Alternatives Development Framework

Final Report

Submitted to:
California State Coastal Conservancy
U.S. Fish & Wildlife Service
California Department of Fish and Game

Prepared by:
Philip Williams & Associates, LTD.
H. T. Harvey & Associates
EDAW
Brown & Caldwell

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1. EXECUTIVE SUMMARY

The South Bay Salt Pond Restoration Project presents a significant challenge for alternatives formulation and evaluation because alternatives can be formulated at many distinct scales – from the South Bay landscape to sets of individual ponds with nearly infinite possibilities for creating and varying alternatives. This document provides a methodology to systematically identify, evaluate and contrast alternatives, facilitate consideration of a range of reasonable alternatives, and provide a defensible basis for selection of the preferred alternative.

The methodology was developed and refined with input from the Project Management Team (PMT), the Regulatory and Trustee Agency Group, the Science Team, the Stakeholder Forum, and the Stakeholder Work Groups. The methodology presented is intended to be a flexible tool and, as such, is a work in progress and may be refined as it is applied**.**

The methodology uses the project objectives as key building blocks for alternatives formulation and evaluation. These objectives will form the basis and guide for decision-making at all scales. To make the project objectives implementable, the methodology includes specific evaluation criteria under each of the six objectives. Each alternative is measured against the criteria in terms of the degree of success in meeting the objective.

Once the evaluation criteria are developed, the alternatives formulation will proceed at two spatial scales – the landscape scale and the pond scale. The landscape scale provides a "top down" consideration of how to achieve the project objectives from a regional, South Bay, perspective. The landscape assessment will provide a systematic rationale for proceeding with a specific mix and geographic distribution of tidal and managed pond habitats within the South Bay. The pond scale provides a "bottom up" formulation, with habitat restoration decisions based on the characteristics of individual ponds and pond clusters. In this formulation, alternatives are the sum of choices made at the local scale.

Each alternative will be rated for how well it meets the evaluation criteria on a nine-point scale from low to high. It is entirely possible – and highly likely – that the selection process will include varying the relative importance of selected evaluation criteria and studying the results. The point scoring will not dictate the selection of the final alternative(s), but rather will provide insight and understanding for informed decision-making.

Once the final alternative(s) have been selected, implementation of phasing will be defined. Specification of project phasing will include the Phase 1 action(s). Likely considerations for selecting the Phase 1 action(s) include habitat value, ease of implementation, public visibility, adaptive management value, and availability of funding. NEPA/CEQA documentation will begin once the final alternative(s) and Phase 1 action(s) have been selected.

2. GLOSSARY

This section defines some of the terminology presented in this report.

alternative	An aggregation of a set of options by pond cluster for the entire project area; to be used as the basis for the NEPA/ CEQA definition of alternatives.
evaluation criteria	Specific descriptive criteria that make the project objectives usable for formulating and evaluating alternatives.
metrics	Measurable criteria that can be used to rate how well an alternative is expected to achieve the evaluation criterion.
evaluation factor	Additions to the project objectives that function as objectives in the evaluation process.
final alternative	An alternative that has gone through the ranking and rating process and has been selected to be carried forward into the Draft Environmental Impact Report/Statement.
landscape scale	South San Francisco Bay, south of the San Bruno Shoal, and the South Bay Salt Pond Restoration Project area.
objectives	The six project objectives developed by the Project Management Team (PMT) with input from the Stakeholder Forum, Science Team, and Regulatory and Trustee Agency Group and adopted by the Stakeholder Forum on February 18, 2004.
option	A comprehensive strategy integrating restoration, food management, and public access/recreation for a given pond cluster.
Phase 1 action	The first phase of implementation for the preferred alternative.
pond cluster	Small groups of ponds organized around major slough systems, usually separated by major sloughs from other ponds.
preferred alternative	The alternative selected from among the final alternatives to be carried forward to implementation.
preliminary alternative	An alternative that has passed the initial screening. Preliminary alternatives will be evaluated using the full suite of evaluation criteria and metrics.
scenario	A preliminary landscape scale restoration strategy.

3. INTRODUCTION

This document provides the Alternatives Development Framework (ADF) for the South Bay Salt Pond Restoration Project. The purpose of the ADF is to provide a methodology to systematically identify, evaluate and contrast alternatives, facilitate consideration of a range of reasonable alternatives, and provide a defensible basis for selection of both the range of alternatives as well as the final alternative(s). The ADF builds upon the project objectives (adopted by the Stakeholder Forum on February 18, 2004).

The ADF contains the following sections:

- **Section 4. Overview of the Alternatives Formulation and Evaluation Process.** This section describes the overall manner in which alternatives will be identified, assessed, and refined, so that ultimately one final alternative can be selected. The alternatives formulation and evaluation process is presented graphically in Figure 1. This process considers two project scales: the landscape scale (the South Bay) and the pond scale (groups of ponds).
- **Section 5. Project Objectives and Evaluation Factors.** The project objectives and evaluation factors are the building blocks of the alternatives formulation and evaluation framework.
- **Section 6. Evaluation Criteria and Metrics.** This section presents and describes the evaluation criteria and metrics. These will be used to evaluate the performance of each alternative.
- **Section 7. Landscape-Scale Restoration Strategies.** The landscape assessment will provide insight into the ecological outcomes of different types of restoration, and between the project and no project conditions.
- **Section 8. Pond-Scale Options.** The development of pond-scale options provides the basis for the specification of preliminary alternatives
- **Section 8. Evaluation, Ranking, and Weighting Procedures.** The final step in the ADF process is the evaluation, ranking, and weighting to compare and contrast alternatives.

The ADF was developed with early input and review from the Project Management Team (PMT), the Stakeholder Forum, the Stakeholder Work Groups, the Science Team, and the Regulatory and Trustee Agency Group and the public in March through June 2004. The ADF will be further refined after public review.

The methodology presented in the ADF is intended to be a flexible tool and, as such, is a work in progress. The evaluation criteria, metrics, and methods may be refined as they are applied.

4. OVERVIEW OF THE ALTERNATIVES FORMULATION AND EVALUATION PROCESS

The process for formulating and evaluating alternatives is depicted on the Alternatives Development Framework flow diagram (Figure 1). The major steps of the process – namely defining evaluation criteria, considering different spatial scales (landscape and pond), selecting preliminary alternatives and final alternatives, and ultimately the preferred alternative for the Environmental Impact Report/Statement (EIR/S) – are presented below.

4.1 Project Objectives and Evaluation Criteria

The first step in the process includes defining the overall project goal and objectives, which were developed by the Project Management Team (PMT) with input from the Stakeholder Forum, Science Team, and Regulatory and Trustee Agency Group, and adopted by the Stakeholder Forum on February 18, 2004. The project objectives and additional evaluation factors are presented in Section 5.

The second step involves further defining the project objectives in terms of specific evaluation criteria and metrics that can be used to rate how well alternatives meet the objectives. The evaluation criteria and metrics were developed with input from the PMT, the Regulatory & Trustee Agency Group, the Science Team, the Stakeholder Forum, and several public work group meetings including the Public Access and Recreation Work Group, the Habitat Work Group, and the Flood Management Work Group, and are presented in Section 6.

4.2 Landscape Scale

Once the evaluation criteria and metrics are developed, the alternatives formulation will proceed at two spatial scales – the landscape scale and the pond scale. The landscape scale provides a "top down" consideration of how to achieve the project objectives from a regional, South Bay, perspective. The landscape assessment will provide a systematic rationale for proceeding with a specific mix and geographic distribution of tidal and managed pond habitats within the South Bay. The pond scale provides a "bottom up" formulation, with habitat restoration decisions based on the characteristics of individual ponds and pond clusters. In this formulation, alternatives are the sum of choices made at the local scale.

Five landscape scale scenarios are proposed, two "No Project" scenarios and three "Project Restoration" scenarios with different mixes of tidal marsh and managed ponds. More detailed descriptions of the scenarios are presented in Section 7 and the Appendix.

Scenarios will be evaluated at the landscape scale before proceeding to more detailed alternatives formulation. By evaluating the landscape scenarios, key planning questions will be addressed early on, such as how much intertidal habitat can be supported in the South Bay with the available sediment supply, and how much managed pond habitat should be maintained to support salt pond dependent bird

species. For example, in order to evaluate the benefits to tidal marsh species such as the salt marsh harvest mouse or the California Clapper Rail, the aerial extent and rate of tidal marsh evolution must be predicted. This requires an understanding of sediment availability at the landscape scale. Understanding landscape scale questions is essential for alternatives selection. A more detailed description of the Landscape-Scale Restoration Strategies is presented in Section 7.

4.3 Pond Scale

Based on the Initial Opportunities and Constraints Summary Report (Philip Williams & Associates, Ltd and others 2004a), the Existing Conditions Reports (Philip Williams & Associates, Ltd and others, in progress), the Mercury Technical Memorandum (Brown and Caldwell 2004), and other data on the location of features important to achieving the project objectives, a range of options will be created for each of the seven pond clusters (see Figure 2). For this study, an option is defined as a comprehensive, integrated strategy for a given pond cluster, including solutions for the primary project goals of habitat restoration, flood management, and public access and recreation.

Options development will involve input from the PMT, the Stakeholder Forum and Work Groups, the Science Team, and the Regulatory and Trustee Agencies Group. Once defined, the pond cluster options will be combined into a matrix of all possible alternatives (all possible combinations of options). For example, an alternative will consist of an aggregation of one option per pond cluster. A more detailed description of Pond-Scale Options is presented in Section 8.

4.4 Preliminary and Final Alternatives Selection

Once the project options have been combined into a matrix of alternatives, an initial screening will be used to reduce the full matrix of alternatives to a smaller set of preliminary alternatives. The initial screening will be guided by the landscape scale assessment, compatibility of neighboring pond cluster options, as well as input from the Stakeholder Forum and Work Groups, the Science Team, and the Regulatory and Trustee Agencies Group. The PMT will make the final selection of which preliminary alternatives to carry forward.

The preliminary alternatives will then be evaluated against the full set of evaluation criteria and metrics (see Section 9). A weighting and sensitivity analysis will be conducted to assist in the selection of the final alternative(s) for the Environmental Impact Report/Statement (EIR/S). As with the earlier steps, the PMT will solicit input from the Stakeholder Forum and Work Groups, the Science Team, and the Regulatory and Trustee Agencies Group. The PMT will make the final selection.

Once the final alternative(s) have been selected, implementation of phasing will be defined. Specification of project phasing will include the Phase 1 action(s) for each alternative. Likely considerations for selecting the Phase 1 action(s) include habitat value, ease of implementation, public visibility, adaptive management value, and availability of funding. NEPA/CEQA documentation will begin once the final

alternative(s) and Phase 1 action(s) have been selected. The EIR/S process will result in the selection of the preferred alternative for implementation.

5. PROJECT OBJECTIVES AND EVALUATION FACTORS

The Alternatives Development Framework uses the project objectives as key building blocks for landscape scale scenario selection and pond scale option development, as well as alternatives formulation and evaluation. 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. 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 Fish and Wildlife Service (FWS) and the California Department of Fish and Game (DFG) staff have reviewed the project objectives to ensure compliance with legal mandates, such as compatibility of wildlife with public access. Since the set of objectives needs to provide a complete basis for alternatives formulation and evaluation, the methodology includes two additional evaluation factors for comparative analysis:

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.

It is important that these evaluation factors are considered throughout the alternatives screening process, not after the fact. Although formal environmental impact analysis will not be conducted until the final alternatives are identified, including these factors during the screening process will ensure that environmental impacts and restoration costs across alternatives are considered, so that the final alternatives can be implemented at a reasonable cost and level of environmental benefit/impact. However, in the early stages of alternative development, cost data will be limited. Thus, cost effectiveness will not be used as a factor until suitable information becomes available.

6. EVALUATION CRITERIA AND METRICS

The project objectives (Section 5) provide broad categories of desired project benefits. To make these broad objectives usable for formulating and evaluating alternatives, each objective is further described in a set of evaluation criteria.[1] The evaluation criteria will be used to assess the set of project alternatives that emerge after the pond scale options have been screened. For each evaluation criterion, metrics are identified for use in rating how well an alternative achieves the criterion. These metrics will be applied both immediately after project implementation (time zero), and at 50 years after implementation, in order to provide the basis for selection of the final alternative.

The evaluation criteria and metrics were developed with input from the PMT, the Regulatory & Trustee Agency Group, the Science Team, the Stakeholder Forum, and several public work group meetings including the Public Access and Recreation Work Group, the Habitat Work Group, and the Flood Management Work Group. The evaluation criteria and metrics have been refined and expanded upon based on comments and insights provided by the various groups, and they may be further refined as they are applied. They are intended to be a flexible tool and, as such, they are a work in progress**.**

Section 6.1 provides an overview of the evaluation criteria and metrics, and presents the evaluation criteria and metrics themselves in Table 1. Section 6.2 provides more detailed discussion of the evaluation criteria and metrics by objective, for example Biological Habitat, Flood Management, etc. The discussion sections also reflect some of the technical and public comments that aided in their development.

6.1 Overview of Evaluation Criteria and Metrics

The evaluation criteria are designed to illustrate specific benefits of project actions. The trade-offs between potentially competing evaluation criteria will be addressed during the rating process (see Section 9). For example, an evaluation criterion may "provide recreation for a variety of uses and user types." It is not necessary to add "while protecting wildlife." The alternative's value to wildlife is considered in other evaluation criteria.

Each evaluation criterion assists in distinguishing between alternatives. Therefore, the evaluation criteria do not include design details that will be incorporated in all of the alternatives. Examples of design details to be included in all alternatives are: including transition zones between restored tidal marsh and levees, lowering levees where feasible, and conducting operations and maintenance for control of invasive species.

[1] Since the two additional Evaluation Factors function as Objectives for purposes of alternatives development, the term "Objectives" is used broadly to include the Evaluation Factors.

Metrics are generally "relative" indicators of performance. Some metrics, called exclusion criteria, are "absolute" or "fatal flaw" criteria. Exclusion criteria must be met for the alternative to be carried forward for further consideration. Exclusion criteria are noted in Table 1.

The metrics are to be measurable, or as measurable as possible. For example: area of tidal marsh, habitat area for breeding birds, dollars. Some metrics identify habitat that has broad benefits beyond those specified in the evaluation criterion. For example, mudflat habitat benefits shorebirds, but also benefits a variety of fish, invertebrates and waterfowl that use and depend on the mudflats.

Note that the evaluation criteria and metrics are not to be confused with project performance criteria. The evaluation criteria and metrics are for use in alternatives development only, during the early planning process. Project performance criteria are for post-implementation assessment during monitoring and adaptive management. Performance criteria will be developed later in the planning process.

Table 1 – Evaluation Criteria and Metrics

BIOLOGICAL HABITAT

Objective 1. Create, restore, or enhance habitats of sufficient size, function, and appropriate structure to:

Objective 1A. 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.	
Evaluation Criteria	**Metrics**
1. Contribute to the recovery of the south bay subspecies of the salt marsh harvest mouse	• Area of complete salt marshes, with broad marshplain (i.e., pickleweed) habitat and broad upland/peripheral halophyte transitional zones • Connectivity of such existing and restored marshes both within and adjacent to the project area • Proximity of restored marshes to existing marshes providing suitable salt marsh harvest mouse habitat
2. Contribute to the recovery of the California Clapper Rail	• Area of broad tidal marshes with suitable channel densities and appropriate vegetation structure • Connectivity of existing and restored marshes, both within and adjacent to the project area • Proximity of restored marshes to existing marshes providing suitable California Clapper Rail habitat
3. Re-establish populations of special-status plants, amphibians and reptiles	• Area of high marsh/upland transitional zones • Connectivity of existing and restored high marsh/upland transitional zones, both within and adjacent to the project area • Proximity of restored high marsh/upland transitional zones to existing populations of special-status species
4. Contribute to the recovery of the Western Snowy Plover and California Least Tern	• Area of suitable breeding habitat (salt pan, islands, undisturbed levees) in combination with appropriate foraging habitat.
5. Enhance habitat for anadromous special-status fish. (Salmon and steelhead)	• Length of tidal channel habitat within marshes connected to creek and river systems that support or could support these species

Table 1 – Evaluation Criteria and Metrics (cont.)

Objective 1B. Maintain current migratory bird species that utilize existing salt ponds and associated structures such as levees.	
Evaluation Criteria	**Metrics**
1. Maintain current populations of some or all bird species breeding at the salt ponds	• Area of managed ponds with associated breeding islands, undisturbed levees, and associated breeding structures
2. Maintain habitat for salt pond specialized birds (*e.g.*, Wilson's Phalaropes)	• Area of managed pond habitat with somewhat elevated salinities (100-140 ppt), and appropriate depths
3. Maintain current population levels for foraging shorebirds	• Estimate of foraging habitat area, including mudflat exterior to salt ponds, ponds and pans in tidal marshes and suitable foraging areas in managed ponds

Objective 1C. 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.	
Evaluation Criteria	**Metrics**
1. Maintain or enhance the populations of shorebirds currently using intertidal mudflat habitat	• Area of mudflat habitat available in the South Bay through the life of the project
2. Enhance South Bay fish populations	• Area of tidal marsh and tidal channel habitat within marshes, in combination with bay and mudflat habitat
3. Enhance habitat for intertidal invertebrate populations by contributing to the grazing and detrital food webs	• Area of intertidal habitat, including tidal marshes and mudflats
4. Maintain or enhance the populations of near-shore birds including waterfowl, currently using the Bay	• Length of edge habitat (water or mudflat bordering on salt marsh) • Area of mudflat and shallow waters inundated at high tide, and area of shallow water ponds
5. Enhance harbor seal habitat for foraging and isolated haul-out areas	• Area of new isolated, large/deep tidal channels adjacent to marsh plain
6. Enhance moist grassland habitats	• Length of edge where transitional habitats could grade into moist grasslands

Table 1 – Evaluation Criteria and Metrics (cont.)

FLOOD MANAGEMENT	
Objective 2. Maintain or improve existing levels of flood protection in the South Bay area.	
Evaluation Criteria	**Metrics**
1. Maintain existing levels of flood protection in the South Bay area	• No increase in the frequency of occurrence of flood inducing water levels[1, 2, *]
2. Improve levels of flood protection in the South Bay area	• Decrease in frequency of occurrence of flood inducing water levels[1, 2]
3. Remove FEMA identified areas of flood risk from the floodplain	• Area removed from the FEMA floodplain[1]
4. Provide flood protection according to Corps criteria	• Area afforded flood protection according to Corps criteria
5. Manage sediment processes to maintain beneficial effects (marsh and mudflat building) while minimizing adverse effects, such as an increased need for dredging	• Volume of sediment available for marsh and mudflat building • Reduction in volume and/or frequency of dredging necessary for maintenance of flood control

[1] in areas where flooding is not desirable based on land use
[2] include consideration of sediment deposition and erosion effects on water levels and flood protection facilities (such as levees)
* EXCLUSION CRITERION, i.e. must be met by alternative to carry forward and receive further consideration

PUBLIC ACCESS & RECREATION	
Objective 3. Provide public access and recreational opportunities compatible with wildlife and habitat goals.	
Evaluation Criteria	**Metrics**
1. Improve public access and recreation in the project area	• Number of compatible public access and recreation opportunities consistent with DFG and USFWS missions and other relevant agency plans, policies and regulatory requirements. • Number of opportunities for multi-agency/stakeholder partnering to plan, implement and manage public access and recreation
2. Provide access and recreation that promotes wildlife-oriented public use and stewardship.	• Number of opportunities for USFWS "priority uses" (wildlife observation, wildlife photography, environmental interpretation, environmental education, hunting, and fishing) • Number of user experiences provided (e.g. access to the water, educational and interpretive opportunities, ability to experience a diversity of habitats)
3. Provide recreation for a variety of uses and user types	• Number of user groups and individuals that can be accommodated • Number of access points and staging areas with amenities required for a variety of different uses • Range and diversity of uses provided
4. Enhance opportunities for linking the project areas to existing public open spaces, trails and adjacent communities	• Number of links provided • Number of Bay Trail spine gaps closed and spur and connector trails provided • Number of links to public transit • Number of opportunities for non-motorized, multi-modal access to and from the project area
5. Enhance opportunity for aesthetic experiences	• Number of opportunities for multi-sensory experiences. (e.g. open water and marsh views, smells of the bay, audibility of wildlife and others) • Number of viewing areas/viewpoints/ scenic overlooks • Number of access points and trails that are close to the open bay

Table 1 – Evaluation Criteria and Metrics (cont.)

WATER & SEDIMENT QUALITY	
Objective 4. Protect or improve existing levels of water and sediment quality in the South Bay, and take into account ecological risks caused by restoration.	
Evaluation Criteria	**Metrics**
1. Maintain existing levels of water quality (surface and ground water)	• Within the range of ambient concentrations of key indicator constituents (e.g., mercury, metals, nutrients, algae)*
2. Improve levels of water quality (surface and ground water)	• Below the range of background concentrations of key indicator constituents (e.g., mercury, metals, nutrients, algae)
3. Limit ecological risk associated with mercury methylation and bioaccumulation	• No net increase in mercury or methylmercury loads to the bay • Minimization of methylmercury production and biological uptake
4. Limit mobilization of contaminants present in sediments	• Higher concentration sediments stabilized and protected from erosion or transport • New sources of contaminated sediment controlled

* EXCLUSION CRITERION, i.e. must be met by alternative to carry forward and receive further consideration

NUISANCE SPECIES MANAGEMENT	
Objective 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 invasive species.	
Evaluation Criteria	**Metrics**
1. Minimize colonization of mudflats and marshplain by non-native Spartina and its hybrids	• Area of mudflat and marshplain potentially colonizable by non-native Spartina and its hybrids (assuming that no control measures are found to be feasible) •
2. Maintain or improve the current levels of vector management	• Must not increase human disease transmission, due to increased mosquito populations* • Area of potential mosquito habitat
3. Improve protection from non-native mammalian predators and reduce need for predator management	• Area of tidal marshes and levees easily accessible by non-native mammalian predators (e.g., cats, dogs, and red foxes)
4. Minimize colonization by non-native *Lepidium*	• Area of potentially colonizable brackish marsh and transitional areas

* EXCLUSION CRITERION, i.e. must be met by alternative to carry forward and receive further consideration

Table 1 – Evaluation Criteria and Metrics (cont.)

INFRASTRUCTURE	
Objective 6. Protect the services provided by existing infrastructure (e.g. power lines, railroads, wastewater treatment plants).	
Evaluation Criteria	**Metrics**
1. Maintain the services provided by existing infrastructure	• Must not increase risk of failure or service degradation due to physical changes*
2. Maintain maintenance access for existing infrastructure	• Does not eliminate maintenance access due to physical changes or limitations resulting from habitat improvements.

• EXCLUSION CRITERION, i.e. must be met by alternative to carry forward and receive further consideration

COST EFFECTIVENESS [1]	
Objective 7. Consider costs of implementation, management, and monitoring so that planned activities can be effectively executed with available funding. Form partnerships and alliances to develop and institute a long-term viable funding strategy.	
Evaluation Criteria	**Metrics**
1. Manage construction costs to achieve project goals and objectives with available funding	• Dollars
2. Manage long-term operations and maintenance costs	• Dollars, 50-year time frame
3. Manage monitoring costs to support project goals and objectives	• Dollars, 50-year time frame
4. Institute a long-term viable funding strategy	• Assessment of institutional complexity and achievability
5. Increase partnerships and alliances to institute a long-term funding strategy	• Participation by multiple entities (e.g., Corps, SCVWD, and others) in long-term funding
6. Achieve a favorable benefit/cost ratio and incremental cost analysis	• Calculation of benefit to cost (b/c) ratio for flood damage reduction, using Corps procedures for multi-purpose projects • Incremental cost analysis for ecosystem restoration
7. Limit costs of delay	• Assessment of institutional and legal complexity/controversy

[1] Not used until suitable information becomes available

Table 1 – Evaluation Criteria and Metrics (cont.)

ENVIRONMENTAL IMPACT	
Objective 8. Promote environmental benefit and reduce impact in topics other than biology.	
Evaluation Criteria	**Metrics**
1. Preserve cultural resources, including important archaeological and historical sites	• Number of cultural resource sites impacted • Number of opportunities for interpretation and education
2. Provide public services to accommodate projected demand	• Number of law enforcement patrols needed • Response times for fire, police and ambulance services
3. Promote compatibility with surrounding land plans and uses	• Level of land use compatibility
4. Provide safe, convenient access to the project area while managing congestion on nearby streets	• Number of vehicle trips • Number of parking spaces • Number of bicycle lanes • Level of service on nearby roads
5. Enhance air quality for proposed and surrounding uses	• Air pollutant levels • Potential for creation of objectionable odors
6. Manage noise levels for proposed and surrounding uses	• Decibel levels • Number of noise-generating activities • Distance between noise-generating activities and nearby sensitive receptors

6.2 Discussion of Evaluation Criteria and Metrics

6.2.1 Biological Habitat

Objective 1. Create, restore, or enhance habitats of sufficient size, function, and appropriate structure.

The first objective is to create, restore, or enhance habitats of sufficient size, function, and appropriate structure to accomplish three sub-objectives. Therefore, most of the metrics for the evaluation criteria focus on predicting the amounts of habitats that will be created, restored, or enhanced. Collectively, the habitats will be managed at the ecosystem level in order to support the variety of species that exist in the project area, including birds, mammals, invertebrates, and fish. The approach for each sub-objective is described below.

Objective 1A: 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.

The five evaluation criteria apply to native special-status species that will benefit from tidal restoration or from enhancement of existing managed ponds. The habitats predicted for each alternative will include tidal marshes appropriate for California Clapper Rails, salt marsh harvest mice, steelhead and salmon, and managed areas for Western Snowy Plovers and California Least Terns. Species were chosen for which the evolution of habitat could be predicted, so that alternatives could be compared. Suggestions from the Science Team and the public have been incorporated, including the discussions at the Habitat Work Group on the use of specific versus representative species in the evaluation criteria.

Many other special status species occur in the South Bay, or could occur with restoration. Other species will benefit from either tidal restoration (e.g., the Alameda Song Sparrow and Saltmarsh Common Yellowthroat) or pond management, but benefits to most of these species are already measured in the metrics described. In a few other cases, it would be very difficult to predict benefits in a manner that would allow a meaningful comparison of alternatives.

Objective 1B: Maintain current migratory bird species that utilize existing salt ponds and associated structures such as levees.

Groups of species were chosen to represent the important functions of the salt ponds and levees for birds, specifically – breeding, foraging, and roosting (or rafting). The metrics are based on the amount of habitat available for each of these functions. For birds breeding at the salt ponds, and for shorebirds foraging within them, the evaluation criteria are to maintain the current population levels for these birds. The area of appropriate habitat is the best measure of our ability to maintain populations. Breeding habitat (unvegetated islands, levees) will also provide roosting habitat.

Objective 1C: 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.

The six evaluation criteria under objective 1C represent the tidal components of bay habitats, specifically intertidal habitats (vegetated marsh and unvegetated mudflats) and subtidal habitats, and the species those habitats support. Terrestrial habitats grading into the upper edges of tidal marshes, or adjoining managed ponds are also represented. As described above, species or groups of species were chosen for which the evolution of habitat could be predicted, so that alternatives could be compared.

6.2.2 Flood Management

Objective 2. Maintain or improve existing levels of flood protection in the South Bay area.

For the first two evaluation criteria, restoration alternatives will be evaluated against the existing level of flood protection in the South Bay. Flood protection will be considered in areas within, and adjacent to, the restoration zones. The level of flood protection will be measured by the flood inducing water levels with a specific frequency of occurrence. The selection of occurrence frequency will be based on frequencies used by the respective flood management authority (i.e. Alameda County Flood Control District, Santa Clara Valley Water District, San Mateo County Flood Control District). The water surface elevations will be compared at locations where water levels could result in flooding (e.g., the Bay, slough or channel water level). Sediment deposition or erosion may impact water levels within the ponds; therefore, the objectives will also consider potential sediment transport impacts on flood management facilities, such as levees.

For the third evaluation criterion, alternatives will be evaluated on the basis of FEMA standards. FEMA standards are used to delineate floodplains for flood insurance purposes. U.S. Army Corps of Engineers (Corps) criteria, assessed under the fourth evaluation criteria, are used to delineate floodplains for projects with Corps partnering. FEMA and the Corps use different methods and assumptions for floodplain delineation. The FEMA process assumes that levees without FEMA certification for flood protection (e.g., the salt pond levees) will fail completely, providing no flood protection. The Corps considers limited flood protection provided by the salt pond levees. The Corps computes an "actual" floodplain, which incorporates the effect of levee overtopping due to high tidal elevations and wave runup. Since these two methods can predict different flood effects, each is considered in separate evaluation criteria. The fourth evaluation criterion will additionally include an assessment of post-project flood damage reduction.

Alternatives will be evaluated on the basis of sediment supply and delivery for the fifth evaluation criterion. This evaluation criterion was added in response to public comments. The objective is to manage sediment processes, maintaining beneficial effects such as availability for marsh and mudflat building while minimizing adverse effects. Metrics for evaluation include the volume and frequency of dredging required for flood control channel maintenance and the volume of sediment available for use in marsh/mudflat building. Evaluation criteria for sediment quality are detailed within Objective 4.

Levees and storm drain systems are considered elements of flood management. Therefore, effects to these facilities will be evaluated with the Flood Management criteria rather than the Infrastructure criteria.

Long-term maintenance and monitoring programs will be provided for the flood management facilities. These programs will involve identification of the public agency responsible for each facility and specification of the long-term monitoring programs. Adaptive management strategies will translate monitoring results into facility design improvements.

6.2.3 Public Access & Recreation

Objective 3. Provide public access and recreation opportunities compatible with wildlife and habitat goals.

The public access and recreation evaluation criteria include provisions for public use, creating public access, and providing and enhancing recreation opportunities for a variety of uses and user types on project lands. An important consideration for the evaluation criteria is that individual recreational uses are not listed. This would require several additional evaluation criteria and would pose the risk of not being inclusive of all possible future activities or options. The planning framework is intended to provide evaluation criteria that encompass all opportunities for public access and recreation. Furthermore, the evaluation criteria are not written to presuppose a particular design solution or ultimate outcome.

The first evaluation criterion states that the restoration plan will improve recreation and public access in the project area. This encompasses the idea that these lands have not had access prior to this time and

public access and recreation will not only be provided, but also improved. The metrics ensure that recreation and public access is consistent with the land owning agencies (DFG and USFWS) missions as well as other applicable plans, policies and regulations, such as Bay Conservation and Development Commission jurisdictional requirements as well as other agencies and organizations. The second evaluation criterion is directly related to the overall objective and has as one of its metrics a reference to USFWS "priority uses," which are established by Congress for wildlife refuges and take priority over all other recreation uses. Additionally, the word stewardship is included in this evaluation criterion to highlight the need and relationship for stewardship in the context of providing access and recreation.

The next three evaluation criteria address three overall concepts related to recreation and public access: types of uses and user groups, connectivity of recreation and community links and the aesthetics of recreation and public access. The last evaluation criterion was originally part of the environmental impact evaluation criteria, specifically addressing a CEQA requirement for "visual" impacts. It was suggested that this criteria be included in Recreation and Public Access evaluation criteria, and subsequently, the meaning was broadened to include more than just visual resources and experiences.

The third evaluation criterion addresses the range of possible recreational uses as well as the diversity of users and user groups. The Recreation and Public Access Work Group added specific language regarding not only the number of access points and staging areas but also references to the quality or type of amenities that are provided. Also, there is an evaluation criterion that allows for a range and diversity of recreation uses. Finally, the fourth evaluation criterion addresses the connectivity of the project area with the surrounding communities and the ability for new recreation and public access facilities to utilize existing links and enhance linkages in the future.

The fifth evaluation criterion addresses enhancing opportunities for aesthetic experiences. The metrics for this criterion relate specifically to numbers of experiences that can be measured in order to form a basis of comparison between alternatives. The need for a way to incorporate the quality of the visitor experience into the objectives and criteria was discussed in detail, and use of the "Recreation Opportunities Spectrum" was requested. However, it was noted that the complexity of methodologies for measuring visitor experience such as this would reduce the ability to incorporate them into the alternative screening process as this system relies on metrics and quality cannot always be measured. The use of specific words to describe the quality of the visitor experience in the metrics was also discussed but it was agreed that these were hard to measure and interpret over time. Although visitor experience quality is not included in the metrics, the desire of the Recreation Work Group is that the project provides the highest quality visitor experiences in recreation and public access elements of the project. The Recreation Work Group agreed that "more is not better" and that the quality of the experience is essential for success and will be considered throughout the use of the screening process.

6.2.4 Water & Sediment Quality

Objective 4. Protect or improve existing levels of water and sediment quality in the South Bay, and take into account ecological risks caused by restoration.

The water quality evaluation criteria include two tiers of protection for existing surface and ground water quality - an exclusionary criterion to at least maintain existing levels and a second desirable criterion to improve water quality. The exclusionary criterion will be evaluated over the long-term and would allow for limited short term effects on water quality that may be associated with restoration activities. Water quality will be evaluated at the pond scale to address known "hot spots" and the range of potential site-specific impacts from restoration. Because of the importance of mercury, a separate objective was dedicated to limiting ecological risk associated with mercury methylation and bioaccumulation. An additional evaluation criteria to address compliance with the San Francisco Bay Mercury Total Maximum Daily Load (TMDL) was considered and rejected because: (1) the Regional Board does not see restoration efforts as creating a new source under the mercury TMDL and (2) TMDLs will not determine which alternative to choose. However, the SF Bay Mercury TMDL was incorporated into the metrics for the ecological risk objective, by including language from the TMDL allocation for wetlands (i.e., "no net increase"). The last evaluation criterion addresses concerns about mobilization of contaminated sediments within the ponds and adjacent channels and sloughs.

6.2.5 Nuisance Species Management

Objective 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 invasive species.

The evaluation criteria were chosen based on design measures that can help control nuisance species, and that can be predicted for the alternatives. Management measures will need to be implemented in all alternatives. There are a variety of other invasive species, both aquatic (e.g. mitten crabs) and terrestrial (e.g. peppergrass), that may require management actions, but do not necessarily distinguish between potential alternatives.

6.2.6 Infrastructure

Objective 6. Protect the services provided by existing infrastructure (e.g. power lines, railroads, wastewater treatment plants).

The potential risk of failure or service degradation due to restoration alternatives will be evaluated for individual structures. The evaluation will be based on the comparison of restoration-induced physical changes, such as scour or sedimentation, water inundation, increased environmental loads (wave action, hydrostatic pressure), direct construction impacts, and increased risk of vandalism from additional public access.

The maintenance access evaluation criterion considers changes in maintenance access due to physical conditions (i.e., tidal flooding, lowering of levees), and changes in the timing or methods of access that

could result from sensitive species regulations applicable after restoration. Risks of increased costs associated with service and maintenance of existing infrastructure are reflected in the cost effectiveness evaluation criterion. In addition, coordination with potentially affected stakeholders will occur during the planning process in order to consider and attempt to minimize the risk of increased costs.

6.2.7 Cost Effectiveness

Objective 7. Consider costs of implementation, management, and monitoring so that planned activities can be effectively executed with available funding. Form partnerships and alliances to develop and institute a long-term viable funding strategy.

Cost effectiveness evaluation criteria and metrics reflect both short- and long-term estimated project costs (i.e., construction costs, operation and maintenance, and monitoring). Operation and maintenance costs will be characterized over the period of economic analysis (50 years) and monitoring costs over the anticipated adaptive management period for each implementation phase of the project (50 years). Estimated project costs will include costs within the SBSP project area that can be clearly identified and quantified. The evaluation criteria also reflect the relative ability to institute a long-term funding strategy and achieve partnerships and alliances to support long-term funding. Partnerships with local agencies will be key to funding the SBSP project. Corps funding is expected to play an important role in project implementation; therefore one evaluation criterion is aimed specifically at the Corps benefit/cost (b/c) ratio analysis. The b/c analysis will follow federal Corps practices for multi-purpose projects, reflecting the value of flood protection, ecosystem restoration, and possibly other benefits like recreation and navigation. Because project delays could significantly affect cost, alternatives will also be evaluated for relative potential to cause delay. Project phasing can be defined to help avoid project delays by deferring certain components to later phases.

Cost effectiveness will be difficult to quantify early in alternatives development. Early on, cost estimates are expected to be rough (low / medium / high) and cost effectiveness measures such as benefit to cost ratios may be impossible to estimate with any certainty. Any consideration of cost effectiveness during the evaluation and weighting process (see Section 8) will be at a level consistent with the relative certainty of the rating information. Cost effectiveness will not be used as an evaluation factor until suitable information becomes available.

6.2.8 Environmental Impact

Objective 8. Promote environmental benefit and reduce impact in topics other than biology.

The evaluation criteria and metrics that address environmental impacts include thresholds for determining cultural resources, public services, land use, traffic, and air quality and noise impacts. These thresholds and criteria are commonly applied in CEQA and NEPA impact analyses and include both qualitative and quantitative measures. While formal environmental impact analysis will not be conducted until the project alternatives are identified, inclusion of these evaluation criteria and metrics will ensure that environmental effects are considered during the alternative screening process.

7. LANDSCAPE-SCALE RESTORATION STRATEGIES

7.1 Purpose of the Landscape Scale

The alternatives formulation will proceed at two spatial scales: the landscape scale and the pond scale. The pond scale provides a "bottom up" formulation, with habitat restoration decisions based on the characteristics of individual ponds and pond clusters. In this formulation, alternatives are the sum of choices made at the local scale. The landscape scale formulation complements the pond scale by providing a "top down" consideration of how to achieve the project objectives from a regional, South Bay, perspective. The landscape assessment will provide a systematic rationale for proceeding with a specific mix and geographic distribution of tidal and managed pond habitats within the South Bay.

The landscape scale assessment will provide direction in answering the following planning questions:

- How much intertidal habitat (mudflats and marsh) can be supported in the South Bay with the available sediment supply?
- How much managed pond habitat should be maintained to support salt pond dependent bird species?
- How will the project alternatives differ from the No Project alternative over the 50-year planning horizon?

The second question addresses the public and scientific concern that large-scale tidal restoration in the South Bay could adversely affect the bird populations that currently use the salt ponds. To answer this question will require assessing how management and grading enhancements can provide more valuable habitat for these birds on a smaller "footprint" of managed pond. It will also require assessing ongoing changes in bird use within the context of large-scale physical changes such as changes in intertidal mudflats (and the associated increases in subtidal habitat) in the South Bay.

The third question recognizes that large-scale physical changes will be occurring throughout the South Bay over the long term, with or without the project. Today's habitat may not exist in the same quantity and locations 50 years from now. Rising sea level, long-term conversion of intertidal mudflats to subtidal habitat, reduction in sediment supply and changes in sedimentation patterns can significantly affect the area of intertidal mudflat and marsh that can be supported under different future scenarios.

7.2 Landscape Scenarios

The landscape scale will consider a range of landscape scenarios with different ratios of restored managed pond and tidal habitat, and the no action scenario(s). At the landscape scale, the term scenario, rather than alternative, is used to describe a project approach. A scenario is more broadly defined than an alternative and does not include pond-by-pond detail. For each scenario, extent and type of tidal habitat in the South Bay will be assessed, including areas inside and outside the restored ponds that are expected to change over time. The ecologic value of the scenarios at decadal intervals will then be compared.

Five landscape scenarios are currently proposed for assessment. Two "No Project" scenarios, and three "Project" scenarios. The two No Project scenarios both assume implementation of the ISP, but with different levels of operations and maintenance (one scenario with minimal and one scenario with full operations and maintenance). The three project scenarios consist of different proportions of tidal and managed pond habitat (one scenarios maximizes managed pond habitat, one maximizes tidal marsh habitat, and one uses a 2:1 ratio of tidal marsh to managed pond habitat). A detailed description of each scenario is presented in the Appendix.

7.3 Ecological Comparison of Scenarios

Comparison of the ecologic value of the landscape scenarios will use a simplified assessment based on three habitat measures that together address 11 out of the 14 Biological Habitat evaluation criteria. The measures are:

1. Tidal marsh functions – area of vegetated tidal marsh. This addresses the metrics for habitat for the salt marsh harvest mouse, California Clapper Rail, and estuarine fish that use tidal channels that are an inherent feature of the tidal marsh.
2. Tidal mudflat functions – area of intertidal mudflats. This addresses the metrics for invertebrate populations that utilize intertidal mudflats and part of the metrics for shorebird use.
3. Bird use functions – area of managed pond, intertidal mudflat, and subtidal bay, adjusted by an index of bird use. The bird use index is used to integrate managed pond and intertidal mudflat use. It also captures the relative benefits of improved management of the ponds. This addresses the metrics for breeding birds that use the salt ponds, habitat available for salt pond specialized birds, and availability of forage areas within the ponds.

The landscape assessment will provide insight into the ecological outcomes of different types of restoration, and between the project and no project conditions. It should be noted that the landscape assessment will not identify an exact number for the ratio of tidal and managed pond habitat, but will point toward a desirable ratio within a range of certainty. The analysis approach for the landscape assessment is described in a separate document, the Analysis Strategy and Model Selection Memorandum (Philip Williams & Associates, Ltd and others 2004b).

8. POND-SCALE OPTIONS

The development of pond-scale options provides the basis for the specification of preliminary alternatives. The first step in the process involves identifying overall approaches for each part of the project goal: habitat restoration, flood management, and public access and recreation. These approaches can then be overlain in order to develop a set of viable "options" for each pond cluster (see Figure 2) that satisfy the restoration objectives, where an option is defined as a comprehensive, integrated strategy for a given pond cluster.

Examples of approaches could include maintaining a continuous band of tidal marsh along the Bay to connect tidal habitats, or locating managed ponds and tidal marsh in order to provide flood management benefits. A pond cluster option would include details such as ponds (or partial ponds) to be restored to tidal marsh, ponds to be managed, new levee placement, public access trials, etc. The evaluation criteria and metrics presented in Section 6 will be used to help shape options formulation.

The options will be developed in parallel with the landscape scale assessment, and based on information documented in the Initial Opportunities and Constraints Summary Report (Philip Williams & Associates, Ltd and others 2004a), the Existing Conditions Reports (Philip Williams & Associates, Ltd and others, in progress), the Mercury Technical Memorandum (Brown & Caldwell 2004), and other data on the location of features important to achieving the project goals and objectives. In addition, this process will include substantive input from the PMT, the Stakeholder Forum and Work Groups, the Science Team, and the Regulatory and Trustee Agencies Group.

There are seven pond clusters assumed at this time – four at Alviso, two at Eden Landing and one at Ravenswood, though the groupings have not been finalized and are for early planning purposes only (see Figure 2). The pond clusters are similar to the pond "systems" developed for the Initial Stewardship Plan (ISP) based on logical physical groupings for the circulation of Bay water through the ponds; however, the ISP subdivided the four largest pond clusters for a total of 11 "systems."

When a broad set of pond cluster options have been formulated, the options will be combined into a matrix of all possible alternatives. An alternative will consist of an aggregation of one option per pond cluster for each of the seven pond clusters. An initial screening will be performed to reduce the full set of alternatives to a more manageable set of preliminary alternatives. This initial screening will not involve the full evaluation, ranking, and weighting procedure described in Section 9, but will rather be based on the landscape scale assessment, compatibility of neighboring pond cluster options, professional judgment, and input from the PMT, Stakeholder Forum and Work Groups, the Science Team, and the Regulatory and Trustee Agencies Group. The final selection of the preliminary alternatives to be carried forward will be made by the PMT.

9. EVALUATION, RANKING, AND WEIGHTING PROCEDURES

Each preliminary alternative will be evaluated against each evaluation criterion both immediately after project implementation (time zero), and at 50 years after implementation. Ratings will be developed based on how well the objective is achieved using a nine-point scale from highly achieved (H) to not achieved (L). The scale is subdivided into three regions, Low (L^-, L, L^+), Medium (M^-, M, M^+), and High (H^-, H, H^+), which are represented graphically on Figure 3. An alternative that is rated H^+ for a particular objective is ideal and maps at the outside of the circle on Figure 3, whereas a rating of L^- means the alternative does not satisfy the objective and is graphed as a dot in the middle. If an objective is temporarily not used in the rating process (for example, Cost Effectiveness is not expected to be used early in the alternatives development; see discussion in Section 6.2.7) it will be temporarily removed from the circle.

It is important to note that the ratings themselves do not dictate the selected alternative. The ratings will not necessarily be totaled across all evaluation criteria. Rather, the ratings provide a transparent and consistent means of comparing alternatives, providing insight and understanding to inform decision-making. Rating guidance will be prepared to facilitate consistency between disciplines in the use of the nine-point scale. Figure 3 readily shows how a given alternative pulls toward certain objectives where high success is likely and away from others where success is less likely. Also, multiple alternatives can be "graphed" as overlays and their differences readily seen. The "No Project" alternative can also be graphed.

There are numerous evaluation criteria under consideration, and the sample in Figure 3 treats each evaluation criterion as equal to all others – in effect, a form of 1:1 weighting as to the relative importance. An examination of a set of alternatives plotted in this way may lead to a conclusion as to a final alternative. However, the relative importance of selected evaluation criteria and/or the relative importance of one overall objective versus the others will also be explored. The ratings for the evaluation criteria will be weighted relative to each other within one objective (e.g., the 14 evaluation criteria within Biological Habitat), and "sensitivity runs" will be conducted to see how the ranking of alternatives may change. Only relative weightings that result in changes in the overall ranking of alternatives will be carried forward for evaluation between objectives. The ratings for the objectives will then be weighed relative to each other using different relative weightings at the objectives level (e.g., Biological Habitat, Flood Management, Public Access and Recreation, etc.).

Ratings on the nine-point scale of how well a given alternative responds to the evaluation criterion will be prepared by project technical staff with input from the Science Team and others. These displays and the dialogue that they will generate are the primary tools for arriving at the final and preferred alternatives among all parties.

10. REFERENCES

Brown & Caldwell. 2004. Mercury Technical Memorandum, Administrative Draft. South Bay Salt Pond Restoration Project. California State Coastal Conservancy.

Philip Williams & Associates, Ltd., H.T. Harvey & Associates, EDAW, Brown & Caldwell. 2004a. Initial Opportunities and Constraints Summary Report, Public Draft. South Bay Salt Pond Restoration Project. California State Coastal Conservancy.

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11. LIST OF PREPARERS

The following PWA Team members assisted in preparation of this document:

Michelle Orr, PWA
Kris May, PWA
David Blau, EDAW
Ron Duke, H.T. Harvey & Associates
Philip Williams, PWA

With:
Bob Battalio, PWA
Shawkat Ali, PWA
Jeff Haltiner, PWA
Amy Stewart, PWA
Donna Plunkett, EDAW
Marie Galvin, EDAW
Cindy Paulson, Brown and Caldwell
John Bourgeois, H.T. Harvey & Associates

Source files for this report are located at PWA:
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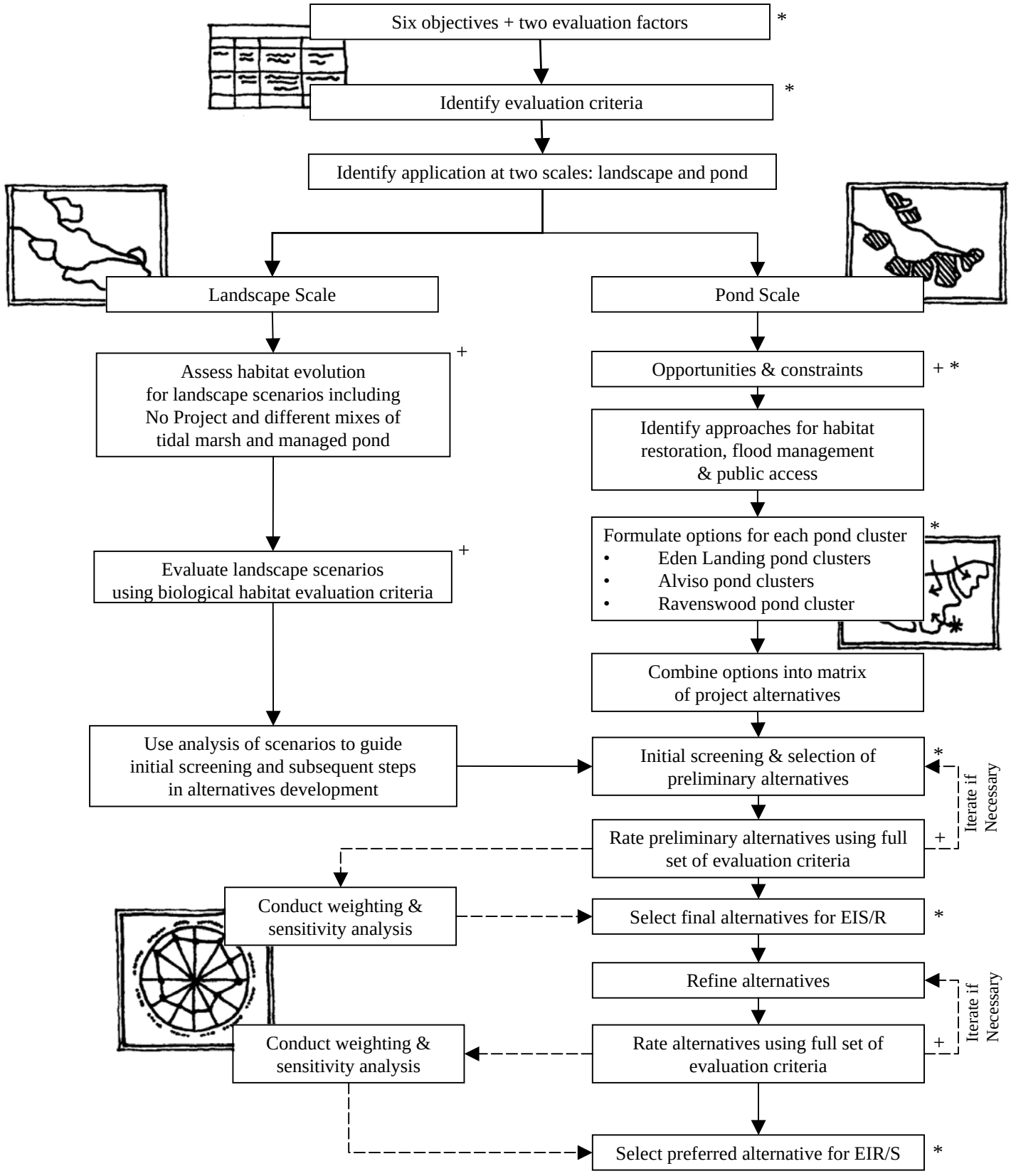
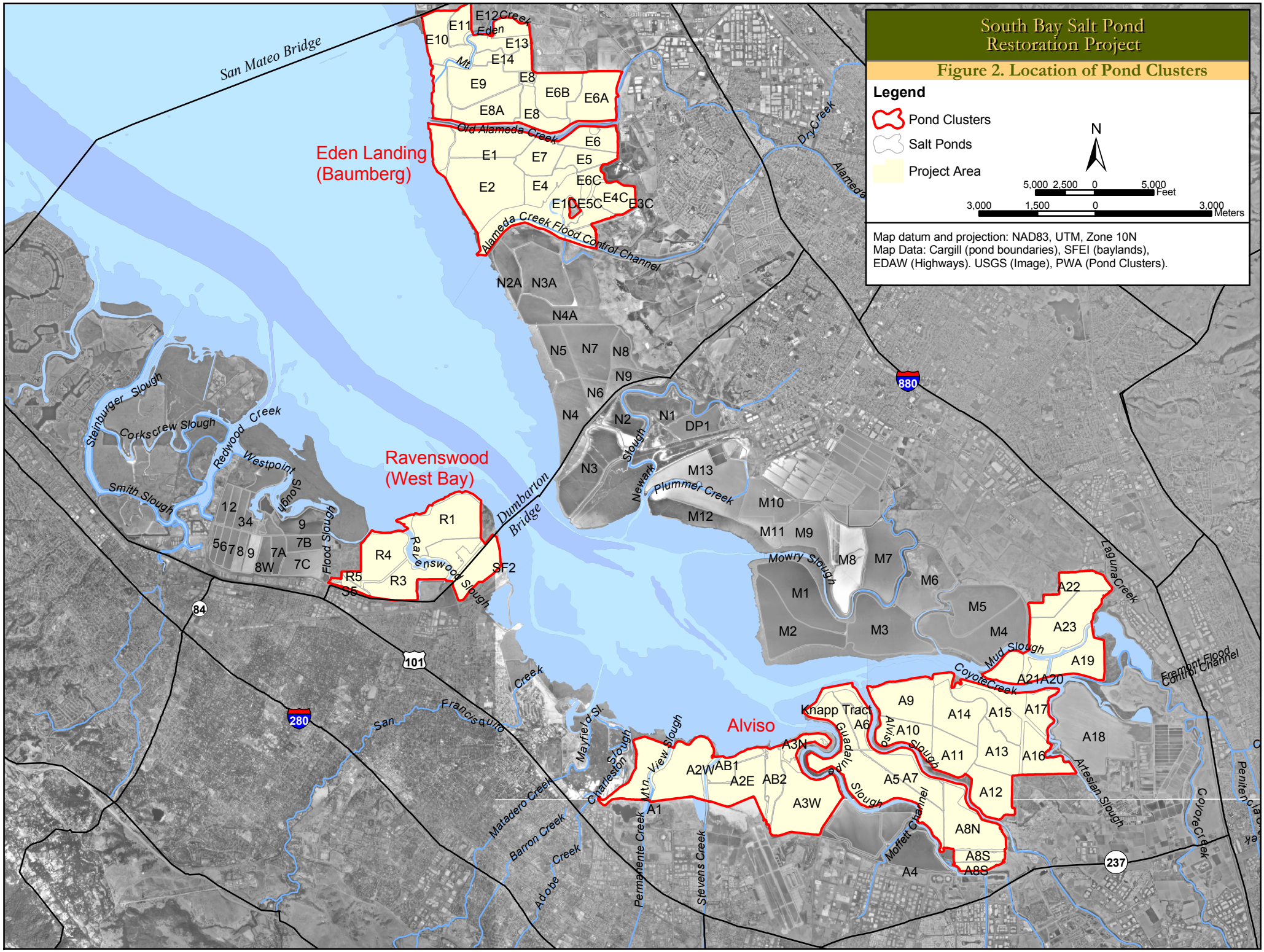


Figure 1. Alternatives Development Framework

+ Input from technical analyses and Science Team

* Input from Stakeholders and Regulatory Agencies



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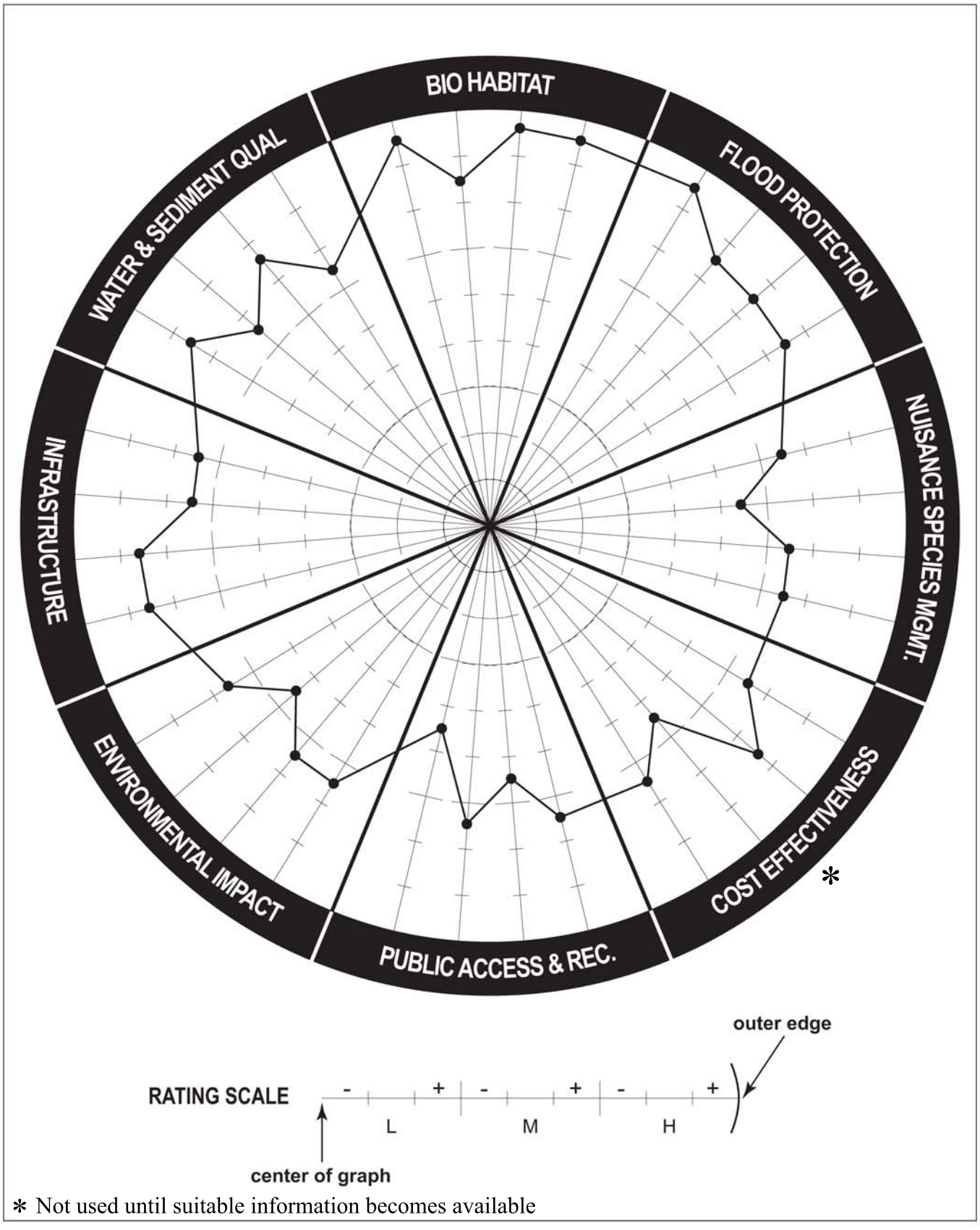

Figure 3. Example Format for Displaying How an Alternative Responds to Each Detailed Objective

APPENDIX – LANDSCAPE SCENARIO DESCRIPTIONS

Scenario A. No Project / ISP with minimal operations and maintenance.

This "No Project" Scenario assumes that the ISP will be implemented, but with minimal operations and maintenance. Under this scenario, the land owners (California Department of Fish and Game (CDFG) and the United States Fish and Wildlife Service (USFWS)) would be unable to fund levee maintenance and on-going water level management in the ponds. This scenario eventually restores tidal action and creates tidal salt marsh and intertidal mudflat habitat throughout the South Bay. However, tidal marsh restoration will occur in an unpredictable and potentially unsafe manner.

Since on-going levee maintenance is discontinued in this scenario, levees gradually deteriorate and eventually fail, allowing tidal action. Some levees will likely overtop and begin to breach within the next ten years, allowing tidal salt or brackish marsh to become established. The existing borrow ditches will capture much of the tidal prism and will not maximize reestablishment of the remnant historic channels. Natural estuarine sedimentation will gradually rebuild the marsh plain to elevations at which vegetation could reestablish. These marshes will evolve over a period of decades. Tidal inundation will increase tidal flows and scour and deepen the major sloughs.

Under this scenario, active management of the ponds will end, and no flow circulation will occur. Any water that is accumulated in the ponds will be allowed to evaporate. The existing levees and water control structures will be allowed to deteriorate. Uncontrolled breaching under this scenario may lead to significant impacts to existing infrastructure as well as inland flooding where interior levees are not sufficient to keep out tidal and/or flood waters.

The purpose of examining this scenario is to compare passive restoration of tidal marsh to the active restoration described in Scenario E. The benefits of passive restoration can be judged against those of active restoration. Furthermore, differences in the timing of restoration and in the impacts of allowing such uncontrolled restoration can be assessed.

Scenario B. No Project / ISP with full operations and maintenance

This scenario assumes that the ISP will be implemented with full long term operations and maintenance. New baseline conditions will be established. The USFWS and CDFG will continue to manage the ponds as proposed under the ISP, and maintain the pond levees.

Under this scenario, the operations will include:

- Circulating bay waters through ponds systems and back into the Bay.
- Managing a limited number of ponds (A3N, A8, E6A, E6B, E8, E11, E12, E13, E14) as seasonal wetlands to provide habitat for migratory shorebirds and waterfowl.

- Three ponds (A19, A20, A21) will be restored to full tidal influence.
- Several ponds (A12, A13, A15) will be managed as "batch ponds" where salinity levels will be allowed to rise to support specific wildlife populations.

Under this scenario, ponds levees will be maintained and heights increased to compensate for sea level rise. In addition, culverts and water control structures will require routine maintenance or re-positioning due to sea level rise. Various flood-control projects will continue to be maintained and/or constructed as currently proposed, but the basic structure of the former salt pond levees will remain intact.

This scenario will not meet the basic goal of the project, namely to restore wetlands in the South San Francisco Bay. Nonetheless, it will meet a number of the objectives of the project, namely providing benefit to the suite of waterbird species that use the salt ponds exclusively, as well as those that use the complex of salt ponds and intertidal mudflats. Therefore this scenario can serve as a metric for judging the benefits of restoration, and the changes that can be expected in the tidal portions of the Bay over time.

Scenario C. Maximize Managed Pond Habitat

Scenario C is based upon the understanding that the salt pond system that has been in place for the past 50 or more years, was designed to maximize salt production and not to maximize habitat for waterbirds. Nonetheless, a suite of salt pond "specialists" and a broader array of waterbirds use many of the existing salt ponds extensively and opportunistically. In contrast to the current pond configuration and ISP management regime, if these ponds were configured and managed to maximize habitat value for these waterbirds, there could be considerably greater use by existing and future species. This assessment of potential greater use is based upon data collected at ponds designed and managed for many of these same species in the San Joaquin Valley. Very high breeding and migrant shorebird densities were achieved at these Central Valley ponds. These data are applicable and can be utilized to estimate attainable densities at managed ponds within the tidal/managed pond habitat complex of the South Bay.

This scenario assumes that the levees remain intact and are maintained. The existing ponds are to be reconfigured to include extensive islands for breeding and roosting. These islands will be positioned and protected to the extent possible to minimize the intrusion by terrestrial predators.

Pond management is to be altered to create extensive shallow water foraging habitat (1-6 inches deep) as well as a range of depths up to about the current levels. This design provides extensive foraging opportunities when tides cover the intertidal mudflats. A range of water salinities will be incorporated into the design, but shallow water habitats are to be maintained at higher salinities to help discourage vegetation growth.

The purpose of exploring this option on a landscape scale is to develop an understanding of the limits of the system for supporting waterbirds, in the absence of tidal restoration. The numbers and densities of birds that use the ponds currently on a regional and pond-complex-wide basis will be used to estimate species and total system numbers of birds under this concept. This will also help to develop predictions

of the number of acres (within the restored habitat mix- Scenario D) of reconfigured and managed ponds that will be required to maintain, or enhance, current (existing conditions) numbers on a regional level.

Also, this scenario examines the changes in the mudflat/bay complex over time, in the absence of tidal restoration.

Scenario D. Mix of Tidal Marsh and Managed Pond Habitat (2:1)

Under this scenario, approximately two-thirds of the ponds are to be restored to tidal salt and brackish marsh, while the remaining one-third will be managed as ponds or restored to mudflats and salinas (salt pan).

Tidal marsh restoration of the ponds will proceed as outlined in Scenario E. Identification of specific areas to be restored to tidal marsh and specific ponds that are to be managed will be based on a variety of factors, including public access, contaminant and water quality issues, pond elevation, and flooding concerns. The selection will be based upon the optimal mix and locations of habitats to maximize ecological functions and values of the South Bay ecosystem. Individual ponds will be managed according to specific target species and detailed goals. Management of the ponds will be similar to that described above in Scenario C. That mix of habitats and their locations will approximate those that are suggested in the Goals Report.

This scenario provides a framework to analyze the system-wide responses to this habitat mix. If sediment supply is a constraint on the restoration process, then a reduced level of tidal restoration may provide the best opportunity for maximizing habitat value over the habitat assessment period (50-years). This scenario also meets most of the objectives of the restoration. The 2:1 habitat mix has been proposed as one that may provide the most benefit for the suite of bird species associated with the South Bay Restoration area; the analysis should help determine if that is accurate.

Scenario E. Maximize Tidal Marsh Habitat

Scenario E restores full tidal inundation to virtually all of the South Bay Salt Ponds. Because this scenario necessitates removal or breaching of former salt pond levees which currently provide some level of flood protection, it is assumed that flood management and infrastructure issues that would arise from these efforts are resolved. Levees are to be breached at historic channels, restoring natural tidal flows to the ponds. Pickleweed-dominated marsh and vegetation will establish quickly in areas already at high intertidal elevations. Natural estuarine sedimentation on the lower mudflat areas will gradually build up until these areas are high enough for cordgrass and pickleweed to establish. By partially filling the borrow ditches, cutoff berms are to be created to prevent tidal capture by the existing borrow ditches, allowing the natural channel system to reestablish. Interior berms and levees are to be selectively lowered or removed to the extent possible, creating additional tidal habitat. Existing levees required to protect infrastructure from wind-wave erosion are to be left in place, or modified to improve either the level of protection, or the value of the habitat.

This scenario does not assume that dredged materials or other sources of fill are used to create upland fringe habitats, but rather considers the restored marsh complex in light of sediment supply availability through natural deposition. This approach will allow analysis of changes over time in the marsh complexes, as well as changes in the mud flat and sub-tidal habitat of the South Bay.

Restoration is to be active and planned, with consideration of flood control infrastructure detailed. Other active restoration techniques might be used (e.g., selective use of dredged materials along upland fringes), but those techniques are not part of this initial analysis. The primary purpose of the analysis is to predict the ability of the Bay to supply the sediment for such restoration, the length of time it would take to accomplish tidal marsh restoration, the interim conditions during the restoration, and the changes in the intertidal mudflats and subtidal habitat of the South Bay that result from this level of restoration.

This scenario meets the basic goal of the project, namely to restore wetlands in the South San Francisco Bay. However, it may not meet a number of the objectives of the project. It benefits those species dependent on the tidal marshes of the bay, and may provide net benefit to those dependent on the intertidal mudflat habitats as well.