MEMORANDUM

TO: Members of the South Bay Salt Pond Restoration Project Management Team

FROM: URS

DATE: 11/24/2014

RE: **Alviso-Mountain View Ponds (A1 and A2W plus Charleston Slough) Restoration Preliminary Design - DRAFT**

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1. INTRODUCTION

This memorandum documents the preliminary design of the South Bay Salt Pond (SBSP) Restoration Project's Phase 2 actions at the Alviso pond complex's Ponds A1 and A2W, and the City of Mountain View's adjacent Charleston Slough. Together, these ponds and the neighboring slough are referred to as the Alviso-Mountain View Ponds or simply the Mountain View Ponds. This memorandum provides foundational technical information for the CEQA and NEPA clearance, regulatory agency permitting processes, and a basis for the next, more detailed design phase.

1.1 Project Background

The Alviso pond complex consists of 25 ponds on the shores of the South Bay in Fremont, San Jose, Sunnyvale and Mountain View, in Santa Clara and Alameda counties (see Appendix A, Figure A-1). The pond complex is bordered on the west by the Palo Alto Baylands Nature Preserve and Charleston Slough, on the south by commercial and industrial land uses as well as NASA Ames Research Center and Sunnyvale Baylands Park, and on the east by Coyote Creek in San Jose and Cushing Parkway in

Fremont. The U.S. Fish and Wildlife Service (USFWS) owns and manages the 8,000-acre Alviso pond complex (EDAW 2007).

The Phase 2 Mountain View Ponds restoration preliminary design, along with the rest of the SBSP Restoration Project, is managed by the SBSP Project Management Team (PMT), which includes the State Coastal Conservancy (SCC), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), Santa Clara Valley Water District (SCVWD) Alameda County Flood Control and Water Conservation District (ACFCWCD), Resources Legacy Fund (RLF), and others.

The Programmatic EIS/R for the SBSP Restoration Project (EDAW 2007) prescribed the initial framework under which restoration would proceed. In that document, program-level alternatives range from a restoration design of 50/50 tidal action/managed pond scenario for the entire restoration project area (Programmatic Alternative B) to a 90/10 tidal action/managed pond scenario for the entire restoration project area (Programmatic Alternative C) (see Appendix A, Figures A-6 and A-7). Programmatic Alternative C was selected and used as a foundation for project-level planning. Phase 1 of the project has since been completed, restoring clusters of ponds at all three pond complexes: Ravenswood, Alviso, and Eden Landing. However, the Mountain View Ponds were not included in the Phase 1 actions.

A design charrette was held May 13, 2010 to discuss conceptual restoration design ideas. Ideas proposed in the charrette document were further refined in coordination with the PMT to develop memoranda that described the opportunities and constraints associated with the construction or implementation of design ideas (URS Corporation 2012). From this, three conceptual designs were developed, which varied in the location and size of various restoration components, such as the estuarine-terrestrial habitat transition zones (HTZs, also known as ecotones), recreational trails, and levee breaches.

This set of three alternatives was developed for conceptual design and inclusion in the comprehensive analysis in the site-specific Public Draft EIS/EIR. Following the public comment period and the results of the impacts analysis, a preferred alternative that best meets the project objectives while providing a cost-efficient design will be identified in the Final EIS/EIR. This memorandum summarizes restoration in the context of the site goals of flood control, habitat restoration, and public/access recreation for the three alternatives.

1.2 Organization and Scope

This memorandum presents the conceptual (approximately 10%) design for the Mountain View Ponds restoration alternatives. It also briefly documents the design constraints and considerations specific to Ponds A1 and A2 and Charleston Slough that formed the basis for the conceptual design.

The preliminary design memorandum is organized as follows:

- Section 2: objectives, design constraints, and considerations
- Section 3: preliminary design analyses, including hydraulic modeling, salinity/water quality management, and topography and geotechnical data
- Section 4: preliminary design including restoration components and construction implementation

1.3 Limitations

This memorandum provides a preliminary design based on information available at the time and our professional judgment pending future engineering analyses. Future design decisions or additional information may change the findings, and corresponding professional judgments presented in this report. Additional engineering will be necessary prior to construction. In the event that conclusions or recommendations based on the information in this memorandum are made by others, such conclusions are not the responsibility of URS, or its subconsultants, unless we have been given an opportunity to review and concur with such conclusions in writing.

2. OBJECTIVES, DESIGN CONSTRAINTS, AND CONSIDERATIONS

The Mountain View Ponds A1 and A2W and Charleston Slough Phase 2 objectives are derived from the overall SBSP objectives as presented in the Programmatic EIS/EIR. The objectives include a restoration action objective, a flood protection objective, and a recreation and public access objective. The restoration action objectives are summarized below.

- *To restore and enhance a mix of wetland habitats*. Restored habitat should be of sufficient size, function, and appropriate structure to promote restoration of special status species, support current migratory bird species that utilize existing salt ponds and associated structures, and increase abundance and diversity of native species in various South San Francisco Bay aquatic and terrestrial ecosystem components (EDAW et al. 2007). In particular, Ponds A1 and A2W are intended to be restored to tidal marsh habitat. Charleston Slough is intended to be approximately 50% tidal marsh, as 53 acres of its 115 acres are targeted to be tidal marsh under a mitigation requirement from a Bay Conservation and Development Commission (BCDC) permit to the City of Mountain View.
- *To provide flood protection in the South Bay*. All project designs and features (e.g. levee improvements) would provide the same level of protection as existing features (i.e. match existing outboard levee elevations), and restored tidal marsh is expected to provide additional flood protection in the long-term.
- *To provide wildlife-oriented public access and recreation*. Public access activities at the Mountain View Ponds may include hiking, wildlife viewing, and other recreational activities.

The restoration preliminary design summarized in this memorandum was developed taking into account several design constraints and considerations. Design constraints are limiting factors that must be considered while developing the design. Design considerations are issues that contribute to design formulation, but are not limiting factors.

2.1 Design constraints

- *Flooding.* The primary constraint on the introduction of tidal action is that coastal flooding could occur unless additional flood protection is provided. Thus, in order to introduce tidal action to Pond A1 and to modify tidal action in Charleston Slough, additional flood protection must be provided. Introducing tidal action into Pond A2W does not require additional flood protection because the adjacent uplands are higher in elevation and not subject to tidal flooding.
- *Maintain City of Mountain View's sailing lake water intake.* The City of Mountain View has a water intake in Charleston Slough to provide water circulation for Shoreline Park's recreational sailing lake; water is then discharged from the sailing lake into Mountain View Slough/Permanente Creek. The water supply (over 8 million gallons per day) must continue to be provided to the lake, though not necessarily from this location.
- *Sedimentation.* If the levee between A1 and Charleston Slough is breached, the sediment budget of Charleston Slough should be considered. There is the possibility that the sediment-starved A1 would draw sediment out of Charleston Slough and degrade habitat there. All proposed levee alterations should be evaluated for their effects on sediment dynamics prior to implementation.
- *Erosion and scour.* Undersized or non-hardened levee breaches may result in erosion and scour of the remaining levee. In some cases erosion would be acceptable, but where existing or proposed

infrastructure needs to be protected (e.g., bridges, Sailing Lake water intake) erosion protection would be needed.

- *Contamination from neighboring landfill.* There is a closed and capped landfill south of A1 and A2W. To avoid contamination from the landfill, the design must not allow the landfill cells to be disturbed.
- *PG&E access.* PG&E has three utility access points along the east and north sides of Pond A2W. Vehicular access to these points must be maintained. Any levee breaches along this route must be hardened and bridged to allow vehicular access. PG&E must also maintain some access to the power lines and towers that run outside of Pond A1 over a portion of San Francisco Bay.
- *Water and sediment quality.* Because of historic mercury mining in the Guadalupe River watershed and use and release of mercury during historic gold mining in the Sierra Nevada mountains, some of the sediment coming in from the Bay may have undesirable characteristics, such as elevated mercury levels. Similarly, dissolved oxygen (DO) has been an occasional problem in these ponds even though the USFWS circulates water through the system.
- *Volume of fill material.* The size of the HTZs and levee enhancements will likely be dependent on the volume and type of fill available for reuse.
- *Public disruptions during construction.* The construction of HTZs would require significant truck traffic for material delivery. This increased traffic may disrupt Shoreline Park trail users and the neighborhoods along the transport routes.
- *Possible future connection with Stevens Creek Marsh or Mountain View Marsh.* If the Stevens Creek or the Mountain View mitigation marshes, located south of the corners of Pond A2W, are ever to be hydraulically connected with Pond A2W, the placement of material for the HTZ would need to accommodate the connection. Also, if the hydraulic connections were to be made using levee breaches rather than culverts, then bridges over the breaches would be needed to maintain the current trail network or the trail network would need to be altered.
- *Integration with City of Mountain View's mitigation requirements.* The existing BCDC mitigation requirement of the City of Mountain View to restore tidal marsh in Charleston Slough may need to be altered to incorporate connectivity with Pond A1, as is the goal under Alternative Mountain View C (described further below). If mitigation requirements cannot be changed, this may constrain breach locations and connectivity. Altering the mitigation requirements may result in increased time in the permitting process.
- *Public access near sensitive species habitat.* Providing recreation and public access is a key goal of the project, but in some areas, public access may negatively affect wildlife using the area.
- *Long-term maintenance.* Constructed features such as levees, trails, control gates, and artificial habitat islands will need to be maintained into the future.
- *Special-status species*. Impacts to special-status species will need to be avoided or minimized. Shoreline Park has known occurrences of burrowing owls that must be protected. A number of the special status species in the South Bay, such as California least tern, California black rail, and salt marsh harvest mouse are fully protected species, and therefore, no take permit can be obtained.
- *Permitting.* Impacts to wetlands, fill volumes, and impacts to special-status species could all affect the ability to obtain permits on the desired schedule.
- *Soil and hydrology*. Habitat restoration is in part dependent on the soil and hydrology of the site. Habitat opportunities are limited by the existing or developed environmental conditions.

2.2 Design considerations

- *Reconnection of historic sloughs.* The design breach locations consider the position and size of historic slough systems, taking advantage of areas where natural conditions may already exist for channel formation and water exchange capacity.
- *Sedimentation.* The existing levees, if left in place, will help slow the discharge of flood and tidal waters, increasing the potential for natural sedimentation within the ponds. This sedimentation is desired to raise pond surface elevations to levels that promote the growth of tidal marsh species and to provide resiliency for sea level rise.
- *Erosion and scour.* Introduction of tidal action in Ponds A1 and A2W could cause scour in the channel bottoms of Charleston Slough, Mountain View Slough, and Whisman Slough due to the increase in tidal prism flowing through the sloughs.
- *Predation.* Levee breaches may serve to isolate habitat from predators. Connecting levees through bridges and trails for public access may limit this value.
- *Nursery habitat.* The tidal marsh habitat and channel network provided through the restoration of tidal action into the ponds could provide protected fish nursery habitat, ultimately increasing fish and populations and recreational opportunities for fishing and birding.
- *Habitat transition zones.* The primary purpose of the HTZ is to provide habitat complexity and refugia for tidal marsh wildlife species during high tides. In addition, the transitional area will provide resiliency to sea level rise, and may provide opportunity for improved public education and outreach.
- *Flood storage capacity.* Breaching levees along the ponds' borders with two large conveyors of stormwater runoff (Mountain View Creek and Stevens Creek) could increase flood storage capacity by linking these water bodies with large basins into which high flows could disperse.
- *Recreation.* Retained levees provide opportunity for recreation and educational signage describing the restoration. Spur trails could be linked to the Bay Trail and/or Shoreline Park trail network. An overlook within the park, perhaps on the hill near Shoreline Amphitheater, would provide a scenic vista with minimal effect on restoration activities. Breaches and sensitive wildlife habitat may limit locations for recreational opportunities.
- *Site access.* In addition to serving as recreation, trails and bridges increase accessibility to scientists to study wildlife and to conduct required monitoring, and also increase access for maintenance and operational activities.
- *Possible future integration of Stevens Creek and Mountain View Marshes.* Opportunities exist to integrate the Stevens Creek and/or the Mountain View mitigation marshes with the larger restoration and recreational actions being considered for Ponds A1 and A2W. While not part of this project, the current designs allow for the possibility of future connectivity. The mitigation marshes are owned by the City of Mountain View and are located immediately south of the eastern and western ends of Pond A2W. Connectivity would create larger continuous restored marshes instead of "pockets" of marsh that are isolated by levees.
- *Cost sharing/efficiency.* Agreements with the City of Mountain View regarding mitigation requirements or pumping requirements may provide opportunities for cost-sharing on the project. In addition, the City of Mountain View has a current capital improvement planning project that addresses the levee system and findings may be utilized to streamline Phase 2 restoration actions leading to increased cost efficiency.

- *Material quality*. The imported fill material in habitat restoration or improvement projects will require environmental screening for contaminants to assess the cleanliness and quality of the material (USFWS 2012). The “dirt broker” that has been acquiring upland fill and arranging for its transport to and use in other projects on land owned by the USFWS is assisting USFWS with a Quality Assurance Project Plan and a permit for assuring this cleanliness and quality.

3. AVAILABLE DATA AND PRELIMINARY DESIGN AANALYSES

The preliminary design was prepared based on the following information and analyses.

- A hydrodynamic analysis of the proposed restoration alternatives was undertaken to determine reasonable breach sizes for use in the preliminary design. As described in the following sections, a two-dimensional hydrodynamic model of the proposed tidal wetland was developed to size breaches and predict levels of wetting and drying within the ponds.

  Analyses were performed on the two action alternatives (Alternatives Mountain View B and Mountain View C). These Alternatives are graphically depicted in Appendix A on Figures A-3 and A-4, and key components are listed in **Table 3.1**.

- Hydrodynamic modeling was used to understand the effect of the 100-year tidal event on the levee between Charleston Slough and the Palo Alto Flood Basin.
- Hydrodynamic modeling was used to estimate the effects on the hydroperiod (time of tidal inundation) within Charleston Slough in order to understand whether tidal marsh vegetation would establish more readily in Charleston Slough with the Restoration Project.
- Hydrodynamic modeling was used to understand changes in the tidal flows adjacent to the existing Shoreline Park Sailing Lake water intake and whether a new location adjacent to a proposed breach would provide better conditions.

Table 3.1. Key Components of Action Alternatives

Alternative Mountain View B	Alternative Mountain View C
	Integrate Charleston Slough with Project
Improve A1 West Levee	Lower and breach Pond A1 West Levee
	Improve Charleston Slough West and South Levees
A1 Northwest Breach	A1 Northwest Breach
	A1 Southwest Breach
	A1 Southeast Breach
A2W Northwest Breach	A2W Northwest Breach
A2W Southwest Breach	A2W Southwest Breach
A2W Northeast Breach with Bridge	A2W Northeast Breach with Bridge
A2W Southeast Breach with Bridge	A2W Southeast Breach with Bridge
	Remove Charleston Slough Tide Gate Structure or Breach Adjacent Levee
Build Nesting Islands	Build Nesting Islands
A1 Habitat Transition Zone	A1 Habitat Transition Zone
A2W Habitat Transition Zone	Shortened A2W Habitat Transition Zone
Shoreline Park Interpretive Platform	Shoreline Park Interpretive Platform
A1 Spur Trail and Viewing Platform	A1 Spur Trail and Viewing Platform
	Charleston Slough Spur Trail and Interpretive Platform
	A2W Trail and Viewing Platform
	Relocate Sailing Lake Water Intake
Improve PG&E towers' concrete footings and access boardwalks	Improve PG&E towers' concrete footings and access boardwalks
Build new PG&E access boardwalk between A2W and Palo Alto Flood Basin	Build new PG&E access boardwalk between A2W and Palo Alto Flood Basin

3.1 Site Topography and Project Datum

The available site topography used in the analysis includes ground surface elevations in the ponds, channels and adjacent Bay and estimates of the tides in San Francisco Bay (tide data). Since the ponds are currently inundated at all times and LiDAR does not penetrate water, bathymetry data were used to supplement the LiDAR data. The topographic data were obtained from three sources:

1. The bottom elevations inside Ponds A1 and A2W were obtained from bathymetry data
2. The high ground surrounding the two ponds, Mountain View Slough, Stevens Creek and Charleston Slough were obtained from LiDAR data
3. The bottom elevations in the adjacent bay were obtained from bathymetry data

The bathymetric data used to define the bottoms of Ponds A1 and A2W were collected by the US Geological Survey (2005). The data were created using a shallow water sounding system comprised of a single beam echosounder (Navisound 210, Reson), differential GPS (AgGPS 124/132 Receiver DGPS, Trimble), and a laptop computer in a water-resistant case affixed to a Bass Hunter boat. Transects were run in parallel directions spaced approximately 100 meters apart. Water depths measured with this system were converted to NAVD88 by surveying the staff gauge in each pond and adjusting water depth to the water level of the pond during the survey. Pond A1 was surveyed on October 22, 2003, and Pond A2W was surveyed on October 28 and 29, 2003.

The available LiDAR data are from USGS (2010) which developed a surface elevation dataset derived from high-accuracy Light Detection and Ranging (LiDAR) technology for the USGS San Francisco Coastal LiDAR project area (San Francisco, Marin, Solano, Contra Costa, Alameda, San Mateo, Santa Clara counties, California). The LiDAR data were processed by USGS to a bare-earth digital terrain model (DTM). USGS developed detailed breaklines and bare-earth DEMs and data were formatted according to tiles with each tile covering an area of 1500 m by 1500 m. A total of 712 tiles were produced for the entire survey area encompassing approximately 610 sq. miles. The horizontal spatial reference system for the USGS San Francisco Coastal LiDAR Project is NAD83, UTM Zone 10N, meters and North American Vertical Datum of 1988 (NAVD88), meters.

The below water elevations in the bay adjacent to the project site and deeper sections of the sloughs were obtained from 2005 Hydrographic Survey of South San Francisco Bay, California by the USGS, published in 2007 (USGS 2007). These data consisted of xyz data collected in 2005 using a single beam acoustic sampler. The horizontal spatial reference system for the bathymetry is NAD83, UTM Zone 10N with Z-values provided in meters relative to NAVD88.

The site topography was generated by merging the three sets of data. The LiDAR grid was re-sampled to a 6-meter grid spacing, which was determined to be sufficient to represent the ponds and channels without significantly increasing hydraulic model run times (model runs times are approximately related to grid spacing by a factor of 8, e.g., doubling the grid resolution results in about a 8-fold increase in model run time). The USGS bathymetry (USGS 2007) data was closely spaced along each transect; transects were spaced at varying intervals. These data were converted to a 6-meter grid. The pond bathymetry points were used to generate another 6-meter grid which was merged with the LiDAR data grid and the USGS bathymetry grid. The grid has units of meters and is vertically referenced to NAVD88. The Palo Alto Flood Basin, Pond AB1 and A2E, and the areas south of Pond A1 and A2W were not included in the model.

Figure 3-1 shows an aerial photo of the model grid extent, and **Figure 3-2** shows the existing bathymetry and topography.

Figure 3-1. Aerial photograph showing the extent of model coverage at the Mountain View Site

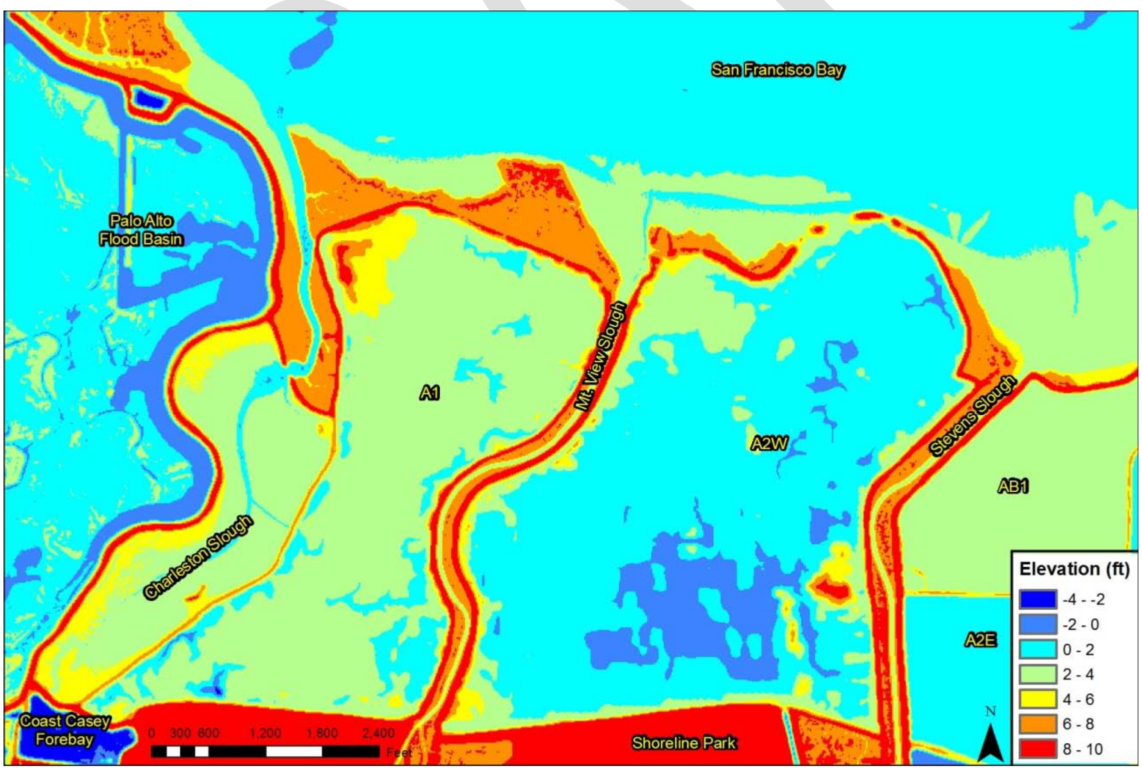


Figure 3-2. Topographic and bathymetric map showing the ground surface elevations of the Mountain View Ponds and surrounding ground

3.2 Hydrologic Data

Water surface elevations representative of tides at the Mountain View site were obtained from the Coyote Creek tide gauge near the mouth of Coyote Creek (NOAA gauge 9414575) and were used as the boundary condition in the hydrodynamic model. This gauge is roughly 6 miles from the Mountain View Ponds. The time series has an increment of 6 minutes and the tide elevation varies between -2.6 feet (-0.8 meters) and 8.9 feet (2.7 meters) during the selected two week modeling period. The modeling period contains typical spring and neap tide conditions. The tide was obtained from National Oceanic Atmospheric Administration’s Tides and Currents website and converted to NAVD88 with data available on the SBSP monitoring tide gauge data webpage. **Figure 3-3** shows the tide data used in the analysis and **Figure 3.4** shows the average tide elevations for the Coyote Creek station.

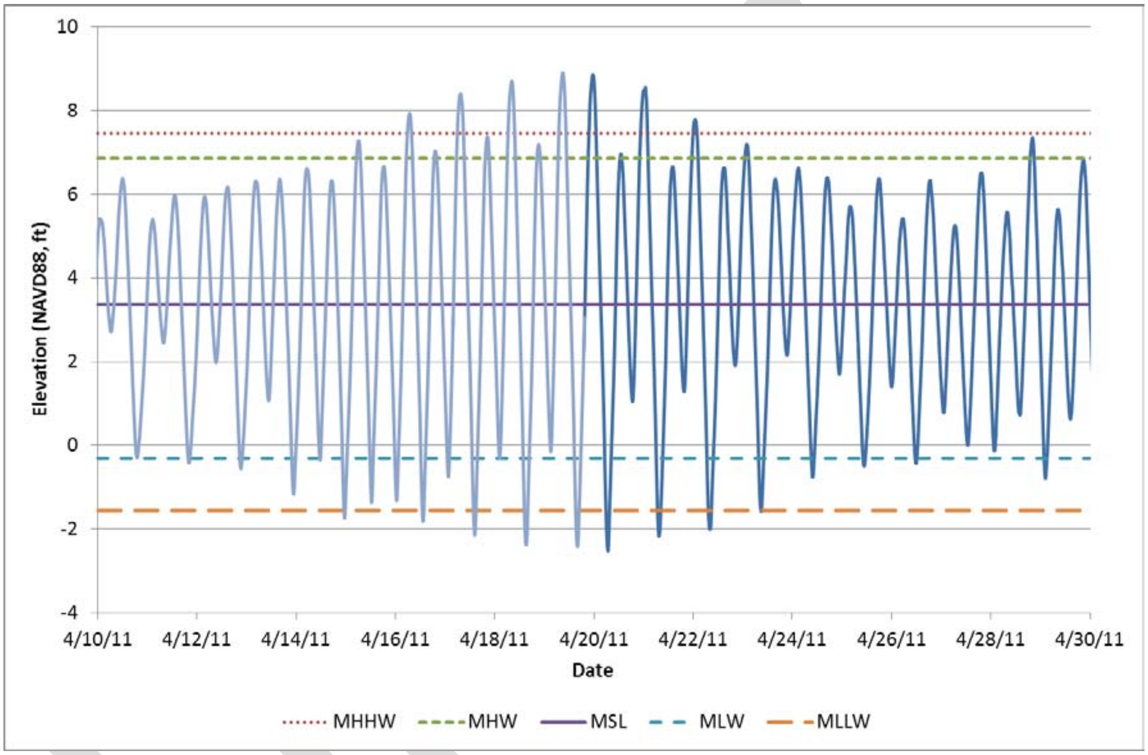
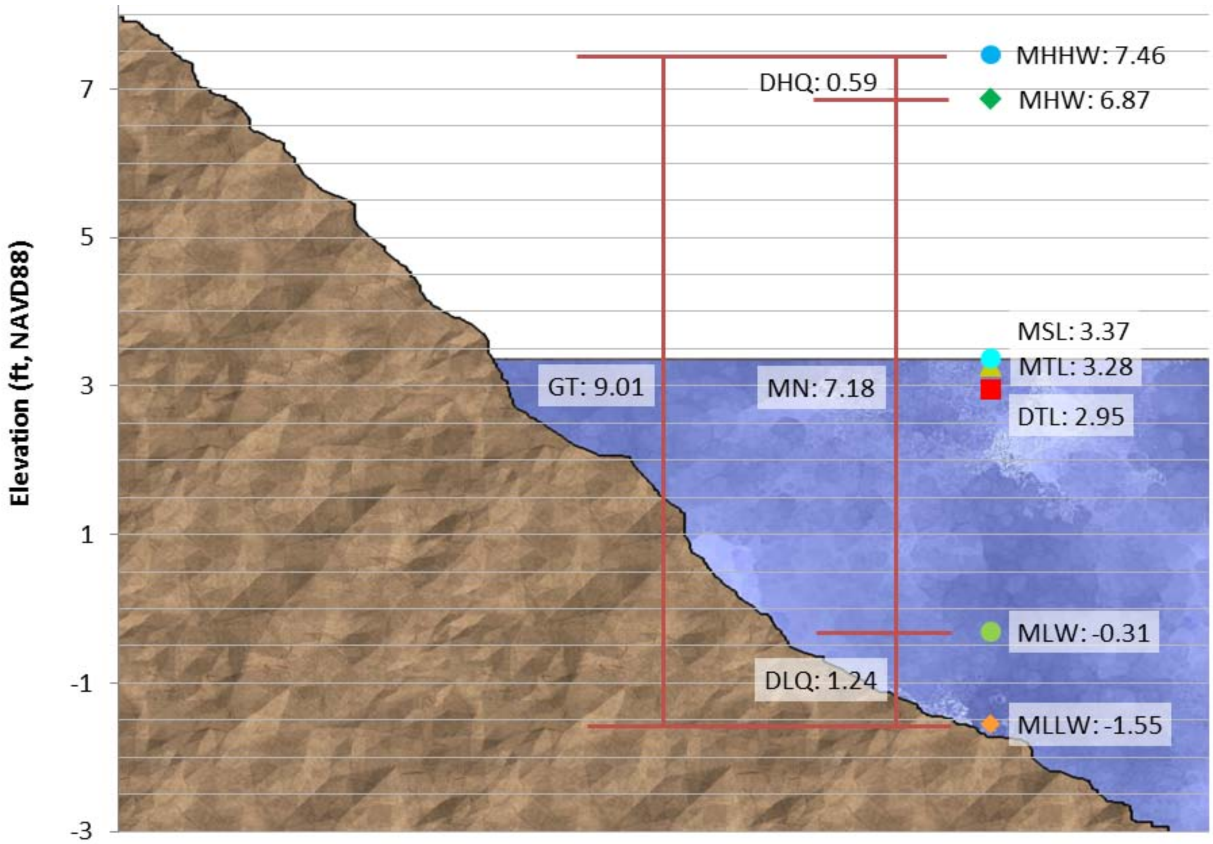


Figure 3-3. Tide data input for model studies



Note: All elevations in feet, NAVD88 Source: NOAA 2013; SBSP 2013

Key: MHHW (mean higher high water) MHW (mean high water) MSL (mean sea level)
MTL (mean tide level) DTL (mean diurnal tide level) MLW (mean low water)
MLLW (mean lower low water) GT (great diurnal range) DHQ (mean diurnal high water inequality)
MN (mean range of tide) DLQ (mean diurnal low water inequality)

Figure 3-4. Coyote Creek tide gauge average tide elevations

3.3 Model Selection and Setup

The MIKE 21 two-dimensional hydrodynamic model was used to simulate flows and water surface elevations in the Mountain View Ponds. MIKE 21 is a two-dimensional, free-surface flow modeling system developed by the Danish Hydraulic Institute (DHI). It simulates the changes in water levels and velocities in response to tides, wind, and freshwater inflows in estuaries, coastal waters, and seas where stratification can be neglected. It consists of a hydrodynamic module to which other modules can be added to address different phenomena. For this study, only the hydrodynamic module (MIKE 21 HD) was used to model the breaching of the salt ponds. Water levels and flows are resolved on a rectangular grid as described in Section 3.1. Other inputs include bed resistance (Manning's n roughness coefficient) and hydrographic boundary conditions (e.g., tides and inflows). The tidal boundary extended about 1000 feet (300 meters) into the San Francisco Bay. The model was run for a two-week tide cycle duration.

3.3.1 Hydraulic Design Criteria and Model Topography

The design criteria used in this preliminary design were that the breach size be sufficient to allow full draining and filling during most tide cycles. The mean tide level at the Coyote Creek tide gauge is 3.28 feet and the mean low water (MLW) is about -0.31 feet. The elevation of the mudflats offshore of the ponds is about 1.6 to 2 feet. The average bottom elevation of Pond A1 and A2W are 0.88 feet and 0.35 feet, respectively, roughly 1 feet above MLW, 2.5 to 3 feet below the mean tide level, and 1 to 1.5 feet below the offshore mudflat elevations. The LiDAR data show a small channel through the mudflats from Mountain View Slough and Stevens Creeks but they are much too small to convey the tidal prism for Ponds A1 and A2W after restoration. Because of the large volume of Ponds A1 and A2W, they will not drain effectively under these conditions. The following modifications were made to the ponds and surrounding bathymetry for the proposed conditions to mimic the scour that would occur over time in the channels and the sedimentation that would occur over time in the ponds (future topography; see **Figure 3-5**). The results of the modeling should be considered future conditions that would occur years after restoration is complete and not immediately after restoration.

1. Raise the bottom of the ponds

   Charleston Slough located east of Pond A1 fills up and drains regularly. Its average bottom elevation is roughly 3.5 feet. Using Charleston Slough as a reference, the bathymetry of Ponds A1 and A2W were raised by 4.0 feet. After the raise, average pond elevation is about 4.9 feet for Pond A1 and 4.4 feet for Pond A2W, above MSL (about 3.4 feet). This would represent the future condition after filling the ponds or after natural sedimentation. This puts the pond bottom elevations 2 to 3 feet above the elevation of the offshore mudflats.

2. Add drainage channels inside the ponds

   The current bathymetry of the ponds is relatively flat. For ponds the size of the A1 and A2W, effective drainage will not occur before a channel network forms. Charleston Slough and historical channels inside the ponds were examined to determine the shapes and widths of the added channels (to represent future conditions). Channels were added to the bathymetry that started from the breach and meander through the ponds, especially in areas with low elevations. These channels were assigned to an elevation of -3 feet (-1 meter) so that the channels are always lower than the MLW and stayed wet. Widths of the channels are generally 50 feet to 100 feet (15 to 30 meters). This would represent a future condition many years after restoration if the ponds are allowed to develop naturally.

3. Mountain View Slough and Stevens Creek

   Currently the Mountain View Slough and Stevens Creek are about 50 feet (15 meters) wide and at rough elevation 3 feet (1 meter). For comparison, Charleston Slough, which has a surface area of about 40% of pond A1's or 25% of pond A2W's has a bottom elevation of about 0.7 feet (0.2 meters) and is about 80 feet wide (25 meters) Bay side of the control structure levee. This indicates that the current Mountain View Slough and Stevens Creek widths and bottom elevations do not have enough capacity to convey the tidal prism from Ponds A1 and A2W. Therefore, the invert of these channels was lowered to elevation 0 meters and widened by 30 to 50 feet (10-15 meters). These modifications are not part of the project, so these conditions would represent a future condition after the increased flow in these creeks has caused them to scour.

Figure 3-5. Topographic and bathymetric map showing the future ground surface elevations used to represent the Mountain View Ponds and surrounding ground in the model

3.4 Hydraulic Design Results

3.4.1 Breach Size

Breaching the levees in Ponds A1 and A2W without the changes to topography will result in tidal conditions in the ponds; however, due to the low elevation of the pond bottoms relative to the tide and offshore mudflats, the ponds will not drain well (i.e. the pond bottom elevations are lower than the mudflat elevations as shown in **Figure 3-6**).

Model results are described for the two cases below.

- Pond breaches with no changes to pond and channel topography (existing topography)
- Pond breaches with the changes to pond and channel topography described in Section 3.3 (future topography)

At low tide with existing topography, the water depth will be about 3.0 feet in Pond A1 and 3.0 to 3.5 feet in Pond A2W. Both ponds will continue to contain open water until natural sedimentation results in pond bottom elevations above the elevation of the offshore mudflats and/or a sufficient offshore channel system develops. This can be seen in plots of water depth in **Figure 3-7** and **Figure 3-8**

Brand et al. (2012) in a study of restored salt ponds in the North Bay found that *Spartina foliosa* (California cordgrass) started to colonize the restored salt ponds when their elevations were near mean sea level depending upon tidal conditions. This is estimated to take less than 5 years.

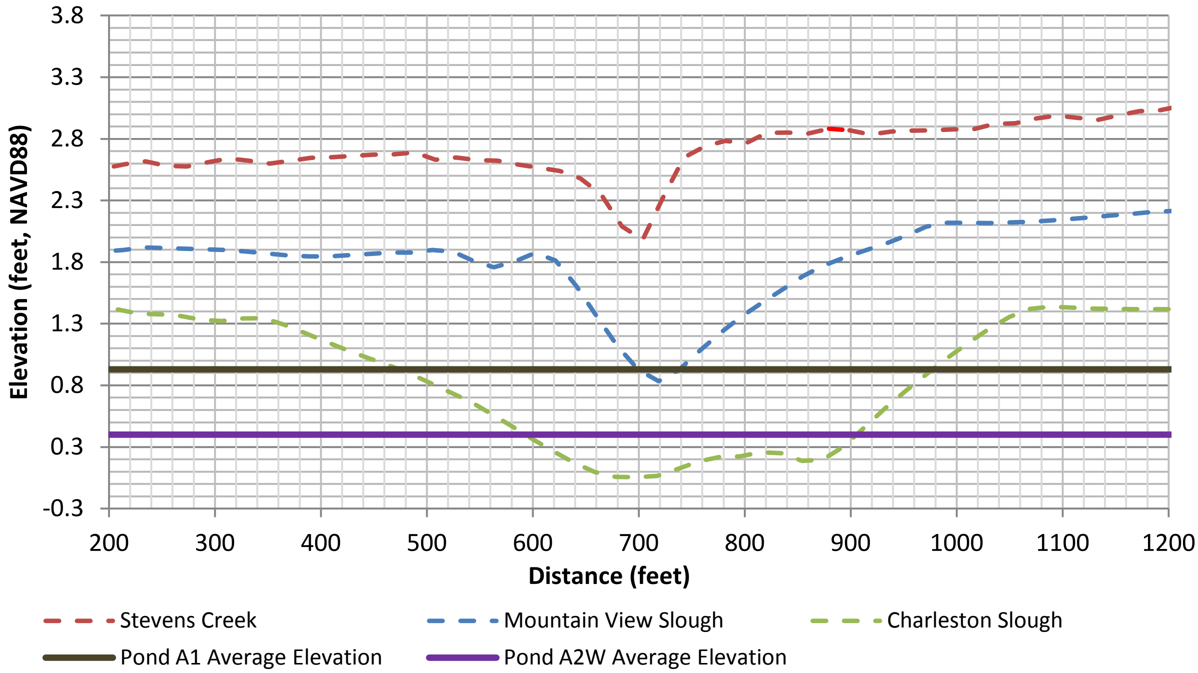


Figure 3-6. Channel and Mudflat Elevations Offshore of Ponds A1 and A2W compared to the Average Elevations in Ponds A1 and A2W. Transects Located about 700 feet Offshore.

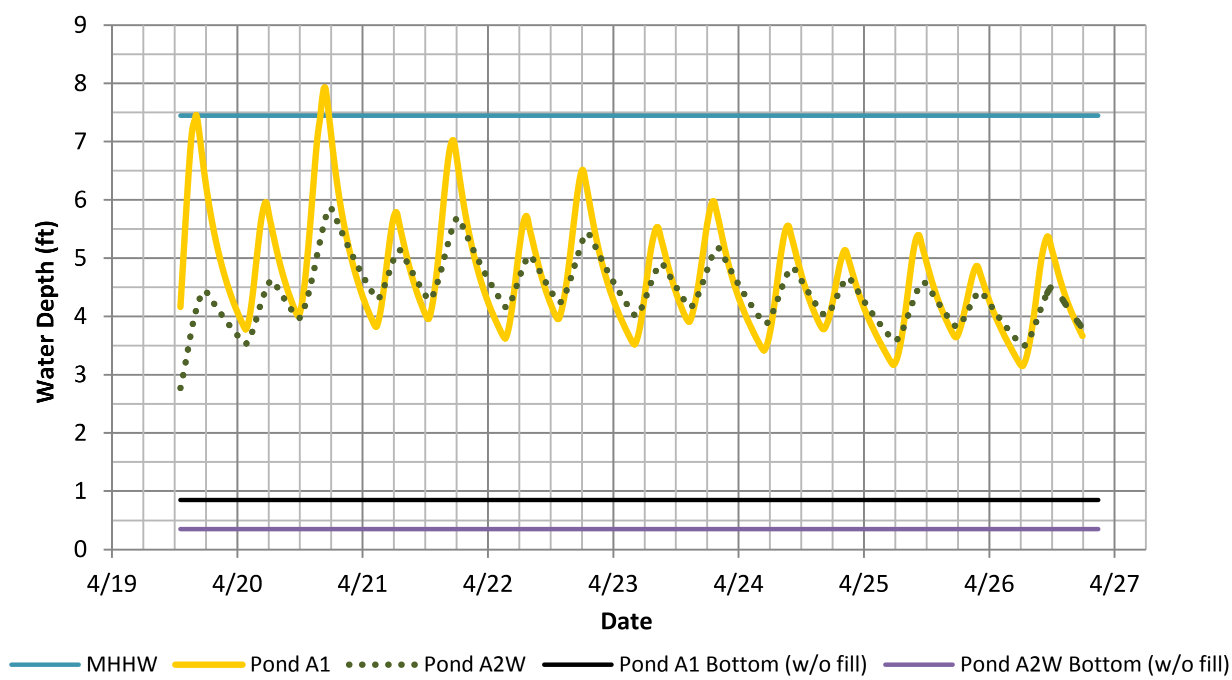


Figure 3-7. Water Surface Elevation in Ponds A1 and A2W (Alternative Mountain View B existing topography)

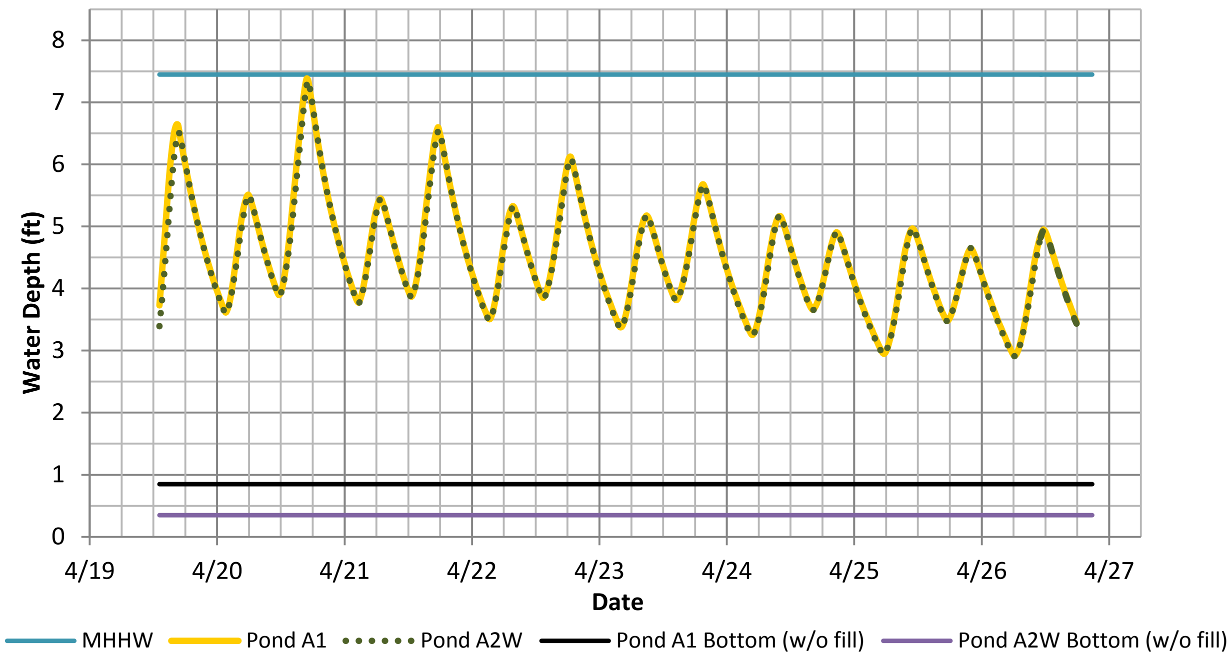


Figure 3-8. Water Surface Elevation in Ponds A1 and A2W (Alternative Mountain View C existing topography)

The model results for water surface in Ponds A1 and A2W after breaching including the changes in topography described in Section 3.3 (future topography) are shown in **Figure 3-9**through **Figure 3-12**.

Figure 3-9 and **Figure 3-10** show the water depth after the ponds are breached for a scenario similar to Alternative Mountain View B[1], assuming:

- One 250-foot breach in Pond A1
- One 400-foot breach in Pond A2W

Figure 3-10 indicates that the ponds are mainly dry during low tide, although it shows slightly more ponding at low tide in Pond A2W than is shown for Alternative Mountain View C (below). However, the differences are due to the locations selected for the breaches and channels inside the ponds rather than differences in performance between the alternatives. The remaining ponding (blue areas) is shallow, less than about 0.1 meters deep. Therefore, one 250-foot breach in Pond A1 and one 400-foot breach in Pond A2W are sufficient to fill up and drain the ponds twice a day assuming a sufficient channel network is available.

Figure 3-11 and **Figure 3-12** show the water depth after the ponds are breached for Alternative Mountain View C, assuming:

- Two 100-foot and one 60-foot breaches in Pond A1
- Two 100-foot and two 60-foot breaches in Pond A2W

[1] The modeling of Alternative Mountain View B assumed only one breach in Pond A2W in order to model another breach scenario for this pond. In the designs described in Section 4, Pond A2W has the same four breaches in Alternative Mountain View B as modeled here in Alternative Mountain View C.

- A breach at the Charleston Slough tide gate

Figure 3-11 indicates that the pond is completely under water during high tide. **Figure 3-12** indicates that majority of the ponds is dry during low tide. The remaining ponding (blue areas) is shallow, less than about 0.1 meters deep. Therefore, these three breaches in Pond A1 and four breaches in Pond A2W are sufficient to fill up and drain the ponds twice a day. If smaller breaches are constructed, it is anticipated that the breaches will quickly enlarge to 100 feet or more.

Larger breaches were also tried but found to provide no additional benefit. For comparison the existing breaches in Ponds A20 and A21 at Island Ponds are almost 100 feet wide, and the existing breach is over 100 feet wide in Pond A19[2]. Warm Springs Marsh breach is almost 200 feet wide and the new breaches in the Ducks Head Marsh (Pond A6) is almost 100 feet wide[3]. Pond A1 is larger than any of those ponds, and Pond A2W is substantially larger, so will possibly develop larger breaches over time except where hardened. **Figure 3-13** compares these breaches to breaches around the bay.

HTZ fill is proposed along the south side of the ponds; however, comparison of model results indicates that the HTZs will not affect the size of the breaches and will have little impact on the overall water depths in the ponds.

Note: The channels represent future conditions. The size of Stevens Creek and Mountain View Slough were increased to allow drainage of the ponds through the mud flats. The size of the channel draining Charleston Slough is the existing channel size.

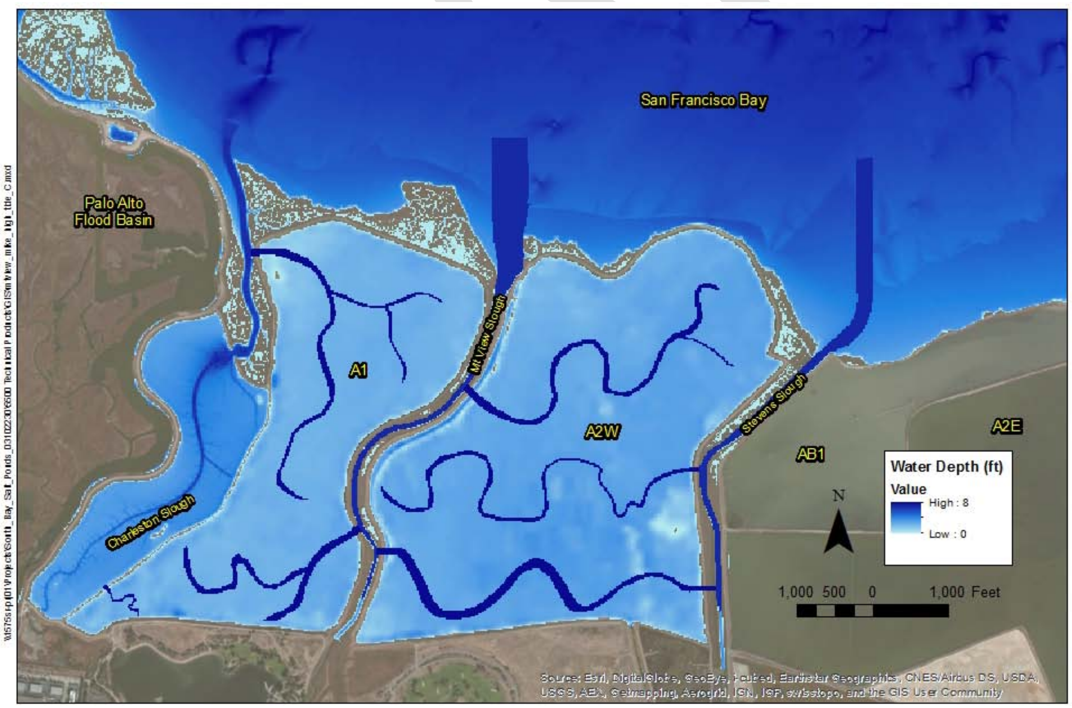
Figure 3-9. Water depth during high tide with future topography (Alternative Mountain View B with only one breach in Pond A2W)

[2] Pond A1 (288 acres) is similar in size to Pond A19 (276 acres). Pond A2W (462 acres) is about 1.7 times larger than Pond A19. Ponds A20 and A21 are both substantially smaller than Pond A19.

[3] Warm Springs Marsh (200 acres) is 0.7 times the size of Pond A1. Duck's Head Marsh (Pond A6; 330 acres) is similar in size to Pond A1.

Note: The channels represent future conditions. The size of Stevens Creek and Mountain View Slough were increased to allow drainage of the ponds through the mud flats. The size of the channel draining Charleston Slough is the existing channel size.

Figure 3-10. Water depth during low tide with future topography (Alternative Mountain View B with only one breach in Pond A2W)



Note: The channels represent future conditions. The size of Stevens Creek and Mountain View Slough were increased to allow drainage of the ponds through the mud flats. The size of the channel draining Charleston Slough is the existing channel size.

Figure 3-11. Water depth during high tide with future topography (Alternative Mountain View C)

Note: The channels represent future conditions. The size of Stevens Creek and Mountain View Slough were increased to allow drainage of the ponds through the mud flats. The size of the channel draining Charleston Slough is the existing channel size.

Figure 3-12. Water depth during low tide with future topography (Alternative Mountain View C)

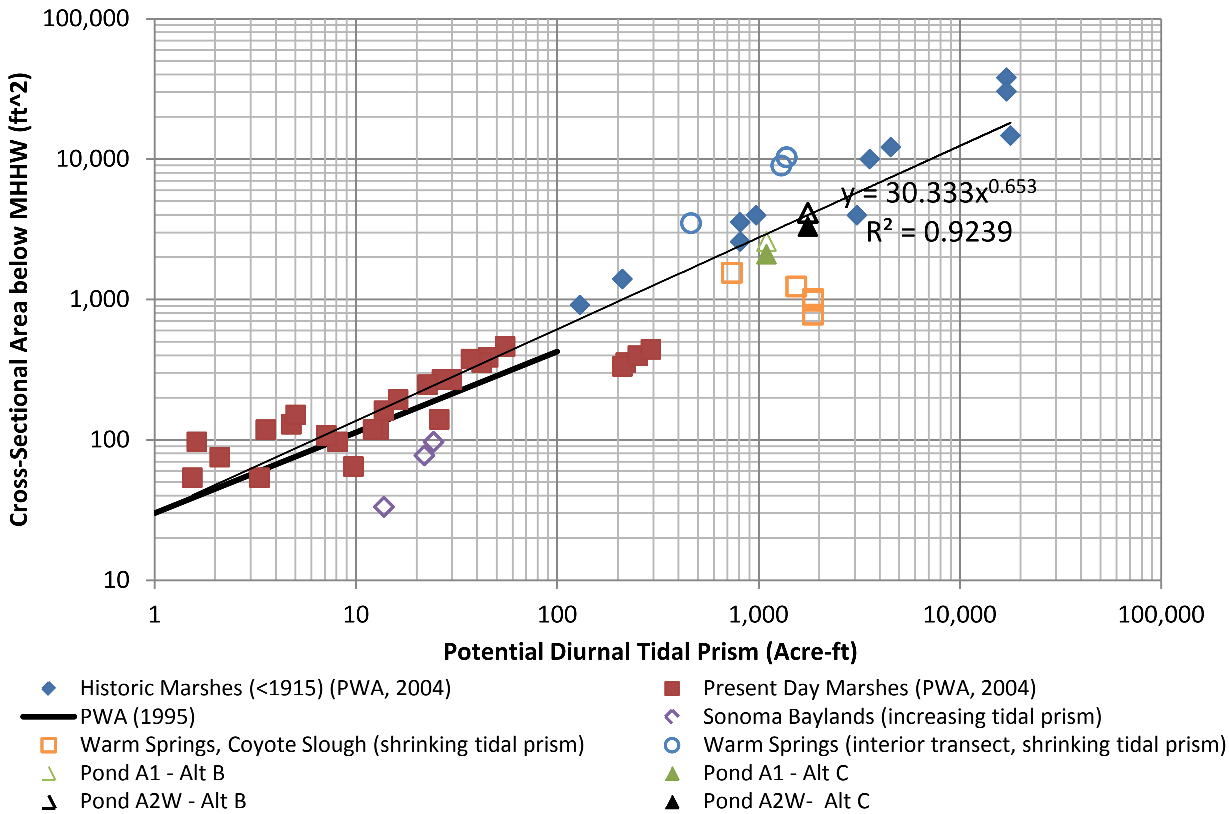


Figure 3-13. Comparison of Breach Sizes Used in the Analysis of Ponds A1 and A2W and Breaches from Other Wetlands Around the Bay (from PWA, 2004)

The results for water elevation in Ponds A1 and A2W after breaching are shown in **Figure 3-14** and **Figure 3-15**. A point was chosen for each pond, located near the middle of the pond, and the time series of water surface elevations was plotted for each point. For the conditions analyzed in Pond A1, the single breach (Alternative Mountain View B) had slightly higher peak water surface elevations (equal to or less than approximately 0.3 meters) than the multiple breaches (Alternative Mountain View C). This indicates that the breach size used for the multiple breach scenario may be slightly small and would enlarge over time. However, for these conditions for Pond A2W, the multiple breaches scenario filled up the pond to a higher level than a single breach, indicating that using a single breach for Pond A2W may result in a breach larger than the 400 foot breach used in the analysis. The results indicate that the either multiple breaches or a single breach allow the ponds to drain and fill up in each tide cycle.

Alternative Mountain View C also proposes lowering the levee between Pond A1 and Charleston Slough to MHW. The lowered levee would allow more water to flow into the west side of pond and have certain habitat benefits, but it is unlikely it will influence the proposed breach sizes. If the levee is lowered to MHW it will only be overtopped about 10% of the time and for an average depth of just over one-half foot. Therefore, lowering the levee is not included in the modeling. In the long term the levee may erode and Ponds A1 and Charleston Slough would then behave more like a single pond.

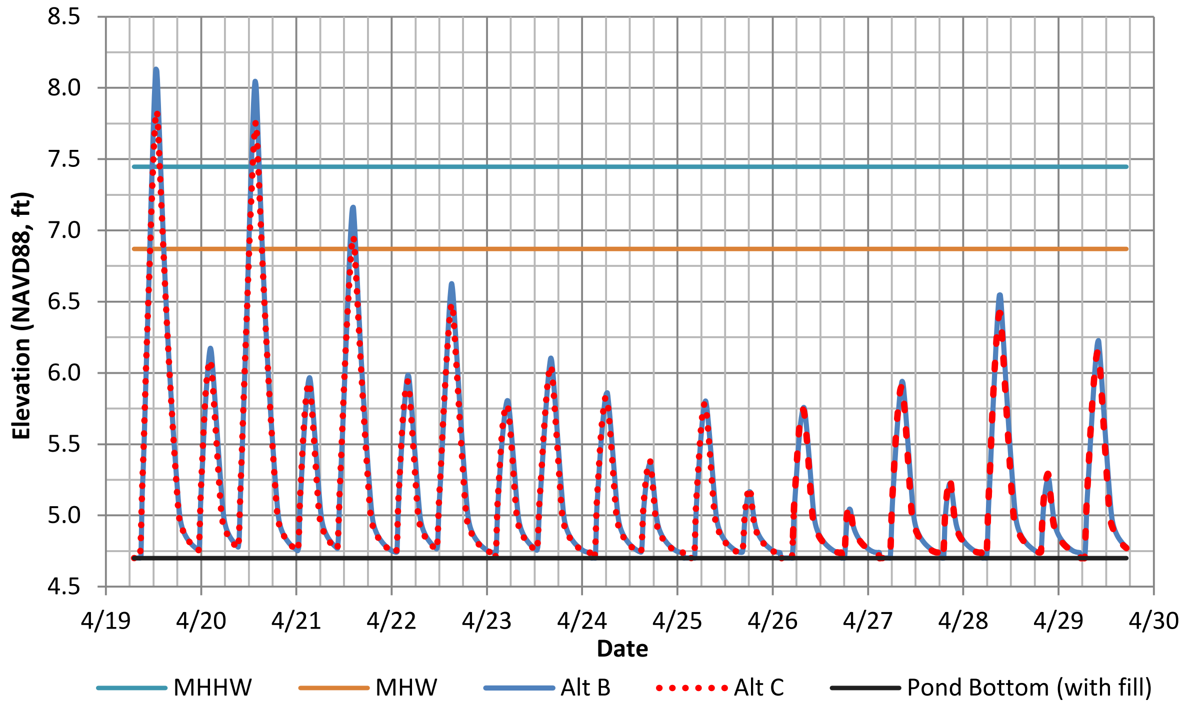


Figure 3-14. Water surface elevation in Pond A1

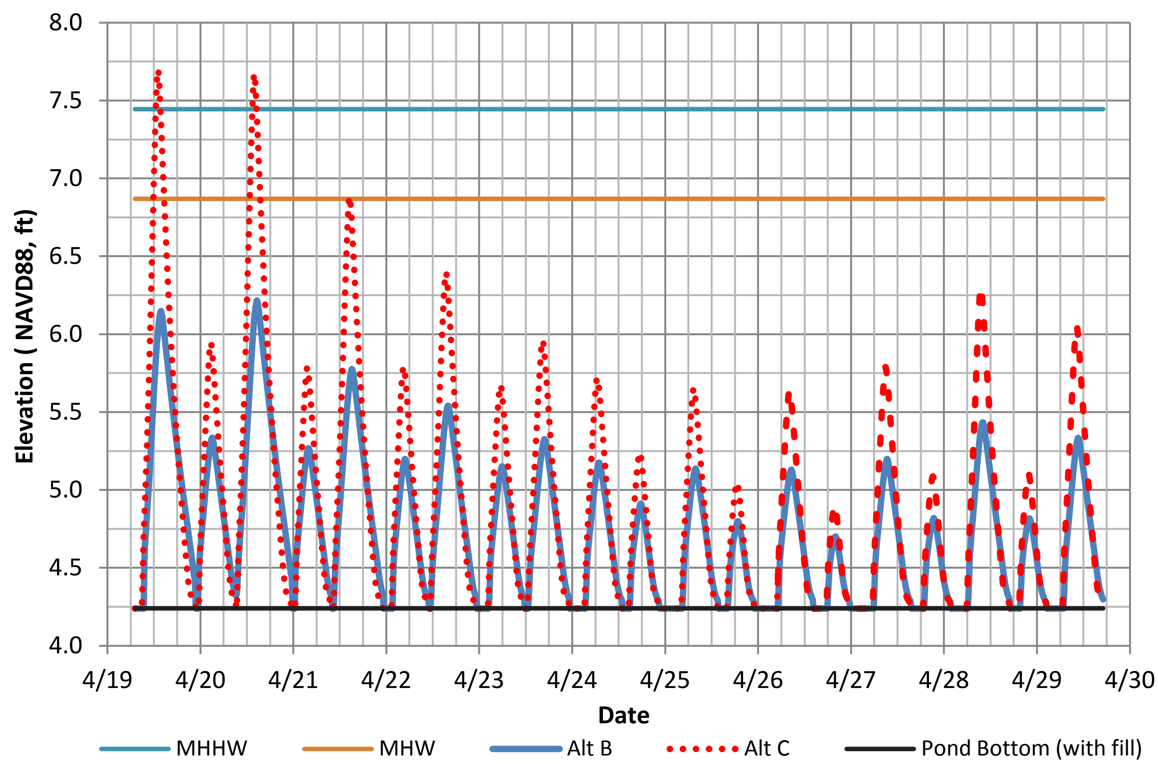


Figure 3-15. Water Surface Elevation in Pond A2W

3.4.2 Effects on City of Mountain View Existing Water Intake

The City of Mountain View currently withdraws water from the head of Charleston Slough to supply the Sailing Lake in Mountain View's Shoreline Park. The restoration of Charleston Slough and Pond A1 as part of the South Bay Salt Pond Restoration Project (as is the case in Alternative Mountain View C) could potentially have an impact on the ability of the City to withdraw water of sufficient quantity and quality to supply the lake. If the restoration does impact the ability of the pumps to withdraw water in sufficient quantity and quality to supply the Sailing Lake in Mountain View's Shoreline Park, an alternative intake location near the breach between Pond A1 and Charleston Slough should be considered.

The City pumps water from Charleston Slough at a rate of about 7,000 to 9,000 gpm for about 13-15 hours per day (5.46 to 8.1 MGD) (City of Mountain View 2013). The invert of the intake to the pump station structure is at elevation -2.8 feet (NAVD88). The minimum operating elevation is 2.6 feet (Drawing G-4, City of Mountain View 2007).

A two-dimensional hydrodynamic model of Charleston Slough was prepared to study the possible effects of the proposed action alternatives on the intake. The following is a summary of those results. Full discussion of the analysis can be found in **Appendix B1**. The model results show that under restoration of Pond A1, Charleston Slough will drain more slowly and retain more water during low tides, especially in the northern portion of the slough. This is primarily due to the outflow from the northwest breach in Pond A1 which creates a backwater condition upstream of the breach and reduces the ability of Charleston Slough to drain. This leads to the conclusion that Alternative Mountain View C should not reduce the quantity of water available to the intake system.

The backwater effect of draining Pond A1 into the same channel that drains Charleston Slough will be the greatest immediately after restoration. Over time it is expected that the increased tidal prism draining through this channel due to the restoration of Pond A1 will enlarge the channel and allow better draining of Charleston Slough. If the channel enlarges (due to increased tidal flows), the draining of Charleston Slough, and the quantity of water available to the intake system, should return to its original condition.

To address these concerns, the City of Mountain View requested a new intake be designed and included in Alternative Mountain View C. **Section 4.1.7** presents the new intake design.

3.4.3 Flood Risk to Palo Alto Flood Basin

Model simulations of Charleston Slough were also conducted to assess the flood risk to the Palo Alto Flood Basin (PAFB) and the City of Mountain View to determine whether any improvements to the existing levees would be needed under Alternative Mountain View C, assuming 100-year tidal event conditions in South San Francisco Bay.[4] The following is a summary of those results. Full discussion of the analysis can be found in Appendix B2. Restoration of Pond A1 and Charleston Slough could potentially increase extreme water levels in Charleston Slough by making the slough fully tidal.[5] This could allow overtopping of the levee between Charleston Slough and the PAFB. **Figure 3-16** shows a profile along the Charleston Slough levee (levee between Charleston Slough and PAFB) and a portion

[4] The San Francisco high tide in January 1983, which exceeds the NOAA 100-year tide estimate of 8.53 feet NAVD88 by less than 0.20 feet, was assumed to be representative of a 100-year event for purposes of modeling and estimating the flood risk to the PAFB. The hydrograph from this event was obtained from NOAA for a period of three days, including the peak tidal elevation of the storm. Data was not available for this event for South San Francisco Bay, so the data was adjusted based on the difference between tidal datums at San Francisco and Coyote Creek gages.

[5] Under Alternative Mountain View B, the west levee of Pond A1 would be raised to contain tides, and Charleston Slough would remain a muted tidal system.

of the PAFB Levee (between the Bay and the PAFB). Most of the Charleston Slough levee is lower than the FEMA 100-year flood elevation (11.0 ft NAVD88[6]) as is some of the PAFB Levee.

Figure 3-17 shows the predicted water levels in Charleston Slough for the 100-year tidal event in the Bay and a more typical, average tidal condition. The peak water levels during the 100-year tidal event exceed the elevations of the average Charleston Slough levee. If a 100-year event were to occur after restoration of Charleston Slough and Pond A1 there could be significant overtopping of the levee.

To address these concerns the City of Mountain View requested that Alternative Mountain View C include a component that would raise the levee between Charleston Slough and the PAFB and between Charleston Slough and the Coast Casey Forebay. Discussion of the design for the raise of the levee and associated appurtenances can be found in **Section 4.1.3**.

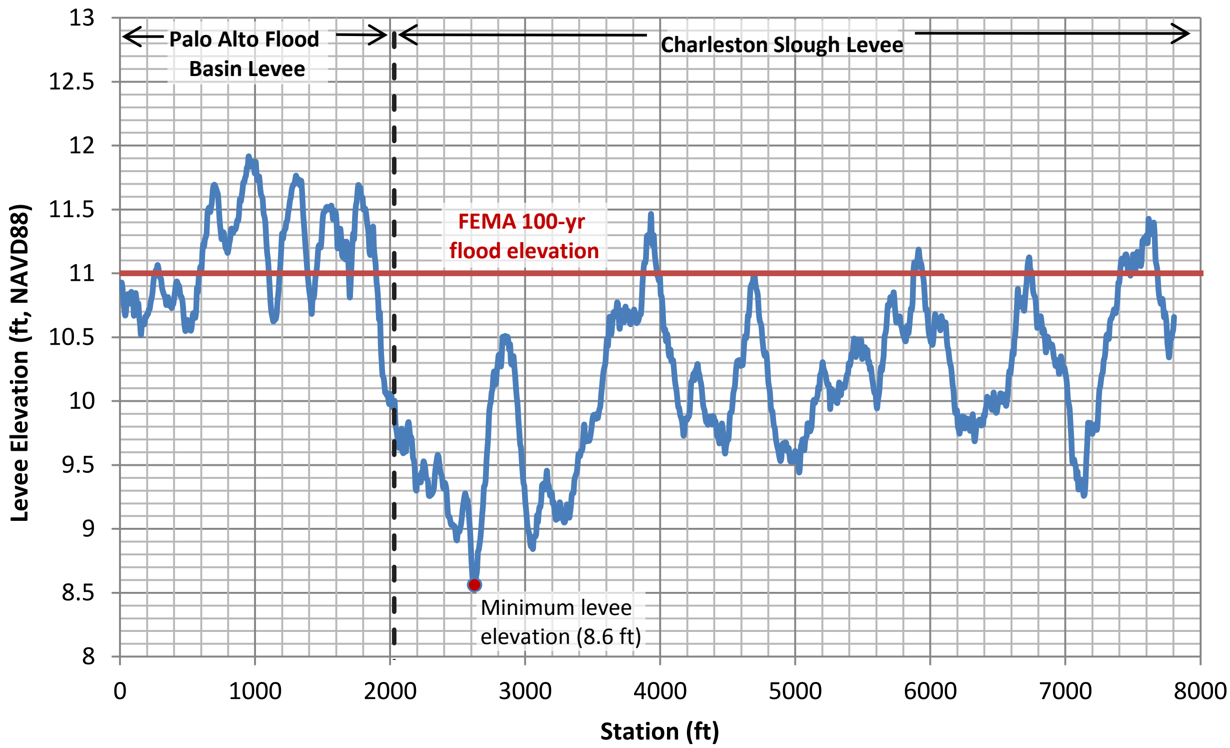


Figure 3-16. Elevation Profile along Charleston Slough Levee and a portion of the PAFB Levee.

[6] The FEMA 100-year flood elevation is used in the development of FEMA's Flood Insurance Rate Maps and is somewhat higher than the statistical data used by NOAA to calculate the 100-year tide estimate.

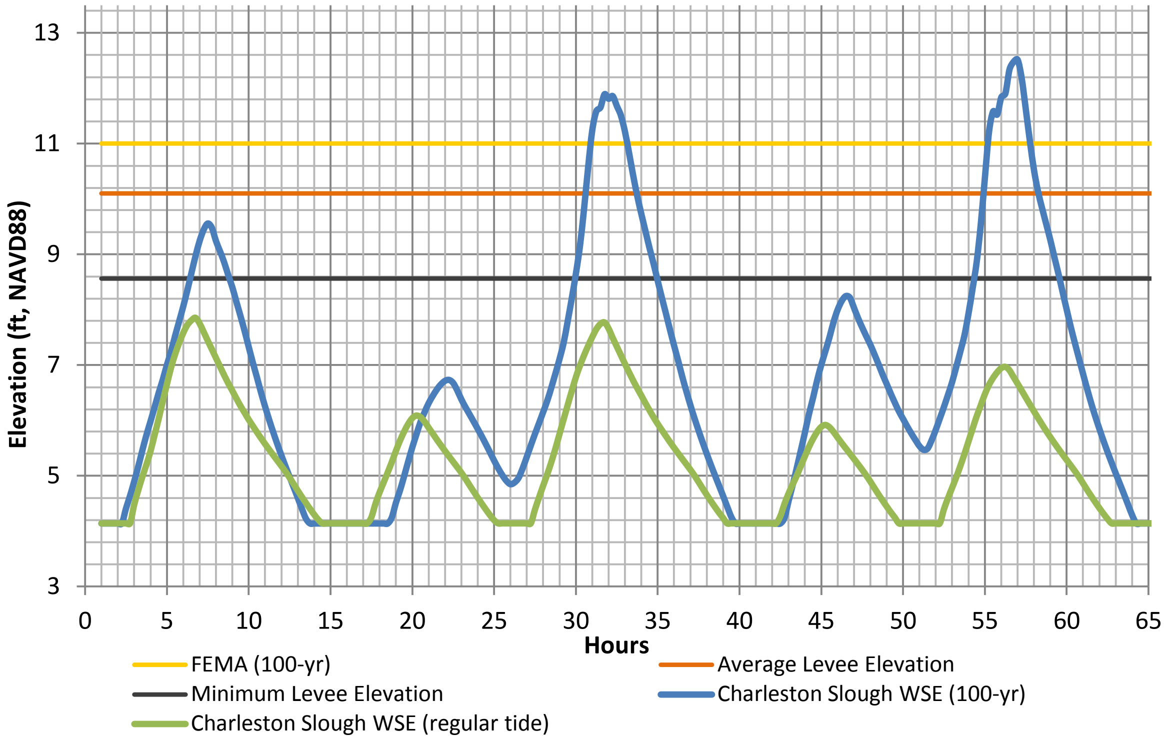
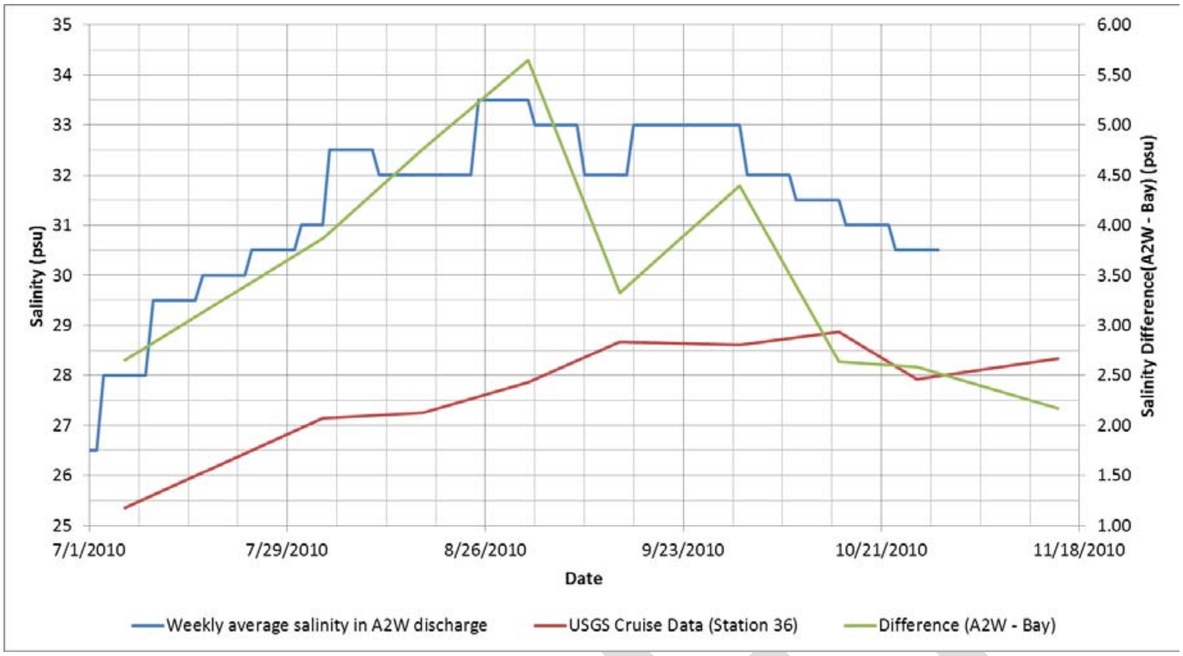


Figure 3-17. Predicted Water Surface Elevations in Charleston Slough during a 100-year Event

3.5 Salinity/Water Quality Management Approaches

3.5.1 Salinity

The Mountain View ponds are not considered high salinity ponds and do not have hypersaline soils. Water is circulated through the ponds starting with water withdrawn from lower Charleston Slough near the Bay through a 48-inch intake located at the northwest end of Pond A1. The system outlet consists of a 48-inch gate to the Bay located at the north end of pond A2W. The flow through the system proceeds from the intake at A1 though the 72-inch siphon under Mountain View Slough to A2W. The salinity of the ponds is not regularly measured but the salinity of the outflow from pond A2W is measured and reported in the "Annual Self-Monitoring Report for South San Francisco Bay Low Salinity Salt Ponds". Results from the latest report (Year 2010; USFWS-USGS 2010) are shown in **Figure 3-18**. For comparison, the salinity in the Bay measured by the USGS at Station 36 (located about 2 km north of A2W) is shown. The salinity of the outflow from A2W is about 3 to 5 psu higher than the Bay and likely due to evapoconcentration in the ponds. Restoration of the ponds will increase circulation in the ponds and the salinity should more closely match the salinity of the Bay.



Source: USFWS-USGS 2010

Figure 3-18. Salinity in the Discharge from Pond A2W compared to Bay Salinity.

3.5.2 Dissolved Oxygen

Adequate circulation and mixing in managed ponds is necessary in order to prevent formation of algal blooms and subsequent drops in DO. The annual self-monitoring reports also report the DO in the A2W discharge as well as salinity. During 2010, the weekly average DO concentration was generally between 3 mg/l and 4 mg/l though some weeks were as low as 1 mg/l and as high as 5 mg/l (USFWS-USGS 2010). After restoration, it is expected that the DO concentration will be similar to the DO concentration in the Bay and adjacent sloughs. The current monitoring plan implements Best Management Practices to increase DO levels when summer monitoring shows that DO levels in discharges from Pond A2W fall below 3.3 mg/L.

3.6 Geotechnical Data

Geotechnical data for the South Bay Salt Pond Restoration Project was provided by the U.S. Army Corps of Engineers (Corps) and was collected as part of their South San Francisco Bay Shoreline Study (AMEC and Geomatrix Consultants 2007, AMEC Geomatrix Inc. 2009, USACE 2011a, USACE 2011b). The available data include soil borings, cone penetrometer tests (CPTs), and geotechnical data from laboratory tests performed on samples taken from the soil borings. Data is available for the Alviso complex pond levees.

During future design phases, geotechnical data will be used to assess the levees' ability to support construction equipment and additional levee material, to assess the earthquake stability of certified flood control levees, to assess levee seepage, and to design bridge abutment and boardwalk supports. Future data collection may also be desirable to assess the existing pond substrate in areas where HTZs are proposed because the pond substrate is generally weak and may require additional fill material to reach proposed grade. The stability of the landfill slopes in Shoreline Park should also be assessed to determine whether they can support HTZ material without damaging the landfill cap.

3.6.1 Subsurface Data

A limited set of the geotechnical data was provided by the Corps for review by this project. Two files were provided which contained only the appendices from two reports by AMEC GeoMatrix, Inc. – the body of the report was not made available. The titles and dates of the full reports were also not made available. Each of the provided files contains three appendices – one each for soil borings, cone penetrometer tests (CPTs), and geotechnical data from laboratory test performed on samples taken from the soil borings.

Each of the AMEC documents reference a boring location figure which was not available for review. There was, however, a USACE figure provided that is dated June 15, 2011 which showed the location of “subsurface investigations”. The same marker was used throughout, though a note states that there are both CPTs and soil borings shown on the figure. Although it is not stated explicitly, these subsurface investigations are presumed to relate to the AMEC reports.

The USACE figure was marked up to show the boring and CPT logs which were available from the AMEC appendices (see Appendix C). In some cases, CPTs and borings were apparently conducted in the same location with the same boring designation; if this is the case, the locations are marked as borings in Appendix C.

The following boring locations are on the exterior levees of the Mountain View Ponds:

- Soil borings: P1, P2, P3, P4, i15a, i18a, i20a (Note: boring log not available for P2)
- CPTs: SA, SB, SC, SD, B9A, B10, B11, i12a, i13a, i14a, i16a, i17a, i19a

The boring logs that were available along the A1 and A2W north levees (P1, P3, and P4) show that the borings were drilled between 38 and 45 feet beneath the ground surface and encountered soft bay mud with organics and shell fragments. There is some marginal increase in stiffness at a depth of about 38 feet beneath the ground surface. The CPTs show similar results.

There are also ten CPTs and three borings (i15a, i18a, and i20a) along the levees of the Charleston Slough (including the west levee of A1). The borings along the A1 west levee/Charleston Slough east levee (i18a and i20a) were drilled between 25 and 30 feet beneath the ground surface and encountered soft bay mud with organics. There is some marginal increase in stiffness at a depth of about 16 feet beneath the ground surface. The boring on the west side of Charleston Slough (i15a) was drilled to almost 30 feet beneath the ground surface and encountered soft bay mud with organics. There is some marginal increase in stiffness at a depth of about 25 feet beneath the ground surface.

There is no subsurface data for the remaining levees of the Mountain View Ponds (east and south sides of A1 and east, west, and south sides of A2W).

The AMEC appendices also present laboratory tests that were performed on selected samples from the borings. **Table 3.1** lists the tests that were performed for the borings associated with the levees of the Mountain View Ponds and Charleston Slough (P1, P2, P3, P4, i15a, i18a, and i20a).

Table 3.1. Laboratory Tests for Borings on A1, A2W, and Charleston Slough Levees

Boring Designation	Tests performed
P1 (A1 north levee)	Moisture-Density-Porosity
	Particle Size Distribution
	Liquid and Plastic Limits
P2 (A1 north levee)	No lab data available
P3 (A2W north levee)	Moisture-Density-Porosity
	Specific Gravity
P4 (A2W north levee)	Unconfined Compressive Strength
	Triaxial Consolidated Undrained
	Consolidation
i15a (Charleston Slough west levee)	Moisture-Density-Porosity
	Particle Size Distribution
	Liquid and Plastic Limits
i18a (A1 west levee/ Charleston Slough east levee)	Moisture-Density-Porosity
	Specific Gravity
	#200 Sieve Wash
	Particle Size Distribution
	Liquid and Plastic Limits
	Unconfined Compressive Strength
	Unconsolidated Undrained Triaxial
	Triaxial Consolidated Undrained
	Consolidation
i20a (A1 west levee/ Charleston Slough east levee)	Moisture-Density-Porosity
	Particle Size Distribution
	Liquid and Plastic Limits
	Unconsolidated Undrained Triaxial
	Triaxial Consolidated Undrained
	Consolidation

3.6.2 Seepage and Stability

The Corps also provided a figure called "Estimated Geotechnical Performance Combining Stability and Seepage" (see Appendix C) which presents a rating for selected levees in the Alviso Pond Complex. The rating is meant to represent the seepage and stability risks for the selected levees. The levees are rated on a 1 to 5 scale, with 1 being the best rating. The method used to develop these ratings was not described on the figure and no other documentation was provided. Due to the locations of the rated levees, it is clear that the subsurface investigations described above were used to develop the ratings.

For the Mountain View Ponds, ratings are given for the north levees of Ponds A1 and A2W and for both sides of Charleston Slough. The north levee of A2W has four ratings of level 2. The north levee of A1 has three ratings total, one level 2 and two level 4. The west side of A1 (east side of Charleston Slough) has five ratings total, four level 2 and one level 3. The west side of Charleston Slough has 7 ratings total, one level 1, two level 2, and four level 3.

3.6.3 Future Data Collection

During future design phases, geotechnical data will be used to assess the levees' ability to support construction equipment and additional levee material, to assess the earthquake stability of certified flood control levees, to assess levee seepage, and to design bridge abutment and boardwalk supports. Future data collection may also be desirable to assess the existing pond substrate in areas where HTZs are proposed because the pond substrate is generally weak and may require additional fill material to reach proposed grade. The stability of the landfill slopes in Shoreline Park should also be assessed to determine whether they can support HTZ material without damaging the landfill cap.

4. PRELIMINARY DESIGN

The preliminary designs of elements in the alternatives for the Mountain View Ponds are discussed in the sections below. Where the elements differ between the alternatives, those differences are noted.

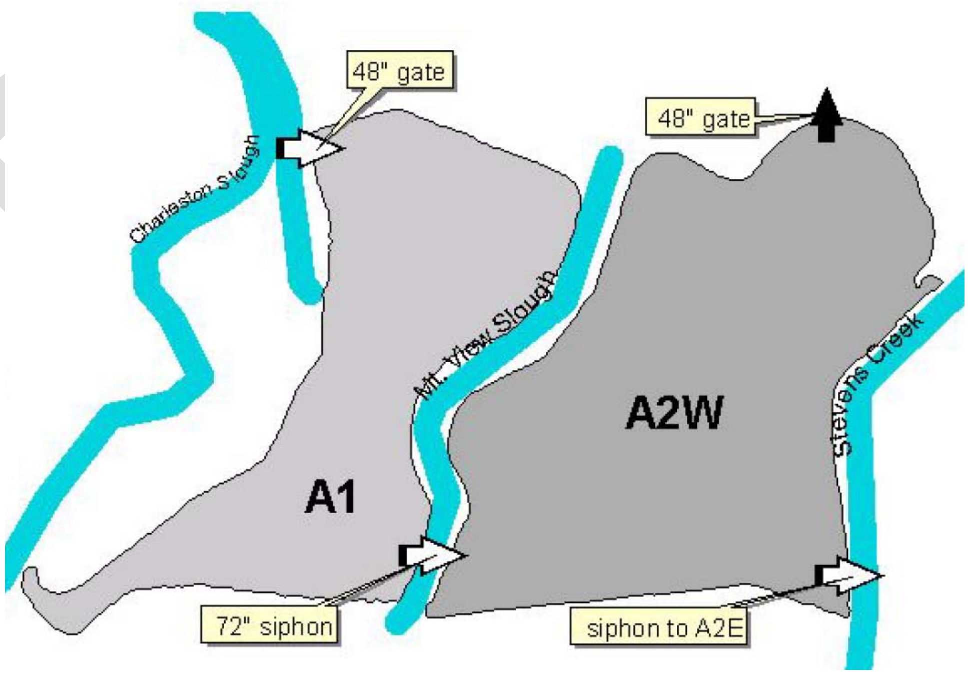
4.1 Preliminary Design Components

4.1.1 Site Clearance and Demolition Activities

Areas that would be disturbed by construction activities would be cleared of any existing vegetation which would be disposed off-site. Similarly, sensitive vegetation in the immediate area around the proposed levee breach locations would be handpicked, salvaged and replanted elsewhere as appropriate.

Existing water control structures, siphons, and material left over from previous Cargill operations on the property are not needed for (and do not detract from) the restoration. The water control structures and siphons are currently used to manage water quality in the ponds; once the ponds are tidal, the structures will not provide additional management opportunities. The two water control structures (between Pond A1 and Charleston Slough and between Pond A2W and the Bay) are located in Pond A1 and A2W along the north levees (**Figure 4.1**), and the two siphons (between Pond A1 and A2W and between Pond A2W and Pond A2E (closed) are located under Mountain View Slough and under Stevens Creek/Whisman Slough closer to the southern extents of the ponds (**Figure 4.2;** the siphons are not visible on aerial imagery). The water control structure in Pond A1 is located near a proposed breach. During construction, this water control structure and all associated support structures would be demolished and disposed off-site or recycled as appropriate. The structure in Pond A2W does not appear to directly conflict with the design. During construction, this structure may be left as is, capped and closed, or demolished and disposed off-site or recycled as appropriate. The siphons are potentially located near the locations of proposed breaches and bridges. Since the precise siphon locations are not discernable on aerial imagery, they have the potential to conflict with the proposed features. Depending on their locations and the potential effects with the proposed features, the siphons may be either left as is, capped and closed, demolished and disposed off-site or recycled as appropriate.

Figure 4.1. Aerial View of Water Control Structures



Source: USFWS-USGS 2010

Figure 4.2. Locations of Water Control Structures

4.1.2 Levee Improvements – Pond A1 West Levee

Two levee alignments are proposed to be raised above the tidal and flood elevations and to enable access along the levee top in order to meet the Flood Protection Objective in Section 2. These include:

- 4,350 feet of levee along Pond A1 west levee (Alternative Mountain View B) starting from the southern end of the levee
- 7,000 feet of levee west of Charleston Slough (Alternative Mountain View C) starting from the southern end of Charleston Slough
- 1,000 feet of levee north of the Coast Casey Forebay (Alternative Mountain View C) starting from the Charleston Slough levee above and continuing east to Shoreline Park

This section discusses the proposed improvements for the Pond A1 west levee (Alternative Mountain View B); **Section 4.1.3** discusses the proposed improvements for the Charleston Slough west levee and Coast Casey Forebay north levee (Alternative Mountain View C). Levee improvements to the Pond A1 west levee would consist of preparing the subgrade to receive additional fill material and placing fill along the slopes and levee top to achieve desired elevation. The levee improvements would provide similar level of flood protection after levee breaching as provided by the existing northern A1 levee. These improvements would also enable temporary construction access. The preliminary design criteria for the levee improvements are below.

Design Criteria:

- Top elevation: the improved levees would have a minimum crest elevation of 10 feet NAVD88 prior to breaching Pond A1. This will provide free board of 2.5 feet above MHHW.
- Compaction: levee fill would be placed and compacted to 90% of maximum dry density as measured using ASTM D1557.
- Side Slope: the improved levee would have side slopes of 5:1 (h:v)

A typical cross-section of the proposed levee improvements for Alternative Mountain View B is shown in **Figure 4.3**. Borrow material would be sourced from off-site upland re-use materials.

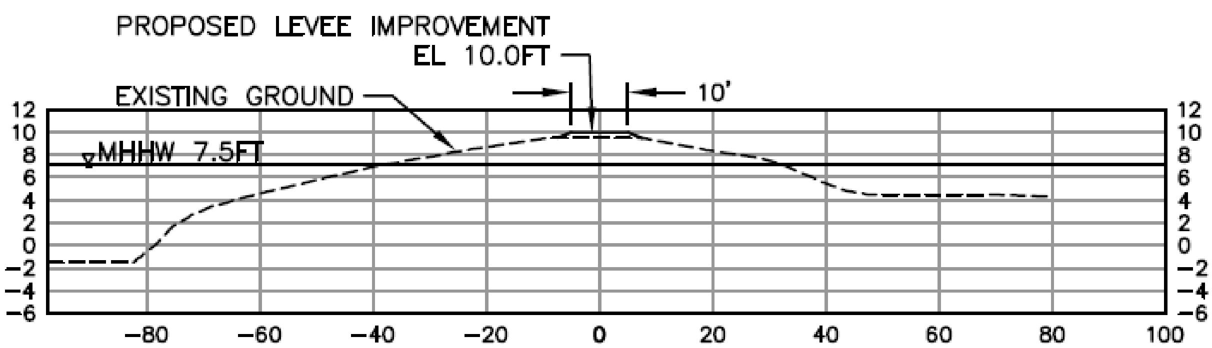


Figure 4.3. Proposed Pond A1 West Levee Improvement – Typical Section.

4.1.3 Levee Improvements – Charleston Slough West Levee and Coast Casey Forebay North Levee

This section discusses the proposed improvements for 7,000 feet of the Charleston Slough west levee and 1,000 feet of the Coast Casey Forebay north levee (Alternative Mountain View C) in order to meet the Flood Protection Objective in Section 2. These levee improvements would consist of preparing the subgrade to receive additional fill material and placing fill along the slopes and levee top to achieve desired elevation and rock slope protection to protect the levee from wave action. The levee improvements would provide greater level of flood protection after Pond A1 is made tidal than currently provided by the existing northern A1 levee. The improvements are designed to meet the levee crest requirements in the Low Sea Level Rise (SLR) Plus scenario in the Shoreline Park SLR Study (ESA PWA 2012). There are two SLR scenarios considered in the Shoreline Park SLR Study: Low SLR and High SLR. The Low and High SLR scenarios consider SLR of 8-inches and 31-inches, respectively, in the next 50 years. The Low SLR Plus scenario was developed to be easily adaptable for future levee raises. The scenario includes a levee crest elevation sufficient to provide protection against floods with a 1% annual probability of occurrence (here after referred to as 100-year flood in this memorandum) flood protection under low SLR scenario but with a broader levee base sized to enable future levee raises for a high SLR scenario. The levee improvements would also provide access along the levee top and enable temporary construction access. The preliminary design criteria for the levee improvements are below.

Design Criteria:

- Top elevation: the improved levees would have a minimum crest elevation of 14.0 feet NAVD88 prior to breaching Pond A1. This will accommodate 0.7 feet of SLR, at least 2.0 feet of still water freeboard, and at least 1.0 feet of free board above wind setup and wave runup for the 100-year flood.
- Compaction: levee fill would be placed and compacted to 90% to 95% of maximum dry density as measured using ASTM D1557.
- Side Slope: the improved levee would have side slopes of 4:1 (h:v)
- Cover: levee crest would be finished with 4 inch thick crushed gravel to provide all weather access and to meet ADA compliance
- Erosion control: the improved levee would have ¼-ton rock slope protection 3 feet thick for the purposes of erosion control from wave action on the Charleston Slough side
- Accessibility: the improved levee would connect to the existing trails with a running slope not steeper than 20:1 (h:v) to comply with ADA Accessible Routes requirement

A typical cross-section of the proposed levee improvements for Alternative Mountain View C is shown in **Figure 4.4**. Borrow material would be sourced from off-site upland re-use materials. Preliminary slope stability and settlement analyses for the levee improvements are described in **Appendix B3**.

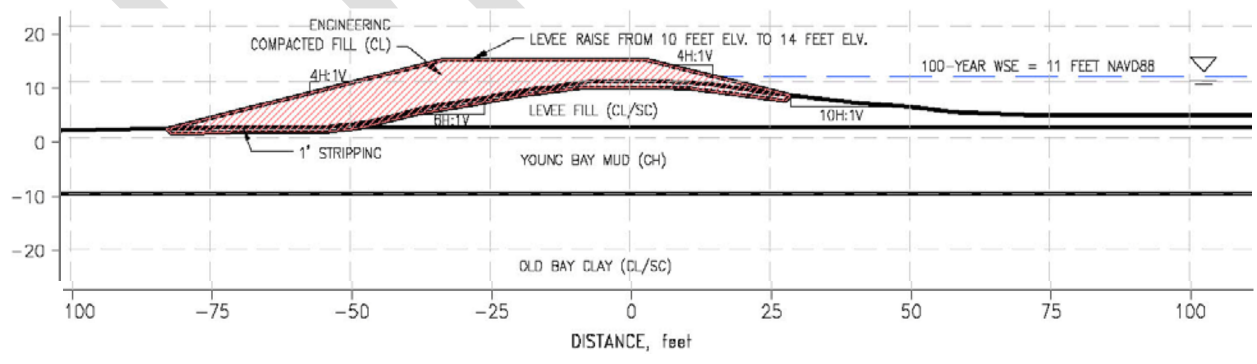


Figure 4.4. Proposed Charleston Slough West Levee and Coast Casey Forebay North Levee Improvements – Typical Section.

4.1.4 Levee Lowering

Approximately 4,730 feet of the west levee of Pond A1 would be lowered to elevation 6.6 feet (Alternative Mountain View C), just below MHW elevation, which is 6.9 feet NAVD88. By reducing the levee height in these areas, tidal waters would overtop the levees at least once per day on average in order to meet the Habitat Restoration Objective in Section 2. Over time, tidal overtopping is expected to promote additional levee erosion, allowing for improved hydraulic and habitat connectivity between ponds.

Design Criteria

- Top elevation: A1 west levee would be lowered to elevation 6.6 feet NAVD88.

A typical cross-section of the proposed levee lowering is shown in **Figure 4.5**.

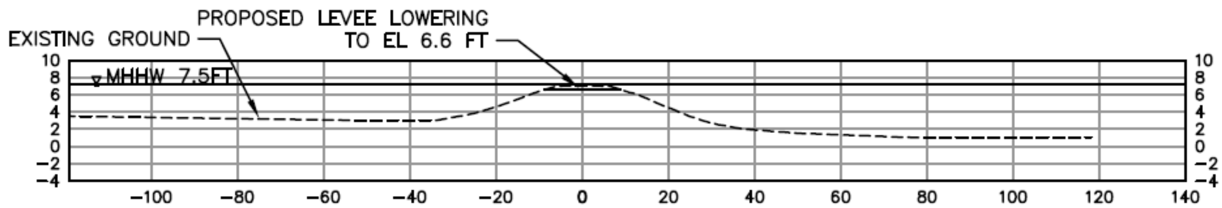


Figure 4.5. Proposed Levee Lowering – Typical Section.

4.1.5 Levee Breach

Several breaches would provide connections to the external sloughs and create tidal conditions within the ponds in order to meet the Habitat Restoration Objective in Section 2. The breach locations were selected based on the locations of historical sloughs in Ponds A1 and A2W shown on the SFEI historical tidal marshland maps, primarily based on 19th century U.S. Coast Survey maps (SFEI 2013). Breach descriptions and locations for both alternatives are listed below.

- Opening at Charleston Slough Tide Gate: A 50-foot wide tide gate structure currently exists in Charleston Slough. This breach would involve removing the tide gate structure and widening the opening to an 80-foot wide breach (Alternative Mountain View C).
- A1northwest breach: levee breach between Pond A1 and Charleston Slough (Alternatives Mountain View B and C).
- A1southwest breach: levee breach between Pond A1 and Charleston Slough (Alternative Mountain View C).
- A1 southeast levee breach: levee breach between Pond A1 and Mountain View Slough (Alternative Mountain View C).
- A2W northwest levee breach: levee breach between Pond A2W and Mountain View Slough (Alternatives Mountain View B and C).
- A2W southwest levee breach: levee breach between Pond A2W and Mountain View Slough (Alternatives Mountain View B and C).
- A2W northeast levee breach: levee breach between Pond A2W and Stevens Creek (Alternatives Mountain View B and C).
- A2W southeast levee breach: levee breach between Pond A2W and Stevens Creek (Alternatives Mountain View B and C).

With the exception of some breach slopes (detailed under design criteria), breaches would not be armored and are expected to evolve naturally with erosion or deposition from tidal flows. Therefore, the side slopes for these breaches are recommended for construction stability only. The total tidal prism for breached Ponds A1 and A2W is estimated to be 2,300 acre-feet. Breach geometry was determined based on modeling described in **Section 3**, and breach invert elevations were determined based on existing invert elevations in adjacent sloughs.

Design Criteria:

- Bottom width and breach invert (opening at Charleston Slough tide gate): 80 feet with an invert elevation of 1.0 feet NAVD88 (Alternative Mountain View C). The western side slope would be armored to protect the trail and interpretive platform from erosion.
- Bottom width and breach invert (A1 northwest breach): 100 feet (Alternative Mountain View C) to 250 feet (Alternative Mountain View B) with an invert elevation of 2.0 feet NAVD88.
- Bottom width and breach invert (A1 southwest breach): 100 feet with an invert elevation of 2.0 feet NAVD88 (Alternative Mountain View C). The southern side slope would be armored to protect the trail and viewing platform from erosion.
- Bottom width and breach invert (A1 southeast breach): 100 feet with an invert elevation of 2.0 feet NAVD88 (Alternative Mountain View C).
- Bottom width and breach invert (A2W northwest breach): 100 feet with an invert elevation of 2.0 feet NAVD88.
- Bottom width and breach invert (A2W southwest breach): 100 feet with an invert elevation of 2.0 feet NAVD88.
- Bottom width and breach invert (A2W northeast breach): 28 feet with an invert elevation of 2.0 feet NAVD88. A railroad car bridge will span the beach to provide access to PG&E facilities along the Pond A2W north levee. The railroad car bridge details are discussed in **Section 4.1.11**. The side slopes would be armored to protect the bridge abutments from erosion.
- Bottom width and breach invert (A2W southeast breach): 28 feet with an invert elevation of 2.0 feet NAVD88. A railroad car bridge will span the beach to provide access to PG&E facilities along the Pond A2W north levee. The railroad car bridge details are discussed in **Section 4.1.11**. The side slopes would be armored to protect the bridge abutments from erosion.
- Side Slope: side slope ratio of 3:1 (h:v) for all breaches except A2W northeast and southeast breaches, which would have a side slope of 2:1 (h:v).
- Slope protection (opening at Charleston Slough tide gate, Alternative Mountain View C): armor the western side slope of the breach with riprap to protect proposed trail and interpretive platform from erosion.
- Slope protection (A1 southwest breach): armor the southern side slope of the breach with riprap to protect proposed trail and viewing platform from erosion
- Slope protection (A2W northeast breach): armor side slopes with riprap to protect the abutment foundations from erosion.
- Slope protection (A2W southeast breach): armor side slopes with riprap to protect the abutment foundations from erosion.

A typical cross-section of the proposed levee breach is shown in **Figure 4.6**.

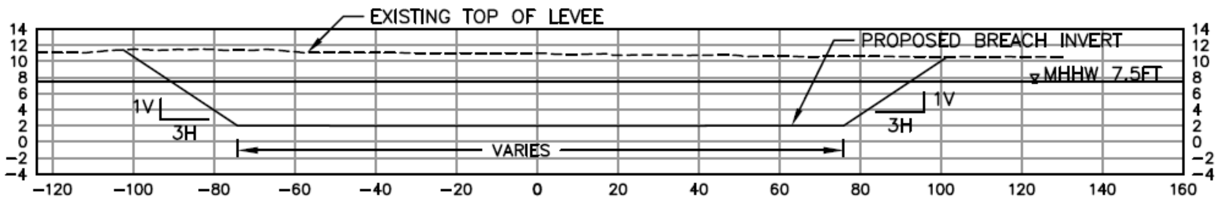


Figure 4.6. Proposed Levee Breach – Typical Section.

Breaching can be accomplished from the levee crest using long reach excavators and hauling material to on-site locations receiving fill for levee improvement or HTZ.

4.1.6 Other Structure Improvements for Coast Casey Forebay North Levee Raise

The City of Mountain View seeks to raise the approximately 1000-ft of levee north of the Coast Casey Pump Station and along the alignment of their Sailing Lake Pump station and pipeline, see Section 4.1.3 for discussion of the levee improvements. Among the three proposed levee remediation approaches for Charleston Slough in Shoreline Park SLR Study (ESA PWA 2012) the option Low SLR Plus is preferred. Raising the levee will impact a number of structures in the levee owned by the City of Mountain View. **Figure 4.7** shows the approximate area where fill will be placed to raise the Coast Casey Forebay Levee, plus the general location of structures impacted. This section provides an overview of the conceptual design for how these structures will be raised to accommodate the higher Coast Casey Forebay North Levee. Additional detail is provided in **Appendix B4**.

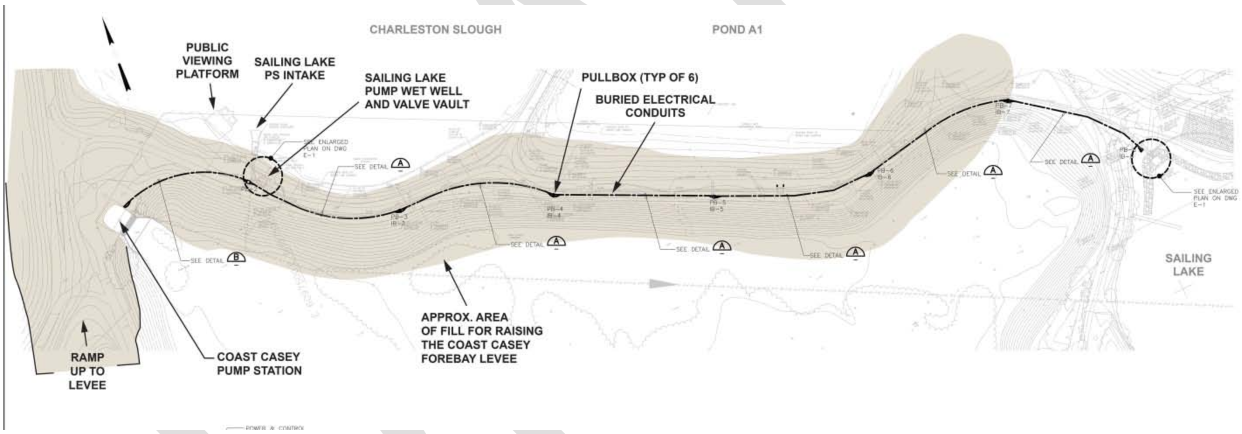


Figure 4.7. Approximate Area and Locations of City of Mountain View Structures Impacted by raising the Coast Casey Forebay Levee

The structures and type of improvements include:

- Electrical pull boxes – six pull boxes would have manholes installed over them to raise the hatch opening to elevation 14.0 NAVD88
- Sailing Lake Pump Station wet well and pump – the wet well and pump would have a new access vault constructed over the existing pump barrel and piping to raise the hatch opening to elevation 16.0 NAVD88. The air valve and pump vents would be raised above grade.
- Sailing Lake Pump Station valve vault – the valve vault, vault lid, and ladder rungs would be raised to elevation 14.0 NAVD88

- Sailing Lake Pump Station retaining wall – the retaining wall would be extended and raised to elevation 9.5 NAVD88
- Charleston Slough public viewing platform – the existing platform would be removed and new platform constructed at elevation 14.0 NAVD88 with higher support pilings and an elevated walkway connecting to the trail on the raised levee
- Coast Casey stormwater pump station – a retaining wall would be constructed around the pump station to retain the raised grade along the ramp connecting the existing Coast Casey Forebay west levee and the raised north levee
- Other minor facilities – fences, signs, and paving would also need to be replaced

Design Criteria:

- Elevation: raise structures and access openings to be consistent with proposed levee grades
- Structural design and foundations: a structural engineer will design the raised structures, foundation supports, and connections to existing structures, as applicable, during future phases

4.1.7 New Sailing Lake Water Intake

As discussed in Section 3.4.2, Alternative Mountain View C, which restores full tidal conditions to Charleston Slough, will likely alter the timing of tidal flows and may change sedimentation patterns in Charleston Slough near the existing Sailing Lake pump station intake at the south end of Charleston Slough. A new pump station intake could be built at the Pond A1 southwest breach as part of Alternative Mountain View C to provide more reliable conditions that would scour the area at the intake and lessen sediment build up at the intake (see Figure A-9 in Appendix A).

The Sailing Lake pump station pumps water from Charleston Slough to the Sailing Lake. A new concrete intake structure for this pump station, at the south end of Charleston Slough, was constructed in 2005. This intake structure, where the water first enters, has an invert of -2.8 feet NAVD88. The intake structure has a small sump area where sediment collects with an invert of -4.8 feet NAVD88. Water flows by gravity in a flat (no slope) 42- and 36-inch HDPE pipe with an invert of -2.15 feet NAVD88, for a distance of approximately 40 feet from the intake to the pump wet well.

According to Jim Baldinger at the City of Mountain View, the pump turns on when the water in the slough reaches a height of 3.29 feet NAVD88 and then shuts off when the water reaches 2.69 feet NAVD88. The pump runs at a constant speed of about 9,000 gpm between 13 and 18 hours a day depending on the tide levels. There is a 2-hour backwash cycle which runs twice a day at low tide. During backwash, water flows by gravity from the lake out the intake, in a pipe that bypasses the pump. The purpose of the backwash is to flush sediment out of the intake pipe and sump, although it is reportedly not completely effective at backwashing the sump. The backwash does appear to be helpful at maintaining the open channel in Charleston Slough between the tide gates (nearer the bay) and the intake.

Charleston Slough is expected to gradually return to a vegetated tidal marsh. The marsh plain is expected to be at elevation 4-5 feet NAVD88. As described in Section 3.4.2, the Alternative Mountain View C restoration of Charleston Slough is not expected to adversely impact the quality or quantity of water entering the Sailing Lake intake. The action of the water flowing into the pump station and flushed out during backwash and ebb tide is expected to continue to maintain a channel in the slough. However, the City currently has a problem with the accumulation of sediment in the Sailing Lake intake.

Modeling for this project has indicated that flows through the Pond A1 southwest breach are expected to be on average 10 times greater than the required intake rate of 9,000 gpm. The higher flows through the breach are expected to reduce the accumulation of sediment in the general vicinity of the intake. This condition should extend the functional service life of the intake. In addition, construction of a larger and/or multiple sediment sumps, could decrease the number of maintenance visits required. These projected improvements are theoretical and have not been quantified or modeled.

It is highly recommended, even if the City elects to not construct a new intake, to incorporate new intake maintenance procedures into the project description and permit applications, which would allow the City to return sediment, removed from the pump and intake, back into Charleston Slough or Pond A1. The City currently hauls the sediment offsite for disposal.

The bottom of the breach is designed at an elevation of about 2.0 feet NAVD88. This elevation was selected because the existing channel in Charleston Slough has an invert of 2.0 feet NAVD88 near the intake as shown in **Figure 4.8**. Pond A1 has an average bottom elevation of 0.88 feet NAVD88. The exact elevations of the Pond A1 bottom at the southwest breach are not known but are assumed to be about 1.0 feet NAVD88.

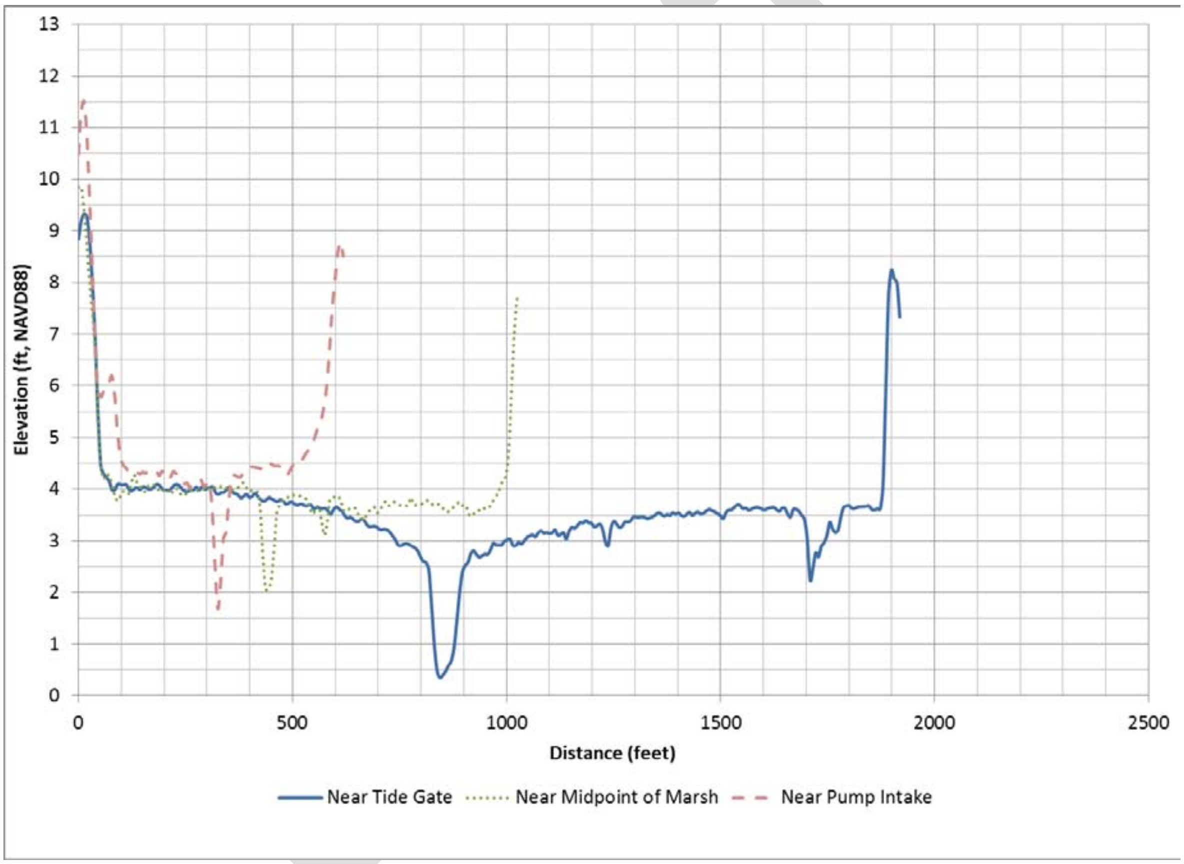


Figure 4.8. Typical Channel Cross-Sections in Charleston Slough Based on LIDAR data

Figure 4.9 shows two options for installing the sailing lake intake at the breach: one centered in the breach and the other angled to face Pond A1. A new intake at the breach should be located just above the bottom of the breach with an invert elevation around 3.0 feet NAVD88 to prevent sediment from entering the intake. A new intake facing Pond A1 could potentially be located slightly deeper with an invert around elevation 2.0 feet NAVD88 (pending confirmation of Pond A1 bottom elevations); however, it is anticipated that Pond A1 will sediment in to marsh plain elevation over time.

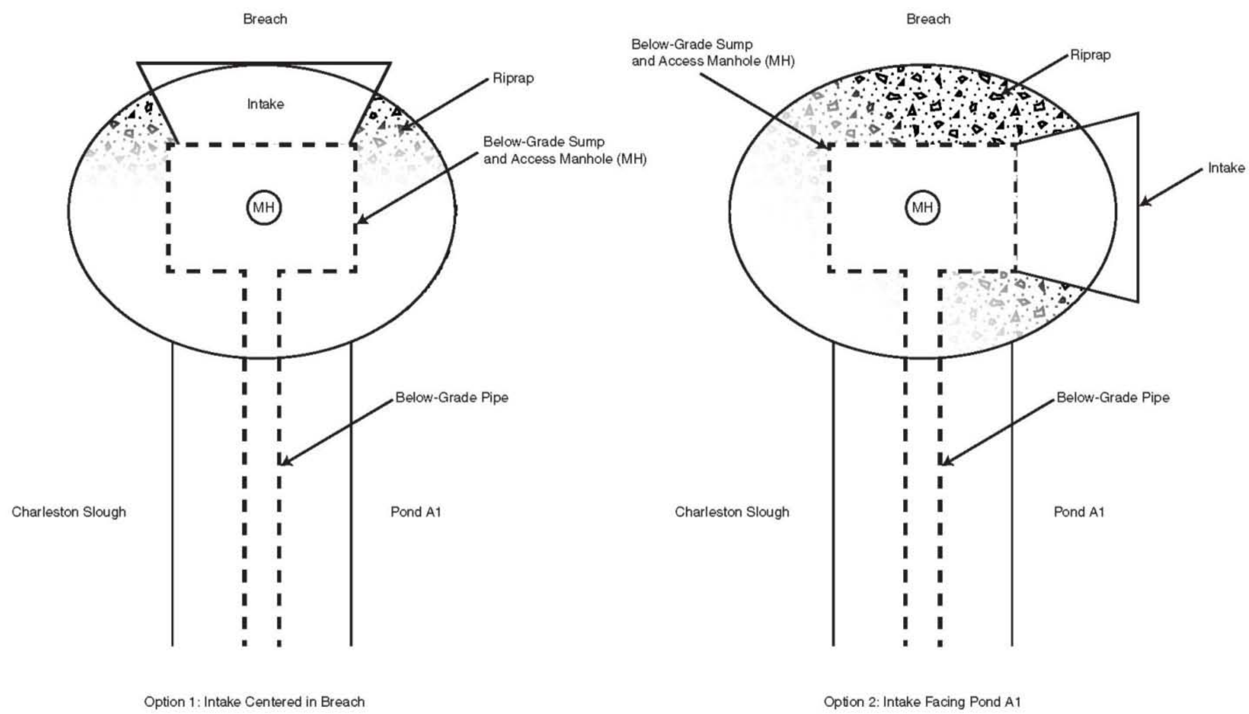


Figure 4.9. Alternative Conceptual Designs for Sailing Lake intake at Pond A1 Southwest Breach

Both locations have the disadvantage of an intake invert several feet higher than the current intake invert (-2.8 feet NAVD88). The new invert elevations are very close to the current settings for starting and stopping the pump (3.29 feet NAVD88 and 2.69 feet NAVD88). At a future design stage, calculations will need to be performed to confirm that the combination of the new tidal response in the ponds with the higher elevation intake will provide sufficient water for the lake.

The proposed new intake location may affect backwashing. The additional 1,200 feet of intake pipe and elbows will add frictional head losses, so lower flushing velocities are expected. In addition, backflushing through the proposed intake would no longer help keep a channel open since the intake invert would be several feet above mean low water. Future design effort should examine this condition in more detail.

As an alternative to installing a new intake at the breach, the City could consider raising the existing intake to extend its useful life.

Design Criteria:

- Location: the new intake would be located at the end of the south side of the breach between Charleston Slough and Pond A1.
- Erosion protection: armoring would be installed at the south end of the breach with riprap to protect the breach and the new intake.
- Elevation: the intake would need to be installed with an invert elevation on the order of 2.0 - 3.0 feet NAVD88, depending on the final elevation of the breach and the elevation of the bottom of Pond A1 in this area.
- Connection with existing system: the City may elect to keep the existing intake in place in Charleston Slough to use until the restored pond system has stabilized and suspended sediment has settled out enough to put the new intake into service. This would require a wye or tee connection between the two intake pipes and the installation of two new 42-inch isolation valves.

- Backflushing: the new intake pipe should connect at the wye to allow for the use of backwashing from the lake. The new intake pipe from the breach to the wye will add approximately 1,200 linear feet of intake piping. The pipe can be sized to minimize head loss so that backflushing can still occur. The new pipe is expected to be 42-inch inner diameter HDPE, similar to the existing intake pipe.
- Trails: the portion of the levee that leads to the breach is planned to be upgraded to support a recreational trail on its surface. The levee and trail will need to be widened and paved or hardpacked enough to be able to handle the load of a City vacuum truck. The trail will need to include enough space at the breach end to turn the truck around.
- Sump volume: at least one large sump, and possibly others, can be incorporated into the intake structure and pipeline to capture sediment. Designing a much larger sump than the current one should allow for less frequent visits by City maintenance staff to pump out sediment.
- Accumulated sediment disposal: permits for the project could include permissions for the City to dispose of accumulated sediment into Charleston Slough or Pond A1, simplifying maintenance.
- Cover: the new intake pipe will be installed to the wye below grade in the Pond A1 west levee. The levee has a current elevation of around 9 ft. The pipe should have at least 3 feet of cover to withstand traffic loads. With an invert as high as 3.0 feet NAVD88 and the 42-inch diameter pipe, the levee top elevation may need to be raised about a foot in the vicinity of the intake or be capped with concrete. Near the wye, where the existing pipe has an invert of -2.18 feet NAVD88, the 42-inch diameter pipe will end up having about 7 feet of cover. Shoring will be needed for such a deep trench to safely keep the trench open during construction. Dewatering of the pipe trench may also be necessary.
- Pipe zone backfill materials: around the pipe zone (1 foot above and below the pipe), it is recommended to backfill with a material that does not require compaction, since the trench will be saturated. Aggregate base and controlled low-strength material (CLSM) are good options for pipe zone backfill.
- Trench backfill materials: above the pipe zone, the trench can be backfilled with native material, as long as it has low organic content, no rocks or objects over 2 inches in size, and can be compacted to a minimum of 95% below where vehicles may drive, and 90% where no vehicles are expected. If native material cannot meet these criteria, then trench backfill material may need to be imported. CLSM, which is a "diggable" concrete slurry, may be necessary as backfill to counteract buoyancy forces. Buoyancy forces should be analyzed as part of final design.
- Pump station location: the existing pump station is assumed to remain in place.
- Pump setpoints: Since the new intake will have a higher invert, the duration of pumping is likely to be shortened with the existing control strategy (pump setpoints). The design will need to examine the predicted tides with the project to make sure higher pump setpoints will provide enough water for the sailing lake.

4.1.8 Habitat Transition Zone

HTZs are transitional habitat areas that would increase habitat diversity and complexity by providing a wide transition in elevation from upland zones to tidal marsh zones allowing for low marsh, high marsh, tidal fringe, and upland habitats to develop in order to enhance conditions further under the Habitat Restoration Objective and Maintain Existing Flood Protection Objective in Section 2. The HTZs would make use of upland fill material available from off-site construction projects. It could also serve to protect the landfill immediately to the south of Ponds A1 and A2W. HTZs would be located along the following levee alignments.

- Approximately 3,000 feet of HTZ along the southern perimeter levee of Pond A1 (Alternatives Mountain View B and C)
- Approximately 4,600 feet (Alternative Mountain View B) or 3,000 feet (Alternative Mountain View C) of HTZ along the southern perimeter levee of Pond A2W

These areas would built with varying slopes to facilitate habitat diversity and erosion protection; they would be sized based on the amount of upland re-use material available. The preliminary design assumes a slope of 30:1 (h:v), which is the flattest slope that would be considered for construction, and thus the maximum fill volume and footprint for the HTZ. This less steep slope would provide a very gradual transition between the pond itself and the adjacent uplands, adding habitat complexity and a larger area over which the transition zone can buffer against sea-level rise, storm surge, wave run-up, and other tidal influences. Future designs may include slopes as steep as 15:1 (h:v), but these would require less fill material and have a smaller footprint. **Figure 4.10** below shows a typical cross-section of the proposed HTZ slopes. Slopes varying from 15:1 (h:v) to 30:1 (h:v) would provide both a wide zone to enhance the transition between estuarine and terrestrial habitats as well as providing a gentle slope for dissipation of wave energy and reduction of erosion potential.

Design Criteria:

- HTZ top elevation and slope: From a high elevation of 9.0 feet NAVD88 extending down to pond bottom with slopes 15:1 (h:v) to 30:1 (h:v) feet NAVD88
- HTZ compaction: Fill would be placed to a minimum of 70 % and a maximum of 80 % of dry density as measured using ASTM D1557. It is important not to over-compact the HTZ fill areas. Over-compacting can inhibit the establishment of vegetation by not allowing sufficient growth of root systems.
- Slope Protection: establishment of native vegetation by hydroseeding with native seed mix and planting schema that would successfully transition from upland vegetation to tidal marsh.

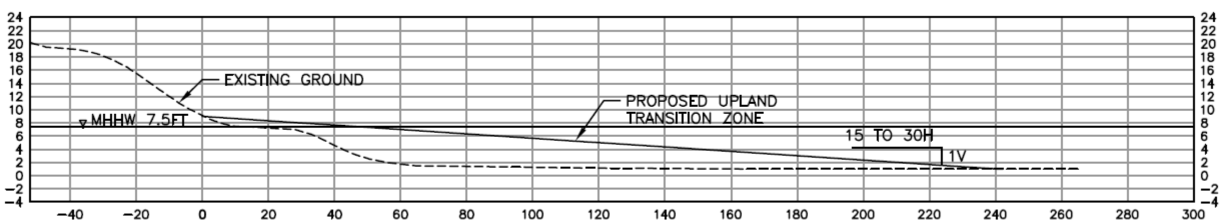


Figure 4.10. Proposed HTZ – Typical Section.

4.1.9 Nesting Island Habitat

Nesting island habitat would be constructed in Alternatives Mountain View B and C to provide nesting grounds for the western snowy plover, California least tern, or other bird species of interest in order to meet the Habitat Restoration Objective in Section 2. The habitat islands would be built up to an elevation of 8.0 feet NAVD88 to provide refuge from MHHW tides.

Depending on the availability of fill material, a total of 16 nesting islands would be built in Ponds A1 and A2W. The nesting islands would be constructed of bay mud. The top surface would be treated with a 12-inch thick sand layer underlain by a 6-inch thick crushed rock to minimize weed establishment. The sand layer would be covered with 4-inch thick oyster shells to provide a light-colored barren land site that provides camouflage and is typically preferred by nesting birds (San Francisco Bay Bird Observatory 2009). A typical cross-section of the nesting island is shown on **Figure 4.11**.

Design Criteria:

- Top elevation and surface area: 11,000 square feet at 8.0 feet NAVD88
- Compaction: earth, crushed rock, and sand fill will be placed at 90% of maximum dry density as measured using ASTM D1557. No compaction is necessary for the oyster shell cover layer.
- Side slopes: 28:1(h:v) to 12:1 (h:v) along the leeward side and no steeper than 6:1 (h:v) along the windward side

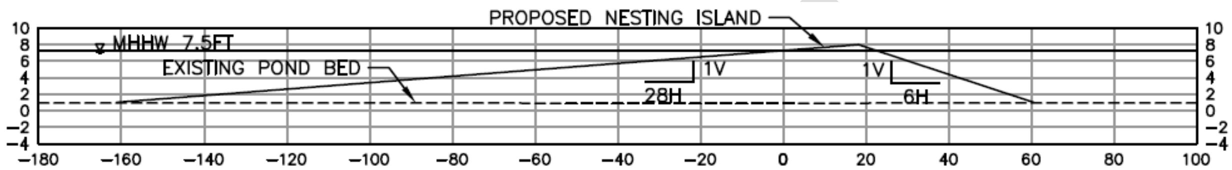


Figure 4.11. Proposed Nesting Island Habitat – Typical Section.

4.1.10 Pond Bottom Fill

Preliminary hydraulic modeling results indicate that the bottom of Ponds A1 and A2W would need to be elevated to approximately 4.4 to 4.9 feet NAVD88 on average for the ponds to drain the ponds completely immediately after breaching. The ponds could be filled with dredge material, or they could be allowed to naturally sediment over time. Natural sedimentation would delay the transition to vegetated marsh habitat. Filling the ponds would meet the Habitat Restoration Objective in Section 2 sooner than natural sedimentation.

Design Criteria:

- Average fill depth: approximately 4.0 feet

4.1.11 Rail Flatcar Bridges

Rail flatcar bridges will be constructed to span the northeast and southeast levee breaches in Pond A2W (see Figure A-3 and A-4 in Appendix A) in Alternatives Mountain View B and C. These bridges will provide access after breaching to the PG&E facilities located on the Pond A2W north levee. Each flatcar would weigh between 70 to 100 tons and will rest on cast-in-place concrete abutments. The abutments will be supported by pre-stressed concrete piles.

Design Criteria:

- Bridge span: approximately 60 feet
- Bridge top elevation: to match existing levee elevations; approximately 10.0 feet NAVD88
- Bridge superstructure: rail flatcar 10 feet wide with a 5-foot thick girder. Safety railing would be provided on either sides of the deck.
- Bridge foundation: with seismic resistant shear keys, the abutment stem would be about 15 feet long. Integrated concrete wing walls would be built with stem to contain the embankment. The abutments would be about 6.5 inches wide by 8 inches deep supported by approximately eight 14 inch by 14 inch precast pre-stressed concrete piles at each abutment. The concrete piles would be about 45 feet long.

A typical cross-section of the proposed rail flatcar bridge is shown on **Figure 4.12** and preliminary design details of the abutment are shown on **Figure 4.13**.

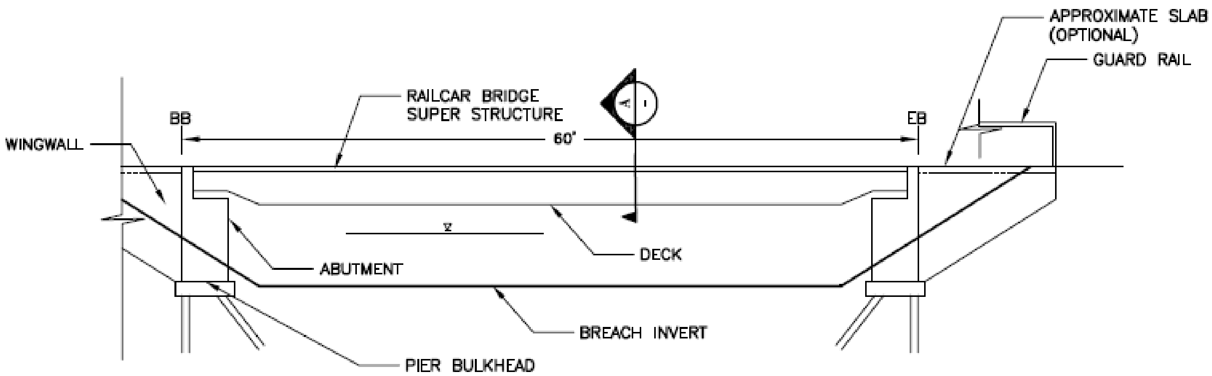


Figure 4.12. Proposed Rail flatcar Bridge – Typical Section.

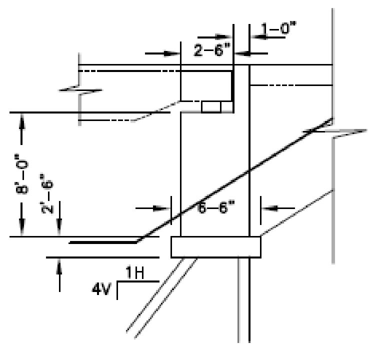


Figure 4.13. Proposed Bridge Abutment Details.

4.1.12 PG&E Towers and Access Boardwalks

PG&E currently owns and operates high-voltage electrical transmission lines that cross over Pond A2W and run just bay-ward of the Pond A1 north levee. The lines are supported by steel towers on concrete foundations. There are sixteen towers in Pond A2W, and currently, the concrete foundations are high enough for the ponded water-level in Pond A2W (see **Figure 4.14**); however, with the introduction of tidal flows, water will rise higher than the footings, and the concrete foundations would need to be raised to protect the steel towers from salt water. The towers themselves would not be raised, but the concrete on the footings would be extended to a higher elevation to "encapsulate" the lower portion of the tower and provide the needed protection.

Running parallel to the transmission lines just above the Pond A2W surface are pedestrian access boardwalks for PG&E to do inspections and provide access to the towers (see **Figure 4.15**). The boardwalks would be replaced at a higher elevation to allow access after tidal flows are introduced.

The existing access boardwalks at Mountain View Ponds are only located within Pond A2W; there are no boardwalks where the transmission lines run above the marsh on the bay side of the Pond A1 north levee. The access boardwalk begins again where the transmission lines cross over open water near the northern most point of Pond A1 and continue west, bay-ward of the mouth of Charleston Slough, across a marsh island north of the PAFB, and toward Mayfield Slough on the west side of the PAFB. PG&E

currently accesses this boardwalk over the open water and to the north of the PAFB from the Pond A1 north levee. Since the Pond A1 north levee will be allowed to erode over time with tidal influences and no land based access will be provided to the north point of Pond A1 with the project, PG&E proposes to build continuous boardwalk to allow access. A new access boardwalk parallel to the transmission lines from where the existing access boardwalk ends at Pond A2W to the end of the other existing access boardwalk off the northern-most point of Pond A1 would be built to provide continuous access.

The design of these features will be prepared in a future phase by PG&E.

Figure 4.14. PG&E Electrical Transmission Towers and Footings in Pond A2W.

Figure 4.15. PG&E Access Boardwalks in Pond A2W.

4.1.13 Recreational Trails

Trails are proposed as part of meeting the Public Access and Recreation objective in Section 2. Trails include:

- Approximately 1,200 feet of new trail along the western levee of Pond A1 (Alternative Mountain View B)
- Approximately 6,400 feet of rebuilt trail along the southern and western levee of Charleston Slough (Alternative Mountain View C)
- Approximately 500 feet of new trail along the western portion of the Charleston Slough tide gate levee (Alternative Mountain View C)
- Approximately 8,900 feet of new trail along the eastern and northern levees of Pond A2W (Alternative Mountain View C)

Design Criteria:

- Width: the trails would be at least 6 feet wide
- Surfacing: the trails would be built on improved or existing levees. Erosion or uneven surfaces on existing levees would be regraded for ADA compliance. Surfacing materials would be decomposed granite with timber or concrete edging

4.1.14 Interpretive Signage and Benches

Interpretive signs with information about the habitats, wildlife, and restoration project are proposed as part of meeting the Public Access and Recreation objective in Section 2. One interpretive sign would be placed Shoreline Park adjacent to Pond A1 and Permanente Creek (Alternatives Mountain View B and

C). A second interpretive sign would be placed on the Pond A2W north levee trail (Alternative Mountain View C). The interpretive signs would be 36 inches by 24 inches, with a one-half-inch thick, high-pressure laminate mounted to a steel pedestal with stainless steel, threaded inserts and vandal-resistant screws. The pedestal would be embedded in 36-inch deep concrete footing.

A bench would be located near each interpretive sign. Benches would be 7 or 8 feet long with coated steel supports and wood slat finished surfaces. The supports would be embedded in 30-inch deep concrete footings.

4.1.15 Trail and Viewing Platform

A trail and viewing platform allowing visitors to see the habitats, wildlife, and restoration project are proposed as part of meeting the Public Access and Recreation objective in Section 2. A trail with viewing platform at the end would be built on the Pond A1 west levee. In Alternative Mountain View B, this levee would be enhanced for flood protection as described above, so the trail would be built on the proposed levee. In Alternative Mountain View C, the trail would extend to the south side of the A1 southwest breach. In both alternatives, the trail and viewing platform would be approximately 8 feet wide and approximately 1,200 feet long with anti-perch railings on the viewing platform to reduce predator perching (**Figure 4.16** and **Figure 4.17**).

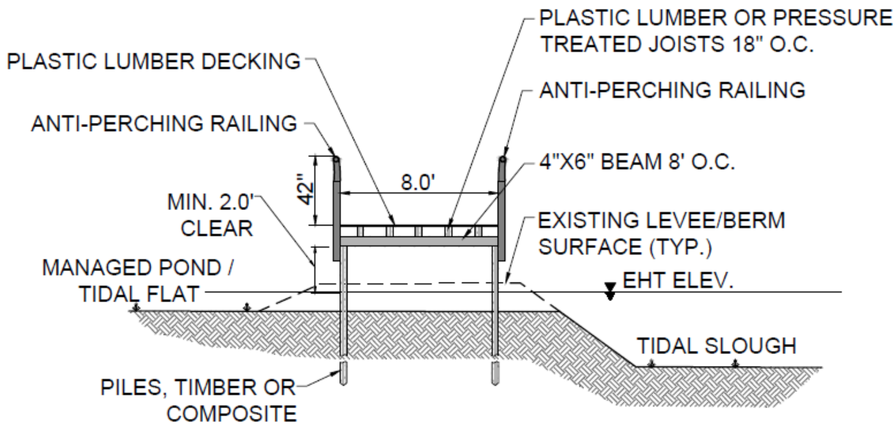


Figure 4.16. Proposed Viewing Platform – Typical Section

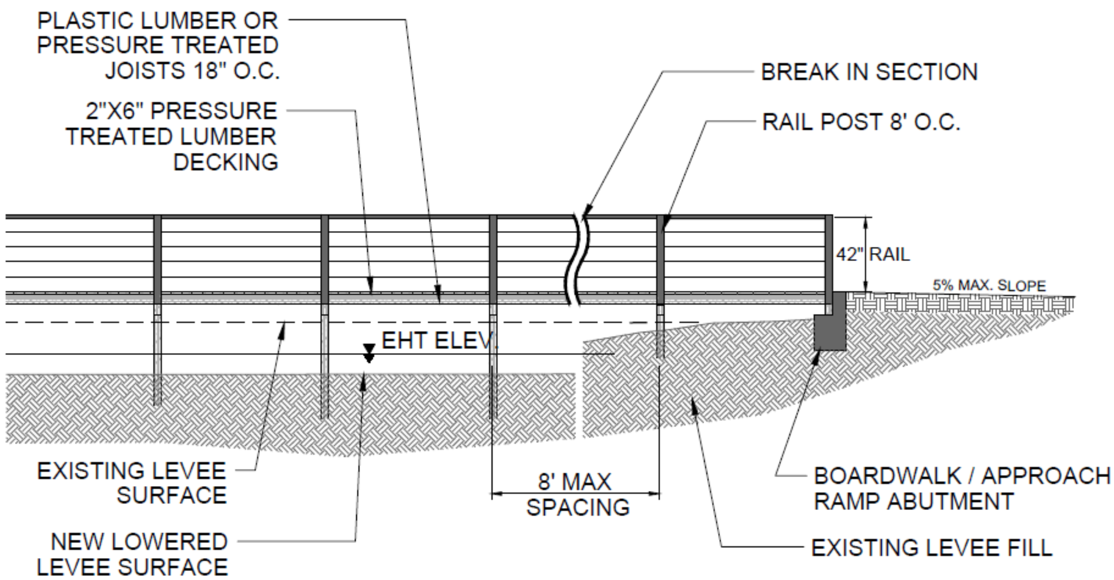


Figure 4.17. Proposed Viewing Platform – Typical Profile

4.2 Construction Implementation

Construction would be implemented by procuring the services of general contractor with experience in performing restoration activities and working within and near tidal waters. Site access information along with a preliminary analysis of the schedule and cost estimate to complete the construction activities are discussed in this section.

4.2.1 Access

Access to Ponds A1 and A2W and to Charleston Slough will be coordinated with the City of Mountain View because its Shoreline Park would be affected. The City will select routes that use local public roads and roads within Shoreline Park to minimize impacts.

Construction crews would typically consist of five to ten people. The pond cluster would likely be accessed by construction crews from U.S. 101, after which various arterial, collectors, and local streets provide access to Mountain View's Shoreline Park and the ponds beyond it.

In general, it is assumed that the existing levees are capable of handling heavy construction equipment, but this would need to be confirmed by the Contractor prior to equipment mobilization. If conditions warrant, levee improvements including widening of the crest to provide adequate pathway for construction equipment may be undertaken. Alternatively, heavy vehicles would avoid crossing structures in the levees if the vehicle exceeds the weight-bearing capacity. If this is not possible, engineer-approved precautions would be taken to avoid damaging the structure.

4.2.2 Schedule

Construction schedule would be driven by the habitat windows, weather conditions, and volume of earthwork quantities to be moved.

4.2.2.1 <u>Habitat Windows</u>

Construction activities would be limited by the following habitat windows that are applicable to the Alviso Mountainview pond complex.

- Bird Nesting Window – From February 1 through August 31 (Work may likely continue within this window in the presence of biological monitor)
- In-channel work – From April 15 to October 15
- Steelhead Migration – From December to Feb and from May to June

4.2.2.2 *Construction Schedule*

Based on the preliminary design, estimated volumes of earthwork to be moved for various alternatives proposed for the Alviso Mountain View pond complex are shown in **Table 4.1**.

Table 4.1. Preliminary estimated earthwork volumes

Alternative	Estimated Earthwork Volume (cy)	
	Cut	Fill
Mountain View A	--	--
Mountain View B	20,400	316,800
Mountain View C	51,100	421,000

In addition to these earthwork volumes, approximately 3,000,000 cubic-yards of fill may be placed at the bottom of Ponds A1 and A2W as material becomes available from off-site resources. Since this would be an ongoing fill and would occur as material becomes available, this design component is ignored in the construction schedule discussion.

Installation of walkway, educational exhibits and viewpoints are estimated to take no more than 2 weeks. These activities are not on critical path, do not affect the construction schedule significantly compared to the earthwork disturbance and bridge construction, and are hence unlikely to drive the alternative selection decision.

Construction is expected to begin in the summer of 2016. Assuming best case scenario and a construction window of May 1 through November 15, a preliminary estimate of the duration of construction is shown in **Table 4.2**. A comprehensive list of equipment, construction means and methods is included in Appendix D.

Table 4.2. Preliminary construction durations for Alviso Mountain View

Alternative	Duration (months)*◊	Construction Season
Mountain View B	27	3
Mountain View C	35	5

*Duration is from initiation of mobilization to final demobilization and includes seasonal down time.

◊ Durations assume that sufficient fill material is available to allow for continuous operation during the construction windows and that work would occur in sequential seasons. Based on experiences at Inner Bair Island, if fill material will be provided by an independent dirt broker at no cost to the project, it is recommended that these durations be increased if used for permitting or scheduling.

The construction durations for most of the Mountain View alternatives will be primarily controlled by the availability of fill that can be imported to the project sites. It was assumed that the availability of fill would be sufficient to allow for a continuous operation, but that the quantity available would only allow for one operation at a time (for instance, import of material for HTZ fill at Mountain View Ponds A1 and A2W would necessitate that they occur as sequential operations). Other construction elements were allowed to occur concurrently provided that they made reasonable sense.

4.2.3 Preliminary Estimate of Construction Quantities and Probable Implementation Costs

Table 4.4 and **Table 4.5** contain preliminary cost estimates for Mountain View Pond alternatives based on the Mountain View Ponds Restoration Preliminary Design Details (Appendix E). Quantities were measured manually from the drawings or within the AutoCAD Civil3D software utilized in preparation of the drawings. Earthwork quantities were typically calculated based on terrain models of the existing and proposed ground surfaces and using the grid method in Civil3D.

Unit costs were developed based on a combination of previous, similar URS project experience, unit construction costs from a construction contractor experienced in salt marsh restoration construction, the R.S. Means estimate guide, and vendor quotes.

Table 4.3. Preliminary Cost Estimate – Alternative Mountain View B

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Mobilization and Demobilization	1	LS	15%	$874,000
2	Improve PGE Bay Front Levee As Necessary	1	LS	$50,000	$50,000
3	Improve West and Southwest A1 Levee	10,400	CY	$14.25	$149,000
4	Pond A1 HTZ	88,000	CY	$2.50	$220,000
5	Pond A2W HTZ	125,700	CY	$2.50	$315,000
6	Islands	92,700	CY	$40.00	$3,708,000
7	Viewing Platform - Charleston Slough	1	LS	$100,000	$100,000
8	Interpretive Platform - Permanente Creek	1	LS	$30,000	$30,000
9	Public Trail to Viewing Platform	1,000	LF	$30.00	$30,000
10	Pond A1 NW Breach	3,100	CY	$10.70	$34,000
11	Pond A2W NW Breach	5,700	CY	$10.70	$61,000
12	Pond A2W SW Breach	8,900	CY	$10.70	$96,000
13	Pond A2W NE Breach	900	CY	$10.70	$10,000
14	Pond A2W SE Breach	1,800	CY	$10.70	$20,000
15	Railroad Car Bridge	2	EA	$500,000	$1,000,000
	Subtotal				$6,697,000
	Design & Unit Cost Contingency			25%	$1,675,000
	Total Direct Construction Cost				$8,372,000
	Construction Contingency			30%	$2,512,000
	Total				**$10,884,000**

Notes: LS = lump sum; CY = cubic yard; LF = linear feet; EA = each

Table 4.4. Preliminary Cost Estimate – Alternative Mountain View C

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Mobilization and Demobilization	1	LS	15%	$2,272,000
2	Improve PGE Bay Front Levee As Necessary*	1	LS	$50,000	$50,000
3	Improve Charleston Slough West and Coast Casey Forebay North Levees	1	LS	$5,300,000	$5,300,000
4	Raise Coast Casey Forebay North Levee Structures	1	LS	$847,000	$847,000
5	Pond A1 Upland Transition Zone	88,000	CY	$2.50	$220,000
6	Pond A2W Upland Transition Zone	81,500	CY	$2.50	$204,000
7	Islands	92,700	CY	$40.00	$3,708,000
8	Lower Pond A1 West Levee	14,000	CY	$3.30	$47,000
9	Charleston Slough Breach	1,100	CY	$10.70	$12,000
10	Pond A1 NW Breach	3,100	CY	$10.70	$34,000
11	Pond A1 SW Breach	6,200	CY	$10.70	$67,000
12	Pond A1 E Breach	3,600	CY	$10.70	$39,000
13	Pond A2W NW Breach	5,700	CY	$10.70	$61,000
14	Pond A2W SW Breach	8,900	CY	$10.70	$96,000
15	Pond A2W NE Breach	900	CY	$10.70	$10,000
16	Pond A2W SE Breach	1,800	CY	$10.70	$20,000
17	New Sailing Lake Pump Station Intake	1	LS	$1,724,000	$1,724,000
18	Railroad Car Bridge	2	EA	$500,000	$1,000,000
19	Charleston Slough Interpretive Platform	1	LS	$50,000	$50,000
20	Charleston Slough West Trail	7,000	LF	$30.00	$210,000
21	Interpretive Platform - Permanente Creek	1	LS	$30,000	$30,000
22	Pond A1 SW Viewing Platform	50	LF	$1,000	$50,000
23	Pond A1 SW Trail	950	LF	$30	$29,000
24	Pond A2 NW Viewing Platform	1	LS	$150,000	$150,000
25	Stevens Creek Levee Trail	8,900	LF	$30.00	$267,000
	Subtotal				$16,359,000
	Design & Unit Cost Contingency			25%	$4,090,000
	Total Direct Construction Cost				$20,449,000
	Construction Contingency			30%	$6,135,000
	Total				**$26,584,000**

Notes: LS = lump sum; CY = cubic yard; LF = linear feet; EA = each

Assumptions:

The following assumptions were made in developing this preliminary cost estimate.

- Observation and interpretive platforms consist of wood structures on shallow concrete footings. Interpretive platforms would be constructed close to grade.
- Rail flatcar bridges consist of cast in place concrete abutments supporting a prefabricated railroad flatcar span.
- Public trails consist of filter fabric, four inches of base rock and four inches of quarry fines.
- Import fill is assumed to be provided to the projects by a dirt broker at no cost to the project and in a quantity that does not limit typical equipment production rates.

- The estimate includes a design and unit cost contingency of 25 percent to cover changes to the design assumptions and components and uncertainty in material unit costs.
- The estimate includes a construction contingency of 30 percent to cover changes to the project costs during construction.
- The contingencies do not include costs for engineering design, environmental documentation, permits, or contract and construction administration.

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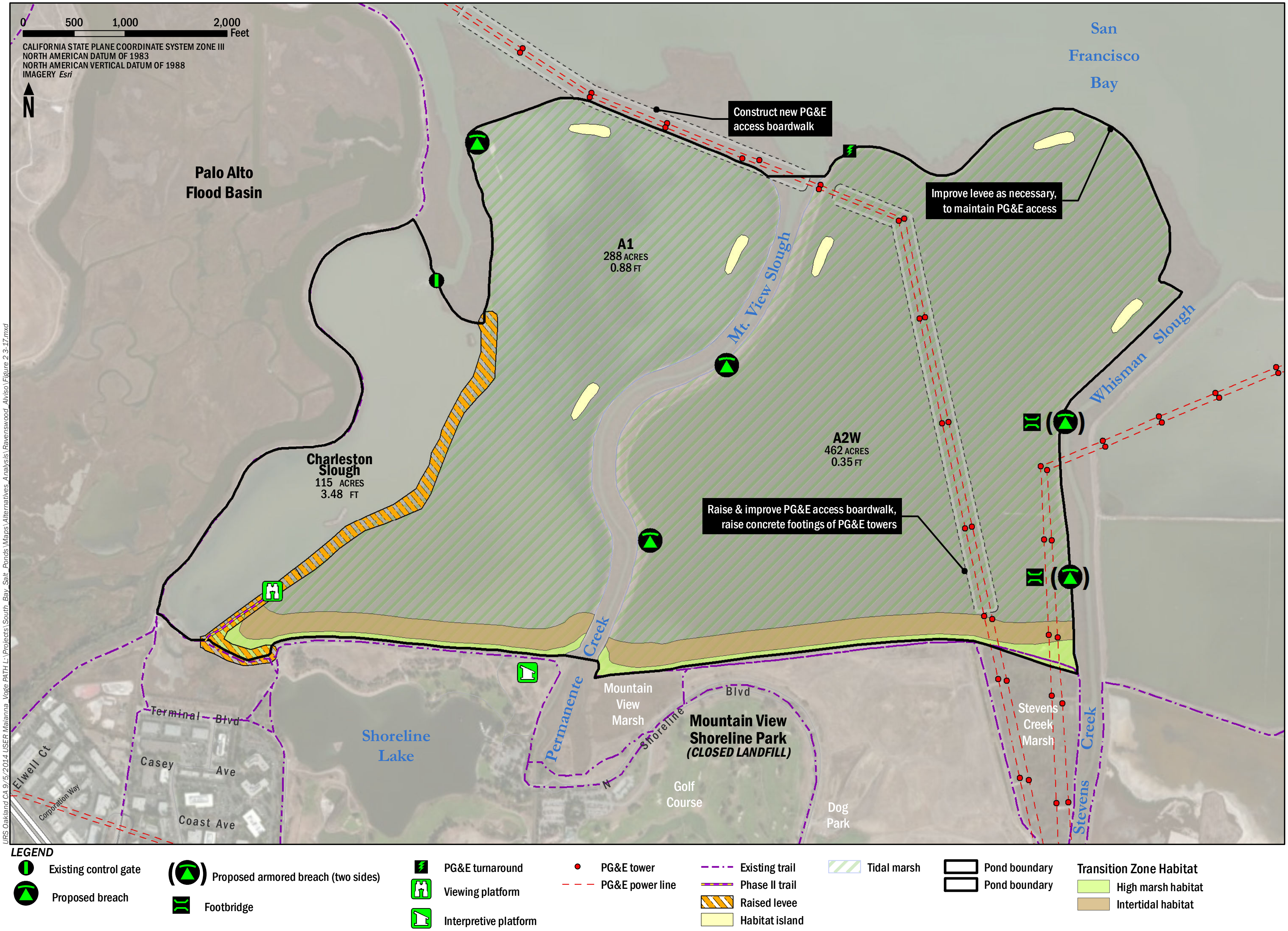
LEGEND

- Existing control gate
- PG&E turnaround
- PG&E tower
- PG&E power line
- Existing trail
- Pond boundary
- Pond boundary

URS
South Bay Salt Pond Restoration Project

Figure 2-7
Alternative Mountain View A



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South Bay Salt Pond Restoration Project

Figure 2-8
Alternative Mountain View B

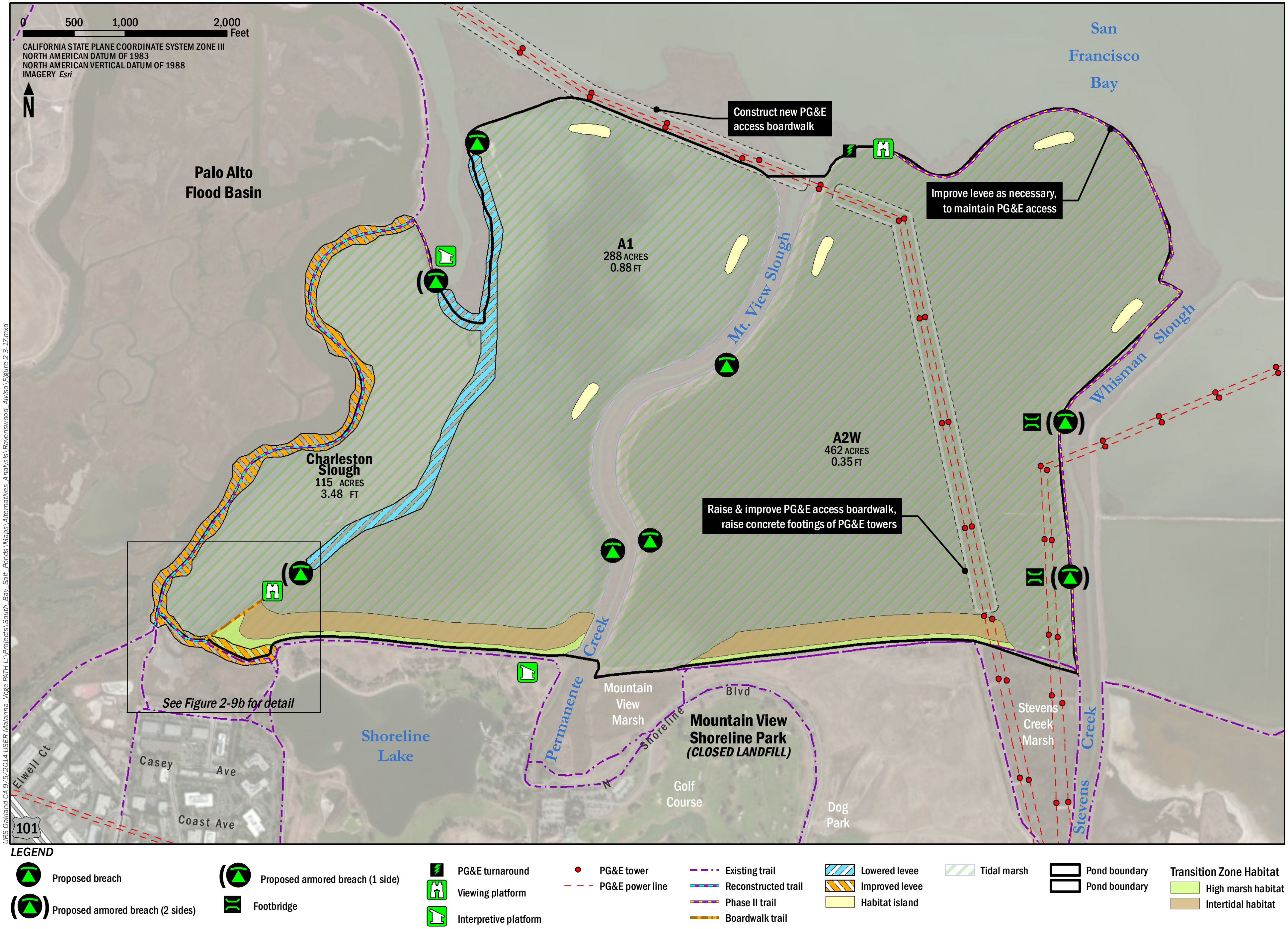

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Figure 2-9a
Alternative Mountain View C

URS Oakland CA 8/15/2014 USER Maianna_Voge PATH L:\Projects\South_Bay_Salt_Ponds\Maps\Alternatives_Analysis\EIR_EIS_Rav-Alviso_20130603\Figure 2-9b.mxd

LEGEND

- Existing pipeline
- Existing pipeline feature
- Proposed pipeline
- Proposed new feature

URS
South Bay Salt Pond Restoration Project

Figure 2-9b
Alternative Mountain View C - Detail

URS

Memorandu

Date: November 5, 2013

To: John Bourgeois, South Bay Salt Pond Restoration Project, and Raymond Wong, City of Mountain View

From: Phillip Mineart, URS Corporation

Subject: ***Revised - Impacts to Shoreline Park Sailing Lake Water Intake with Restoration of Charleston Slough and Pond A1***

The City of Mountain View withdraws water from the head of Charleston Slough to supply the sailing lake in Mountain View's Shoreline Park. The restoration of Charleston Slough and Pond A1 as part of the South Bay Salt Pond Restoration Project could potentially have an impact on the ability of the City to withdraw water of sufficient quantity and quality to supply the lake. This memo provides an estimate of the likelihood of such an impact. If the restoration does impact the ability of the pumps to withdraw water in sufficient quantity and quality to supply the sailing lake in Mountain View Park an alternative location near the breach between Pond A1 and Charleston Slough will be considered.

The City pumps water from Charleston Slough at a rate of about 7,000 to 9,000 gpm for about 13-15 hours per day (5.46 to 8.1 MGD) (PSD Shoreline Sailing Lake Fact Sheet). The invert of the intake to the pump station structure is at elevation -2.8 feet (all elevations are relative to NAVD88 datum). The minimum operating level is 2.6 feet (Drawing G-4, Shoreline Sailing Lake Water Supply Construction Project No. 06-30, 2007).

Figure 1 shows the layout for Alternative Mountain View C. The restoration of Pond A1 will involve three breaches, two of which could potentially impact the water levels in Charleston Slough. One breach will be located on the northwest corner of Pond A1 drawing water from the same channel that feeds Charleston Slough. Another breach will feed directly into Charleston Slough. The tide gate structure at the mouth of Charleston Slough will be removed. The hydrodynamic model for the Mountain View Ponds (A1 and A2W) was rerun for existing conditions and Alternative Mountain View C with the addition of the extraction of water from the head of Charleston Slough of 9,000 gpm for 24 hours a day. The model was based on LIDAR data taken at low tide. The channel invert in the model is about 1.5 near the pump, approximately 2 feet at the mid-point and near 0 near the tide gates. Figure 2 shows typical cross sections from the LIDAR data. Based on the shape of the cross-sections (bottom of channels are not flat) the LIDAR appear to capture most of the channel. The pumps shut off at elevation 2.6 feet, when the model would indicate 1.1 feet of water available to the pumps, therefore, the model should provide a reasonable estimate of when water is available to the pumps. .

Figures 3, 4 and 5 show water levels in the Slough near the intake, at about the midpoint, and near the tide gate structure. The points were selected at the location along the channel where water depths are deepest. The model results show that under restoration of Pond A1, Charleston Slough will drain more slowly and retain more water during low tides, especially in the northern portion of the slough. This is primarily due to the outflow from the northwest breach in Pond A1 (see Figure 1) which creates a backwater condition upstream of the breach and reduces the ability of Charleston Slough to drain. This leads to the conclusion that Alternative Mountain View C should not reduce the quantity of water available to the intake system.

The backwater effect of draining Pond A1 into the same channel that drains Charleston Slough will be have the greatest affect immediately after restoration. Overtime it is expected that the increased tidal prism draining through this channel due to the restoration of Pond A1 will enlarge the channel and allow better draining of Charleston Slough. Results assuming the channel incised up to a foot deeper is also included on Figures 3, 4, and 5. These results show that if the channel enlarges (due to increased tidal flows) the draining of Charleston Slough will return to its original condition. The results on the figures indicate improved drainage compared to the original condition but that may be more due to over enlarging the channel in the model analysis rather than what will actually occur.

Figures 6, 7, and 8 show modeled velocities at the same locations as those in Figures 3, 4, and 5. Positive velocities are out of Charleston Slough (ebb tide) and negative values are in (flood tide). The velocities are generally less than 1 foot/second, which is below the scour velocity for bay muds or sands.

Also, the velocity tends to be smaller under the proposed conditions due to the slower drainage. The reduction in velocities in Charleston Slough relative to existing conditions should reduce any scour that may occur and the amount of sediment transported by the tide. The lack of an increase in flow velocities leads to the conclusion that scour should not increase and that, therefore, the turbidity or total suspended solids (TSS) of the water passing near the intake pump should not increase relative to the water management regime. In Figure 6 the negative spikes in velocity are artifacts of the modeling. Since the withdrawal due to pumping occurs for 24 hours in the model the velocity spikes in value just before the area around the pump goes dry and just after it rewets. These values can be ignored.

The existing intake to Charleston Slough has historically had problems obtaining sufficient water due to sedimentation in the Slough. Prior to the pump upgrades after 2005 up to 0.23 feet/year of sedimentation was reported (RMC Alternatives Evaluation Report). The upgrades to the pump station allows for back flushing of the pump station to keep the intake and channel near the pump station clear of sediment. It is unclear if the new pump station has solved the water supply problem related to sedimentation. The restoration of the Pond A1, as discussed above, may initially reduce the tidal prism in Charleston Slough (i.e., smaller tidal range). The modeling discussed above indicated an average decrease of about 25%. However, the increased tidal prism in the outlet channel from Charleston Slough to the Bay should enlarge overtime eventually restoring Charleston Slough to a similar tidal condition as now.

An alternative to the existing location of the pump intake is to move it near the proposed breach between Pond A1 and Charleston Slough. This location should have more water available since a pump at this location could draw water from Pond A1 as well as Charleston Slough. An analysis of this location is not included in this memo because the analysis indicated that the problems associated with withdrawing water of sufficient quantity and quality from Charleston Slough should not get worse with the Pond A1 restoration, therefore, it is not recommended that the pump be moved to maintain the existing pumping capacity. Note, that this memo does not provide an analysis of the future viability of withdrawing water from Charleston Slough, it only discusses if the restoration would make the existing problems worse. The conversion of Charleston Slough to tidal marsh either alone or in conjunction with the conversion of Pond A1 to tidal marsh may adversely impact the long term viability of the sailing lake intake. If Pond A1 is restored it will provide an opportunity to the City to move the pump intake to extend the life of the intake.

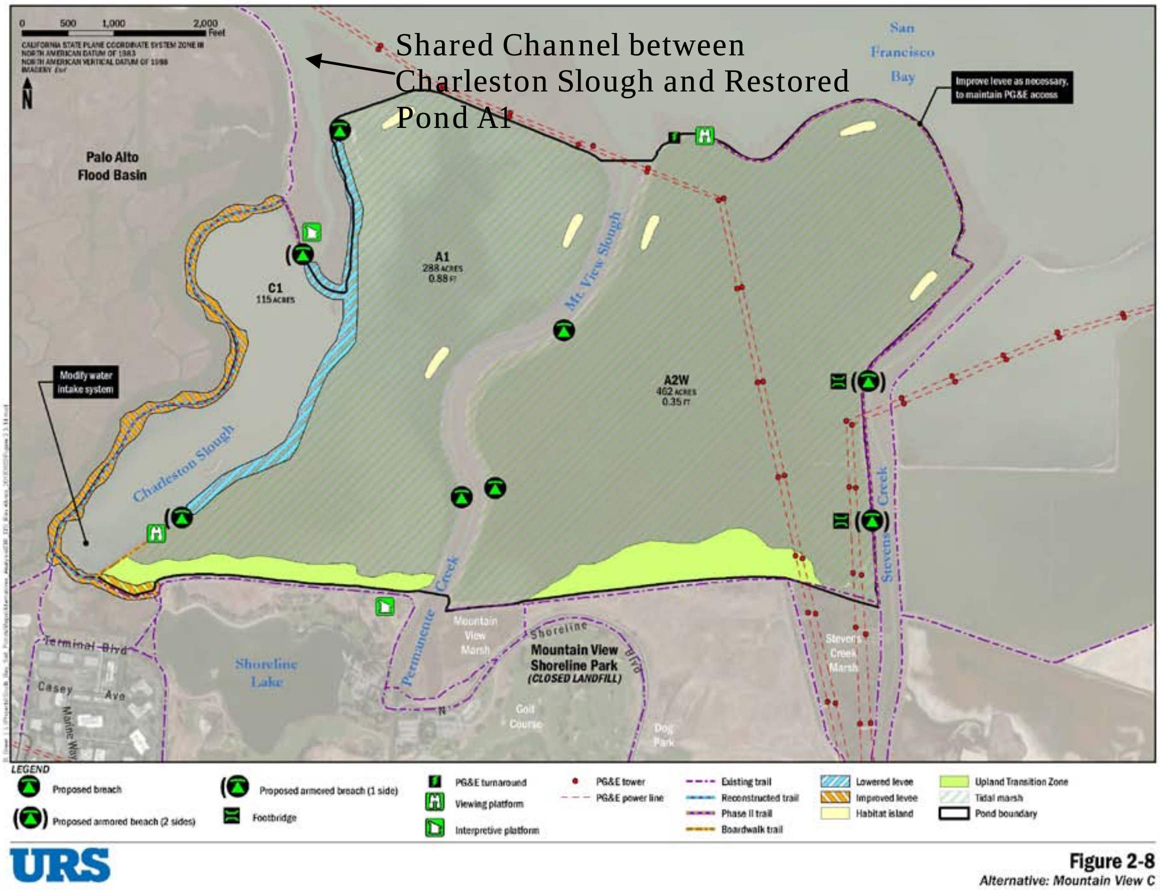


Figure 1. Potential Breach Locations for Alternative Mountain View C

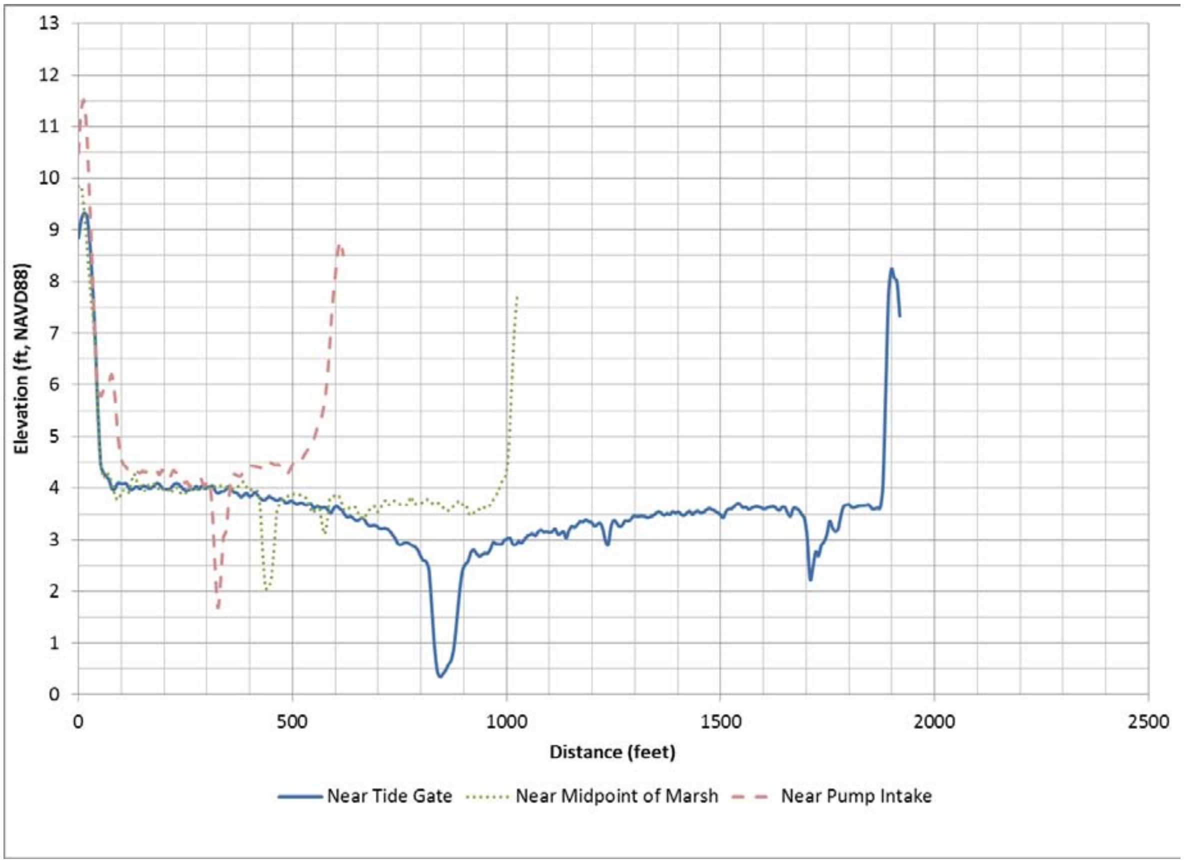


Figure 2. Typical Channel Cross-Sections in Charleston Slough Based on LIDAR data

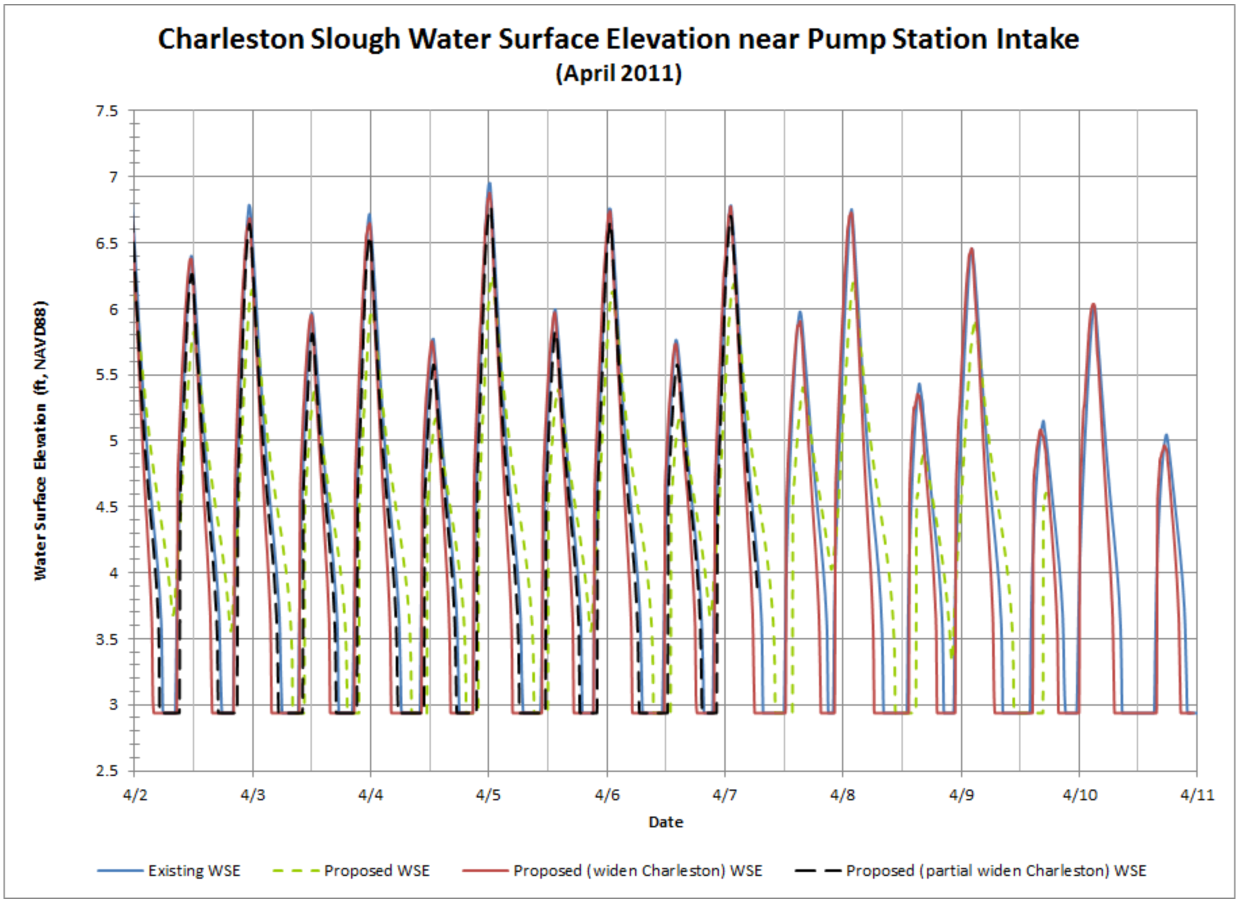


Figure 3. Charleston Slough Water Surface Elevation near Pump Station Intake (April 2011) Comparing Existing to Proposed Conditions including Possible Future Condition with Enlarged Outlet Channel

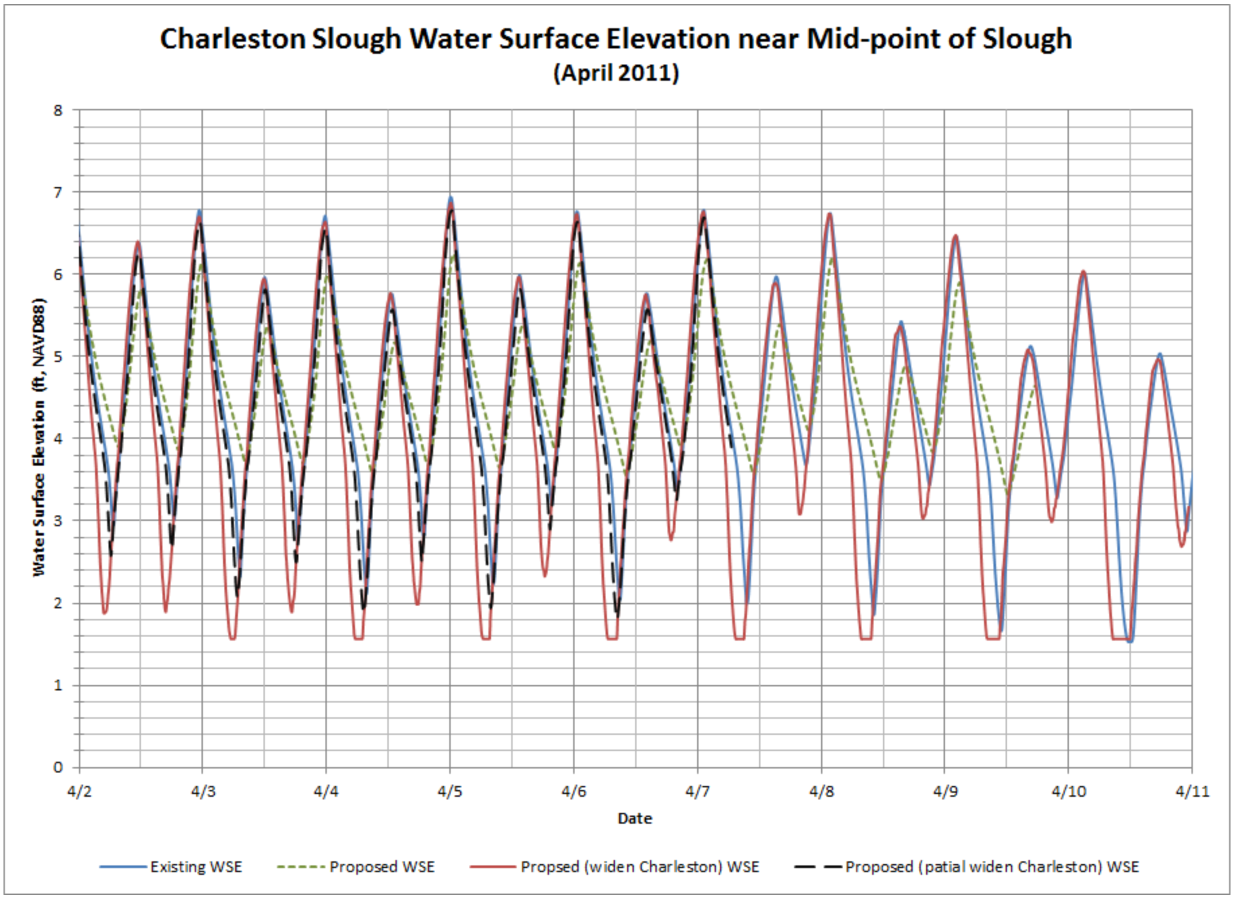


Figure 4. Charleston Slough Water Surface Elevation near Mid-point of Slough (April 2011) Comparing Existing to Proposed Conditions including Possible Future Condition with Enlarged Outlet Channel

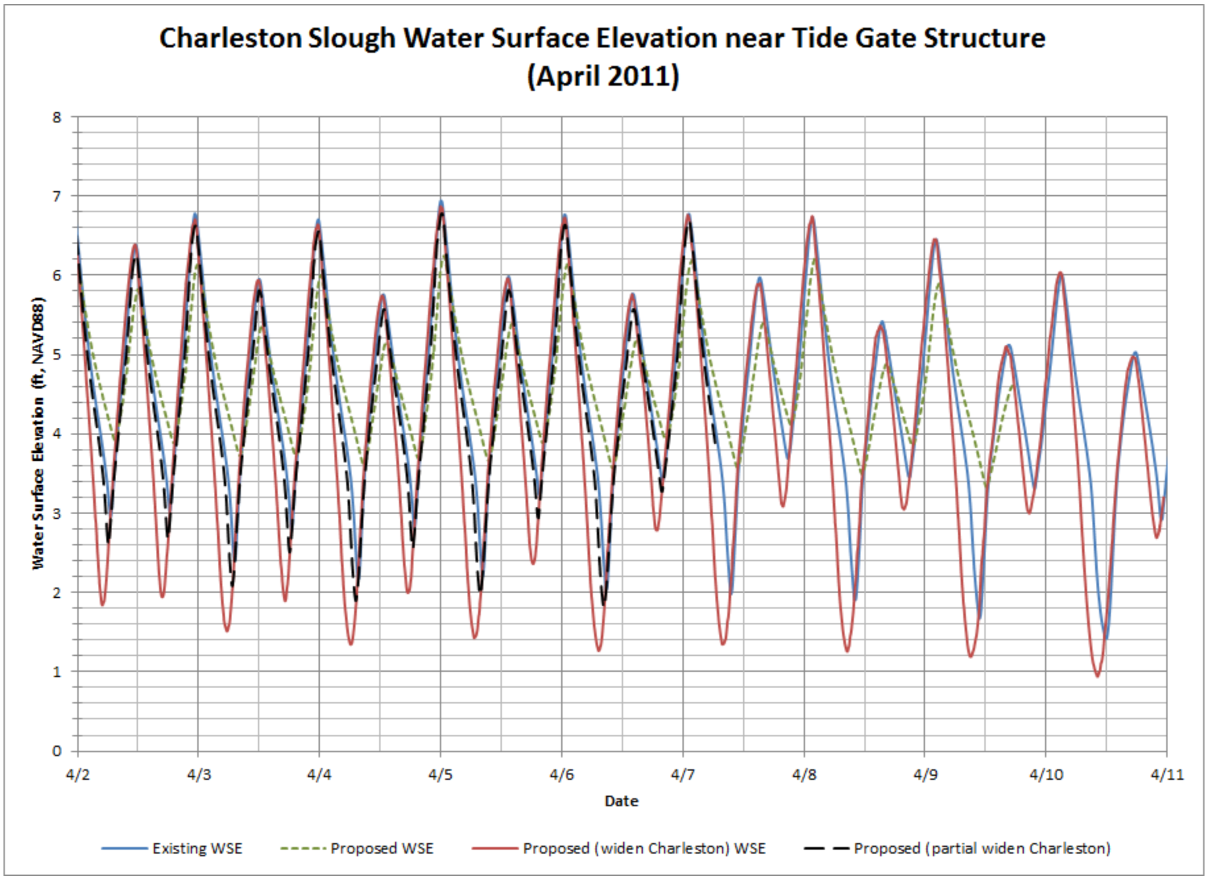


Figure 5. Charleston Slough Water Surface Elevation near Tide Gate Structure (April 2011) Comparing Existing to Proposed Conditions including Possible Future Condition with Enlarged Outlet Channel

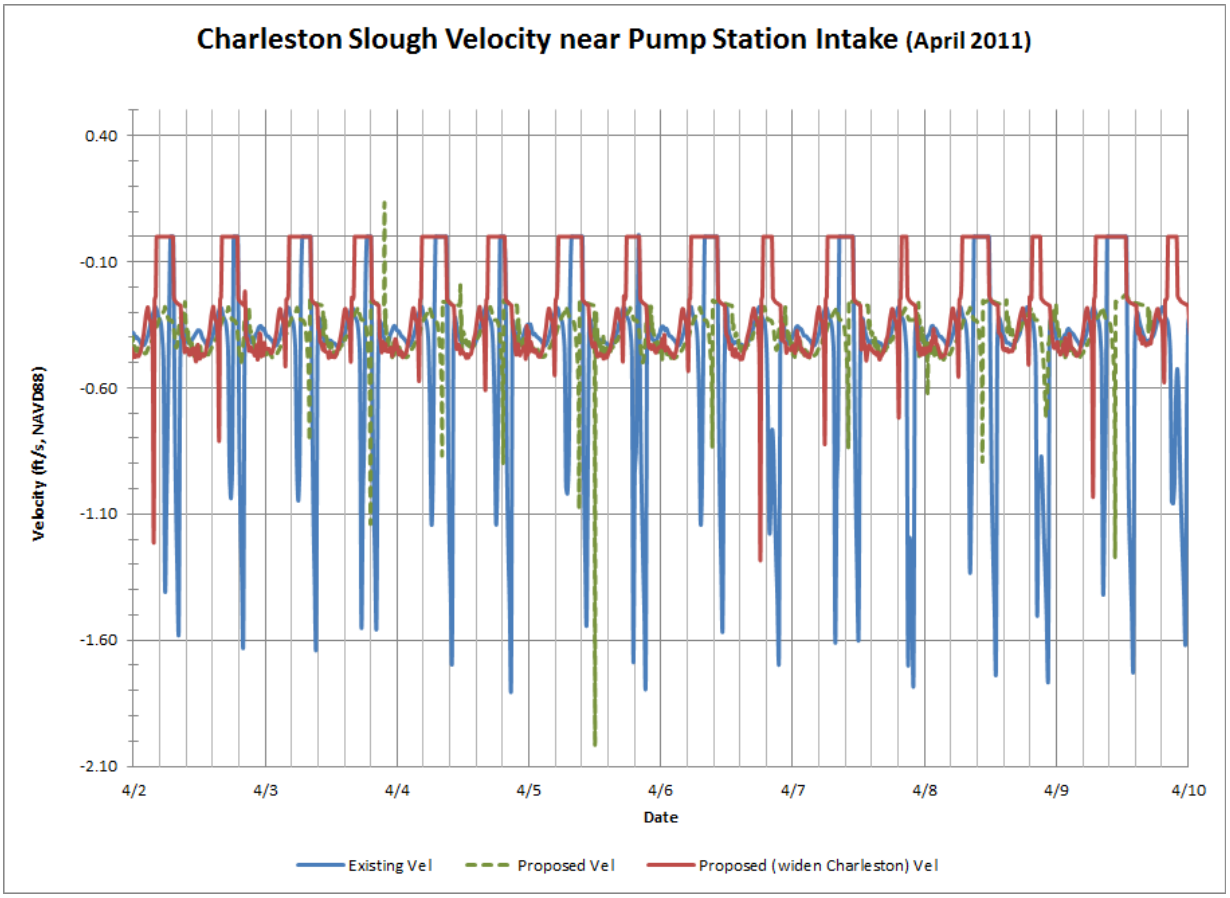


Figure 6. Charleston Slough Velocity near Pump Station Intake (April 2011) Comparing Existing to Proposed Conditions

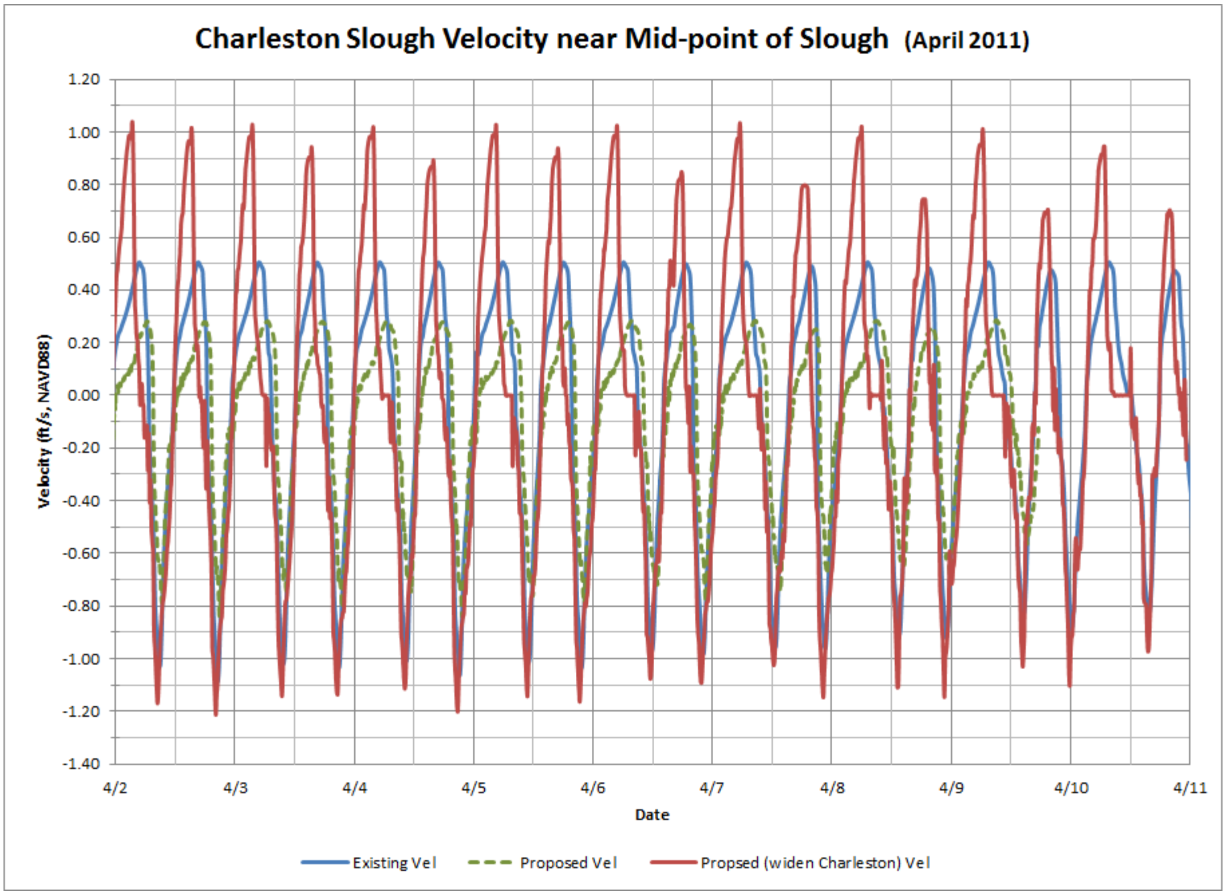


Figure 7. Charleston Slough Velocity near Pump Station Intake (April 2011) Comparing Existing to Proposed Conditions

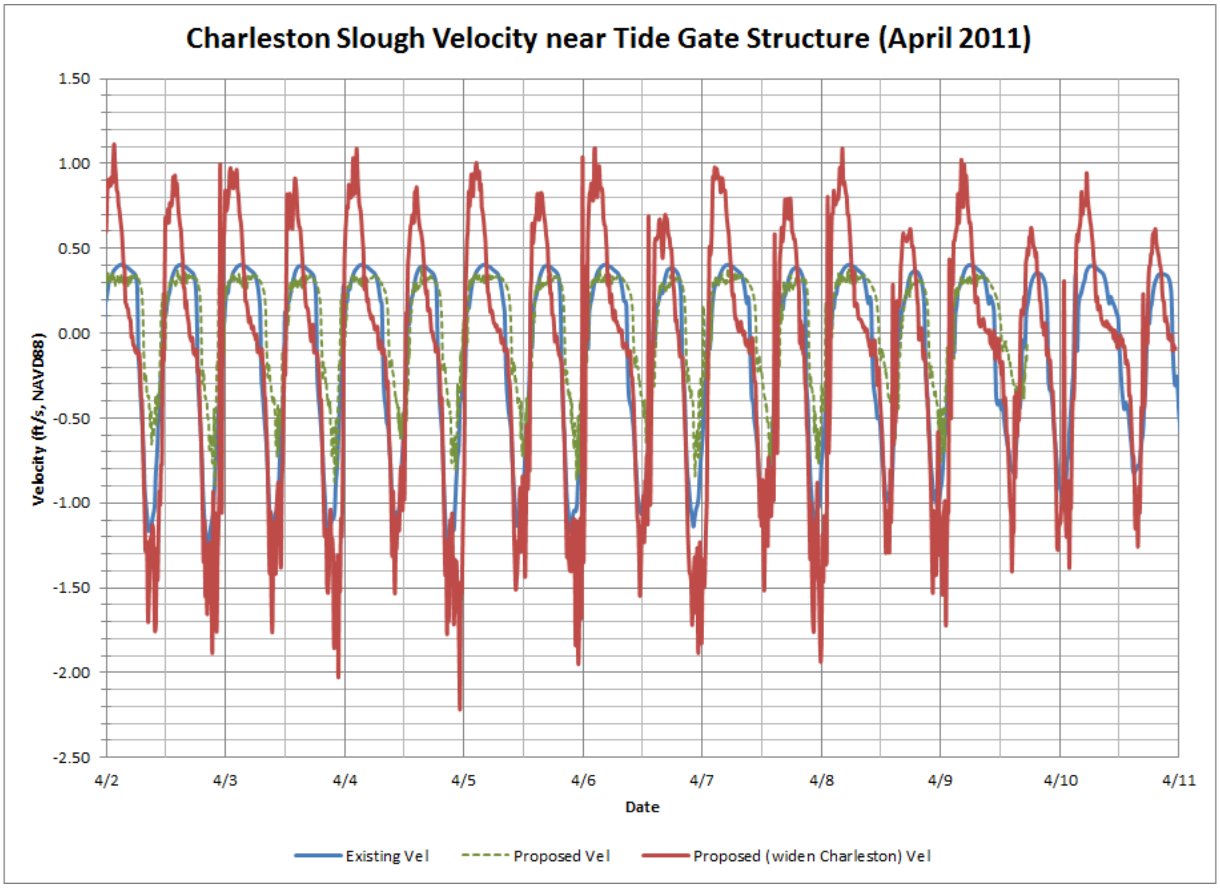


Figure 8. Charleston Slough Velocity near Tide Gate Structure (April 2011) Comparing Existing to Proposed Conditions

URS

Memorandu

Date: February 5, 2014

To: John Bourgeois, South Bay Salt Pond Restoration Project, and Raymond Wong, City of Mountain View

From: Phillip Mineart and Snow Deng, URS Corporation

Subject *Revised - Impacts from Restoration of Charleston Slough and Pond A1*

This memorandum is a supplement to the previous memorandum sent to Raymond Wong, City of Mountain View, on November 5th, 2013 and the response to comments on that memo provided on November 14, 2013. This supplement is intended to answer or address three questions or issues in those documents:

1. Assess the flood risk to the Palo Alto Flood Basin (PAFB) and the City of Mountain View and assess whether any improvements to the existing conditions are needed.
2. Project the Charleston Slough tidal marsh establishment as it would be influenced by a combination of tide gate removal, Pond A1 levee breach, future outer Charleston Slough channel widening, and the new tidal cycle and inundation regime in Charleston Slough.
3. Project the fate of the existing Shoreline Park sailing lake water intake and pump station, and discuss the proposed concept to relocate the intake to Pond A1 levee breach and armor the breach.

1. FLOOD RISK TO PAFB AND CITY OF MOUNTAIN VIEW

The previous memorandum and correspondence presented results of the restoration for "typical" conditions in the Mountain View area, but not for extreme conditions, such as a 100-year tidal flow event. Model simulations were conducted assuming 100-year event tidal conditions in South San Francisco Bay. Figure 1 shows different tidal datums at the San Francisco tide gauge (Station 9414290[1]). At San Francisco, the 100-year tidal elevation is 1.63 meters (5.35 ft) above mean sea level (MSL). At San Francisco MSL is 3.18 feet above the NAVD88 datum[2] resulting in a 100-year tidal elevation of 8.53 feet NAVD88.

Figure 2 shows the peak annual tide at San Francisco from 1900 to 2013. Also included on the figure are the NOAA estimate of the 100-year tide at San Francisco and the URS (2011) estimate from the San Francisco Sea Level Rise Study. The January 1983 high tide exceeds the NOAA 100-year tide estimate and is about 0.8 feet below the URS (2011) estimate. For purposes of estimating the flood risk to the PAFB, the 1983 event was assumed to be representative of a 100-year event. The hydrograph from this event was obtained from the National Oceanic and Atmospheric Administration (NOAA) for a period of three days, including the peak tidal elevation of the storm. It should be noted that the annual peak tide level has been increasing since the year 1900, implying that the 100-year tide level may also be increasing.

The tidal elevations and range in the South Bay are higher than at San Francisco, and, since there was no measured data for the 1983 event in the South Bay, the tide obtained from NOAA at San Francisco must be adjusted to use for the Palo Alto Flood Basin analysis. A simple adjustment was used to correct the tide based on the tidal datums at San Francisco and the Coyote Creek tide gage (used to represent the South Bay). Figure 3 shows the relationship between tidal datums at San Francisco and at the Coyote Creek gage. This relationship

[1] http://tidesandcurrents.noaa.gov/est/est_station.shtml?stnid=9414290
[2] http://tidesandcurrents.noaa.gov/datums.html?id=9414290

was used to convert the measured data at San Francisco to a predicted hydrograph in the South Bay for use in the PAFB analysis. The 100-year water level from the Phase I EIR/EIS (EDAW 2007) was included on the figure for comparison. This comparison indicates that the relationship may over-predict the 100-year event based on the Phase I EIR/S estimate.

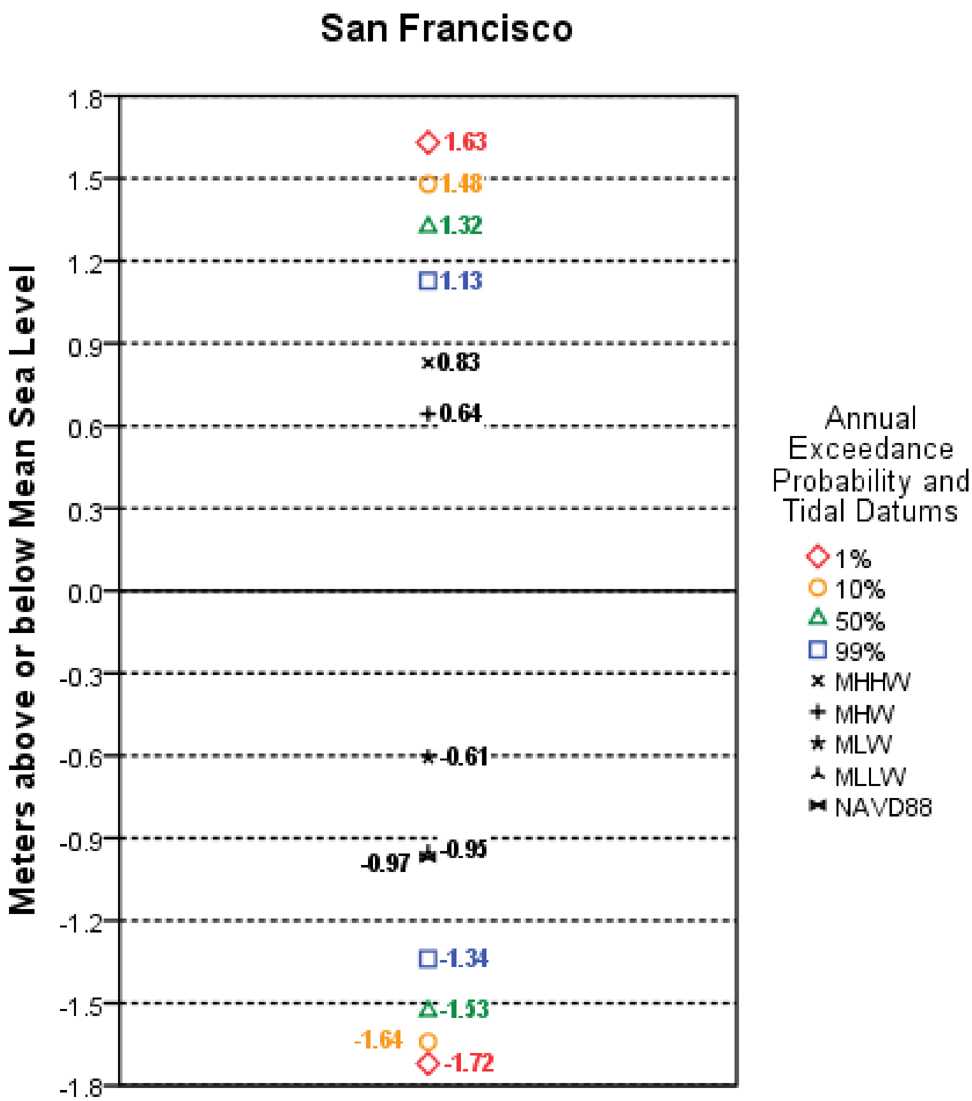


Figure 1. Tidal Datums and Extreme Water Levels at the San Francisco Tide Gauge (from http://tidesandcurrents.noaa.gov/est/est_station.shtml?stnid=9414290)

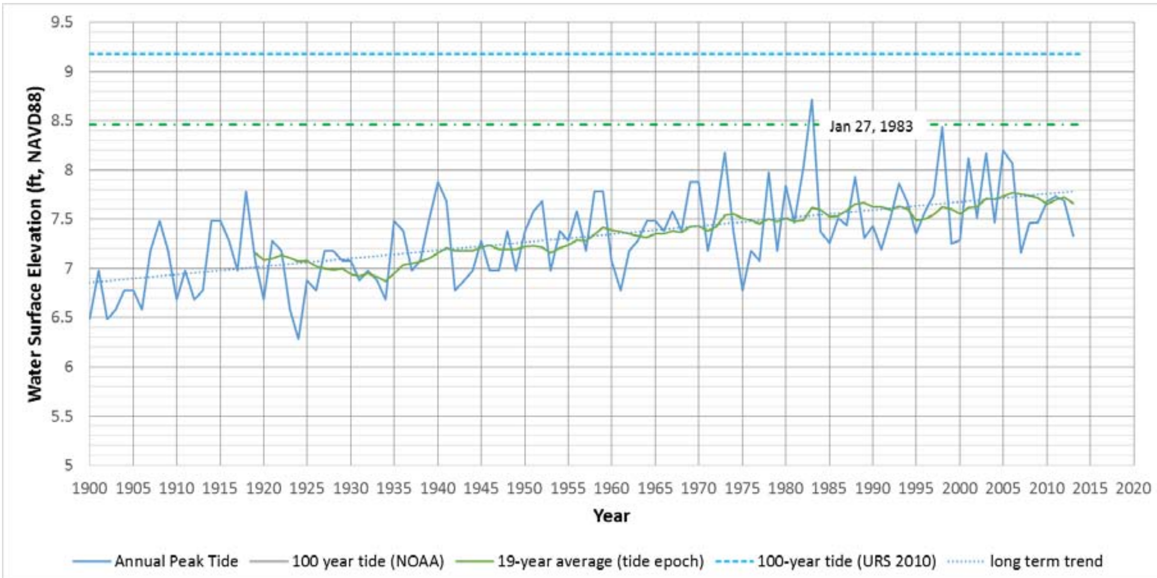


Figure 2. Annual Peak Water Surface Elevations (tidal elevations) at San Francisco

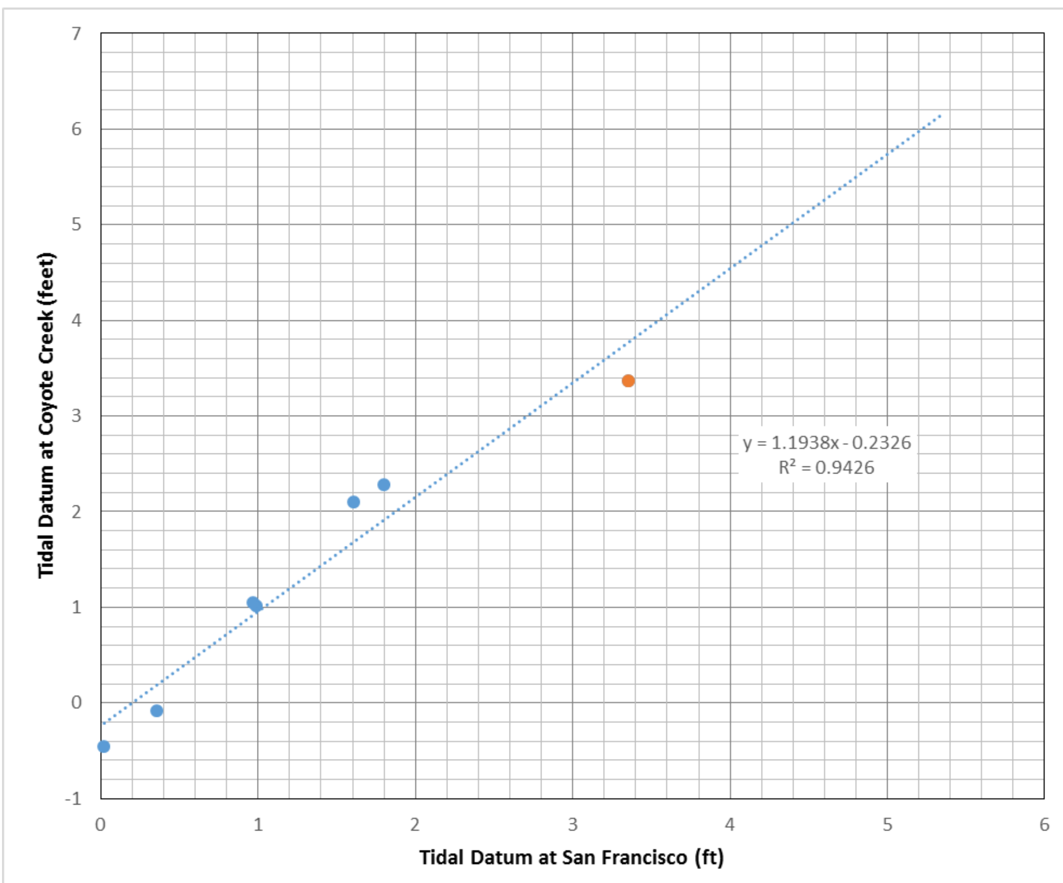


Figure 3. Comparison between Tidal Datums at San Francisco and Coyote Creek gages used to Adjust San Francisco 100-year Storm Event to South Bay Storm Event

Figure 4 shows a profile of elevations along the west Charleston Slough levee (the levee between Charleston Slough and the PAFB) and a portion of the PAFB levee that is facing the bay and external to Charleston Slough. The dashed vertical line marks the location of the levee constructed to contain the tide gates and that separates "inner Charleston Slough" from "outer Charleston Slough." Clearly, most of west levee of Charleston Slough is lower than the FEMA 100-year flood elevation, as is some of the PAFB levee.

Figure 5 shows the predicted water levels in Charleston Slough for the 100-year event and a more "typical" tidal condition. The peak water levels during the 100-year event exceed the average elevation of the Charleston Slough levee. Therefore, although the Charleston Slough levee is sufficient for typical tidal conditions, if an extreme event such as a 100-year event were to occur after restoration of Charleston Slough and Pond A1, there could be significant overtopping of the levee. This is a different finding than those for the normal tidal cycle analysis presented in the November memorandum.

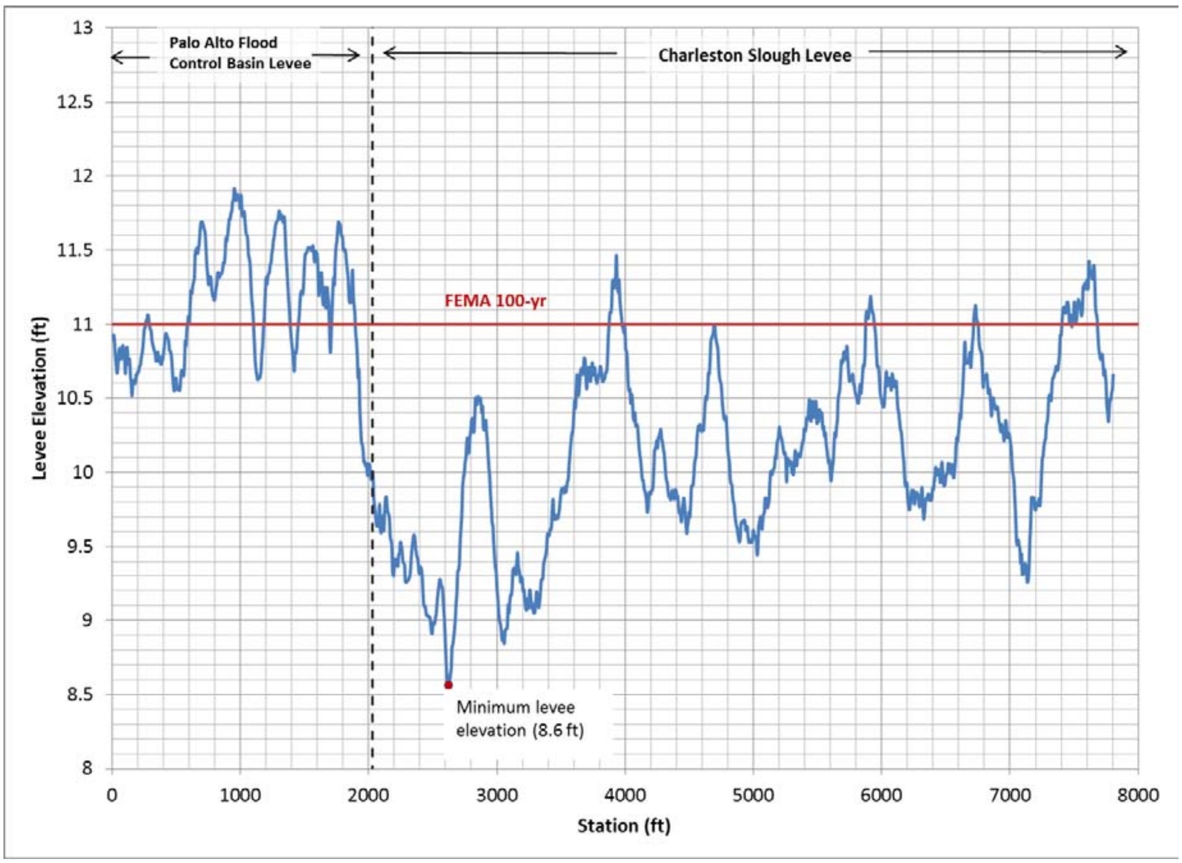


Figure 4. Elevation Profile along Charleston Slough's West Levee and a portion of the Palo Alto Flood Basin Levee.

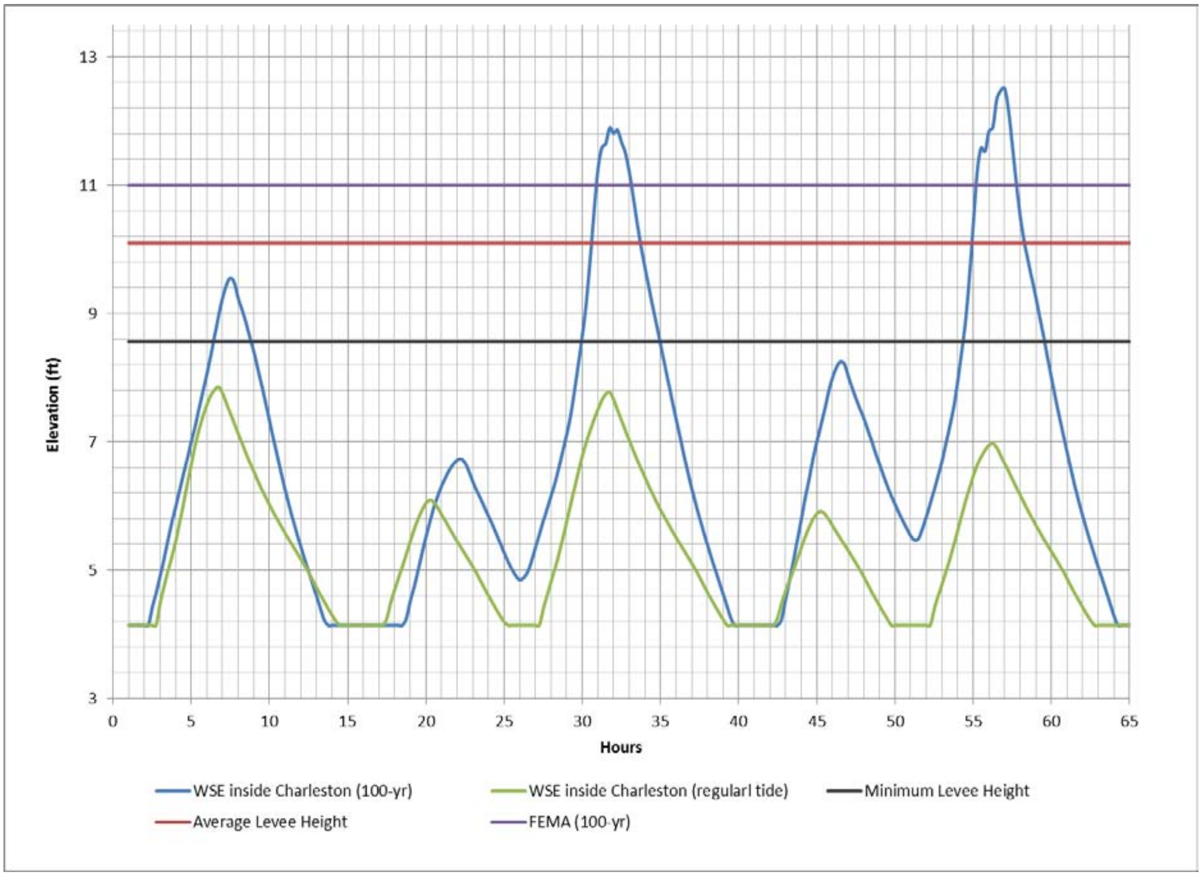


Figure 5. Predicted Water Levels in Charleston Slough during a 100-year Event

2. CHARLESTON SLOUGH TIDAL MARSH ESTABLISHMENT UNDER PROPOSED CONDITIONS

Charleston Slough behaves as an intertidal mudflat, though the establishment of vegetation is the desired condition. A typical mudflat is exposed twice a day during the low tides. In the bay, mud flats are generally located below mean tide level (the average elevation of Charleston Slough). If the pond bottom in Charleston Slough is exposed more than about 50% of the time it may develop into a tidal marsh since vegetation may be able to root and survive the shallower and shorter tidal inundation. If the pond bottom is submerged most of the time, it will continue to resemble shallow subtidal habitat or mudflat habitat and is less likely to become vegetated. Thus, the hydroperiod, the time the pond is inundated, can have a significant effect on the type of habitat that develops in a former pond.

The hydroperiod for the scenarios simulated is summarized in Table 1. The results for three points are shown; one near the south end, one near the middle, and one near the north end of the slough. The percent inundation indicates how long that part of Charleston Slough is inundated. For vegetation growth, the pond should be inundated less than about 50% of the time. Under existing conditions, the pond bottom is inundated from about 60% to almost 80% of the time. Under these conditions vegetation growth is inhibited. As the pond continues to accumulate sediment, the period of inundation will decrease.

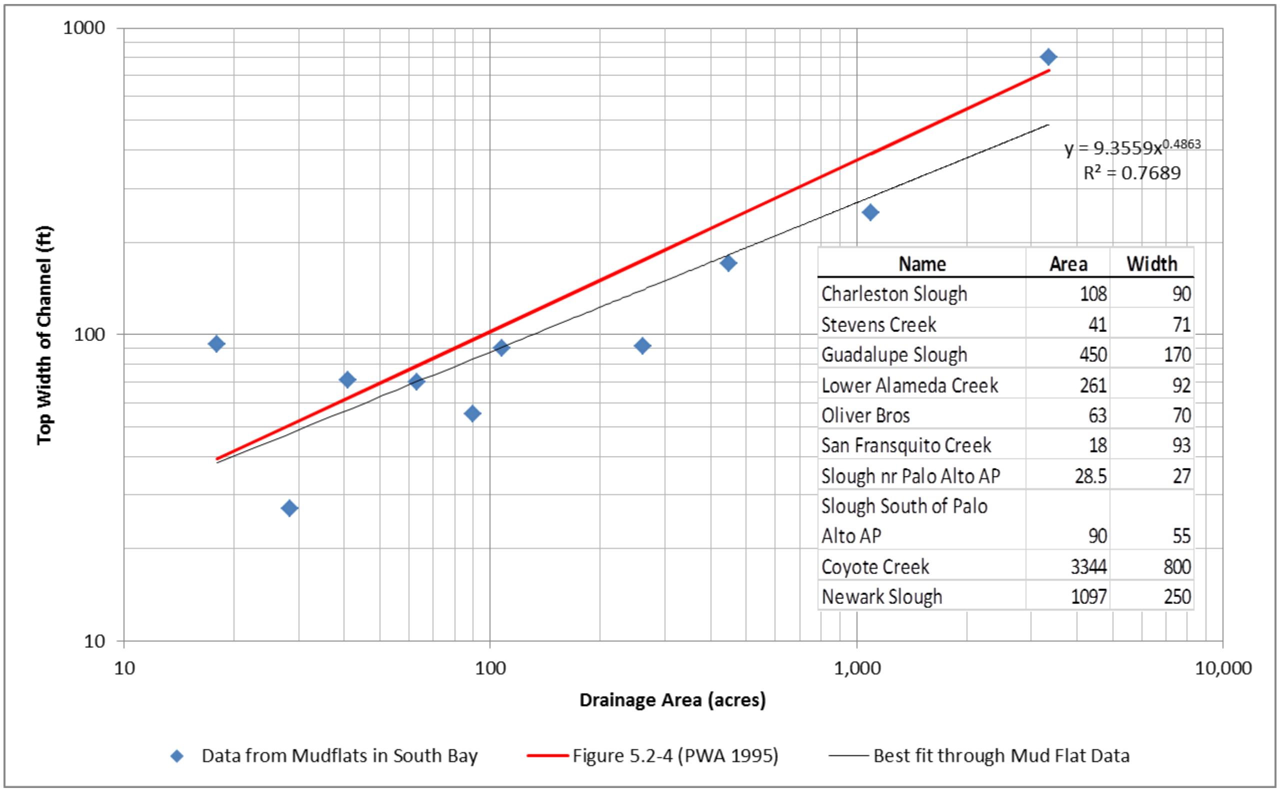
Under proposed conditions, the tide gate is removed and Pond A1 is restored. As discussed in the Memorandum to Raymond Wong (dated November 5, 2013, attached), and the response to comments (dated November 14, 2013, attached), the proposed restoration of Pond A1 results in a backwater of Charleston Slough drainage, which increases the period of inundation. Initially, this effect will inhibit the formation of tidal marsh within the slough.

However, the flow through the existing Charleston Slough channel will increase after the restoration of Pond A1 and Charleston Slough, which would eventually result in an enlargement of the channel draining Charleston Slough. This will reduce the backwater effects of Pond A1 and allow better drainage of Charleston Slough itself. The results presented in Table 1 show that the percent of time the pond bottom is inundated will decrease to about 50% of the time at the southern end of the pond and less than 70% at the northern end. This is an improvement over existing conditions and should accelerate the conversion of Charleston Slough to a vegetated tidal marsh.

Table 1. Hydroperiod of Charleston Slough for Different Restoration Scenarios (% of time inundated)

Scenario	South	Middle	North
Existing	62.4%	83.7%	84.3%
Proposed	72.8%	99.3%	96.9%
Proposed with Channel Enlargement	51.3%	69.9%	63.8%

The hydroperiod of Charleston Slough was estimated using the DHI MIKE21 model (DHI, 2011) with bathymetry based upon the existing measurements. The channels found in the existing bathymetry data are based on existing tidal prisms. Figure 6 shows the relationship between basin or wetland area and the top width of the channel draining the wetland. The data shown on the figure were measured from images from aerial imagery (available on GoogleMaps ™) taken at a very low tide. For comparison, the top width from Philip Williams and Associates (PWA 1995) for tidal sloughs is included on the figure. The channel draining Charleston Slough in the model was enlarged to be consistent with the results shown in Figure 6. The channel was increased in depth to 2 feet below MLLW between Charleston Slough and the breach between it and Pond A1, and to 3 feet below MLLW from the breach through the mudflat.



Name	Area	Width
Charleston Slough	108	90
Stevens Creek	41	71
Guadalupe Slough	450	170
Lower Alameda Creek	261	92
Oliver Bros	63	70
San Fransquito Creek	18	93
Slough nr Palo Alto AP	28.5	27
Slough South of Palo Alto AP	90	55
Coyote Creek	3344	800
Newark Slough	1097	250

Figure 6. Relationship between Channel Top Width and Drainage Area

3. FATE OF SAILING LAKE PUMP STATION INTAKE AND POSSIBLE RELOCATION

The existing Shoreline Park sailing lake pump station is located at the southern end of Charleston Slough, adjacent to the Coast Casey Forebay. At this location, the pump is subject to sedimentation under the existing conditions and in the conditions proposed under the South Bay Salt Pond Restoration Project.

Moving the pump intake to a location associated with the proposed breach location between Pond A1 and Charleston Slough may increase the long-term usability of the intake and pump. To address this question, model simulations were conducted with the pump intake located in the breach. The pump was assumed to withdraw 20 cfs for 24 hours. This is greater than the actual pumping rate under the current configurations. The average flow through the breach was predicted to be about 10 times the sailing lake intake pumping rate, with peak flows almost 100 times greater. Velocities in the breach (assumed to be 100 feet wide) averaged about 1 ft/s, with peak flows about 3 ft/s. Sediment could potentially settle in the breach during slack tide, but the peak velocities should be sufficient to prevent significant accumulation. Model simulations indicated that the breach would only seldom go dry, but that will depend upon the depth the breach is dredged to. Model simulations assumed the breach was dredged to an elevation just below MLLW. Dredging it to an even lower elevation could further reduce the likelihood of it going dry.

References

DHI. 2011. MIKE21 Flow Model Hydrodynamic Module Users Guide.

EDAW, Philip Williams and Associates Ltd, H.T. Harvey and Associates, Brown and Caldwell, and Geomatrix. 2007. South Bay Salt Pond Restoration Project. Final Environmental Impact Statement/ Report. Submitted to: U.S. Fish and Wildlife Service and California Department of Fish and Game.

PWA, Joy B. Zedler, Denise Reed, and William Lettis and Associates. 1995. Design Guidelines for Tidal Channels in Coastal Wetlands. Prepared for the U.S. Army Corps of Engineers Waterways Experiment Station.

URS, 2011. Sea Level Rise and Adaptation Study, Coastal Inundation Report. Prepared for the Port of San Francisco.

URS

Memorandum

Date: September 8, 2014

To: David Halsing

From: Sherry Liu, Rajendram Arulnathan

Subject: Conceptual Design for Improvement of Portions of Charleston Slough and Coast Casey Forebay Levees

1.0 Introduction

This memorandum presents a conceptual level design of levee improvements for approximately 7,000 linear feet of Charleston Slough west levee and approximately 1,000 linear feet of levee north of Coast Casey Forebay. This conceptual design is performed as part of the South Bay Salt Pond Restoration Project's Phase 2 work at the Alviso-Mountain View Ponds. This memorandum is prepared to facilitate a preliminary assessment of environmental impacts from construction of proposed improvements for Phase 2 EIS/R and to provide a basis for final design.

2.0 Available Data

2.1 Topography Data

We reviewed available existing topographic and geotechnical data to facilitate the engineering analysis for the conceptual design. Table 1 presents average values for levee crest elevation, height, width, and side slopes along both levees. It also presents the mean higher high water (MHHW) and 100-year flood water surface elevations (WSE).

Table 1. Existing Levee Detail for Charleston Slough and Coast Casey

	Charleston Slough west levee	Coast Casey Forebay levee
Average levee crest elevation (feet)[1]	10	11
Average levee height (feet)	6	7
Crest width (feet)	20-50	
Landside slope ratio (H:V)	5:1 to 8:1	
Waterside slope ratio (H:V)	8:1 to 10:1	
MHHW (feet) [1]	7.5	
100-year WSE (feet) [1]	11	

[1]Datum: NAVD88

2.2 Geotechnical data

As part of the South San Francisco Bay Shoreline Study by U.S. Army Corps of Engineers (USACE), subsurface investigations were performed by others for the Alviso complex pond levees (Figure 1). Figure 2 shows available borings and cone penetration test (CPT) locations along both Charleston Slough's levees and the levee north of Coast Casey Forebay. A total of three borings, one each on

Charleston Slough west and east levees and one on Coast Casey Forebay's north levee are reviewed for this design. The borings encountered fill, young Bay Mud (YBM), Old Bay Mud (OBM), and Alluvium. The thickness of YBM along Charleston Slough west levee ranges from 10 to 20 feet. The thickness of YBM encountered in boring i20a which is located on Coast Casey north levee is approximately 8 feet. YBM is described in logs as soft, fat clay becoming firmer with depth containing varying amount of organic matters.

It was judged that available data is adequate for the permitting level of design. However, for purposes of FEMA certification additional geotechnical data should be collected during final design (before the 100% design is complete) along both Charleston Slough west levee and Coast Casey north levee to verify the subsurface conditions.

3.0 Preliminary Design

The proposed levee improvement is to raise the levee to meet the crest elevation criterion.

3.1 Design Criterion

The levee design criterion used for selecting the crest elevation for the conceptual design is called "Low Sea Level Rise (SLR) Plus". There are two SLR scenarios considered for the CIP project: Low SLR and High SLR. The Low and High SLR scenarios consider SLR of 8-inches and 31-inches, respectively, in the next 50 years. The Low SLR Plus criterion was developed to be easily adaptable for future levee raises. The criterion calls for a levee crest elevation sufficient to provide protection against floods with a 1% annual probability of occurrence (here after referred to as 100-year flood in this memorandum) flood protection under low SLR scenario but with a broader base sized for a high SLR scenario. For the Charleston slough west and Coast Casey Forebay north levees, the proposed crest elevation to meet this design criterion is 14.0 feet (Datum: NAVD88).

3.2 Levee Raise Design Components

The levee raise will consist of placing additional fill on existing crest and on landside slope. The placement of fill would result in consolidation of underlying soft YBM. Slope stability analysis was performed to assess whether a stability berm would be required to provide required stability after placement of fill. Additionally, consolidation settlement analysis was performed to estimate the volume of additional fill. The levee crest will include a 4-inch thick crushed gravel to provide all-weather access on the reconstructed trail. To be compliant with the ADA Accessible Routes requirement, a ramp will be constructed with a running slope not steeper than 1: 20 (ADA Standards, 2010) near the pump house.

3.3 Engineering Analysis

Material Properties

The material properties for the analysis were selected based on available laboratory data, published correlations, and our experience with similar soils. The key soil parameter for the stability analysis is the shear strength of the YBM. The shear strength parameters for the YBM were developed using limited available data and published correlation proposed by Bonaparte (1979). The effective friction angle for the levee fill was developed based on recorded standard penetration test (SPT) blow counts. The material properties used in the analyses are presented in Table 2.

Table 2. Summary of Soil Property for Slope Stability Analysis

Soil Layer	Unit Weight (pcf)	Effective Stress Parameters		Undrained Shear Strength Parameters	
		Cohesion (psf)	Friction (Degrees)	S_u/σ_v'	Minimum Su (psf)
Levee Fill (CL/SC)	125	0	30	-	-
YBM (CH)	94	-	-	0.34	300
OBM (CL/SC)	125	-	-	0.35	700

The additional fill is assumed to be compacted to 90% to 95% of maximum dry density as measured using ASTM D1557. The lower compaction effort was proposed if available levee fill material is only lean clay. The effective stress parameters for the compacted fill were assumed to be cohesion of 100 psf and friction angle of 31 degrees.

Analysis Section

The slope stability analysis was performed for the improved (raised) levee conditions. A typical cross section was developed based on available topography and geotechnical data as shown in Figure 3. For developing the typical cross section, average values were selected for representing the conditions (both geometric and subsurface) along the Charleston Slough west and Coast Casey north levees. The typical cross section includes 8 feet of levee fill underlain by 12 feet of YBM. Underlying the YBM layer is medium stiff to stiff Old Bay Mud (OBM). Figure 4 shows the analysis section with proposed levee raise. The raised levee crest elevation is 16 feet and crest width is 36 feet. The slopes on landside and water side (above MHHW line) are 4:1.

Slope Stability Analysis

The slope stability analyses were performed using the computer program Slope/W (Geo-Slope Internationals, 2007). The slope stability analysis was performed assuming steady-state conditions for two analysis water surface elevations: MHHW and 100-year flood elevation. The calculated minimum factors of safety for both analysis water surface elevations are summarized in Table 3. Figure 5 shows the calculated factors of safety for the 100-year flood water surface elevation. The minimum acceptable factor of safety for long term steady-state conditions per FEMA guidelines (44 CFR 65.10) is 1.4. Therefore, the calculated factors of safety for raised levee conditions are acceptable. However, it is important to perform additional analyses during final design to estimate the safe fill thickness to construct in each phase of the construction. The levee raise may need to be constructed in stages to avoid bearing failure of YBM as a result of rapid loading. The details regarding staged construction will be finalized during final design.

Table 3. Summary of Calculated Minimum factors of Safety

Analysis Conditions	Minimum Calculated Factors of Safety	
	waterside	landside
MHHW	2.2	1.5
100-year flood	2.60	1.43

Settlement Analysis

A consolidation settlement analysis was performed to estimate the new levee fill-induced settlement of YBM. Both the rate and the amount of settlement are important for the design. We performed 1-dimensional consolidation settlement analyses at two points: one beneath center of new levee crest, and one beneath the landside slope. The results show that the maximum settlement is approximately 1.5 feet. This amount of settlement will occur over several years after the placement of levee fill.

3.3 Modified Levee Section

The proposed levee improvement will consists of placing compacted engineering fill on crest and both sides of levee as depicted in Figure 4. The results from our preliminary analysis indicate the raised levee will be stable. Therefore, our conceptual level design does not include stability berm. However, as we discussed above, during final design the proposed improvement will be revisited with additional data. For the cost estimation purposes, we assumed that levees will be over-built to accommodate the consolidation settlement.

3.4 Preliminary Construction Cost Estimate

Table 3 contains preliminary cost estimates for the Low SLR Plus design option along Charleston Slough west levee and Coast Casey Forebay north levee. Quantities were measured manually from the drawings of designed cross section in AutoCAD Civil3D. The levee raise is up to 4 feet along Charleston Slough west levee and up to 3 feet along Coast Casey Forebay north levee. Earthwork quantities were typically calculated by considering existing terrain and proposed ground surfaces. This approach for estimating quantities is judged adequate for the preliminary cost estimates. For the case of new levee fill quantities, estimates for overbuilt conditions also presented as a separate line item. The key assumptions made for each line item are presented in as notes below Table 3. Unit costs were developed based on combination of previous, similar URS project experience, and the R.S. Means estimate guide.

Table 3. Cost Estimate for Charleston Slough West and Coast Casey North Forebay Levee Improvement

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Engineered Levee Fill	155,000	CY	$18.00	$2,790,000
2	Stripping	15	ACRE	$3,500.00	$52,500
3	Hydroseeding	10	ACRE	$4,000.00	$40,000
4	Aggregate base levee road (Coast Casey Forebay)	1,200	TON	$40.00	$48,000
5	Rock Slope Protection	11,000	TON	$62.00	$682,000
Total without overbuilt for settlement					$3,612,500
Total with overbuilt for settlement					$5,300,000

Notes:

1. Engineered fill includes quantities estimates for new levee fill material for raising and widening levee and ADA –complaint accessible ramp. The ramp width was assumed to be 20 feet (same as existing crest width) at the entrance area.
2. It was assumed that both hydro-seeding and aggregate base road will be used for levee reach along Coast Casey north.
3. Rock slope protection is provided only for erosion control.
4. Earthwork quantities for overbuilt was estimated using limited consolidation analysis. A conservative estimate was used considering the maximum potential settlement. These quantities will be further refined during final design.

4.0 References

AMEC Geomatrix, Inc. 2009. Draft Geotechnical Study. South Bay Salt Pond Restoration Project.

Bonaparte R. and Mitchell J. K., 1979. The properties of San Francisco Bay Mud at Hamilton Air Force Base, California.

City of Mountain View, CIP 12-48, 2012. Shoreline Regional Park Community, Sea Level Rise Study, Feasibility Report and Capital Improvement Program.

USGS 2010. U.S. Geological Survey. San Francisco Coastal LiDAR Project.

URS

Memorandu

Date: November 5, 2013

To: David Halsing, URS Corporation, Project Manager for South Bay Salt Pond Restoration Project

From: Jenn Hyman, P.E., URS Corporation

Subject: ***Impacts on City of Mountain View Sailing Lake Pump Station and Public Viewing Platform from Raising the Coast Casey Forebay Levee***

1.0 BACKGROUND

The City of Mountain View seeks to raise the approximately 1000-ft of levee north of the Coast Casey Pump Station and along the alignment of their Sailing Lake Pump station and pipeline, as shown in Figure 1. Among the three proposed levee remediation approaches for Charleston Slough in *Sea Level Rise Study, Feasibility Report and Capital Improvement Program*, prepared by City of Mountain View, the option of Low Sea Level Rise (SLR) crest elevation 'Plus' is preferred. This option is defined as follows: Build a levee with the 16.0 ft NAVD88 cross section but without the top 2 ft such that it has the base of the high SLR cross section but the crest elevation of the low SLR projection. This design levee height satisfies the FEMA design criteria of 100-year flood level plus 3 ft. Therefore the final height of the levee in this phase of work is 14.0 ft NAVD88.

A typical cross section for the conceptual design of the raised levee is shown below in Figure 1. The toe of the fill for the new levee facing Charleston Slough goes down to an elevation 7.5 ft. The new levee is about 40 ft across at the top, and has an overall footprint width along the levee of just over 100 ft.

Raising the levee will impact a number of structures in the levee owned by the City of Mountain View. Figure 1 below shows the approximate area where fill will be placed to raise the Coast Casey Forebay Levee, plus the general location of structures impacted. This section presents a conceptual design for how these structures will be raised up to accommodate the higher Coast Casey Forebay Levee.

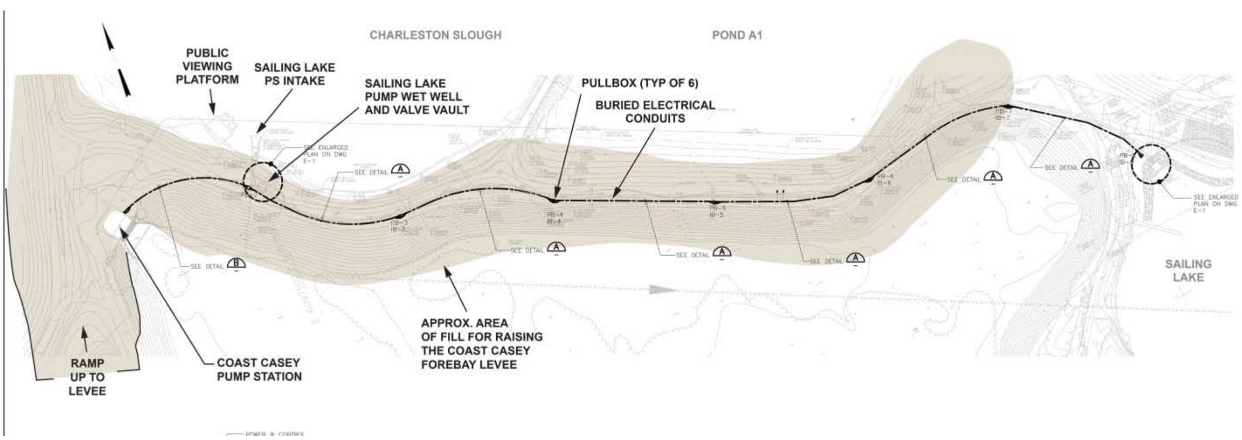


Figure 1. Approximate Area and Locations of City of Mountain View Structures Impacted by raising the Coast Casey Forebay Levee

2.0 CONCEPTUAL DESIGN

The structures in the Coast Casey Forebay Levee will need to be raised or protected in some fashion as a result of raising the levee to an elevation of 14.0 ft as described above. Table 1 below lists the structures affected, estimates the amount of raising needed, and briefly describes the conceptual design approach for that item. More detailed explanations of these conceptual designs are provided below.

Table 1. List of Structures Affected by Raising the Coast Casey levee

Structure	Estimate of Current Top Elevation	Estimate of Final Top Elevation	Conceptual Design Approach
Electrical Pull Box PB-2*	10	14	Install (N) manhole over PB
Electrical Pull Boxes PB-3 and IB-3*	10.8	14	Install (N) manhole over each PB
Electrical Pull Boxes PB-4 and IB-4*	11.2	14	Install (N) manhole over each PB
Electrical Pull Boxes PB-5 and IB-5*	11	14	Install (N) manhole over each PB
Electrical Pull Boxes PB-6 and IB-6*	11	14	Install (N) manhole over each PB
Electrical Pull Boxes PB-7 and IB-7*	11.6	14	Install (N) manhole over each PB
Sailing Lake Pump Station (wet well and pump)	10.5	16	Install (N) access vault around top of pump barrel and piping. Raise air valve and pump vents above grade.
Sailing Lake Pump Station valve vault	11.0	14	Raise vault lid and ladder rungs for entry
Sailing Lake Pump Station Intake Retaining wall	8.5	9.5	Raise/extend concrete retaining wall
Public Viewing Platform at the south end of Charleston Slough	8	14	Remove (E) platform and construct with (N) foundation, taller support pilings, and elevated walkway from trail on raised levee.
Coast Casey Stormwater Pump Station	8	?	Install (N) retaining wall around PS to hold back ramp up to levee
Minor facilities on/near the levee such as fences and paving	10	14	Minor facilities such as fences and paving will need to be replaced.

*Pull box IDs are from drawing E-3 of the Shoreline Sailing Lake Water Supply Construction Record Drawings by RMC dated 8/15/05.

It is assumed the following structures can remain in place:

- The water pipelines associated with the Sailing Lake water supply pump station
- The electrical conduits associated with the Sailing Lake water supply pump station
- The Coast Casey Stormwater Pump Station

2.1 RAISING PULLBOX LIDS

There are 2 types of electrical pull poxes at the site: a “power and control pullbox” that is 24” x 24” x 18” deep and an “instrument pullbox” that is 18” x 18” x 12” deep. Except for at PB-2, there is one of each next to each other at each location. Access to the pull boxes will likely be preserved in the new higher levee by excavating around the boxes after the levee is raised, and installing a new standard 36” precast sewer manhole over the pullbox. A small area between the bottom of the new manhole and around the top of the existing pullbox top will need to be filled in with some concrete poured in place, as shown in Figure 2. The new manholes will be at least 3 ft in diameter, which will allow a worker to climb in to access the pull boxes. If the two pullboxes are close together, one large precast manhole of a larger inside diameter may be able to be placed around both.

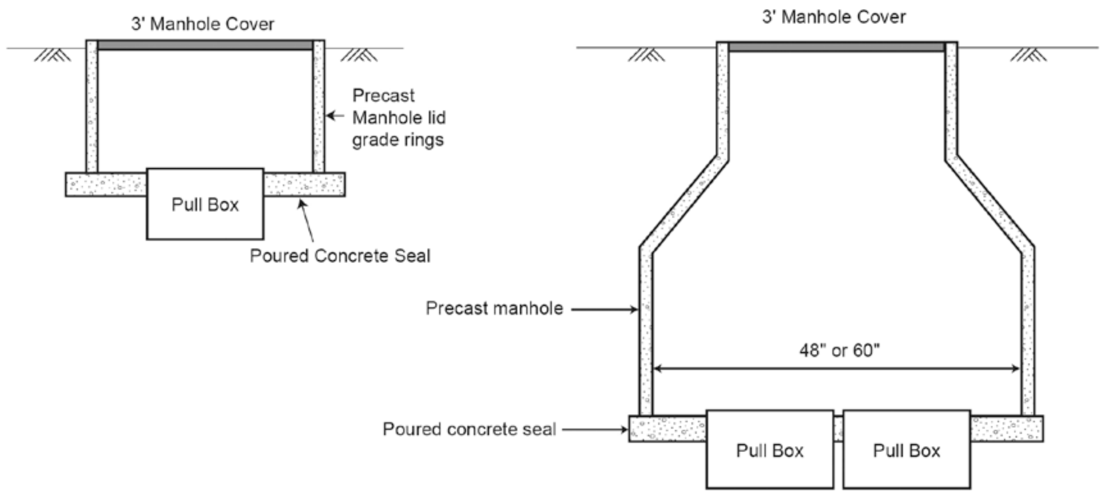


Figure 2. Schematic of Conceptual Design Approach to Raising the Pullbox Lids (Single and Double Arrangements).

2.2 SAILING LAKE PUMP STATION WET WELL AND PUMP

A photo of this structure is provided in Figure 3 and a section drawing is shown in Figure 4. The wet well and pump are located off to the side of the top of the new raised levee, out of the way of vehicles and foot traffic. Therefore it is recommended that final grade for the wet well be the ultimate final future grade of the project, which for this feature is about 16 ft. As a result the structure will be about 2 feet above final grade unless or until the levee is raised to 16 ft.

Since the check valve will need to be accessed for maintenance in the future, and since raising the level of the pump discharge piping could affect the hydraulics of the pump, it is recommended to not raise these structures. Instead it is recommended that a new vault be poured in place around these structures, with the top of the vault at about 6 inches above finished grade. The most practical layout of a new vault would have walls enclosing the wet well, check valve and the elbow immediately after the check valve. The vault would likely have interior dimensions of approximately 24 ft x 12 ft and be 6 ft deep. It would have 2 vault hatches, one over the pump end and one over the other end for staff access for maintenance. A metal ladder will be installed along the wall and a sump pump will be added at the floor of the vault. Electrical junction boxes will be raised up above grade with conduits extended and cables spliced as necessary. The 2-inch air valve and gooseneck vent will be raised above grade.

A structural engineer will design the vault as well as a foundation to support the heavy vault so it does not settle. It may be practical to construct the vault prior to performing the earthwork in this area to raise the levee.

The vault will be quite large inside to accommodate all the components. It will be a confined space and will require special monitoring and training certification for City staff to enter.

Figure 3. Photo of the Sailing Lake Pump Station Wet Well with the Valve Vault in the background to the right.

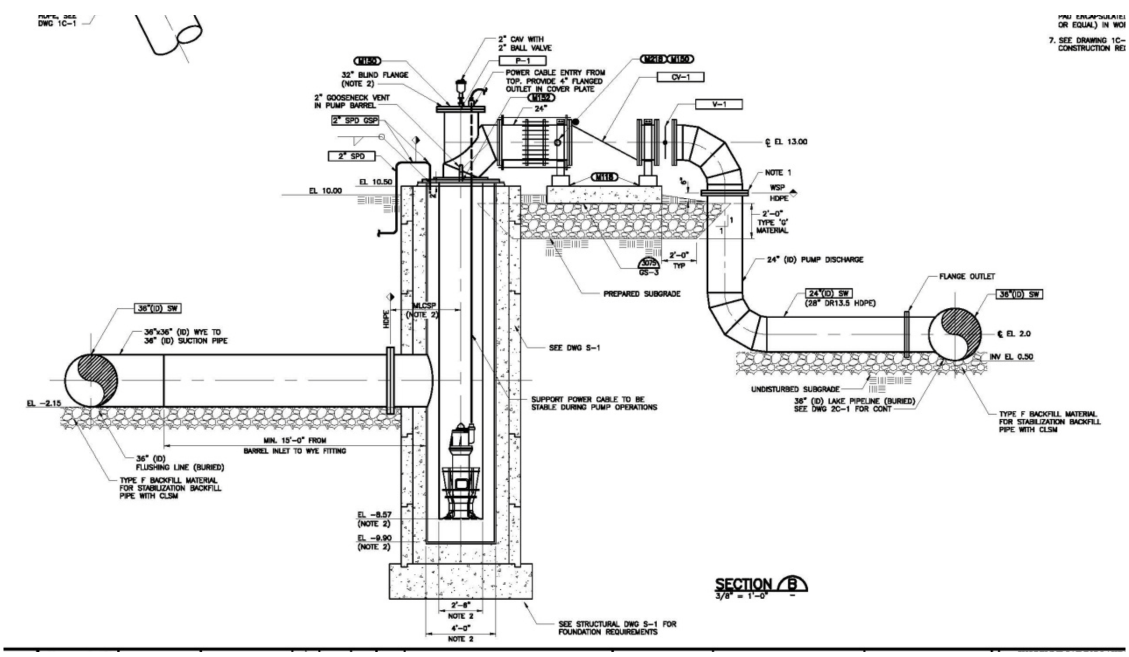


Figure 4. Section drawing of the Sailing Lake Pump Station Wet Well (RMC 2007)

2.3 RAISING THE SAILING LAKE PUMP STATION VALVE VAULT

The valve vault can be seen behind and to the right of the Sailing Lake Pump Station Wet Well in Figure 3 and a section drawing is provided in Figure 5. Raising the valve vault structure will involve removing the top of the vault, adding a poured-in-place concrete extension to the sides of the vault to bring it up to the new grade, pouring a new top with a new hatch, and extending the ladder up the new vault wall extension. Electrical equipment may need to be moved to a higher elevation to be above the flood plain.

A structural engineer will design the vault extension. It may be practical to construct the vault prior to performing the earthwork in this area to raise the levee. The extension of this vault should be constructed in conjunction with the new vault for the wet well (described above).

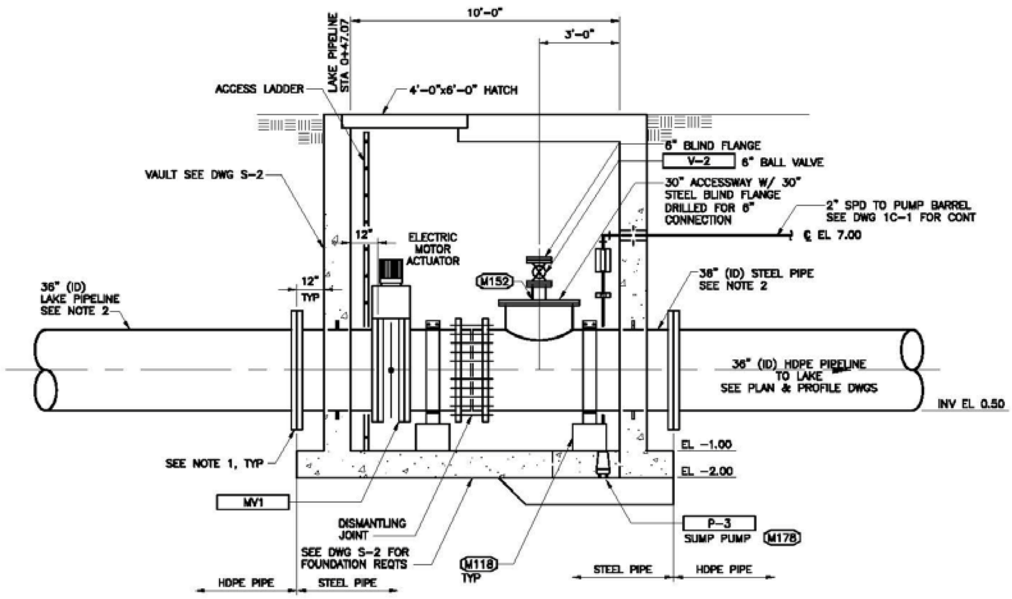


Figure 5. Section drawing of the Sailing Lake Pump Station Valve Vault (RMC 2007)

2.4 RAISING THE SAILING LAKE PUMP STATION WATER INTAKE RETAINING WALL

A photo of the Sailing Lake Pump Station's water intake is provided in Figure 6. The fill needed to raise the levee will begin very close to the top of the concrete retaining wall around the intake, which the RMC record drawings show is around 8 ft in elevation. It is likely the top of the retaining wall will need to be raised about 1-2 ft. The railing will need to be removed first and a wall extension poured in place and doweled into the existing wall. Then the railing will be replaced on top of the new higher wall. The City may elect to extend the wood-supported gravel stairs adjacent to the intake up to the top of the levee for worker safety.

Figure 6. Photo of the Sailing Lake Pump Station's Water Intake

2.5 RAISING THE PUBLIC VIEWING PLATFORM

A photo of the Public Viewing Platform is provided in Figure 7. Design drawings for the platform have not been made available to URS. The platform appears to be made of stained pressure-treated wood with poured concrete footings in the water. The platform will need to be raised not just to meet the new higher levee top elevation of 14 ft, but also because opening up Charleston Slough to the tides will increase water levels at the platform above its current elevation of 8 ft.

Figure 8 shows a sketch of a proposed section of the raised platform. It will consist of a square platform at about the same location as it is currently but installed on a new wooden support structure on the existing concrete footing. A walkway will connect the platform to the top of the levee, which will need a timber platform on new concrete footings. A safety railing will surround the platform and walkway.

If the existing wood planks are in good shape the City may elect to reuse them, since we understand the platform is not very old (assumed 5-10 years). In a worst-case scenario, the entire structure including the concrete supports will need to be replaced.

Figure 7. Photo of the Public Viewing Platform

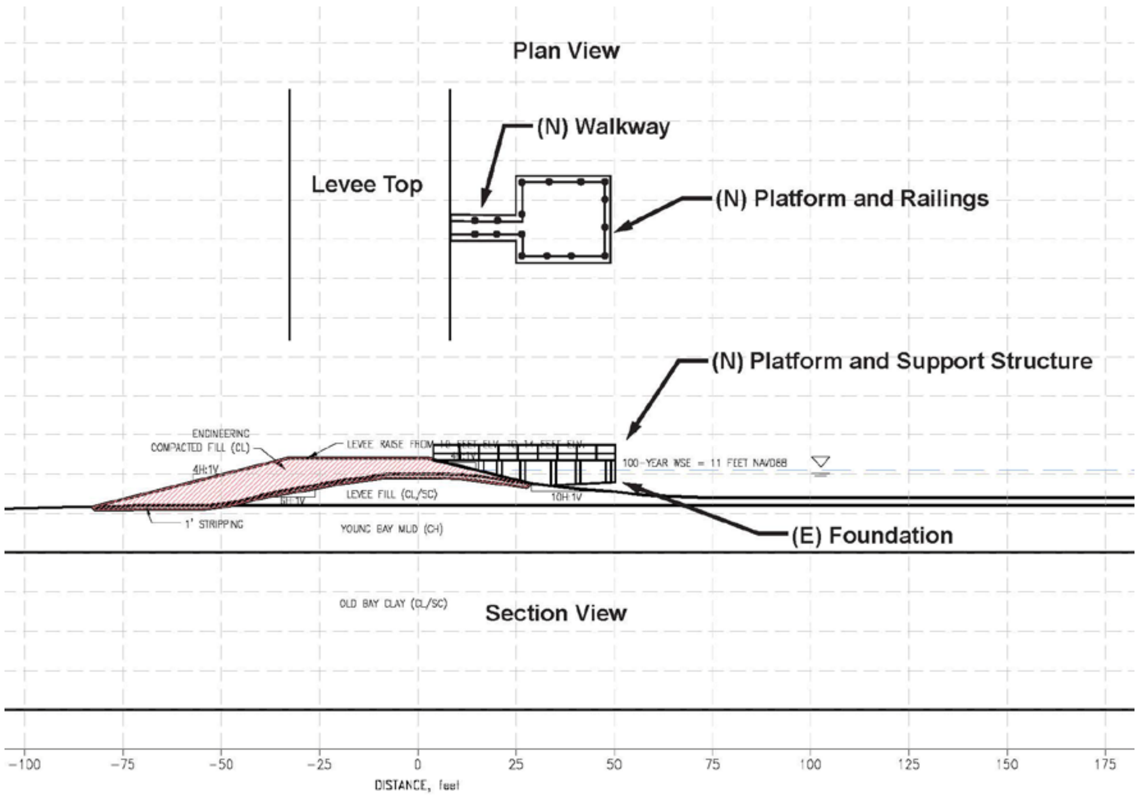


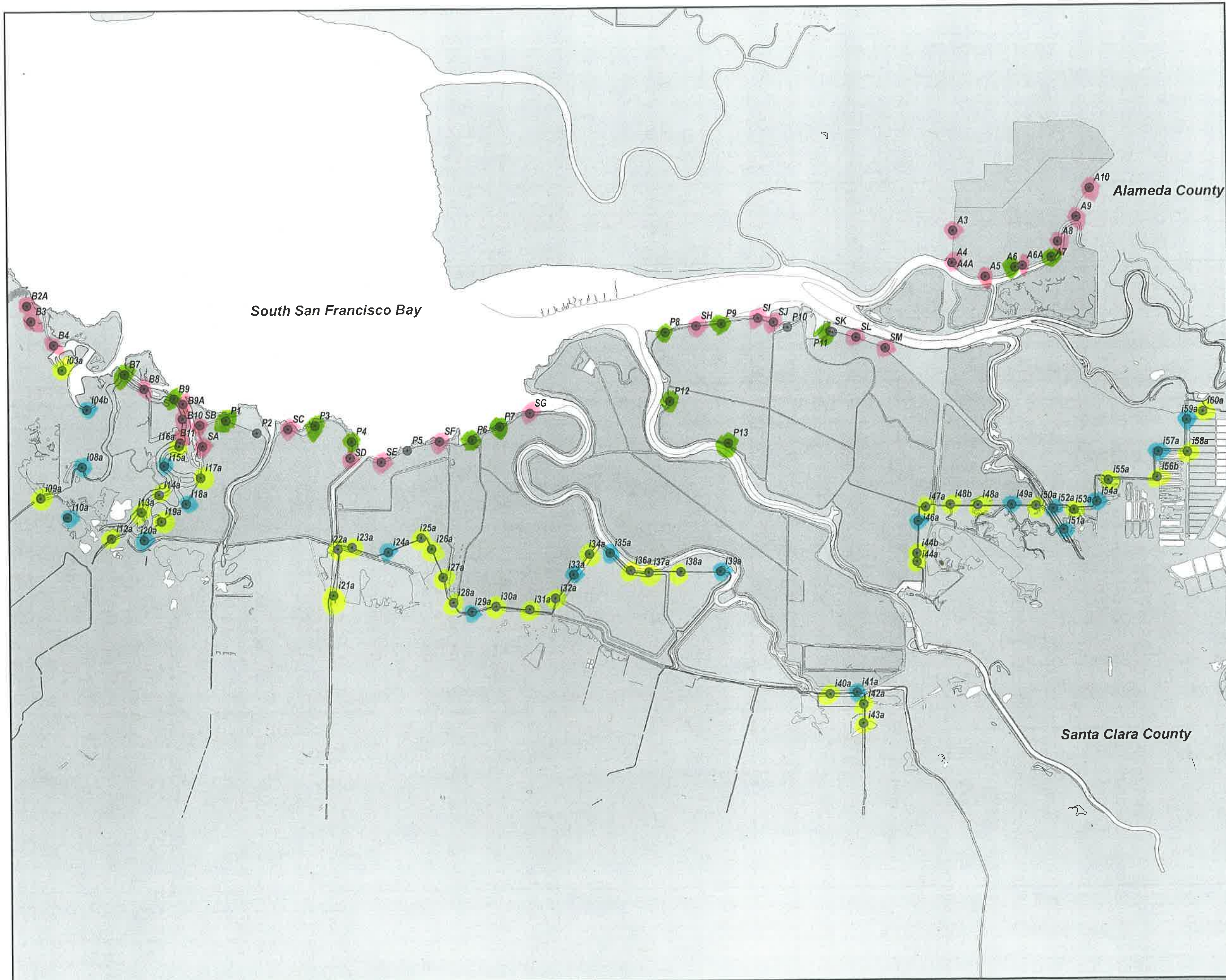
Figure 8. Conceptual Design Approach for raising the Public Viewing Platform.

2.6 RETAINING WALL AROUND THE COAST CASEY STORMWATER PUMP STATION

The building housing the Coast Casey Stormwater Pump Station also contains the motor controls for operating the Sailing Lake Pump Station. Raising the levee to an elevation of 14 ft will require that an earthen ramp be built up to it adjacent to the Coast Casey Stormwater Pump Station, as shown in Figure 1. The ramp will need to have a very gradual incline (1:20) to meet ADA requirements for public access and therefore it could be 50 – 100 ft long. In order to maintain City maintenance and emergency vehicle access to the pump station, it is likely a retaining wall will need to be built to hold up this ramp, along the west, north and east sides. The minimum clearance required around the pump station is unknown at this time but could be at least 10 ft, with access maintained from the south.

The retaining wall would be designed by a structural engineer once the final configuration of the ramp was determined. It would be constructed of reinforced poured-in-place concrete and would need a safety railing along the top. The foundation of the wall would need to extend below grade in the likely form of concrete spread footing.

AMEC Borings (11/2006 – 4/2007)
AMEC CPTs (11/2006 – 4/2007)
AMEC Borings (8/2009)
AMEC CPTs (11/2008)



United States Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103

Map of Subsurface Exploration Logs

Map Prepared for:
United States Fish and Wildlife Service
Levee Maintenance Support

15 June 2011

USACE San Francisco
Geo-Sciences Section

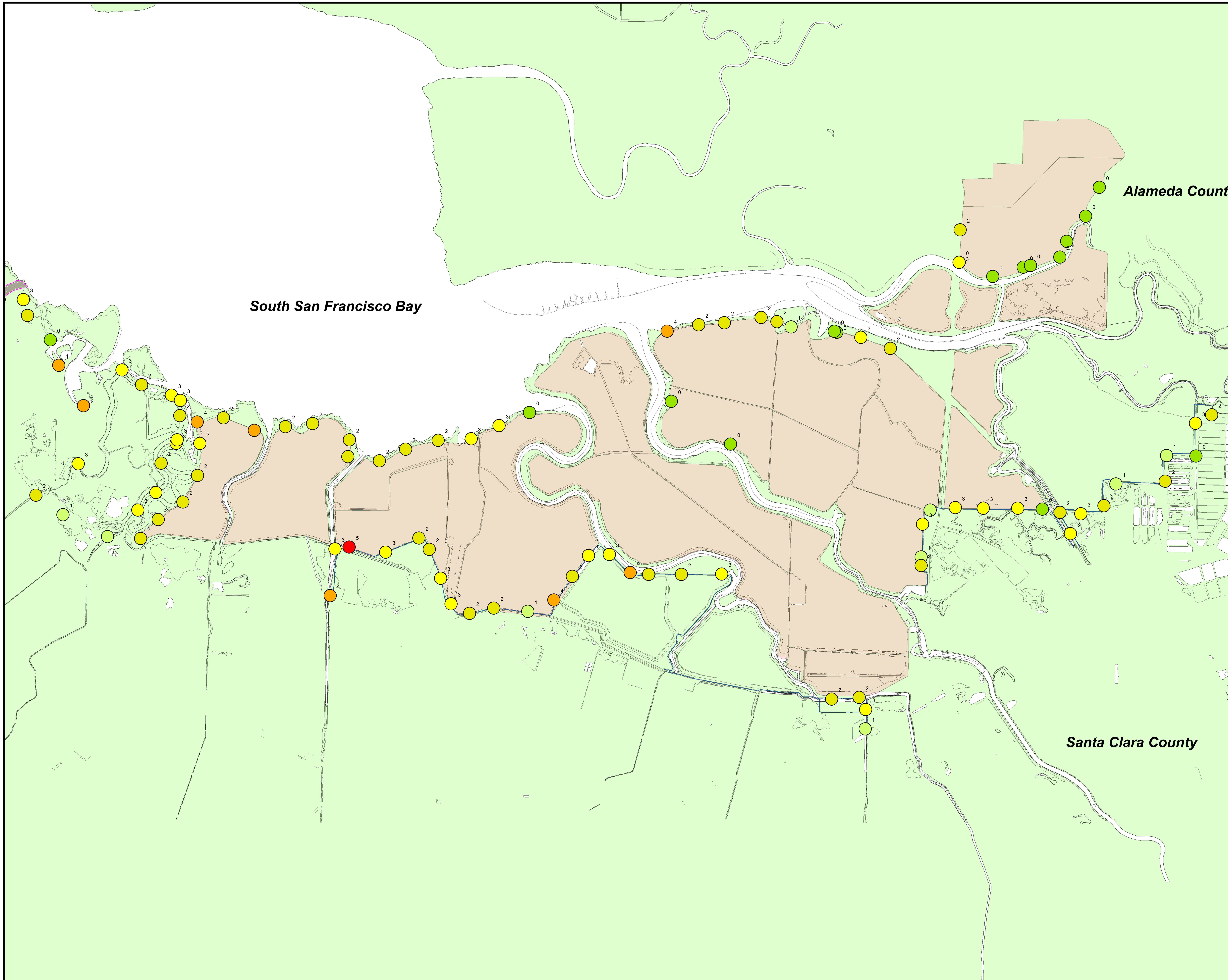
Notes:
Subsurface investigation data are a product of geotechnical investigations performed in support of the Corps of Engineers South San Francisco Bay Shorline feasibility study. Explorations include a combination of Cone Penterometer Testing and Rotary Wash Borings. Exploration locations are approximate.

N

Legend

Subsurface Explorations

0 2,000 4,000 8,000
Feet



United States Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103

Estimated Geotechnical Performance Combining Stability and Seepage

Map Prepared for:
United States Fish and Wildlife Service
Levee Maintenance Support

15 June 2011

USACE San Francisco
Geo-Sciences Section

Legend
5=worst
1=best

- <all other values>
- 5
- 4
- 3
- 2
- 1
- 0

N

Notes:
Subsurface investigation data are a product of geotechnical investigations performed in support of the Corps of Engineers South San Francisco Bay Shorline feasibility study. Explorations include a combination of Cone Penterometer Testing and Rotary Wash Borings. Exploration locations are approximate.

0 2,000 4,000 8,000
Feet

Appendix D

Anticipated Means, Methods and Durations for the Mountain View Ponds

Preliminary Design (10 Percent Design Level)

Mountain View Ponds - Alternative B

Basis of Review

1. Ponds A1 and A2W could be constructed independently of each other or simultaneously without affecting the adjacent pond.
2. A combination of onsite borrow and import fill will be used. All fill will be imported by a dirt marketer at no cost to the project.
3. Fill will be imported at a rate that ensures an efficient construction operation.
4. Superintendent, fuel service, maintenance service, personal vehicles, small tools and small equipment are not included in the list of Resources. Equipment hours are operated hours.
5. Dredge material may also be used to raise the subsided pond bottoms, but this design is not included in this sequence.
6. Ponds will contain approximately four feet of water during construction prior to breaching.

Pond A1							
Sequence	Component	Scope	Means & Methods	Resource	Resource Quantity	Total Equip. Hours	Total Labor Hours
1	Mobilization	Develop submittals, staging areas and other facilities. Mobilize equipment and labor to the site.	Equipment and labor will be brought in by ground transportation. This includes portable barges and a crane for offloading. Barge sections will be assembled in the ponds.	Lowbed Truck Crane, 80 TN Pile Butt	2 1 4	128 24 	128 24 224
2	Improve Pond A1 West levee	Grading and import of fill to raise low areas and repair localized erosion.	Areas to be improved will be prepared with a dozer or excavator by stripping vegetation and scarifying the soil. Stripping material would be hauled to the upland transition zone for disposal. Import fill material would be trucked to the placement site, moisture conditioned and compacted in place with a dozer or excavator and sheepsfoot compactor.	Dozer Long reach excavator Compactor Dump truck Water truck	2 1 1 3 1	862 80 431 240 431	862 80 431 240 431
3	Place upland transition zone fill	Place and grade import fill.	Slopes would be scarified prior to placement. A water truck would be available for moisture conditioning and dust control as required. Fill would be imported and dumped at the placement site by others. A dozer would shape and moderately compact the fill into place.	Dozer Water truck	2 1	308 77	308 77
4	Construct islands	Construct islands in the pond interior with imported fill.	Four portable barges would be assembled in the pond. One barge would have an excavator mounted on it and the others used to transport fill material. The crane used to offload and assemble the barges would be used to load them with fill. Once loaded, a skiff would transport the material barge to the island site where it would be tied up to the work barge. The excavator would place the material in the pond. While one barge is being offloaded others will be loaded and transported to the worksite to keep the operation continuous. A water truck would be used for dust control.	Crane, 80 TN Dozer Portable Barge Long Reach Excavator Water truck Skiff Pile Butt	1 1 4 1 1 4 4	930 230 3,720 930 230 3,720 	930 230 3,720 930 230 3,720 3,720
5	Raise and pave A1 southwest levee	Demolish existing asphalt, raise section of levee, repave.	Existing asphalt would be removed by a skid loader and placed into trucks for disposal. The levee would be ripped and scarified and moisture conditioned. Import fill would be placed and compacted with a sheepsfoot compactor and trimmed with a dozer. Base rock would be imported, placed and compacted with a smooth drum roller. After a week of resting a paving machine would place the asphalt pavement which would then be compacted with a smooth drum roller.	Skid loader Dump truck Dozer Compactor Water truck Paving Machine Laborer	1 1 1 1 1 1 2	16 16 8 16 4 8 	16 16 8 16 4 8 32
6	Construct Viewing Platform - Pond A1 West Levee	Construct wood platform on shallow concrete footings.	Foundations would be dug with an auger attachment on a bobcat. Concrete would be imported and foundation cast in place. Construction materials would be imported to the site and the platform assembled using small power tools.	Bobcat with Auger Concrete truck Flatbed truck Carpenter	1 1 1 3	24 8 16 	24 8 16 720
7	Construct Interpretive Platform - Permanente	Construct wood platform on shallow concrete footings.	Foundations would be dug with an auger attachment on a bobcat. Concrete would be imported and foundation cast in place. Construction materials would be imported to the site and the	Bobcat with Auger Concrete truck	1 1	8 8	8 8

	Creek		platform assembled using small power tools.	Flatbed truck Carpenter	1 3	8	8 120
8	Construct public trail	Import and place of 4 inch of quarry fines over 4 inches of base rock over geotextile fabric.	Levees would be graded and compacted. Geotextile fabric would be laid out and gravel imported and compacted in place. Quarry fines would then be compacted over the gravel with a smooth drum compactor to create an accessible surface.	Dozer Compactor Water truck Laborer	1 1 1 2	16 16 8	16 16 8 32
9	Construct A1 Northwest Levee Breach	Excavate breach and side cast material into pond.	Long reach excavators would excavate the breach and place material in the pond. Dozers would move material laterally down the levee as necessary to dispose of fill.	Long Reach Excavator Dozer	1 1	233 233	233 233
Pond A2W							
Sequence	**Component**	**Scope**	**Means & Methods**	**Resources**	**Quantity**	**Total Equip. Hours**	**Total Labor Hours**
10	Improve PGE Bay-front Levee as necessary	Minor grading and import of fill to raise low areas and repair localized erosion.	Areas to be improved will be prepared with a dozer or excavator by stripping vegetation and scarifying the soil. Import fill material would be trucked to the placement site, moisture conditioned and compacted in place with a dozer or excavator and sheepsfoot compactor.	Dozer Long reach excavator Compactor Water truck	2 1 1 1	116 58 58 58	116 58 58 58
11	Place upland transition zone fill	Place and grade import fill.	Slopes would be scarified prior to placement. A water truck would be available for moisture conditioning and dust control as required. Fill would be imported and dumped at the placement site by others. A dozer would shape and moderately compact the fill into place.	Dozer Water truck	2 1	348 90	348 90
12	Construct islands	Construct islands in the pond interior with imported fill.	Four portable barges would be assembled in the pond. One barge would have an excavator mounted on it and the others used to transport fill material. The crane used to offload and assemble the barges would be used to load them with fill. Once loaded, a skiff would transport the material barge to the island site where it would be tied up to the work barge. The excavator would place the material in the pond. While one barge is being offloaded others will be loaded and transported to the worksite to keep the operation continuous. A water truck would be used for dust control.	Crane, 80 TN Dozer Portable Barge Long Reach Excavator Water truck Skiff Deckhand	1 1 4 1 1 4 4	930 230 3,720 930 230 3,720	930 230 3,720 930 230 3,720 3,720
13	Install north railroad car bridge/ Construct A2W Northeast breach	Excavate breach, drive coffer dam and piles, cast in place concrete abutments, set bridge.	A sheet pile coffer dam would be driven around both sides of the bridge site to isolate if from pond and tidal waters. The breach would be over excavated and material used for transition habitat or side cast into the pond. Foundation piles would be driven, the abutments formed and concrete placed. Once cured, riprap protection at the abutments would be installed, and the railroad car bridge would be delivered to the site. It would be unloaded with a crane and walked down the levee and set in place.	Crane, 80 TN Dozer Long Reach Excavator Dump truck Concrete truck Flatbed truck Pile butt	1 1 1 2 1 1 6	160 50 180 250 16 16	160 50 180 250 16 16 1,216
14	Install south railroad car bridge/ Construct A2W Southeast breach	Excavate breach, drive coffer dam and piles, cast in place concrete abutments, set bridge.	A sheet pile coffer dam would be driven around both sides of the bridge site to isolate if from pond and tidal waters. The breach would be over excavated and material used for transition habitat or side cast into the pond. Foundation piles would be driven, the abutments formed and concrete placed. Once cured, riprap protection at the abutments would be installed, and the railroad car bridge would be delivered to the site. It would be unloaded with a crane and walked down the levee and set in place.	Crane, 80 TN Dozer Long Reach Excavator Dump truck Concrete truck Flatbed truck Pile butt	1 1 1 2 1 1 6	160 50 200 300 16 16	160 50 200 300 16 16 1,216
15	Construct A2W Northwest and Southwest breaches	Excavate breach and side cast material into pond.	Long reach excavators would excavate the breach from the levee top and side cast material into Pond A2W. Dozers would move material laterally down the levee as necessary for disposal.	Long reach excavator Dozer	1 1	460 460	460 460
17	Demobilization	Demobilize equipment and Labor.	Same as mobilization.	Lowbed Truck Crane, 80 TN Pile Butt	2 1 4	128 24	128 24 224

Mountain View Ponds - Alternative C

Basis of Review

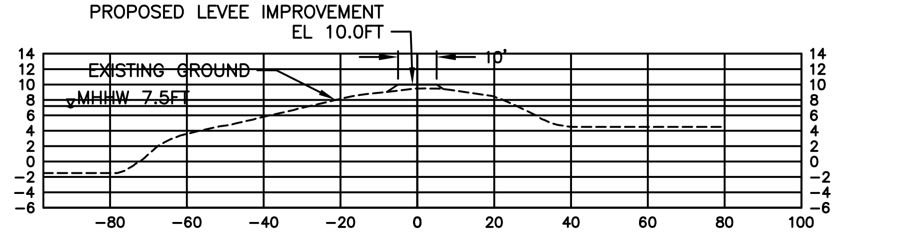
1. Ponds A1 and A2W could be constructed independently of each other or simultaneously without affecting the adjacent pond.
2. A combination of onsite borrow and import fill will be used. All fill will be imported by a dirt marketer at no cost to the project.
3. Fill will be imported at a rate that ensures an efficient construction operation.
4. Charleston Slough concrete water control structure will be incorporated into the public interpretive platform
5. Superintendent, fuel service, maintenance service, personal vehicles, small tools and small equipment are not included in the list of Resources. Equipment hours are operated hours.
6. Dredge material may also be used to raise the subsided pond bottoms, but this design is not included in this sequence.
7. Ponds will contain approximately four feet of water during construction prior to breaching.

Pond A1							
Sequence	**Component**	**Scope**	**Means & Methods**	**Resources**	**Quantity**	**Total Equip. Hours**	**Total Labor Hours**
1	Mobilization	Develop submittals, staging areas and other facilities. Mobilize equipment and labor to the site.	Equipment and labor will be brought in by ground transportation. This includes portable barges and a crane assist in offloading. Barge sections will be assembled in the ponds.	Lowbed Truck	2	128	128
				Crane, 80 TN	1	24	24
				Pile Butt	4		224
2	Improve Coast Casey Forebay north levee structures	Raise electrical pull boxes, electrical instrumentation, Sailing Lake pump station wet well and piping, Sailing Lake pump station valve vault, Sailing Lake intake retaining wall, public viewing platform, Coast Casey pump station retaining wall.	Raise electrical pull boxes, wet well , valve vault, and retaining walls: concrete forms would be constructed and concrete poured in place; electrical and piping, ladders and vault lids would be installed. Viewing platform: existing platform would be disassembled and reused to the extent possible, new foundation piles installed, and new platform and railings installed.	Laborer	2		400
				Concrete truck	1	80	80
3	Improve Charleston Slough West and Coast Casey Forebay North Levee	Demolish existing asphalt, grading and import of fill to build SLR Low Plus option, repave.	Existing asphalt would be removed by a skid loader and placed into trucks for disposal. Structures would be raised to new levee height. Areas to be improved will be prepared with a dozer or excavator by stripping vegetation and scarifying the soil. Stripping material would be hauled to the upland transition zone for disposal. Import fill material would be trucked to the placement site, moisture conditioned and compacted in place with a dozer or excavator and sheepsfoot compactor. Pavement base rock would be imported, placed and compacted with a smooth drum roller. After a week of resting a paving machine would place the asphalt pavement which would then be compacted with a smooth drum roller.	Skid loader	1	16	16
				Dump truck	1	16	16
				Dozer	2	1770	1770
				Long reach excavator	1	440	440
				Compactor	1	900	900
				Dump truck	2	440	440
				Water truck	1	900	900
				Paving Machine	1	8	8
				Roller compactor	1	8	8
				Laborer	2		32
4	Construct Charleston Slough Interpretive Platform	Construct handrails and interpretive structure on top of existing concrete water control structure.	Existing concrete water control structure superstructure will be demolished and hauled off for disposal. Hand rails would be constructed on top of structure along with interpretive features. Construction materials would be imported to the site and the platform assembled using small power tools.	Bobcat with Auger	1	24	24
				Concrete truck	1	8	8
				Flatbed truck	1	16	16
				Carpenter	3		720
5	Construct Charleston Slough West Levee trail	Import and place of 4 inch of quarry fines over 4 inches of base rock over geotextile fabric.	Levees would be graded and compacted. Geotextile fabric would be laid out and gravel imported and compacted in place. Quarry fines would then be compacted over the gravel with a smooth drum compactor to create an accessible surface.	Dozer	1	80	80
				Compactor	1	80	80
				Water truck	1	80	80
				Dump truck	6	560	560
				Laborer	4		320
6	Install Charleston Slough Breach (at existing tide gate) and Lower Portion of Charleston Slough	Excavate levee and transport material for use as transition habitat fill.	Long reach excavator would excavate the breach from the levee top and place material in a truck for use has onsite fill. The excavator would lower levee as it backed along the levee	Long reach excavator	1	8	8
				Dump truck	2	16	16

	North Levee						
7	Construct Pond A1 Islands	Construct islands in the pond interior with imported fill.	Four portable barges would be assembled in the pond. One barge would have an excavator mounted on it and the others used to transport fill material. The crane used to offload and assemble the barges would be used to load them with fill. Once loaded, a skiff would transport the material barge to the island site where it would be tied up to the work barge. The excavator would place the material in the pond. While one barge is being offloaded others will be loaded and transported to the worksite to keep the operation continuous. A water truck would be used for dust control.	Crane, 80 TN Dozer Portable Barge Long Reach Excavator Water truck Skiff Pile Butt	1 1 4 1 1 4 4	930 230 3,720 930 230 3,720	930 230 3,720 930 230 3,720 3,720
8	Begin placing upland transition zone fill	Place and grade import fill.	Slopes would be scarified prior to placement. A water truck would be available for moisture conditioning and dust control as required. Fill would be imported and dumped at the placement site by others. A dozer would shape and moderately compact the fill into place.	Dozer Water truck	2 1	260 130	260 130
9	Construct Pond A1 Northwest breach	Excavate breach and transport material for use in transition habitat fill.	Long reach excavators would excavate the breach and place material in a truck to transport for use in the habitat fill zone.	Long reach excavator Dump truck	1 2	36 72	36 72
10	Lower Pond A1 west levee	Lower levee and transport fill for use as habitat fill.	Long reach excavator would lower the levee and place material in a dump truck for transport to the habitat fill site.	Long reach excavator Dump truck	1 2	87 174	87 174
11	Construct Pond A1 Southwest breach	Excavate breach and transport material for use in transition habitat fill.	Long reach excavators would excavate the breach and place material in a truck to transport for use in the habitat fill zone.	Long reach excavator Dump truck	1 2	15 30	15 30
12	Complete Pond A1 transition zone	Place and finish grade fill material.	A combination of onsite and import material would be placed and moderately compacted with a dozer.	Dozer Water truck	2 1	50 8	50 8
13	Construct New Sailing Lake Intake and Pipeline	Excavate trench, shore, construct pipeline, and backfill. Construct sump and intake. Construct vehicle turn-around. Pave levee-top roadway.	Long reach excavator would excavate trench, valve vault, sump, and intake area and loaders would place material in dump trucks for transport to temporary stockpile area. Install about 1,200 LF of 42" (outside diameter) HDPE pipe using flatbed trucks for delivery, loaders for lowering pipe in place, and HDPE pipe fuser to connect pipe sections. Connect the new pipe to the existing pipe and install two 42-inch isolation valves. Construct a below-grade, poured in place concrete sump. Construct a concrete intake into the water surrounded by riprap to prevent erosion near the intake. Install electrical instrumentation at the intake with conduit and wiring back to the pump station control building. Widen the end of the embankment by the new intake and construct a paved access road and turn around area with paving machine and roller compactor.	Long reach excavator Dump truck Loader HDPE pipe fuser Flatbed truck Concrete truck Paving machine Roller compactor Laborer	1 2 1 1 1 1 1 1 2	40 160 40 40 20 24 16 16	40 160 40 40 20 24 16 16 560
14	Construct Pond A1 Southeast breach	Excavate breach and transport material for use in transition habitat fill.	Long reach excavators would excavate the breach and place material in a truck to transport for use in the habitat fill zone.	Long reach excavator Dump truck	1 2	35 70	35 70
15	Construct Pond A1 southwest boardwalk and viewing platform	Construct wood boardwalk on shallow foundations and wood viewing platform of similar construction.	Foundations would be dug with an auger attachment on a bobcat. Concrete would be imported and foundation cast in place. Construction materials would be imported to the site and the platform assembled using small power tools.	Bobcat with Auger Concrete truck Flatbed truck Carpenter	1 1 1 4	40 32 40	40 32 40 640
16	Construct Interpretive Platform - Permanente Creek	Construct wood platform close to grade on shallow concrete footings.	Foundations would be dug with an auger attachment on a bobcat. Concrete would be imported and foundation cast in place. Construction materials would be imported to the site and the platform assembled using small power tools.	Bobcat with Auger Concrete truck Flatbed truck Carpenter	1 1 1 3	8 8 8	8 8 8 120

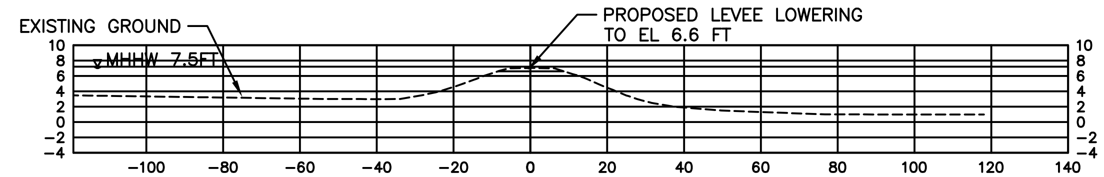
Pond A2W							
Sequence	**Component**	**Scope**	**Means & Methods**	**Resources**	**Quantity**	**Total Equip. Hours**	**Total Labor Hours**
16	Improve PGE Bay-front Levee as necessary	Minor grading and import of fill to raise low areas and repair localized erosion.	Areas to be improved will be prepared with a dozer or excavator by stripping vegetation and scarifying the soil. Import fill material would be trucked to the placement site, moisture conditioned and compacted in place with a dozer or excavator and sheepsfoot compactor.	Dozer	2	116	116
				Long reach excavator	1	58	58
				Compactor	1	58	58
				Water truck	1	58	58
17	Construct Pond A2 Northwest Viewing Platform	Construct wood platform on shallow concrete footings.	Foundations would be dug with an auger attachment on a bobcat. Concrete would be imported and foundation cast in place. Construction materials would be imported to the site and the platform assembled using small power tools.	Bobcat with Auger	1	16	16
				Concrete truck	1	8	8
				Flatbed truck	1	16	16
				Carpenter	3		240
18	Construct A2W West levee trail north of bridges	Import and place of 4 inch of quarry fines over 4 inches of base rock over geotextile fabric.	Levees would be graded and compacted. Geotextile fabric would be laid out and gravel imported and compacted in place. Quarry fines would then be compacted over the gravel with a smooth drum compactor to create an accessible surface.	Dozer	1	80	80
				Compactor	1	80	80
				Water truck	1	80	80
				Dump truck	6	560	560
				Laborer	4		320
19	Place upland transition zone fill	Place and grade import fill.	Slopes would be scarified prior to placement. A water truck would be available for moisture conditioning and dust control as required. Fill would be imported and dumped at the placement site by others. A dozer would shape and moderately compact the fill into place.	Dozer	2	348	348
				Water truck	1	90	90
20	Construct Islands	Construct islands in the pond interior with imported fill.	Four portable barges would be assembled in the pond. One barge would have an excavator mounted on it and the others used to transport fill material. The crane used to offload and assemble the barges would be used to load them with fill. Once loaded a skiff would transport the material barge to the island site where it would be tied up to the work barge. The excavator would place the material in the pond. While one barge is being offloaded others will be loaded and transported to the worksite to keep the operation continuous. A water truck would be used for dust control.	Crane, 80 TN	1	930	930
				Dozer	1	230	230
				Portable Barge	4	3,720	3,720
				Long Reach Excavator	1	930	930
				Water truck	1	230	230
				Skiff	4	3,720	3,720
				Pile Butt	4		3,720
21	Install north railroad car bridge/ Construct A2W Northeast breach	Excavate breach, drive coffer dam and piles, cast in place concrete abutments, set bridge.	A sheet pile coffer dam would be driven around both sides of the bridge site to isolate if from pond and tidal waters. The breach would be over excavated and material used for transition habitat or side cast into the pond. Foundation piles would be driven, the abutments formed and concrete placed. Once cured, riprap protection at the abutments would be installed, and the railroad car bridge would be delivered to the site. It would be unloaded with a crane and walked down the levee and set in place.	Crane, 80 TN	1	160	160
				Dozer	1	50	50
				Long Reach Excavator	1	180	180
				Dump truck	2	250	250
				Concrete truck	1	16	16
				Flatbed truck	1	16	16
				Pile butt	6		1,216
22	Install south railroad car bridge/ Construct A2W Southeast breach	Excavate breach, drive coffer dam and piles, cast in place concrete abutments, set bridge.	A sheet pile coffer dam would be driven around both sides of the bridge site to isolate if from pond and tidal waters. The breach would be over excavated and material used for transition habitat or side cast into the pond. Foundation piles would be driven, the abutments formed and concrete placed. Once cured, riprap protection at the abutments would be installed, and the railroad car bridge would be delivered to the site. It would be unloaded with a crane and walked down the levee and set in place.	Crane, 80 TN	1	160	160
				Dozer	1	50	50
				Long Reach Excavator	1	200	200
				Dump truck	2	300	300
				Concrete truck	1	16	16
				Flatbed truck	1	16	16
				Pile butt	6		1,216
23	Complete A2W West levee trail	Import and place of 4 inch of quarry fines over 4 inches of base rock over geotextile fabric.	Levees would be graded and compacted. Geotextile fabric would be laid out and gravel imported and compacted in place. Quarry fines would then be compacted over the gravel with a smooth drum compactor to create an accessible surface.	Dozer	1	40	40
				Compactor	1	40	40
				Water truck	1	40	40
				Dump truck	6	280	280
				Laborer	4		160
24	Construct A2W Northwest and Southwest breaches	Excavate breaches and side cast material into pond and used to flatten levee slopes	Long reach excavator would excavate the breach from the levee top and side cast material into Pond A2W. Dozers would move material laterally down the levee as necessary for disposal.	Long reach excavator	1	240	240
				Dozer	2	480	480
25	Demobilization	Demobilize equipment and	Same as mobilization	Lowbed Truck	2	128	128

		Labor		Crane, 80 TN Pile Butt	1 4	24	24 224



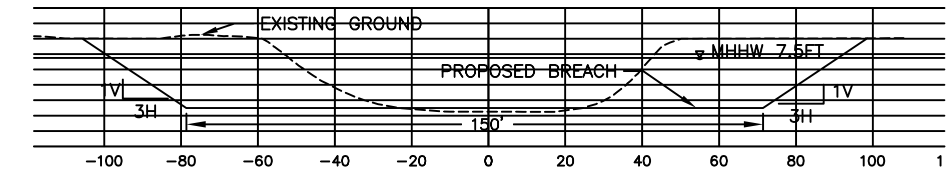
A1 WEST LEVEE IMPROVEMENT – TYPICAL SECTION (1/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



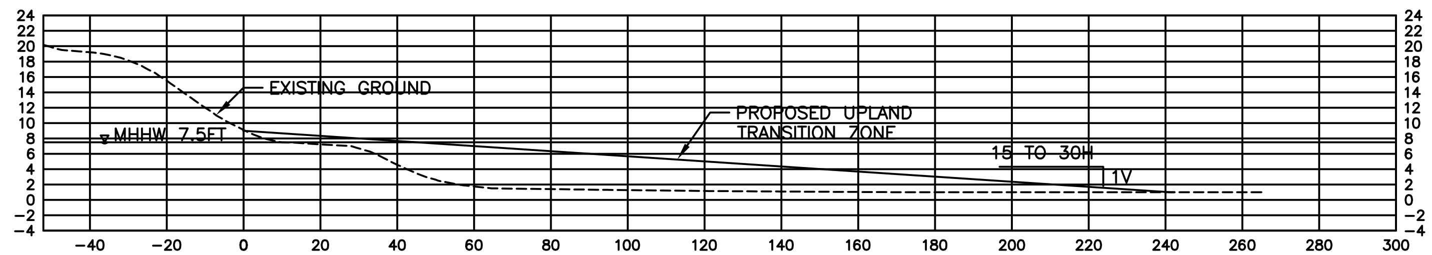
LEVEE LOWERING – TYPICAL SECTION (2/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



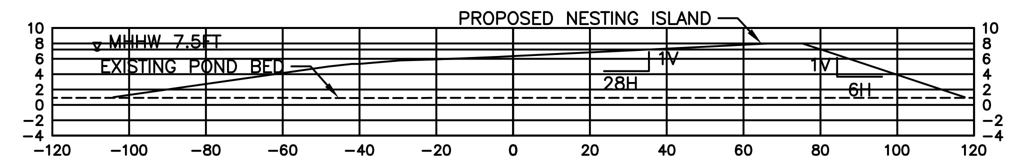
CHARLESTON SLOUGH OPENING – TYPICAL SECTION (4/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'
NOTE: TIDAL GATE SUPER STRUCTURE NOT SHOWN



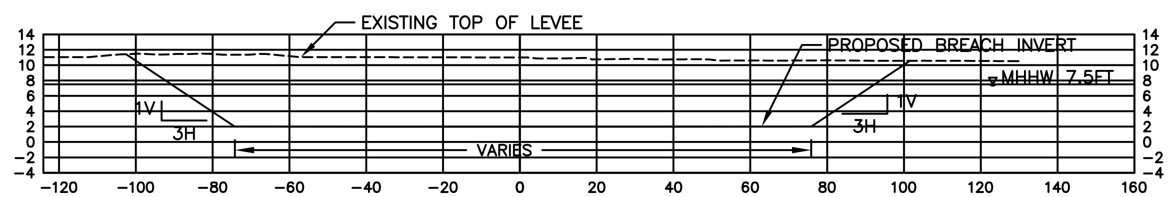
UPLAND TRANSITION ZONE – TYPICAL SECTION (3/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



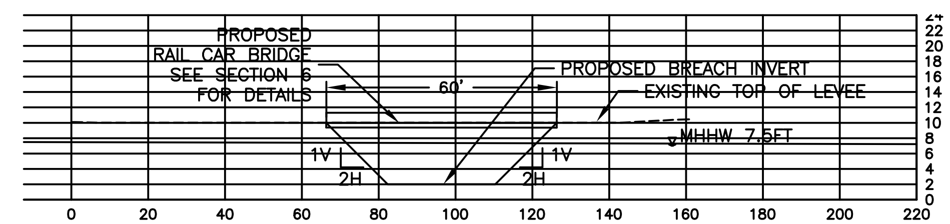
NESTING ISLAND – TYPICAL SECTION (5/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



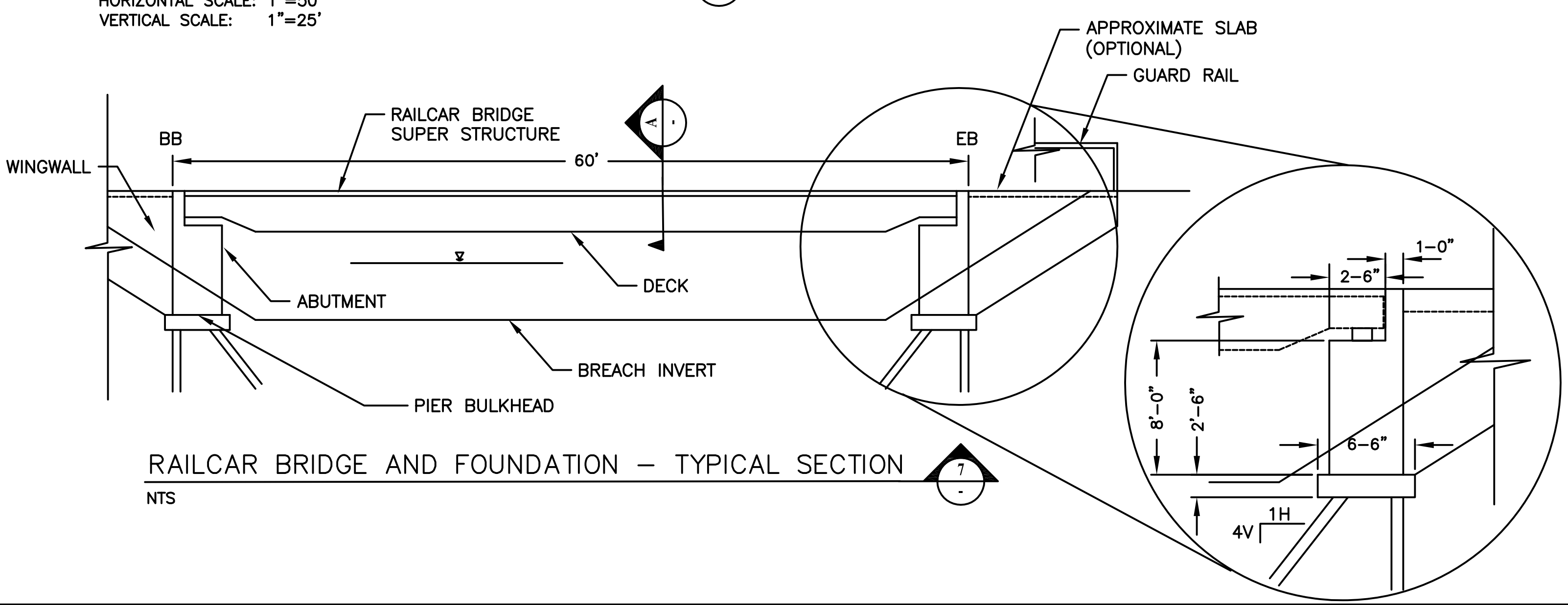
LEVEE BREACH – TYPICAL SECTION (6/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



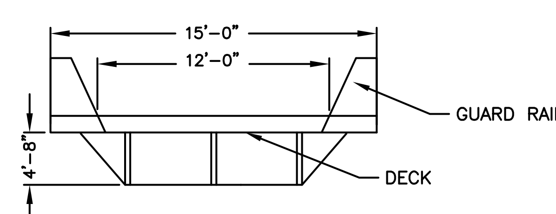
RAILCAR BRIDGE – TYPICAL PROFILE (8/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'

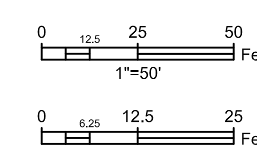


RAILCAR BRIDGE AND FOUNDATION – TYPICAL SECTION (7/-)

NTS



DECK – TYPICAL SECTION (A/-)



REV	DESCRIPTION OF REVISION	BY	DATE

CALIFORNIA STATE COASTAL CONSERVANCY
1330 BROADWAY
OAKLAND, CA 94612

URS

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OAKLAND, CA 94612
PHONE: (510) 893-3600
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DESIGNED SS
DRAWN SS/VD
CHECKED SL
PEER REVIEWED SG
PROJECT MANAGER TC/DH
DATE 05/06/2014

ALVISO MOUNTAIN VIEW PONDS

DETAILS

REVISION
PROJECT 26818349
DRAWING
SHEET 1 OF 1

Nov 12, 2014 – 1:47pm
\\1575SR-PRJ01\Projects\South_Bay_Salt_Ponds_03102230\5500 Technical Products\CAD\Mt View\Mt View_Xs_Rev-sel.dwg