

**Development of the Wetlands Regional Monitoring Program
for the San Francisco Estuary**

Work Plan for USEPA CWA Section 104 Funds 2002-03

**SF Bay Area Wetlands Monitoring Program
San Francisco Estuary Institute
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Oakland, CA 94621**

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INTRODUCTION and PROJECT LOCATION

The San Francisco Bay Area Wetlands Regional Monitoring Program (WRMP) is seeking a US EPA Wetlands Grant to develop a set of landscape-level assessments and Rapid Assessment Indicators (RAIs) of tidal wetland condition in the San Francisco Estuary.

The geographic scope of the WRMP is the San Francisco Estuary and its watersheds. The project will initially focus on Central Bay and South Bay (see Figure 1). This focus will enable the WRMP to work closely with the Santa Clara Basin Watershed Management Initiative (SCBWMI) of South Bay to transfer EPA's National Wetlands Assessment and Monitoring Strategy to the Bay Area. The collaboration between the WRMP and the SCBWMI will foster linkages between watershed assessment and wetland assessment in the region. The project will also build on existing collaborations with other regional sources of wetland science, including the West Coast EMAP, the EPA-funded center for Pacific Estuarine Ecological Indicators Research (PEEIR), and the CALFED Science Program. CALFED is a consortium of federal and California state agencies working to meet the diverse demands for freshwater in California.

The project will emphasize landscape assessments and the development of RAIs for landscape ecology, hydrology-geomorphology, vegetation, and contaminants. The WRMP recognizes that RAIs are needed for these parameters to assess the overall quality of estuarine habitats as affected by major stressors. The effort to develop RAIs will draw upon the wealth of existing regional information to develop RAIs that are robust across short time periods but sensitive to changes in stressor levels. The candidate RAIs will then be tested along known gradients of key stressors, such as water pollution, marsh age or elevation, salinity, and urban runoff. The RAIs can then be applied to the rest of the Estuary using the EMAP sampling design or a comparable design, with the advice and review of EPA. The existing GIS of past and present estuarine wetlands (see Figures 2 and 3) will be updated as the base map for landscape assessment and for selecting study sites for the development of the RAIs. We look forward to subsequent work to develop the WRMP as the best way for the Bay Area wetland management community to maximize the efficacy of its wetland policies, programs, and projects.

The San Francisco Estuary Project (SFEP) and its partner and fiscal agent the Association of Bay Area Governments will administer the grant. The SFEP is one of 28 National Estuary Programs mandated under the Clean Water Act. It serves to implement the Comprehensive Conservation and Management Plan (CCMP) for the San Francisco Estuary (SFEP 1993).

The San Francisco Estuary Institute (SFEI) will manage the project, coordinate the technical work, and communicate the progress and findings of the project to EPA, to the other partners and collaborators in the project, and to the public. This role for SFEI follows from the CCMP of the Estuary

Project. SFEI will communicate with other regional wetland monitoring efforts on the West Coast to share experiences and to help maximize the consistency of the monitoring efforts for the different regions.

The Santa Clara Basin Watershed Management Initiative (SCBWMI) is a collaborative, stakeholder driven effort among representatives from regional and local public agencies; civic, environmental, resource conservation and agricultural groups; professional and trade organizations; business and industrial sectors; and the general public. The SCBWMI will help guide the project to assure that it meets local needs for information about tidal wetlands as estuarine extensions of local watersheds (see Appendix A: SCBWMI Roster).

The WRMP has a multi-agency Steering Committee with scientific Focus Teams that will advise the project to maximize its practical utility to the wetland management agencies of the region (see Appendix B: WRMP Steering Committee and Focus Team Rosters). Some of the Focus Teams will conduct the fieldwork, as coordinated by SFEI. The WRMP is also forming a Science Review Group to provide outside technical review of the WRMP products.

PROJECT PURPOSE, OBJECTIVES and FINAL PRODUCTS

The mission of the WRMP is to provide the scientific understanding necessary to protect, create, restore, and enhance wetlands of the San Francisco Bay Region, through objective and cost-effective monitoring, research, and communication (WRMP 2001). The WRMP is the monitoring component of the Bay Area Wetlands Recovery Program (See Figure 4). The WRMP is being developed in two major phases. Phase II has two major parts.

Phase I: (accomplished) develop regional habitat goals for wetlands based on inventories of historical and present-day wetlands and forecasts of expected change under different policy scenarios (Goals Project 1999);

Phase II: (Underway): develop protocols for data collection to track wetland project performance and to track progress toward the regional goals for (IIA) estuarine wetlands and (IIB) palustrine, lacustrine, and riverine wetlands, relative to the regional ambient variability in their form and ecological function.

WRMP consists of four elements: (1) monitoring of ambient status and trends, and the effects of restoration on the wetland ecosystem; (2) monitoring the performance of restoration and mitigation projects, including the review and interpretation of the monitoring data from projects; (3) special scientific studies to improve basic understanding of wetlands in the region, develop indicators, and improve sample designs; and (4) an information system to provide public access to monitoring results and other products of the WRMP (see Figure 4)

Project Objectives

The objectives of the project are to help develop the ambient monitoring and project monitoring elements of Phase IIA of the WRMP by producing and implementing protocols for landscape-level assessment and rapid project-level assessment of tidal wetlands.

To achieve these objectives, a two-part study is required over a 2.5-year period. As part one of the required study, the 1.5-yr project will undertake the following tasks:

- Task 1:* Update the regional map of existing estuarine wetlands, especially for South Bay, with input and review from the SCBWMI.
- Task 2:* Conduct landscape-level assessments of the tidal wetland ecosystem for Central Bay and South Bay.
- Task 3:* Develop a set of field-based Rapid Assessment Indicators (RAIs) that can be used routinely in a monitoring program.
- Task 4:* Perform a field test to verify the accuracy of the RAIs.
- Task 5:* Document the RAIs as a set of protocols for data collection for restoration practitioners, with guidelines for data interpretation by wetland managers.

Pending future funding of about \$200,000 for Phase IIB of this project, the following tasks would be undertaken in the third year of the project to meet all the Phase IIB objectives:

- Task 6:* Verify rapid assessment methodology using a randomly-selected set of sites from throughout the Estuary based on a sampling design that is compatible with EMAP.
- Task 7:* Assemble technical teams as needed to expand the scope of the WRMP to include palustrine, riverine, and lacustrine (i.e., non-estuarine) wetlands.
- Task 8:* Prepare a draft plan for the assessment of the ambient status and trends of non-estuarine wetlands and the performance of projects to recover non-estuarine wetlands.
- Task 9:* Develop an implementation plan to conduct regular ambient wetland surveys and to assess and compare the performance of wetland projects into the future.

BACKGROUND and NEED for the PROJECT

In 1993, the Governor of California and the Administrator of the US Environmental Protection Agency signed the Comprehensive Conservation and Management Plan for the San Francisco Estuary (SFEP 1993). The CCMP called for a Regional Wetlands Plan based upon habitat goals. As an appendix to the CCMP, the Regional Monitoring Strategy called for comprehensive environmental monitoring programs. The CCMP also called for the creation of the San Francisco Estuary Institute (SFEI) to help coordinate environmental monitoring. In 1994, SFEI and the Regional Water Quality Control Board initiated the Wetlands Ecosystem Goals Project to establish wetland habitat goals. In 1999, after goals had been set, many of the same agencies and SFEI began planning the WRMP as part of the Regional Wetlands Plan. A multi-agency Steering Committee was created to direct SFEI in WRMP development. The Regional Wetland Plan has given rise the San Francisco Bay Area Wetlands Recovery Program, which recognizes the WRMP as the source of information about the status and trends of wetlands in the region.

Large amounts of public funds and human resources are being invested in the protection,

creation, restoration, and enhancement of wetlands in the Region. The Wetland Recovery Program calls for tens of thousands of acres of new wetland projects. Both the number and size of wetland projects are increasing each year, and the overall ecological and economic importance of wetlands is therefore also increasing.

A monitoring program is needed to evaluate wetland policies, programs, and projects in the region. Wetlands need to be compared to each other and over time to assess the status and trends of the wetlands ecosystem, measure the progress of wetlands projects, assess the efficacy of management decisions, and otherwise account for the public investment in wetlands.

But these needs cannot be met at this time because the ambient conditions of wetlands in the region are not being monitored, local projects are monitored in disparate ways, there is little assurance of data quality, and monitoring results are not readily available to the public.

The SCBWMI was initiated by the US EPA and the S F Bay Regional Water Quality Control Board in 1996 to provide an opportunity for local watershed stewardship. The SCBWMI Core Group and its Wetlands Advisory Group have identified the assessment of the estuarine wetlands of the basin as a high priority.

DEFINITIONS OF SUCCESS

SFEI and all Focus Team leaders will regularly monitor progress on each project task through monthly or quarterly meetings as needed. Updates on the progress of the project will be included in written quarterly reports to EPA through the SF Estuary Project. SFEI will provide progress reports to the WRMP Steering Committee, the SCBWMI, and to the leaders of related efforts in the SF Estuary and elsewhere on the West Coast, as might be recommended by EPA. SFEI will announce interim and final results to the public via the WRMP web site and other related web sites, and will, through these web sites, seek feedback from the wetland interests in the region.

SFEI will work with the Focus Team leaders to produce a set of quality assurance project plans (QAPPs) that reflect the protocols for data collection and analysis. The QAPPs will pass EPA review.

The larger successes of the project will be defined by the response of the regional community of wetland scientists and managers to the products listed below. The responses will be solicited through the WRMP Steering Committee, the Estuary Project, and the Santa Clara Basin Watershed Management Initiative.

PROJECT TASKS, MILESTONES, DELIVERABLES, TIMETABLE AND FUNDING

Task 1: Update the map of existing estuarine wetlands

The WRMP has produced a regional GIS through SFEI called the Bay Area EcoAtlas that includes detailed maps of the historical (circa 1790-1810) and existing (circa 1998) distribution and abundance of estuarine wetlands and related habitats (see Figures 2 and 3). The map of existing wetlands need to be updated to include new information about the historical condition and to incorporate changes due to re-classification, restoration projects, failed levees, etc. This map will be

used to make sure that sample sites for the RAI development effort are representative of the region. In addition, the existing maps follow a parochial nomenclature of wetland types that, while being very useful to the regional community of interests, is not immediately compatible to other, more standard wetland classification systems used elsewhere. SFEI and the Landscape Ecology Team of the WRMP (see Appendix B for Team roster) will work together, with input from the SCBWMI, to update the map of existing wetlands and to translate the regional nomenclature into the federal standard classification system (Cowardin et al 1979) used by the National Wetlands Inventory (NWI) of the USFWS.

Task 1 Schedule and Budget Task 1 Deliverables

Task 1 will yield updated GIS coverages of the historical and modern estuarine wetlands as classified by the region-specific system and according to Cowardin et al 1985.

Task 2: Conduct landscape-level assessments of the tidal wetland ecosystem for Central Bay and South Bay, and develop the landscape ecology RAIs.

SFEI and the Landscape Ecology Team of the WRMP will develop a set of protocols to help assess the ecological and hydrological functions of tidal wetlands based on their distribution, abundance, shape, connectedness, and position along stressor gradients. These landscape ecology RAIs will also be used to help assess how wetland restoration and mitigation might relieve the stresses on wetlands. One of the main reasons for this landscape analysis is to begin to assess and perhaps forecast the cumulative effects of proposed projects on key concerns about the tidal marsh ecosystem, such as protecting native species, controlling non-native invasive species, minimizing the methylation of mercury, enhancing pollutant filtration, and reducing flood risks. These are topics of interest to most of the wetland management agencies in the region. This analysis will benefit from GIS coverages, now in production, of the past, present, and proposed wetland restoration and mitigation projects in the region.

Task 2 Deliverables

Task 2 will yield protocols for landscape-level assessment and a report on the results of the assessment using the protocols, and a QAPP that reflects the protocols.

Task 3 Develop a set of field-based RAIs for hydro-geomorphology, vegetation, and contaminants that can be used routinely in a monitoring program.

SFEI will work with the Plant Team, the Bio-Geo Chemistry Team, and the Physical Processes Team of the WRMP to compile existing data relating key indicators of tidal marsh condition to gradients of dominant stressors and forcing functions, such as water pollution, hydrological alteration, marsh elevation, time since restoration, and aqueous salinity regime. The SCBWMI will contribute to and review the data sets. Based on these existing data sets, many of which were developed by members of the WRMP Focus Teams, SFEI and the Teams will work with EPA to develop candidate RAIs.

SFEI and the Teams will review the RAIs produced for wetlands in Ohio (Ohio EPA 2001) and any Bioassessment Methods produced by EPA's Biological Assessment of Wetlands Workgroup (OWOW 2001) for possible application in the SF Bay Area.

When supporting data exist, and as agreed to by the sampling design advisors, then the existing data will be used to develop predictive models for key state indicators. It should be possible, for example, to predict the status of key indicators of marsh form, sediment condition, and plant and animal communities based on their known relationship to marsh age, salinity regime, patch size, and patch location along disturbance gradients. Candidate datasets relate channel density to salinity and marsh age (Grossinger 1995, Siegel 1993); plant community composition to salinity regime and channel order (Atwater and Hedel 1976, Culberson 2001, Sanderson et al. 2001); resident passerine and rail assemblage composition to salinity regime, marsh age and channel order (Collins and Resh 1985, Nur et al. 1997); shorebird and waterfowl assemblage composition to distance from bayshore, amount of surface ponding, and salinity regime (Page et al. 1989, Bias et al. 1999); and contaminant loading in relation to channel order and distance from channel banks (Collins and May 1996). These datasets and others can be explored for their predictive capability.

Task 3 deliverables

Task 3 will yield Lists of existing data sets for key indicators of state conditions and stress that can be used to select parameters for the RAIs, plus draft protocols for using and interpreting the RAIs.

Task 4: Perform a field test to verify the accuracy of the RAIs

SFEI will work with the Plant Team, the Bio-Geo Chemistry Team, and Physical Processes Team of the WRMP to develop protocols for data collection, select test sites, and collect and analyze data in an effort to verify and calibrate the RAIs. Restoration projects in South Bay are potential opportunities to coordinate RAI development with the design of new restoration projects. These opportunities will be will be further explored as appropriate.

Task 4 deliverables

Task 4 will yield verified and calibrated RAIs for selected sites along known gradients of stressors and forcing functions, and a QAPP that reflects the protocols for using the RAIs.

Task 5: Document the RAIs as a set of protocols for data collection for use by restoration practitioners, with guidelines for data interpretation by wetland managers

SFEI will work with the Focus Team leaders to finalize the RAIs as a set of protocols for data collection and interpretation. The draft report can be reviewed by the Steering Committee and scientific Focus Teams of the WRMP, the Science Review Group of the WRMP, EPA, and other partners and collaborators in the project. Every effort will be made to develop the RAIs as practical ways to provide timely and relevant information to wetland managers.

Task 5 Deliverables

Task 5 will yield a report to EPA and the regional community of wetland managers and scientists on the process and findings of the project.

Regional Support for the Project

The work plan is endorsed by the Steering Committee of the WRMP, which includes many of the state and federal agencies that have major operational or regulatory responsibility for wetlands protection in the San Francisco Bay Area. As a project of the WRMP, which is the monitoring component for the SF Bay Wetlands Recovery Program (see Figure 4), The project will have a high profile in the regional community of wetland managers and scientists. This will help to appraise the success of the project. The partnership between SFEI, the SCBWMI, and the SFEP will assure that the project is accessible to watershed management interests and the concerned public.

Relation to the Regional Wetlands Recovery Program and the State Wetlands Policy

This work plan addresses two technical objectives identified for the SF Bay Area by the State Wetlands Conservation Policy: a wetlands inventory, and methods to evaluate wetland projects. The region's primary Watershed Management Initiatives, the Santa Clara Basin WMI, has recognized that estuarine wetlands are sensitive to watershed management practices, and the WMI is seeking help with wetland assessment through this project.

The project represents an extension of efforts completed by the California Regional Water Quality Control Board, San Francisco Bay Region to assess the success of compensatory wetland mitigation.

The objectives of the project are consistent with EPA's National Strategy on Wetlands Monitoring and Assessment and the National Research Council's Recommendations for Compensating Wetland Losses under the Clean Water Act.

REFERENCES

- Atwater, B.F. and C.W. Hedel. 1976. Distribution of seed plants with respect to tide levels and waster salinity in the natural marshes of the northern San Francisco Bay estuary, California. US Geological Survey Open-File Report 76-389, USGS, Menlo Park, Ca.
- Bias, M. A., J. Y. Takekawa, R. E. Laird, M. Eagan, M. Hulst, and L. Vicencio. 1999. Easier said than done: lessons learned from a tidal restoration in San Pablo Bay. Society for Ecological Restoration, 19th Annual Meeting, San Francisco, Ca..
- Collins, J.N. and M. May. 1996. Contamination of tidal wetlands. Report to the San Francisco Bay Area Regional Monitoring Program for Trace Substances, San Francisco Estuary Institute, Oakland, Ca.
- Collins, J.N. and M. May. 2001. Regional spatial analysis of NIS *Spartina* invasions in the San Francisco Estuary. Report to the California Coastal Conservancy, Oakland, Ca.
- Collins, J.N. and V.H. Resh. 1985. Utilization of natural and man-made habitats by the salt marsh song sparrow *Melospiza melodia samuelis* (Baird). California Fish and Game 71(1):40-52.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. US Fish and Wildlife Service, report no. FWS/OBS-79/31, Washington, D.C.
- Culberson, S.D. 2001. Tidal Marsh Geomorphology: the interaction of physical and biological processes producing vegetation zonation of estuarine wetland ecosystems in the San Francisco Bay/Delta, California, U.S.A./. Doctoral Dissertation, Agronomy and range Sciences, University of California at Davis, Ca.
- Grossinger, R. M. 1995. Historical evidence of freshwater effects on the plan form of tidal marshlands in the Golden Gate Estuary. Masters Thesis, Marine Sciences, University of California at Santa Cruz, Ca.
- Nur, N., S. Zack, J. Evens, & T. Gardali. 1997. Tidal marsh birds of the San Francisco Bay region: status, distribution, and conservation of five Category 2 taxa. Draft final report to U.S. Geological Survey, Biological Resources Division.
- Ohio EPA. 2001. Ohio rapid assessment methods for wetlands. Ohio EPA, Division of Surface Water, Columbus, Oh.
- OWOW 2001. "Methods for Evaluating Wetland Condition" Reports. US EPA, Office of Wetlands, Oceans, Watersheds. <http://www.epa.gov/owow/wetlands/bawwg/biomethod.html>; Revised: Wednesday, July 25, 2001 11:32:20.

- Page, G.W., J.E. Kjelson & L.E. Stenzel. Results of the 21-24 April 1989 shorebird census of San Francisco Bay and coastal wetlands of the Point Reyes/Bodega Bay area. Point Reyes Bird Observatory Report, 1989.
- Sanderson, E.W., S.L. Ustin, and T.C. Foin. 2001. A simple empirical model of salt marsh plant spatial distributions with respect to a tidal channel network. *Ecological Modeling*, 139:293-307.
- SFEP 1993. Comprehensive Conservation and Management Plan for the San Francisco Estuary. San Francisco Estuary Project, San Francisco Bay Regional Water Quality Control Board, Oakland, Ca.
- Siegel, S.W. 1993. Tidal marsh restoration and dredge disposal in the San Francisco Estuary, California. Masters Thesis, Geography, University of California at Berkeley, Ca.
- WRMP 2001. Prospectus for the San Francisco Bay Area Wetlands Regional Monitoring Program. San Francisco Estuary Institute, Oakland, Ca.

Figure 1
Conventional segmentation of the San Francisco Estuary into four major subregions: Suisun, North Bay, Central Bay, and South Bay.

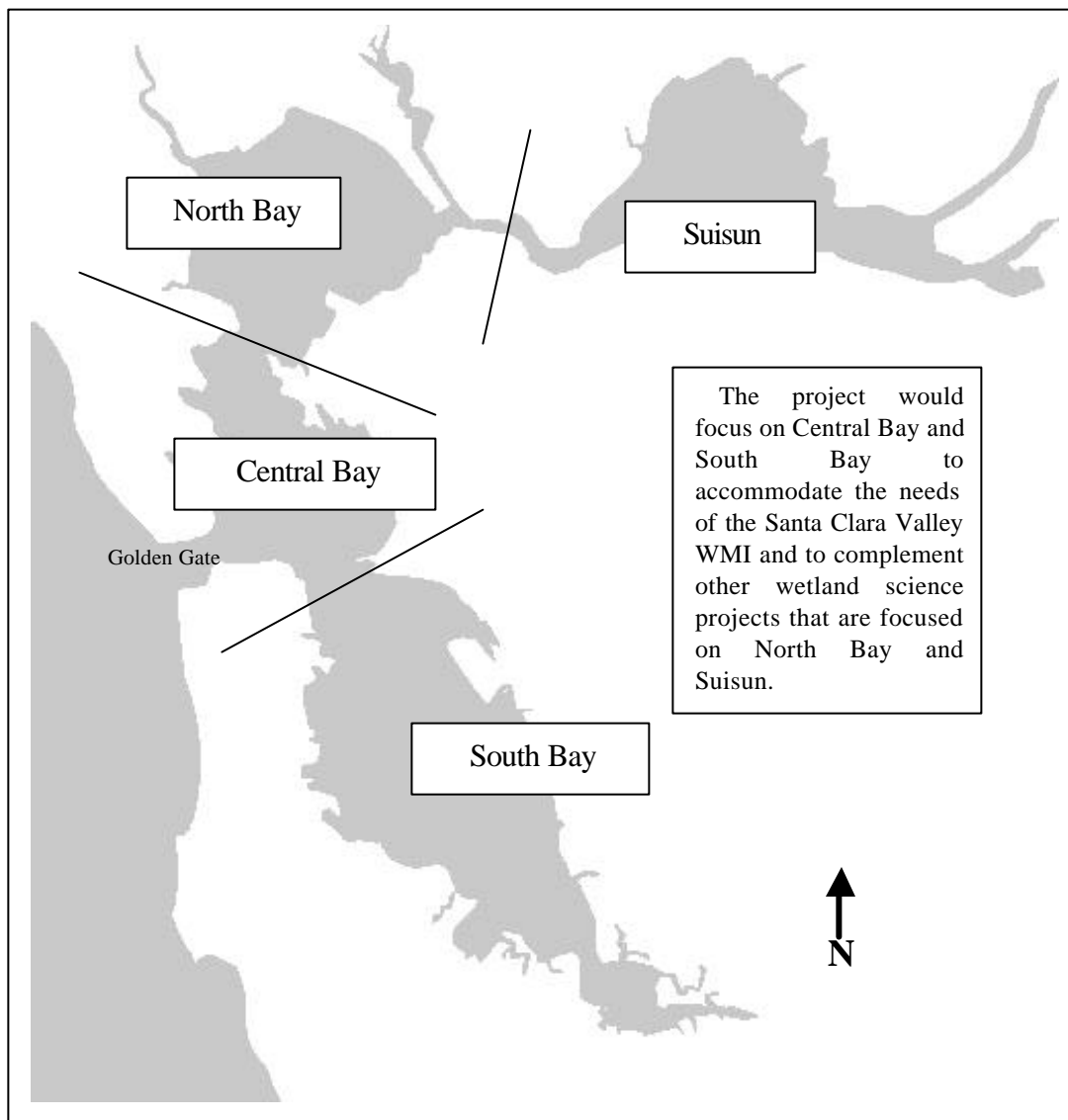


Figure 2
Historical distribution of tidal wetlands and related habitats in the SF Bay Area

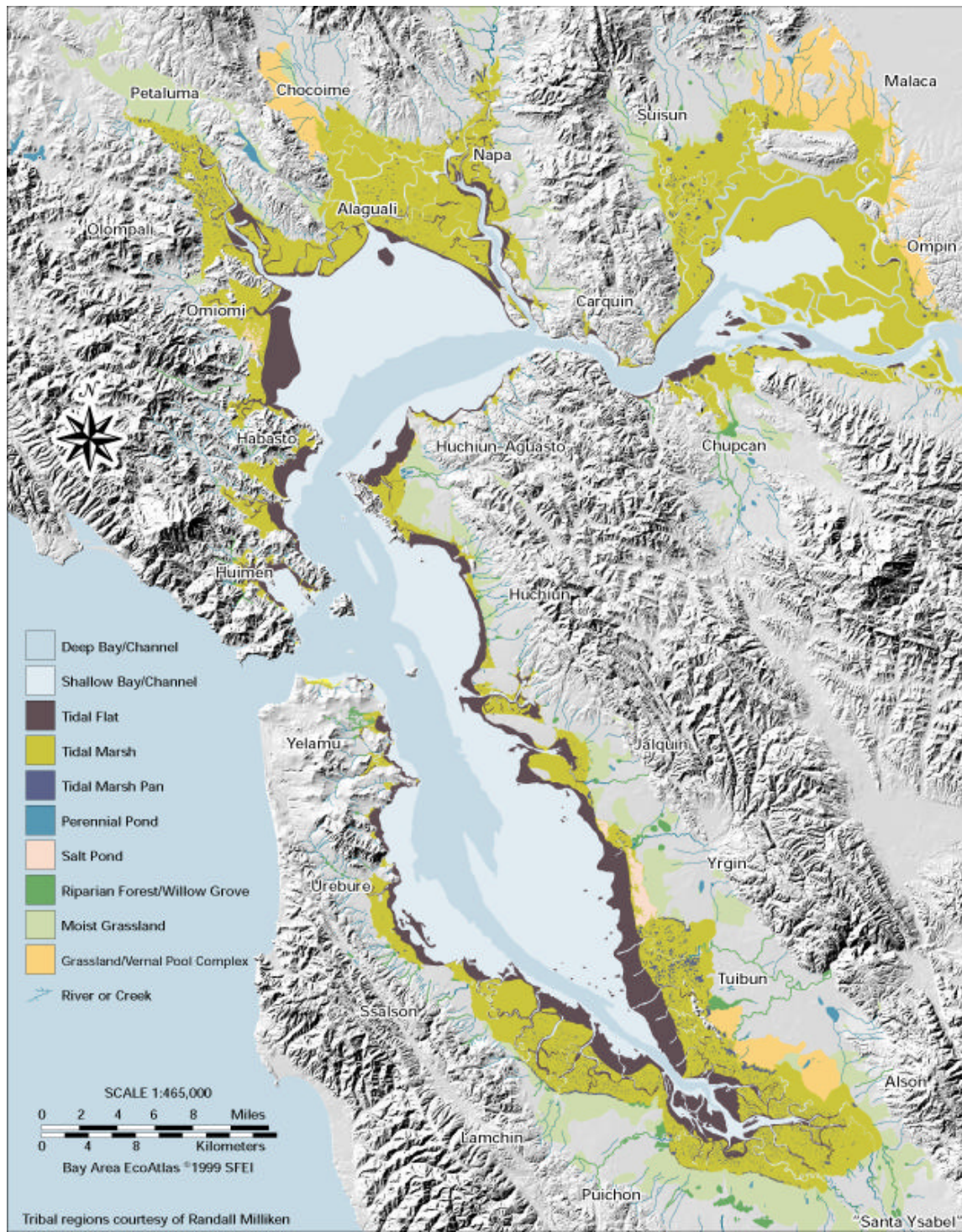


Figure 3
Current distribution of tidal wetlands and related habitats in the SF Bay Area

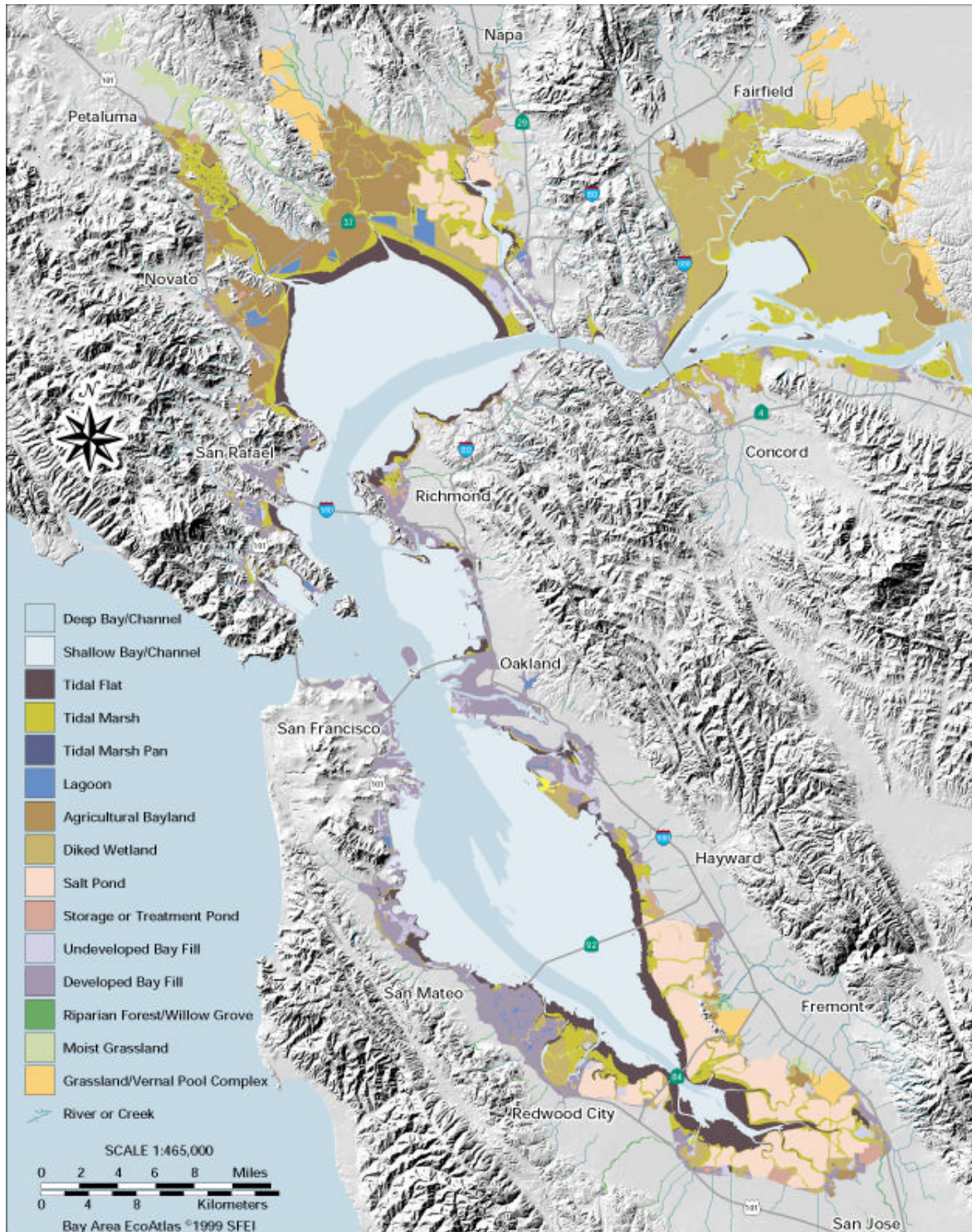
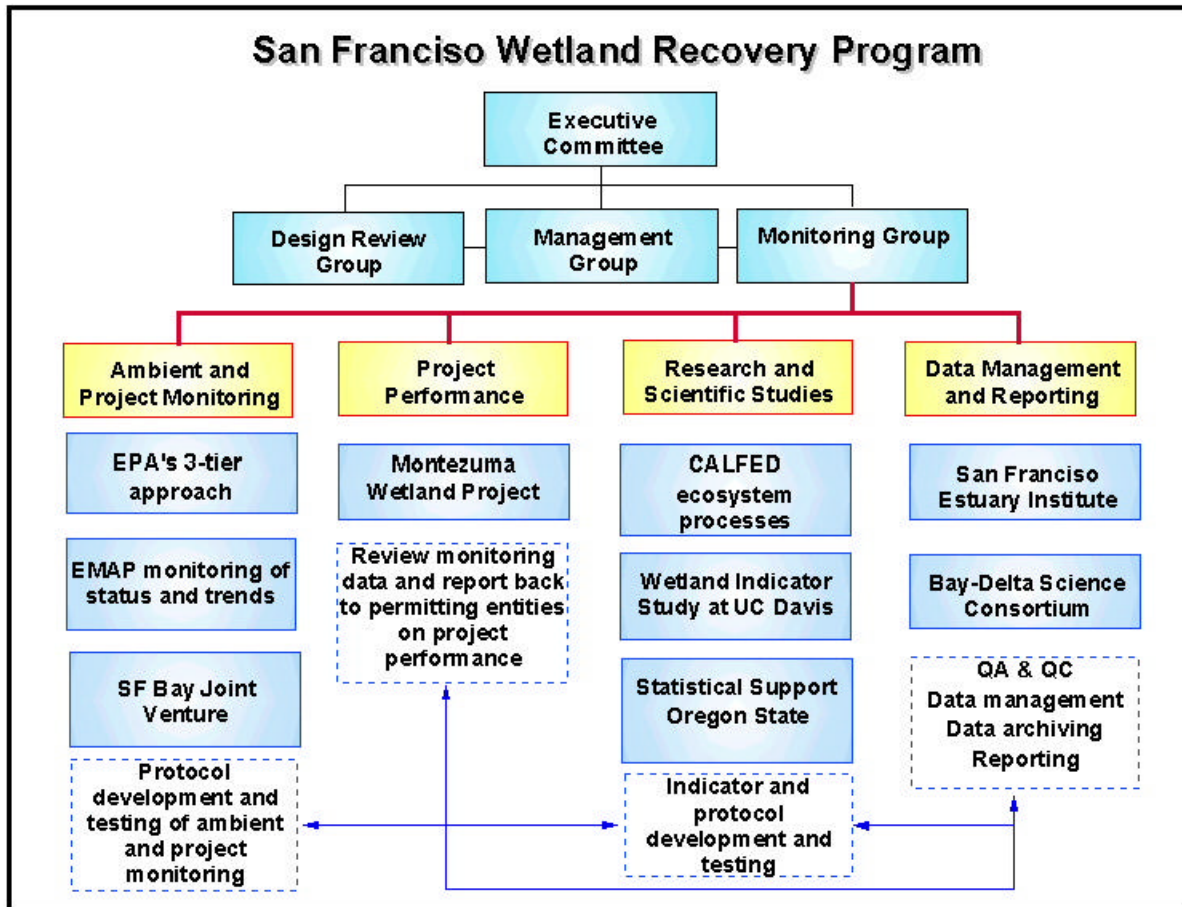


Figure 4

Organizational chart for the SF Bay Wetlands Recovery Program showing the four major components of the WRMP (yellow boxes), existing and proposed projects for each component (blue boxes below the yellow boxes), and basic products (dashed boxes at the bottom of the diagram).



Appendix A
Santa Clara Basin Watershed Management Initiative Roster
As of February, 2001

Public Agencies

California Department of Fish & Game
City of Cupertino
City of Palo Alto
City of San Jose
City of Santa Clara
City of Sunnyvale
Guadalupe-Coyote Resource Conservation District
San Francisco Bay Regional Water Quality Control Board
San Francisquito Creek Joint Powers Authority
Santa Clara County
Santa Clara Valley Transportation Authority
Santa Clara Valley Urban Runoff Pollution Prevention Program
Santa Clara Valley Water District
US Army Corps of Engineers
US Environmental Protection Agency
USDA Natural Resource Conservation Service

Business & Trade Associations

California Restaurant Association/Dairy
Belle Freeze
Home Builders Association of Northern California
San Jose Silicon Valley Chamber of Commerce
Santa Clara Cattlemen's Association
Santa Clara County Farm Bureau
Silicon Valley Manufacturing Group

Environmental & Civic Groups

CLEAN South Bay
League of Women Voters
Salmon and Steelhead Restoration Group
San Francisco Bay Bird Observatory
San Francisquito Creek CRMP
Santa Clara County Streams for Tomorrow
Santa Clara Valley Audubon Society
Silicon Valley Pollution Prevention Center
Silicon Valley Toxics Coalition
Western Waters Canoe Club

Appendix B
WRMP Steering Committee and Focus Team Rosters As of February 2002
Steering Committee

Bob Batha, SF Bay Conservation and Development Commission (BCDC)
 Andree Breaux, SF Bay Regional Water Quality Control Board (SFBWQCB)
 Joelle Buffa, US Fish and Wildlife Service (USFWS)
 Josh Collins, SF Estuary Institute (SFEI)
 Jay Davis, SF Estuary Institute (SFEI)
 Michael Gallagher, National Oceanic and Atmospheric Administration (NOAA)
 Nadine Hitchcock, California State Coastal Conservancy (CCC)
 Todd Hopkins, SF Bay National Estuarine Research Reserve (SFBNERR)
 Beth Huning, SF Bay Joint Venture (SFBJV)
 Paul Jones, US EPA Region 9 (USEPA)
 Maggi Kelly, University of California at Berkeley (UCB)
 Karl Malamud-Roam, Association of Mosquito Abatement Districts (SFBMAD)
 Molly Martindale, US Army Corps of Engineers (USCOE)
 Nadav Nur, Point Reyes Bird Observatory (PRBO)
 Gary Page, Point Reyes Bird Observatory (PRBO)
 Anitra Pawley, SF Bay Institute (SFBI)
 Stuart Siegel, Wetlands and Water Resources (WWR)
 Mike Vasey, SF State University (SFSU)
 Carl Wilcox, California State Department of Fish and Game (CDFG)
 Cathryn Wild, California State Coastal Conservancy (CCC)
 Bryan Winton, US Fish and Wildlife Service (USFWS)

Physical Processes Focus Team Core

Karl Malamud-Roam (SFBMAD)
 Stuart Siegel (WWR)
 David Schoellhamer (USGS)

Bio/Geo Chemistry Focus Team Core

Jay Davis (SFEI)
 Don Yee (SFEI)
 Susan Anderson (UCD)

Plant Focus Team Core

Mike Vasey (SFSU)
 John Callaway (USF)
 Tom Parker (SFSU)

Fish Focus Team Core

Todd Hopkins (SFBNERR)

Chris Kitting (HSU)

Mike McGowan (SFSU)

Amphibian, Reptile and Mammal Focus Team Core

Andree Breaux (SFBWQCB)
 Tom Kucera (Kucera Associates)
 Mark Jennings (Rana Associates)

Bird Focus Team Core

Gary Page (PRBO)
 Nadav Nur (PRBO)
 John Takekawa (USGS)

Landscape Ecology Focus Team Core

Maggi Kelley (UCB)
 Trish Foschi (SFSU)
 Jim Quinn (UCD)