MEMORANDUM

TO: South Bay Salt Pond Restoration Project Management Team

FROM: Philip Williams & Associates, Ltd. and the PWA Team

DATE: January 21, 2005

RE: **South Bay Salt Pond Preliminary Program Alternatives Memorandum**

1. EXECUTIVE SUMMARY

This memorandum describes the preliminary program alternatives for the South Bay Salt Pond (SBSP) Restoration Project. Planning for the SBSP Restoration Project is being conducted first at the program level, to be followed by more detailed project-level planning as individual pieces of the program proceed to implementation. The planning process for formulating and evaluating the preliminary program alternatives is described in the Alternatives Development Framework document (PWA and others 2004a) and presented in Figure 1.

The preliminary program alternatives are:
- No Project Alternative
- Alternative 1: Managed Pond Emphasis
- Alternative 2: Mix of Tidal Habitat and Managed Pond
- Alternative 3: Tidal Habitat Emphasis

Each preliminary program alternative integrates habitat-restoration, flood-management, and public-access features for the three pond complexes (Figures 2-5). The alternatives have been formulated to explore different extents of managed pond and tidal habitat restoration to allow the project to address the trade-offs between these habitat types in meeting the project objectives, and to address key uncertainties regarding bird use and the evolution of the tidal mudflats and marshes. The mix of habitats would benefit a diversity of wildlife, including special-status species and migratory birds, and would increase the overall abundance and diversity of native species in South San Francisco Bay. All program alternatives would improve existing levels of flood protection and provide high quality public access and recreation opportunities. Implementation would be phased over many years, with adaptive management of key elements to meet the project objectives more effectively.

The preliminary program alternatives will be refined into final program alternatives for evaluation in the NEPA/CEQA compliance process beginning in 2005. The preliminary program alternatives were developed with input from the Project Management Team, Science Team, Regulatory and Trustee Agency Group, and the public through a series of workshops and meetings.[1]

2. INTRODUCTION

The process for formulating and evaluating alternatives for the South Bay Salt Pond (SBSP) Restoration Project is outlined in the Alternatives Development Framework (ADF) (PWA and others 2004a) and depicted graphically in Figure 1. Formulation of the preliminary program alternatives builds on previous steps in the alternatives development process: identification of project goals and objectives, opportunities and constraints assessment, and identification of initial options for restoration at each pond complex. The project goal and objectives are shown in Attachment 1.

The immediate next steps will be to evaluate the preliminary program alternatives using a weighting and ranking process, and then to refine the preliminary program alternatives into final program alternatives for NEPA/CEQA assessment beginning in mid-2005. The landscape-scale assessment of tidal habitat evolution and bird use will inform the preliminary program alternatives evaluation. The landscape-scale assessment will provide estimates of the rates and patterns of tidal-habitat evolution in South San Francisco Bay following restoration, and predictions of bird use within the managed ponds and the evolving tidal landscape.

This memorandum is organized into the following sections:

3. DEFINITION OF A PROGRAM ALTERNATIVE

Planning for the SBSP Restoration Project is being conducted first at the program level, to be followed by more detailed project-level planning as individual pieces of the program proceed to implementation. A program alternative is an integrated plan for habitat restoration, flood protection, and public access. Each program alternative includes identification of the Phase 1 actions, a description of the overall phasing plan for full implementation, and a description of the key elements subject to adaptive management. The Phase 1 actions, while identified and generally characterized in the program alternatives, will be detailed fully at the project level.

At the program level the alternatives are defined broadly. Table 1 provides example levels of detail for program and project alternatives. It will be important to maintain some flexibility in the alternatives at the

[1] See the SBSP Restoration Project website (southbayrestoration.org) for a complete list of participants and workshop and meeting schedules

program level. For example, specific locations of managed pond vs. tidal habitat may need to be adjusted to provide for flood management based on detailed project-level flood studies.

The *preliminary* program alternatives will continue to be refined in terms of features and phasing as they progress to *final* program alternatives for NEPA/CEQA assessment. For example, levee locations and public access/recreation alignments will continue to be refined in response to ongoing studies and discussions with stakeholders (*e.g.*, PG&E, Alameda County Flood Control District, Santa Clara Valley Water District, San Francisco Bay Trail Project, etc.). Overall phasing will be refined and the Phase 1 actions will be identified. The program alternatives are expected to be finalized by mid-2005, and the draft Environmental Impact Statement / Report (EIS/R) is expected to be released in mid-2006.

Future phases of the SBSP Restoration Project, such as the Phase 2 actions and subsequent actions, will be generally specified based on the overall phasing plan for the preferred program alternative. Each phase will be accompanied by project-level planning efforts, and will be subject to modifications based on adaptive management and monitoring of previously implemented restoration actions. Ongoing monitoring efforts and management decisions may also lead to the recommendation of future project-level actions from multiple program-level alternatives.

Table 1. Level of detail for Program versus Project Alternatives

	Program Alternative	**Project Alternative**
Habitat Restoration	• Approx. locations & total extent of habitat types • Types of habitat to be restored and conceptual schematic of design features to create each habitat type • General operations and management regimes for the managed ponds	• Exact locations of habitat types • Pond-specific layout of design features - *e.g.*, exact breach locations • Specific operations and management regimes for the managed ponds
Flood Management	• Approaches, *e.g.*, levees (approx. alignments) • Maintain flexibility pending detailed modeling & assessment	• Specific levee alignments • Detailed flood modeling and assessment
Public Access/ Recreation	• Types of access/ recreation, *e.g.*, trails, hunting, kayak launches • General trail alignments	• Exact trail alignments, parking lot locations, etc.

4. PLANNING FEATURES AND CONSIDERATIONS

This section describes the program-level approaches to habitat restoration, flood management, and public access/recreation, as well as more detailed considerations for determining where to locate specific design elements (*e.g.*, tidal habitat, managed pond habitat, flood management, and public access/recreation) within the landscape.

4.1 Habitat Types and Restoration Features

The habitats to be created by the SBSP Restoration Project include a mix of managed pond habitats and restored tidal habitats. Multiple options for pond reconfiguration and water regime management will be used to enhance and create ponds with a variety of depths (including vegetated ponds, salt flats, very shallow ponded areas, and deep-water areas) and salinities (*e.g.*, ponds with salinity close to bay water as well as higher salinity brine ponds), and associated levees and islands. Tidal habitat to be created by this project includes tidal brackish and salt marsh, tidal mudflat, subtidal flats and channels, marsh ecotones and upland transitional zones, salt pans and ponds.

4.1.1 Managed Ponds

The general categories of managed ponds consist of five specific managed pond types: enhanced ponds, seasonal ponds, high salinity ponds, reconfigured ponds, and vegetated ponds. These five managed pond types are being considered because they differ in terms of the type and quality of habitat provided for different suites of wildlife species, and to some extent in terms of up-front construction costs and longer-term operations and maintenance costs. The first four pond types listed above focus on project objective 1b (maintaining current migratory bird species that utilize existing salt ponds and associated structures). The bird species utilizing these ponds, and the quality of habitat that may be achieved for various species, is expected to differ among these four pond alternatives, as discussed below under the description for each pond type. The fifth pond type, *vegetated ponds*, provides habitat both for migratory birds (project objective 1b) and for salt marsh harvest mice (project objective 1a); see Attachment 1 for the project objectives, and Attachment 4 for the glossary of managed pond type definitions.

Enhanced ponds will be improved (relative to their existing condition) for use by nesting, roosting, and foraging birds, but are not expected to undergo extensive reconfiguration. *Seasonal ponds* and *high salinity ponds* will be managed as described in the Initial Stewardship Plan (ISP, Life Science 2003) and in Sections 4.1.1.2 and 4.1.1.3 below. *Reconfigured ponds* will be more extensively graded than *enhanced ponds*, and will be intensively managed to achieve a highly productive habitat for foraging, roosting and breeding. The fifth managed pond type consists of *vegetated ponds* with managed hydrology.

To the extent practicable, active management of water levels is anticipated to occur via gravity flow (both intake and discharge) in all of the managed pond types to allow water levels to be controlled without the need for pumping. However, pumping may be required to manage water levels in ponds with bottom elevations that are not conducive to the use of gravity flow (*i.e.*, ponds that are deeply subsided and thus can not be easily drained or ponds that are elevated well above mean tide level and thus can not be easily flooded), or to manage water levels in extremely wet or dry years.

Whether all, or just a subset, of these pond types will ultimately be incorporated into restoration planning will depend on the outcome of further design refinements. The benefit to cost trade-off of the various managed pond habitat types will be assessed during evaluation of the preliminary program alternatives in the spring of 2005 and the mix of managed pond types may be revised for the final program alternatives prior to NEPA/CEQA assessment.

The use of recycled fresh water for flooding (*i.e.*, to assist in the management of water levels) in at least some ponds was initially considered. However, control of tall, dense emergent vegetation such as cattails and bulrush (*e.g.*, to maintain suitable shorebird foraging and habitat) would be more difficult in freshwater ponds than in higher-salinity ponds, and salt marsh vegetation that might be used by salt marsh harvest mice in vegetated ponds would not be supported by fresh water. Therefore, the use of recycled fresh water to maintain water levels in ponds would not address the project objectives as well as the use of bay water, and this option was not recommended for further consideration.

4.1.1.1 <u>Enhanced Ponds</u>

Enhanced ponds will not undergo extensive grading or reconfiguration, but will be improved (relative to their ISP condition) by management of water levels specifically for the purpose of providing suitable habitat for targeted species, and potentially by the limited creation of islands in some ponds. Creation of islands will provide habitat for nesting, roosting, and foraging birds. Water management regimes will be enhanced to provide improved mudflat and open-water foraging habitat for certain suites of species, to manage/limit vegetation, and/or to create nesting habitat for species such as the Snowy Plover via altered flooding and drying regimes. It is expected that the densities of targeted bird species (*e.g.*, shorebirds in shallower ponds or portions of ponds, and waterfowl and piscivores in deeper ponds or areas) can be increased above current levels through enhanced water level management.

Enhanced water level management will occur through operational changes (in response to lessons learned through the adaptive management process) and installation of additional water control structures as needed. Water levels would be monitored regularly and managed as needed via gravity-flow control structures, with pumping used only if necessary. Muted tidal exchange may be used in some situations to maintain appropriate habitat conditions. Salinity will be close to that of bay water in most *enhanced ponds*, providing suitable conditions for a variety of fish and benthic invertebrates, but may be elevated to some extent in “intermediate” ponds that transfer water between intake ponds and *high-salinity ponds*. Existing levees and water control structures will be maintained, and vegetation management (*i.e.*, removal and/or inhibition of growth) on islands may be required.

4.1.1.2 Seasonal Ponds

As described in the ISP, *seasonal ponds* will be flooded by precipitation, pumping, or gravity intake through existing water control structures in fall, but will be allowed to dry out via evaporation in spring (Life Science 2003). Such ponds are expected to provide open-water foraging and/or roosting habitat for waterfowl or shorebirds (depending on water depth and variability in the pond topography) from fall through early spring, moist mudflats in spring for foraging shorebirds, and dry-pond/salt flat nesting habitat for Snowy Plovers in late spring and summer. Although intake of water through control structures into these ponds will occur as necessary (*e.g.*, to flood them in fall, possibly with additional intake during dry winters), water level management in *seasonal ponds* is expected to be limited in comparison to the other managed pond types, and no creation of nesting islands or other grading will occur. Although densities of waterbirds in *seasonal ponds* may be high when conditions are suitable for certain species, bird use is not expected to be as consistently high as in the more heavily managed *enhanced ponds* or *reconfigured ponds*. Existing levees, water control structures, and pumps will be maintained.

4.1.1.3 High Salinity Ponds

High salinity ponds, referred to in the ISP as "batch" ponds, will be managed as described in the ISP to provide shallow, high-salinity water; and the ISP pond management will be supplemented with the limited creation of islands for nesting birds. High salinities (*e.g.*, 60-200 parts per thousand) are conducive to the maintenance of high populations of certain invertebrate prey species (*e.g.*, brine flies, brine shrimp, and reticulated water boatmen) that are preyed upon heavily by Eared Grebes, phalaropes, and other waterbirds in some South Bay salt ponds. Shallow-water conditions increase the availability of these prey to birds.

High salinity ponds will take advantage of existing gravity-flow water control structures to the extent possible to allow intake of water from adjacent ponds and discharge into small mixing basins, where the high salinity water will be mixed with bay water to reduce the salinity (for water quality control purposes) before discharge into the Bay. High salinities will be achieved primarily by increasing the residence time of water in the ponds, thus allowing salt to concentrate as water evaporates. However, water circulation will be important to prevent stagnation of the ponds, and pumping may be required to maintain this circulation by bringing water into higher-elevation ponds or discharging water from subsided ponds. Water levels would be monitored regularly to ensure that water depths are suitable for foraging birds. This level of water management is expected to result in higher densities of salt pond-dependent shorebirds than will be present in *seasonal ponds*.

Limited creation of islands will enhance the use of *high salinity ponds* by nesting birds, such as Snowy Plovers, American Avocets, and Black-necked Stilts, that prey heavily on the abundant invertebrates in the *high salinity ponds*, and will provide foraging and roosting habitat for shorebirds as well. However, no extensive grading or pond reconfiguration is anticipated in the *high salinity ponds*. Existing levees, water control structures, and pumps will be maintained, and some vegetation management (*i.e.*, removal) may be needed on islands, although spray from highly saline pond water will help to inhibit the growth of vegetation in these ponds.

4.1.1.4 Reconfigured Ponds

Reconfigured ponds will undergo extensive grading to produce a heterogeneous mix of deep and shallow-water habitats, with numerous islands, that can be actively managed to provide nesting, brooding, roosting, and foraging habitat in order to support large and diverse populations of waterbirds. These ponds are expected to support significantly higher densities of birds than the average salt pond or any of the other managed pond types described herein. For example, given a certain level of water management, the value of *enhanced ponds* to birds (determined largely by water depth) is constrained by existing topography, whereas *reconfigured ponds* will be graded to help optimize topography so that more pond area will provide high-quality habitat for birds. Reconfigured ponds are thus expected to provide suitable habitat conditions more consistently over time (due to water level management) and space (due to grading for suitable elevations over large areas) than current ponds or other pond types. Adaptive management of these ponds, coupled with phasing of the SBSP Restoration Project, will allow for informed management of these ponds to optimize bird use.

Reconfigured ponds may retain the footprint of existing smaller salt ponds, or may be created by the subdivision of larger salt ponds via the construction of small internal check berms. A series of small management units will be created by these berms. New water control structures within these berms will allow water levels and salinities in individual cells to be managed independently. Water levels would be monitored regularly, and control structures adjusted as needed to maintain optimal conditions for foraging, roosting, and nesting.

Creation of the individual cells within a *reconfigured pond* will take advantage of natural contours to create a series of tiered cells connected by gravity flow. Check berms will be constructed along contours, using material from borrow ditches that will be flooded to inhibit access to nesting islands by mammalian predators. Islands will be graded, with some deeper water moats and some shallower slopes surrounding the islands. The higher portions of the cells will generally include very gradual slopes, so that manipulation of water depths by only a few centimeters can allow the flooding or uncovering of vast areas of managed mudflats. In cells or ponds with flatter bottoms, extensive shallow-water areas with numerous very small islands (*e.g.*, water-filled furrows alternating with long, low, narrow islands) can be managed to provide both nesting and foraging habitat for shorebirds. Deep-water habitats will be created by excavation within the deeper portions of the cells, or by taking advantage of existing topographic heterogeneity, to provide habitat for diving birds. Desired grades within the managed ponds will be achieved with conventional grading equipment (if the substrate is firm enough), or with specialized soft-terrain, amphibious grading equipment on less consolidated substrates.

The degree of modification (*e.g.*, grading and water level adjustments) required for *reconfigured ponds* to achieve high bird use will vary depending on the current elevation, topographic variability, and other features of existing ponds. For example, some ponds currently support high shorebird densities when water depths are suitable; such ponds would not require extensive grading, although enhanced water level management to target depths for specific species is expected to benefit waterbirds.

Experimentation with island design and configuration via monitoring and adaptive management will allow the optimal design for use by nesting, brooding, roosting, and foraging birds to be refined. Initially, a variety of islands of different shapes will be provided, although long, narrow islands averaging 40 ft wide and 300 ft long have proven successful in providing roosting and nesting habitat in managed ponds in the San Joaquin Valley (Gordus and others 1996; H.T. Harvey & Associates 1996). Islands will be located away from levees and public access points to reduce disturbance, and will generally be located in the deeper portions of the cells (including areas along remnant channels). Islands will typically be oriented against the wind to provide sheltered lee-side areas, although irregular and zig-zagged islands will provide shelter from wind originating from virtually any direction. At least some islands will be high enough to prevent overwashing during high winds.

Water control structures, remnant channels, and new excavated channels will allow water to be circulated through and among cells to meet target ponding depths, allow flooding and drawdown of cells to optimize prey availability, prevent stagnation, and deter vegetation establishment. Water levels will be managed through a combination of gravity drainage (preferred, to facilitate management and reduce long-term costs) and pumping (where required) to allow the maintenance of desired water depths. A flexible water circulation program with independently managed cells will allow for management of salinity within cells, allowing increased salinity in some cells and allowing salinity to be diluted in others prior to discharge into the Bay. Flexibility in the water circulation program would allow for seasonal and inter-annual variation in water depth within a given pond or cell.

The level of active management of water levels expected (*i.e.*, one person monitoring water depths and adjusting inlets and outlets every few days, with limited pumping as needed) is comparable to ongoing management levels at waterfowl refuges in the Central Valley. Ongoing water level management requirements to maintain certain conditions (e.g., specific water depths for foraging shorebirds) may be less intensive for *reconfigured ponds* than for *enhanced ponds* that lack suitable topography. The initial grading of *reconfigured ponds* can help ensure that at a given water level the desired conditions will be present somewhere within the pond, whereas for *enhanced ponds* with limited topographic variation, the desired condition would not be met if water levels became temporarily either too deep due to heavy rainfall or too shallow due to excessive evaporation.

Compared to the other types of managed ponds, the *reconfigured ponds* are expected to create additional habitat benefits and entail additional costs. The *reconfigured ponds* will require more initial grading and a higher ongoing level of effort for operation and maintenance due to the greater number of islands and check berms (which will require control of vegetation) and water control structures.

The concept behind reconfiguring ponds to maximize the availability of suitable habitat for target species is based on well established relationships between pond characteristics (such as water depth) and bird use and ample empirical evidence of the use of South Bay salt ponds and managed ponds (*e.g.*, the Coyote

Creek Reach 1A pond) with certain characteristics by high numbers of birds. The ability of *reconfigured ponds* to attract and support high densities of migrant and breeding waterbirds has been well established based on 10 years of experimentation and management experience in the San Joaquin Valley, where the suite of species using these managed ponds is very similar to those currently using South Bay salt ponds (Gordus and others 1996; H.T. Harvey & Associates 1996). Given that such intensively *reconfigured ponds* have not yet been constructed in the immediate South Bay area, the use of reconfigured ponds by the SBSP Restoration Project is considered experimental. These ponds will not be implemented at a broad scale until construction and maintenance costs of the pilot *reconfigured ponds* are determined, the benefits of increased bird use have been determined by monitoring, and these costs and benefits can be adequately compared.

4.1.1.5 Vegetated Ponds

There are certain circumstances where it may be desirable to manage *vegetated ponds*, rather than allow such areas to be fully tidal. For example, managed, diked salt marsh, such as now exists in New Chicago Marsh in Alviso, may be created in some ponds by managing water levels and allowing (or promoting) vegetation establishment in order to provide protected reserves for the salt marsh harvest mouse while providing nesting, foraging, brooding, and roosting habitat for shorebirds and waterfowl as well. *Vegetated ponds* will require water management, either through controlled, muted tidal action, or via water control structures (gravity flow or pumping). They may require some initial grading, and/or internal water control structures, depending on the management goal. Full tidal action may eventually be restored to *vegetated ponds* to create tidal marsh, depending on the management goal and pond characteristics (*e.g.*, degree of subsidence).

4.1.2 Tidal Habitat

Tidal habitat is a general term that refers to the range of habitats between subtidal bay and uplands. These primarily consist of unvegetated mudflats, emergent marsh, tidal channels, tidal ponds, salt pans, salt marsh, and upland transition zones. Each of these tidal habitats has unique functions and values that contribute to the health of the estuary. For example, *salt marsh* and *upland transition zones* are critical for the salt marsh harvest mouse, while *emergent marshes* comprised of pickleweed and cordgrass with complex dendritic *tidal channel* networks are important for the California Clapper Rail. Meanwhile, shorebirds, waterfowl, and other waterbirds will utilize the *unvegetated mudflats, salt pans, tidal channels* and associated *tidal ponds*. This mosaic of habitat types with a range of values for numerous species is referred to collectively as tidal habitat.

Breaching and/or removing artificial outboard levees will restore the twice-a-day ebb and flow of the tides through the ponds. The bay waters bring with them sediments from the Bay, which will be deposited in the ponds. The sedimentation process can be accelerated in certain areas by preserving sections of levees as wave breaks to create sheltered areas. *Emergent marsh* vegetation will colonize in the higher elevation tidal areas. Some areas of the ponds are at elevations where vegetation such as cordgrass and pickleweed will colonize rapidly. Other areas will require the build up of mudflats through sedimentation before vegetation will colonize. Planting of native marsh plant species can facilitate *salt marsh* establishment, if necessary.

In large natural marsh systems, low natural levees along higher-order (*i.e.*, 4th and 5th order) *tidal channels* provide nesting habitat for California Clapper Rails and serve as intra-marsh refugia for salt marsh harvest mice, rails, and other species during spring tides. Restoration of natural levees can be facilitated by sidecasting sediments from the channel onto the adjacent marsh. Placement of fill to block borrow ditches will prevent these artificial ditches from dominating the tide's ebb and flow within a restored marsh, allowing for faster and more complete rejuvenation of remnant *tidal channels*.

Upland transitional zone habitat areas can be created at the upper edge of marshes by importing fill to produce broad, gently sloping areas adjacent to flood control levees or adjoining upland habitat. These habitats can also be created passively in the long-term through natural marshplain evolution processes. These unique marsh-associated habitats, including the upland ecotone as well as natural *salt pan* areas within upper *salt marshes*, are critical components of bay wetlands and require thoughtful restoration design. Excavation of shallow depressions in the upper *salt marsh* will facilitate the formation of *salt pans*.

If sediment deposition does not outpace sea level rise in a given area, then *salt marsh* will not be created. Some areas where tidal inundation has been restored may remain *unvegetated mudflat*. The landscape-scale sediment analysis will inform predictions of how rapidly the ponds will fill in with sediments.

4.2 Flood Management Features

A key element of the restoration project is to ensure that flood hazards to adjacent communities and infrastructure are not increased as a result of the restoration. Therefore, the proposed restoration alternatives contain provisions to manage flood hazards from both fluvial (stream) and coastal flood sources. One feature consistent across restoration alternatives is an inboard levee to protect against coastal flooding. This proposed line of coastal flood protection would be comprised of existing levees, high ground, and new (engineered) flood protection levees. The existing inboard levees are predominantly interior salt pond levees that are typically smaller than the outboard levees. Some of the existing levees have been modified or raised to improve flood protection but most have not been constructed to standards that would make them acceptable as flood protection levees. Therefore, many of the berms and levees associated with the salt ponds will require improvement, or replacement, if they are to provide the level of flood protection required for FEMA flood standards. Flood protection provided by levees may be enhanced by maintenance and retrofitting of existing levees or the construction of new levees.

Flooding is also possible from the major stream channels that flow from the surrounding watersheds through the salt ponds to the Bay. During large rainstorms, these channels convey flood flows to the Bay. Because the channels are constricted, these flood flows can produce high water levels upstream, resulting in levee overtopping and local flooding. If flood events occur concurrent with high tides, flood hazards are increased. From a fluvial flood-management perspective, there are two approaches to reducing flood hazards: providing increased channel-flow conveyance or providing increased flood storage (detention). Both approaches are utilized within the project alternatives.

Conveyance can be increased by removing, breaching, or setting back the existing channel levees, widening the channel and providing additional cross-sectional area for flow. Conveyance can also be increased using regular tidal scour to enlarge the channel cross-section. Breaching slough levees will route more tidal flow through the sloughs/channels, resulting in channel deepening and widening. The expansion of the cross-section will increase channel flood flow conveyance and thereby reduce upstream water levels and flood hazards without requiring repeated dredging.

Flooding impacts may also be reduced by providing temporary storage of floodwater within the managed ponds. Conversion of ponds to muted tidal or seasonal wetland with flood-flow diversion will increase storage of fluvial flood waters, resulting in decreased water levels and reduced flood hazards in the tributary channels.

4.3 Public Access/Recreation Features

The integration of public access and recreation features into the project area addresses the objectives for public access and recreation as well as specific planning considerations for the development of preliminary options, as presented in three public workshops held in September and October 2004 and documented in Section 4.4. The public access and recreation features proposed as part of the program alternatives include an interrelated system of trails and viewing platforms, hunting, access to and interpretation of cultural resource features, opportunities for field education and interpretation, non-motorized boat launching points and associated staging and parking areas.

The trails component of the public access and recreation will be layered with certain segments linking the Bay Trail spine, some spur segments that will also be part of the Bay Trail regional system, and some local trail connectors that may be part of an existing local trail or part of the Bay Trail connector system. Trails form the network of interconnection between the project area and other recreation and public access features. Trail segments will vary in size, width, surfacing and the types of users they can accommodate and when visitors will have access.

Trail location and type may suggest how cultural features are accessed and where interpretive signage and guided or self-guided walks can be accommodated. Trails may be designed to accommodate vehicular use in some locations to provide access to a staging area or launching point or for disabled access to certain locations within the SBSP Restoration Project area. Trails will also provide hunting and fishing access to areas that will accommodate these activities. These factors will be further developed for the project-level alternatives, however, they are relevant for the program level to ensure the trail system provides the ability to integrate all features in a comprehensive, interrelated system that responds to habitat and flood control features.

All public access and program features will be developed in concert with each other to maximize the ability to manage these resources over time and will be designed to withstand their location within the restoration area. Trails and other access features that are developed on existing or proposed levees will be designed to be integrated with the levee structure, without interrupting the flood control function. Tidal access and recreation areas will be designed to withstand inundation and may be in locations that will have more limited access or use, depending on tidal location and habitat requirements. Public access and recreation features will need to be designed to respect habitat requirements and therefore may be seasonal or limited in the number of visitors that can be accommodated.

Public access and recreation features in all program alternatives will provide many different aesthetic experiences including access to the Bay and access in a natural setting, recreation for a variety of users including multi-use trail users, kayakers, hunters, anglers, school and other interested groups, and will close gaps in the Bay Trail spine for the South Bay. These can be accomplished in a variety of physical locations and alignments to be refined in the final program alternatives, using the metrics that were developed as part of the ADF as well as financial, managerial and environmental factors. Once refined, the final program alternatives will still allow for flexibility in future planning at the project level.

4.4 Planning Considerations

A set of Planning Considerations (considerations) was developed to help guide the location of specific design elements (*e.g.*, tidal habitat, managed pond habitat, flood management, and public access/recreation) within the landscape and within each pond complex (PWA and others 2004b). The considerations are presented in Attachment 2. The considerations were guided by a draft set of science-based conceptual models that link project actions to achievement of the project objectives. The considerations were developed with input from the Project Management Team and the consultant team, and were refined with input from the public and the Science Team. Because trade-offs must often be made between desirable land uses, the considerations guide, but don't dictate, a particular layout of the design features.

The consideration "create broad upland transitional areas" (Attachment 2, Tidal Habitat Consideration #2), provides an example of how the project objectives, conceptual models of habitat restoration and opportunities and constraints (PWA and others 2004c) have been used in alternatives formulation. This consideration incorporates:

- Two evaluation criteria under project objective 1a (PWA and others 2004a):
    - Contribute to the recovery of the salt marsh harvest mouse
    - Re-establish populations of special-status plants

- Consideration of how marsh/upland transition contributes to satisfying the evaluation criteria, as documented in the conceptual models for habitat restoration (*in progress*):
    - Transitional habitat provides high tide refuge for the mouse, contributing to survival
    - Transitional habitat is necessary for growth and survival of rare plants

- Opportunities and Constraints (PWA and others 2004c)
    - Location of adjacent upland areas

5. PRELIMINARY PROGRAM ALTERNATIVES

The preliminary program alternatives are:
- No Action Alternative
- Alternative 1: Managed Pond Emphasis
- Alternative 2: Mix of Managed Pond and Tidal Habitat
- Alternative 3: Tidal Habitat Emphasis

Each preliminary program alternative integrates habitat-restoration, flood-management, and public-access features for the three pond complexes, as shown in Figures 2 to 5. The No Action alternative is required for NEPA/CEQA compliance and represents the most likely condition in the absence of a long-term restoration plan. The three "action" alternatives provide for a mix of managed pond and tidal habitat, but vary in the relative extents of these habitats. The mix of habitats would benefit a variety of wildlife, including special-status species and migratory birds, and would increase the abundance and diversity of native species in the South Bay. Alternatives 1 through 3 all improve existing levels of flood protection and provide high quality public access and recreation opportunities.

The variation in relative extents of tidal and managed pond habitat among the three project alternatives will allow the project to consider trade offs between project objectives that respond differently to one type of habitat versus another. The landscape-scale assessment, in progress and described in the ADF (PWA and others 2004a), will help inform this consideration of trade offs by increasing the level of understanding of sediment availability and bird use. Uncertainties about sediment availability affect our ability to know where and to what extent tidal marsh can be restored, as well as how much existing and created mudflats there will be following project implementation. Uncertainties about bird use affect our ability to know the extent of managed pond, mudflat, tidal marsh, and bay habitat required to maintain current migratory bird species that use the South Bay. The adaptive management program (Section 7) will be important in further improving understanding (and reducing uncertainty) as the project is implemented.

Alternatives 1 to 3 all include at least 10% reconfigured pond habitat, with the exact locations within the designated managed pond areas to be determined during the planning process. To maintain current populations of bird species breeding in the ponds[2], it is likely that at least 10% of the existing salt pond area (i.e., approximately 1,500 acres) will need to be managed as reconfigured ponds for nesting. This

[2] Evaluation criteria for project objective 1b, see the Alternatives Development Framework (PWA and others 2004a)

estimate is based on current breeding populations of shorebirds and terns in the South Bay salt ponds, and densities of nesting birds that may be achievable with intensive management. Landscape-scale modeling of bird populations under the preliminary alternatives will help to refine this percentage.

Figures 2 to 5 show the alternatives for key times during the 50-year planning horizon. For the No Action alternative, the figure represents initial conditions (or baseline conditions), before deterioration of infrastructure. For Alternatives 1 to 3, the figures show conditions after complete implementation. Phasing of the alternatives (discussed in Sections 5.1 through 5.4 and Section 6) is not shown graphically. Phasing and evolution diagrams will be developed for the final program alternatives, including evolution of the No Action alternative.

Because of the complexity of the program alternatives, it is difficult to graphically display the complete range of potential flood protection levee and trail alignments that are being considered within a given alternative. For simplicity, the alternative maps show only one of several potential alignments. The full range of alignments being considered for each alternative is presented in Attachment 3. For example, while three trail alignments are possible at the historic Oliver Salt Works at Eden Landing -- a loop trail, short-spur trail, or long-spur trial -- the map for Alternative 1 shows just one of these possibilities, the loop trail.

5.1 No Action Alternative

The No Action Alternative (Figure 2) assumes that the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS) will operate and maintain the ponds in a manner similar to the ISP (Life Science 2003), although ongoing operations and maintenance activities would be scaled back. The ISP is intended as an interim plan for the period while the long-term restoration plans are developed and implemented. In the absence of a long-term restoration plan, the ISP would be replaced by a smaller set of prioritized operations and maintenance actions. The No Action Alternative assumes that the CDFG and USFWS will not have funding to maintain full ISP operations.

Under the No Action Alternative, pumping will be discontinued. Ponds that require pumping for water circulation in the ISP will be dewatered or allowed to evaporate. These ponds will fill with rainwater and dry through evaporation. The landowners will manage water circulation in some or all of the remaining ponds using gravity-flow control structures, with the extent of management depending on the funds available.

Over time, operations will become more limited. Water management will be discontinued on a pond-by-pond basis as hydraulic structures break. CDFG and USFWS will maintain, but not improve, the pond levees. With continued levee subsidence and sea level rise, the levees would be prone to failure. Stop gap measures such as sand bags and rock will be used to slow deterioration of key flood protection levees. Other levees will be allowed to erode and breach.

Compared to the ISP conditions, ecosystem value to migratory shorebirds and waterfowl would be drastically reduced due to the increasingly limited availability of managed pond habitat caused by dewatering of ponds and uncontrolled breaching. On the other hand, ecosystem value to species that use tidal habitats would improve due to the increased availability of tidally inundated areas and the eventual establishment of salt marsh within the breached ponds. However, the uncontrolled nature of the breaching could limit the habitat benefits. Early unintentional breaches would create expansive new mudflats for potential vegetation colonization, and if these early breaches occur near areas with *Spartina alterniflora* and its hybrids, this could inadvertently help spread this invasive species. In addition, the unplanned evolution of the landscape could further endanger salt marsh harvest mouse populations if existing fringe marsh is lost through tidal scour before new marsh is established.

Flood risks and damages would increase over time due to deteriorating levee conditions and future sea level rise. Uncontrolled breaching under this alternative may lead to significant impacts to existing infrastructure, such as causing instability problems for the PG&E towers, as well as inland flooding where interior levees are not sufficient to keep out tidal and/or flood waters. Existing public access and recreational value will ultimately decrease due to the deteriorating condition of the levees.

5.2 Alternative 1: Managed Pond Emphasis (50:50 Tidal Habitat to Managed Pond)

Alternative 1 emphasizes managed pond habitat and provides an approximately 50:50 mix by area of tidal habitat and managed pond. Habitat-restoration, flood-management, and public-access features of Alternative 1 are shown on Figure 3 and listed in Attachment 3.

Alternative 1 provides approximately 7,500 acres of managed ponds grouped for ease of management, with many of the pond groupings corresponding to those in the ISP. Approximately 20% of the managed ponds by area (10% of the project area) will be reconfigured to significantly enhance foraging, roosting, and nesting opportunities for shorebirds, waterfowl, and other waterbirds. The remainder will be a combination of enhanced ponds, seasonal ponds, high salinity ponds, and vegetated ponds.

Alternative 1 also provides approximately 7,500 acres of tidal habitat and maintains continuous tidal marsh corridors from Greco Island (north of the Ravenswood ponds) to Alviso Slough and along most of the length of the Eden Landing shoreline. Because some reaches of this marsh corridor will require sheltered conditions to evolve from mudflat to vegetated marsh, the outboard levee will need to be maintained in these areas until tidal marsh develops. The entire area between Old Alameda Creek and the Alameda Creek Flood Control Channel will be tidal under this alternative.

New or improved flood management levees would be located along the landward edge of the project site or, in a few locations, possibly bayward of the managed ponds. The levees would tie into existing high ground and levees along the major creeks. Public access and recreation would be provided in each of the pond complexes. Because public access trails are integrated with flood control and managed pond levees, Alternative 1, with its emphasis on managed ponds, offers trail access further bayward than is offered in the other alternatives.

5.3 Alternative 2: Mix of Tidal Habitat and Managed Pond (75:25 Tidal Habitat to Managed Pond)

Relative to the other two action alternatives, Alternative 2 provides an intermediate mix of habitat types. It provides an approximately 75:25 ratio by area of tidal habitat (11,250 acres) to managed pond (3,750 acres). Habitat-restoration, flood-management, and public-access features of Alternative 2 are shown on Figure 4 and listed in Attachment 3.

As in Alternative 1, the managed ponds are grouped for ease of management, with many of the pond groups corresponding to those in the ISP, and reconfigured managed ponds making up approximately 10% of the project area. The remainder of the managed ponds will be a combination of enhanced ponds, seasonal ponds, high salinity ponds, and vegetated ponds. Alternative 2 includes all the tidal areas of Alternative 1, plus additional areas. The tidal corridor in Alternative 2 is similar to that in Alternative 1.

As in Alternative 1, new or improved flood protection levees would generally be located along the landward edge of the project site and would tie into existing high ground and levees along the major creeks. Public access and recreation would be provided within each of the pond complexes.

5.4 Alternative 3: Tidal Habitat Emphasis (90:10 Tidal Habitat to Managed Pond)

Alternative 3 emphasizes tidal restoration, relative to the other alternatives, and provides an approximately 90:10 ratio by area of tidal habitat to managed pond. Habitat-restoration, flood-management, and public-access features of Alternative 2 are shown on Figure 5 and listed in Attachment 3.

All the managed ponds in Alternative 3 would be reconfigured to significantly enhance foraging, roosting, and nesting opportunities for shorebirds, waterfowl, and other waterbirds. Reconfiguration is particularly important in Alternative 3 since it has the least area of managed pond of the three alternatives. Alternative 3 will create the most extensive tidal marsh corridor of the three alternatives, allowing for a continuous corridor along the entire project area shoreline.

New or improved flood protection levees would be located along the landward edge of the project site, on the inboard side of tidal restoration areas, and would tie into existing high ground and levees along the major creeks. Public access and recreation would be provided within each of the pond complexes. Compared to Alternatives 1 and 2, there would be fewer opportunities for direct bay access via the trails because there would be fewer maintained levees in this alternative.

5.5 Preliminary Alternatives Considered and Not Recommended

Additional preliminary alternatives were considered but not recommended for further analysis based on the limited extent to which they satisfy the project objectives. These preliminary alternatives are briefly described below.

5.5.1.1 ISP Management Alternative

The ISP could be extended as a long-term management alternative. The main feature of the ISP includes circulating bay waters through small systems of ponds in order to prevent salt production and maintain water quality (Life Science 2003). In addition, some ponds would be dewatered and managed as seasonal wetlands, select ponds in the Alviso complex would be managed as high salinity ponds to support specific wildlife populations, and a limited number of ponds would be managed with different summer and winter water levels to optimize habitat for migratory shorebirds and waterfowl. Under the ISP, the only areas currently designated for tidal-habitat restoration are the Island Ponds (A19, 20, and 21) in the Alviso complex (Life Science 2003). The existing pond levees would be maintained to preserve existing levels of flood protection and public access afforded by the salt ponds. However, the pond levees, as well as much of the inboard 'flood protection' levee system, are not certified as flood protection by FEMA.

The ISP Management alternative was eliminated from consideration because the quality of the managed pond habitat would not be as high with respect to bird use as the more intensively graded and managed ponds habitat included in the three recommended alternatives. Extending existing ISP operations indefinitely would not satisfy project objective 1a (promote restoration of native special-status plans and animals) or 1c (support increased abundance and diversity of native species) because no restoration activities to improve the existing habitats would be planned. It is also unlikely that a long-term funding source would be identified to maintain a levee system that is not adequately designed for flood control.

5.5.1.2 All Tidal Restoration Alternative

Restoring all the ponds to tidal habitat would support certain native special-status plants and animals, therefore meeting project objective 1a. However, this would not meet project objective 1b for maintaining migratory bird species that utilize the existing ponds, or project objective 1c for supporting increased abundance and diversity of the native species of the South Bay because all of the existing ponds within the project area would be eliminated. This alternative was not retained for further analysis because it does not meet project objectives 1b and c.

5.5.1.3 All or Majority Managed Pond Alternative

Retaining all ponds as managed ponds would not meet project objective 1a for promoting the restoration of special-status and native species as this objective requires at least some tidal restoration. In addition, this alternative would not satisfy project objective 4 because water quality in the South Bay would not be improved. These outcomes would conflict with Federal and State plans for endangered species recovery and would be widely considered unacceptable to agencies and other stakeholders. This alternative was not recommended because it does not meet key project objectives.

5.5.1.4 Large-scale Sediment Import Alternative

The three preliminary alternatives include the potential for importing sediment to create upland transition zones, construct levees, and raise the bottom elevations in a small subset of the ponds. Certain benefits of using imported fill could be maximized with the import of larger quantities of sediment. Large-scale sediment import was eliminated from consideration because of limitations to the amount of clean fill that could feasibly be supplied to the South Bay, and because ecological benefits decrease as the use of fill increases, and adverse environmental impacts cumulatively increase, such as changes in water quality and temporary increases in turbidity. Sediment placement, while accelerating the establishment of vegetated tidal marsh, might result in fewer and less sinuous tidal channels and less heterogeneous pond topography.

6. PHASING

The plan will be implemented in a series of phases over many years, on the order of a couple decades. Each pond will be managed according to the ISP until its implementation phase. The initial phases will include a range of habitat types – tidal habitat, enhanced managed ponds, and reconfigured managed ponds – as early experiments for adaptive management (see Section 7). Each phase will have its own project-level NEPA/CEQA document.

The final ratio of tidal habitat to managed pond acreage might change from what is specified in the program-level alternative selected for implementation as a result of adaptive management, therefore – in the absence of other considerations – the phasing of tidal and managed pond restoration will begin with areas that are most feasible and/or have the highest certainty of achieving the project objectives. Generally, these areas are those identified as tidal habitat or managed pond across all three action alternatives. For example, the area between Old Alameda Creek and Alameda Creek Flood Control Channel in the Eden Landing complex is recommended for tidal restoration in all three alternatives (Figures 3a, 4a, and 5a), therefore this area is considered one of the most feasible/highest certainty areas for tidal restoration. Similarly, ponds E11 – E14 are designated as managed pond across all three alternatives (Figures 3a, 4a, and 5a), therefore these ponds are considered some of the most feasible/highest certainty areas for managed pond habitat.

The exact progression of restoration activities will need to consider many other factors. Implementation in particular locations may be delayed pending successful eradication or control of invasive *Spartina* in that area. Maintaining consistency with anticipated future phases is another factor. For example, it would not make sense to build a levee along one alignment for an early phase if a different levee alignment might be needed in a later phase. It will also be important to phase the project to mitigate for impacts as early as possible before they occur, for example creating the high marsh corridor before existing marsh is lost through tidal scour.

7. ADAPTIVE MANAGEMENT DECISIONS

Implementation of the later phases of any given program alternative will be subject to adaptive management based on feedback from on-going monitoring efforts of the earlier phases. Adaptive management can be used to adjust previously implemented actions as well as future actions to better meet the project objectives. As a result of these manipulations, the final implemented restoration plan will likely look different from the selected program-level alternative, but the objectives will be achieved.

In each alternative, there are three types of decisions with respect to adaptive management.

- "Irreversible" decisions, not subject to adaptive management once implemented. For example, levee alignment, infrastructure, marsh/transitional habitat locations, most public access structures
- "Implemented" decisions subject to adaptive management. Early restoration actions that can be modified and/or adjusted after implementation. For example, pond water management plans, breaching (possibly), minor modifications to managed pond cell grading and trail alignments, and non-structural public-access/ recreation features
- "Future" decisions subject to adaptive management. Restoration actions that have not yet been implemented that can be modified and/or adjusted prior to implementation. For example, aerial extent of tidal versus managed pond habitats needed to achieve the objectives, modifications to which ponds may be managed or tidal, locations and types of public access/recreation based on how people are responding

For the preliminary program alternatives, there are three key areas of uncertainty for particular attention in adaptive management. The predictions referred to below will be developed during subsequent alternatives development and referenced in the adaptive management plan.

1. Are the rates and patterns of tidal-habitat conversion occurring as predicted? If not, adjust the locations and extent of tidal restoration to meet the objectives.
2. Is bird use occurring as predicted? If not, adjust the locations, extent, and types of managed ponds to meet the objectives.
3. Are the rates, patterns, and environmental impacts of human recreation use occurring as predicted or do they cause adverse environmental impacts? If the results are not occurring as predicted, adjust the locations, extents, and types of public-access/recreation features to meet the objectives.

8. NEXT STEPS

The next steps through mid-2005 will be to complete the landscape assessment of tidal-habitat evolution and bird use, evaluate the preliminary program alternatives using weighting and ranking, then to refine the preliminary program alternatives into final program alternatives for NEPA/CEQA assessment. The landscape assessment of tidal-habitat evolution and bird use will inform the weighting and ranking process by providing estimates of the rates and patterns of tidal-habitat evolution following restoration and estimates of bird use by alternative.

As the preliminary program alternatives are developed into final program alternatives, they will be refined with respect to features and phasing. The features will be refined in response to detailed analyses, evaluation, and input from the regulatory and trustee agencies, the public, and the project science team. The final program alternatives will include phasing diagrams of the alternatives at approximately decadal intervals over 50 years, and will identify the Phase 1 project.

9. REFERENCES

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Source files for this report are located at PWA:
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11. LIST OF ATTACHMENTS

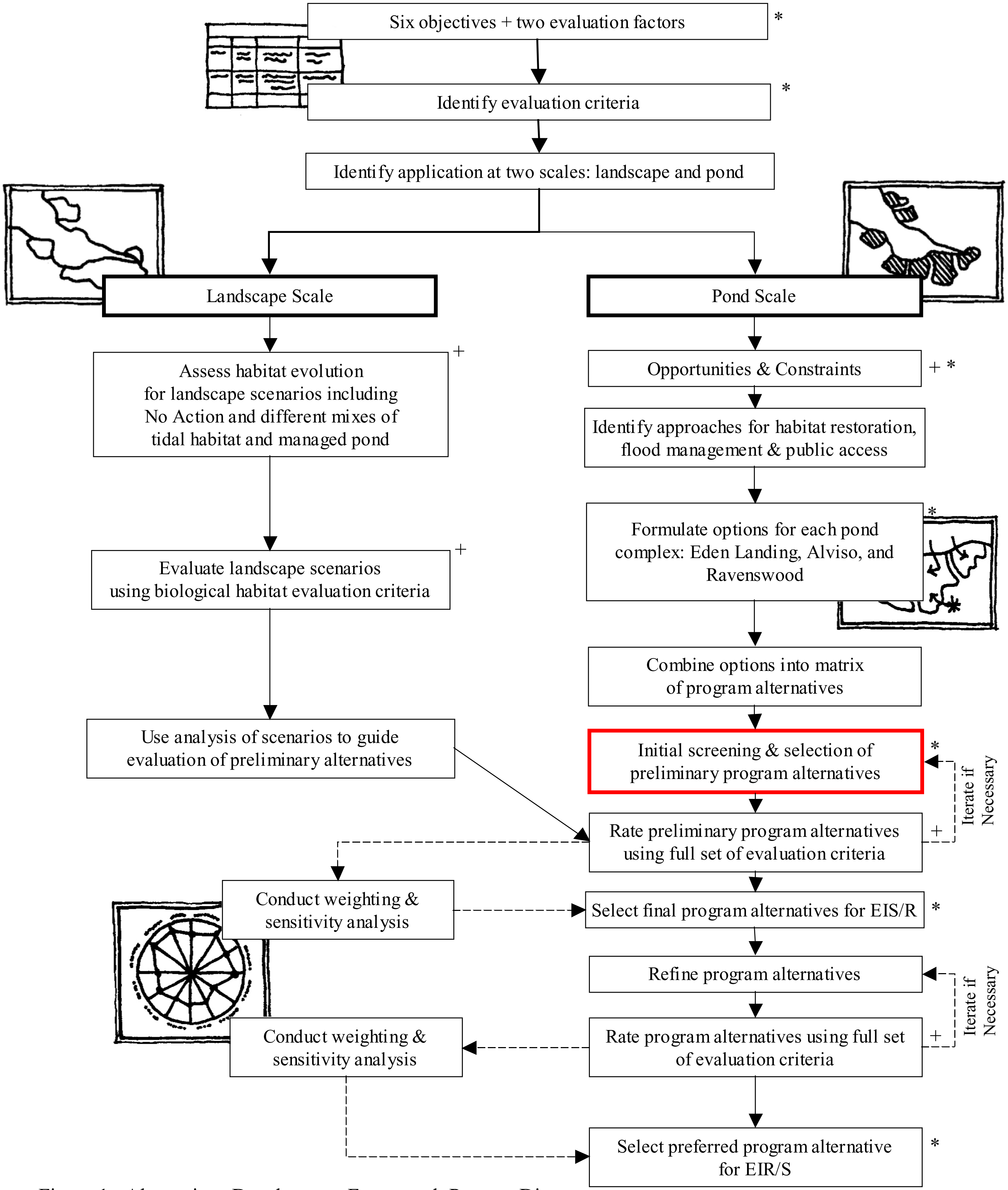

Figure 1. Alternatives Development Framework Process Diagram

Current location in the ADF process

\+ Input from technical analyses and Science Team

* Input from Stakeholders and Regulatory Agencies

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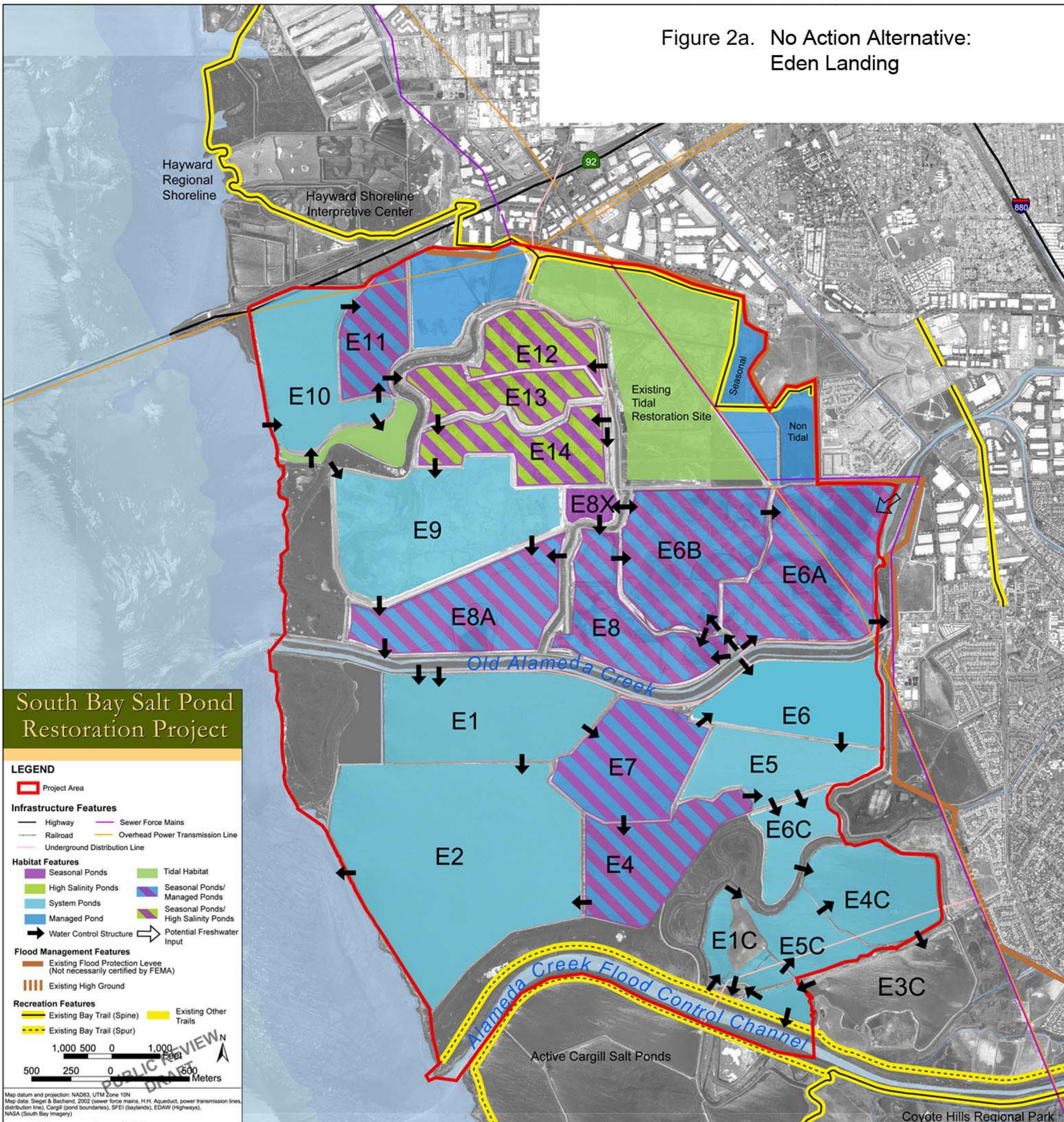


Figure 2a. No Action Alternative:
Eden Landing
Hayward
Regional
Shoreline
Hayward Shoreline
Interpretive Center
92
880
E11
E10
E12
E13
E14
Existing
Tidal
Restoration Site
Seasonal
Non
Tidal
E9
E8X
E6B
E6A
E8A
E8
Old Alameda Creek
E1
E6
E5
E7
E2
E6C
E4
E4C
E1C
E5C
E3C
Alameda Creek Flood Control Channel
Active Cargill Salt Ponds
Coyote Hills Regional Park
South Bay Salt Pond
Restoration Project
LEGEND
Project Area
Infrastructure Features
Highway
Sewer Force Mains
Railroad
Overhead Power Transmission Line
Underground Distribution Line
Habitat Features
Seasonal Ponds
Tidal Habitat
High Salinity Ponds
Seasonal Ponds/
Managed Ponds
System Ponds
Seasonal Ponds/
High Salinity Ponds
Managed Pond
Water Control Structure
Potential Freshwater
Input
Flood Management Features
Existing Flood Protection Levee
(Not necessarily certified by FEMA)
Existing High Ground
Recreation Features
Existing Bay Trail (Spine)
Existing Other
Trails
Existing Bay Trail (Spur)
1,000 500 0 1,000
Feet
500 250 0 500
Meters
N
PUBLIC REVIEW
DRAFT
Map datum and projection: NAD83, UTM Zone 10N
Map data: Siegel & Bachand, 2002 (sewer force mains, H.H. Aqueduct, power transmission lines, distribution line), Cargill (pond boundaries), SFEI (baylands), EDAW (Highways), NASA (South Bay Imagery)
Map by: EDAW Inc. Map date: January 13, 2005

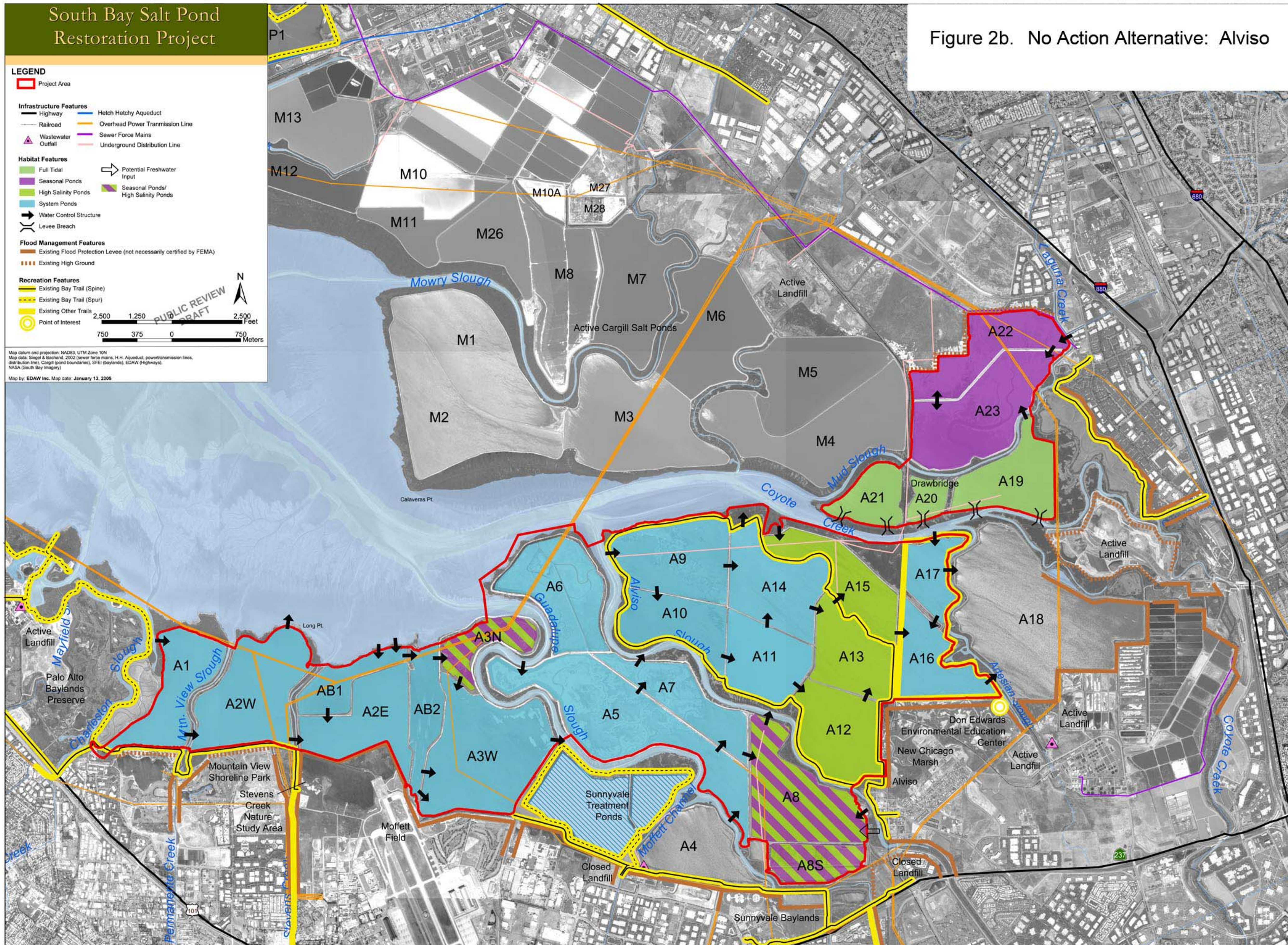
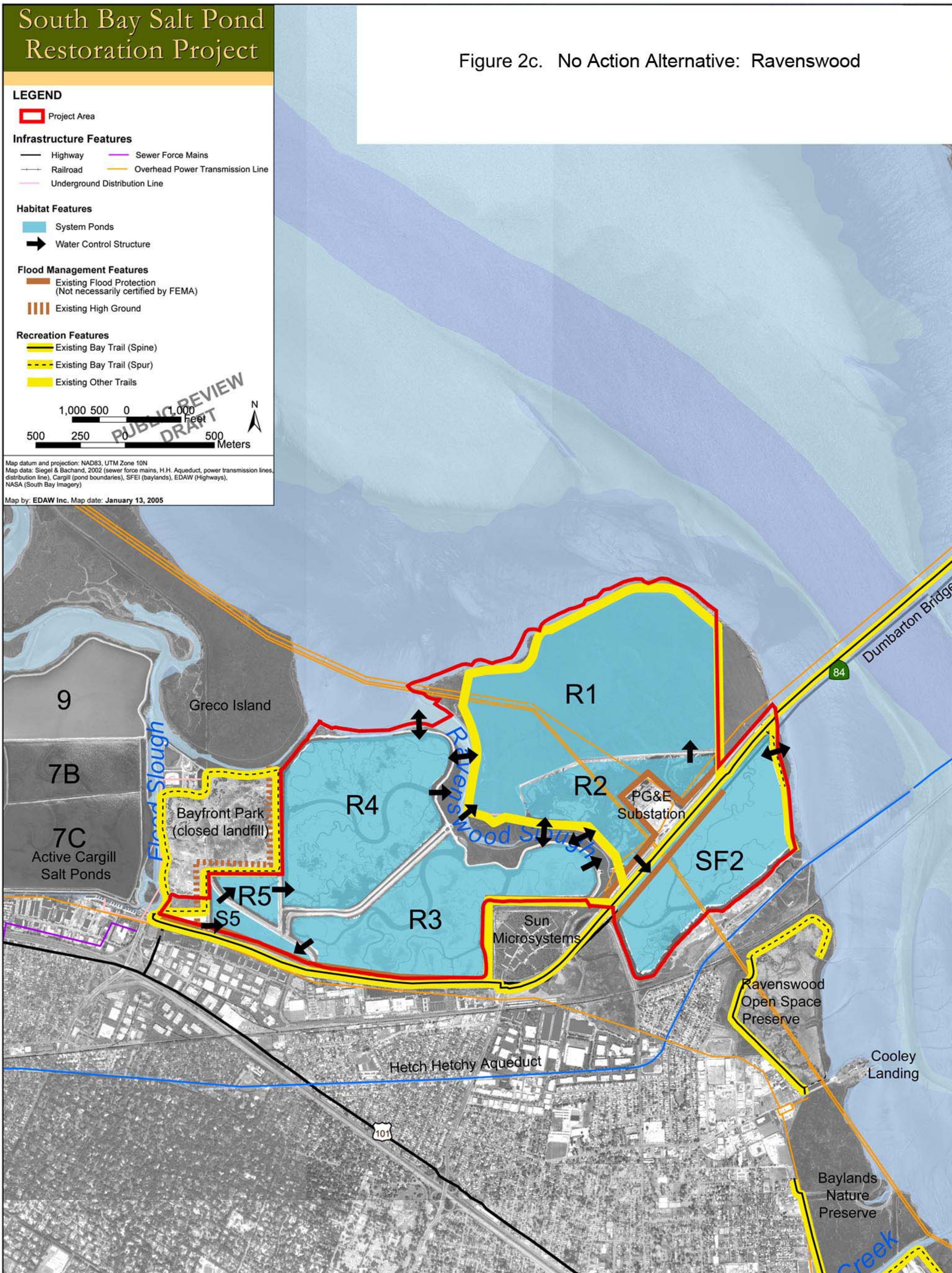


Figure 2b. No Action Alternative: Alviso

Figure 2c. No Action Alternative: Ravenswood



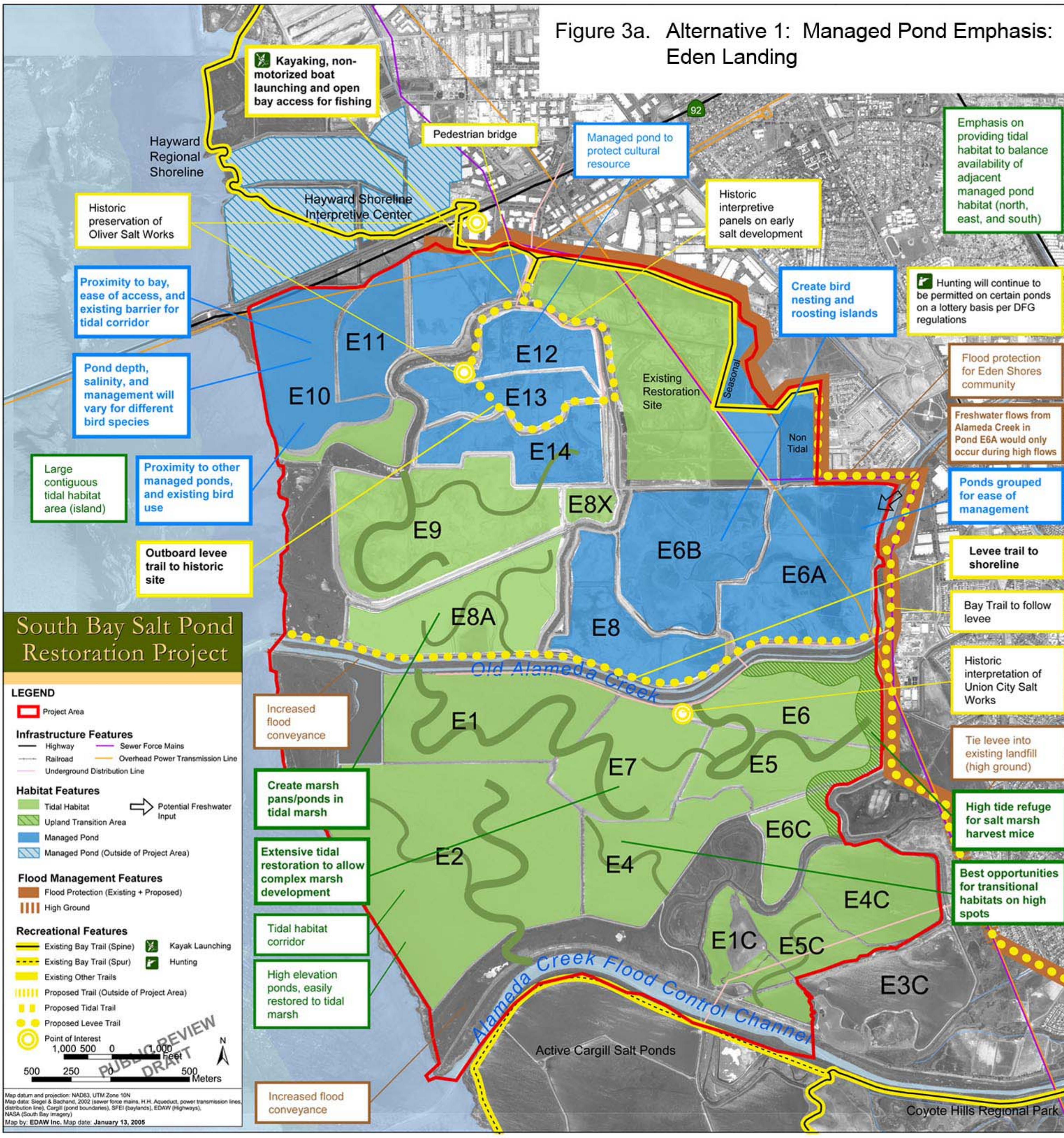
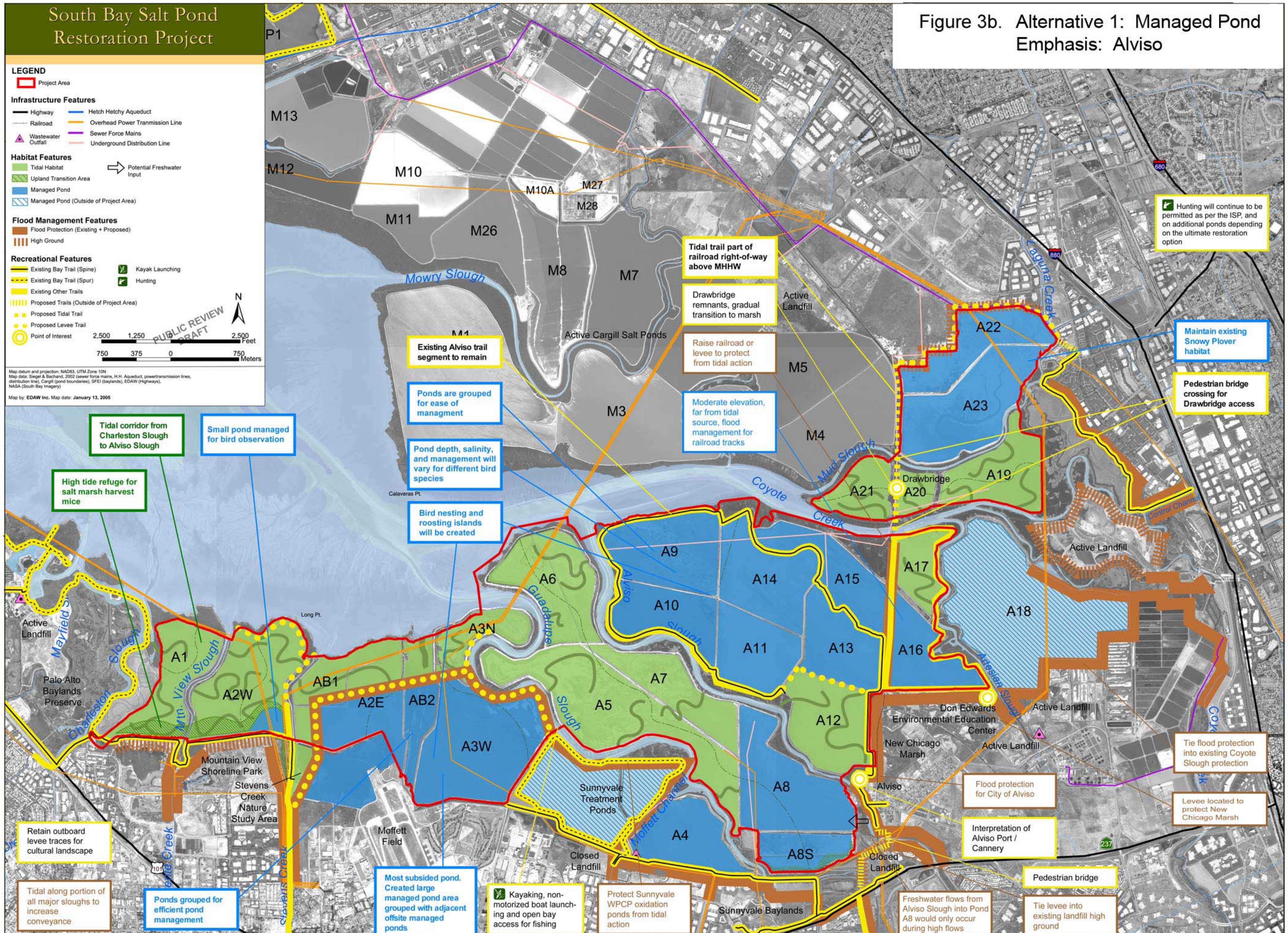


Figure 3a. Alternative 1: Managed Pond Emphasis: Eden Landing
Kayaking, non-motorized boat launching and open bay access for fishing
Pedestrian bridge
Managed pond to protect cultural resource
Emphasis on providing tidal habitat to balance availability of adjacent managed pond habitat (north, east, and south)
Hayward Regional Shoreline
Hayward Shoreline Interpretive Center
Historic preservation of Oliver Salt Works
Historic interpretive panels on early salt development
Proximity to bay, ease of access, and existing barrier for tidal corridor
Create bird nesting and roosting islands
Hunting will continue to be permitted on certain ponds on a lottery basis per DFG regulations
Pond depth, salinity, and management will vary for different bird species
Flood protection for Eden Shores community
Freshwater flows from Alameda Creek in Pond E6A would only occur during high flows
Large contiguous tidal habitat area (island)
Proximity to other managed ponds, and existing bird use
Ponds grouped for ease of management
Outboard levee trail to historic site
Levee trail to shoreline
Bay Trail to follow levee
Historic interpretation of Union City Salt Works
Tie levee into existing landfill (high ground)
Increased flood conveyance
Create marsh pans/ponds in tidal marsh
High tide refuge for salt marsh harvest mice
Extensive tidal restoration to allow complex marsh development
Best opportunities for transitional habitats on high spots
Tidal habitat corridor
High elevation ponds, easily restored to tidal marsh
Increased flood conveyance
E11
E12
E10
E13
E14
Existing Restoration Site
Seasonal
Non Tidal
E9
E8X
E6B
E6A
E8A
E8
Old Alameda Creek
E1
E6
E7
E5
E6C
E2
E4
E4C
E1C
E5C
E3C
Alameda Creek Flood Control Channel
Active Cargill Salt Ponds
Coyote Hills Regional Park
92
South Bay Salt Pond Restoration Project
LEGEND
Project Area
Infrastructure Features
Highway
Sewer Force Mains
Railroad
Overhead Power Transmission Line
Underground Distribution Line
Habitat Features
Tidal Habitat
Potential Freshwater Input
Upland Transition Area
Managed Pond
Managed Pond (Outside of Project Area)
Flood Management Features
Flood Protection (Existing + Proposed)
High Ground
Recreational Features
Existing Bay Trail (Spine)
Kayak Launching
Existing Bay Trail (Spur)
Hunting
Existing Other Trails
Proposed Trail (Outside of Project Area)
Proposed Tidal Trail
Proposed Levee Trail
Point of Interest
1,000 500 0 1,000 Feet
500 250 0 500 Meters
N
PUBLIC REVIEW DRAFT
Map datum and projection: NAD83, UTM Zone 10N
Map data: Siegel & Bachand, 2002 (sewer force mains, H.H. Aqueduct, power transmission lines, distribution line), Cargill (pond boundaries), SFEI (baylands), EDAW (Highways), NASA (South Bay Imagery)
Map by: EDAW Inc. Map date: January 13, 2005

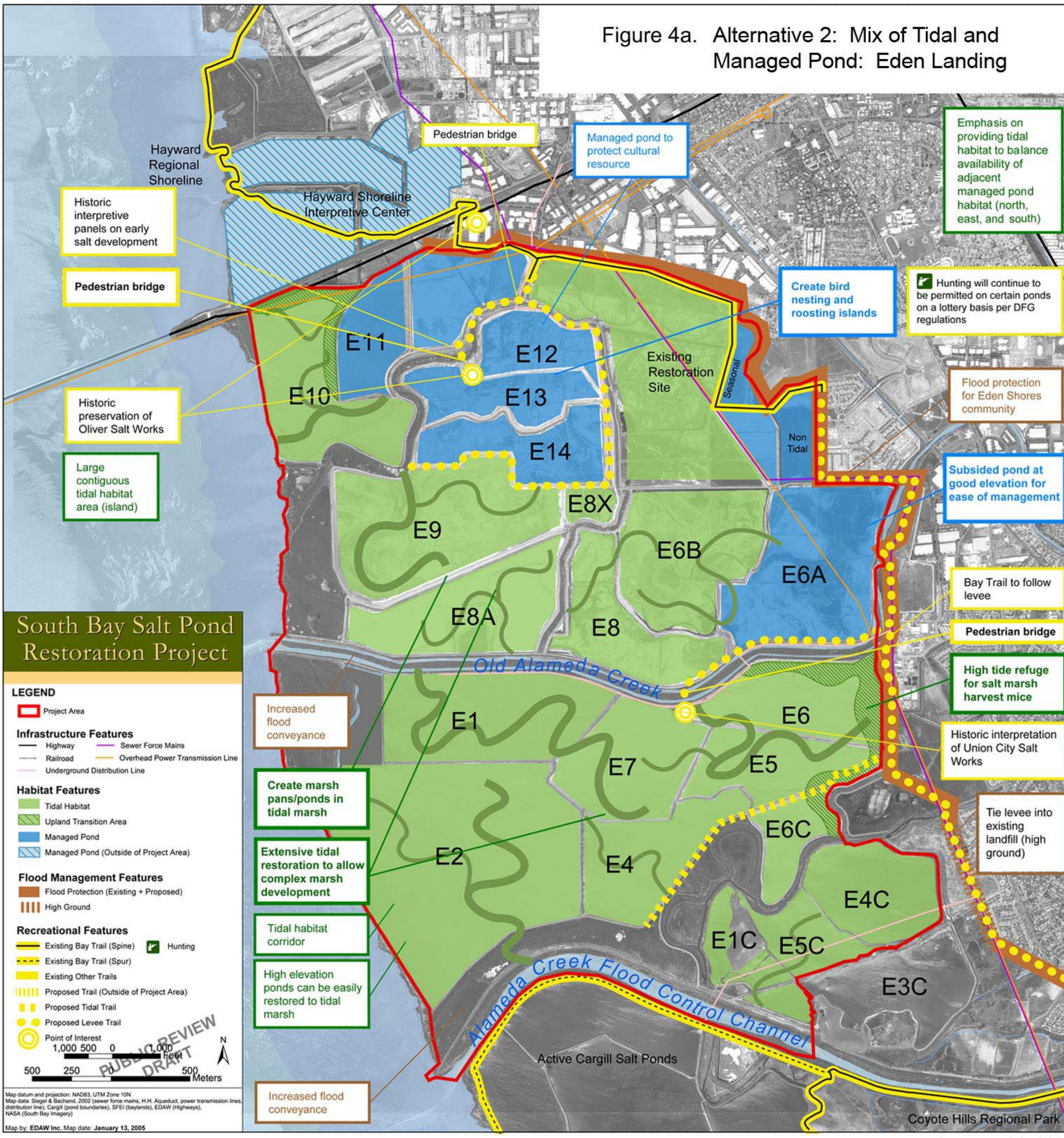


Preliminary Program Alternative DRAFT

January 21, 2005

Figure 3c. Alternative 1: Managed Pond Emphasis: Ravenswood

Figure 4a. Alternative 2: Mix of Tidal and Managed Pond: Eden Landing



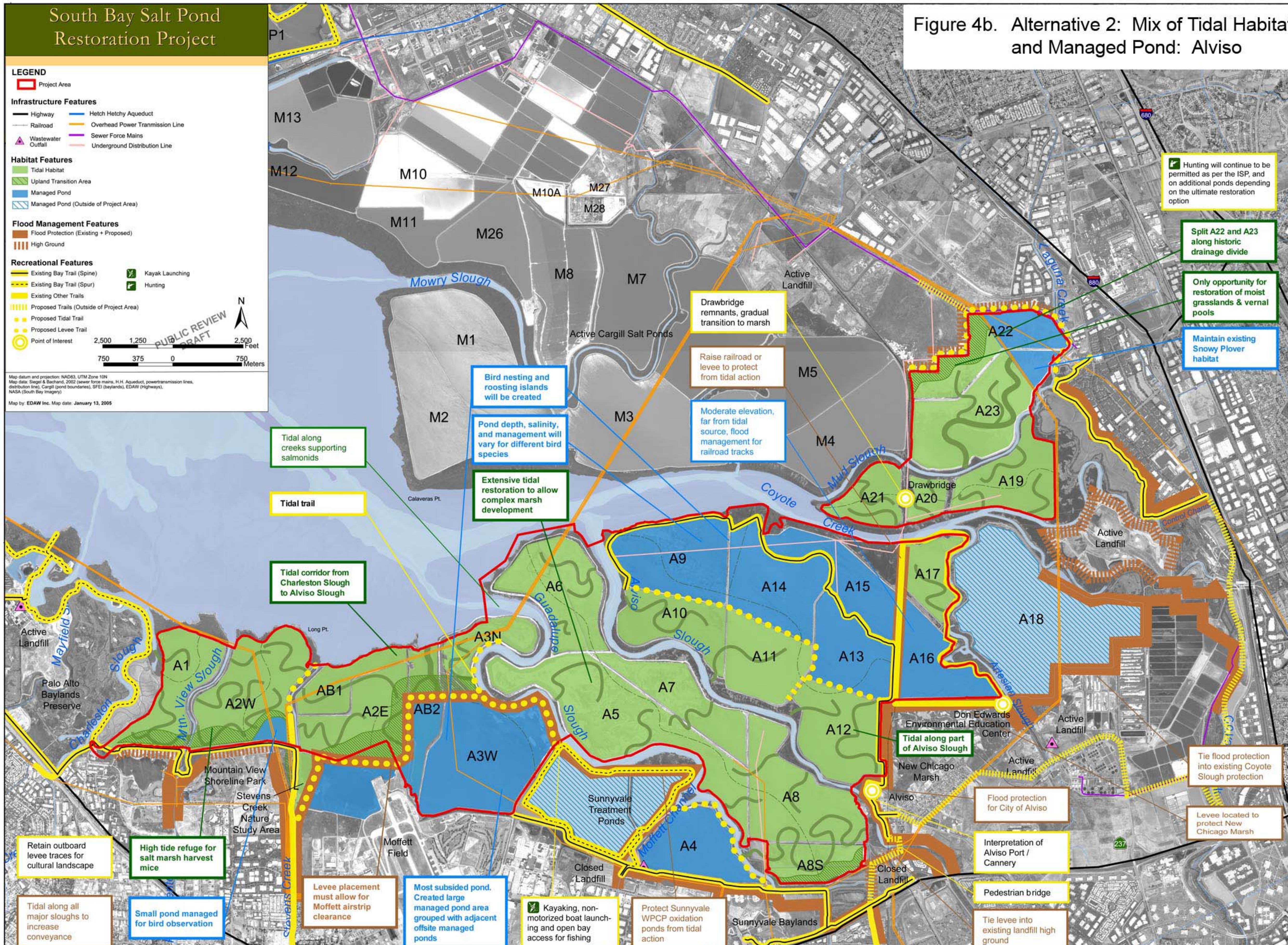


Figure 4b. Alternative 2: Mix of Tidal Habitat and Managed Pond: Alviso

South Bay Salt Pond Restoration Project
Figure 4c. Alternative 2: Mix of Tidal Habitat and Managed Pond: Ravenswood
LEGEND
Project Area
Infrastructure Features
Highway
Sewer Force Mains
Railroad
Overhead Power Transmission Line
Underground Distribution Line
Habitat Features
Tidal Habitat
Tidal Habitat (Outside of Project Area)
Upland Transition Area
Managed Pond
Managed Pond (Outside of Project Area)
Flood Management Features
Flood Protection (Existing + Proposed)
High Ground
Recreational Features
Existing Bay Trail (Spine)
Kayak Launching
Existing Bay Trail (Spur)
Hunting
Existing Other Trails
Proposed Trail (Outside of Project Area)
Proposed Tidal Trail
Proposed Levee Trail
Point of Interest
1,000 500 0 1,000 Feet
500 250 0 500 Meters
PUBLIC REVIEW DRAFT
Map datum and projection: NAD83, UTM Zone 10N
Map data: Siegel & Bachand, 2002 (sewer force mains, H.H. Aqueduct, power transmission lines, distribution line), Cargill (pond boundaries), SFEI (baylands), EDAW (Highways), NASA (South Bay Imagery)
Map by: EDAW Inc. Map date: January 13, 2005
Hunting will continue to be permitted as per the ISP, and on additional ponds depending on the ultimate restoration option
Groin to capture sediment and create tidal habitat connectivity under bridge
Large complex marsh with existing historic drainage systems
Provide flood protection for PG&E
Dumbarton Bridge
84
Tidal habitat corridor
Greco Island
R1
Tidal habitat corridor
Create bird nesting and roosting islands
Ravenswood Slough
R2
PG&E Substation
Existing nesting Snowy Plover and shorebird roosting habitat
Flood Slough
R4
Historic red barn interpretive site and trailhead
Bayfront Park (closed landfill)
SF2
Inboard levee provides flood protection
Active Cargill Salt Ponds
R5
S5
R3
Sun Microsystems
Utilize PG&E right-of-way to cross SFPUC right-of-way for Bay Trail connection
Connect to existing periphery Bay Trail
Ravenswood Open Space Preserve
Utilize existing Bay Trail
Hetch Hetchy Aqueduct
Cooley Landing
Ease of tidal restoration due to high elevations
Kayaking, non-motorized boat launching and open bay access for fishing
Tie levee into existing Sun Microsystems flood protection
Interpretation of oyster and salt industries
101
High tide refuge for salt marsh harvest mice
Baylands Nature Preserve
Creek

Figure 5a. Alternative 3: Tidal Habitat
Emphasis: Eden Landing
Hayward Regional Shoreline
Hayward Shoreline Interpretive Center
Pedestrian bridge
Managed pond to protect cultural resource
Emphasis on providing tidal habitat to balance availability of adjacent managed pond habitat (north, east, and south)
Kayaking, non-motorized boat launching and open bay access for fishing
Create bird nesting and roosting islands
Hunting will continue to be permitted on certain ponds on a lottery basis per DFG regulations
Historic interpretive panels on early salt development
Historic preservation of Oliver Salt Works
Flood protection for Eden Shores community
Large contiguous tidal habitat area
E11
E12
E13
E14
E10
Existing Restoration Site
Seasonal
Non Tidal
E8X
E9
E6B
E6A
E8A
E8
Bay Trail to follow levee
Pedestrian bridge
Old Alameda Creek
Historic interpretation of Union City Salt Works
Increased flood conveyance
E1
E6
Tie levee into existing landfill (high ground)
E7
E5
Create numerous marsh pans/ponds in tidal marsh
Extensive upland transition/high tide refuge for salt marsh harvest mice
E6C
Extensive tidal restoration to allow complex marsh development
E2
E4
E4C
Tidal habitat corridor
E1C
E5C
High elevation ponds can be easily restored to tidal marsh
Alameda Creek Flood Control Channel
E3C
Active Cargill Salt Ponds
Alternate outboard levee (south) to connect to Coyote Hills
Pedestrian bridge
Increased flood conveyance
Coyote Hills Regional Park
South Bay Salt Pond Restoration Project
LEGEND
Project Area
Infrastructure Features
Highway
Sewer Force Mains
Railroad
Overhead Power Transmission Line
Underground Distribution Line
Habitat Features
Tidal Habitat
Upland Transition Area
Managed Pond
Managed Pond (Outside of Project Area)
Flood Management Features
Flood Protection (Existing + Proposed)
High Ground
Recreational Features
Existing Bay Trail (Spine)
Kayak Launching
Existing Bay Trail (Spur)
Hunting
Existing Other Trails
Proposed Trail (Outside of Project Area)
Proposed Tidal Trail
Proposed Levee Trail
Point of Interest
1,000 500 0 1,000 Feet
500 250 0 500 Meters
PUBLIC REVIEW DRAFT
Map by: EDAW Inc. Map date: January 13, 2005

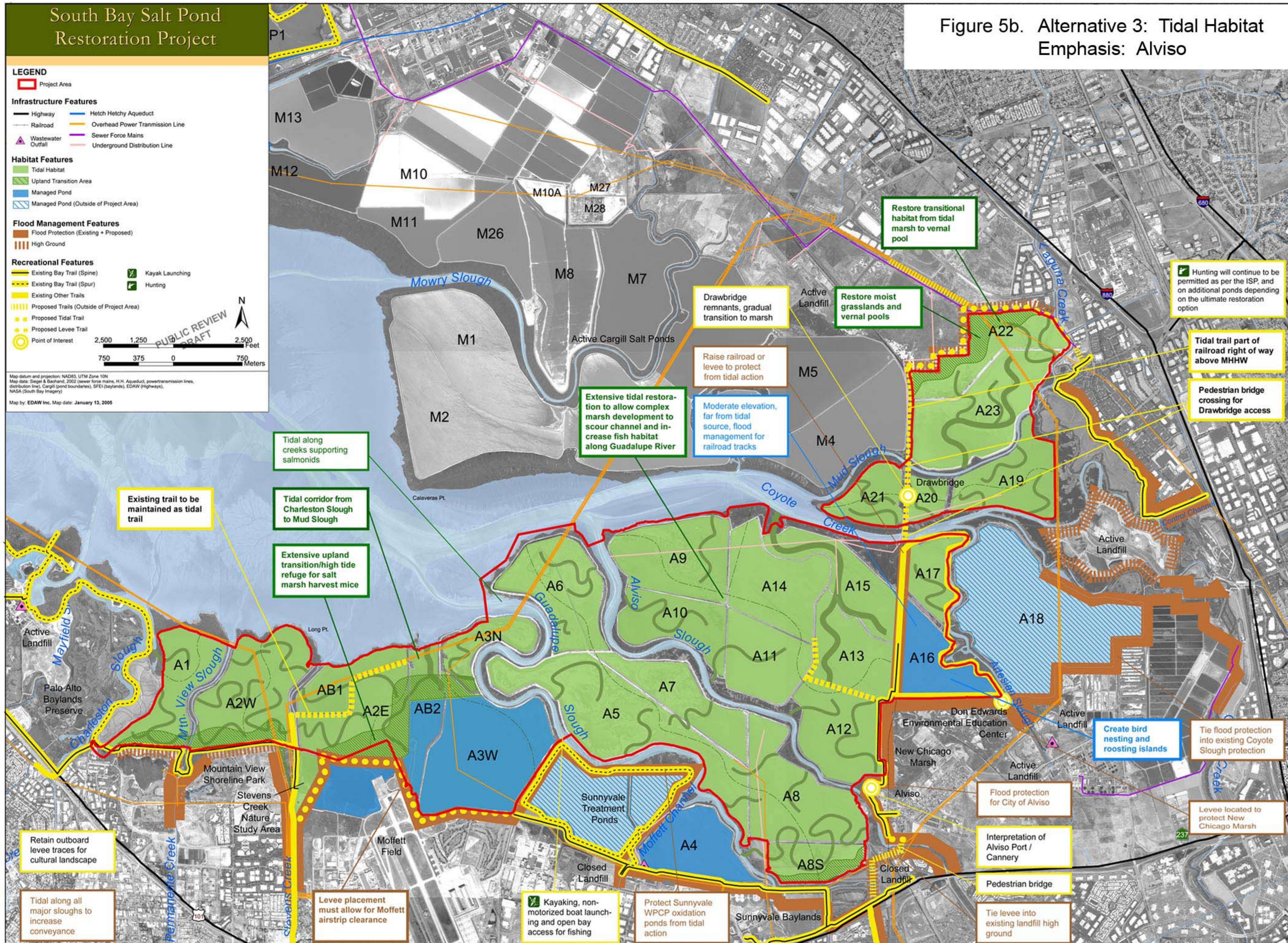

South Bay Salt Pond Restoration Project
Figure 5b. Alternative 3: Tidal Habitat Emphasis: Alviso
LEGEND
Project Area
Infrastructure Features
Highway
Railroad
Wastewater Outfall
Hetch Hetchy Aqueduct
Overhead Power Tranmission Line
Sewer Force Mains
Underground Distribution Line
Habitat Features
Tidal Habitat
Upland Transition Area
Managed Pond
Managed Pond (Outside of Project Area)
Flood Management Features
Flood Protection (Existing + Proposed)
High Ground
Recreational Features
Existing Bay Trail (Spine)
Existing Bay Trail (Spur)
Existing Other Trails
Proposed Trails (Outside of Project Area)
Proposed Tidal Trail
Proposed Levee Trail
Point of Interest
Kayak Launching
Hunting
PUBLIC REVIEW DRAFT
Feet
Meters
Map by: EDAW Inc. Map date: January 13, 2005
Restore transitional habitat from tidal marsh to vernal pool
Hunting will continue to be permitted as per the ISP, and on additional ponds depending on the ultimate restoration option
Drawbridge remnants, gradual transition to marsh
Restore moist grasslands and vernal pools
Tidal trail part of railroad right of way above MHHW
Raise railroad or levee to protect from tidal action
Pedestrian bridge crossing for Drawbridge access
Extensive tidal restoration to allow complex marsh development to scour channel and increase fish habitat along Guadalupe River
Moderate elevation, far from tidal source, flood management for railroad tracks
Tidal along creeks supporting salmonids
Existing trail to be maintained as tidal trail
Tidal corridor from Charleston Slough to Mud Slough
Extensive upland transition/high tide refuge for salt marsh harvest mice
Create bird nesting and roosting islands
Tie flood protection into existing Coyote Slough protection
Flood protection for City of Alviso
Levee located to protect New Chicago Marsh
Interpretation of Alviso Port / Cannery
Pedestrian bridge
Retain outboard levee traces for cultural landscape
Tidal along all major sloughs to increase conveyance
Levee placement must allow for Moffett airstrip clearance
Kayaking, non-motorized boat launching and open bay access for fishing
Protect Sunnyvale WPCP oxidation ponds from tidal action
Tie levee into existing landfill high ground
Active Cargill Salt Ponds
Active Landfill
Closed Landfill
Mowry Slough
Coyote Creek
Mud Slough
Alviso Slough
Guadalupe Slough
Mayfield Slough
Charleston Slough
Mtn. View Slough
Artesian Slough
Moffett Channel
Laguna Creek
Permanente Creek
Stevens Creek
Drawbridge
Calaveras Pt.
Long Pt.
Palo Alto Baylands Preserve
Mountain View Shoreline Park
Stevens Creek Nature Study Area
Moffett Field
Sunnyvale Treatment Ponds
Sunnyvale Baylands
Don Edwards Environmental Education Center
New Chicago Marsh
Alviso
M1
M2
M4
M5
M7
M8
M10
M10A
M11
M12
M13
M26
M27
M28
P1
A1
A2W
A2E
AB1
AB2
A3N
A3W
A4
A5
A6
A7
A8
A8S
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23

Figure 5c. Alternative 3: Tidal Habitat Emphasis: Ravenswood

ATTACHMENT 1. PROJECT GOALS AND OBJECTIVES

The project objectives were developed by the Project Management Team (PMT) with input from the Stakeholder Forum, Science Team, and Regulatory and Trustee Agency Group (PWA and others, 2004a). The overarching project goal and six project objectives, as adopted by the Stakeholder Forum on February 18, 2004, are as follows:

Overarching project goal:

> Restoration and enhancement of wetlands in the South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation.

Objectives:

1. Create, restore, or enhance habitats of sufficient size, function, and appropriate structure to:
    a. Promote restoration of native special-status plants and animals that depend on South San Francisco Bay habitat for all or part of their life cycles.
    b. Maintain current migratory bird species that utilize existing salt ponds and associated structures such as levees.
    c. Support increased abundance and diversity of native species in various South San Francisco Bay aquatic and terrestrial ecosystem components, including plants, invertebrates, fish, mammals, birds, reptiles and amphibians.
2. Maintain or improve existing levels of flood protection in the South Bay area.
3. Provide public access and recreational opportunities compatible with wildlife and habitat goals.
4. Protect or improve existing levels of water and sediment quality in the South Bay, and take into account ecological risks caused by restoration.
5. Implement design and management measures to maintain or improve current levels of vector management, control predation on special-status species, and manage the spread of non-native species.
6. Protect the services provided by existing infrastructure (e.g., power lines, railroads).

The Alternatives Development Framework methodology includes two additional evaluation factors in order to provide a complete basis for alternatives formulation and evaluation:

7. Cost Effectiveness: Consider costs of implementation, management, and monitoring so that planned activities can be effectively executed with available funding.
8. Environmental Impact: Promote environmental benefit and reduce impact in topics other than biology.

ATTACHMENT 2. PLANNING CONSIDERATIONS

Table A1. Planning Considerations (PWA and others, 2004b)

Tidal Habitat		
Consideration	**Purpose / Rationale**	**How and Where to Achieve within the Project Area**
Create a tidal marsh corridor	Provide connectivity of habitat for salt marsh dependent species, particularly the salt marsh harvest mouse (high marsh habitat).	Create a continuous band of tidal marsh along the Bay.
Create broad upland transitional areas	Provide high tide refuge for the salt marsh harvest mouse, and provide necessary habitat for the growth and survival of special-status plants.	Conduct tidal restoration in areas where there are opportunities to create a natural transition from marsh to upland habitat. Upland transition can also be created along levees by constructing broad, gently sloping outboard levee sides.
Restore tidal action to high elevation ponds	Provide habitat quickly for marsh dependent species. This does not mean that only high elevation are appropriate for tidal restoration, but that relatively quick restoration of tidal marsh in some areas may be important on the landscape-scale, and for protection of existing populations.	Conduct tidal restoration in ponds that are only slightly subsided – with pond bottoms above approximately mean tide level
Restore tidal marshes adjacent to anadromous fish migration corridors	Provide habitat for anadromous fish; provide benefits for harbor seals by enlarging and deepening the major sloughs; complements the flood management planning considerations	Conduct tidal restoration in ponds adjacent to major sloughs that serve as fish migration corridors
Reconnect historic tidal channels with extensive intact drainage systems	Rapidly establish multi-order channel systems.	Conduct tidal restoration in areas with intact relic drainage systems.
Create large marsh systems where possible	Provide opportunity for establishment of complex/high-order drainages; isolates broad areas from human disturbance and predator access; and provided habitat to support larger populations of salt marsh harvest mice in case connectivity is interrupted by future marsh loss due to sediment deficits or sea level rise.	Conduct tidal restoration in large contiguous areas
Incorporate unmanaged ponds and salt pans into salt marsh areas	Provides benefits waterbirds and mimics historical marsh conditions.	Although the majority of these features will evolve gradually through natural processes, their development may be expedited by excavation of shallow basins in the upper marsh and/or along drainage divides.

Table A1. Planning Considerations (continued) (PWA and others, 2004b)

Managed Pond Habitat		
Consideration	**Purpose / Rationale**	**How and Where to Achieve within the Project Area**
Preserve and enhance managed ponds near interpretive opportunities	Protect cultural resources and provide public access routes on maintained pond levees	For example, locate manages ponds near historic salt works (*e.g.* ponds E12 and E13)
Consider moderately subsided ponds with bottoms near mean tide elevations as candidates for managed ponds	Moderately subsided ponds are the least expensive to manage because flow in and out of the ponds can be accomplished by gravity drainage. No/minimal pumping is required.	Locate ponds with bottoms near mean tide elevations
Create managed pond habitat in accessible areas	Provides the easiest operations and maintenance access.	Locate managed ponds landward of the restored tidal habitat and generally group managed ponds together
Avoid grouping managed pond habitat in only one part of the project area	Reduces the travel distance by waterbirds that use both pond and tidal habitats.	Locate managed ponds throughout the project area, considering the distance between managed ponds
Widely disperse ponds that are to be managed for breeding habitat	Reduces predation and competition between colonies.	Locate ponds designated for breeding habitat throughout the project area, considering the distance between similarly managed ponds
Restore managed ponds in areas with relatively less adjacent managed pond habitat	Provides a more even distribution of pond habitat	Locate managed ponds in areas with less adjacent (outside the project area) managed pond habitat

Table A1. Planning Considerations (continued) (PWA and others, 2004b)

Flood Management		
Consideration	**Purpose / Rationale**	**How and Where to Achieve within the Project Area**
Improve flood management at the mouths of major creeks that currently experience flooding or are otherwise undersized	Improve flood management and lessen flooding risks upstream	Conduct tidal restoration adjacent to the following major sloughs and channels in order to encourage channel scour and enlargement to increase conveyance: Alameda Flood Control Channel, Old Alameda Creek, Stevens Creek, Permanente Creek, Sunnyvale West and East Channels, Guadalupe Slough, and Alviso Slough (Guadalupe River). It is assumed that Coyote Creek has adequate flood protection above the creek mouth. Although Alviso Slough also has adequate flood protection, it is considered advantageous to encourage channel scour and enlargement to increase conveyance.
Integrate with existing flood protection	Planning and placement of the flood protection levees will take into consideration existing lines of flood protection.	Where feasible, proposed levees will be integrated into the existing levee alignment.
Locate levees for improved coastal flood protection	At this time, it is assumed that the flood control levee alignments will be decided largely through engineering feasibility assessment rather than through the alternatives development process.	Coastal flood control levees may be located along the landward edge of the project site or bayward of managed ponds. Levees may consist of one large levee or two moderately-sized levees in parallel, allowing for controlled overtopping of the bayward levee. At some locations the levee alignment is likely to be outside the SBSP boundary. At the program level, alternatives include the potential for variations in levee alignments to protect a given reach of shoreline.

Table A1. Planning Considerations (continued) (PWA and others, 2004b)

Public Access and Recreation		
Consideration	**Purpose / Rationale**	**How and Where to Achieve within the Project Area**
Provide options to cluster access and associated facilities	Reduce habitat encroachment and associated human disturbance to wildlife	Locate opportunities to cluster access
Allow for a range of options to complete the Bay Trail	Completion of the Bay Trail	For example, use inboard levees and/or rail corridor right of way
Provide public access such as trails and staging areas that can be integrated with historic and cultural features	Allows for interpretive and educational components associated with points of interest.	Locate historic and cultural features
Integrate public access (trails) with flood control structures (levees) where appropriate	Simultaneously satisfies multiple objectives, reduces the creation of separate trail corridors and reduces infrastructure costs.	Locate flood control levees relative to desirable access points and trail locations
Allow for a variety of different and high quality user experiences	Provides a mixture of access possibilities.	For example, access at different locations, trails with varying lengths, and access to the Bay.
Integrate public access and recreation with existing access opportunities	Expand and enhance existing public access and recreation opportunities	For example, integrate with existing trail segments and other recreational facilities on adjacent parks and open space parcels.

ATTACHMENT 3. FEATURES OF PRELIMINARY PROGRAM ALTERNATIVES

Table A2. Features of Preliminary Program Alternatives

Note: Each bullet item represents a possible feature for the particular program alternative. Features shown on the maps are identified with an asterisk (*).

FEATURE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Habitat Restoration			
Ratio tidal: managed pond habitat	50:50	75:25	90:10
Flood Protection Levee			
Alviso			
Stevens Creek to Sunnyvale Treatment Plant	• Inboard • Through A2E, AB2 and A3W*	• Inboard • Through AB2 and A3W*	• Inboard* • Through A2E, AB2 and A3W
Ravenswood			
Ponds R3, R4 (part), R5, and S5	• Inboard • Outboard through R4* • Outboard of R5/S5	• Inboard • Outboard of R5/S5*	• Inboard • Outboard of R5/S5*
All other areas	• See alignment on maps	• See alignment on maps	• See alignment on maps
Public Access / Recreation Trails			
Eden Landing			
Bay Trail spine	• Along flood protection levee for entire length* • Bayward south of E6	• Along flood protection levee for entire length* • Bayward south of E6	• Along flood protection levee for entire length • Bayward south of E6*
Oliver Salt Works	• Loop* • Spur(s), various alignments	• Loop • Spur(s), various alignments*	• Loop • Spur(s), various alignments*
Union City Salt Works	• Spur to salt works • No access*	• Spur to salt works* • No access	• Spur to salt works* • No access
Old Alameda Creek bay access	• Spur* • No access	• Spur • No access*	• Spur • No access*
Alviso			
Bay Trail spine: Charleston Slough to Alviso Slough	• Dependent on flood protection levee location	• Dependent on flood protection levee location	• Dependent on flood protection levee location
Bay Trail spine: Alviso Slough to Pond A22	• Through Drawbridge* • Through San Jose	• Through Drawbridge • Through San Jose*	• Through Drawbridge* • Through San Jose

Table A2. Features of Preliminary Program Alternatives

Note: Each bullet item represents a possible feature for the particular program alternative. Features shown on the maps are identified with an asterisk (*).

Steven Creek bay access	• Spur, various alignments* • No access	• Spur, various alignments * • No access	• Spur, various alignments * • No access
Stevens Creek to Sunnyvale Treatment Plant	• Depends on flood protection levee location	• Depends on flood protection levee location	• Depends on flood protection levee location
Pond A3N	• No access • Spur*	• No access • Spur*	• No access* • Spur
Pond A4	• Spur • No access*	• Spur* • No access	• Spur • No access*
Pond A9 loop	• Large loop	• Medium loop	• Tidal trail spur
Pond A16/17	• Loop	• Loop	• Loop
Ravenswood			
Pond R2	• No access* • Spur	• No access* • Spur	• No access • Spur*
Ponds R3 and R4	• Along flood protection levee* • R4 bay spur	• R4 bay spur*	• R4 bay spur*
Bay Trail spine: Pond SF2	• Inboard • Outboard*	• Inboard* • Outboard	• Inboard* • Outboard
Other (non-trail) Public Access and Recreation			
Hunting/Fishing	• DFG lands: will continue to be permitted on certain ponds on a lottery basis per DFG regulations • USFWS lands: will be permitted as per the ISP and on additional ponds depending on habitat features		
Non-motorized (kayak and canoe) boat launch**	• Eden Creek depending on trail alignment • Guadalupe Slough • Ravenswood Slough		
Education + Guided Walks	• Signage and trails exist in all options		
Viewing Platforms	• Opportunities exist in each option and in more than one location		
Cultural Resource Interpretation	• Oliver Salt Works, Union City Salt Works, Drawbridge, Alviso Port/Cannery, Historic red barn		

Note: Inboard levee location refers to along the pond/upland edge.

** Does not include windsurfers. Windsurfers will probably not be permitted because of incompatibilities with wildlife habitat per USFWS, and due to potential hazards with respect to overhead PG&E power lines

ATTACHMENT 4. GLOSSARY

Enhanced pond – a managed pond that will be improved (relative to its ISP condition) by management of water levels specifically for the purpose of providing suitable habitat for targeted species, and (potentially in some ponds) by the limited creation of islands. Enhanced ponds will not undergo extensive grading or reconfiguration. Measures to control vegetation growth will be implemented as needed.

Channel Order – channel order designates the relative position of a channel within a channel system or network. A channel without a tributary is a first-order channel. The convergence of two first-order channels produces a second-order channel; the convergence of two second-order channels produces a third-order channel, and so on.

High salinity pond – a pond that will managed to provide shallow, high-salinity (*e.g.*, 60-200 parts per thousand) water conducive to the maintenance of high densities of specific invertebrate prey used by some salt pond-dependent bird species. High salinity ponds will be maintained in concert with medium-salinity enhanced ponds and small mixing basins, and will not undergo extensive grading or reconfiguration (although limited creation of nesting islands may occur). Due to high salinities (which will limit plant growth), the need for vegetation control will likely be limited.

Reconfigured pond – a managed pond that will undergo grading to produce a heterogeneous mix of deep and shallow-water habitats, with islands, that can be carefully managed to provide nesting, brooding, roosting, and foraging habitat for high numbers and diversity of waterbirds. Measures to control vegetation growth will be implemented as needed.

Seasonal pond – a managed pond that will be flooded by precipitation, pumping, or gravity intake through existing water control structures in fall but will be allowed to dry out via evaporation in spring. Seasonal ponds will not undergo grading or reconfiguration, and will have more limited water level management than other pond types. Measures to control vegetation growth will be implemented as needed.

Vegetated pond – a pond in which broad-scale vegetation growth will be allowed, and possibly even promoted, but in which hydrology will be actively managed, either through controlled, muted tidal action, or via water control structures (*i.e.*, gravity flow or pumping). In contrast, other managed pond types entail measures to control vegetation growth.