to your earlier preliminary feedback, Section 6.2.1 was expanded to include additional discussion related to the restoration planting approach used in the design of the Preferred Restoration Concept. While there are some challenges associated with establishing rare plants in the early stages of a restoration project (e.g. once rare species are established they will be subject to regulatory protection which could put restrictions on the types of adaptive management activities permissible), it is noted that rare plant restoration efforts (perhaps best done after the initial large scale restoration is complete), would certainly provide a more floristically diverse site and could be more reflective of the vegetation communities suggested by the historical mapping. As the design of the Preferred Restoration Concept is refined and finalized these ideas should be revisited and discussed more specifically with regulatory agencies and State Parks.

Comment Letter No. 6 – Independent Technical Adviser: Mark Abramson

6-1	Thank you for your comments and your participation in the Project. Your thoughts and ideas significantly influenced the shaping of the Preferred Restoration Concept. The list of ideas for further study is noted. Though some items are beyond the scope of the present Project (as they pertain to the longer term management and potential regulatory decisions related to the SCRE), many are key considerations for the final restoration designs.

Comment Letter No. 7 – Independent Technical Adviser: Prof. Sean Anderson

7-1	Thank you for your comments, your participation in the Project, and your support for the Preferred Restoration Concept.
7-2	Comments noted. The potential for significant changes within the main estuary (e.g. due to a large runoff event) and the uncertain future hydrology (sea level rise, climate change, and potential VWRF discharge reductions, etc.) were indeed major considerations for the development of the Preferred Restoration Concept and this theme is reiterated throughout the report. As suggested, the executive summary has been revised to further acknowledge that the dynamic nature of the estuary should continue to be considered an integral part of the ecological and physical restoration designs as concepts are refined beyond the 30% level. The executive summary was also expanded to specifically note that, "Adaptive management of the SCRE should allow for an evolving system (the natural condition), and a could even explore methods for specifically encouraging it to do so while providing the much needed habitat for native and endangered species."
7-3	Additional rationale for several design features has been added to Section 4, but the comment is well stated: Uncertainty in this type of project is often best addressed through heterogeneity in the restoration design and a diversity of restoration elements.

APPENDIX J – NATURAL AND CULTURAL RESOURCES INTERPRETATIVE AREA

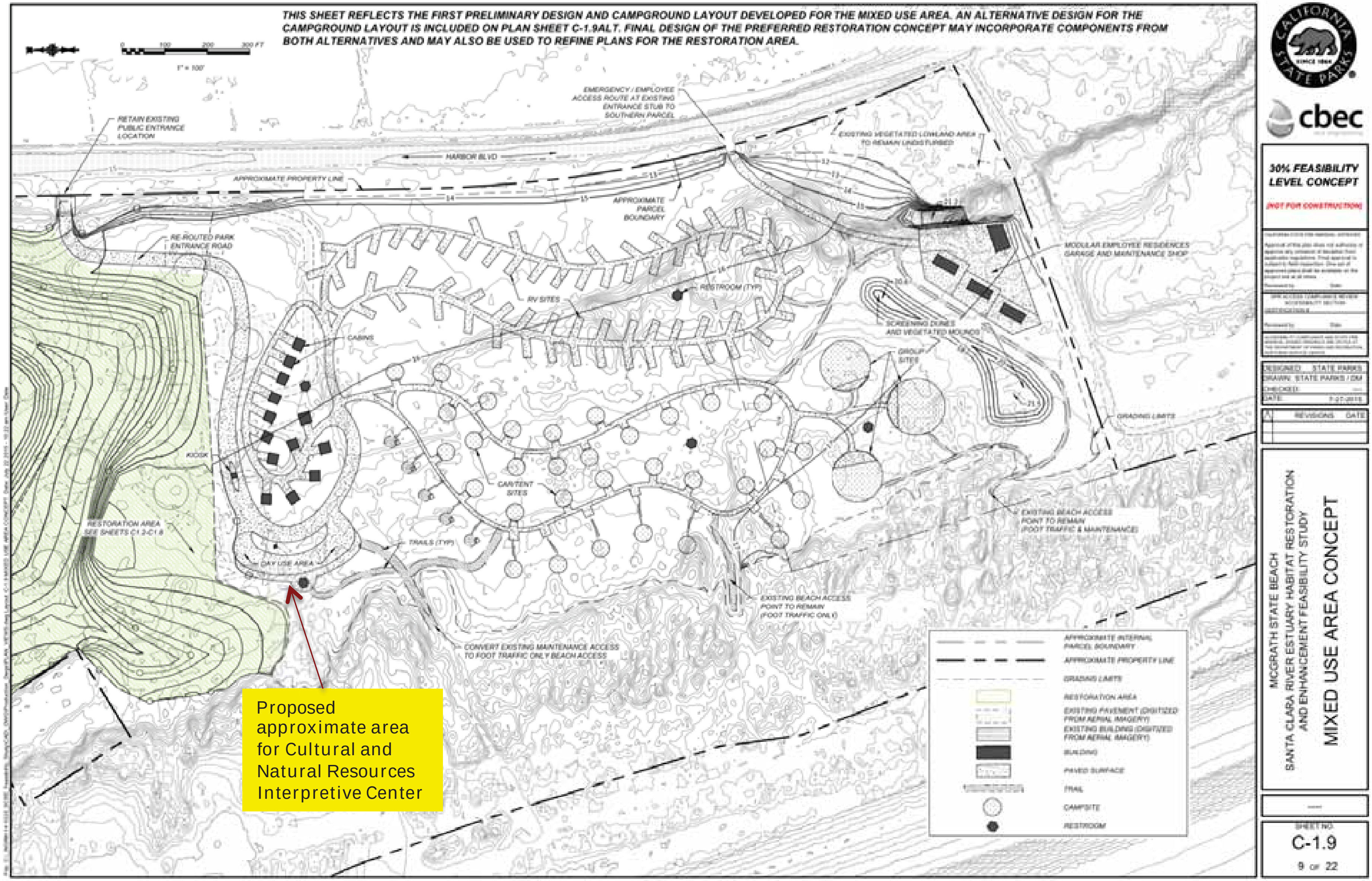
McGrath State Beach Proposed Cultural and Natural Resources Interpretive Area Concept

The following pages provide examples of Chumash structures and items that are suggested elements for a possible Natural and Cultural Resources Interpretive Area at the McGrath State Beach Campground which could be integral components of mixed use and gathering area for campers and day visitors. Guided and unguided tours would be conducted through a Chumash Demonstration Village Area where associated natural and cultural signage would depict the historical and present day life and relationships with the natural habitat of native plants and animals, and perhaps highlight endangered and native species of concern in the estuary and local coastal waters, and the environmental work being done to protect and restore those species today.

The *Sil'i'yik*/Amphitheater can be a mixed use gathering area for Chumash presenters, State Parks Staff and Special presenters to engage campers in storytelling, songs, dances and hands on activities (i.e. Chumash clapper sticks, baskets, rock art, etc.). In addition, campers/ student participants can engage in hands on science activities (i.e. Ocean Acidification, native plants education or bird identification). Cultural and environmental activities can increase a sense of place and bring cultural and environmental awareness while instilling a conservation ethic.

Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

Proposed Area for Cultural and Natural Resources Interpretive Area on the Preferred Alternative Map



Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

Proposed Area for Cultural and Natural Resources Interpretive Area on the Alternative Map

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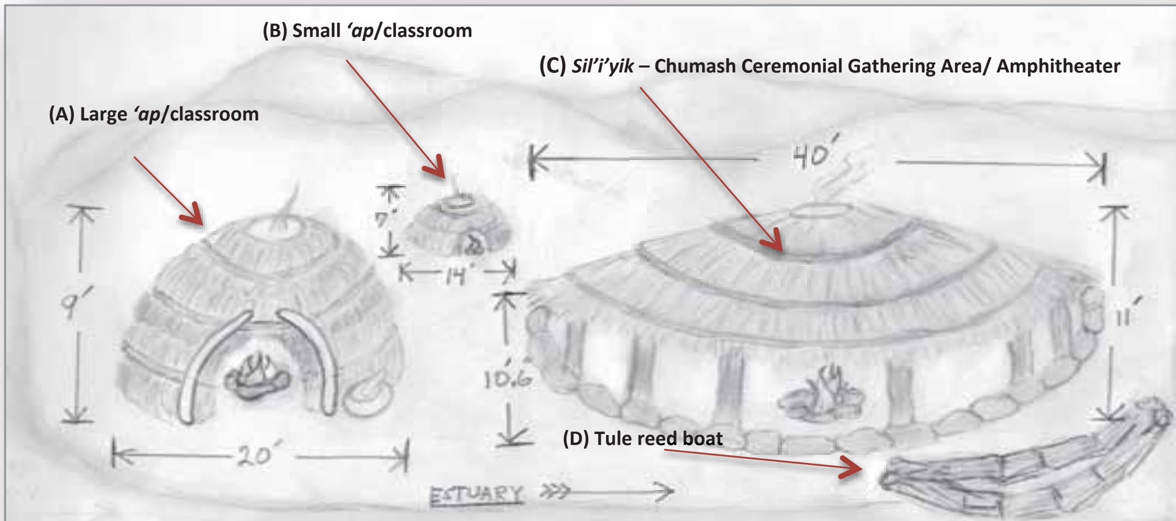
30 ft. Redwood Plank *Tomol* (Chumash canoe) and *Tomol* House

Actual *'ap* w/ whale ribs adorning entrance used for traditional purposes and as a classroom

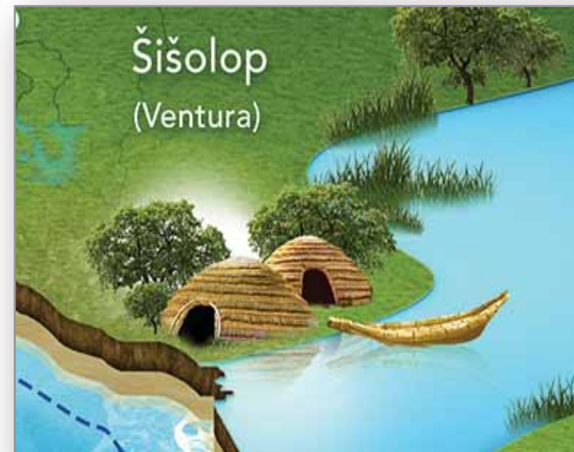
Teaching cultural & environmental science inside *'ap*

Students inside *'ap* utilized as a classroom

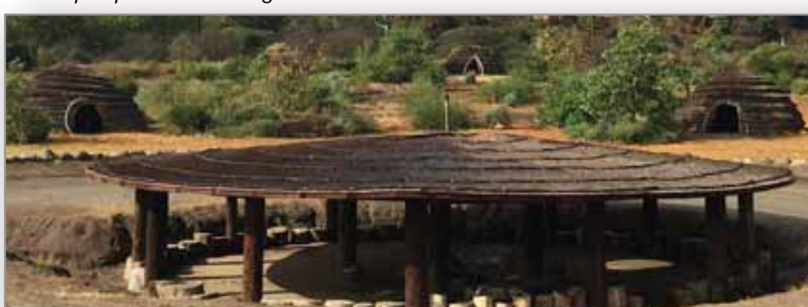
McGrath State Beach Cultural and Natural Resources Interpretive Area Concept



Rendering of *'ap 'ap* and tule reed boat on a river



Chumash Ceremonial and Gathering Area, *sil'i'yik/* Amphitheater w/*'ap 'ap* in the background



Cultural Presentation inside the *sil'i'yik* /Amphitheater during a program

Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

McGrath State Beach Proposed Cultural and Natural Resources Interpretive Area Concept
Tomol and Tule Reed Boat

Redwood Plank *Tomol* (Chumash canoe/Ocean vessel) and *Tomol* House

- 26 Ft. Redwood Plank Tomol – Estimate: $35,000
  (includes time and materials)

Tule Reed Boat (river vessel)

- 12 - 15 ft. Tule Reed Boat – Estimate: $5,000 - $7,000
  (includes time and materials)

Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

McGrath State Beach Proposed Cultural and Natural Resources Interpretive Area Concept
Chumash Houses ‘ap ‘ap and Sil’i’yik (Amphitheater)

Chumash House called ‘ap made with a willow frame and tule thatching. More than one house called *‘ap ‘ap*.

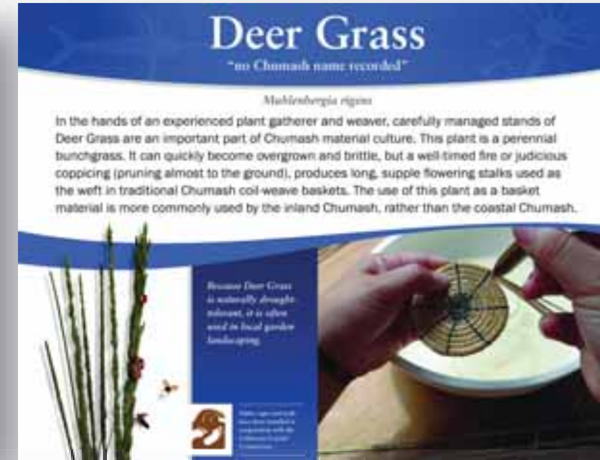
- 1 *‘ap* – 9ft. X 20 ft. – Estimate: $24,000 (includes time & materials and takes approximately 4 months to build and will hold 25 - 30 people.)
- 1 *‘ap* – 7 ft. x 14 ft. – Estimate: $18,000 (includes time & materials and takes approximately 3 months to build.)

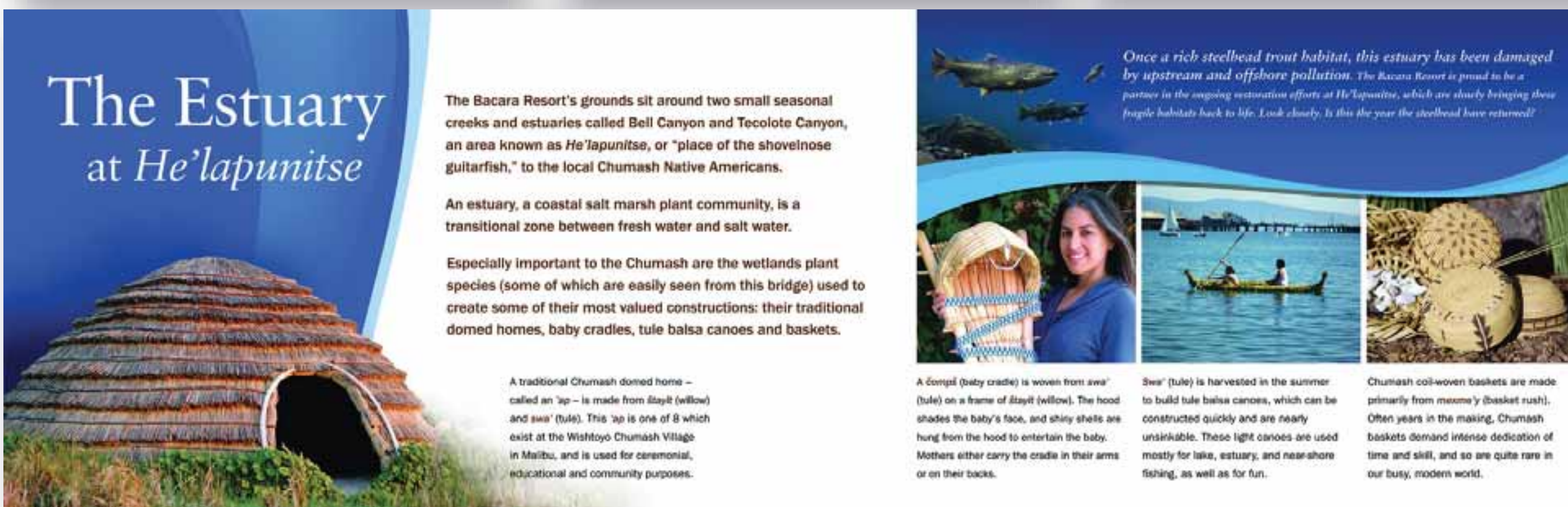
Sil’i’yik - Chumash Ceremonial and Gathering Area/Amphitheater with Fire Circle

- *Sil’i’yik* 40 ft. Round and 11 Ft. in Center and 10.6 Ft. high on periphery.
- Estimate: $45,000 (includes time and all materials. Takes approximately two months to build and will hold 100+ people.

Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

Examples of Interpretive Signage for Proposed Natural and Cultural Resources Interpretive Area for McGrath State Beach





The above examples were done by designer Tima Link Lotah for a Chumash Interpretive Trail at Bacara Resort in Santa Barbara

Wishtoyo Foundation and Ventura Coastkeeper
3875 Telegraph Rd., #A
Ventura, CA 93003

APPENDIX K – MCGRATH STATE BEACH RELOCATION FEASIBILITY STUDY

911 San Pedro Street
Ventura, California 93001

July 27, 2015

Jason Weiner
Wishtoyo Foundation
3875 Telegraph Road
Ventura, California 93003

Re: Santa Clara River Estuary Habitat Restoration and Enhancement Feasibility Study, California State Parks Deliverables for Task 3: McGrath State Beach Campground Demolition Plan, and New Campground Designs and Site Plan to 30% Completion

Dear Mr. Weiner:

Thank you for the opportunity to work with your organization as we develop future plans for estuary restoration and campground relocation at McGrath State Beach. California State Parks played a crucial role in the development of the Preferred Restoration Concept by providing detailed local site knowledge, a wealth of restoration and recreation planning and management experience, facilities to support Project meetings and design workshops, and helpful technical and campground staff to support the field work surveys and assessments completed for this Project. In addition, State Parks has also provided a number of deliverables for the campground design as specified in Task 3 of the FRGP Grant. These Task 3 deliverables, encompassing the "McGrath State Beach Campground Demolition Plan, and New Campground Designs and Site Plan to 30% Completion include the following:

Topographical Study

Sheets C-1.9 and C-1.9Alt include a topographical overlay which was developed using LIDAR technology and on-site visual work. Horizontal and vertical control points were located and established by a Professional Licensed Surveyor and can be found on Sheet C-1.1 in Appendix F. Appendix B describes the work done to acquire/confirm bathymetry for the estuary and an updated survey of the mouth berm. Other topographic studies involved acquiring LIDAR datasets and review/datum updates to previous contours. Older State Park plans and topographical data were migrated into NAVD88. All the various topographical surfaces (the plans in Appendix F of the Feasibility Study and all the figures in the Feasibility Study showing a shaded digital elevation model) are in the same vertical datum.

Campground Site Plans Alternative Analysis

The two campground alternatives were developed after the design team received extensive stakeholder feedback and preliminary evaluation of the environmental constraints found within McGrath State Beach including the availability of fill material and future regional recreation trends. State Park Landscape Architects and Civil Engineers, who have been designing coastal campgrounds for decades, placed a high emphasis on balancing coastal access with habitat protection, wetland and dune restoration, as well as recreational use and park education/interpretation. Sheets C-1.9 and C-1.9Alt in Appendix F display the two campground site alternatives developed through the Feasibility Study.

Existing Campground Demolition Plan

All structures, including existing restrooms, kiosks, residences and maintenance buildings, as well as support infrastructure, such as roads and utilities found within the wetland restoration area, will be demolished (or relocated if later to be determined feasible) and removed from the site. Sheets C-1.2 to C-1.8 in Appendix F illustrate the extent of the existing pavement and other campground infrastructure that will need to be removed.

Campground Site Plan Designs/Construction Plans

Sheets C-1.9, C-1.9Alt, and C-1.10 in Appendix F provide two alternative site plans for the relocated campground at the 30% level of detail including campground layout, road alignments, bathrooms, an entrance kiosk, pedestrian trails, and potential locations for environmental and cultural interpretative areas. See Appendix J for details regarding a potential Natural and Cultural Resources Interpretive Area.

Campground Construction Cost Estimates

State Park estimators determined the campground construction (hard and soft costs) are $11,503,587 including 43 month escalation.

Grading Plans

Cut and fill are balanced on site, including the spoils from the wetland restoration (however, additional geotechnical and soil study is required to determine quality of the spoils and to determine the level of engineered sub-base required for the new campground infrastructure work). The campground elevation is proposed to be the same if not higher than the existing elevation of Harbor Boulevard, thus providing protection of the new campground and maintenance facilities during high flood periods. Section 4 of the Feasibility Study describes the overall grading plan for the Preferred Restoration Concept and provides additional details for the features of the Restoration Area. Figure 15 shows cut/fill areas for the entire site (corresponding to the alternative shown on C-1.9 in Appendix F). Sheets C-1.9 and C-1.9Alt in Appendix F detail the grading plans for the campground.

Civil Engineering - Road Design

Proper road design including road widths, profile and turning radii, are illustrated on sheet C-1.9 and C-1.9Alt in Appendix F . Road design and road layout were determined by the proposed vehicular use, including large recreational and maintenance vehicles.

Civil Engineering - Utility Placement
Utilities will be sized and located to accommodate the planned facilities as shown on sheet C-1.9 and C-1.9Alt in Appendix F. Carrying capacity/loads of such structures is denoted on sheet C-1.10 in Appendix F .

Structural Engineer - Bathrooms
Typical restroom floor plans are provided on sheet C-1.10 in Appendix F. Construction material and construction type have yet to be determined, awaiting further public and agency input on the desired campground aesthetics.

Horizontal/Vertical Control
The horizontal and vertical control was set per the in the proposed wetland restoration area by cbec and by the elevation of the adjacent Harbor Boulevard. Control points are shown on sheet C-1.1 in Appendix F.

SWPPP/Erosion Control
The best management practices described in the preliminary SWPPP (Appendix E) developed for the restoration area are also appropriate for use in the new campground. In addition, proposed bio-swales and retention ponds will help direct and control run-off (and control erosion) and flood waters away from the new campground.

Please let us know if you have any questions.

Sincerely,

Richard Rozzelle
District Superintendent