PWA
PHILIP WILLIAMS & ASSOCIATES, LTD
ENVIRONMENTAL HYDROLOGY
550 Kearny Street, Suite 900
San Francisco, California 94108-2404
TEL 415.262.2300 FAX 415.262.2303
www.pwa-ltd.com

M E M O R A N D U M

Date:	January 15, 2010
To:	California State Coastal Conservancy
From:	Philip Williams & Associates Santa Monica Bay Restoration Commission Nordby Biological Consulting
PWA Project #:	1793
PWA Project Name:	Ballona Wetlands Restoration
Subject:	Preferred Alternatives Memorandum
Copy(ies) To:	Ballona Wetlands Project Management Team

1. INTRODUCTION

This memorandum documents revisions and refinements of Alternatives 4 and 5 from the Ballona Wetlands Restoration Feasibility Study (PWA and others 2008). The Project Management Team (PMT) directed the consultant team to develop revised versions of Alternatives 4 and 5 from the Feasibility Study as the two preferred preliminary restoration alternatives based on recommendations from the Science Advisory Committee (SAC 2008) and input from the Ballona Wetlands Restoration Working Group and the Agency Advisory Committee.

The revised versions of Alternative 4 (Figures 1 to 4) and Alternative 5 (Figures 5 to 8) are described at a conceptual-level of detail in this memorandum. These conceptual alternatives will serve as the basis for the project description in the environmental document and further development of the restoration design.

This memorandum is organized as follows:

- Section 2 of this memo summarizes refinements to the alternatives based on key constraints identified in the feasibility study. Meetings were held with the Southern California Gas Company (Gas Company) (a Sempra Energy utility), Los Angeles Department of Water and Power (DWP), City of Los Angeles Department of Transportation (LADOT), County of Los Angeles Department of Public Works Watershed Management Division (LA County Watershed Management), Los Angeles County Department of Beaches and Harbors (Beaches and Harbors), California Department of Transportation (CalTrans), and Tongva Tribal Representatives. A more detailed description of the issues raised in each of these meetings is included in Appendix A of this document.
- Section 3 discusses a target species analysis performed to evaluate which species would potentially benefit from the refined alternatives.

- Section 4 includes habitat elevations used for alternative revisions.
- Section 5 describes how sea level rise is considered in the alternative refinements and how restored wetlands in the revised alternatives are expected to accommodate and respond to sea level rise.
- Section 6 describes the revised alternatives with a discussion of their phasing.
- Section 7 describes adaptation strategies that could be incorporated into an adaptive management plan.
- Section 8 describes next steps for further developing restoration plans.

This memo uses information from both the Draft Ballona Wetlands Existing Conditions Report (PWA and others 2006) and the Feasibility Study (PWA and others 2008). These two reports may be downloaded from the Ballona Wetlands Restoration Project web page (www.ballonarestoration.org).

2. INFRASTRUCTURE AND CULTURAL RESOURCE CONSTRAINTS MEETINGS

After completion of the Feasibility Study, members of the PMT and consultant team met with agencies, businesses, and organizations that have an interest in the infrastructure or cultural resources within and adjacent to the Ballona restoration site. The purpose of these meetings was to give an overview of the restoration plan to these groups, obtain additional information related to infrastructure and cultural resource constraints, and discuss project approaches to address these constraints. The following is a list of issues that will affect the wetland restoration design. Details can be found in Appendix A of this memo.

New Culvert Connections to Marina Del Rey

Providing an adequate tidal connection to Area A from Marina Del Rey in Alternative 4 could be accomplished by increasing the capacity of the culvert under Dock 52 into Basin H and/or by constructing one or two new culverts between Marina Del Rey and Area A. There are two possible locations where a new tidal connection from Marina del Rey could be located: (1) under the parking lot north of the Beaches and Harbors office and (2) under Parcel 55, which is located at the northwest corner of Fiji Way and planned for redevelopment.

Bike Path around Marina Del Rey

The Ballona Creek bike path will be realigned in Alternative 5 to run along the north side of Area A. Beaches and Harbors would like to make a connection between the existing bike route at Fiji Way and the Ballona Creek bike path. In addition, the County may be required to make improvements to the bike route around the Marina as part of any redevelopment plans. The County would be interested in partnering with Ballona Wetlands Restoration project to develop an improved trail along the Ballona Wetlands rather than on the street.

Gas Company Infrastructure

1. Most on-site infrastructure is in the process of being abandoned and/or replaced by directionally drilled wells.

2. The 30-inch gas transmission line from the Gas Company facility at the base of Westchester Bluff to Jefferson may need to be relocated along the Gas Company Road. Pipeline relocation costs may be roughly $2 to $3 million per mile, or possibly more for a section less than a mile.

3. Decommissioning of wells requires heavy rigs (approximately 80,000 lbs) and existing access roads will have to be improved in the short-term to allow decommissioning.

4. There may be some local contamination near the wells from previous crude oil operations.

5. Flood levees and drainage of the Gas Company facility at the base of the Westchester Bluff need to be incorporated into the restoration design.

6. The Gas Company's projects to consolidate its infrastructure could be integrated with the overall restoration plan to help facilitate environmental review and permitting.

Power Lines

1. The existing "Scattergood-Olympic Line 2" power transmission line, which runs under Culver Blvd. for the entire length of the project area, has a maximum 4-ft cover requirement. This line will have to be raised or moved if Culver Blvd. is raised or moved. The replacement cost is approximately $10 million per mile. Rather than replacing the power line, it may be possible to construct the raised road next to Culver Blvd. and leave the existing road and power line in the shoulder of the new raised road. The feasibility of this approach will need to be further evaluated and discussed with DWP and LADOT in future phases of the project.

2. In or around 2011, DWP plans to install a new power transmission line from the Scattergood Plant in El Segundo through Playa del Rey to the substation at Centinella Ave. and Olympic Blvd. The presently preferred alignment is through LAX airport property. Alternative alignments considered, but not preferred, are along Culver Blvd. and Jefferson Blvd. to Lincoln Blvd. and also along Cabora Dr. The new transmission line and the existing line (item 1 above) could be relocated along the same route, provided that the lines are a minimum of 20 ft apart. DWP practice is to avoid having two lines crossing the same bridge.

3. DWP indicated their overhead power distribution lines could be relocated underground for a cost of approximately $3 million per mile and that funding is available from three conversion programs.

Sanitary Storm Drains and Sewers

1. The property boundary and easement map (Rosell 2007) shows a 20-ft wide sanitary sewer and storm drain easement to the City of Los Angeles that generally runs north to south through Area A and Area B west of the Gas Company Road.

2. Members of the PMT contacted the City of Los Angeles, who provided information indicating that there is an abandoned 36" reinforced concrete pipe (RCP) within this easement (S. Kharagani, City of LA, pers. comm.). The abandoned pipe would likely need to be removed and capped where any excavation down to the pipe is planned for the restoration.

Flood Management

A more detailed flood management plan will need to be developed in future phases of the restoration project in coordination with LA County Watershed Management, U.S. Army Corps of Engineers (USACE), and FEMA. Additional modeling of flood scenarios and coordination with LA County Watershed Management on the modeling scope, assumptions, and results will be required. PWA performed flood modeling for the Feasibility Study (PWA and others 2008) to evaluate potential changes to flood hazards for the Feasibility Study alternatives. This flood modeling showed that Alternatives 4 and 5 reduced peak flood levels in Ballona Creek due to storage of flood water in the restored wetlands. Alternative 5 had slightly less of a reduction in peak flood levels than Alternative 4, due in part to the channel configuration and roughness of the vegetated floodplain. Flood modeling has not been performed for the revised versions of Alternatives 4 and 5 described in this memo; however, the revised alternatives are expected to also reduce peak flood levels in Ballona Creek. The reduction in the revised Alternative 5 may be less than previously modeled due to the smaller area of restored floodplain (i.e., Area C is not restored to tidal marsh/floodplain in the revised Alternative 5).

In Area B, most of Culver Blvd., Jefferson Blvd. and the Gas Company road are below the 100-year flood elevation. The 100-year water surface elevation in Ballona Creek at the Culver Blvd. bridge is approximately 13 ft NAVD (USACE 2008). Culver Blvd. elevations range from approximately 7 to 10 ft NAVD before the bridge, Jefferson Blvd. ranges from approximately 8 to 14 ft NAVD, and the Gas Co. road ranges from approximately 9 to 10 ft NAVD (PSOMAS 2005).

Roads

1. LADOT and Caltrans traffic engineers will need to coordinate on moving the intersection of Culver Blvd. and Jefferson Blvd. to realign Culver Blvd. as proposed in Alternative 5. There is the potential for road improvements to provide traffic improvements (e.g., smooth intersections).

2. In 2011, Caltrans expects to be "ready to list" a project for construction bids to widen Lincoln Blvd. from Ballona Creek to Fiji Way, construct a new bridge over Ballona Creek, and replace

the Culver Blvd. overpass. This also presents the opportunity to replace the existing culvert between Areas A and C with a new culvert.

Native American Cultural Resources

The PMT has coordinated with a Tongva representative to obtain information about the location of potential cultural sites. This coordination will continue and expand as restoration alternatives are further defined. The proposed approach to cultural resources is to avoid disturbance of any intact cultural sites during construction. Restoration of tidal wetlands may enhance these cultural resources and erosion caused by the tides or other natural processes may be acceptable. Cultural resources located within the fill material placed at Ballona during construction of Marina Del Rey may be considered to have already been disturbed. Removal of fill material and disturbed Tongva resources within the fill material may be acceptable, and would be coordinated with the Tongva Tribal representatives.

3. POTENTIAL TARGET SPECIES

One of the recommendations from the Science Advisory Committee and many of the stakeholders in reviewing the Feasibility Report was to include an analysis of the potential ability of the restoration alternatives to support specific target species.

The use of target species and habitat to compare and refine proposed restoration alternatives were based on a modified framework approach developed by Ambrose and Bear, 2008. Those authors developed a framework that incorporated historical data on habitat types, habitat mix and extent, habitat-species relationships and habitat function relationships for Ballona wetlands. The framework consisted of a spreadsheet that quantified the distribution of habitats and species that historically occurred in the Ballona area as well as those that would be created under the proposed conceptual restoration alternatives.

The current analysis employs a modified framework based on the one developed by Ambrose and Bear (2008). Attachment 2 includes the potential target species analysis and results.

4. HABITAT ELEVATIONS

Table 1 includes the elevations used to define different habitat types for the purposes of revising the preferred restoration alternatives. These habitat elevations are based on Zedler (2000) and Josselyn and Whelchel (1999), as well as a review of previous habitat elevations from the Feasibility Study. These habitat elevations are related to tide levels as noted in Table 1, and are used as a surrogate for inundation frequency. Table 1 also shows habitat elevations with the addition of 16 in. (1.3 ft) and 55 in. (4.6 ft) of SLR. The habitat elevations in Table 1 may be refined during future phases of the design based on additional data and information from existing wetland habitats at Ballona and other reference sites in Southern California.

5. RESTORED WETLAND RESPONSE TO SEA LEVEL RISE

The primary adaption strategy for this site is to use broad transitional slopes between wetland and upland habitats to allow wetland habitats to transgress landward with sea level rise (PWA and others 2008). The State Coastal Conservancy's Climate Change Policy adopted June 4, 2009 includes the following policy on sea level rise:

> "Prior to the completion of the National Academies of Science report on sea level rise, consistent with Executive Order S-13-08, the Conservancy will consider the following sea level rise scenarios in assessing project vulnerability and, to the extent feasible, reducing expected risks and increasing resiliency to sea level rise:
>
> a. 16 inches (40 cm) by 2050.
> b. 55 inches (140 cm) by 2100."

The preferred alternatives were revised to better accommodate projected sea level rise. Revisions include increasing the acreage of transition and upland habitats that provide space for wetland habitat transgression over time, and also identification of potential adaptive management responses to sea level rise (see Section 7).

Sediment supply from the Ballona Creek watershed and Santa Monica Bay is expected to be low, as are sedimentation and accretion/aggradation of the restored wetland surface (marshplain). Therefore, the potential for sediment accretion in the restored wetland to keep pace with SLR is not likely. To accommodate future sea level rise, the preferred restoration alternatives include grading long gradually sloping transitions from mudflat to upland habitat in Area A. These gradual slopes are intended to allow wetland habitats to transgress up slope with rising sea levels. Wetland habitats types are generally found within a range of elevations related to specific tidal inundation frequencies that are suitable for associated plant types. As tide levels and inundation frequencies increase with sea level rise, wetland habitat types may be converted to habitats that occupy lower portions of the tide frame (e.g., conversion of vegetated marsh to mudflat) and upland transition habitats may be converted to wetland habitats. This process of "coastal rollover" has occurred over geologic time, and is expected to continue and accelerate with projected sea level rise.

Figure **9** shows a conceptual cross-section of the restored grade in Alternative 5 from the south (Ballona Creek) to the north (Fiji Way). Habitat types expected post-restoration are shown conceptually, with narrow bands of mudflat and low salt marsh along the Ballona Creek channel bank and broad areas of mid marsh, high marsh, transition zone, and upland habitats. With 1.3 ft (16 in.) of SLR and associated increased inundation frequencies, mid marsh may be converted to mudflat and low marsh, high marsh may be converted to mid marsh, and the transition zone may "squeeze" upland habitats into a narrow band along the steeper upland/levee slope. With 4.6 ft (55 in.) of SLR, the site may be converted to a mix of mudflat, low marsh, and mid marsh, with high marsh and transition zone habitats "squeezed" onto the

levee slope. The restored slopes of Area A in both Alternatives 4 and 5 are intended to maintain the restored area of vegetated mid marsh with 55 in. of SLR. (Note these slopes could be changed to also maintain the restored area of high marsh.) The preferred alternatives therefore include large areas of upland and transition zone habitats around the perimeter of Area A that are expected to be converted to wetland habitats over time. These restored upland and transition habitats are expected to provide interim habitat benefits and avoid the cost of initially grading these areas to wetland habitat elevations.

This simplified conceptual model of restored wetland response to sea level rise assumes minimal sedimentation and aggradation of the wetland surface occurs. The conceptual model also does not consider more complex ecological processes and responses that will likely occur. Attachment 3 includes figures that show how Alternatives 4 and 5 are expected to respond to sea level rise based on this conceptual model.

6. PREFERRED RESTORATION ALTERNATIVES

6.1 ALTERNATIVE 4: A LARGE AREA TIDAL WETLAND RESTORATION WITH SUBTIDAL COMPONENT

Alternative 4 (Figures 1 and 2) would restore a subtidal embayment surrounded by marsh, transition zone, and upland habitats in Area A (Section 6.1.1); marsh and transition zone habitats in Area B (Section 6.1.2), and primarily upland habitats in Area C (Section 6.1.3). Public access features for Alternative 4 (Section 6.1.4) are shown in Figure 3. Figure 4 shows an artistic rendering of Alternative 4..

6.1.1 Area A

Area A would be graded to include a shallow subtidal embayment, tidal channels, intertidal mudflat, low salt marsh, mid marsh, high marsh and associated transition zone habitats, and upland habitats. The depth of the shallow subtidal habitat will be about -5 ft NAVD. There will be a long transition from mudflat to upland on the south side of Area A, adjacent to Ballona Creek. This will consist of grading a gentle slope ranging from about 50:1 to 300:1 (horizontal:vertical) from approximately 0 ft NAVD to an elevation of 11 ft NAVD around the southern perimeter of Area A (including the southwest and southeast corners). This gentle slope would allow marsh habitats to transgress to upland areas over time with future sea level rise as described in Section 5. A sinuous network of branching tidal channels will be excavated through restored mudflat and marsh habitats. A steeper slope of about 5:1 will be graded above 11 ft NAVD to connect to the existing grade along the southern perimeter, which ranges in elevation from about 12 ft to 18 ft NAVD. In a few locations along the southern perimeter, fill may be placed to raise lower elevation areas and reduce the potential for overtopping of Ballona Creek flood flows into Area A. On the northern side, adjacent to Fiji Way, the slopes will also be steeper and habitat zones will be narrower. The slope along the northern perimeter will be graded at about 5:1 or 10:1, from -5 ft NAVD to existing grade. The existing grade along the northern perimeter ranges from about 11 ft to 16 ft NAVD and, west of Fiji Ditch, is typically above the elevation of Fiji Way. Fill may be placed to raise portions of the existing

grade to create a buffer and reduce the potential for coastal flooding of Fiji Way from Area A, with an accommodation for future sea level rise. Fill may also be placed to raise and/or protect the portion of Lincoln Boulevard along the east side of Area A.

The large restored subtidal area requires a substantial tidal connection to Marina del Rey under Fiji Way. Preliminary analysis of the culvert capacity suggests a cross-sectional area of about 500 sq. ft. would be required; further analysis is required to refine this estimate. Providing an adequate tidal connection could be accomplished by increasing the capacity of the culvert under Dock 52 into Basin H and/or by constructing one or two new culverts between Marina Del Rey and Area A. The two new tidal connections directly from Marina del Rey could be located: (1) under the parking lot north of the Beaches and Harbors office and (2) under Parcel 55, which is located at the northwest corner of Fiji Way and planned for redevelopment. One, two, or three tidal connections could be used to provide tidal water to Area A.

Fiji Ditch would be realigned to create a new tidal channel that meanders through marsh habitat in Area A and connects to Area C under Lincoln Blvd. A new larger culvert may be constructed under Lincoln Blvd. to replace the existing culvert connection between Areas A and C.

6.1.2 Area B

Area B would be graded to include fully tidal channels, low marsh, mid marsh, high marsh and associated transition zone habitats, and upland habitats. The Ballona Creek south levee would be breached in two locations to provide tidal connections to Area B. The existing grade of the majority of Area B is at elevations that are expected to support low marsh and mid marsh habitats, and these areas would therefore not be graded. A network of sinuous and branching tidal channels would be excavated within the marsh habitats.

New levees would be constructed to protect low-lying areas along the south side of Area B, as well as Culver Blvd., Jefferson Blvd., and the Gas Company Road. The new levee elevations will be determined through further analysis in future phases of the project; the objective is to at least maintain the existing level of flood protection for urban development and the roads, with consideration of sea level rise as discussed in Section 5. Ideally, Culver Blvd., Jefferson Blvd., and the Gas Company Road will be raised onto the tops of new levees. Gentle levee slopes of about 20:1 would be constructed to provide an upland transition zone up to an elevation of about 11 ft NAVD. Above 11 ft NAVD, a steeper slope of about 5:1 would be constructed up to the top of the new levee or road.

The western portion of Area B, to the west of the Gas Company Road (which runs south from the intersection of Culver Blvd. and Jefferson Blvd.), would be connected to Ballona Creek by a breach in the same location as the existing self-regulating tide gates. The existing tidal channel network would be extended to allow tidal flow to reach all parts of the site. The Ballona Creek breach would be about 100 ft wide; further analysis is required to refine the size of this breach, the channels, and the culvert. A new

culvert or bridge in Culver Blvd. would provide a full tidal connection to the area south of Culver Blvd. and wildlife passage under Culver Blvd. Most of the western portion of Area B is at elevations that are expected to support low marsh and mid marsh habitat after restoration, and will therefore remain at existing grade. The existing dunes along the western edge of Area B would be retained.

The eastern portion of Area B, to the east of the Gas Company Road, would also be restored to full tidal action by breaching the Ballona Creek levee at the present location of the Freshwater Marsh culvert. The existing underground culvert would be replaced with an open, meandering tidal channel between the existing culvert sections under Culver Blvd. and Jefferson Blvd. These culvert sections would be replaced when the roads are raised. A tidal channel network would be excavated in the areas north of Culver Blvd., between Culver Blvd. and Jefferson Blvd., and in the area south of Jefferson, adjacent to the Freshwater Marsh.

An area of brackish marsh would be created in the southeastern portion of Area B, between the restored salt marsh and Freshwater Marsh. The brackish marsh area may be filled to an elevation higher within the tide range. Alternatively, water control structures (e.g., weirs) may be used to limit the influence of saline tidal water. Freshwater from the Freshwater Marsh would be routed to the brackish marsh via the Freshwater Marsh outflow/overflow structures. Channels may be constructed through the brackish marsh to connect to these freshwater outflow structures. Brackish marsh salinities could be adaptively managed by adjusting water control structures to vary the amount of freshwater outflow and/or saline tidal inflows.

A tide gate would be constructed immediately adjacent to the Freshwater Marsh outlet to prevent saline water from entering the Freshwater Marsh. The Freshwater Marsh would be retained and operated as it has been in the past.

6.1.3 Area C

Area C includes the highest elevations of the project area. In Area C, the emphasis will be on enhancing the upland habitat with Coastal Sage Scrub and native grassland habitat. Any excess material excavated from Areas A and B would be placed in Area C. The construction of seasonal wetlands and a small treatment wetland is planned. An area of salt marsh and transition zone habitat will be restored west of Lincoln Blvd. by grading this area down to the appropriate elevation, with a gentle slope of about 250:1 extending through the transition zone and adjacent upland habitat. This gentle slope would allow marsh transgression with future sea level rise as described in Section 5.

6.1.4 Public Access

In Area A, there would be a loop trail on the existing Gas Company Road, and a perimeter trail along the southern edge of the restored estuarine wetland, portions of which would be boardwalk (Figure 3). Gateway entrances would be located at the existing parking area near Fisherman's Village and along the Ballona Creek Bicycle Path. The loop and perimeter trails would link the gateway entrance near

Fisherman's Village to the Ballona Creek trail located along the north levee and the two gateway entrances along Ballona Creek. Overlooks would be located near the Fisherman's Village gateway entrance and along the perimeter trail. A formal parking/staging area would be developed at the gateway entrance near Fisherman's Village.

In Area B, formal parking areas would be located at the gateway entrance behind Gordon's Market and along Jefferson Blvd. at the Freshwater Marsh. A link between the east and west portions of Area B would be provided by a pedestrian crossing located on Culver Boulevard. A pedestrian crossing exists over Ballona Creek at the western end of the project site; an additional pedestrian crossing over Ballona Creek is needed near Lincoln Blvd. to allow a loop trail around the site.

Public access features in Area C would include two loop trails originating from the gateway entrances at La Villa Marina and near the Little League fields. A parking area would continue to be located at the Little League fields. Overlooks would be located at viewing points for the seasonal wetland area near the Little League fields and north of Culver Blvd at the restored estuarine wetland area. The Little League fields will be preserved, but may be reconfigured.

6.1.5 Alternative 4 Phasing

Alternative 4 could be implemented in a single phase, with a series of steps or stages occurring over several years. A single-phase construction is preferable in terms of construction efficiency. A possible sequence of stages for constructing Alternative 4 in a single phase is listed in Section 6.1.5.1. If implementing Alternative 4 in a single phase is not possible due to project funding or other constraints, implementation could occur in multiple phases, with several years between each phase. Section 6.1.5.2 lists possible construction phases.

Note that stockpiling and/or disposal of excavated material may be required between stages and phases. Construction staging and stockpiling areas will be identified in future phases of the project.

6.1.5.1 Alternative 4 Single-Phase Construction

The following list is a possible sequence of stages for constructing Alternative 4 in a single phase.

Stage 1. *Restore wetlands in Areas A and C*

- Grade Area A to provide wetland habitats and create tidal channels
- Place fill to raise portions of the Area A northern perimeter and protect Fiji Way and Lincoln Blvd. as needed (including possibly raising a portion of Lincoln Blvd.)
- Grade northwest portion of Area C to provide wetland habitats
- Improve culvert connection under Lincoln Blvd. (i.e., install a new culvert or improve the existing culvert)

- Expand or install new culvert connections under Fiji Way between Area A and Marina Del Rey to restore tidal connections

Stage 2. *Protect infrastructure in Area B*

- Place fill excavated from Area A in Area B to build levees between the restored wetlands and low areas along the southern edge of Area B
- Place fill to raise and/or protect low portions of Culver Blvd., Jefferson Blvd., and the Gas Company Road. Install new culverts or bridges in Culver Blvd. and Jefferson Blvd. to provide tidal connections south of Culver Blvd.
- As needed, replace the existing segment of the DWP high-voltage electric transmission line along Culver Blvd. with a new segment in the improved roadway or an alternate route
- As needed, replace the existing Gas Company 30" gas line through the southeast portion of Area B (from the Gas Company to Jefferson Blvd.) with a new gas line along the Gas Company road and Jefferson Blvd. (to connect to the existing gas line in Jefferson Blvd.)

Stage 3. *Restore wetlands in Area B*

- Grade Area B to create channels and provide wetland habitats
- Breach Ballona Creek south levee to restore tidal connections

Stage 4. *Dispose of excess excavated material.*

- Place excess material in Area C
- Dispose any remaining excess material off-site. Possible construction methods for transporting material offsite include trucking material to a barge in Marina Del Rey or Ballona Creek and transporting the material to a disposal or off-loading site.

6.1.5.2 Alternative 4 Phased Construction

Possible phases for constructing Alternative 4 are listed below. Each phase consists of stages described above. The list below only describes additional steps required to construct Alternative 4 in phases. See the section above for descriptions of other steps in each stage.

Phase 1: Protect infrastructure (portions of Stage 2) and restore wetlands (Stage 3) in the southeast portion of Area B (south of Jefferson Blvd., east of the Gas Company Rd., and west of the Freshwater Marsh).

- As needed, protect infrastructure as described above for Stage 2: replace the existing Gas Company 30" gas line, raise and/or protect Jefferson Blvd. and the Gas Company Road, build levees along the southern edge
- Grade the southeast portion of Area B to create channels and provide wetland habitats
- Daylight the culvert between the wetland restoration area and Ballona Creek to restore an open meandering channel.

- Build (temporary) levees along the restored channel from Jefferson Bvld. to Ballona Creek to protect areas to the east and west from flooding.
- If the capacity of the existing culverts under Culver Blvd. and Jefferson Blvd. are not adequate to provide full tidal action, replace the existing culverts or add additional culverts to increase culvert capacity
- Remove the existing tide gate and breach the south Ballona Creek levee to introduce tidal action to the wetland restoration area through the restored channel

Phase 2: Restore wetlands in Areas A and C (Stage 1)

- As described above for Stage 1, grade Area A and the northwest portion of Area C to provide wetland habitats and create tidal channels, place fill as needed to raise portions of the Area A northern perimeter and protect Fiji Way and Lincoln Blvd., improve culvert connection under Lincoln Blvd., and expand or install new culvert connections under Fiji Way between Area A and Marina Del Rey to restore tidal connections
- Stockpile material in Area B and/or Area C for use in Phase 3

Phase 3: Protect infrastructure in Area B (Stage 2), restore wetlands in Area B (Stage 3), and dispose of excess material (Stage 6).

- As needed, protect infrastructure as described above for Stage 2: place fill excavated from Area A in Area B to build levees between the restored wetlands and low areas along the southern edge of Area B and to raise and/or protect low portions of Culver Blvd, install new culverts or bridges in Culver Blvd., replace the existing segment of the DWP high-voltage electric transmission line along Culver Blvd.
- Grade Area B to create channels and provide wetland habitats
- Remove the levees built in Phase 1 along the restored channel to the southeast portion of Area B
- Place excess material in Area C or dispose any remaining excess material off-site as described for Stage 6.

6.2 ALTERNATIVE 5: A REALIGNMENT OF BALLONA CREEK

Alternative 5 (Figure 5 and 6) proposes the greatest amount of change to the project area, including the greatest degree of fully tidal wetland creation. The fundamental change would be the removal of the Ballona Creek flood control channel levees and creation of a sinuous creek and associated tidal channel network through the site. The site would be interconnected across Areas A and B, with shallow subtidal and mudflats sloping up to vegetated marsh habitats and higher wetland-upland transition habitat (Section 6.2.1). Public access features for Alternative 5 (Section 6.2.3) are shown in Figure 7. Figure 8 shows an artistic rendering of Alternative 5.

6.2.1 Areas A and B

In Areas A and B, a tidal channel network would be excavated and new flood protection levees would be constructed. In Area A, the site would be graded to create a long gently-sloping transition from upland habitats along the northern perimeter of Area A down through vegetated marsh habitat and mudflat habitat along the banks of the restored Ballona Creek channel. Area A would generally slope from north to south from about 11 ft NAVD to 4.5 ft NAVD, with slopes of about 150 to 200:1. The majority of Area B would not be graded because the existing grade is at elevations that are expected to support low marsh and mid marsh habitats.

The new Ballona Creek channel would start west of the Culver Bridge and extend through the site to the west (to the beginning of the northern breakwater). The restored Ballona Creek banks would be graded to provide mudflat and low marsh habitat. The initial channel alignment is intended to avoid cultural resource areas identified by the Tongva tribe and to facilitate construction. The existing Ballona Creek channel would be filled where necessary. Further research and analysis is required to refine the alignment of the channel. Once constructed, the channel would be free to migrate across the tidal floodplain, limited only where necessary by buried rock protection. The restored Ballona Creek floodplain is expected to be a highly dynamic environment, with active erosion and deposition that change the channel alignment. These disturbances may require maintenance and adaptive management, and may also benefit ecological processes.

The northern breakwater of Ballona Creek would be lowered between its eastern end and the foot bridge in Playa del Rey. This would allow a portion of flood flows to spill over into Marina Del Rey. Buried rock protection would be provided around the eastern end of the northern breakwater, and also along the southern creek bank near the west side of Area B, to guide Ballona Creek flows back into the downstream channel reach and reduce the potential for the channel to meander too far north or south.

New flood protection levees would be constructed along portions of the Area B southern perimeter and to protect roads. Fill may be placed to raise portions of the Area A northern perimeter to create a buffer and reduce the potential for increasing the risk of flooding Fiji Way and/or Lincoln Blvd. from Ballona Creek. The portion of Lincoln Blvd. along the east side of Area A may be raised. The new levee elevations will be determined through further analysis in future phases of the project; the objective is to at least maintain the existing level of flood protection for urban development and the roads, with consideration of sea level rise as discussed in Section 5. Culver Blvd., Jefferson Blvd., and the Gas Company road will be raised onto the tops of new levees, or protected by levees. Gentle levee slopes of about 20:1 would be constructed to provide an upland transition zone up to an elevation of about 11 ft NAVD, primarily in Area B. A steeper slope of about 5:1 will be graded above 11 ft NAVD around the perimeter of Areas A and B to connect to the new levee crests or existing high ground.

The intersection of Culver Blvd. and Jefferson Blvd. may be moved westward, closer to Lincoln. Upland habitat between Culver Blvd. and Jefferson Blvd. would be retained and enhanced. New Culver Blvd.

culverts or bridges would provide full tidal connections to wetland areas restored south of Culver Blvd. and wildlife passage under Culver Blvd.

The southeast portion of Area B would be restored to tidal salt marsh and brackish marsh as in Alternative 4 (see Section 6.1.2). Freshwater Marsh would be retained and operated as it has been in the past. The existing dunes along the western edge of Area B would also be retained.

In Area A, Fiji Ditch would be realigned to create a new tidal channel that meanders through restored marsh habitat along the northern edge of Area A and connects to Area C under Lincoln Blvd. As in Alternative 4, a new larger culvert may be constructed under Lincoln Blvd. to replace the existing culvert connection between Areas A and C. Fiji Ditch would not be connected to Ballona Creek.

6.2.2 Area C

Area C includes the highest elevations of the project area. Restoration of Area C in Alternative 5 would be identical to Alternative 4 (see Section 6.1.3).

6.2.3 Public Access

A perimeter trail would be constructed along Fiji Way and gateway entrances located at the existing parking area near Fisherman's Village and along Fiji Way (Figure **7**). A boardwalk containing an overlook would link the two gateway entrances as well as overlooks located at both gateway entrances. A vehicular pullout would be located along Culver Blvd. and would also provide an overlook. Linkages within Area A would be provided through two pedestrian crossings located along Lincoln Blvd. A formal parking/staging area would be developed at the gateway entrance near Fisherman's Village.

Area B gateway entrances and parking would be located behind Gordon's Market, along the southern bank of Ballona Creek, along Lincoln Blvd., and along Jefferson Blvd. at the entrance to the Freshwater Marsh. Boardwalk spur trails leading to overlooks would be located along the Freshwater Marsh Trail and at a vehicular pullout along Culver Blvd. Overlooks would also be located at the existing Boy Scout Overlook Platform, at the gateway entrance along the south levee, and along the Cabora Dr. trail at Pershing Dr. Linkages throughout Area B would be provided by three pedestrian crossings located on Culver Blvd. An upland area along Lincoln Blvd. provides for a possible visitor center location.

Public access features in Area C would include two loop trails originating from the gateway entrances at La Villa Marina and near the Little League fields. A parking area would continue to be located at the Little League fields. Overlooks would be located at viewing points for the seasonal wetland area near the Little League fields, north of Culver Blvd. at the restored estuarine wetland area, and at the La Villa Marina gateway entrance. The Little League fields will be preserved, but may be reconfigured.

The Ballona Creek bike path will be realigned in Alternative 5 to run around the northern perimeter of Area A (i.e., traveling north from Ballona Creek parallel to Lincoln Blvd. and west parallel to Fiji Way). This trail would connect to a similar trail in Area B along Culver Blvd. using a crossing over Ballona Creek near Lincoln Blvd. Both roads would be improved within this restoration alternative, and inclusion of improved bicycle lanes would facilitate this regional connection.

6.2.4 Alternative 5 Phasing Discussion

Alternative 5 could be implemented in a single phase, with a series of steps or stages occurring over several years. A single-phase construction is preferable in terms of construction efficiency. A possible sequence of stages for constructing Alternative 5 in a single phase is listed in Section 6.2.4.1. If implementing Alternative 5 in a single phase is not possible due to project funding or other constraints, implementation could occur in multiple phases, with several years between each phase. Section 6.2.4.2 lists possible construction phases.

Note that stockpiling and/or disposal of excavated material may be required between stages and phases. Construction staging and stockpiling areas will be identified in future phases of the project.

6.2.4.1 Alternative 5 Single-Phase Construction

The following list is a possible sequence of stages for constructing Alternative 5 in a single phase.

Stage 1. *Restore wetlands in Areas A and C*

- Grade Area A to provide wetland habitats and create tidal channels
- Place fill to raise portions of the Area A northern perimeter and protect Fiji Way and Lincoln Blvd. as needed (including possibly raising a portion of Lincoln Blvd.)
- Grade northwest portion of Area C to provide wetland habitats.
- Improve culvert connection under Lincoln Blvd. (i.e., install a new culvert or improve the existing culvert)

Stage 2. *Protect infrastructure in Area B*

- Place fill excavated from Area A to build levees between the restored wetlands and low areas along the southern edge of Area B
- Place fill to raise and/or protect low portions of Culver Blvd. and Jefferson Blvd. Possibly relocate a portion of Culver Blvd. and the intersection between Culver Blvd. and Jefferson Blvd. Install new culverts or bridges in Culver Blvd. to provide tidal connections south of Culver Blvd.
- Replace the existing segment of the DWP high-voltage electric transmission line along Culver Blvd. with a new segment in the improved roadway or an alternate route.
- Place fill to raise and/or protect the Gas Company road.

- As needed, replace the existing Gas Company 30" gas line through the southeast portion of Area B (from the Gas Company to Jefferson Blvd.) with a new gas line along the Gas Company road and Jefferson Blvd. (to connect to the existing gas line in Jefferson Blvd.)

Stage 3. *Restore wetlands in Area B*

- Grade Area B to create channels and provide wetland habitats

Stage 4. *Realign Ballona Creek in Area A*

- Excavate Ballona Creek channel meander in Area A
- Lower portions of the north Ballona Creek levee to near high marsh elevation
- Excavate two breaches to connect the meander and Area A wetlands to Ballona Creek
- Place fill excavated from the meanders and Area A to block the existing Ballona Creek channel and realign the creek through the meander. Build two rock dikes to block the existing Ballona Creek channel on the inside of the meander bend and create an enclosed area for fill placement between the rock dikes, the lowered north levee, and the south Ballona Creek levee. Place fill in the enclosed area. Possible construction methods include: barge and clamshell dredge to construct rock dikes, hydraulic placement of fill material (e.g., pump sand in a slurry, decant water to Ballona Creek), and land-based equipment to truck material along the south levee for capping the fill area with dry material.

Stage 5. *Realign Ballona Creek in Area B*

- Note realignment of Ballona Creek in Area B (Stage 5) could be performed at the same time as in Area A (Stage 4).
- Excavate the two Ballona Creek channel meanders in Area B
- Lower portions of the existing south Ballona Creek levee inside the meander bends to near high marsh elevation
- Excavate four breaches to connect the two meanders and Area B wetlands to Ballona Creek
- Place fill excavated from the meanders and Area A to block the existing Ballona Creek channel and realign the creek through the meanders as described for Stage 4. Portions of the north Ballona Creek levee could be retained to allow land-based access from Lincoln Blvd. and Fiji Way to the two Ballona Creek fill areas. The north levee could then be completely lowered after this step.

Stage 6. *Dispose of excess excavated material.*

- Place excess material in Area C.
- Dispose any remaining excess material off-site. Possible construction methods for transporting material offsite include trucking material to a barge in Marina Del Rey or Ballona Creek and transporting the material to a disposal or off-loading site.

6.2.4.2 Alternative 5 Phased Construction

Possible phases for constructing Alternative 5 are listed below. Each phase consists of stages described above. The list below only describes additional steps required to construct Alternative 5 in phases. See the section above for descriptions of other steps in each stage.

Phase 1: Protect infrastructure (portions of Stage 2) and restore wetlands (Stage 3) in the southeast portion of Area B (south of Jefferson Blvd., east of the Gas Company Rd., and west of the Freshwater Marsh). This phase is identical to Phase 1 of Alternative 4 described in Section 6.1.5.2.

Phase 2: Restore wetlands in Areas A and C (Stage 1) and realign Ballona Creek in Area A (Stage 4)

- As described above for Stage 1: grade Area A and northwest portion of Area C to provide wetland habitats and create tidal channels, place fill to raise portions of the Area A northern perimeter and protect Fiji Way and Lincoln Blvd. as needed, and improve culvert connection under Lincoln Blvd.
- As described above for Stage 4: excavate Ballona Creek channel meander in Areas A, lower portions of the north Ballona Creek levee to near high marsh elevation, excavate two breaches to connect the meander and Area A wetlands to Ballona Creek, place fill excavated from the meanders and Area A to block the existing Ballona Creek channel and realign the creek through the meander in Area A.
- Stockpile material in Area B and/or Area C for use in future phases.

Phase 3: Realign Ballona Creek in Area B (Stage 5)

- Note that realignment of Ballona Creek in Area B (Phase 3) could be performed at the same time as Phase 2 or Phase 4.
- As described above for Stage 5: excavate the two Ballona Creek channel meanders in Area B, lower portions of the existing south Ballona Creek levee inside the meander bends to near high marsh elevation, excavate four breaches to connect the two meanders and Area B wetlands to Ballona Creek, and place fill excavated from the meanders and Area A to block the existing Ballona Creek channel and realign the creek through the meanders.
- Place fill to build (temporary) levees south of the channel meanders in Area B that connect to the existing south Ballona Creek levee. This step would not be necessary if Phase 3 is performed at the same time as Phase 4.

Phase 4: Protect infrastructure in Area B (Stage 2), restore wetlands in the west and north portions of Area B (Stage 3), and dispose of excess material (Stage 6).

- As needed, protect infrastructure as described above for Stage 2: place fill excavated from Area A in Area B to build levees between the restored wetlands and low areas along the southern edge of Area B and to raise and/or protect low portions of Culver Blvd, install new culverts or bridges in Culver Blvd., replace the existing segment of the DWP high-voltage electric transmission line along Culver Blvd.

- Grade Area B to create channels and provide wetland habitats
- Remove the levees built in Phase 1 along the restored channel to the southeast portion of Area B
- Lower levees south of the channel meanders in Area B. This step would not be necessary if Phase 3 is performed at the same time as Phase 4 and these levees are therefore not constructed.
- Place excess material in Area C or dispose any remaining excess material off-site as described for Stage 6.

7. ADAPTIVE MANAGEMENT DISCUSSION

The SAC recommended that the restoration project should be implemented in phases to allow mid-course corrections and re-evaluation of progress toward achieving project goals. This process of re-evaluation and mid-course correction could be accomplished by implementing phased restoration within an adaptive management framework. Adaptive management can be defined as the process of learning from restoration and management actions, then using this knowledge to inform and adapt future actions. These may be actions that modify parts of a restoration that have already been implemented or modify subsequent restoration phases.

Adaptive management could be accomplished through an iterative process as follows:

1. Define measurable ecological objectives.
2. Articulate conceptual models of the process linkages that explain how the restoration actions address the ecological objectives.
3. Identify key restoration uncertainties in the conceptual models.
4. Articulate hypotheses for each of the key uncertainties.
5. Design experiments to test these hypotheses.
6. Implement a monitoring and adaptive management plan for the experiments and the restoration project.

Measurable objectives (step 1) would be based on the project goals and objectives and measures of change from the Feasibility Study (PWA and others 2008).Conceptual models (step 2) that link restorations actions to the ecological objectives have not been developed at this stage of project planning. However, several potential restoration uncertainties (step 4) and experiments (step 5) have arisen from the Feasibility Study process. Each of these steps could be developed further and documented in an adaptive management plan (step 6), with assistance from the SAC.

Adaptive management could consist of implementing early small-scale pilot projects that address key restoration uncertainties for future large-scale restoration at Ballona. The first phases of restoration would also inform subsequent phases within the adaptive management framework. Monitoring data would be collected and assessed to inform adaptive management decisions and refine the adaptive management process (i.e., refine conceptual models, answer and identify any new uncertainties, etc.). The adaptive management plan would identify thresholds or triggers for adaptive management actions.

The restored habitats at Ballona are expected to evolve over time in response to short-term processes (e.g., tidal action, drought and flood events) and long-term processes (e.g., climate change and sea level rise). The restoration response cannot be predicted with certainty, and adaptive management will be necessary to understand how the restoration is responding and modify restoration actions accordingly.

Potential restoration uncertainties, experiments, and adaptive management actions that could be incorporated into an adaptive management process are listed below:

- *Habitat development.* The restoration site will be graded to elevations that are appropriate for different types of wetland and upland habitat. Certain types of vegetation may be actively planted, while others (such as cordgrass and pickleweed in low, mid, and high marsh) may be allowed to colonize naturally. Design elevations for habitats and initial site grading will be based on habitat elevation data from both existing wetland habitat at Ballona and other reference sites in the Southern California region. Habitat development and survival of plantings may differ from expectations. Early small-scale pilot studies could be designed and implemented to test key uncertainties (e.g., habitat elevations, soil amendments, invasive control). Monitoring of pilot studies (e.g., vegetation distribution, elevation, tidal inundation, soil conditions, etc.) would be performed to refine habitat design criteria in subsequent restoration phases.
- *Existing sensitive species use*. The restoration will include actions to encourage sensitive species that currently use existing managed wetland habitats, such as the Belding's Savannah Sparrow, to use restored wetland habitats. Existing habitats may be preserved in initial phases. Monitoring of species use of existing habitats and restored habitats would be performed. If monitoring indicates successful use of restored habitats, existing habitats could be restored in subsequent phases. This adaptive approach to phasing may help to mitigate potential impacts to sensitive species.
- *Introduction of native species*. Potential target species that may use restored habitats are discussed in Section 3 and Attachment 2. Certain native target species may be actively introduced into the restoration area. The success of species introduction would be monitored and the program of species introduction would be modified to improve future success.
- *Water and sediment quality*. A targeted monitoring program could be implemented to evaluate water quality and the affects on/of the restored wetlands to address potential water quality impacts of restoring wetlands along Ballona Creek. If water quality targets are met, subsequent phases would be implemented and monitoring would be continued. Similarly, meeting upstream TMDLs could trigger full implementation of wetland restoration along Ballona Creek.
- *Ballona Creek realignment and morphology*. In Alternative 5, the realignment of Ballona Creek could be constructed in phases. The success of construction techniques and performance of the realigned creek during a winter flood season could be evaluated in an initial phase. Subsequent phases of the realignment and construction could be modified based on the performance of the initial phase.
- *Sea level rise (SLR)*. The Ballona Wetland Restoration would be designed to accommodate 55 in. of SLR, which is an estimate that may correspond to the timeframe around 2100. The distribution of habitats is expected to change slowly over time due to SLR. Conversion of some wetland areas to lower elevation habitats is anticipated (i.e., conversion of mudflat habitat to subtidal habitat,

low marsh habitat to mudflat habitat, etc.) (see Section 5). The adaptive management plan could establish a threshold of habitat conversion that would trigger adaptive management actions. For example, at a future time beyond this planning timeframe, the portion of Area C between Ballona Creek and Culver Blvd. could be excavated to restore additional vegetated wetland habitat along the creek. The excavated material could be a resource for protecting (e.g., raising) infrastructure at risk due to SLR and augmenting natural sedimentation within the restoration. The material could be placed within the restoration to re-create vegetated wetland habitats that may be converted to lower elevation mudflat and subtidal habitats. (e.g., by placing dredge material within a contained area). Alternatively, the material could be supplied over time in a wetland maintenance program to maintain the elevation of vegetated wetlands relative to rising sea levels (e.g., by "rainbow" spraying a thin layer of sediment on vegetated wetland habitats from a dredge).

- *Salt panne design*. Different design techniques could be used to create salt panne micro-habitat along the upland edge. The performance of different techniques would be evaluated. These techniques could be refined and used to design salt panne habitat in subsequent phases and in higher elevation areas along the upland edge, where sea level rise would be expected to support salt panne habitat in the future.
- *Brackish marsh habitat*. Freshwater outflow from the Freshwater Marsh would be managed to encourage development of brackish marsh in the southeast portion of Area B. The amount and frequency of freshwater outflow could be varied over a number of years to evaluate the results of different flow regimes on the development and persistence of brackish marsh habitat, and to establish the preferred regime.
- *Tide gates*. The existing operations of Area B tide gates would be continued during any initial phases prior to restoration of Area B. If useful, tide gate operations may also be modified to test restoration uncertainties (e.g., different inundation regimes for wetland habitat types.
- *Invasive and nuisance species*. Methods for controlling invasive and nuisance species could be tested within an adaptive management framework.

8. NEXT STEPS

The following items are recommended as next steps to complete a conceptual restoration plan and inform CEQA environmental review and engineering design:

- Identify appropriate reference sites for restoration planning, design, and monitoring. For example, reference sites could be used to inform habitat design elevations and the geomorphologic design of the Ballona Creek channel realignment.
- Specify habitat treatments for habitat restoration and enhancement at a conceptual-level (e.g., soil treatment, planting, exotic species control).
- Refine the geomorphic basis of design for the Ballona Creek channel realignment in Alternative 5.

- Perform additional hydrodynamic modeling to inform potential flood impact analyses (including consideration of SLR) and to assess the stability of the realigned Ballona Creek channel in Alternative 5.
- Update the project base map to reflect recently collected mapping data (e.g., property boundaries, easements, topography, existing vegetation, cultural resources, and utilities).
- Develop the conceptual design for new flood protection levees, including levee design elevations, cross-sections, and levee alignments.
- Develop conceptual grading plans and graphics (e.g., sections) for the two preferred alternatives.
- Research soil disposal options.
- Provide updated conceptual-level construction quantity estimates and opinions of probable construction costs for the revised Alternatives 4 and 5, including public access features.
- Identify potential construction methods and schedule, and potential locations for construction staging and soil stockpiling areas.
- Develop an adaptive management plan and a pre- and post-restoration monitoring plan framework.
- Develop an operations and maintenance (O&M) plan for short-term (project establishment) and long-term (project operation) components, including the need for inspection, maintenance, etc. for any structures (culverts, gates, levees, weirs, etc), vector control, etc.

9. REFERENCES

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10. LIST OF PREPARERS

This memorandum was prepared by the following PWA staff:

Nick Garrity, P.E.
Jeremy Lowe
Jeff Haltiner, Ph.D., P.E.

With:

Sean Bergquist, Santa Monica Bay Restoration Commission
Chris Nordby, Nordby Biological Consulting

11. LIST OF ATTACHMENTS

Tables

Figures

Attachments

Attachment 1. Infrastructure and Cultural Resource Constraints Meetings
Attachment 2. Ballona Wetlands Restoration Alternatives Target Species Analysis
Attachment 3. Figures Showing Conceptual Response to Sea Level Rise Scenarios

Table 1. Habitat Elevations.

Habitat elevations		Elevation			1.3 ft of SLR (2050)	4.6 ft of SLR (2100)	Note
Bottom of:	Top of:	ft MLLW	ft NGVD	ft NAVD	ft NAVD	ft NAVD	
	Levee (crest) [A]	20.8	18.2	20.6	20.6	20.6	
Levee toe [A]	Upland	11.2	8.6	11.0	11.0	11.0	Top of gradual slope selected to correspond with top of mid marsh zone with 4.6 ft of SLR
Upland	Transition Zone	9.8	7.2	9.6	10.9	NA [B]	9.8 ft MLLW per Zedler (2001)
Transition Zone	High Marsh	7.5	4.8	7.3	8.6	NA [B]	7.5 ft MLLW per Zedler (2001), 0.3 ft below highest observed tide level
High Marsh	Mid Marsh	6.5	3.9	6.3	7.6	10.9	1 ft abve MHHW, consistent with San Dieguito / Josselyn and Whelchel (1999); exceeded by spring tides
Mid Marsh	Low Marsh	4.8	2.1	4.6	5.9	9.2	MHW, similar to (0.2 ft lower than) San Dieguito / Josselyn and Whelchel (1999)
Low Marsh	Mudflat	3.8	1.2	3.6	4.9	8.2	1 ft above MTL, similar to San Dieguito / Josselyn and Whelchel (1999)
Mudflat	Subtidal - small subtidal channel	0.0	-2.6	-0.2	1.1	4.4	MLLW
Subtidal - small subtidal channel	Subtital - Large Subtidal Channel	-2.8	-5.4	-3.0	-1.7	1.6	

Notes:

A - Top of levee elevation approximated as:

13 ft NAVD (100-yr WSE at Culver Blvd. bridge from USACE (2008), NAVD datum assumed; similar to upstream WSE modeled by PWA for existing conditions)

3 ft FEMA levee freeboard requirement

+4.6 ft of SLR for 2100

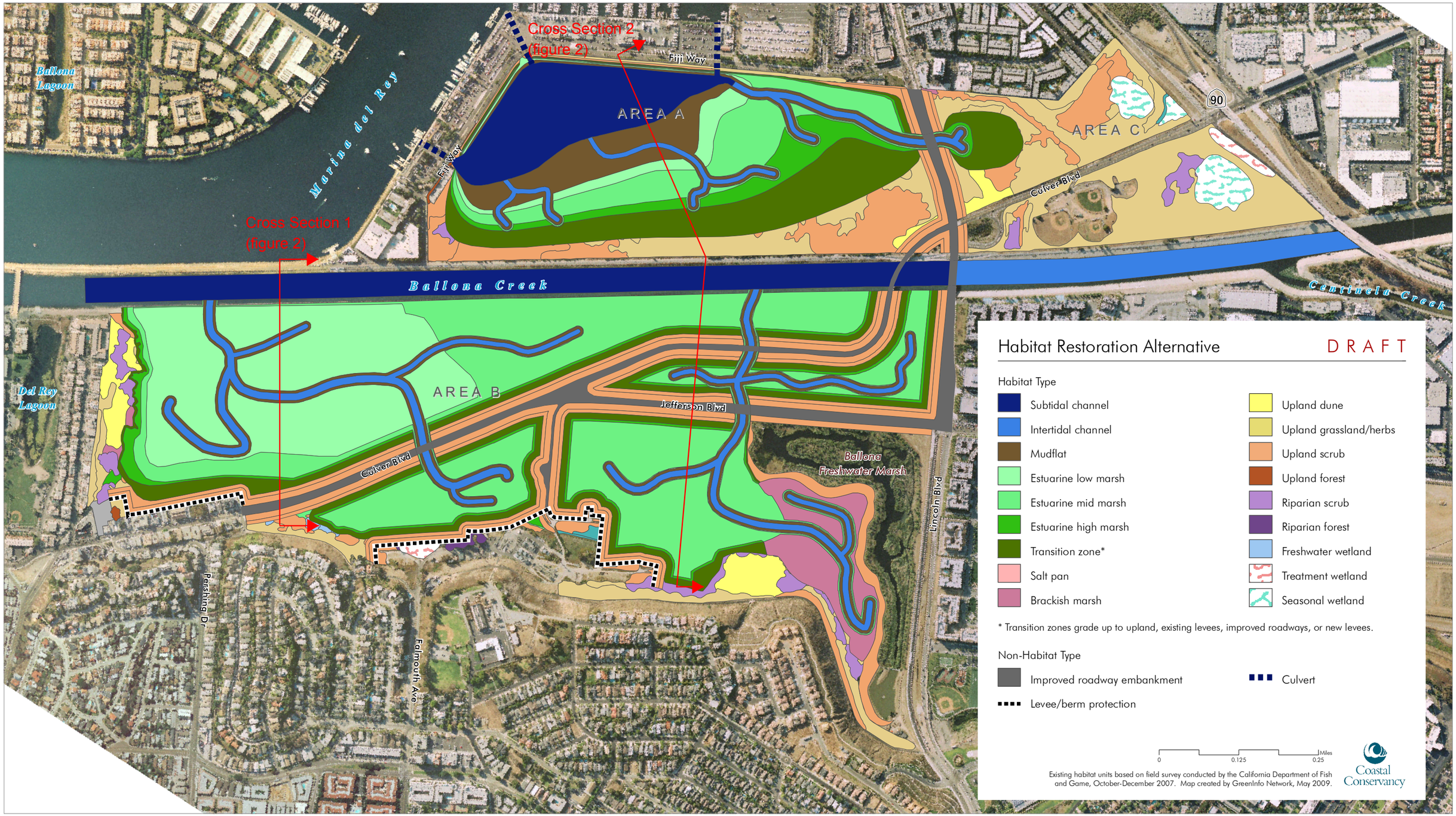
20.6 ft NAVD (approximate)

Elevation for toe of levee slope / top of gradual slope selected to correspond with top of mid marsh zone with 4.6 ft of SLR for 2100

Elevations for top and toe of levee do not change with SLR

B - With 4.6 ft of SLR, upland and transition zone habitat elevations are above the levee toe elevation

Habitat Restoration Alternative



Habitat Restoration Alternative — DRAFT

Habitat Type

- Subtidal channel
- Intertidal channel
- Mudflat
- Estuarine low marsh
- Estuarine mid marsh
- Estuarine high marsh
- Transition zone*
- Salt pan
- Brackish marsh
- Upland dune
- Upland grassland/herbs
- Upland scrub
- Upland forest
- Riparian scrub
- Riparian forest
- Freshwater wetland
- Treatment wetland
- Seasonal wetland

* Transition zones grade up to upland, existing levees, improved roadways, or new levees.

Non-Habitat Type

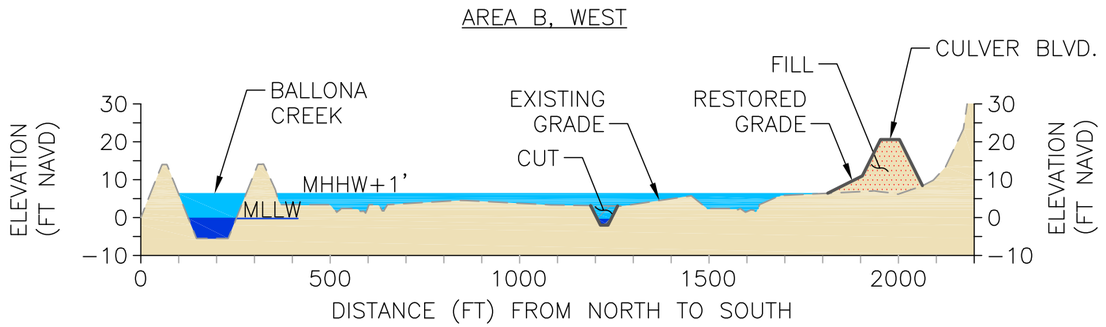
- Improved roadway embankment
- Culvert
- Levee/berm protection

0 0.125 0.25 Miles

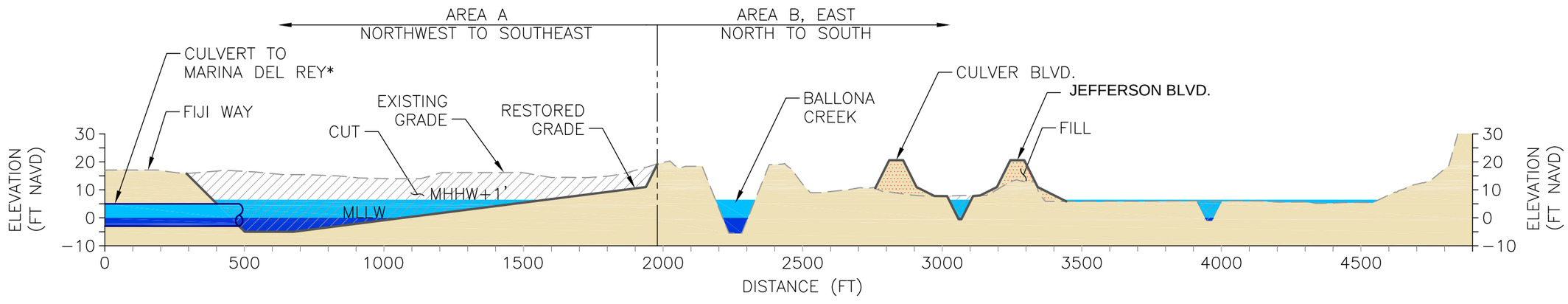
Existing habitat units based on field survey conducted by the California Department of Fish and Game, October-December 2007. Map created by GreenInfo Network, May 2009.

Coastal Conservancy

figure 1



ALTERNATIVE 4
CROSS-SECTION 1



ALTERNATIVE 4
CROSS-SECTION 2

NOTE: EXISTING AND CONCEPTUAL RESTORED GRADES ARE SCHEMATIC AND APPROXIMATE. NOT TO SCALE.

* CULVERTS ARE ACTUALLY LOCATED WEST OF CROSS–SECTION LOCATION

figure 2

Ballona Wetlands

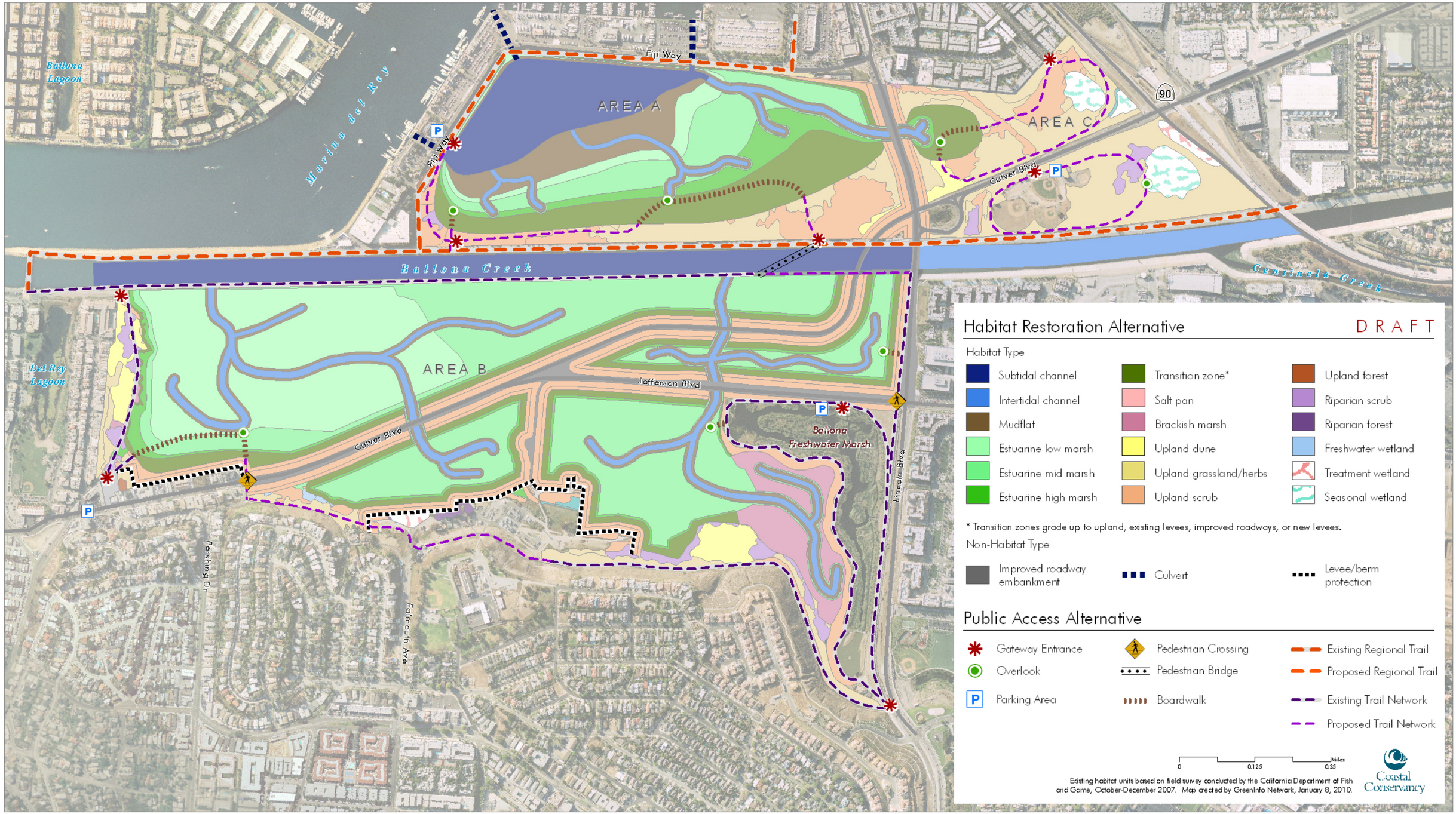
Alternative 4 - Conceptual Cross-Sections

PWA Ref. # 1793

PWA

Ballona Wetlands
Restoration Project

Alternative 4 - Habitat Restoration and Public Access



Habitat Restoration Alternative

DRAFT

Habitat Type

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- Mudflat
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- Upland grassland/herbs
- Upland scrub
- Upland forest
- Riparian scrub
- Riparian forest
- Freshwater wetland
- Treatment wetland
- Seasonal wetland

* Transition zones grade up to upland, existing levees, improved roadways, or new levees.

Non-Habitat Type

- Improved roadway embankment
- Culvert
- Levee/berm protection

Public Access Alternative

- Gateway Entrance
- Overlook
- Parking Area
- Pedestrian Crossing
- Pedestrian Bridge
- Boardwalk
- Existing Regional Trail
- Proposed Regional Trail
- Existing Trail Network
- Proposed Trail Network

0 0.125 0.25 Miles

Existing habitat units based on field survey conducted by the California Department of Fish and Game, October-December 2007. Map created by GreenInfo Network, January 8, 2010.

Coastal Conservancy

figure 3

figure 4

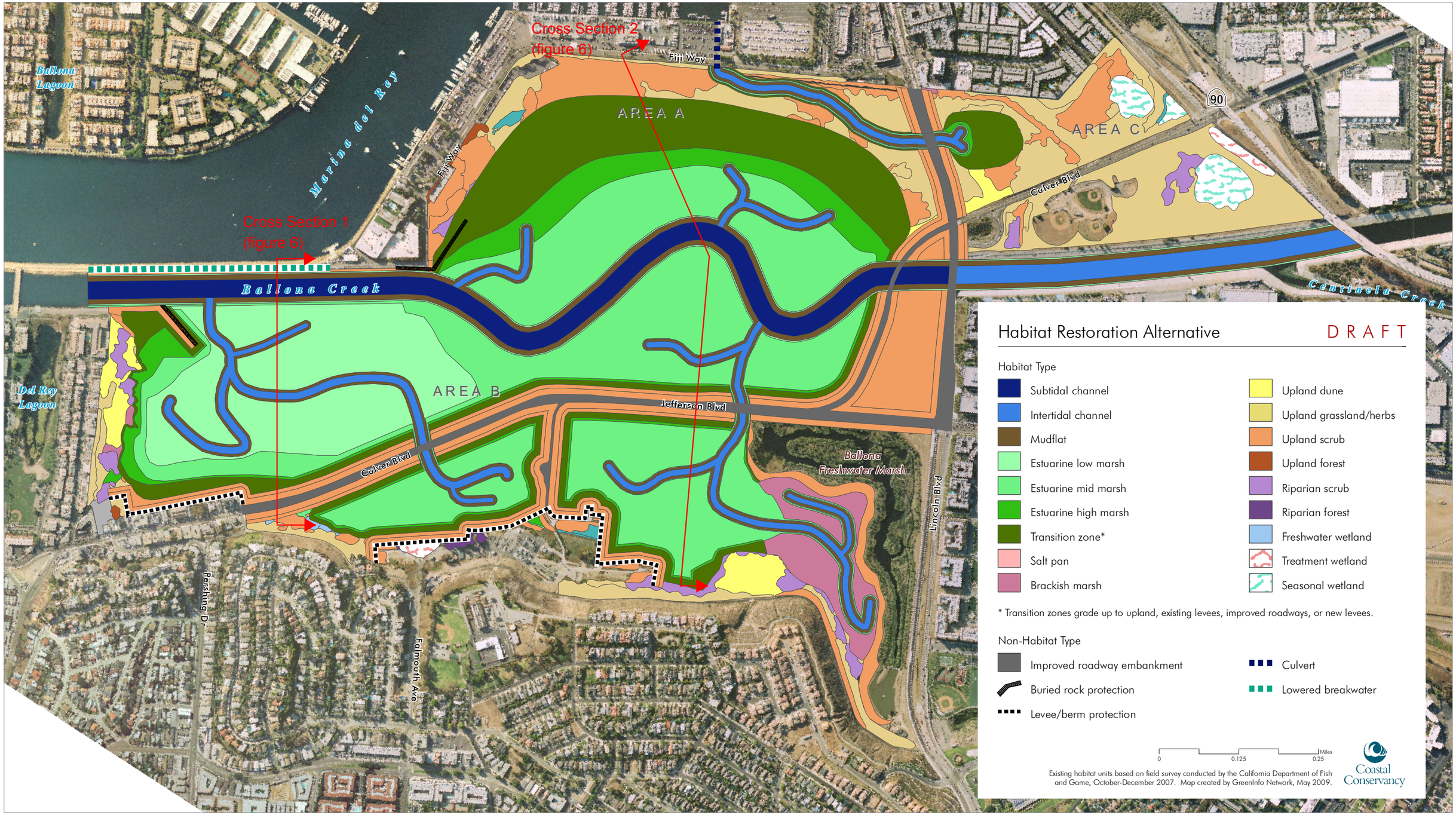
Ballona Wetlands Restoration

Alternative 4 - Artistic Rendering

#1793

PWA

Habitat Restoration Alternative



Habitat Restoration Alternative — DRAFT

Habitat Type

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- Upland grassland/herbs
- Upland scrub
- Upland forest
- Riparian scrub
- Riparian forest
- Freshwater wetland
- Treatment wetland
- Seasonal wetland

* Transition zones grade up to upland, existing levees, improved roadways, or new levees.

Non-Habitat Type

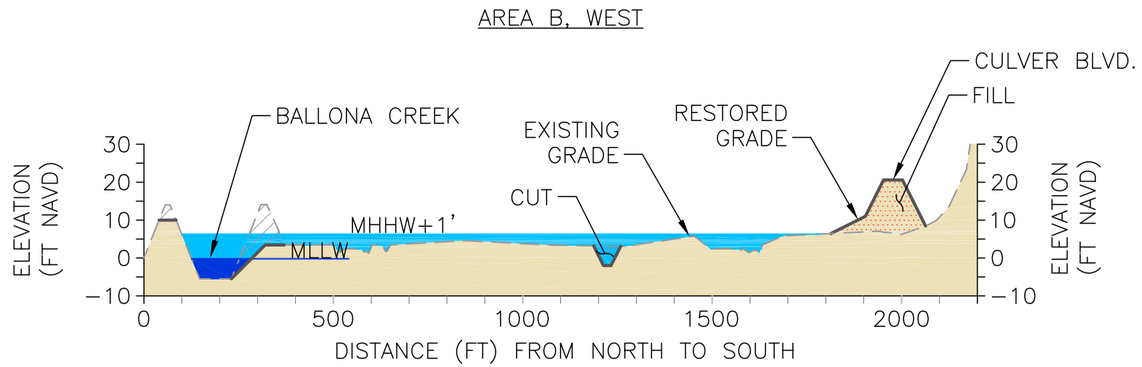
- Improved roadway embankment
- Buried rock protection
- Levee/berm protection
- Culvert
- Lowered breakwater

0 0.125 0.25 Miles

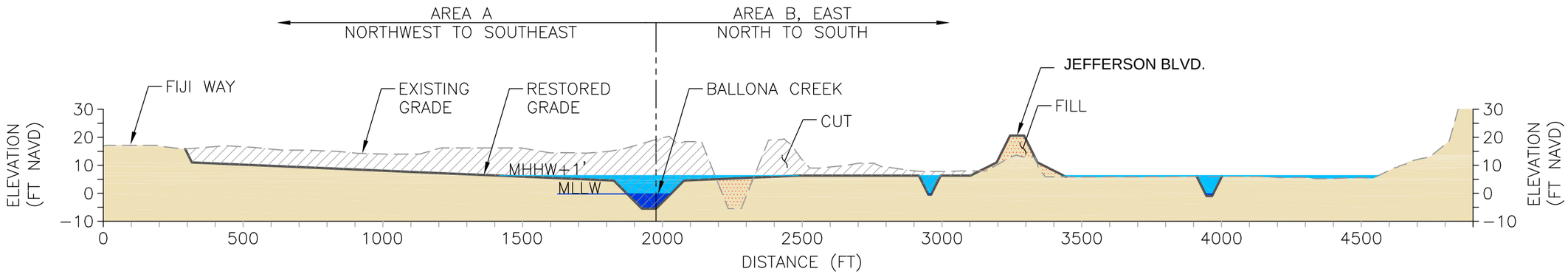
Existing habitat units based on field survey conducted by the California Department of Fish and Game, October-December 2007. Map created by GreenInfo Network, May 2009.

Coastal Conservancy

figure 5



ALTERNATIVE 5
CROSS-SECTION 1



ALTERNATIVE 5
CROSS-SECTION 2

figure 6

Ballona Wetlands

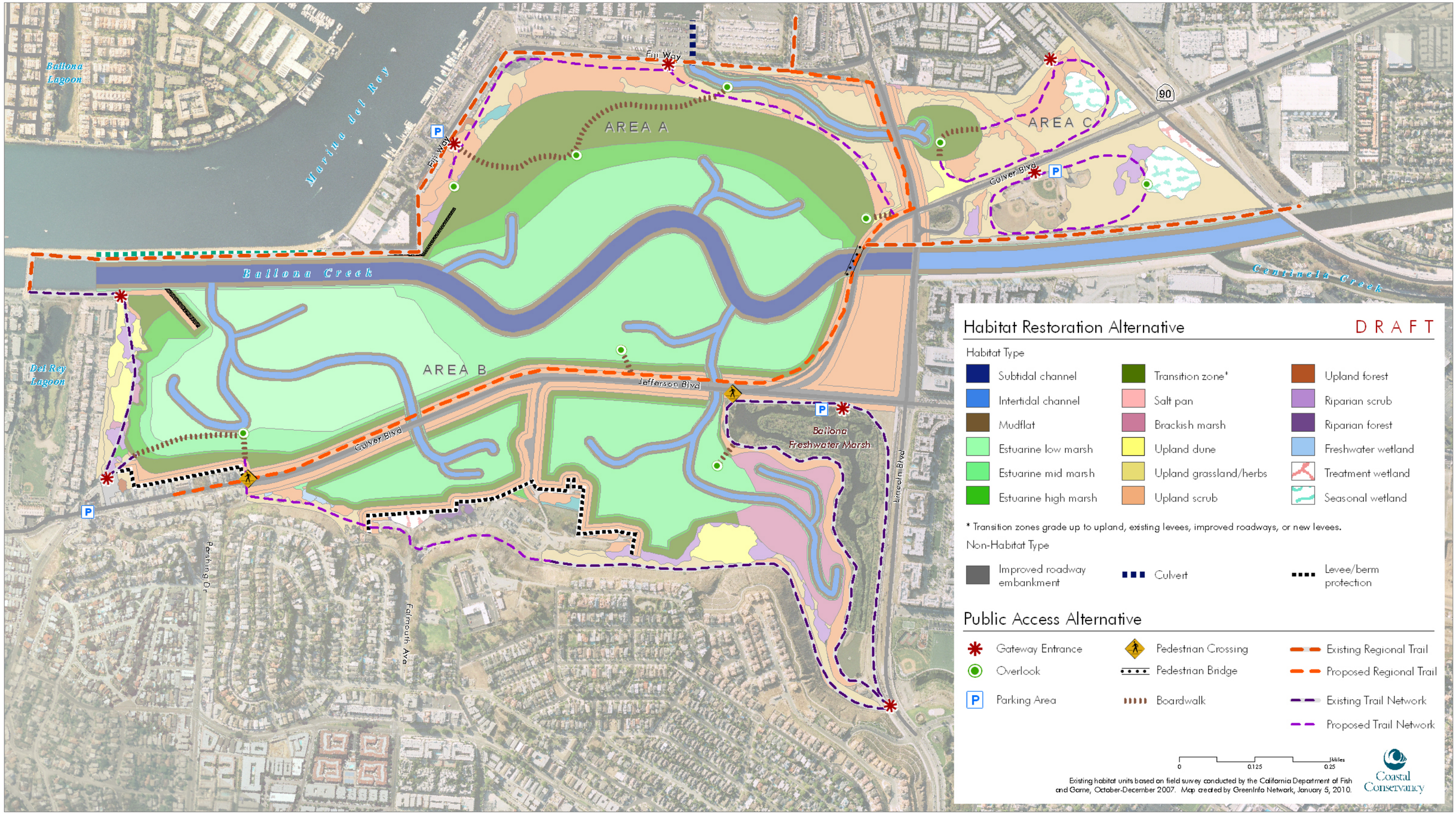
Alternative 5 - Conseptual Cross-Sections

PWA Ref. # 1793

PWA

Ballona Wetlands
Restoration Project

Alternative 5 - Habitat Restoration and Public Access



Habitat Restoration Alternative

DRAFT

Habitat Type

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- Upland grassland/herbs
- Upland scrub
- Upland forest
- Riparian scrub
- Riparian forest
- Freshwater wetland
- Treatment wetland
- Seasonal wetland

* Transition zones grade up to upland, existing levees, improved roadways, or new levees.

Non-Habitat Type

- Improved roadway embankment
- Culvert
- Levee/berm protection

Public Access Alternative

- Gateway Entrance
- Overlook
- Parking Area
- Pedestrian Crossing
- Pedestrian Bridge
- Boardwalk
- Existing Regional Trail
- Proposed Regional Trail
- Existing Trail Network
- Proposed Trail Network

0 0.125 0.25 Miles

Existing habitat units based on field survey conducted by the California Department of Fish and Game, October-December 2007. Map created by GreenInfo Network, January 5, 2010.

Coastal Conservancy

figure 7

figure 8

Ballona Wetlands Restoration

Alternative 5 - Artistic Rendering

#1793

PWA

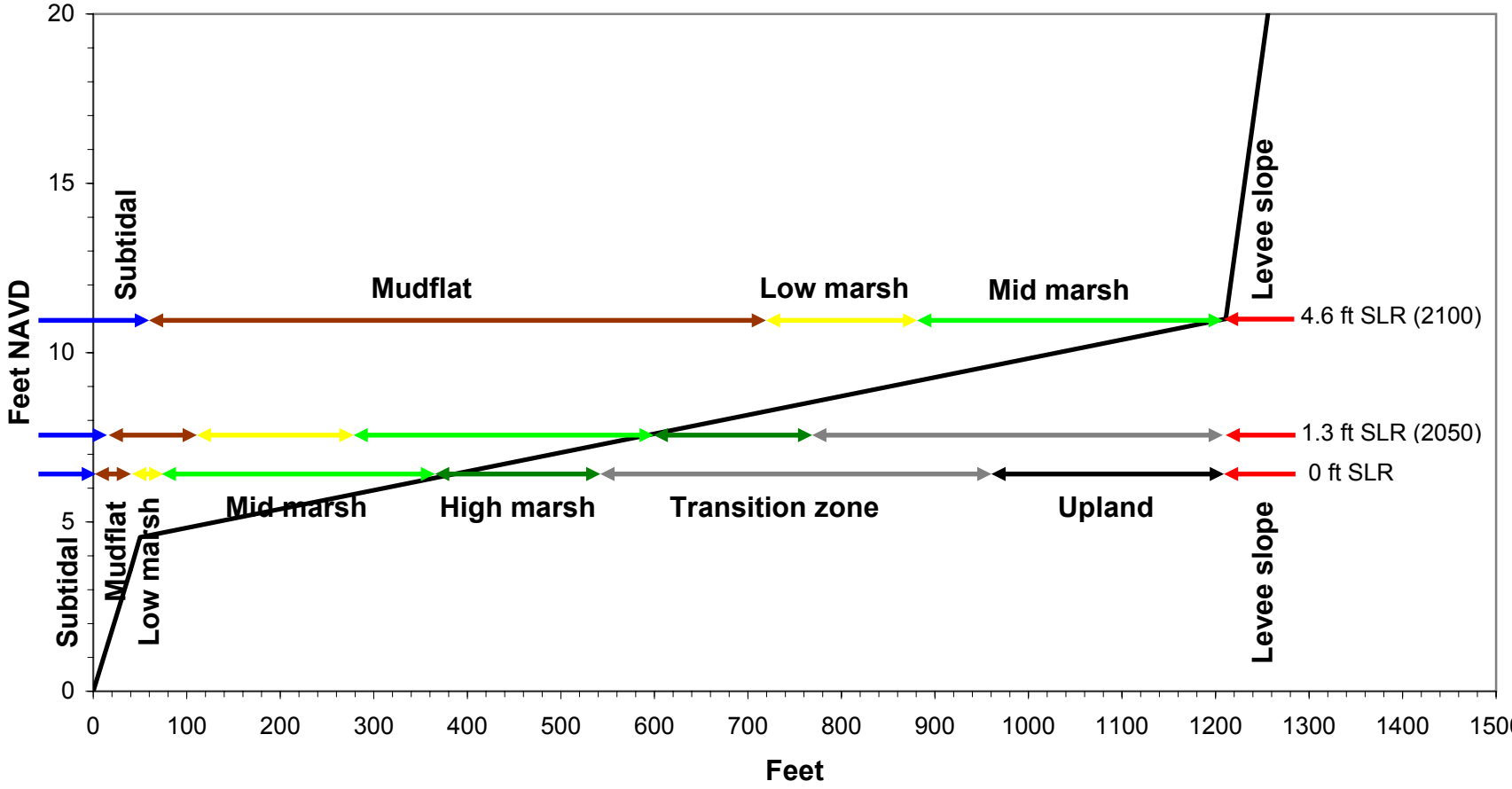

figure 9

Ballona Wetlands Restoration

Conceptual cross-section showing haibtat transgression with SLR

PWA Ref# 1793

PWA

Attachment 1

INFRASTRUCTURE AND CULTURAL RESOURCE CONSTRAINTS MEETINGS

After completion of the Feasibility Study, members of the PMT and consultant team met with agencies, businesses, and organizations that have an interest in the infrastructure or cultural resources within and adjacent to the Ballona restoration site. The purpose of these meetings was to give an overview of the restoration plan to these groups, obtain additional information related to infrastructure and cultural resource constraints, and discuss project approaches to address these constraints. This section includes summaries of these meetings and new information on these constraints and the proposed solutions as a supplement to the Draft Ballona Wetlands Existing Conditions Report (2006) and the Ballona Wetlands Feasibility Report (2008). A property boundary and easement map of the Ballona site by Rosell Surveying and Mapping, Inc. (2007) also provides additional information. This appendix does not include a comprehensive assessment of on-site infrastructure and other restoration constraints.

1. UTILITIES

1.1 THE GAS COMPANY

Members of the PMT and consultant team met with the Gas Company on October 28, 2008. The Gas Company infrastructure includes on-site wells (19 total), roads, underground gas pipelines, and off-site facilities at the base of the Westchester Bluff. The wells extend to underground storage fields for natural gas, and may also produce oil and water in some cases. The Gas Company is in the process of installing and testing several new directional-drill wells from their facilities to replace existing on-site surface wells. No wells have been decommissioned as of December 2008.

The Del Rey 15 well north of the Ballona site will be replaced by directional-drill wells. Once Del Rey 15 is replaced (northwest well of the square of four wells in the west portion of Area A), the pipeline that runs from this, and adjacent wells, to the Gas Company facility through Area B west of the Gas Company road could be decommissioned.

The pipeline to Del Rey 10 runs along the southern boundary of Area A and crosses the east portion of Area A from north to south. This pipeline is inactive. The Gas Company plans to abandon the pipeline in place and is coordinating with Beaches and Harbors on the abandonment. The pipeline may need to be removed in both of the current restoration alternatives.

The portion of the 30 in. gas transmission pipeline running from The Gas Company facility to Jefferson Boulevard through Area B east of The Gas Company road may need to be relocated before wetlands are restored in this area. A water line previously located along this pipeline has recently been moved into The Gas Company road. The 30 in. gas pipeline could also be moved into the Gas Company road and connected to the existing pipeline in Jefferson. Pipeline relocation costs may be roughly $2 to $3 million per mile, or possibly more for a section less than a mile. The length of new pipeline may be approximately 2500 ft (0.5 mi). There are a number of requirements for burial of the pipe - depth of cover

requirements may apply to the transmission pipeline (e.g., 3 ft of cover) and the pipeline may need to be located higher than the water table. However, locating the pipe above ground may also be an option. The elevation of the Gas Company road (to be raised for the restoration as it will function as a levee) would need to be sufficient for the pipeline to be above the water table and have the required depth of cover.

Of the remaining on-site surface wells, only the Vidor 18 well near the western end of Area B will need to be abandoned and/or replaced. Replacing the surface wells may require one or two additional directional-drill wells, at a cost of approximately $3 million each. The Gas Company may need to maintain a small number of surface wells for pressure monitoring. Surface wells that are replaced by directional-drill wells can be decommissioned, which requires a large rig (approximately 80,000 lbs). Roads to the wells may need to be improved to provide rig access. There may possibly be some contamination near the wells from previous crude oil operations, which would need to be removed.

The Ballona restoration alternatives include a levee between the restored wetlands and low-lying Gas Company facilities along the Westchester Bluff. The restoration plan and design will need to consider drainage from this area, including the Falmouth drain, and the potential for elevating groundwater levels in this area.

1.2 POWER LINES

Members of the PMT and consultant team met with the Los Angeles Department of Water and Power (DWP) Underground Transmission Group on December 4, 2008. DWP's existing on-site power infrastructure includes an underground power transmission line and overhead pole power distribution lines along Culver and Jefferson. Southern California Edison has overhead power distribution lines on the same poles as DWP. In the future, DWP plans to install a new underground power transmission line.

Existing underground power line. DWP's "Scattergood-Olympic Line 2" is a high-voltage (230-kV) underground transmission line that runs under Pershing Drive and Culver Boulevard to the east of Highway 90, and is suspended under the Culver Boulevard bridge. The line is a high-pressure oil-filled pipe-type cable. Special backfill around the pipe conducts heat away from the cables. The pipe is buried 4 ft below the road. Any greater depth of cover would adversely affect the conduction of heat and electricity. The pipe is currently below the groundwater table, which improves heat conduction. The line is designed to operate in both dry and saturated soil conditions.

Due to the maximum 4-ft cover requirement, portions of the existing Scattergood-Olympic Line 2 would need to be replaced to allow fill placement to raise Culver Blvd. for the restoration. The replacement cost is approximately $10 million per mile. The timeframe for replacement includes one year to purchase the cable and three years for design and construction. In locations where the line would need to cross new channels, directional drilling the pipe under the channel is preferred by DWP. Alternatively, the pipe can be suspended on causeways over channels for distances up to approximately 2,000 ft, provided that the causeway and pipe do not bend.

An alternative to replacing the power line may be to construct the raised road next to Culver Blvd. and leave the existing road and power line in the shoulder of the new raised road. The feasibility of this alternative will need to be further evaluated and discussed with DWP and LADOT in future phases of the project.

Additional information on the existing line and line relocation process has been provided by DWP including as-built construction drawings for the existing line.

Planned new underground power line. In or around 2011, DWP plans to install a new plastic-type cable underground power transmission line from the Scattergood facilities in El Segundo through Playa Del Rey to the substation at Centinella Avenue and Olympic Boulevard. DWP has developed several alternative routes for this line. The alternative currently preferred by DWP is to route the new line through the site under Culver and Jefferson to Lincoln. If the new line is installed along this route, portions of the new line would need to be replaced in order to raise Culver and Jefferson. The replacement cost is approximately $7 to $8 million per mile. DWP will consider other alternative routes that would avoid the need to replace the line, including an off-site route through LAX property to the south. DWP will also investigate using Cabora Drive along the Westchester Bluffs as a new alternative.

The new line and/or the existing line could be relocated along the same route, providing that the lines are a minimum of 20 ft apart. Also, DWP practice is to avoid having two lines crossing a single bridge.

Overhead power lines. DWP overhead pole power distribution lines run along Culver Boulevard through the Ballona restoration site. DWP indicated that their overhead lines could be relocated underground for a cost of approximately $3 million per mile and that funding is available from three conversion programs.

Southern California Edison has power lines on the same poles as DWP along Culver Boulevard Southern California Edison also has pole power lines running south from the intersection of Culver Boulevard and Jefferson Boulevard to The Gas Company facility. The PMT and consultant team have not met with Southern California Edison yet. The power lines to The Gas Company would likely need to be relocated underground in The Gas Company road.

1.3 SANITARY STORM DRAINS AND SEWERS

The property boundary and easement map (Rosell 2007) shows a 20-ft wide sanitary sewer and storm drain easement to the City of Los Angeles that generally runs north to south through Area A and Area B west of the Gas Company Road. Members of the PMT contacted the City of Los Angeles, who provided information indicating that there is an abandoned 36” reinforced concrete pipe (RCP) within this easement. The abandoned pipe would likely need to be removed and capped where any excavation down to the pipe is planned for the restoration.

2. FLOOD MANAGEMENT

Members of the PMT and Consultant Team met with the County of Los Angeles Department of Public Works Watershed Management Division (LA County Watershed Management),, staff for the Los Angeles County Supervisors, and Beaches and Harbors on November 4, 2008. LA County Department of Public Works maintains the Ballona Creek flood control channel and levees through the project. The flood control channel was built by the U.S. Army Corps of Engineers (USACE), which would also have to approve a project to alter it. LA County Watershed Management's interests include maintaining existing levels of flood management, managing erosion of flood management infrastructure, and maintenance of the flood control channel.

The Ballona Wetlands Restoration Project is intended to maintain existing levels of flood management (PWA and others 2008). The conceptual alternatives include potential flood management measures such as raising roads, building levees with gradual habitat slopes between the restored wetlands and adjacent low lying areas, and buried rock protection for erosion management. Existing higher-elevation upland areas will remain around the perimeter of the restored wetlands. In some locations, such as along Fiji Way and Lincoln Boulevard, fill material may be placed to raise the existing uplands to higher elevations for flood management. Where feasible, the preferred approach to erosion protection will be to create gradual slopes from the restored wetlands to upland areas that support transitional and upland habitats, provide wave dissipation, and reduce the potential for erosion.

Preliminary hydrodynamic modeling of flood scenarios performed for the Feasibility Study indicate the potential for the restoration to lower flood levels within Ballona Creek due to increased flood conveyance and storage within the restoration site (PWA and others 2008). As possible, the Ballona Restoration project is intended to be self-maintaining and to reduce maintenance requirements.

This section provides only a general discussion of potential flood management approaches. A more detailed flood management plan will need to be developed in future phases of the restoration project in coordination with LA County Watershed Management, U.S. Army Corps of Engineers, and FEMA. Additional modeling of flood scenarios and coordination with the LA County Watershed Management on the modeling scope, assumptions, and results will be required. The PMT and Consultant Team did not meet with the USACE or FEMA; however, the PMT is in communication with the USACE on the Ballona restoration.

3. ROADS

Members of the PMT and Consultant Team met with the City of Los Angeles Department of Transportation (LADOT) and Caltrans on December 11, 2008. Culver Boulevard and Jefferson Boulevard are LADOT roads. Lincoln Boulevard is a Caltrans road.

Further coordination with LADOT on improvements to Culver Boulevard and Jefferson Boulevard will be required in future phases of the project. LADOT and Caltrans traffic engineers will need to coordinate on moving the intersection of Culver Boulevard and Jefferson Boulevard to realign Culver. There is the

potential for road improvements to provide traffic improvements (e.g., smooth intersections). LADOT will provide a contact for future coordination.

Caltrans has several projects in planning to improve Lincoln Boulevard near the Ballona Wetlands. Appendix B lists these projects. In 2011, Caltrans expects to be "ready to list" a project for construction bids to widen Lincoln Boulevard from Ballona Creek to Fiji Way, construct a new bridge over Ballona Creek, and replace the Culver Boulevard overpass. This project will also provide the opportunity to widen the existing culvert or install a new culvert between Areas A and C. While Caltrans' projects may be a few years ahead of the Ballona restoration, Caltrans could incorporate elements of the restoration into their projects provided assurances that these elements would not need to be modified at a later time.

4. BEACHES AND HARBORS: NEW CULVERT CONNECTIONS TO MARINA DEL REY AND BIKE PATH AROUND MARINA DEL REY

Members of the PMT and Consultant Team met with the Los Angeles County Department of Beaches and Harbors (Beaches and Harbors) on October 28, 2008.

Two new tidal connections to Area A directly from Marina del Rey could be located: (1) under the parking lot north of the Beaches and Harbors office and (2) under Parcel 55, which is located at the northwest corner of Fiji Way and planned for redevelopment. At the time of the meeting, the redevelopment had initiated planning, but not CEQA environmental review.

Beaches and Harbors has an interested in moving the bike path off of Fiji Way. Beaches and Harbors has funds to widen the Fiji Way bike lanes, and the design for this was in progress at the time of the meeting.

Beaches and Harbors and the USACE collaborate on maintenance dredging for the mouth of Ballona Creek. The ability to dredge the creek mouth is currently limited due to soil contamination and Beaches and Harbors is interested in reducing sedimentation and contamination at the creek mouth.

The two overflow parking lots within the Ballona Wetlands project area should be considered in the restoration planning.

5. NATIVE AMERICAN CULTURAL RESOURCES

The PMT has coordinated with representatives of the Tongva Tribe to obtain information about the location of potential cultural sites. This coordination will continue as restoration alternatives are further defined.

The initial approach discussed has been to avoid disturbance of intact cultural sites during construction. Restoration of tidal wetlands may enhance these cultural resources and erosion caused by the tides or other natural processes may be acceptable. Any Tongva cultural resources located within the fill material placed at Ballona during construction of Marina Del Rey may be considered to have already been

disturbed. Removal of fill material and disturbed Tongva resources within the fill material may be acceptable, and would be coordinated with the Tongva Tribe.

Attachment 2

Ballona Wetlands Restoration Alternatives Target Species Analysis

The development of restoration alternatives for the Ballona Wetlands Ecological Reserve has involved significant input from stakeholders, agency staff, consultants, and the Science Advisory Committee (SAC). Alternatives have progressed from drawings by the public at the first design charrette to a broad array of concepts including a variety of site improvements to support desired habitat types. A set of five concept level alternatives were developed for detailed analysis and input from interested parties. The Ballona Wetland Feasibility Report was prepared by the project management and consultant teams, with assistance from agency staff and the property owners, and includes a detailed discussion of these analyses. The Feasibility Report and SAC both recommended further development of Alternatives 4 and 5.

One of the recommendations from the Science Advisory Committee and many of the stakeholders in reviewing the Feasibility Report was to include an analysis of the potential ability of the restoration alternatives to support specific target species.

The use of target species and habitat to compare and refine proposed restoration alternatives were based on a modified framework approach developed by Ambrose and Bear, 2008. Those authors developed a framework that incorporated historical data on habitat types, habitat mix and extent, habitat-species relationships and habitat function relationships for Ballona wetlands. The framework consisted of a spreadsheet that quantified the distribution of habitats and species that historically occurred in the Ballona area as well as those that would be created under the proposed conceptual restoration alternatives. This framework was utilized for a number of analyses, including the Species-Habitat Use relationship. The method employed by Ambrose and Bear for the Species-Habitat Use relationship analysis entailed assigning a numerical score for primary or secondary use of each habitat type by each species that utilize such habitats. Primary use, defined as breeding or primary foraging habitat for animal species, was assigned a score of 2. Secondary use, such as resting or loafing areas for bird species, was assigned a 1. A score is then derived by summing the scores for each species by habitat. This score is termed the Species Habitat Combination or SHC. The SHC scores for each habitat type were then multiplied by the total area of each habitat proposed under various restoration alternatives to provide a weighed or scaled score. Higher scores suggest a higher relative habitat value.

The current analysis employs a modified framework based on the one developed by Ambrose and Bear (Ambrose and Bear 2008). In this analysis, each habitat was scored based on its relationship with a number of selected target species (Table 1). Target species were selected based on the following criteria:

- Species that are indicators of ecosystem function. These are species that would be expected in a healthy, functional natural habitat. The presence of these species in a

restored system could be used as a measure of restoration progress. These species may or may not be rare, threatened, or endangered.

- Species with special status, especially those included in USFWS recovery plans that include Ballona. These species would either be actively introduced or would be expected to become established following restoration of their required habitat. The list includes some species historically found at Ballona, currently extirpated or thought to be extinct but that could be reintroduced if seed stock were located;
- Species that represent resident and transient use. Transient species, including species of birds and fish, indicate a connection with nearby or distant habitats.
- Species or taxa recommended by resource agencies (USFWS, CDFG, NMFS);
- Species or taxa recommended by the Scientific Advisory Committee for the Ballona Wetland Restoration Project.

The sources for target species included the Ballona Wetland Restoration Project, Habitat Descriptions for Restoration Alternatives, prepared by Ferren et al. and the Ballona Wetland Restoration Science Advisory Committee, 2007; the Existing Conditions report prepared for the Ballona Restoration Feasibility Study; the California Natural Diversity Data Base search performed for the Feasibility Study; Establishing Goals for Restoration of Coastal Wetlands in Southern California Based on Historical and Contemporary Habitat Distributions by Ambrose and Bear, 2008; and numerous published and unpublished sources. As Alternatives are largely conceptual, representative species for restoration of upland habitats, such as plant species for coastal sage scrub, were taken from Holland 1986 (Preliminary Descriptions of the Terrestrial Communities of California). Native grassland species were taken from The Los Angeles Coastal Prairie, A Vanished Community (Mattoni and Longcore 1997).

It should be cautioned that this list of target species is representative but is in no way a comprehensive list of all species that might occur at a restored site. Dozens of species of plants and various taxa and guilds of animals would be expected to occur in each habitat of a successfully restored site. The number of bird species alone that might be expected in a restored wetland could equal or exceed the total number of target species presented here. Such a comprehensive list is beyond the scale of this analysis.

The list represents target species for each major habitat expected to be created/restored under the conceptual level restoration alternatives. For example, the alternatives would restore considerable areas of salt marsh. Thus, species of salt marsh plants, invertebrates, birds, and mammals were included in the list. Neither alternative will result in a substantial change in the area of dune habitat; as a result, species associated with dune habitats were not selected for this analysis

Habitats were defined as Subtidal, Intertidal Channel/Mudflat, Low Marsh, Mid-Marsh, High Marsh, Transition, Salt Pan, Brackish Marsh, Grassland/Herbaceous, and Coastal Scrub in accordance with the conceptual level restoration alternatives. To compare current conditions and

alternatives to habitats described on historical maps, a category termed "Lower Marsh to Transition" was created for salt marsh habitats.

Each target species was assigned a score of 2 (primary) or 1 (secondary) according to the methods of Ambrose and Bear (Table 2). These target species scores were then summed for each habitat type yielding a Species Habitat Combination (SHC) score. Each SHC score was then multiplied by the area of each habitat proposed for restoration alternative, as well as current conditions, yielding a scaled SHC score. Scaled SHC score were used to compare the relative value of each habitat for the target species selected.

Each target species is presented by habitat in Table 1. Many of the species presented in Table 1 may occur in several habitats. In an attempt to reduce redundancies in the table, the habitat relationships of each target species are presented in the species descriptions below.

Subtidal – Eelgrass???

Salt Marsh/Transition

This section includes all target plant species associated with salt marsh and transition habitats, and include all vegetated estuarine habitats; low, middle and high marsh, and transitional zones.

California boxthorn (*Lycium californicum*). California boxthorn is a perennial shrub that occurs in the transition zone between southern California salt marshes and upland habitats. It is most plentiful in the ecotone between salt marshes and the coastal sage scrub plant community. Boxthorn produces shiny red berries that provide food for small mammals and birds, and it is used as perch by the state-listed endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). California boxthorn is listed as a List 4 (limited distribution) plant by the California Native Plant Society (CNPS).

Salt Marsh Bird's Beak (*Cordylanthus maritimus* ssp. *maritimus*). Salt marsh bird's beak is a state- and federal-listed endangered species that occurs in the high marsh. This annual species is a facultative hemiparasite, developing haustoria that penetrate the tissues of host plants for nutrients. Host species include shoregrass (*Monanthochloe littoralis*), Pacific pickleweed (*Salicornia virginica = Sarcocornia pacifica*), alkali heath (*Frankenia salina*), Parish's pickleweed (*Salicornia subterminalis = Arthrocnemum subterminale*), and saltgrass (*Distichlis spicata*), all high marsh species. This species appears to require partially shaded upper marsh habitats with reduced soil salinity in spring, but only where water is not impounded. Its habitat specificity of this species makes it an ideal indicator of the upper marsh.

Parish's pickleweed (*Arthrocnemum subterminale*). Parish's pickleweed, formerly known as glasswort (*Salicornia subterminalis*), is a perennial shrub that occurs in the high marsh/transition zone. It is an obligate wetland plant, requiring saturated soils for seedling germination. However, it occurs at an elevation with non-wetland, upland species, such as California boxthorn (*Lycium californicum*) and California buckwheat (*Eriogonum fasciculatum*). Thus, this species represents a true transition from wetland to upland. It is also a host plant for salt marsh bird's beak.

Shoregrass (*Monathochloe littoralis*). Shoregrass occurs at the highest elevation levels of salt marsh vascular plant species, along with Parish's pickleweed. Like Parish's pickleweed, it is an indicator of the biodiversity of the transition zone and is a host plant of salt marsh bird's beak.

Bigelow's Pickleweed (*Salicornia bigelovii*). Bigelow's pickleweed is an annual species that occurs in openings in the canopy of the marsh plain. This species appears to prefer pools in poorly drained areas of the marsh plain. This ability to persist in water-logged soils allows it to co-exist with Pacific pickleweed (*Sarcocornia pacifica*), the dominant species of the marsh plain. The occurrence of Bigelow's pickleweed in a restored salt marsh suggests that pooled areas exist as pockets of habitat for this species.

Sea blite (*Sueada esteroa*). Sea blite was once a common component of the marsh plain in many southern California coastal wetlands. However, analysis of a long-term data set collected at Tijuana Estuary suggests that this species is sensitive to hypersalinity resulting from closure of the tidal inlet. The population of this species declined dramatically following mouth closure and did not recover after tidal exchange was reestablished. Presence and persistence of this species at a restored site indicates functional tidal conditions.

Arrow grass (*Triglochin concinnum*). Arrow grass is an annual species that occurs in the same shallow pools as those described for Bigelow's pickleweed. Zedler 1982 describes it as the earliest growing species in southern California salt marshes, completing its life cycle on the marsh plain before most species are initiating spring growth. Arrow grass is an indicator of biodiversity of the marsh plain and of the functioning of shallow intertidal pools.

Pacific cordgrass (*Spartina foliosa*). Pacific cordgrass is the dominant species of the lower intertidal zone in tidally flushed southern California wetlands. It is typically absent in non-tidal marshes. Cordgrass forms monotypic stands at the lower elevations of the marsh and intergrades with other marsh plain species at its upper elevation limit. It is the preferred nesting and foraging habitat of the federal- and state-listed endangered light-footed clapper rail (*Rallus longirostris levipes*). The cordgrass-dominated marsh also provides habitat for a number of invertebrates, including species of beetles and snails. The presence of cordgrass in a restored

marsh suggests regular tidal flushing, biodiversity, energy transfer, and potential habitat for the clapper rail.

Ventura marsh milk vetch (*Astragulus pycnostachyus* var. *lanosissimus*). Ventura marsh milk vetch occurs on well-drained soils of open coastal habitats, including coastal scrub and dunes near bodies of brackish water or a high water table. It is known from a single locality in Oxnard, California. Historical records indicate the occurrence of as many as 4 or 5 populations along the coast between Ventura and Orange counties, including the Ballona area. Through the efforts of the CDFG, small experimental populations have been established at four sites in Santa Barbara and Ventura counties. Establishment of this specie at the restored Ballona site would provide a small but significant buffer from possible extinction.

Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*). Coulter's goldfields occurs in the high marsh and transition zones of southern California salt marshes. It germinates in areas with reduced soil salinities, such as those areas that pool freshwater, although it does not grow in persistent pools. This species is considered rare by the California Native Plant Society (list 1B - rare, threatened, or endangered in California and elsewhere). Coulter's goldfields is an indicator of a diverse upper marsh physiography and biology.

Southern tarplant (*Centromadia parryi* ssp. *australis*). Southern tarplant occurs in a variety of habitats, including along the edges of salt marshes, in native grasslands, vernal pools and freshwater wetlands. This species is listed as a list 1B (rare, threatened, or endangered in California and elsewhere) by the CNPS. It has been recorded from Ballona and the expansion of the existing population following restoration would indicate an increased biodiversity of the various habitats it is reported to occupy.

Native Grassland

Nodding needlegrass (*Nassella cernua*). Nodding needlegrass was an element of the Los Angeles Coastal Prairie reported by Mattoni and Longcore 1997. Native grasses typically grow as bunchgrasses forming small evenly-spaced tussocks. Needlegrass provides cover and its seeds food for native songbirds and rodents. The presence of nodding needlegrass would indicate successful restoration of a species that historically existed in the Ballona area.

Purple owl's clover (*Castilleja exserta*). Purple owl's clover is one of many species of annual forb found in native grasslands. It was reported as an element of the Los Angeles Coastal Prairie reported by Mattoni and Longcore 1997. It's occurrence in a restored grassland is a positive indicator of plant biodiversity.

Common goldenstar (*Bloomeria crocea* var. *crocea*). Common goldenstar is one of many species of annual forb found in native grasslands. It was reported as an element of the Los Angeles Coastal Prairie reported by Mattoni and Longcore 1997. It's occurrence in a restored grassland is a positive indicator of plant biodiversity.

Coastal Scrub

Coastal sagebrush (*Artemisia californica*). Coastal sagebrush is one of the dominant shrub species that occurs in coastal scrub habitats. It requires full sun and occurs naturally on west and north slopes. It is drought tolerant and occurs on a number of soil types. Animals rarely eat *Artemisia californica*, probably due to the presence of bitter aromatic terpenes, but it does provide cover for smaller birds and other animals associated with coastal scrub habitats. It is an important habitat plant for the threatened California gnatcatcher (*Polioptila californica californica*).

Seacliff buckwheat (*Eriogonum parvifolium*). Seacliff buckwheat occurs in coastal scrub assemblages in southern and central California. This evergreen shrub is an important host for a number of pollinating insects. Seacliff buckwheat has been reported as the sole host plant for the larvae of the endangered El Segundo blue butterfly (*Euphilotes battiodes allyni*); however, this function may be restricted to a single genotype of this species. Seacliff buckwheat has been reported from Ballona and would benefit from restored coastal scrub habitats.

Coastal goldenbush (*Isocoma menziesii* var *vernonoides*). Coastal goldenbush is a perennial shrub that occurs in coastal scrub habitats in southern California and Baja California, Mexico. It grows on sandy soils in full sunlight and can occur as dense monotypic stands. It is an important source of nectar for butterflies and other insects.

Brackish Marsh/Seeps

Ballona cinquefoil (*Potentilla multjuga*). Ballona cinquefoil is a perennial dicot that is native California and is presumed extinct. It was reported from the Ballona area but is considered extinct or extirpated there. While the ability to reestablish this species is questionable, creation of the proper brackish marsh conditions at the restored Ballona wetlands has the potential to reintroduce this species, if a donor source can be located.

Southwestern spiny rush (*Juncus acutus* ssp. *leopoldii*). Southwestern spiny rush is a perennial shrub that occurs in a variety of marsh habitats, including freshwater, brackish and salt water marshes. It is associated with areas that receive freshwater influence and frequently becomes established after flood events. Southwestern spiny rush is a CNPS list 4 species (limited distribution). Due to its affinity for reduced salinities, at least in its early developmental stages,

it has been included as a target species for brackish marsh/seep restoration at Ballona. This species occurred historically at Ballona wetlands but is presumed extirpated.

Basket rush *(Juncus textilis).* Basket rush is endemic to southern California, where it occurs along the coast and in the coastal mountain ranges. It occurs primarily in freshwater habitats, including streams and freshwater seeps. This species of rush has been used historically for basket weaving by area Native Americans. This species has not been reported from Ballona, but is very similar in form to wire rush (*Juncus arcticus* vat *balticus*) which was reported for the extirpated Los Angeles coastal prairie community by Mattoni and Longcore 1997.

Terrestrial Invertebrates

Wandering skipper (*Panoquina errans*). The wandering skipper is a small brown butterfly with cream colored spots that resides in coastal areas. Its larvae depend upon saltgrass (*Distichlis spicata*) for food and adults have been observed nectaring on the flowers of heliotrope (*Heliotropum curassavicum*) and alkali heath. The wandering skipper is considered Lower Risk/Near Threatened by the International Union for the Conservation of Nature and Natural Resources (IUCN). The presence of wandering skipper in a restored marsh would indicate a diverse insect assemblage.

El Segundo blue butterfly (*Euphilotes battoides allyni*). The El Segundo blue butterfly is named for the dunes that it inhabits. One of the last populations exists adjacent to the Los Angeles International Airport. The butterfly's larvae appear to be dependent upon a single genotype of seacliff buckwheat, as presented previously. This species historically occurred at Ballona, which is designated as a Recovery Unit in the USFWs Recovery Plan.

Mudflat tiger beetle (*Cicindella trifasciata sigmoidea*). The mudflat tiger beetle is a predator of other insects and arthropods. They occur on mud or sand flats near permanent bodies of water. Tiger beetles are considered to be good indicators of a healthy coastal wetland system as they are typically absent at disturbed sites.

Rove beetle (Staphylinidae). A number of rove beetles (family Staphylinidae) inhabit salt marshes, many of which burrow into salt flats and mudflats. Their burrowing activities are thought to aerate the often compacted soils of these habitats.

Aquatic Invertebrates

California brackish water snail (*Tryonia imitator*). The California brackish water snail occurs in brackish seeps and marshes. The IUCN considers it a red-listed species. The California brackish water snail requires permanently submerged areas and is reportedly able to tolerate a wide range of salinity. It has been reported from the Ballona area and the population there is considered

extant. Restoration of Ballona Wetlands affords the opportunity to create brackish habitat for this species.

Fiddler crab (*Uca crenulata*). The fiddler crab lives in burrows intertidal mudflat habitats at the upper limit of the tide. It feeds on plant and animal matter deposited by the tides. The presence of this crab indicates healthy intertidal mudflat habitat.

Ghost shrimp (*Callianassa californiensis*). Ghost shrimp are decapod crustaceans that inhabit burrows in the sandy intertidal zone. They were commercially harvested as fish bait until the late 1970s and are still collected by sports fishermen for that purpose. Given the proper substrate and tidal conditions, ghost shrimp have been reported as the dominant intertidal organism at some southern California coastal wetlands.

California oyster (*Ostreola conchalphia*). The California or Olympic oyster is native to the west coast of North America. They are generally found attached to hard substrate or loose on soft substrate in singles or small groups. They occur in estuaries, lagoons, bays, tidal flats or attached to pilings or floating structures. This species is declining in the southern California region and would indicate a diverse aquatic fauna at the restored Ballona Wetlands.

California horn snail (*Cerithidia californica*). California horn snails are one of the dominant invertebrates of the tidal creeks where they have been found at densities exceeding 1,000/m^2. They are important grazers of algal mats and transfer the energy of those primary producers directly to higher order consumers, such as the light-footed clapper rail (*Rallus longirostris levipes*). They also serve as hosts for specific taxa of trematodes found only in healthy marsh systems.

Salt marsh snail. (*Melampus olivaceus*). As the common name implies, the salt marsh snail occurs within the vegetated marsh of southern California coastal wetlands, where there is evidence that it feeds on Pacific pickleweed. It breaths air and does not tolerate inundation for long periods. Like the California horn snail, it has been documented to be a source of food for the light-footed clear rail.

California assiminea (*Assiminea californica*). California assiminea is a small snail that usually occurs in the upper intertidal under driftwood and debris, or in pickleweed-dominated marsh and on mudflats. It feeds on epibenthic algae and in turn is preyed upon birds and fish. Its presence indicates a diverse invertebrate assemblage in the upper marsh and food chain support.

Fishes

Gobies. There are several gobiids that inhabit southern California coastal wetlands; however, three species that have similar life history requirements commonly co-occur. These include the

arrow goby (*Clevelandia ios*), cheekspot goby (*Ilypnus gilberti*) and shadow goby (*Quietula y-cauda*). These species inhabit shallow subtidal and intertidal mudflats, often living in burrows, sometimes commensally with other organisms, such as ghost shrimp. These goby species feed on polychaete worms and other infauna. They in turn provide food for picivorous fishes such as California halibut (*Paralichthys californicus*) and diving and wading birds. Gobies provide food chain support and are indicators of lower intertidal and upper subtidal habitats.

Barred sand bass (*Paralabrax nebulifer*). Barred sand bass are most commonly found in the shallow intertidal zone of the open coast. However, they are frequently present in low numbers in the channels of southern California coastal wetlands. Whether they actively seek to enter through the mouth of a bay or estuary or are accidental visitors is not clear; however, it has been theorized that the presence of so called "transient' species in coastal estuaries and lagoons is an indicator of connectivity with the nearshore habitat and an example of how marsh productivity is exploited by higher order consumers.

California killifish (*Funduls parvippinis*). California killifish are small, pelagic, schooling fish that are known to leave tidal channels at high tide and forage in the low marsh and in low marsh pools. Thus, they represent a direct trophic link between subtidal and intertidal, vegetated salt marsh. The presence of California killifish in a restored salt marsh would indicate healthy functioning of both the subtidal and vegetated intertidal habitats, and biodiversity of channel organisms.

Shovelnose guitarfish (*Rhynobatos productus*). The shovelnose guitarfish is a cartilagenous, demersal fish, similar in form and life history strategy to some skates, rays and sharks. For the purposes of target species for restoration, it has been selected as an example of these taxa that may use restored bays and estuaries on a transient basis.

California halibut (*Paralichtys californicus*). California halibut is a demersal flat fish that utilizes enclosed bays and estuaries as a nursery ground. Halibut spawn in the nearshore environment and juvenile halibut move into bays and estuaries soon after metamorphosis form the larval form. It is hypothesized that these enclosed water bodies provide refuge from predators and afford abundant food sources, e.g., gobies. California halibut are an important sport fish in southern California. As a target species for restoration, their presence indicates regular, diurnal tidal flushing and connectivity with the nearshore.

Longjaw mudsucker (*Gillichthys mirabilis*). The longjaw mudsucker is noted for its extremely large mouth and ability to survive out of water for short periods. They inhabit the tidal channels and low intertidal marshes of coastal wetlands. They may occupy the burrows of estuarine invertebrates, such as the yellow shore crab (*Hemigrapsus oregonensis*) or may burrow into the fine substrate of back -bay areas. Longjaw mudsucker were once heavily collected for fish bait,

reducing local populations. Their presence indicates the health of the shallow, muddy tidal creeks and sloughs.

Topsmelt (*Atherinops affinis*). Topsmelt are often the dominant pelagic species collected in bays and estuaries in southern California. They attach their eggs to floating mats of algae (*Enteromorpha* sp. and other species). After hatching, many of the larvae remain among the thick mats, which provide a source of food, at least for a portion of their lives, and protection from predators. Topsmelt are often taken by diving birds, including the California least tern (*Sterna antillarum browni*) and picivorous fishes, such as California halibut. Thus they are an example of the telescoped food chain of coastal wetlands, feeding directly on primary plant producers and providing food for higher order consumers.

Birds

Light-footed clapper rail (*Rallus longirostris levipes*). The light-footed clapper rail is a state- and federal-listed endangered species that inhabits the cordgrass-dominated low marsh plain. They are a secretive species that nests in the cordgrass canopy and feed primarily on intertidal invertebrates, but also utilize upland prey, such as insects and herpetofuana. The clapper rail has been the focus of a USFWS recovery plan that includes an active captive breeding plan. Captive bred clapper rails are released to USFWS designated sites.

The historic presence of the light-footed clapper rail as a resident at Ballona is disputed, as there is evidence that cordgrass did not occur in the area. However, this species has been reported as a winter visitor. Should the restoration project seek to include clapper rail as a target species, the captive breeding program could provide a mechanism for establishing a population at Ballona. Light-footed clapper rails are an important indicator of the health and functioning of the low marsh plain.

Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). The Belding's savannah sparrow is a small, state-listed endangered passerine that nests primarily in the pickleweed-dominated marsh plain. There is a small population of approximately 12 pairs that presently reside at Ballona. Restoration of large areas of marsh plain, as currently envisioned for Ballona, should substantially increase the size of the resident population.

California least tern (*Sterna antillarum browni*). The California least tern is a state- and federal-listed endangered subspecies of least tern that nests in small depressions on dunes and beaches. They are primarily picivorous, diving to capture their prey, with northern anchovy (*Engraulis mordax*) their preferred prey item. They also have been reported to take topsmelt, gobies, and a variety of invertebrates. Least terns may forage on the open coast, especially near bays and estuaries, but the young feed almost exclusively in enclosed water bodies.

Least terns nested historically at Ballona and an active colony is located nearby at Dockweiler State Beach. The increased open water habitats included in restoration alternatives would provide foraging habitat for this endangered species.

White-tailed kite (*Elanus caeruleus*). The white-tailed kite is a small raptor typically found in open lowland areas. It is a state fully protected species and a federal species of concern. They roost and nest in trees that border grasslands or open fields that support their preferred prey, the California vole (*Microtus californicus*). They will also take house mouse (*Mus musculus*), havest mouse (*Reithrodontomys megalotis*), shrews (*Sorex* sp) and white-footed mouse (*Peromyscus* spp.). The presence of white-tailed kites in the restored Ballona system would indicate functional upland habitats and small mammal populations.

Western snowy plover (*Charadrius alexandrius nivosus*). The western snowy plover is a federal-listed threatened subspecies of snowy plover that nests and forages on beaches and dunes. They typically forage for small invertebrates in wet or dry beach-sand, among tide-cast kelp, and within low foredune vegetation. Although the proposed restoration plan does not include an increase in beach and dune habitat, this species was included as a potential target species at the suggestion of the USFWS.

Great blue heron (*Ardea herodias*). The great blue heron is one of the most noticed and popular birds associated with wetland habitats. This large (length up to 46 inches) wading bird feeds on fishes and invertebrates in aquatic habitats, and also forages for small mammals, such as pocket gophers (*Thomomys* spp.) in upland areas. Thus, the great blue heron exploits wetland, transition and upland habitats.

There is currently a breeding colony of great blue herons located in non-native trees adjacent to Ballona wetlands, north of Fiji Way. The final restoration plan can benefit this species by including areas of large, native trees for nesting.

Coastal California gnatcatcher (*Polioptila californica californica*). The coastal California gnatcatcher is a small, federal-listed threatened songbird that resides almost exclusively in coastal scrub habitats. They nest generally less than a meter off the ground in branch forks of coastal sagebrush, California buckwheat or other coastal scrub shrubs. They feed primarily on insects. The presence of the gnatcatcher in restored coastal scrub habitat would indicate the successful establishment of scrub plant species and associated insect fauna.

Herpetofauna

San Diego horned lizard (*Phrynosoma coronatum blanvillei*). The San Diego horned lizard resides in the transition zone and dunes. Habitat requirements appears to be loose sand or soil for burrowing to avoid predators and an abundance of wood or harvest ants upon which this

species feed almost exclusively. This species is easily captured and populations have been reduced by pet collectors. As an indicator of restoration success, the occurrence of the species would suggest a functional transition zone and viable native ant populations.

California kingsnake (*Lampropeltis getulus californiae*). California kingsnakes are predaceous on other snake species. Kingsnakes occur in variety of habitats, including transition and upland habitats associated with coastal wetlands. Their presence at a restored Ballona would indicate, directly, suitable populations of other snake species, which would indirectly infer suitable populations of small mammals.

Mammals

California vole (*Microtus californicus*). The California vole inhabits the high marsh/transition zone, grasslands and wet meadows. They feed on forbs and grasses and shun insects. They are the preferred prey item of the white-tailed kite. Their presence in a restored system would indicate an abundance of food sources, a diverse small mammal community, and prey items for raptors and other species.

Long-tail weasel (*Mustela frenata*). Long-tail weasels occur in many habitats except extremely arid ones, including upland adjacent to coastal wetlands. They are carnivorous, feeding on a number of small mammal species and small birds. Although the long-tail weasel has not been reported from Ballona, conditions of the restored site would support this carnivore and provide regional and local biodiversity.

Salt marsh shrew (*Sorex ornatus salicornius*). Salt marsh shrews are confined to the coastal marshes in Los Angeles, Orange, and Ventura counties. Known occurrence extends from Point Mugu, Ventura County on the north to the salt marshes around Anaheim Bay and Newport Beach in Orange County. Little is known about the requirements of the salt marsh shrew other than it inhabits salt marshes and feeds on a variety of small insects. It was included as a target species for restoration in order to provide biodiversity of small mammals.

Table 1. Target Species

Salt Marsh/Transition	Habitat	Status	Rationale	History
California boxthorn *(Lycium califonicum)*	High marsh/transiton.	CNDDB List 4	Good indicator of transiton to upland.	NR
salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*)	High marsh/transition; dunes.	FE -SE	Good indicator of tidal flushing; Biodiversity of high marsh/trans.	Potentially occurring presumed extinct.
Parish's pickleweed (*Arthrocnemum subterminale*)	High marsh/transiton.	None	Good indicator of transiton to upland. Suitable host for Salt marsh birds' beak	Confirmed present at BW.
Shoregrass (*Monanthochloe littoralis*)	High marsh/transiton.	None	Good indicator of transiton to upland. Suitable host for Salt marsh birds' beak	NR
Bigelow's pickleweed (*Salicornia bigelovii*)	openings in marsh plain.	None	Good indicator of tidal flushing; Biodiversity of marsh plain.	NR
sea-blite (*Suaeda esteroa*)	marsh plain.	None	Biodiversity of marsh plain.	NR
arrow grass (*Triglochin concinnum*)	marsh plain.	None	Biodiveristy of marsh plain.	NR
Pacific cordgrass (*Spartina foliosa*)	marsh plain.	None	Good indicator of tidal flushing; Associated with Light-footed CR.	NR
Ventura Marsh milk vetch (*Astragulus pycnostachyus* var. *lanosissimus*)	high marsh/transition.	FE, SE CNPS 1B	Endangered; Biodiversity of high marsh/transition	Reported from BW; presumed extirpated.
Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*)	high marsh/transition.	CNPS 1B	Biodiversity of high marsh/transition	Reported from BW; presumed extirpated.
southern tarplant (*Centromadia parryi* ssp. *australis*)	high marsh/transition.	CNPS 1B	Biodiversity of high marsh/transition	Confirmed present at BW

Native Grassland	**Habitat**	**Status**	**Rationale**	**History**
nodding needlegrass (*Nassella cernua*)	grassland.	None	Biodiversity of restored grassland.	Reported from BW area.
purple owl's clover (*Castilleja exserta*)	grassland.	None	Biodiversity of restored grassland.	Reported from BW area.
common goldenstar (*Bloomeria crocea* var *crocea*)	grassland.	None	Biodiversity of restored grassland.	Reported from BW area.
Coastal Scrub				
coastal sagebrush (*Artemisia californica*)	coastal scrub.	None	Biodiversity of restored coastal scrub.	NR
seacliff buckwheat (*Eriogonum parvifolium*)	coastal scrub.	None	Biodiversity of restored coastal scrub. Important for pollenator insects	Confirmed present at BW.
coastal goldenbush (*Isocoma menziesii* var *vernonoides*)	coastal scrub.	None	Biodiversity of restored coastal scrub.	Confirmed present at BW.
Brackish Meadows/Seeps				
Ballona cinquefoil (*Potentilla multjuga*)	Brackish marsh; seeps.	CNPS List 1A	Biodiversity of brackish marsh/seeps.	
southwestern spiny rush (*Juncus acutus* ssp. *leopoldii*)	fresh, brackish, salt marshes.	CNPS List 4	Biodiversity of brackish marsh/seeps.	Reported from BW; presumed extinct.
basket rush (*Juncus textilis*)	freshwater streams and seeps.	None	Biodiversity of brackish marsh/seeps.	Reported from BW. presumed extirpated.

Terrestrial Invertebrates	**Habitat**	**Status**	**Rationale**	**History**
wandering skipper (*Panoquina errans***)**	high salt marsh. *D. spicata* larval host.	LR/n (IUCN)	Biodiversity of high salt marsh.	Reported from BW. presumed extant
El Segundo blue butterfly (*Euphilotes battoides allyni*)	coastal sand dunes; *E. parvifolium* larval host.	FE	Biodiversity of dunes. Suggested by USFWS.	Reported from BW. presumed extirpated
mudflat tiger beetle (*Cicindella trifasciata sigmoidea*)	mudflats and salt panne.	None	Biodiversity of mudflant and salt panne habitats.	Reported from BW. Presumed extant.
rove beetle Family Staphylinidae	mudflats and salt panne.	None	Biodiversity of mudflant and salt panne habitats.	NR
Aquatic Invertebrates				
California brackish water snail (*Tryonia imitator*)	brackish meadow/seeps.	DD (IUCN)	Biodiversity of brackish wetlands. Good indicator of tidal flushing.	Reported from BW. Canal; extant?
fiddler crab (*Uca crenulata*)	high mudflats.	None	Biodiversity of high mudflats	Reported from BW. Canal; extant.
ghost shrimp (*Callinassa californiensis*)	sandy subtidal.	None	Biodiversity of subtidal habitat. Associated with gobiid larvae.	NR
California oyster (*Ostreola conchalphia*)	tidal flats	None	Biodiversity of intertidal habitat.	NR
California horn snail (*Cerithidea califonica*)	tidal creeks and tidal flats	None	Biodiversity of intertidal habitat. food chain support.	Reported from BW.
salt marsh snail (*Melampus olivaceus*)	vegetated marsh plain.	None	Biodiversity of intertidal habitat. food chain support.	Reported from BW.
California assiminea (*Assiminea californic*a)	upper intertidal; muflats or pickleweed.	None	Biodiversity of intertidal habitat. food chain support.	Reported from BW.

Fish	Habitat	Status	Rationale	History
arrow goby (*Clevelandia ios*),	demersal, sandy subtidal.	None	Estuarine residents; food chain support for higher	Reported from BW.
cheekspot goby (*Ilypnus gilberti*)	demersal, sandy subtidal.	None	Estuarine residents; order consumers (e.g., halibut)	Reported from BW.
shadow goby (*Quietula y-cuada*)	demersal, sandy subtidal.	None	Estuarine residents; order consumers (e.g., halibut)	Reported from BW.
northern anchovy (*Engraulis mordax*)	pelagic, subtidal.	None	Food chain support for picivorous birds; good indicator of transient use suggested by NMFS.	NR
barred sand bass (*Paralabrax nebulifer*)	pelagic, subtidal.	None	Good indicator of transient use; suggested by NMFS.	Reported from BW.
California killifish (*Fundulus parvipinnis*)	pelagic, subtidal intertidal.	None	Forages in salt marsh on high tide exploiting low marsh resources	Reported from BW.
shovelnose guitarfish (*Rhinobatos productus*)	demersal, subtidal.	None	Good indicator of transient use; Taxon suggested by NMFS.	NR
California halibut (*Paralichthys californicus*)	demersal, sandy subtidal.	None	Good indicator of tidal flushing Good indicator of nursery function	Reported from BW.
Longjaw mudsucker (*Gillichthys mirabilis*)	muddy subtidal; intertidal marsh.	None	Biodiversity of tidal marsh	Reported from BW.
topsmelt (Atherinops affinis)	pelagis; subtidal.	None	Biodiversity of Fishes; food chain support.	Reported from BW.

Birds	**Habitat**	**Status**	**Rationale**	**History**
Light-footed Clapper Rail (*Rallus longirostris levipes*)	salt marsh; uplands/transition	FE, SE	Biodiversity of tidal marsh. Suggested by USFWS.	Reported from BW; winter visitor.
Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)	mid-high marsh; transition.	SE	Biodiversity of mid-high marsh; transition.	Reported from BW; current resident.
California least tern (Sterna antillarum browni)	dune/beach.	FE, SE	Nests nearby; Suggested by USFWS.	Reported near BW; summer visitor
White-tailed Kite (*Elanus caeruleus*)	uplands/transition; grassland.	FSC, SFP	Biodiversity of upland/transition; Indicator of small mammal populations.	Reported from BW; confirmed present
Western snowy plover (*Charadrius alexandrius nivosis*)	dunes/beaches.	FT, CSC	Biodiversity of dunes/beaches; Suggestion of USFWS.	Former resident; winter transient.
great blue heron (*Ardea herodias*)	mid-high marsh; uplands/transition.	None	Biodiversity of various habitats;	current resident.
coastal California gnatcatcher (*Polioptila californica californica*)	CSS	FT	biodiversity of restored coastal scrub; threatened.	NR
Herpetofauna				
San Diego horned lizard (*Phrynosoma coronatum blainvillei*)	dunes/transition	CSC	Biodiversity of dunes/transition; Indicator of specific ant populations.	NR
common kingsnake (*Lampropeltis getulus var californiae*)	uplands	None	Biodiversity of uplands;	Reported from BW; presumed extant.
Mammals				
California vole (*Microtus californicus*)	high marsh/transition wet meadows/grslnds	CSC	Biodiversity of uplands; food chain support- raptors	Reported from BW; confirmed present.
Long-tail weasel (*Mustela frenata*)	high marsh /transition	None	Biodiverity of high marsh/transition idicator of small mammal poulations	NR
salt marsh shrew (*Sorex ornatus salicornius*)	high marsh /transition	CSC	Biodiverity of high marsh/transition idicator of small mammal poulations	Historic resdient; current status unknown.

Table 2. Species Use Scores

Habitat Type	Subtidal	Intertidal Channel/Mudflat	Low Marsh	Mid Marsh	High Marsh	Transition	Low Marsh to Transition	Salt Pan	Brackish Marsh	Grassland/Herbaceous	Coastal Scrub
California boxthorn						2	2				1
salt marsh bird's beak					2	1	3				
Parish's pickleweed					2	1	3				
Shoregrass					2	1	3				
Bigelow's pickleweed				2			2				
sea-blite				2	1		3				
arrow grass				2			2				
Pacific cordgrass			2	1			3				
Ventura Marsh milk vetch							0				2
Coulter's goldfields					1	2	3				
southern tarplant						2	2			2	
nodding needlegrass							0			2	1
purple owl's clover							0			2	1
common goldenstar							0			2	1
coastal sagebrush							0				2
seacliff buckwheat							0				2
coastal goldenbush						1	1				2
Ballona cinquefoil							0		2		
southwestern spiny rush					2	2	4		2		
basket rush							0		1		
wandering skipper					2	1	3				
El Segundo blue butterfly							0				2
mudflat tiger beetle		2					0	2			
rove beetle		1					0	2			
California brackish water snail							0		2		
fiddler crab		2					0				
ghost shrimp	2	1					0				
California oyster	2	1					0				
California horn snail	2	2	2	1			3				

Habitat Type	Subtidal	Intertidal Channel/Mudflat	Low Marsh	Mid Marsh	High Marsh	Transition	Low Marsh to Transition	Salt Pan	Brackish Marsh	Grassland/Herbaceous	Coastal Scrub
salt marsh snail		1	1	2	2		5				
California assiminea		1		1	2		3				
arrow goby	2	1					0				
cheekspot goby	2	1					0				
shadow goby	2	1					0				
northern anchovy	2						0				
barred sand bass	2						0				
California killifish	2	2	1				1				
shovelnose guitarfish	2						0				
California halibut	2						0				
Longjaw mudsucker	2	1	1				1				
topsmelt	2						0				
Light-footed Clapper Rail		2	1	1	1		3				1
Belding's savannah sparrow				1	2		3				
California least tern		2					0				
White-tailed Kite							0			2	
Western snowy plover							0				
great blue heron				2	2	1	5			1	1
coastal California gnatcatcher							0				2
San Diego horned lizard						1	1				1
common kingsnake						1	1			2	2
California vole							0			2	
Long-tail weasel						1	1			2	1
salt marsh shrew					2	1	3				
total	26	21	8	15	23	18	64	4	7	17	22

Species Habitat Combination Scores

The target species analysis of the revised restoration alternatives employed the methodology developed by Ambrose and Bear. Application of this methodology to the Ballona Wetlands provides a scaled SHC score for each alternative, as well as the current conditions. The scaled SHC score is based on the acreage of each habitat type and species use score for each habitat. The scaled SHC score may be used to compare the mix of species which may be supported by each alternative. Table 3 presents the results of the target species analysis including acreages for each of the habitat types assessed for the purpose this analysis.

Table 3. Species Habitat Combination Scores

		Current Conditions		**Revised Alternative 4**		**Revised Alternative 5**	
Habitat Type	**Species Use Score**	Area (Ha)	Species Use Score Scaled for Area	Area (Ha)	Species Use Score Scaled for Area	Area (Ha)	Species Use Score Scaled for Area
Subtidal	26	29.95	778.64	24.17	628.34	11.37	295.72
Intertidal Channel/mudflat	21	0.69	14.45	28.93	607.57	28.05	588.95
Low Marsh to Transition	64	26.99	1727.58	104.45	6685.00	121.86	7799.10
Salt Pan	4	9.07	36.26	0.00	0.00	0.00	0.00
Brackish Marsh	7	1.25	8.78	4.48	31.36	4.48	31.36
Grassland/herbaceous	17	71.39	1213.61	23.87	405.71	24.94	424.04
Coastal Scrub	22	38.00	836.03	33.06	727.23	36.33	799.32
Species Habitat Combination Score			**4615.36**		**9085.20**		**9938.49**

The scaled SHC scores indicate the restoration alternatives would provide significant improvements to habitats that support species considered in this analysis. The species habitat combination score for the current conditions is 4615, while the scores for the revised alternatives 4 and 5 are 9085 and 9938 respectively.

Ambrose and Bear suggest the species habitat combination scores support a diverse mix of habitats focused on salt marsh habitat (low marsh to transition). Salt marsh habitats provide support to a wide range of species either as essential primary (eg. many plant, bird, invertebrate, small mammal and herpetofauna species) or secondary habitat (eg. many fish species). While subtidal, channel and mudflat habitats are critical for some species (fish in particular), salt marsh habitat provides unique conditions across the tidal range that supports a great diversity of species. As a result, the species habitat combination scores indicate an improvement of species use in the revised Alternative 5 as opposed to Alternative 4.

References

Ambrose, Rich and Todd Bear. 2008. Establishing Goals for Restoration of Coastal Wetlands in Southern California Based on Historical and Contemporary Habitat Distributions. University of California Los Angeles.