

## COASTAL CONSERVANCY

Staff Recommendation  
October 21, 2010

### **SAN FRANCISCO BAY WETLAND MAPPING AND ECOLOGICAL MODELING**

File No. 08-172-01  
Project Manager: Amy Hutzal

**RECOMMENDED ACTION:** Authorization to disburse up to \$100,000 to Point Reyes Bird Observatory to model ecological changes to San Francisco Bay wetland habitats based on a range of sea level rise and salinity change projections due to climate change and develop recommendations of high priority sites for wetland restoration and conservation in light of the predictions.

**LOCATION:** Tidal wetland habitats along San Francisco Bay in all nine Bay Area counties

**PROGRAM CATEGORY:** San Francisco Bay Area Conservancy

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#### **EXHIBITS**

Exhibit 1: [Project Location](#)

Exhibit 2: [Results of Preliminary Wetland Modeling Efforts](#)

Exhibit 3: [Project Letters](#)

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#### **RESOLUTION AND FINDINGS:**

Staff recommends that the State Coastal Conservancy adopt the following resolution pursuant to Sections 31160-31165 of the Public Resources Code:

“The State Coastal Conservancy (the “Conservancy”) hereby authorizes disbursement of an amount not to exceed \$100,000 (one hundred thousand dollars) to Point Reyes Bird Observatory to model ecological changes to San Francisco Bay wetland habitats based on a range of sea level rise and salinity change projections due to climate change and develop recommendations of high priority sites for wetland restoration and conservation in light of the predictions. Prior to the disbursement of funds, Point Reyes Bird Observatory shall submit for the review and approval of the Executive Officer of the Conservancy, a work program, including project schedule and budget, and the names of any contractors or consultants to be employed on the project.”

Staff further recommends that the Conservancy adopt the following findings:

“Based on the accompanying staff report and attached exhibits, the State Coastal Conservancy hereby finds that:

1. The proposed project is consistent with the current Project Selection Criteria and Guidelines.

2. The proposed authorization is consistent with the purposes and objectives of Chapter 4.5 of Division 21 of the Public Resources Code, regarding the San Francisco Bay Area Conservancy Program.
  3. Point Reyes Bird Observatory is a nonprofit organization existing under the provisions of section 501(c)(3) of the United States Internal Revenue Code, whose purposes are consistent with Division 21 of the Public Resources Code.”
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**PROJECT SUMMARY:**

Staff recommends that the Conservancy authorize disbursement of up to \$100,000 to Point Reyes Bird Observatory (“PRBO”) to model ecological changes to San Francisco Bay wetland habitats based on a range of sea level rise and salinity change projections due to climate change and develop recommendations of high priority sites for wetland restoration and conservation in light of the predictions. PRBO will map current wetland plant and bird species distributions and use the maps to model wetland plant and bird species under various climate change scenarios. The modeling information is a critical aspect of planning land acquisitions and habitat restoration projects in the Bay.

San Francisco Bay (the “Bay”) is the largest estuary on the west coast of the United States and its wetlands provide crucial habitat for a wide range of wildlife species and critical services to human communities including flood control, buffering storms, and improving water quality. In addition, tidal marshes may sequester potentially significant amounts of carbon from the atmosphere.

Many bird species depend on the Bay wetlands all year round, including several that are listed as threatened or of special concern. Research conducted by PRBO has shown that hundreds of thousands of shorebirds and waterfowl use various Bay habitats including tidal flats and marshes as wintering grounds, stopover “refueling” areas during annual migration, and for breeding. As such, the Bay is critically important estuary and link in the Pacific Flyway; it has been declared a site of “Hemispheric Importance” by the Western Hemisphere Shorebird Reserve Network.

Climate change is projected to affect wetlands in the Bay through a variety of factors, most notably, sea level rise and seasonal salinity increases. These changes will likely convert tidal freshwater and brackish wetlands into more saline systems and result in greater tidal inundation, thereby changing the species composition and habitat structure for birds and other wildlife. Early analyses of climate change scenarios indicate that sea level rise and seasonal salinity shifts resulting from climate change will reduce the extent of wetlands in the Bay over the next 30 to 100 years. Baylands that are already filled or cut off by dikes and development will restrict inland migration of wetlands resulting in smaller, more fragmented tidal marsh systems.

To understand the implications of the changes to the system and to help guide those changes, predictive tools such as models and modeling frameworks are extremely valuable in informing management and planning decisions with respect to expected change. Researchers working on climate change issues in the Bay Area have indicated to Conservancy staff that development of an ensemble of models to address the broad array of management questions regarding San Francisco Bay is necessary to meet the needs for science to guide management decisions in response to climate change. Furthermore, millions in state, federal, and local dollars will be spent on wetland restoration in the Bay Area over the next five years, for projects such as the

South San Francisco Bay Salt Pond Restoration Project, Bair Island Restoration in Redwood City, Dutch Slough in Oakley, and several projects around the perimeter of San Pablo Bay including the Napa Salt Ponds, Cullinan Ranch, Sears Point, and Hamilton Field/Bel Marin Keys. The proposed Bay wetland mapping and modeling effort will provide detailed information on the likely changes in wetland habitats and the corresponding changes to the distribution of birds due to sea level rise and salinity that is necessary to planning of wetland acquisition and restoration projects.

Tidal marshes are dynamic ecosystems, capable of maintaining equilibrium with rising sea levels through accretion of mineral and organic sediments. However, the extent to which San Francisco Bay tidal marshes can keep up with sea level-rise and salinity changes is highly uncertain. In light of current data gaps and model limitations, PRBO's flexible, scenario-based approach takes full advantage of existing information and uses a simple sediment accretion model developed by Philip Williams and Associates (PWA). In collaboration with PWA and other wetland scientists, PRBO has developed a modeling framework and a preliminary set of geographically based climate change scenarios for San Francisco Bay.

Preliminary projections have been developed for a set of sea-level rise, salinity, sediment supply, and levee scenarios. These projections provide a broad overview of future tidal marsh extent and location in San Francisco Bay as well as a basis for developing more detailed estimates, recommendations and tools to guide planning and management in the second phase of the project. Building on previous efforts and utilizing available spatial data, PRBO plans to develop robust models of wetland habitats, as well as distribution and abundance of tidal marsh species at a scale that is relevant for managers of Bay habitats and wildlife. The two specific activities funded by this grant are:

- 1. *Assess the effects of climate change on wetlands and tidal marsh bird populations.*** PRBO will refine its preliminary models that predict percent cover and height of dominant tidal marsh plant species under various potential climate change scenarios. Using the results of the refined habitat models, PRBO will prepare additional models that predict the future abundance of four marsh bird species of concern: Black Rail, Clapper Rail, Song Sparrow, and Common Yellowthroat and produce a report including a set of maps depicting the impacts of sea-level rise, salinity shifts and other climate change effects on wetland habitats and these tidal marsh bird populations. PRBO will also integrate the results of this analysis into their effort to identify priority sites for conservation and restoration (Task #2).
- 2. *Identify priority sites for wetland conservation and restoration.*** PRBO will identify areas of current and potential future tidal marsh habitats and associated bird populations, and recommend high priority sites for wetland conservation and restoration. PRBO will produce a report describing the analysis, findings and recommendations. In order to identify high priority sites, PRBO will: a) work with the Coastal Conservancy, San Francisco Bay Joint Venture, U.S. Fish and Wildlife Service, and others to develop a set of restoration scenarios based on planned or proposed tidal restoration projects in San Francisco Bay; b) assess marsh sustainability and the potential for future marsh migration for these restoration scenarios; c) evaluate the potential for planned restoration projects to

result in high quality wetland habitat; and d) evaluate impacts of alternative restoration scenarios on bird populations, building on results developed in Task #1.

The Bay wetland model will complement the Bay Hydrodynamic and Sediment Transport modeling effort, called “SUNTANS” for Stanford Unstructured Nonhydrostatic Terrain-Following Adaptive Navier-Stokes Simulator, Fringer et al., 2005, underway by researchers from Stanford University and University of California, Berkeley. Funding for the SUNTANS model was approved by the Conservancy Board in July 2007. The SUNTANS model will result in an improved ability to understand and respond to climate change including sea level rise, sediment availability and circulation throughout the Bay. The SUNTANS model will also evaluate upland areas that may be inundated in the future with sea level rise and simulate changes in mean sea level rise to evaluate changes in inundation, salinity and rates of sediment accretion and deposition. The results of the SUNTANS model will eventually provide data inputs to the PRBO work for sea level rise and salinity to produce a more robust and accurate wetland model.

The results of this project will inform the efforts of the Bay Area Ecosystem Climate Change Consortium (BAECCC), which includes PRBO and the Conservancy, and will particularly aid BAECCC’s efforts to update the Baylands Ecosystem Habitat Goals Report to incorporate climate change impacts. This work is the subject of a separate staff recommendation before the Conservancy at the October, 2010 meeting.

PRBO will carry out this project with a combination of funds from the Conservancy and other sources. PRBO has already begun to use the funds from other sources to develop maps and models for some dominant tidal marsh plant species and specialist bird species by compiling current and future spatial data on inundation, salinity, and marsh accretion. The resulting projections for distribution and abundance of these plant and the specialist birds are shown in Exhibit 2. The funds provided by the Conservancy are necessary to enable PRBO to complete the project. Conservancy funds are necessary to: (1) incorporate into the maps and models the most up-to-date elevation and levee data and evaluate realistic restoration scenarios; and (2) update and synthesize model results and develop site-level decision support tools for managers. Conservancy funding will also require coordination and incorporation of additional data from other complementary modeling efforts that are currently underway to evaluate climate change impacts on the San Francisco Bay (see “Project History” section below for more information on other modeling efforts). The additional data and “outputs” from other models will improve the accuracy of this project’s wetland model results.

PRBO is a registered 501(c)(3) nonprofit organization dedicated to conserving birds, other wildlife and ecosystems through innovative scientific research and outreach. Founded in 1965, PRBO is recognized as a leader in conservation science because its bird ecology research, management tools and field training programs are advancing biodiversity conservation on land and at sea. PRBO works in partnership with wildlife and habitat management agencies, nongovernmental organizations, academic institutions, private landowners, fisheries and others. The organization is qualified and appropriate to carryout the proposed wetland mapping and modeling project.

**PROJECT FINANCING**

Coastal Conservancy	\$100,000
Landscape Conservation Cooperative	\$141,236
San Francisco Foundation	\$120,000
Anonymous Donor to PRBO	\$25,000
<b>Total Project Costs</b>	<b>\$386,236</b>

It is anticipated that the Conservancy's funding will come from the fiscal year 2008/09 appropriation to the San Francisco Bay Area Conservancy Program from the "Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006" (Proposition 84, Public Resources Code Sections 75001-75090). Proposition 84 funds are available for all projects authorized under Chapter 4.5 of Division 21 of the Public Resources Code (i.e. the San Francisco Bay Area Conservancy Program) that protect and restore natural habitat values of coastal waters and lands. This project will inform acquisition decisions and the design of wetland habitat restoration and enhancement projects to help protect natural habitat values of the San Francisco Bay, and is undertaken pursuant to Chapter 4.5 of Division 21 of the Public Resources Code, as discussed below.

Under Public Resources Code section 75072, up to 10 percent of Proposition 84 funds allocated for Chapter 4.5 of Division 21 may be used to finance planning and monitoring necessary for the successful design, selection, and implementation of the projects authorized by Chapter 4.5. The proposed San Francisco Bay Wetland Mapping and Ecological Modeling project is a conservation planning project; the results will provide the data and recommendations necessary for the successful design, selection and implementation of future wetland acquisition and restoration projects.

Section 75003.5 of Proposition 84 also recognizes that the impacts of climate change pose significant challenges and that "...these challenges must be addressed through careful planning and through improvements in land use and water management that both reduce contributions to global warming and improve the adaptability of our water and flood control systems...and encourage ecosystem protection...". This project will provide the information necessary to enable such careful planning and improvements.

**CONSISTENCY WITH CONSERVANCY'S ENABLING LEGISLATION:**

This project will be undertaken pursuant to Chapter 4.5 of the Conservancy's enabling legislation, Public Resources Code Sections 31160-31165, to address resource goals in the San Francisco Bay Area. The project will provide information for planning efforts in all of the nine counties which make up the jurisdiction of the San Francisco Bay Area Conservancy Program, as described in Section 31162. Section 31161 declares that San Francisco Bay is the central feature in an interconnected open-space system of watersheds, natural habitats, waterways and scenic areas.

Under Section 31162(b), the Conservancy may award grants that will help achieve the goal of

protecting, restoring and enhancing natural habitats and connecting corridors, watersheds, scenic areas, and other open-space resources of regional importance. This project will help to achieve this goal by developing information that is critical to acquisition decisions and the successful design of habitat restoration and enhancement projects in San Francisco Bay.

Consistent with Section 31163(c), the modeling project is a priority since it: (1) serves a regional constituency; (2) is consistent with regional plans, including the San Francisco Bay Plan, the San Francisco Bay Joint Venture's Implementation Strategy, and San Francisco Estuary Project's Comprehensive Conservation and Management Plan; (3) can be implemented in a timely way; and (4) includes matching funds from other sources, as described in the "Project Financing" section of this staff recommendation.

**CONSISTENCY WITH CONSERVANCY'S 2007  
STRATEGIC PLAN GOAL(S) & OBJECTIVE(S):**

Consistent with Goal **10**, Objective **B** of the Conservancy's Strategic Plan, the proposed project will help the Conservancy and others develop plans for protection, restoration and enhancement of natural habitats in the San Francisco Bay Area.

**CONSISTENCY WITH CONSERVANCY'S  
PROJECT SELECTION CRITERIA & GUIDELINES:**

The proposed project is consistent with the Conservancy's Project Selection Criteria and Guidelines, last updated on June 4, 2009, in the following respects:

**Required Criteria**

1. **Promotion of the Conservancy's statutory programs and purposes:** See the "Consistency with Conservancy's Enabling Legislation" section above.
2. **Consistency with purposes of the funding source:** See the "Project Financing" section above.
3. **Support of the public:** The project is supported by San Francisco Bay organizations and agencies who are involved with wetland restoration, management and planning including the San Francisco Bay Joint Venture, the Don Edwards San Francisco Bay National Wildlife Refuge and BCDC (See Exhibit 3).
4. **Location:** The proposed project will map and model tidal wetlands habitats in all nine Bay Area counties (bay and outer coast).
5. **Need:** Without Conservancy funding, this project would not be able to incorporate the level of detailed information that is needed to provide the best results for the modeling effort, including spatial data on levees and community dynamic analysis.
6. **Greater-than-local interest:** The maps and recommendations resulting from the modeling effort will address conservation of multiple special status species of birds and tidal marsh plant species, and will characterize the distribution and quality of high priority tidal habitats. The results will also highlight opportunities for preservation and enhancement of tidal marsh habitat, connectivity and wildlife corridors. This information will be useful to the numerous

federal, state and local conservation agencies and non-profit organizations that work in the San Francisco Bay area.

7. **Sea level rise vulnerability:** The project is intended to evaluate the vulnerability of tidal marshes and marsh birds to sea level rise.

#### **Additional Criteria**

8. **Resolution of more than one issue:** The project will provide information (current distribution of tidal wetland habitats and bird species) that can be used immediately for wetland management and restoration decisions; the results of the modeling efforts will also provide recommendations that can guide future wetland conservation priorities for acquisition and improve the design of restoration. In addition, the project contributes towards understanding how global warming will affect the Bay and will provide important information to support regulatory decisions by agencies such as BCDC.
9. **Leverage:** See the “Project Financing” section above.
10. **Innovation:** This project is innovative in its application of species distribution modeling techniques. Distribution models are widely used to address broad-scale distribution shifts in species under multiple climate change scenarios. This project will use the distribution modeling techniques to address specific climate change drivers on sea level rise and salinity at a regional scale to anticipate fine-scale ecological responses for Bay tidal vegetation and the bird species.
11. **Readiness:** PRBO has already begun some initial mapping and modeling efforts with monies received from the San Francisco Foundation (see “Project Financing”). PRBO is ready to incorporate additional data sets that will further refine and improve the mapping and modeling effort.
12. **Realization of prior Conservancy goals:** “See “Project History” above.”
13. **Return to Conservancy:** See the “Project Financing” section above.
14. **Cooperation:** The results of the mapping and modeling efforts supports the San Francisco Bay Joint Venture’s Implementation Strategy and the San Francisco Estuary Project’s Comprehensive Conservation and Management Plan and will directly inform planning and adaptation efforts conducted by BCDC, the Conservancy, and other State agencies in response to sea level rise and changes in ecosystem dynamics leading to habitat and wildlife changes.
15. **Vulnerability from climate change impacts other than sea level rise:** Along with the evaluation of the impacts of Sea Level Rise on tidal marshes and marsh birds, the project will evaluate the impacts of salinity changes in the Bay, changes in sediment supply, and increased tidal flooding.

#### **CONSISTENCY WITH SAN FRANCISCO BAY PLAN:**

This project will help plan acquisitions and restoration projects that are consistent with the San Francisco Bay Plan. For example, the Tidal Marsh and Tidal Flats Policies of the Bay Plan state that: (1) Tidal marshes and tidal flats should be conserved to the fullest extent; (2) [development] projects [must be] sited and designed to avoid, or if avoidance is infeasible, minimize adverse

impacts on any transition zone present between tidal and upland habitats; (3) tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging and breeding habitat for fish, other aquatic organisms and wildlife; (4) any tidal restoration project should include clear and specific long-term and short-term biological and physical goals [...]; and (5) design and evaluation of restoration projects should include an analysis of the effects of relative sea level rise, rates of colonization by vegetation, and the expected use of the site by wildlife.”

To the extent that the model will include some areas of open waters and subtidal habitat, the project is also consistent with Policy 5 of the Subtidal Areas section: “The Commission should continue to support and encourage expansion of scientific information on the Bay’s subtidal areas, including:...(b) the relationship between the Bay’s physical regime and biological populations; (c) sediment dynamics, including sand transport, and wind and wave effects on sediment movement; ...and (e) where and how restoration should occur.”

#### **COMPLIANCE WITH CEQA:**

The proposed project is statutorily exempt from preparation of an EIR or negative declaration under the California Environmental Quality Act pursuant to 14 California Code of Regulations, Title 14, Section 15262, because it involves only planning studies and feasibility analyses for possible future action not yet funded by the Conservancy. Implementation of this modeling project does not legally bind the Conservancy to future implementation of protection, restoration or enhancement projects whose design may be guided by the recommendations of the modeling project. The project is also categorically exempt under Section 15306, which exempts basic data collection and resource evaluation activities that do not result in a serious or major disturbance to an environmental resource. Upon approval, Conservancy staff will file a Notice of Exemption for this project.