

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

Project Information

1. Proposal Title:

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

2. Proposal applicants:

Mary Small, California State Coastal Conservancy
John Elam, City of Brentwood
Nancy Thomas, Contra Costa Resource Conservation District
Chris Kitting, California State University at Hayward
Joy Andrews, California State University at Hayward
Steve Barbata, Delta Science Center
John Cain, Natural Heritage Institute

3. Corresponding Contact Person:

Mary Small
State Coastal Conservancy
1330 Broadway 1100 Oakland, CA 94612
510 286-4181
msmall@scc.ca.gov

4. Project Keywords:

At-risk species, fish
Habitat Restoration, Wetland
Water Quality Assessment & Monitoring

5. Type of project:

Implementation_Pilot

6. Does the project involve land acquisition, either in fee or through a conservation easement?

No

7. Topic Area:

Shallow Water, Tidal and Marsh Habitat

8. Type of applicant:

State Agency

9. Location - GIS coordinates:

Latitude: 38.003
Longitude: -121.693
Datum: NAD83

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

The Marsh Creek watershed drains from Mt. Diablo into the Delta at Big Break. The proposed lower Marsh Creek restoration site is approximately 30 acres adjacent to the creek to the west, extending north from the Contra Costa Canal to the bridge on the East Bay Regional Park District's bicycle path. The proposed riparian restoration sites are adjacent to Marsh Creek in the City of Brentwood.

10. Location - Ecozone:

1.4 Central and West Delta

11. Location - County:

Contra Costa

12. Location - City:

Does your project fall within a city jurisdiction?

Yes

If yes, please list the city: Brentwood and Oakley

13. Location - Tribal Lands:

Does your project fall on or adjacent to tribal lands?

No

14. Location - Congressional District:

10

15. Location:

California State Senate District Number: 7

California Assembly District Number: 15

16. How many years of funding are you requesting?

3

17. Requested Funds:

a) Are your overhead rates different depending on whether funds are state or federal?

No

If no, list single overhead rate and total requested funds:

Single Overhead Rate: 3

Total Requested Funds: 2998049

b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

Coastal Conservancy \$110,000

San Francisco Bay Fund \$30,000

Switzer Foundation \$25,000

Cal State Hayward \$276,094

c) Do you have potential cost share partners?

Yes

If yes, list partners and amount contributed by each:

Coastal Conservancy 200,000

City of Brentwood 700,000

Ironhouse Sanitary District 460,000

Contra Costa Flood Control District 400,000

Contra Costa Resource Conservation District 75,000

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. Is this proposal for next-phase funding of an ongoing project funded by CALFED?

No

Have you previously received funding from CALFED for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CALFED program.

11332-0-J001 Introduced Spartina Eradication Project Ecosystem Restoration

B81642 Hamilton Wetland Restoration Project Ecosystem Restoration

19. Is this proposal for next-phase funding of an ongoing project funded by CVPIA?

No

Have you previously received funding from CVPIA for other projects not listed above?

No

20. Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?

Yes

If yes, identify project number(s), title(s) and funding source.

N/A Marsh Creek Restoration Planning Coastal Conservancy

N/A Marsh Creek Restoration Planning San Francisco Bay Fund

Please list suggested reviewers for your proposal. (optional)

Bruce Herbold US EPA 415-744-1992 herbold.bruce@epa.gov

Ted Department of Water 916-227-7537 tsommer@water.ca.gov
Sommer Resources

21. Comments:

6. The project does not involve land acquisition, the Ironhouse Sanitary District and the City of Brentwood will provide land for restoration as part of the match for this grant. A specific plan has been developed for the lower Marsh Creek site, owned by Ironhouse Sanitary District.

Environmental Compliance Checklist

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

1. CEQA or NEPA Compliance

a) Will this project require compliance with CEQA?

Yes

b) Will this project require compliance with NEPA?

No

c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

2. If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies). *If not applicable, put "None".*

CEQA Lead Agency: Coastal Conservancy

NEPA Lead Agency (or co-lead:)

NEPA Co-Lead Agency (if applicable):

3. Please check which type of CEQA/NEPA documentation is anticipated.

CEQA

-Categorical Exemption

☒ Negative Declaration or Mitigated Negative Declaration

-EIR

-none

NEPA

-Categorical Exclusion

-Environmental Assessment/FONSI

-EIS

☒ none

If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. CEQA/NEPA Process

a) Is the CEQA/NEPA process complete?

No

If the CEQA/NEPA process is not complete, please describe the dates for completing draft and/or final CEQA/NEPA documents.

The Coastal Conservancy will fund the environmental review for the restoration projects. It is anticipated that these projects will require mitigated negative declarations. Environmental review will begin in January 2002, with the goal of adopting the final environmental documents by May 2002.

b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

STATE PERMITS AND APPROVALS

Scientific Collecting Permit Required, Obtained

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03 Required

CWA 401 certification Required

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC Required, Obtained

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit Required

Rivers and Harbors Act

CWA 404 Required

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.

Agency Name: Ironhouse Sanitary District, Contra Costa Flood Control District, City of Brentwood and East Bay Regional Park District

Required,
Obtained

Permission to access state land.

Agency Name:

Permission to access federal land.

Agency Name:

Permission to access private land.

Landowner Name:

6. Comments.

5. Wetland delineation and biological survey have already been completed for the lower Marsh Creek restoration site. No jurisdictional wetlands were identified except for the existing Marsh Creek channel. No special status species were located except for native fish generally present in the delta. The Coastal Conservancy will work with all appropriate agencies to review proposed restoration design and obtain all necessary permits.

Land Use Checklist

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

1. Does the project involve land acquisition, either in fee or through a conservation easement?

No

2. Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?

Yes

3. Do the actions in the proposal involve physical changes in the land use?

Yes

If you answered yes to #3, please answer the following questions:

- a) How many acres of land will be subject to a land use change under the proposal?

29 acres

- b) Describe what changes will occur on the land involved in the proposal.

29 acres of Ironhouse Sanitary District Land currently managed for reclaimed sewage water discharge will be converted to wetland and marsh habitat. Approximately 5,000 linear feet along Marsh Creek will be restored to create a two-stage channel with floodplains and wetlands.

- c) List current and proposed land use, zoning and general plan designations of the area subject to a land use change under the proposal.

Category	Current	Proposed (if no change, specify "none")
Land Use	Ironhouse Sanitary District (ISD) land is in the city of Oakley is used as grazing land irrigated with treated effluent. The land adjacent to Marsh Creek is undeveloped.	The ISD property will be restored to wetland and floodplain Land adjacent to Marsh Creek in Brentwood will be restored to create additional floodplain, wetlands and riparian vegetation.
Zoning	ISD Land A-2 - general agriculture Marsh Creek sites: various zoning	none
General Plan Designation	ISD A-2 - general agriculture, the City of Oakley is in the process of revising its general plan Marsh Creek sites: various	none

d) Is the land currently under a Williamson Act contract?

No

e) Is the land mapped as Prime Farmland, Farmland of Statewide Importance, Unique Farmland or Farmland of Local Importance under the California Department of Conservation's Farmland Mapping and Monitoring Program?

No

f) Describe what entity or organization will manage the property and provide operations and maintenance services.

Contra Costa County Flood Control District will maintain flood conveyance functions. Ironhouse Sanitary District will manage access to the lower 23 acre site. The Delta Science Center will maintain the habitat area on lower Marsh Creek. Local landscape and lighting districts will be formed by the City of Brentwood to manage vegetation in the 10 acres restored on upper Marsh Creek.

4. Comments.

3c. The Marsh Creek riparian restoration project includes 5,000 linear feet of the creek in the City of Brentwood and crosses several zoning and general plan designations. However, the restoration will generally occur on land designated as a set-back or buffer from the creek. The project is consistent with recently updated Brentwood City Plan. The project would not require any zoning or general plan changes.

Conflict of Interest Checklist

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

Mary Small, California State Coastal Conservancy
John Elam, City of Brentwood
Nancy Thomas, Contra Costa Resource Conservation District
Chris Kitting, California State University at Hayward
Joy Andrews, California State University at Hayward
Steve Barbata, Delta Science Center
John Cain, Natural Heritage Institute

Subcontractor(s):

Are specific subcontractors identified in this proposal? Yes

If yes, please list the name(s) and organization(s):

Stuart Siegel	Wetland and Water Resources
Roger Leventhal	FarWest Engineering
Sue Orlof	Ibis Environmental
Ron Lutsco	Lutsco Landscape Architecture
John Volmar	Volmar Consulting
Bruce Pavlic	Mills College
Bill Wells	Museum Tools

Helped with proposal development:

Are there persons who helped with proposal development?

No

Comments:

Budget Summary

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

Independent of Fund Source

Year 1												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Project Management	669	26755	6689						33444.0	1004	34448.00
2	Big Break Biological and Water Quality Monitoring						132354			132354.0	3971	136325.00
3	Marsh Creek Water Quality Monitoring						101,335			101335.0	3040	104375.00
4	Tidal Marsh and Floodplain Restoration						1162048			1162048.0	34861	1196909.00
5	Channel Restoration and Water Quality Remediation						128386			128386.0	3852	132238.00
6	Public Outreach, Education and Watershed Planning						96813			96813.0	2904	99717.00
7	Native Plant Nursery Program						30000			30000.0	900	30900.00
		669	26755.00	6689.00	0.00	0.00	1650936.00	0.00	0.00	1684380.00	50532.00	1734912.00

Year 2												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Project Management	669	26755	6689						33444.0	1004	34448.00
2	Big Break Biological and Water Quality Monitoring						123616			123616.0	3708	127324.00
3	Marsh Creek Water Quality Monitoring						85724			85724.0	2572	88296.00
4	Tidal Marsh and Floodplain Restoration						180000			180000.0	5400	185400.00
5	Channel Restoration and Water Quality Remediation						172182			172182.0	5165	177347.00
6	Public Outreach, Education and Watershed Planning						71813			71813.0	2154	73967.00
7	Native Plant Nursery Program						22500			22500.0	675	23175.00
		669	26755.00	6689.00	0.00	0.00	655835.00	0.00	0.00	689279.00	20678.00	709957.00

Year 3												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Project Management	669	26755	6689						33444.0	1004	34448.00
2	Big Break Biological and Water Quality Monitoring						131044			131044.0	3931	134975.00
3	Marsh Creek Water Quality Monitoring						88649			88649.0	2659	91308.00
4	Tidal Marsh and Floodplain Restoration						90000			90000.0	2700	92700.00
5	Channel Restoration and Water Quality Remediation						67901			67901.0	2037	69938.00
6	Public Outreach, Education and Watershed Planning						81030			81030.0	2431	83461.00
7	Native Plant Nursery Program						45000			45000.0	1350	46350.00
		669	26755.00	6689.00	0.00	0.00	503624.00	0.00	0.00	537068.00	16112.00	553180.00

Grand Total=2998049.00

Comments.

Detailed budgets are attached to the written proposal.

Budget Justification

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

Direct Labor Hours. Provide estimated hours proposed for each individual.

The project management task is estimated as follows: 1/4 PY for the Coastal Conservancy (490 hrs/year) 1/8 PY for NHI (245 hrs/year) 1/20 PY for Delta Science Center (100 hrs/year)

Salary. Provide estimated rate of compensation proposed for each individual.

For the purposes of this proposal, the coapplicants are estimating compensation for their staff time at \$40/hr

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

20%

Travel. Provide purpose and estimate costs for all non-local travel.

not paid for by this grant

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

not paid for by this grant

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Consultants will be hired for Tasks 2, 3, 4, 5, 6 and 7. Detailed budgets are included in the proposal.

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than \$5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

none

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentations, response to project specific questions and necessary costs directly associated with specific project oversight.

Project management will be billed as a direct labor cost, see above.

Other Direct Costs. Provide any other direct costs not already covered.

none

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

The Coastal Conservancy is charging a flat overhead rate of 3% on the requested funds to pay for office expenses, general office staff and other expenses associated with administering the program.

Executive Summary

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

B. EXECUTIVE SUMMARY Title: Big Break and Marsh Creek Water Quality and Habitat Restoration Program Amount Requested:\$2,998,049 (plus a cost share of \$2,346,094)
Applicant:California Coastal Conservancy, Mary Small 1330 Broadway, 11th Floor Oakland, CA 94612-2530 Phone: 510/286-4181 Fax: 510/286-0470 E-mail: msmall@scc.ca.gov Participants and Collaborators: Coastal Conservancy, City of Brentwood, Cal State University at Hayward, Contra Costa Flood Control District, and the Natural Heritage Institute, and several other local entities. Project Location: The project is located in northeast Contra Costa County in the western Delta at Big Break, the Marsh Creek Delta, and in the urbanizing reaches of Marsh Creek. Project Description: This pilot scale project will: 1) restore tidal marsh, floodplain, and Antioch dune habitat on the Delta of Marsh Creek to restore target fish and dune species; 2) restore bio-filtration floodplains along urbanizing reaches of Marsh Creek to protect and improve water quality entering the Delta; 3) monitor aquatic species in Big Break and water quality along Marsh Creek; 4) develop a volunteer driven native plant nursery to generate plant material for restoration; 5) continue a public outreach, education, and citizen planning program in the watershed. Project Significance: The project will restore 30 acres of CALFED priority habitats including tidal marsh, seasonally inundated floodplain, riparian forest, and Antioch dune scrub. With scientific design input from agency scientists, the project applicants have specifically designed the project to benefit numerous target species including splittail, juvenile salmon, delta smelt, black rail, and pond turtle. To protect and improve the quality of water entering the Delta from Marsh Creek, the project applicants will restore approximately 10 acres and 5,000 linear feet of bio-filtration floodplains in the Marsh Creek flood control channel in Brentwood. Both Marsh Creek and Big Break will be heavily monitored to measure the water quality and biological benefits of restoration as well as to increase knowledge regarding water quality and native delta fish. Learning Rich: The tidal marsh restoration component is specially designed to test fish use of wetlands along a gradient from marsh to seasonal floodplain. If implemented this pilot along with a pilot sand dune restoration on the site will provide information to guide future projects such as the Dutch Slough Restoration Project.

Proposal

California State Coastal Conservancy

Big Break and Marsh Creek Water Quality and Habitat Restoration Program

Mary Small, California State Coastal Conservancy

John Elam, City of Brentwood

Nancy Thomas, Contra Costa Resource Conservation District

Chris Kitting, California State University at Hayward

Joy Andrews, California State University at Hayward

Steve Barbata, Delta Science Center

John Cain, Natural Heritage Institute

Big Break and Marsh Creek Water Quality and Habitat Restoration Program Proposal to CALFED

A. Project Description: Project Goals and Scope of Work

1. Problem

Problem Statement. Many endangered fish species targeted for conservation by CALFED congregate in or pass through the western Delta during key life stages. CALFED's restoration implementation plan prioritizes protection and restoration of freshwater tidal marsh, yet there are very few opportunities for restoration of tidal marsh in the western Delta where most target fish species congregate and no significant restoration projects. The Big Break Regional Shoreline, a flooded Delta Island owned by the East Bay Regional Park District, is the third largest tidal marsh in the western Delta (figure 1).

Historical tide-lands along its shore provide some of the best opportunities for tidal marsh restoration in the entire Delta particularly on the Marsh Creek delta. Yet very little is known about the species that utilize Big Break, and there are no specific prescriptions to improve its management for the benefit of CALFED priority species. This proposal seeks funding to monitor and improve water quality and habitat in Big Break and to implement a pilot scale tidal marsh restoration project on the Marsh Creek Delta that will yield valuable information for planning future restoration projects in the Delta.

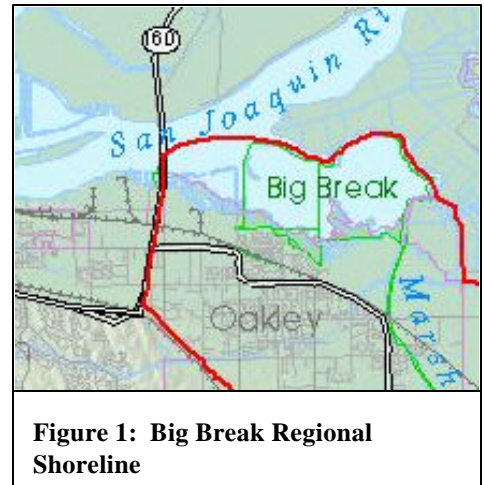


Figure 1: Big Break Regional Shoreline



Figure 2: Comparison of Vegetated and Channelized Portions of Marsh Creek

Even as CALFED works to restore endangered species in the western Delta, the habitats upon which these species depend are threatened by the rapid pace of urbanization, particularly in the 100 square mile Marsh Creek watershed which drains to the western Delta via Big Break. In the early 1960's approximately 10 miles of Marsh Creek and its tributaries were channelized for flood control purposes, converting a sinuous, multi-channelled system with a dense riparian corridor into a single, earthen trapezoidal channel with no riparian vegetation. Today, communities in the watershed are among the fastest growing in all of California (CA Dept. of Finance, 2000) further changing Marsh Creek. If unmitigated, urbanization and other point and non-point impacts will diminish water quality in Marsh Creek and degrade important freshwater tidal marsh and shallow open water habitat in Big Break and the western Delta. Without action, Marsh Creek could become little more than an urban storm drain conveying polluted run-off into the heart of the Delta. This threatens not only existing biological resources in Big

Break and the western Delta, but also the promise of restoration near the mouth of Marsh Creek and along the Big Break shoreline. This project will also restore approximately 5,000 linear feet of bio-filtration floodplains and wetlands along the urbanizing reaches of Marsh Creek to improve riparian habitat and filter out pollutants before they enter the Delta.

Fortunately, there is time and public resolve to protect Marsh Creek and its 100 square mile watershed. As testament to years of groundwork and collaboration by the proposal applicants, nearly every jurisdiction with land or water management jurisdiction in the watershed has joined in or expressed strong support for this proposal (see appendix A) to monitor, protect, and restore the water quality and habitats of Marsh Creek, Big Break and the western Delta. The window of opportunity is here now and is grounded by significant work already accomplished and work now underway. The Cities of Brentwood and Oakley are among the fastest growing cities in the state and major subdivisions are scheduled for construction along several miles of Marsh Creek and its principal tributary in the next 2-3 years (figure 3). The City of Brentwood is receptive to protecting and restoring the creek corridor, but they need planning and design assistance immediately to maintain a sufficiently wide corridor and restore some semblance of a natural channel. In order to demonstrate the potential of restoration and to galvanize local support for wetland and creek restoration before it is too late, we must act immediately to expand our existing watershed science and community based restoration plan to mobilize all of the municipalities in the watershed and to implement the low-conflict, high priority restoration

actions described in this proposal.

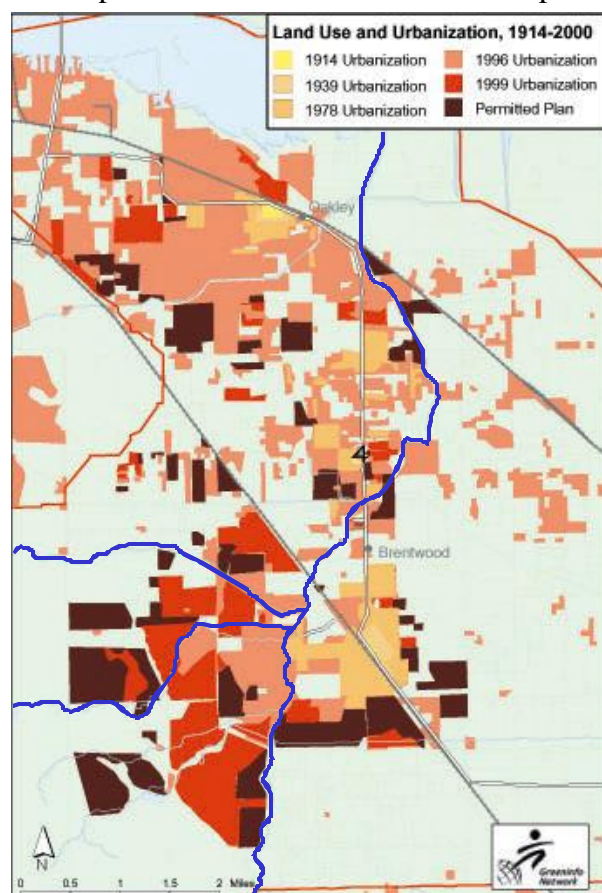


Figure 3: Urbanization in Marsh Creek Watershed

Project Location. Project activity is located in Big Break and the Marsh Creek watershed. Marsh Creek drains a 100 square mile watershed on the back-side of Mt. Diablo and flows through Brentwood and Oakley before entering into Big Break. Big Break is located immediately north of the City of Oakley. Both are located in northeastern Contra Costa within CALFED’s “Delta and Eastside Tributaries” region in the central and western Delta ecozone. The tidal marsh and shallow open water areas of Big Break are owned and managed by the East Bay Regional Park District, a collaborator on this project.

Project Description. Thanks to initial funding from the Coastal Conservancy, the San Francisco Foundation, the Switzer Foundation, the Contra Costa Resource Conservation District, and CALFED; the Delta Science Center and NHI have already developed community supported restoration and monitoring programs for Marsh Creek and the Big Break shoreline. This proposal seeks funds to advance those programs and facilitate the newly initiated Marsh Creek Coordinated

Resource Management Planning process. Specifically, this proposal seeks funding to implement six integrated programs throughout the watershed depicted in (figure 4) and discussed below:

1. Restoration of 29 acres of tidal marsh and flood plain to provide spawning and rearing habitat for native endangered fish and 1 acre of dune scrub on the Marsh Creek delta (figures 5 and 6).
2. Restoration of approximately 5,000 linear feet of flood control channel in the City of Brentwood to create a two-staged channel with bio-filtration floodplains and wetlands along Marsh Creek to improve water quality entering the lower restoration site and Big Break (figure 7);
3. and the mouth of Marsh Creek to identify the distribution and abundance of native and invasive species in Big Break and the physical conditions they utilize as well as to measure the efficacy of marsh restoration.
4. Water quality monitoring along Marsh Creek to identify the type, source, and magnitude of pollutants and measure the effectiveness of pilot restoration treatments.
5. Development of a locally based, volunteer driven native plant nursery to propagate plants for use in creek restoration.
6. Continue and expand a public outreach, education, and public planning program to educate citizens about ecological processes and to further develop a long-term and locally supported watershed stewardship CRMP.

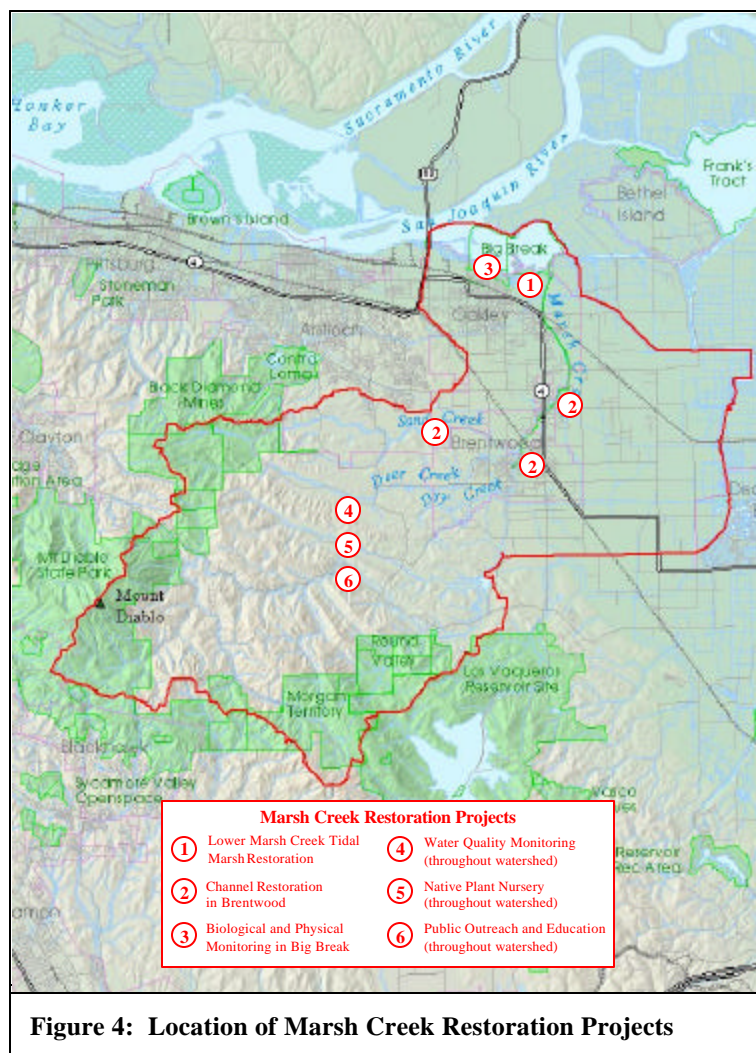
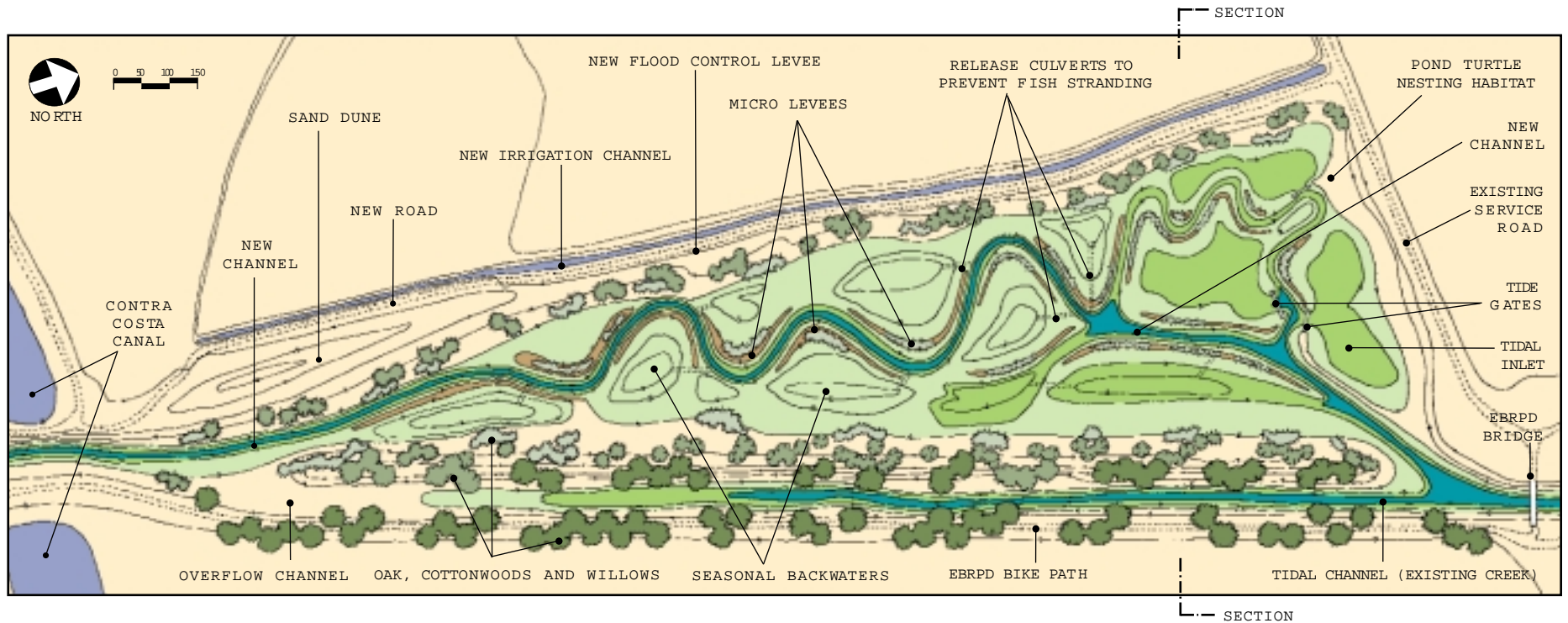
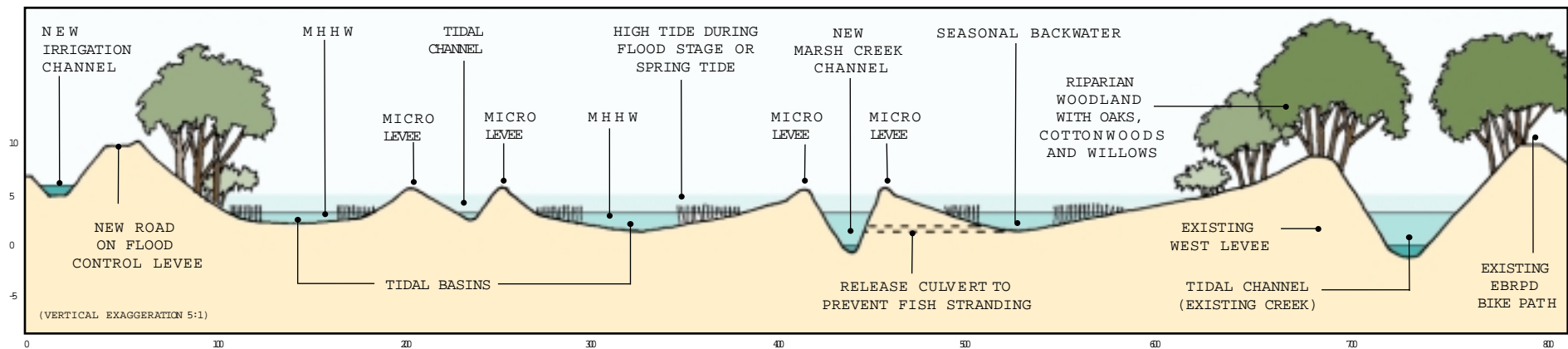


Figure 4: Location of Marsh Creek Restoration Projects

FIGURE 5: MARSH CREEK DELTA RESTORATION PLAN

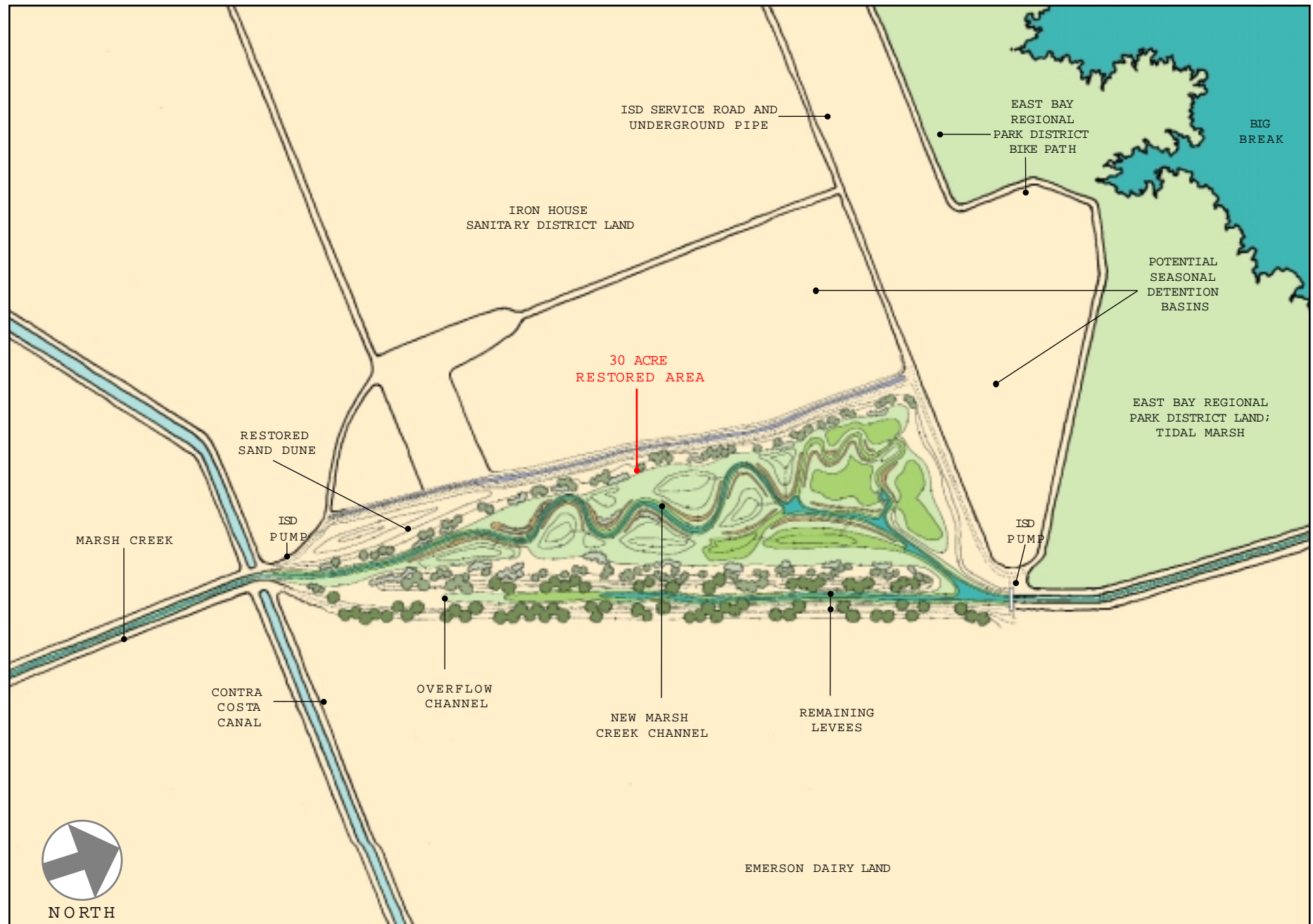


PLAN VIEW



SECTION

FIGURE 6: PROPOSED RESTORATION AT MARSH CREEK DELTA SITE



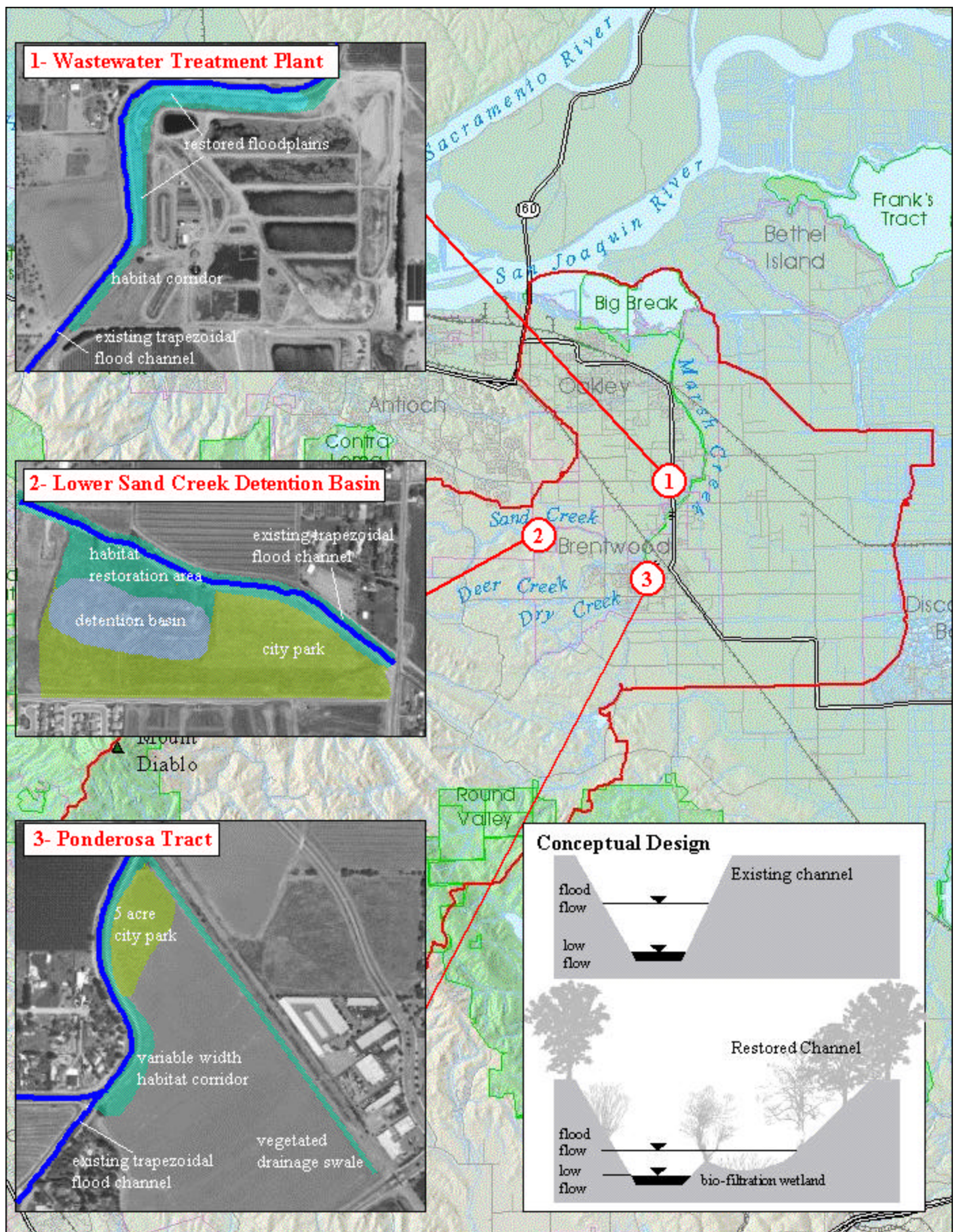


Figure 7: Marsh Creek Channel Restoration Sites

Project Goals and Objectives: This project goals and objectives are:

Goal 1: Restore 29 acres of freshwater tidal marsh, seasonal floodplain, and riparian habitat, as well as one acre of sand dune habitat on the Marsh Creek delta to protect and restore populations of Sacramento splittail, juvenile salmon, Delta smelt, and other aquatic, avian, and endangered dune species. We have already developed a detailed grading and vegetation plan (Figure 5 and appendix B) for the site that includes the following objectives:

- Design the project to explicitly test hypotheses so that project monitoring results will be useful for guiding other management and restoration programs.
- Create inundated habitat 1-4 feet deep for at least 30 days between February 1 and May 15 every 1-2 years for spawning and rearing by splittail and Delta smelt and rearing by salmonids; maintain at least some of the inundated habitat at a depth of 3 feet or more to prevent predation of fish by wading birds; provide escape routes to avoid stranding of native fish; drain or dewater periodically to reduce numbers of exotic fish.
- If possible, concentrate salts slightly (5-10 ppm) in backwater areas to favor native species such as western pond turtle and red-legged frogs; control exotic species such as egeria densa, bullfrog, and cyprinidae.
- Create south facing slope of less than 25% in silty-clay to clay soils to provide nesting habitat for western pond turtles.
- Restore approximately one acre of dune habitat for Antioch dune plant and animal species including legless lizards to test efficacy of dune restoration techniques.
- Create nesting and foraging habitat for black rail, tricolored black bird, and yellow breasted chat; perching habitat for Swainsons hawk.

Goal 2: Protect and improve water quality in Marsh Creek through remediation and wetland restoration along the upstream, urbanizing reaches of Marsh Creek to improve conditions for target species in Big Break, Dutch Slough and the western Delta.

- Restore approximately 5,000 linear feet of the existing Marsh Creek flood control channel in the City of Brentwood to bio-filtration floodplains and wetlands to improve the quality of water flowing into Big Break and the Delta.
- Create bio-filtration wetlands and swales at the termini of major storm-drain outfalls in the City of Brentwood.

Goal 3: Increase knowledge regarding physical conditions and species use of Big Break shallow water and marsh habitat to develop strategies for both restoring target species and controlling non-native exotic species.

- Determine native and non-native plant and fish species abundance, and distribution in Big Break.
- Measure native and non-native fish habitat and macroinvertebrate preference and use of both shallow open-water and intertidal marsh habitats in Big Break.
- Measure the efficacy of proposed tidal marsh and floodplain restoration project on the Marsh Creek delta.
- Quantify the concentration or level of various water and sediment quality parameters in Big Break including: pH, DO, temperature, conductivity, salinity, alkalinity, total and dissolved metals, anions, Dissolved Organic Carbon, Selenium speciation by IC, and Pesticides by GC/MS.

Goal 4: Increase knowledge regarding the type, source, and toxicity of water quality constituents flowing into Big Break and the Western Delta from Marsh Creek.

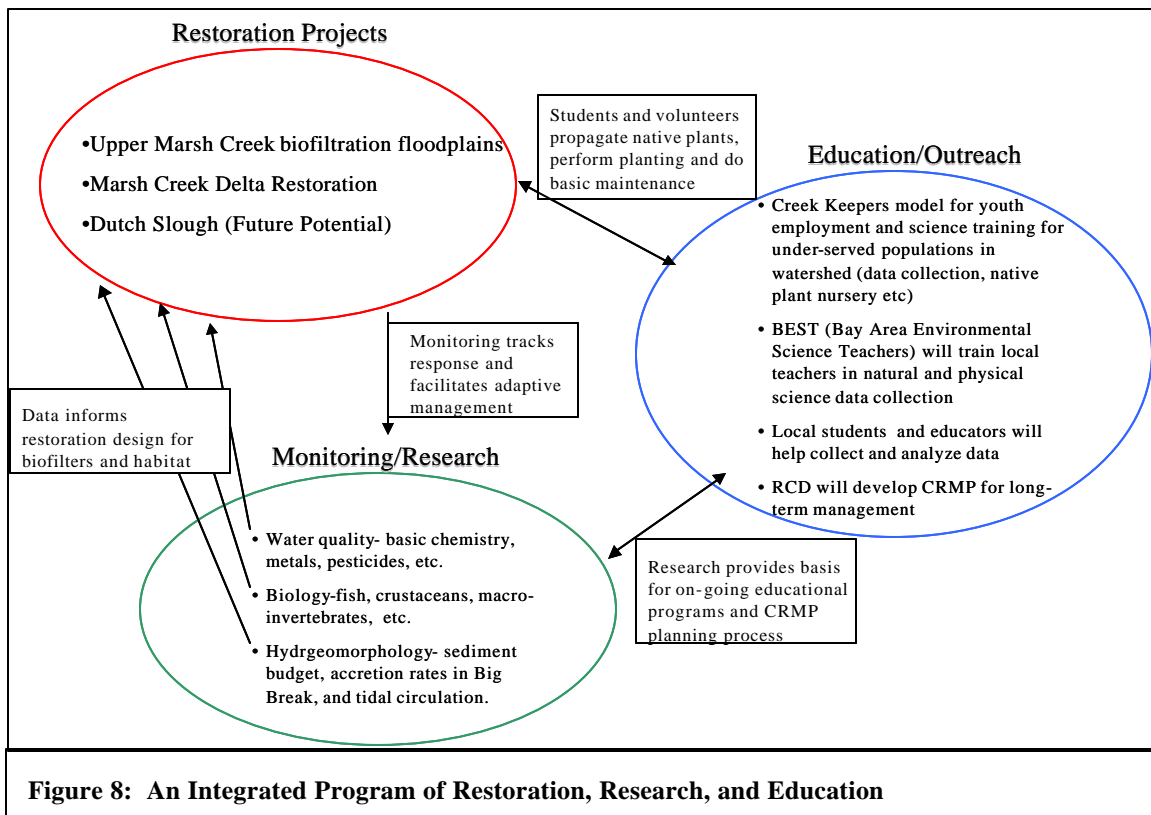
- Quantify the concentration or level of various water quality parameters in Marsh Creek, including: pH, DO, temperature, conductivity, salinity, alkalinity, total and dissolved metals, anions, Dissolved Organic Carbon, Selenium speciation by IC, and Pesticides by GC/MS.
- Identify point and non-point sources of pollutants.
- Measure the efficacy of the channel restoration and remediation actions described in Goal 2.
- Test and demonstrate a new potential water quality performance measure utilizing innovative enzyme bio-marker techniques to identify biological stressors that may not be evident from traditional water quality sampling techniques.

Goal 5: Develop a locally supported watershed and shoreline stewardship program through a multi-tiered outreach and educational initiative that involves schools and municipalities in water quality and biological monitoring as well as planning, implementation and maintenance of restoration programs. Objectives include:

- Fund and facilitate a Coordinated Resource Management Planning (CRMP) program for the Marsh Creek Watershed that will provide residents the opportunity to plan their own future for Marsh Creek.
- Engage university, community college, and high school students in water quality monitoring programs.
- Engage residents and students in a native plant propagation program at local schools to provide genetically appropriate plant material for future restoration projects along Marsh creek.

2. Justification

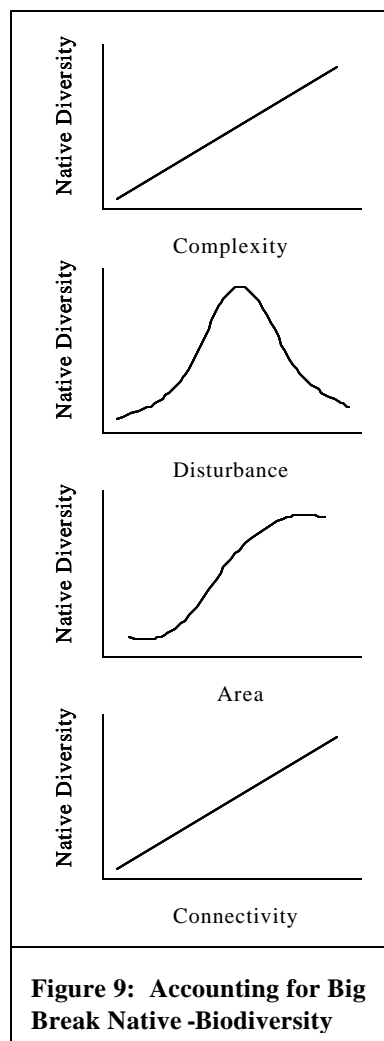
Conceptual Model. This proposal is premised upon three interlinked but distinct conceptual models. The first model addresses the importance of an educated and supportive local constituency for restoration and outlines a public outreach approach that integrates restoration, research, and education. The second model describes the hydrologic, geomorphic, and biologic conditions and processes that create aquatic habitats for CALFED target species. The third model assumes that poor water quality degrades habitat for target species and that urbanization and its attendant changes in hydrologic and biogeochemical cycles will further degrade water quality. This second model then describes a set of actions to remediate water quality problems and improve riparian habitat by modifying urban, watershed hydrology and floodplain geomorphology.



Model 1: Successful ecological restoration and conservation is generally an expensive, scientifically complex, and oftentimes controversial endeavor that requires strong public support. As controversies over several recent CALFED proposals demonstrate, restoration cannot proceed effectively without local support. The project applicants believe that the best way to build local support is to involve local people in the planning, implementation and monitoring of restoration projects. Figure 8 depicts our vision of an integrated restoration, research, and monitoring program that builds local participation into all facets of the program. This integrated program will include outreach and collaboration with local municipalities, facilitation of a recently initiated Coordinated Resource Management Program under the auspices of the Contra Costa Resource Conservation District, hands-on learning programs with the local schools, scientifically supervised water quality monitoring by high school and college students, and volunteer programs to get residents and students involved in restoration plantings. Although we are hopeful that citizen monitoring and restoration work will save CALFED money, their primary purpose is for education. To insure quality control, University scientists will collect most data and volunteer work will be carefully supervised and reviewed.

Model 2: Our second conceptual model regarding hydrologic and geomorphic conditions for aquatic species is that, provided sufficient area and connectivity to other habitat areas, physical habitat complexity combined with natural disturbance regimes, yields the highest native biodiversity and may impede the progress of non-native invasive species. Big Break and adjacent Little Break encompass over 2,000 acres of varying shallow water and tidal marsh habitats and have good connectivity to important habitat areas such as Suisun Marsh, Sherman Lake and the San Joaquin and Sacramento Rivers. Big Break is also exposed to a number of disturbance events along the Big Break shoreline, including cycles of inundation, pulses of water and

sediment, changes in salinity and water temperature, wind and wave action, fire (historically), and introductions of exotic species.¹ We hypothesize that the area, connectivity, complexity and disturbance regime of Big Break and the Marsh Creek delta are the primary reasons for its biological richness and that restoration actions to restore more natural disturbance regimes, habitat area, complexity, and connectivity will result in even greater biodiversity. Due to its shallow depth, Big Break has not been well studied to date, but the few studies and surveys that sampled areas within Big Break and the Marsh Creek delta, suggest that the area provides important habitat for numerous CALFED target species including Sacramento splittail, Chinook salmon, and Delta smelt. A comprehensive survey of splittail determined that Big Break is one of only three locations where adult splittail congregate in large numbers (Meng and Moyle, 1995; R. Baxter DFG, 2000). Juvenile salmon were recently collected in lower Marsh Creek during two consecutive years, indicating that salmon either spawn in Marsh Creek or that juvenile salmon migrate from the Delta to rear in lower Marsh Creek (Slotton, 1998). Reliable sources have observed adult salmon congregating behind the first major drop structure in the Marsh Creek flood control channel, approximately two miles upstream of Big Break (D. Bright, pers com, 2001; M. Painter, pers com, 2001). Unpublished surveys by Hanson (pers. com., 2000) and DFG surveys (R. Baxter, 2000) indicate that late juvenile Delta smelt use Big Break and confirm the presence of adult splittail and juvenile salmon. Hanson independently attributed Big Break's species diversity – over 35 fish taxa identified during 1997 surveys between Big Break and Antioch – to its unique habitat complexity (pers com.2000). The area also provides habitat or restoration potential for numerous other aquatic and terrestrial species prioritized by CALFED. Qualified biologists have recorded over 150 bird species including several CALFED and CVPIA priority targets. A recent survey of lower Marsh Creek by DWR biologists confirmed a western pond turtle population of approximately 15-20 individuals. Park District scientists believe the area supports giant garter snakes and have discussed the suitability of Big Break's habitat with USFWS experts who agree (S. Bobzien, pers com 2001). Finally, Delhi sands and bush lupines on the lower Marsh Creek restoration site demonstrate potential for restoring Antioch Dune scrub on the site.



Habitat complexity provides a range of structures that support different species during different life cycles while intermediate disturbance events trigger successional processes or serve biological functions that native species have evolved to utilize. For example, splittail evolved to utilize floodplain surfaces for spawning; thus, floodplain inundation is important for splittail spawning. The process of flooding dry land, moreover, is a disturbance event that creates an opportunity for fecund species to colonize without the limits imposed by competition and predation in a more static environment. Similarly, the process of

¹ Large or unnatural disturbance regimes such as catastrophic floods, filling of wetlands, or introductions of exotic species can reduce native biodiversity at least temporarily and are not desired.

evaporation and floodplain drainage serves the function of disrupting the establishment of an exotic, predator population that would limit native fish recruitment if the floodplain remained wet throughout the year. The Big Break shoreline and our restoration site on the delta of Marsh Creek encompass physically diverse soils and topography that are subjected to disturbance regimes. We hypothesize that this creates, and will create in the course of proposed restoration, a broad range of physical habitat types or ecological gradients providing a wide diversity of niches favored or required by different species at different life stages.

This conceptual model is supported generically in the ecological literature on complexity and intermediate disturbance hypothesis (Connell, 1978). It is also supported in estuarine environments, including the Delta, by recent studies from the Yolo Bypass (Sommer et al 2001), Delta marshes (Grimaldo et al 1998), and other estuaries (Healey 1991). Research suggests that seasonally inundated floodplains and intertidal marshes provide important habitat for the rearing and spawning life stages of native aquatic species including Sacramento splittail, juvenile salmon, Delta smelt, and giant garter snake (Chotkowski 1999, Junk et al. 1989). Furthermore, these and other studies (Bayley 1991) indicate that a range of elevation gradients within a wetland site, as well as disturbance regimes associated with sediment input and other fluvial processes, result in greater biodiversity and utilization by native aquatic species. The present lack of these types of habitats and processes for early life stages of endangered fish may be a major reason for the decline of these populations (Bennett and Moyle 1996).

Before the area and complexity of habitats, as well as the range of disturbance events, were reduced by the channelization of Marsh Creek and the conversion of tidal and seasonal marsh and dune habitat into pasture, the diversity and abundance of species along the Big Break shoreline was probably much higher. We hypothesize that this creates an opportunity to restore a range of physical habitat types and ecological gradients for a wide diversity of niches favored or required by different species at different life stages. Specifically, this proposal seeks to restore 29 acres of tidal marsh and floodplain on the delta of Marsh Creek designed to address the limited rearing and spawning life stages of native fish. The presence of target species, historic tidelands and sand dunes on the site provides a unique opportunity to restore a mosaic of target habitats along a range of ecological gradients. The proximity of the restored site to the western Delta where many endangered species congregate both increases the likelihood that the habitat will be colonized by target species and exposes it to a broader range of disturbance from varying salinity regimes and tidal fluctuation that may limit exotic species.

Model 3: Numerous studies suggest that polluted runoff from Marsh Creek and high concentrations of pollutants in Big Break would be harmful to endangered fish and lead to the long-term degradation of aquatic habitat in both Big Break and Marsh Creek (Pillard, 1996; Maguad et al., 1997; Hinton, 1998; Wenning et al, 1999; Fisher et al., 2000). Slotton (1998) described the aquatic insect fauna of lower Marsh Creek as “highly impoverished” and speculated that its poor water quality was associated with agricultural drainage. Because of the closed configuration of Big Break, poor water quality entering

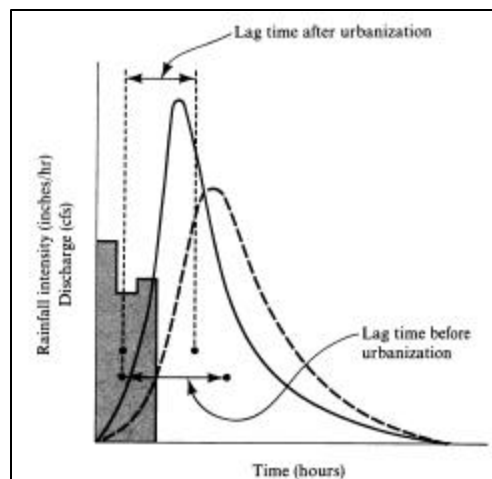


Figure 10: The effect of urbanization on runoff dynamics. The peak is exaggerated and the lag-time is decreased (from Leopold, 1978).

from Big Break may have a relatively long residence time and thus greater biological impacts on the species utilizing Big Break (J. Bureau, pers com, 2002).

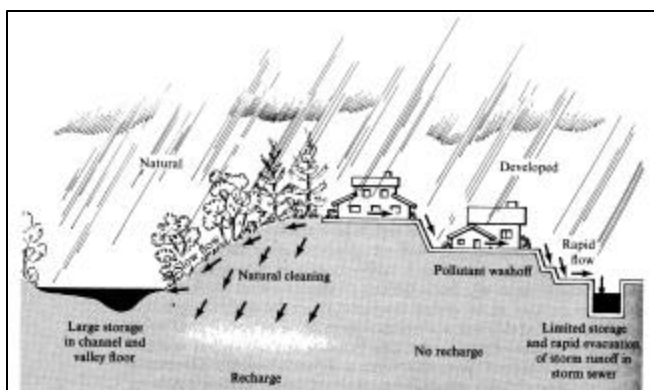


Figure 11. This illustration depicts the basic assumptions regarding the relationship between urbanization and hydrology inherent in the conceptual model for this proposal (from Dunne and Leopold 1978).

The channelization of Marsh Creek and increases in the area of impervious surfaces and the density of the storm drain network will increase flood peaks and decrease base flows (figures 10 and 11) (Dunne and Leopold, 1978). Research indicates that these hydrologic alterations will facilitate the transport of pollutants such as methyl mercury, pesticides, metals, dioxins, and n-nitroso compounds during high run-off periods and reduce dilution of pollutants during low flow periods (US EPA, 1992; and Skinner et al 1999). All of these chemicals have been linked to developmental toxicity in aquatic biota (Marsh, 1993; Schiff and Stevenson, 1996). Under natural conditions, wetland

vegetation along Marsh Creek would have filtered pollutants from the watershed, but today legitimate flood control management practices intentionally denude riparian vegetation to accelerate conveyance of floodwaters and thus facilitate the transport of pollutants to Big Break. Marsh Creek is already too small to sufficiently convey floodwaters, and thus further urbanization will only exacerbate flooding and storm water pollution problems and increase conflicts between flood control and habitat restoration unless remedial action is taken.

To improve water quality without exacerbating flood control efforts, this proposal seeks funding to regrade the existing trapezoidal channel into a two-staged channel to create bio-filtration floodplains and wetland along the channel (figure 12) and at large storm drain outfalls. Utilization of wetland retention basins and a two-staged channel design are well tested techniques for reducing flood damage, improving instream habitat, restoring flood plain habitat, decreasing bank and bed erosion, and filtering and buffering toxins and pollutants (McArthur 1989; Mitsch and Gosselink, 1993). The Contra Costa Flood Control District is encouraging these techniques in the County, particularly in new developments adjacent to the Delta. Research indicates that toxicity levels in reconstructed wetlands are not likely to be problematic if the wetlands are designed to specifically address local contamination issues (Rochfort et al. 1997; Zayed et al. 1998; Keller et al. 1998; McArthur

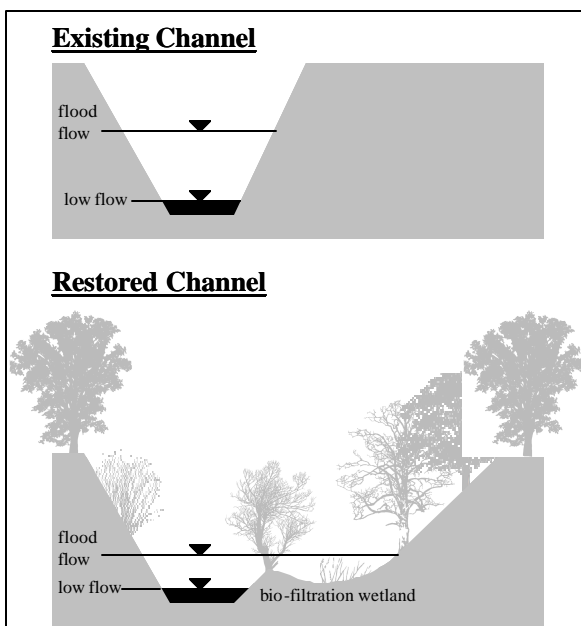


Figure 12: Restoration of trapezoidal flood control channel into a two-stage stream channel with bio-filtration wetlands for water quality improvement.

1989). Nevertheless, all newly reconstructed floodplains will be monitored regularly to ensure that we are not creating toxic habitat. If successful, these cumulative efforts would restore a healthy aquatic resource and an essential biotic corridor between the Diablo Range and the Delta.

Project Hypotheses. Multiple hypotheses are discussed below under the heading of seven overarching project hypotheses.

Hypothesis 1: Restoration of 29 acres of freshwater tidal marsh and low floodplains along lower Marsh Creek will create habitat for Sacramento splittail, Delta smelt, juvenile salmon and other target species as well as provide valuable information regarding tidal marsh processes and restoration.

Along its historic Delta, lower Marsh Creek is currently confined by a trapezoidal flood control channel devoid of riparian vegetation (figure 13 and figure 14). Based on extensive surveys of site topography, avian and herptofauna, wetlands, and historical geomorphic analysis, project partners² developed a detailed restoration design and grading plan that entails moving the creek out of the existing channel and relocating it into a more natural channel that meanders through 30 acres of floodplain and marsh (figure 5 and appendix B). Based on criteria provided by several knowledgeable biologists, ecologists, and geomorphologists, project applicants have designed the project to encompass a gradient from



Figure 13: Marsh Creek Delta Restoration Site

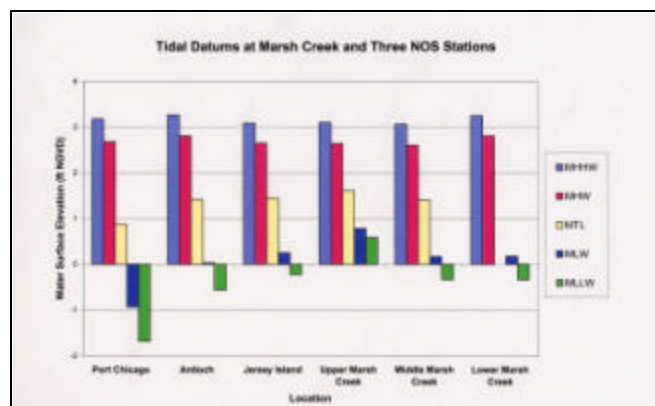
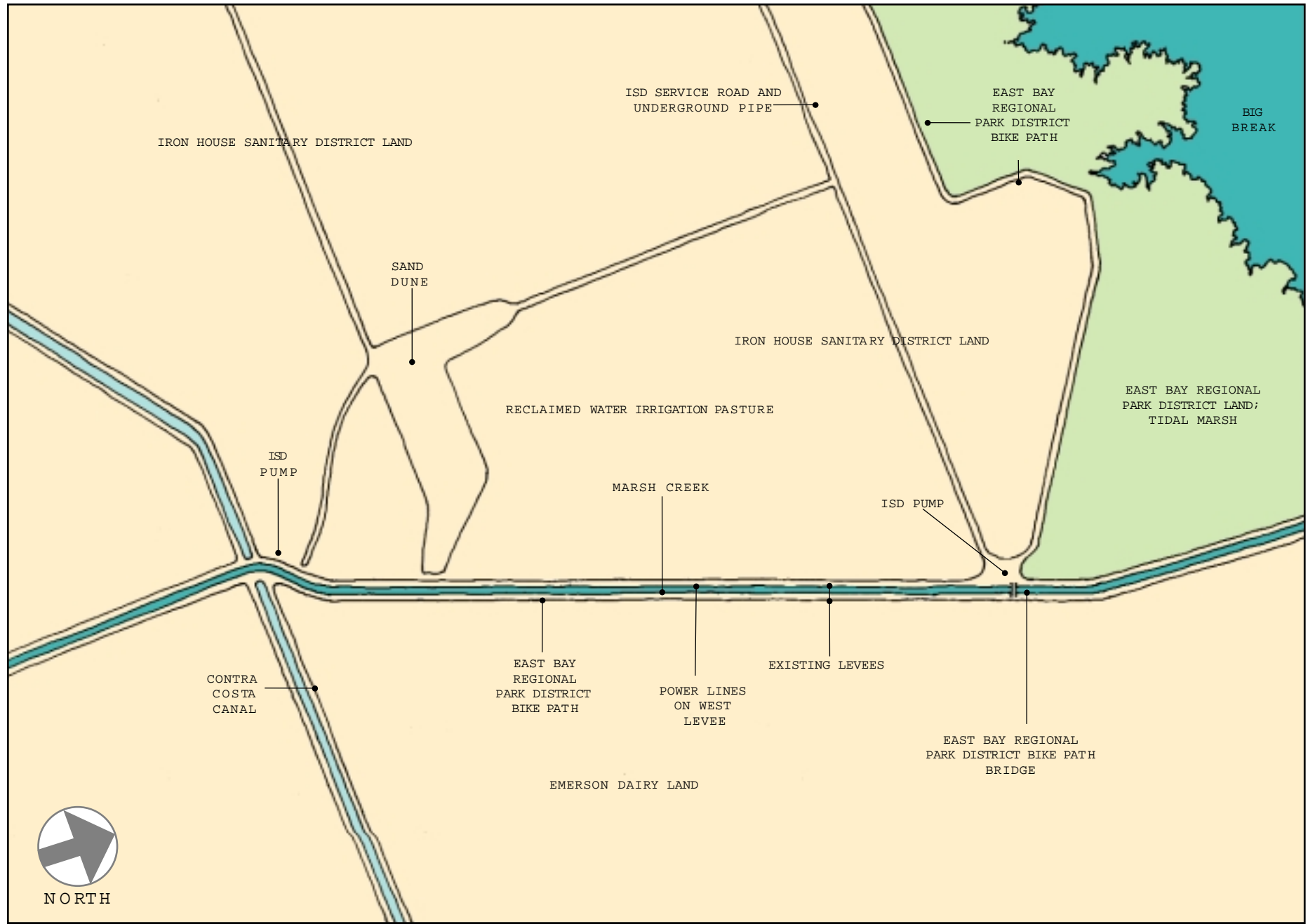


Figure 15: Tidal Reckoning Plots

moderately high marsh to low floodplain. The grading plan was informed by data from three tidal gauging stations in Marsh Creek that we have continuously operated since June 2000 (figure 15). To maximize adaptive management learning opportunities, the design includes a number of replicate backwater wetlands that could be managed somewhat independently to test hypotheses about the interrelationship between restoration objectives and elevation, hydrodynamics, vegetative structure, salinity, temperature, avian predation, fish stranding, and other factors.

² Scientists and engineers John Cain of NHI, Roger Leventhal of Farwest Engineering and Stewart Sigel developed the restoration design with input from a highly respected panel of Delta fish biologists.

FIGURE 14: EXISTING CONDITIONS AT MARSH CREEK DELTA RESTORATION SITE



Project partners hypothesize that the project will provide good habitat for several species of native fish based on previous studies that indicate that periodically inundated habitat and inter-tidal marsh provide excellent habitat for the rearing and spawning of native fishes (Chotkowski 1999, Junk et al. 1989). These areas appear to provide good habitat for native fish because: 1) native fish have evolved to spawn in seasonally inundated areas; 2) seasonally inundated areas do not harbor populations of exotic, nesting predator fish that prey on native juveniles; and 3) the periodicity, temperature, nutrient supply, and depth of seasonally inundated habitats trigger rapid colonization of macro invertebrates that native fish feed upon. We also hypothesize that proximity of the site to the western Delta where adult splittail and smelt congregate will increase the likelihood that these species will colonize and use the site.

The project site is ideally suited for monitoring species use of the floodplain in order to test the hypotheses described above. Measuring fish utilization of floodplains and tidal marshes is generally extremely difficult because of difficulties accessing the habitat during flood stage and because fish, water, and nutrients normally enter and exit at multiple points. However, at the Marsh Creek site, all water and fish enter and exit at only two points, allowing scientists to more easily measure all species entering and leaving the floodplain zone. This physical configuration is similar to the one that has proved successful for monitoring efforts at the Yolo Bypass. Scientists from Cal State University of Hayward will employ innovative, but tested, shallow-water monitoring techniques to measure species utilization of the site.

Based on research from the Yolo Bypass (Sommer et al. 2001), project partners hypothesize that spawning splittail require, and rearing salmon, benefit from 30 days of inundated habitat between February 12 and May 15.³ To avoid predation by wading birds, at least some of the inundated area should be greater than 2.5 – 3 feet deep or protected by dense vegetative cover. One uncertainty is the manner in which native fish such as splittail utilize marsh and floodplains with tidally fluctuating water levels and whether these dynamic environments can provide the same spawning and rearing benefits of less fluctuating non-tidal inundation zones. While studies from the Yolo Bypass measured the benefits of non-tidal floodplains, this project will provide an opportunity to measure spawning and rearing on high marsh and tidally influenced floodplain. Modeling analysis discussed in the splittail white paper (Sommer 2000) hypothesizes that these types of tidal wetlands provide spawning habitat to maintain a base population of splittail and thus would prevent extinction in the event of a long drought exceeding the life span of splittail.

The fishery benefits of seasonally inundated habitat will vary by species. Project partners expect splittail to benefit the most from such inundation relative to diurnally fluctuating environments. Juvenile salmon, which have been sampled in Marsh Creek (Slotten, 1998), are also expected to benefit, but it is not clear whether stable water levels during the spring months provide appreciably better habitat than tidally fluctuating marsh habitats. Project partners are less certain about benefits for Delta smelt but hope to create an opportunity for observing Delta smelt spawning in the wild. Delta smelt seem to prefer sand substrates (L. Grimaldo, pers com) and spawn during the lower low of spring tides with larvae emerging on the neap tides (Bennett, et al, 2000; L. Brown, pers com 2001). This early life history seems to require sub-tidal emergent

³ Splittail may enter the restoration site at lower Marsh Creek earlier than they enter the Yolo Bypass, because the restoration site is so much closer to the western Delta where adult splittail congregate (T. Sommer pers com 2001).

marsh, a habitat that is more hospitable to exotic, nesting predator fish than intertidal and floodplain environments. This project will create inundated habitat with sandy substrate that will remain wet on the lower low, late January “spring” tide and subsequent spring months with low tech tide gates, but not during the rest of the year, increasing the chances of creating smelt spawning and rearing habitat in a relatively predator-free environment.

The major design challenge was to maintain habitat inundated at 2-3 feet for extended periods of time, given the fact that tides cause water levels to fluctuate on the order of 3 feet daily. Implicit in the design is the hypothesis that historically, topographic depressions or poorly drained backwaters on the marsh plain flooded on high tides and during winter floods and then continued to hold water during low tides. It is likely that native fish were concentrated in these backwater areas for spawning and rearing during low tides, then able to exit the marsh during high tides. Project partners have attempted to recreate this process in our design for the 30 acre Marsh Creek site by utilizing micro levee features (1.5 –2 feet above the marsh plain) along the channel and “backwater swamp” areas on the floodplain to achieve the design objective of creating inundated habitat 1-4 feet deep for at least 30 days between February 1 and May 15 every 1-2 years. Figure 16 shows the sequence of tidal hydrology and inundation on various tides from lower low tide to the maximum annual stage which will occur in any given year either on spring tide (January or July), during high flow and stage periods in the Delta during the spring months, or during winter flood events on Marsh Creek. High tides and stage in the Delta during January “spring” tides at new and full moons will combine with high delta inflow and floods on Marsh Creek to inundate the floodplains. During the subsequent low tide, the backwater swamp areas will remain inundated at a depth of 2-3 feet for fish habitat even as the tide levels drop below the elevation of the floodplain. Fish will exit the backwaters on high tide and, if necessary, each backwater will be equipped with a culvert and plug gate for drainage in the mid-late spring to prevent fish stranding or the establishment of permanent ponds that harbor exotic species.

One key uncertainty is the potential for rapid sedimentation of the restored site. Project partners have designed the grading plan based on natural analogues specifically known to reduce the potential for sedimentation build-up. Coast Range streams are known for high sediment loads, and Marsh Creek flows through large areas of highly mobile relict dune sands. Project partners have compared historical and existing cross sections of lower Marsh Creek and determined that the channel has not aggraded over the last four decades, but waves of sand at the mouth of the creek evident from aerial photographs and in the field indicate that Marsh Creek conveys a significant amount of sand through its existing trapezoidal channel. Our proposal to restore the floodplain, however, will also reduce sheer stress and potentially result in increased sediment deposition on the site. To avoid such sedimentation, we have designed micro levees (1.5 – 2 feet above the marsh plain) to route the majority of the bed load (sand) through the restoration site and into Big Break. The micro levees are based on those observed at the delta of Wildcat Creek in Alameda County (Collins, pers. com., 2001) site and the levees (at a larger scale) that funneled the Sacramento River into the Delta marsh prior to European settlement (Bay Institute, 1998). If our design attempts to limit sedimentation fail, however, the project will still provide valuable fish habitat for at least several years and will create an opportunity to study the habitat value of a dynamically aggrading tidal marsh environment.

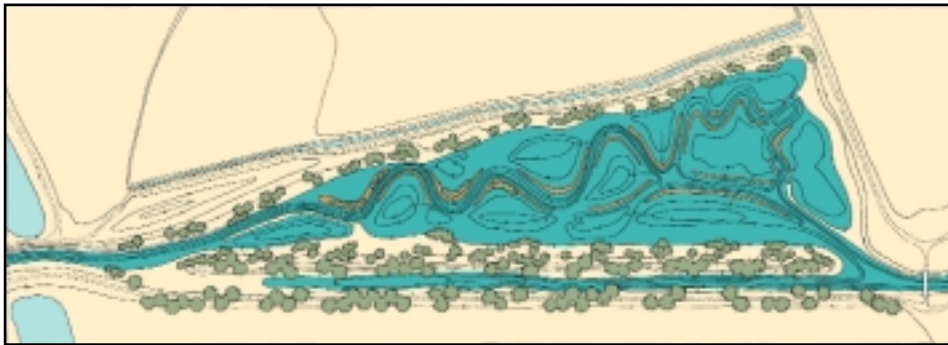
Another uncertainty is the potential for invasion of the project site by exotic plant and animal species. Project partners are hopeful that frequent changes in water level (wetting and drying daily or seasonally) will keep most invasive fish species from colonizing the site. The number

FIGURE 16: Hydrologic Patterns on Marsk Creek Delta Restoration Site



MEAN LOWER LOW WATER

Tidal marsh inundated daily by mean higher high tide all year.



HIGH TIDE DURING FLOOD STAGE OR SPRING TIDE

Floodplain and marsh completely inundated at high stage every 1-2 years.



LOW TIDE DURING FLOOD STAGE OR SPRING TIDE

Locked flap gates maintain inundated floodplain on low tide from February to May as desired.



MEAN HIGHER HIGH WATER

Marsh and floodplain drain completely on lower low tide from June to November.

and spatial-temporal distribution of exotic fish will be documented through the biological monitoring plan. Exotic plant species, particularly broad-leaf pepper-grass (*Lepidium latifolium*), are possibly a greater threat. Pepper-grass is adapted to sites in riparian and wetland areas that are at least seasonally moist and is highly adaptable to saline soils such as those found on the Marsh Creek site. However, pepper-grass is vulnerable to prolonged inundation during its growing season. Careful grading and full tidal and seasonal inundation of the restoration site are likely to minimize or limit the area of pepper-grass colonization. A detailed vegetative study of a nearby site showed that, while pepper-grass thrived in the margins of muted tidal slough at elevations up to 2 feet above the mean higher high water, it was non-existent in the fully tidal slough less than 100 feet away. The lack of pepper-grass on adjacent parcels also reduces the prospects for its colonization of the restoration site.

Hypothesis 2: It is possible to restore new patches of functioning Antioch Dune plant and insect species on outcrops of Delhi sand that have been cleared for agricultural uses over the last century.

A community of unique dune species once thrived on the Pleistocene relict dunes that extend from Antioch across the lower Marsh Creek watershed. These species are now highly endangered, confined to a relict patch at the Antioch Dunes National Wildlife Refuge, and identified by CALFED and USFWS as restoration priorities. Sand dune features, degraded by past agricultural practices, are found all along the publicly owned Big Break Regional Shoreline, offering special opportunities for long-term dune restoration. If dune restoration is possible, over 30 acres of dune habitat could be restored as part of the Dutch Slough Restoration project (see Dutch Slough proposal).

The site proposed for tidal marsh and wetland restoration described in this proposal includes a large patch of Delhi sand suitable for dune restoration. As part of the restoration project, project partners propose restoring approximately one acre of dune scrub plant community on a pilot scale to gather information for a larger scale restoration efforts on the neighboring Dutch Slough site. The first challenge will be to restore a stand of native dune vegetation. Competition from weeds has plagued management of the Antioch Dune reserve and could greatly complicate successful restoration. We will attempt to control weeds through intensive volunteer weed control and, if possible, fire. If the project has success with establishing plant species, project partners will then consider including activities to facilitate insect colonization as part of a future proposal.

Hypothesis 3: The intertidal marshes along the Big Break shoreline provide important habitat for native fish such as Sacramento splittail, Delta smelt, and Chinook salmon during at least one stage of their life histories, while the shallow open water areas of Big Break are more favorable to exotic species.

As in many deltas, the San Joaquin Delta has lost many of its major creeks, hypothetically so important to many estuarine fishes. As discussed in Section A.1, previous studies indicate that Big Break provides important habitat for numerous native aquatic species. However, there have been very few sampling efforts in Big Break and thus our knowledge of the site is very limited.⁴

⁴ DFG and other state fish monitoring efforts have avoided sampling in Big Break because its shallow waters and abundant vegetation make monitoring difficult and time consuming (K. Hieb, pers com with Dr. Kitting). Dr. Kitting and Dr. McGuinness at Cal State Hayward University have perfected shallow water sampling techniques in

The major uncertainties associated with fauna distribution in Big Break relate to which species utilize Big Break and their preferred habitats. If Big Break is truly important to native fish, we need to develop a better stewardship program to protect and improve habitat conditions that benefit native species. If Big Break is not important for native species, we will want to learn why and shape future CALFED restoration efforts accordingly.

This monitoring effort will yield broadly applicable results that will be both necessary to test the efficacy of restoration projects along the Big Break shoreline as well as gather useful information on native and non-native invasive species distribution and habitat preference in a unique wetland environment located on the edge of the ecological gradient between freshwater and brackish marsh.⁵ In Big Break and at the restoration site on the Marsh Creek Delta, will test the hypothesis that intertidal marsh provides important spawning and rearing habitat for native species while shallow open water areas are more conducive to non-native invasive species which crowd out native species.

Monitoring fish, particularly in shallow open water, is expensive, so it is highly desirable to prioritize monitoring efforts that will obtain information for multiple purposes. This monitoring program will serve the multiple purposes of: 1) testing the efficacy of the lower Marsh Creek tidal marsh restoration project described below; 2) collect species abundance and distribution information in a large marsh that has rarely been sampled; 3) generate information regarding the types of physical conditions favored by native and non-native species; 4) provide recommendations for management prescriptions in a large marsh that has rarely been sampled; and 5) collect baseline data for the neighboring 1200 acre Dutch Slough tidal marsh restoration project (described in another proposal).

Rapid urbanization, and agricultural run-off combined with the current channelized condition of Marsh Creek have degraded water quality in Marsh Creek and Big Break.

There is ample evidence that agricultural, urban, and mining pollutants harm aquatic organisms. Many of the practices which generate these pollutants are prevalent in the Marsh Creek watershed. Although there is strong evidence that Marsh Creek water quality is severely degraded by pollution (Slotton, 1997), there is great uncertainty regarding the source and type of pollutants in the watershed. This proposal will implement a water quality monitoring program to identify the sources and types of pollutants, and their fate and transport. Several of the project collaborators have initiated a preliminary water quality monitoring project following RWQCB protocol, providing for monthly sampling at 5 sites along lower Marsh to identify the spatial and temporal dimensions of various parameters including dissolved oxygen (DO), pH, temperature, conductivity, TDS, pesticides, nitrates, phosphates; and ion chromatography for metals, cations, and anions. Information derived from these data will be used to develop a more sophisticated 3 year study design for implementation if CALFED accepts this proposal. Information from the initial on-going water quality survey also will be used to identify sources of pollutants where possible and to identify remediation priorities.

the Suisun Marsh (Huh and Kitting 1985 and Kitting 1994) that will be employed in Big Break if this proposal is funded.

⁵ Today Big Break is primarily a freshwater tidal marsh, but x¹ moves into or east of Big Break in over one third of the years and historically Big Break was probably more brackish at least during late summer months as evidenced by the alkali soils and remnant patches of pickle weed.

Information on the levels and factors affecting the transformation and speciation of selenium and mercury is especially important at this site because of its location downstream from a former mercury mining facility and proximity to local petroleum processing plants. Speciation of selenium and mercury has drastic effects on their toxicity and bioavailability (Kadlec et al., 1995). Parameters affecting mercury and selenium transformation include pH, chloride and sulfate levels, and redox environment expressed as pE (Cossa et al., 1994). The redox environment can be determined by the ratio of Fe(III)/Fe(II), nitrogen speciation (nitrate/ nitrite/ ammonia), and selenium speciation (selenate/selenite). (All of these ratios can be determined with ion chromatography). Selenium is present in several chemical forms in the environment, including water-soluble selenate and selenite, which are the most toxic to aquatic organisms. Bacteria can convert the toxic selenate and selenite, and reduce soluble selenium into the other forms which are volatile and easily removed from the local environment. Previous studies in our laboratory (Regnier et al., 1991) indicated that selenium can disrupt the nitrogen cycle by inhibiting the conversion of nitrite to nitrate by *Nitrobacter* spp. This break in the normal cycle allows nitrite, which is highly toxic in low levels to aquatic organisms, to accumulate in the environment. Studies on our laboratory, using the environmentally prevalent organism *Aeromonas*, indicated that this organism was able to convert water-soluble selenium into the elemental form (Dixon et al., 2001). We plan to continue looking at speciation changes produced by *Aeromonas* using isolates collected from Marsh Creek. Additionally we plan to look at anaerobic transformation of selenate and selenite to reduced selenium by anaerobic bacteria from Marsh Creek sediments. In a constructed wetland on San Francisco Bay, microbes on plant roots were able to reduce selenium concentrations from 20-30 ppb to 5 ppb, due to volatilization (Hansen et al., 1998). Thus, the role of selenium-volatilizing microorganisms is important in long-term remediation of sediments contaminated with selenium. We plan to monitor the chemistry of the bacterial transformations using X-Ray Absorption Spectroscopy at Stanford Synchrotron Radiation Laboratories (we already have a grant to use these facilities). These studies will provide valuable information relevant to many sites in the Delta.

As shown in other studies (Weston et al., 2000), pollutants can reduce the diversity of the natural bacterial flora. When a pollutant is present in the environment, those bacteria that are not sensitive to it or that can utilize it as a nutrient source are selected, increasing their numbers. Bacterial diversity can act as a biomarker, signaling the presence of a contaminant if diversity decreases. Therefore we propose to monitor bacterial diversity in water and sediment samples from Marsh Creek. Bacterial diversity will be correlated with chemical analysis of these samples.

Total mercury levels will also be monitored in sediment, plants and non-endangered fish species to determine whether bioavailability and biomagnification change during the restoration process. Other metals such as copper, cadmium and zinc are known to be immunosuppressive in fish, and will be monitored as well. Pesticides present at this site due to nearby farming will be monitored as well.

We will employ innovative enzyme bio-marker techniques (Munkittrick et al., 1993; Stegeman, 1993) to identify biological stressors that may not be evident from traditional water quality sampling techniques. Fish produce enzymes called mixed function oxidases (MFO) such as cytochrome P450. These enzymes transform compounds such as insoluble pesticides into forms that can be excreted. We plan to monitor levels of cytochrome P450 in fish liver microsomes, as a potential biomarker of environmental stress. We will monitor pollutant levels and MFO levels

over time and different conditions to determine possible correlation. Identification of MFOs as biomarkers could prove very useful in monitoring the environmental health of aquatic areas, and thus serve as an excellent performance measure for water quality remediation programs. The water quality monitoring program will be especially designed to test the efficacy of bio-filtration wetlands proposed as part of this project and discussed below under hypothesis #4.

Hypothesis 5: Restoration of floodplains and wetlands along Marsh Creek and at the termini of storm drain outfalls will improve the quality of water entering Big Break through the process of biofiltration and create new riparian habitat.

The fourth element of this project is a channel restoration and storm water management program to create storm water detention wetlands and restore floodplains that will filter pollutants, provide habitat, and reduce flood stage, velocity, and erosion. Project partners hypothesize that rerouting urban and agricultural storm water into restored wetlands will foster bio-filtration of non-point source pollutants (Mitsch and Gosselink 1993; Scholes et al. 1998; Scholes et al. 1999). Research indicates that toxicity levels in reconstructed wetlands are not likely to be problematic if the wetlands are designed to specifically address local contamination issues (Rochfort et al. 1997; Zayed et al. 1998; Keller et al. 1998; McArthur 1989). Nevertheless, all newly reconstructed floodplains will be monitored regularly to ensure that rerouting water is not creating toxic habitat. If successful, these cumulative efforts would restore a healthy aquatic resource and an essential biotic corridor between the Diablo Range and the Delta.

Under funding from the Coastal Conservancy, project partners have already begun the conceptual design of 3-5 acres of bio-filtration wetlands and 10-12 acres of floodplain, wetlands and riparian forest along Marsh Creek (Figure 7). This proposal to CALFED solicits funds to implement these projects at three locations downstream of major storm water outfalls along Marsh Creek in the City of Brentwood. These demonstration projects will convert approximately 5,000 feet of earthen trapezoidal channel into a two-staged channel to simultaneously improve water quality, habitat, and flood conveyance. We expect that these demonstration projects will be the catalyst for many similar projects along Marsh Creek. Over the long-term, the partners to this proposal will work together to create miles of naturalized channel and many more acres of bio-filtration wetlands where major agricultural and urban drains discharge into the creek. Finally, when we have more information about the sources of pollution, we will work with landowners and local municipalities to reduce and remediate pollution at various sources.

The water quality monitoring program discussed above will be designed and conducted to determine whether restoration, including bio-filtration wetlands, affects water quality parameters important for drinking water quality, fish viability and suitability of fish for human consumption. Fish growth and fecundity are closely linked to dissolved oxygen (DO) levels. Factors affecting DO such as temperature, salinity, presence of nutrient anions (nitrate, phosphate) and dissolved organic carbon will also be measured. Samples will be collected at the restoration site as well as sites upstream and downstream from the restoration site. Baseline values will be taken before, during and after restoration. Monitoring goals will be integrated with attention to previous work on mercury levels in the Marsh Creek Watershed (Slotton reports, SFEI reports).

Hypothesis 6: Riparian, wetland, grassland, and dune vegetation in the Marsh Creek watershed are genetically unique due to their proximity to Mt. Diablo and their location at the ecotone

between the Coastal and Central Valley bioregions. A nursery and plant propagation program that draws on local, volunteer expertise to propagate native phenotypes will preserve this genetic stock, reduce the costs of restoration plantings, and generate a pride of ownership necessary to help ensure that restoration projects succeed over the long-term.

Mt. Diablo's elevation above the surrounding countryside creates a unique island biological province that harbors unique species, and possibly genotypes, from previous climatic regimes (Mt. Diablo Interpretive Society, 2000). The Antioch dune community is even more unique (Pavlik 1997). Upstream of Brentwood, Marsh Creek supports an impressive and diverse stand of riparian species including mature valley oak, cottonwood, sycamore, box elder, Oregon ash, and California walnut. Until recently, Oakley and Brentwood were exclusively agricultural communities specializing in orchard, vineyard, and nursery crops for over 150 years. This program will draw on that local expertise, a compensated expert advisory panel, and local volunteers to propagate native plants for restoration planting. We will recruit and compensate "at risk" youth from local schools to help implement the program. Details on the program are described in the approach section.

The hypothesis above consists of three parts: genetics, cost, and public pride – all of which will be difficult to test. We will focus on testing the cost hypothesis by maintaining careful nursery records on volunteer and paid labor, expenses, nursery production, and survival to determine whether a student and volunteer nursery can cost effectively generate plant stock for restoration planting, and if not, why. To gather information that might disprove our public pride hypothesis, we will keep track of the students and residents exposed to the nursery program, measure whether they attend other restoration programs, and send them and a control population an annual questionnaire regarding the nursery and restoration program. We will not directly attempt to test the genetics hypothesis but we will maintain detailed records regarding the source of local plant stock, native soil conditions, its physical attributes, and survival rates in the nursery or restoration planting to enhance the educational benefits and to develop knowledge that may help us identify more specific and testable botanical hypotheses.

Hypothesis 7: Education and outreach programs that engage students and residents in data collection, watershed planning, and restoration implementation will create a long-term constituency for enlightened watershed stewardship, improve the success of restoration, and reduce incidents of vandalism on restoration and research parcels.

Education and outreach are the foundation upon which this entire proposal is built. The partners to this proposal believe that conservation and restoration projects that fail to actively generate local involvement are far more likely to meet resistance and delay from local jurisdictions and permitting agencies. Furthermore, management and restoration projects that don't include extensive local involvement miss an incredible "hands on" opportunity to educate students and residents about general scientific principles and the factors that shape natural environments. This proposal is joined or supported by nearly every municipality and jurisdiction in the watershed. The project will engage local students in the collection and analysis of water quality and biological data to: 1) improve the monitoring program; and 2) help educate students in the scientific method, with the hope of encouraging future involvement and/or careers in conservation and resource management. Project partners will form a special advisory committee made up of faculty and staff at Cal State Hayward, Los Medanos College, the SWRCB, and the Delta Science Center to design the student monitoring programs. We will work with

academically accomplished students and educators from local high schools, Los Medanos College and Cal State Hayward (Main Campus and Contra Costa Campus) will implement most of the monitoring. Special protocols such as multiple samples and replicate analysis, fully described in Section A.3. of this proposal, will insure quality control.

This proposal also requests funding to facilitate the continuation of a Coordinated Research and Management Plan (CRMP) by the Contra Costa Resource Conservation District, which has already convened a public watershed-planning group and initiated a consensus-based planning process. The CRMP process has started through a California Department of Conservation grant but is underfunded and needs additional funding to further finance and support the development of a completed watershed management plan. Because CRMP is a consensus-driven model, the end result will have broad citizen support. Through the CRMP process, local residents and other interested parties will help to shape and refine the restoration elements of this proposal.

Project Type: While relatively large areas will be restored for water quality, flood control, and biological functions, this is a pilot/demonstration project. The restoration projects are linked to biological and water quality monitoring programs that will increase understanding of the role of tidal habitats and wetlands for fish and water quality. The lower Marsh Creek project will yield particularly useful information for planning the adjacent 1200-acre Dutch Slough site that is the subject of another proposal. Our simultaneous monitoring of both reference and restoration marshes will enable a continuous fine-tuning and resolution of uncertainties, limiting factors, and bottlenecks in restored marshes. Testing changes in restoration design based on our adaptive management practices will support or modify our hypotheses about improved habitat for larval and juvenile native threatened species (Delta smelt, splittail), and about other CALFED ERP goals.

3. Approach

Study Design. This proposal is based on the premise that a coordinated program of restoration, research, education, and local decision-making is essential to creating a watershed management program that is successful in the long-term. The proposal includes several distinct components that various parties throughout the watershed could have pursued independently. However, for the purposes of ensuring local support, coordinating activities throughout the watershed, and expediting progress on remedial actions, the project partners decided it best to join together in one collaborative effort. The interdependence of the three critical components of this project – monitoring/research, ecological restoration, and education/outreach – is diagramed above in figure 8. A decision by the CALFED Program to fund only some components of this project could greatly undermine our ability to marshal local support and comprehensive action across the watershed.

Big Break Biological and Physical Monitoring: To achieve Goal 3 in section A.1 of this proposal, we will emphasize an integrated, multi-disciplinary physical and biological data collection effort within different habitat types in Big Break and at the mouth of Marsh Creek. We will release the monitoring plan and provide funding for peer review by experts recommended by CALFED science staff or the CALFED science consortium and revise it accordingly before we commence fieldwork.

The monitoring study is designed to collect pre-restoration baseline data, compare differences between shallow open water and tidal marsh habitats, replicate samples from like habitats, and measure the benefits of restoration actions. The monitoring program will collect replicate samples from a total of six sites: two open water sites in Big Break, two marsh sites along the Big Break shoreline, the Marsh Creek channel, and the lower Marsh Creek restoration site. We will contrast data from the open water, marsh, and creek sites to determine differences in physical and chemical conditions and species utilization. We will contrast the restoration site to reference sites in Big Break to identify colonization source populations, compare species utilization, and measure differences in physical parameters. Monitoring design for the marsh restoration site at the mouth of Marsh Creek is discussed below under that element

We will monitor seasonally, and monthly during early spring months for CALFED priority fishes; particularly Delta smelt, splittail, Chinook salmon (all runs), steelhead, green and white sturgeon, and possibly their food resources (zooplankton and zoobenthos) as well as non-native invasive species. Occasional specimens will be preserved for reference/voucher specimens. Physical factors that will be monitored at each site include: approximate wind and water current; water depth; clarity (secchi depth); and basic surface and bottom water parameters (with probes and recorders, seasonally for continuous ~3-wk records) of temperature, depth, salinity/conductivity, pore water salinity/conductivity (subsurface, if different), redox environment, and O₂ content. Sediment accumulation or net erosion in sediment traps (or with sediment “pins”) will also be assessed seasonally, and analyses of large fishes (in fyke nets) and plant densities (in permanent quadrats) seasonally or annually.

Approximately monthly, “crayfish” traps and “minnow” traps will be used for sampling larger, less abundant epibenthos and nekton, such as large crustacea (including crabs and crayfish) and certain fishes. Other information, logged approximately monthly (see basic data table in appendix), includes site identification, date/time/tide, physical factors (below), and replicated plant and animal abundances with quadrats, 1-m³ plankton tows, thrown cages (benthos), and fish live traps. Similarly, epibenthic sampling, including algal and animal densities, is performed in replicate 0.05-m² thrown cage samplers after Weinstein pers. comm. and Huh and Kitting (1985). Our sampling protocol, schedule, and logistics are designed to minimize ecological impacts to each site.⁶

Quality assurance and control procedures include careful standardization of methods and confirmed species identification, performed by photography and experienced principal investigators and their personally trained and supervised assistants. Each senior staff will continue to collect and analyze data first-hand at least throughout the first year of sampling.

Biological data will be tabulated with at least four replicates per sampling date, per site. Each team member will record his/her data on standardized data tables, and entered into standardized computer data tables. Sampling will be seasonally, and monthly or more frequently during key periods if conditions dictate (e.g., presence of species of concern, problems with low DO, abrupt microbiological changes). Orders of magnitude differences among data sets at sites will be statistically distinguishable using sets of four replicates. Significant qualitative observations will

⁶ Muddy equipment will be washed (and misted with bleach or alcohol) to minimize any transfer among sites of aquatic animal pathogens present in marsh mud. Care will be taken to prevent risks from factors such as nets extending above water to air-breathing animals whose presence in each area will be tabulated qualitatively.

be noted and communicated to others of the team for confirmation as required. Consistency among teammates and senior scientists will be achieved by sampling together >~8 replicate samples per site (>~40 samples), or more, until observations are consistent. As each season or year of data is obtained, graphic and (often non-parametric) statistical analyses of data, as appropriate, will be conducted.

Marsh Creek Water Quality Monitoring:

This proposal will implement a water quality-monitoring program to identify the sources and types of pollutants, and their fate and transport. Several of the project collaborators have initiated a preliminary water quality monitoring project following RWQCB protocol, providing for monthly sampling at 5 sites along lower Marsh Creek to identify the spatial and temporal dimensions of various parameters, including dissolved oxygen (DO), pH, temperature, conductivity, TDS, pesticides, nitrates, phosphates; and ion chromatography for metals, cations, and anions. Information derived from these data will be used to develop a more sophisticated 3-year study design for implementation if CALFED accepts this proposal.

A summary of parameters to be measured includes:

In the field: pH, DO, temperature, conductivity, salinity, alkalinity

In the laboratory:

- Total and dissolved Hg, Se, Cu, Cd and Zn in water, and total Hg in sediment, plants and fish by AA (Hg by CVAA, Se and Cu by GFAA, Zn by flame AA)
- Anions: fluoride, chloride, ammonia nitrogen, nitrite, nitrate, phosphate and sulfate by ion chromatography (IC) or spectrophotometry
- Dissolved metals Fe(II), Fe(III), Mn(II), Cu(II), Ni(II), Zn(II), Co(II), Cd(II), by IC
- Dissolved Organic Carbon
- Selenium speciation by IC
- Pesticides by GC/MS
- Cytochrome P450 can be monitored in fish liver microsomes

Sample collection procedure protocols and quality control measures will be followed to ensure lack of contamination and accurate results. Sample containers will be acid washed, and all acid preservation and digestion will be done with trace metal grade acid. Field blank and trip blanks will be taken into the field, and duplicate samples will be taken. Digestion blanks, duplicates (1 per 10 samples) and spikes (1 per 10 samples) and standardized NIST samples will be included to ensure proper sample digestion. Analytical calibration ($R^2 > .995$) and blanks, spikes and replicates of each measurement will ensure proper analysis.

Lower Marsh Creek Tidal Marsh and Floodplain Restoration

Restoration of the lower Marsh Creek site will be challenging because it is both a tidal and a fluvial system. To reduce the need for a massive planting program and to allow vegetation to become established and stabilize the site, the project will be implemented in two steps. After site grading, the project will be opened to tidal action. After two seasons of vegetative growth, the levee on the upstream end of the site will be breached to allow the creek to flow through the site.

Major grading is the largest expense and construction activity for this project, but overall costs are relatively low due to the fact that there are not land acquisition costs. Twenty-three acres of land have been generously offered by the Ironhouse Sanitary District and the remaining seven have been offered by the Contra Costa Flood District. We estimate that we will need to grade

125,000 cubic yards and move 85,000 cubic yards off site to create elevations suitable for marsh establishment. Fortunately, we don't have to move material more than 100 yards from the site because both the Ironhouse Sanitary District and the other neighboring landowner, Emerson Dairy, can easily use the material on their lands. If the neighboring Dutch Slough Restoration proposal is also approved, the fill material will greatly enhance restoration at that site.

The restoration project at the mouth of Marsh Creek is specifically designed to facilitate monitoring and research. All estuarine species must enter and exit from one site. Fyke nets will be placed at the entrance of the restoration site and marsh reference sampling sites quarterly, and monthly during the spring spawning and rearing season, to measure colonization of the restored marsh and out migration and make comparisons to the reference sites. Additionally, the design includes twelve rearing and spawning backwaters ranging in size from 0.5 to 1.5 acres that are designed to flood at different stages for experimental purposes. Approximately 1/3 of the backwaters will be graded to elevations for inter-tidal marsh and outfitted with simple plug gates to hold water on low tides during the spawning season. Another 1/3 of the ponds will be graded to flood at tide levels between MHHW (3.2 feet) and the spring tide (4.2 feet). The remaining 1/3 will be graded to flood on the spring tide or during flood events on Marsh Creek or in the Delta. A total of two replicates will be taken from backwaters in each elevation zone within the 30-acre site to compare species utilization in different elevation zones.

To test the efficacy and need of restoration planting, as well as to reduce the cost of expensive restoration plantings, we will only plant half of the site, to measure native and non-native vegetation colonization rates. We have budgeted an ample vegetation management budget combined with a volunteer program to control non-native invasive vegetation if it becomes a problem on the unplanted sites. We will grade and inundate the site to minimize pepper-grass on the hypothesis that pepper grass does not thrive where it is inundated during the growing season (Fredrickson, et al, 1999) or where it is elevated above the water table in sandy soil. By grading a relatively steep slope from the frequently inundated zone to the upland riparian area, we hypothesize that we will create a relatively narrow zone that is susceptible to pepper grass invasion that we will manage by densely planting it with woody riparian species and mechanically removing pepper-grass before it goes to seed.

Upper Marsh Creek Water Quality Remediation and Channel Restoration

We will restore bio-filtration floodplains and wetlands at three separate sites on Marsh Creek and its principal tributary, Sand Creek. All three sites are located at the termini of major storm water drains. Urbanization is imminent immediately adjacent to all sites. The Sand Creek site will be integrated with an adjacent flood control district detention basin/ball field to create flood plain, wetland and riparian habitat along approximately 1,500 – 2,000 feet of channel. Another floodplain restoration project will be constructed immediately below the confluence of Marsh and Sand Creeks in conjunction with a City of Brentwood Park. The third floodplain project will be constructed adjacent to the Brentwood Tertiary sewage treatment facility and will filter discharge from the outfall that is currently permitted for release into the creek as well as water from a major urban storm drain along Sellers avenue.

At all three sites the project proponents will reconstruct the trapezoidal channel into a two-staged channel (figures 7 and 12). Often times, grading and right-away costs make this type of channel restoration prohibitively expensive on urban creeks. Fortunately, the right-away costs will not be a problem because the Contra Costa Flood Control District already holds fee title to a 100-foot

wide corridor along the creek, and the City of Brentwood requires future developments along the creek to establish a buffer strip for City parks which will further increase the width of the corridor. Grading costs will be limited, because the majority of grading will be completed at the direction of the City of Brentwood by developers who seek fill material for nearby subdivisions. If we don't receive CALFED funding, imminent urbanization will preclude any restoration at these sites in the future. Project applicants will contract with private firms for fine grading, landscape and engineering design, and project implementation. A large portion of the plant material and labor will be provided by the volunteer driven native plant nursery program under the supervision of experienced professionals.

Native Plant Nursery

This proposal seeks funding for a student and volunteer restoration nursery program to propagate native riparian, grassland, wetland, and dune species for use in restoration plantings.

We will recruit and compensate underprivileged and at risk youth to participate in the program. We are exceptionally fortunate to be joined in this proposal by Delta Informal Gardens (DIG), one of the most active civic organizations in northeast Contra Costa County, and Creek Keepers, a west county group that has successfully managed a student-implemented restoration nursery program in Richmond. With technical guidance from these groups and an expert advisory panel consisting of Bruce Pavlich, Jon Volmar, Ron Lutsko, and others this project will design and implement a nursery program in greenhouse space managed by DIG. This proposal seeks funds to hire a coordinator, retain technical consultation and acquire basic supplies necessary to maintain a successful student and volunteer run nursery program.

Public Outreach and Education

The public outreach and education components of the project involve several initiatives to educate local citizens and build a locally supported restoration program. All the restoration projects are located on a heavily used regional trail that connects the Cities of Antioch and Brentwood and thus are ideally suited for public involvement. With significant cost share provided by applicants, these initiatives will facilitate the Delta Science Center to organize volunteer student and resident participation in monitoring and restoration implementation, train local teachers in science and monitoring curricula, and coordinate planning and implementation with local officials.

The Contra Costa Resource Conservation District will oversee the Marsh Creek Watershed Planning group which is currently developing a CRMP – an essential step toward developing a long-term watershed management program supported by local citizens and major landowners, particularly in the upper watershed. Nancy Thomas, the coordinator of the Marsh Creek Watershed Group is funded through June 2002, and if granted, this proposal will provide cost share funds to complete the CRMP and initiate additional watershed scale initiatives.

The Delta Science Center will organize volunteer students and residents to implement restoration and monitoring programs. Students, faculty and staff from local high schools, Los Medanos College and Cal State Hayward (Main Campus and Contra Costa Campus) will be involved in monitoring efforts. Dr. Chris Kitting and Dr. Joy Andrews will be coordinating the Cal State-Los Medanos College monitoring effort out of laboratory facilities at the Contra Costa Campus. Local college students will be trained and employed in data collection and analysis. Moreover, Cal State will be offering several related courses at the Contra Costa County Campus to integrate hands-on science with existing curricula. Teachers and students at Liberty Union High School in

Brentwood and Freedom High School in Oakley will implement a complimentary monitoring program. Basic water quality data will be collected in real-time and analyzed by students. We will utilize State Water Resources Control monitoring protocols. Biological monitoring will be designed to compliment existing protocols. High school student and educators will be responsible for regular monitoring in Marsh and Sand Creeks, while Cal State-Los Medanos monitoring will be focused on Big Break. In addition, the Bay Area Environmental Science Teachers (BEST) has offered to run training sessions for local educators interested in integrating creek monitoring into their curricula.

The final component of the education/outreach plan is the development of an integrated program to train and employ under-served youth as watershed stewards. We propose to use a model based on the Creek Keepers Program in Richmond. The mission of the Creek Keepers Program includes the following: 1) support the development of a multicultural environmental leadership; 2) raise awareness of urban youth to environmental quality within their neighborhood; 3) educate about the causes and sources of pollution; 4) empower students to take actions to improve the environmental quality and public health of their community; and 5) provide employment and job training to youth.

With collaboration from students in Richmond involved in the Creek Keepers Program, local educators, and members of the Delta Informal Gardeners (DIG), we envision training local youths as environmental scientists. We propose building a pilot project that would include training students in plant identification, seed collection, propagation techniques and planting. This pilot project will provide local source riparian plants for various restoration initiatives as well as provide skilled paid labor for planting and maintenance. This program would offer under-served youth an opportunity to learn a variety of skills, bring home a paycheck and play an active role in learning about and restoring their local watershed.

4. Feasibility

Landowner Permission: All project work and data collection will be conducted on public lands owned by the East Bay Regional Park District, the Ironhouse Sanitary District, the Contra Costa Flood Control District or the City of Brentwood. All of these public entities are supporters or collaborators on this project (see attached letters of support).

Permits: The project applicants must obtain several permits to complete restoration components of the project. All necessary monitoring permits have already been obtained. On the lower Marsh Creek restoration site, we have already completed intensive biological surveys and a wetland delineation, and did not identify any wetlands or special status species that would be adversely effected in the first stage of the project which entails restoring tidal action to the site. Less than one acre of wetland in the existing marsh creek flood control channel will be filled in exchange for approximately 28 acres of new, higher quality wetland in the second stage of the project. When the creek is routed though the restored wetland we will need to obtain 404 and 401 permits. We have contacted the permitting agencies and staff, but have not yet begun the formal permitting process. The channel restoration along the flood control channel in City limits of Brentwood will require a stream alteration agreement (1601) and may require a 401 and 404 permit as well, but impacts to existing and degraded creek side wetland vegetation will be minimal and non-controversial.

Schedule: We plan to complete construction of the lower Marsh Creek site in the fall of 2002. Detailed topographic and biological surveys as well as a detailed grading design have already been completed and publicly vetted. If CALFED awards funding, the Coastal Conservancy will fund final planning, permitting, and construction drawings in early 2002 to maintain project momentum during the CALFED contracting period. We plan to complete construction of the 3 upstream channel restoration sites in the summer of 2002. We are currently developing grading and planting plans for the sites that will be completed in January 2002 with funding from the Coastal Conservancy. The Coastal Conservancy will begin the environmental review process in January 2002.

Constraints: The Coastal Conservancy, NHI, DSC, and Ironhouse Sanitary District still need to resolve legal matters regarding how the marsh creek delta restoration site will be managed consistent with the districts' primary responsibility of treating sewage. We anticipate working out these issues in the near future (see attached letter).

5. Performance Measures

Goal #1, Marsh Creek Delta restoration:

- Habitat area; acres; 29 of marsh, floodplain, and riparian as well as 1 acre of dune habitat; project team has already collected baseline data for topography, tidal hydrology, wetland, and wildlife.

Goal #2, Channel restoration upper Marsh Creek;

- area and length of floodplain wetlands and grassy swales; linear feet and acres; 5,000 linear feet and 10 acres; we just recently collected baseline geomorphology, hydrology, vegetation and wildlife data.
- Water quality improvements; key parameters described in approach section, tissue concentration of mercury and selenium in fish, diversity of macroinvertebrates; safe levels has specified by EPA, macroinvertebrate biological richness indexes; currently collecting baseline data and Slotton developed bioassay baseline in mid nineties.

Goal #3, Biological and Physical Monitoring in Big Break

- Habitat and species base-line information; measure species presence, distribution, abundance, and habitat preference; existing base line limited
- Restoration efficacy information; measure species presence, distribution, abundance at restoration site.

Goal #4, Water Quality Monitoring in Big Brea

- Water quality information; location, source, and concentration of key parameters;
- Measure biological stressors; called mixed function oxidases (MFO) such as cytochrome P450; target unknown; no baseline – new technique.

Goal #5, Public Outreach, Education, and planning

- Number of volunteers in restoration planting and monitoring programs.
- Attendance at public meetings.

6. Data Handling and Storage

Water quality data will be logged directly into our standardized, initialed data tables in Microsoft Excel or Data will be posted on CSUH website if requested and funded in accordance with specifications of the CALFED Science Consortium. A very limited number of fish specimens will be kept for identification verification.

7. Expected Products/Outcomes

Project partners will submit quarterly reports or annual reports as required, in a scientific paper format, to local officials and CALFED throughout the project. Drafts of major reports will be available in advance to collaborators for their comments. Key milestones and deliverables for various components are:

- Marsh Creek delta restoration site: final construction drawings; monitoring plan; permits; implementation; final implementation; annual monitoring reports.
- Upper Marsh Creek restoration sites: preliminary design; permits; construction drawings and planting plans; monitoring plan; implementation.
- Big Break and Water Quality Monitoring: detailed study designs; implementation; annual reports; peer reviewed articles.
- Native plant nursery: develop detailed implementation plan, hire coordinator, begin propagation in greenhouse space; plant at restoration sites; survival report.
- Public Outreach: monthly CRMP meetings, student and resident training for monitoring, Coordinated Resource Management Plan.

8. Work Schedule

Assuming CALFED makes a final funding decision by March 2002, the project applicants will use early cost share dollars from the Coastal Conservancy to finalize permits and begin construction of the lower Marsh Creek tidal marsh and flood plain restoration by the fall of 2002. The project applicants have already begun planning and design on the upper Marsh Creek restoration projects and will finalize designs in the late fall of 2002, commence grading in the spring of 2003, and finalize the first round of plantings in the fall of that year. With early Coastal Conservancy funding, the applicants will start operations of the native plant nursery in the summer of 2002 to provide plant stock for both the 2002 and 2003 plantings. Public outreach, education, and monitoring will commence at the start of the project and continue for 3 years.

The project tasks are largely inseparable, and thus the overall project would be greatly limited if the project was only partially funded. Before cutting tasks, CALFED should carefully consider cost share implications of cuts. The lower marsh creek tidal marsh pilot restoration project is separable and could be delayed but cannot be reduced without jeopardizing the project. Foregoing the pilot marsh restoration project would reduce the need for Big Break monitoring, but would also eliminate a good adaptive management opportunity for gaining information to plan the adjacent Dutch Slough proposal. If restoration proceeds, the monitoring programs are necessary to test the efficacy of the restoration treatments. Monitoring could be scaled back to solely test the impacts of the restoration, but that would not result in large cost savings because a major part of the costs are associated with equipment and mobilization, particularly for the open water and tidal marsh monitoring task. The upper Marsh creek restoration costs, already heavily cost shared, could be scaled back by eliminating one or two of the restoration sites, but these opportunities would then be permanently lost due to pending urban development and complications associated with grading the sites after development occurs. If the heavily cost shared native plant nursery were cut back, it would make it far more difficult to cost effectively plant the restoration sites. Finally, reducing the heavily cost shared public outreach program

would greatly undermine our ability to gain support and plan for future restoration before the lower watershed is fully urbanized.

If CALFED cannot afford to fund the entire program, they could scale back the monitoring, public outreach, and upper Marsh Creek restoration programs. Eliminating the innovative water quality bio-marker component would save approximately \$95,000. Remaining elements of the monitoring programs could be scaled back to focus solely on monitoring restoration. For the Big Break open-water monitoring program this would only yield a 25% cost savings of \$93,250 due to high fixed costs. For the remainder of the Marsh Creek water quality monitoring program (not including the bio-marker study), this would yield a savings of 33% or 55,500. Restoration of one of the upper Marsh Creek channel sites (at the sewage treatment plant) could be delayed for a savings of \$105,000. If CALFED does not wish to fund the heavily cost shared CRMP program, they could cut it for a savings of \$100,000, and the project partners will seek funding elsewhere. Public outreach and education could be further cut to a bare minimum yielding an additional savings of \$45,000. Cumulatively, these program reductions would reduce the costs of the project by \$493,250.

B. Applicability to CALFED ERP and Science Program Goals and Implementation Plan and CVPIA Priorities

1. ERP, Science Program and CVPIA Priorities

This project will directly achieve several CALFED goals associated with restoring tidal marsh, floodplains, native fish, water quality, and dune habitat. The table below provides a more detailed description of how the project will achieve various CALFED goals.

<u>Program Goals and Priorities Addressed</u>	<u>Description of Project Actions and Targeted Parameters</u>
<i>(DR-1.) Restore habitat corridors in the North Delta, East Delta and San Joaquin River</i>	
<ul style="list-style-type: none"> Restore tidal marsh and mid-channel island littoral zone - Strategic Goal 4, Shallow water, tidal and Marsh habitat Acquire protect and restore habitat - Strategic Goal 1, at risk species and Strategic Goal 4, habitats Restore inland dune scrub habitat - Strategic Goal 1, at risk species and Strategic Goal 4, habitats 	<ul style="list-style-type: none"> Restore 29 acres of freshwater tidal marsh and seasonal floodplain for the benefit of Sacramento splittail, juvenile salmon, Delta smelt, and other native aquatic and avian species. Create nesting and foraging habitat for black rail, tricolored black bird, yellow breasted chat and perching habitat for Swainsons hawk. Create south facing slope of less than 25% in silty-clay to clay soil for pond turtle nesting habitat. Restore approximately 1 acre of dune habitat for Antioch dune plant and animal species to test efficacy of dune restoration techniques
<i>(DR-2) Restore and rehabilitate floodplain habitat in eastside tributaries and the lower Sacramento</i>	
<i>(DR-4) Restore habitat that would specifically benefit one or more at-risk species; improve knowledge of optimal restoration strategies for these species.</i>	
<ul style="list-style-type: none"> Adaptive experimentation with species-specific restoration approaches - Strategic Goal 4, habitat Restoration of Sacramento splittail and delta smelt - Strategic Goal 1, at risk species assessments and Strategic Goal 4, habitats Life histories and restoration or habitat requirements of at risk species - Strategic Goal 1, at risk species assessments. 	<ul style="list-style-type: none"> Create 29 acres of tidal marsh and inundated habitat for spawning and rearing by splittail and Delta smelt, and rearing by salmonids. Design and manage wetland features to test hypothesis about the interrelationship of hydrodynamics, vegetative structure, salinity, temperature, avian predation, fish stranding, etc. Measure spawning splittail and rearing salmon on high marsh and tidally influenced floodplain. Monitor for CALFED priority fishes; particularly delta smelt, splittail, Chinook salmon (all runs), steelhead as well as non-native exotic species.
<i>(DR-5) Implement actions to prevent, control and reduce impacts of non-native invasive species.</i>	
Develop pilot projects and research - Strategic Goal 5, non-native invasive species	<ul style="list-style-type: none"> Physically manage pilot tidal marsh and floodplain restoration site to test actions that may limit exotic species use, such as dewatering or salinity increase Implement a monitoring plan to document the number and spatial-temporal distribution of non-native fish and plant species, such as the broad-leaf pepper-grass (<i>Lepidium latifolium</i>)
<i>(DR-6) Restore shallow water habitats in the Delta for the benefit of at-risk species while minimizing potential adverse effects of contaminants</i>	
<ul style="list-style-type: none"> Finding solutions to the constraints to restoring ecosystems of inundated islands by advancing process understanding of Delta ecosystems - Strategic Goal 1,2,5, and 6 Restoration and monitoring strategies for riparian zones - Strategic Goal 4, riparian Effects of contaminants, Mercury, Selenium, Transport of nutrients and current-use pesticides - Strategic Goal 6, water and sediment Fish survival in the Central and South Delta - Strategic Goal 6, water and sediment 	<ul style="list-style-type: none"> Biological and physical monitoring in Big Break, a flooded Delta island. Remediate point and non-point pollution sources by creating and restoring biofiltration wetlands, and riparian floodplains along 5,000 feet of Marsh Creek Employ innovative and tested shallow water monitoring techniques to measure tidal marsh/flood plain processes and species preference for future tidal marsh restoration projects. Measure key water quality parameters in Big Break and Marsh Creek Monitor mercury levels in sediment, plants and non-endangered fish species to determine whether bioavailability and biomagnification change during the restoration process. Employ innovative new enzyme bio-marker technique to identify biological stressors that may not be evident from traditional water quality sampling techniques.
<i>Multi-Regional Bay Delta Areas (MR-3) Implement environmental education actions throughout the geographic scope</i>	
Environmental Education Programs – Draft Stage 1 Implementation Plan	<ul style="list-style-type: none"> Engage university, community college, and high school students in water quality monitoring pr Engage local residents and schools in a native plant propagation program at local schools to provide genetically appropriate plant material for future restoration projects along Marsh creek.
<i>Central valley Improvement Act Goals</i>	
Section 3402 (a), (b), and (c) Section 3406 (b) (1) Anadromous Fish Restoration Program	<ul style="list-style-type: none"> Restore juvenile salmon rearing habitat in the Delta

2. Relationship to Other Ecosystem Restoration Projects

This project follows on Coastal Conservancy planning grants along Big Break and the Marsh Creek watershed as well as a CALFED grant to NHI for the Marsh Creek watershed science program. The design for the restoration elements of this proposal were funded by the initial Coastal Conservancy grant. The water quality monitoring components, education, and outreach components of this proposal will augment and extend the previous CALFED grant which is more focused on hydrology, geomorphology and scheduled for completion in June 2003. Under the current CALFED proposal we are working with local high schools to collect a limited quantity of water quality data. The results of this initial effort will inform the design of a far more detailed water quality study proposed in this request. The public outreach elements of this proposal will fund the second phase of the RCD CRMP process recently initiated in the watershed as well as new programs by CSUH and the Delta Science Center.

This proposed project will also be important to the 1200 acre Dutch Slough restoration project proposed by the Coastal Conservancy for CALFED funding during this solicitation round. The lower Marsh Creek tidal marsh component of this project is immediately adjacent to the Dutch Slough site and will provide valuable data for the Dutch Slough project. Marsh Creek drains into or very near the Dutch Slough site and thus the water quality components of this proposal will help design and ensure the success of the Dutch Slough project.

3. Request for Next-Phase Funding

This proposal is not a request for next phase funding but is related to a previous Marsh Creek CALFED Grant to NHI. Funding for this current grant request will use much coarser water quality data collected mostly by students to design and implement a far more detailed water quality analysis. It will expand the public outreach component to fund the CRMP process desired by the RCD. Lastly, it will fund locally supported restoration recommendations developed under the first grant.

NHI and its partners have made excellent progress in implementation of the earlier CALFED grant. They helped the RCD staff obtain funding for the CRMP program and have contributed time and materials to that process. They have launched a water quality monitoring program with CSUH and local high schools using RWQCB protocols and have initiated a major geomorphic and hydrologic data collection effort including over 35 graduate students from UC Berkeley's core environmental planning class who are focusing on surveying Marsh Creek and designing restoration designs. By the end of the semester, these students will have spent at least 3,500 hours on high quality creek surveys and design. NHI have also collected all the existing data on the creek from several agencies, made it available to the class for their work, and is on track to complete a resource inventory report deliverable by mid November.

4. Previous Recipients of CALFED Program or CVPIA Funding

The Coastal Conservancy has applied for and obtained Calfed funding for two previous projects: 1) Introduced Spartan Eradication Project (Project #11332-0-J001, and 2) Hamilton Wetland Restoration Project (Project #B81642).

5. System-Wide Ecosystem Benefits

The most important system wide benefit of this project will be improved water quality for the Delta and Bay. The restoration of tidal marsh and adjacent floodplains may have system wide benefits for splittail and salmon if it provides critical spawning and rearing habitat in years when very little habitat is available elsewhere such as the Yolo bypass. The tidal marsh restoration component will answer many questions about tidal marsh processes and native fish habitat preference – information that will prove extremely useful for planning the adjacent 1200-acre Dutch Slough project.

C. Qualifications

Professors from Cal State University Hayward will serve as the principal investigators for the monitoring and research components of the proposal. **Dr. Christopher L. Kitting, Ph.D.**, will supervise all biological monitoring. He earned a Ph.D. in Biological Sciences from Stanford University, and is currently a professor of Biological Sciences at Cal State University at Hayward where his research focuses on determining the natural importance and suitable conservation and restoration of shallow-water communities, particularly on San Francisco Bay and Delta Shores. He has authored over 20 scientific articles published in major journals and has developed innovative shallow water monitoring techniques, which he described at the CALFED Science Conference, that have now been adopted for the Suisun Marsh monitoring program. **Dr. Joy C. Andrews, Ph.D.** will serve as the principal investigator for all water quality monitoring. Dr. Andrews, an environmental chemist, received her Ph.D. in Biophysical Chemistry at the University of California at Berkeley. She is currently an Assistant Professor of Chemistry, CSUH. She has over 20 years of experience in water quality analysis and co-authored the book “The Chemistry of Water” (1997 University Science Books) as well as numerous papers in leading edge chemistry journals and conference proceedings on the analysis of metals, especially in plants. **Dr. Chad Stessman** has worked both on the synthesis of natural products and on the identification and structure elucidation of several terrestrial natural products. An example of this work is “Cyclic Hemiacetals with Seven-Membered Rings From an Undescribed *Salacia* Species from Monteverde, Costa Rica” *J. Nat. Prod.* 1999, 62, 340-341. He has studied marine sponges as sources of bioactive natural products. An example of this work is “Employing Dereplication and Gradient 1D-NMR Methods to Rapidly Characterize Sponge-Derived Sesterterpenes”; submitted for publication in the *Journal of Natural Products* in April of 2001. Chad has numerous publications in the general area of organic chemistry, including four that deal with structure elucidation and using spectroscopic techniques to answer structural questions. **Dr. Beverly Dixon, Ph.D.** will serve as the principal investigator for all microbiological monitoring and research. She is a professor in the Department of Biological Sciences at California State University at Hayward and has conducted research on fish diseases and the immune response to disease for over two decades. Dr. Dixon is the immediate past president of the Fish Health Section (FHS)/American Fisheries Society and is currently the co-editor of the FHS newsletter. She also is a member of the World Aquaculture Society, and served as the Secretary-Treasurer of the International Association for Aquatic Animal Medicine for three years. She has over two dozen publications in peer-reviewed scientific journals, and four book chapters.

For over a decade the **Natural Heritage Institute** has applied state of the art science and law to resolve complex environmental problems, particularly in the Bay-Delta arena. NHI was an original signatory to the Bay-Delta Accord that precipitated the CALFED program and has contributed significantly to the development of several CALFED programs. NHI Restoration Ecologist, **John Cain, M.L.A.**, will coordinate planning and design of the restoration projects. Mr. Cain has over 12 years of experience in the field of stream and river restoration. **Richard P. Walkling, M.L.A.**, who will assist in restoration planning, is an environmental planner who

focuses on water management and environmental restoration. He has designed restoration plans for alluvial streams in California and for subsided islands in the Sacramento-San Joaquin delta. **Dr. Elizabeth Soderstrom, Ph.D.**, who will provide technical guidance, is an expert on adaptive management and has extensive experience in water resources management in the international and domestic arenas. **Jim Robins, M.S.**, who has a graduate degree in rangeland ecology and 6 years of experience in watershed research and planning will coordinate the native plant nursery program. NHI Board member **Luna Leopold, Ph.D.**, is world renowned for his expertise in hydrology and fluvial systems, will regularly advise NHI staff in project implementation.

The **Delta Science Center at Big Break (DSC)**, a non-profit, public benefit corporation, is a collaborative project by government, industry, agriculture, educators, and environmentalists to build a science center focused on Delta restoration, research, and education. Member organizations governing the DSC include Contra Costa County, East Bay Regional Park District, Contra Costa Water District, Cal State Hayward, Contra Costa Community College District, Ironhouse Sanitary District, Emerson Dairy, the cities of Oakley and Brentwood, PG&E, and local chapters of the Audubon Society and Sierra Club. **Stephen Barbata**, Executive Director of the DSC, will coordinate public outreach and education components of the project. As director of the Lindsay Museum in Walnut Creek he was responsible for the successful completion of its \$8 million capital campaign. **William S. Wells**, principal of William S. Wells Design and consultant to the DSC, will oversee graphic presentation and production to communicate complex scientific trends to students and residents, a critical element of the public outreach program. Mr. Wells has over 25 years of experience in the design of educational exhibitions and publications.

Mitch Avalon, P.E., is the Deputy Public Works Director for Contra Costa County Flood Control District (CCCFCDD). Mr. Avalon has an engineering degree from UC Berkeley and has worked for CCCFCDD for 20 years. Mr. Avalon will actively provide guidance on restoration engineering and implementation. **Nancy Thomas, J.D.** is the watershed coordinator for the Marsh Creek Coordinated Resources Management Plan for the Contra Costa Resource Conservation District. She will organize and facilitate the public outreach and CRMP planning program.

The Coastal Conservancy and NHI will contract with a number of scientists, engineers, and landscape architects who will assist in the restoration design and plant propagation program. **Dr. Bruce Pavlik, Ph.D.**, will provide technical guidance on the dune restoration and native plant propagation program. Dr. Pavlik graduated from UC Davis where he worked on the physiological ecology of grasses with Professor Michael Barbour. Dr. Pavlik has focused much of his work on the conservation of rare and endangered ecosystems such as the Antioch Dunes. He is currently Professor of Biology at Mills College in Oakland, California and author or co-author of more than forty scientific and popular publications, including *Oaks of California* (1991, Cachuma Press), *California's Changing Landscapes* (1993, California Native Plant Society) and the fifth edition of the *Inventory of Rare and Endangered Vascular Plants of California* (1994, California Native Plant Society). **Roger Leventhal, M.S. P.E.**, of Farwest Engineering has a masters degree from UC Berkeley in Civil Engineering, Hydraulics and Water Resources. He has acquired unique experience in ecological restoration/environmental engineering projects as the project manager or lead engineer on many projects for Levine Frickes ecological services division where he was employed for 15 years. **Stewart Siegel, Ph.D. (pending)**, is a registered wetland scientist with over a decade of tidal marsh restoration and an

expert in wetland geomorphology. He will assist in restoration at the mouth of Marsh Creek. **John Volmar**, who will advise on planting plans and propagation, is a consulting botanist with 15 years of experience and detailed knowledge of the restoration sites. **Ron Lutsco, M.L.A.** and **Tracy Westphal**, who will assist with planting design and propagation, are certified landscape architects with extensive experience in California native plants.

The City of Brentwood is one of the fastest growing cities in California and has retained an impressive staff to manage this growth. **John Elam**, the City Manager of Brentwood since 1998 has over 30 years of experience managing municipalities and public works programs is spearheading the effort to create integrated public amenities within Marsh Creek and believes that this project should be one of Brentwood's highest priorities. Karen Wahl, Grants Coordinator for the City of Brentwood, has a degree in education and will serve as the City's public liaison and fundraiser for the project. **John Stevenson, P.E.** has been the City Engineer for over 20 years and will provide technical design assistance.

D. Cost

1. Budget

In addition to the budget breakdown by general task that was submitted by the on-line form and shown below, more detailed budgets for various partners and components of the project are detailed in appendix C.

2. Cost Sharing

This project is heavily cost shared. The project partners are requesting \$2,998,049 and providing a cost share of \$2,910,727 and an additional in-kind contribution of \$287,500. Approximately \$1.6 million of the cost share is from land for restoration provided by the City of Brentwood, Contra Costa Flood Control District, and the Ironhouse Sanitary District. Task 5, 6, and 7 are particularly heavy on cost share as shown in the table below.

Task	Description	Request	Match	In Kind	Total	Total Request w/overhead
1	Project Management	100,332	0	0	100,332	103,342
2	Big Break Biological and Water Quality Monitoring	387,014	84,125	68,000	539,139	398,624
3	Marsh Creek Water Quality Monitoring	275,708	62,594	10,000	348,302	283,979
4	Tidal Marsh and Floodplain Restoration on Lower Marsh Creek	1,432,048	655,000	60,000	2,110,248	1,475,009
5	Channel Restoration and Water Quality Remediation	368,469	1,240,000	100,000	1,698,583	379,523
6	Public Outreach, Education, and Watershed Planning	249,656	254,375	35,000	539,031	257,146
7	Native Plant Nursery Program	97,500	50,000	14,500	124,500	100,425
TOTAL		2,910,727	2,346,094	287,500	5,460,135	2,998,049

E. Local Involvement

Virtually all of the municipalities and districts and many local politicians are aware of and enthusiastically supportive of this project (see attached letters of support). Several key

municipalities are active collaborators including the City of Brentwood, Contra Costa Flood Control District, the Ironhouse Sanitary District, the Resource Conservation District, and the East Bay Regional Park District.

This proposal represents more than just the union of a variety of project concepts, but the creation of a diverse local stakeholder collaborative effort. Below is a list of collaborators that illustrates our vision for a strong and inclusive local partnership.

- California State Coastal Conservancy
- The Delta Science Center
- Contra Costa County Resource Conservation District
- The City of Brentwood
- The City of Oakley
- Liberty Union High School District
- Los Medanos College
- Cal State Hayward Main Campus and Contra Costa Campus
- Contra Costa County
- East Bay Regional Park District
- Natural Heritage Institute
- Contra Costa County Mosquito and Vector Control
- Contra Costa County Clean Water Program
- Contra Costa County Flood Control District
- Bay Regional Water Quality Control Boards
- Ironhouse Sanitary District
- Delta Informal Gardeners
- University of California, Berkeley
- SF Estuary Project (Creek Keepers)

Public Outreach and Education Plan. As described in Section A.2., Hypothesis 5 and Hypothesis 6, the education and public outreach components of this proposal are integral to its success. Local citizens – including students, educators and community members – will be involved in designing and implementing monitoring at project sites and helping to propagate native phenotypes through a nursery program. All of the proposed restoration project are located on a heavily used regional bike trail between Oakley and Brentwood which will greatly facilitate our public outreach vision.

F. Compliance with Standard Terms and Conditions

The Coastal Conservancy is agreeable to, and able to comply with, terms and conditions included in Attachment D, the Terms and Conditions for State Funds, except as follows: (1) the Conservancy would revise or exclude Paragraph 11 in the “Attachment D Terms and Conditions for State Funds”, requiring it to indemnify, defend and save harmless the State because the Conservancy is itself an agency of the State. (2) The Conservancy would exclude Paragraph 12 in the “Attachment D Terms and Conditions for State Funds”, because agents and employees of the Conservancy are, in fact, officers and employees or agents of the State of California.

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