F1-082

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HAYWARD, CALIFORNIA 94542-3089

DEPARTMENT OF CHEMISTRY
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7/26/97

Dear Colleagues,

We are pleased to submit the enclosed, 10 copies of our CALFED proposal for Category III, group 3 funding (services), for the present review process.

We have adhered to the RFP guidelines.

Best wishes for your review process. We will be looking forward to hearing from you.

Sincerely,

Christopher L. Kitting, Ph.D.
Professor of Biological Sciences

Joy C. Andrews, Ph.D.
Assistant Professor of Chemistry

F1-082

Please note that CALFED's stated policy is to make all proposals public, which we agree to if necessary. However, standard scientific practice is that proposals are intellectual property, and that information contained herein is not to be used (pirated) by others, until funded and acknowledged, without prior consent. For further information on this proposal, and/or literature to be cited within it, contact Dr. Chris Kitting at California State University, Hayward (510) 885-3001. This proposal has been prepared following CALFED's guidelines on short notice.

CALFED PROPOSAL, CATEGORY 3 FUNDING: HABITAT RESTORATION

GROUP 3: SERVICES

Section I: Executive Summary

a. **Project Title:** Completing Biological Restoration and Use of Biofiltration for Contaminant Reduction in Delta Tidal Freshwater Wetlands through Cultivation of Native Species in Restored Marshes.

Applicant Names: Drs. C. Kitting, J. Rees, J. Andrews, and S. McGinnis, Departments of Biological Sciences and Chemistry, California State University, Hayward (CSUH).

b. **Project Description and Primary Biological/Ecological Objectives:** Using Delta shorelines previously acquired for restoration, our primary objectives are to provide marsh community restorations complete with native species (via mesocosm polycultures, initially small-scale field enclosures of diverse taxa), which then we would use to help repopulate large-scale restorations of Delta regions. These biological restorations are necessary to improve Delta water quality and to increase populations of threatened and endangered fishes, including Delta smelt, splittail, and salmon, particularly as vulnerable juveniles. We propose four integrated, major project tasks: (1) Provision and monitoring of *in-situ* tidal freshwater mesocosms, as pilot community restorations, then used for enhancing larger scale native plant and animal populations, and removal of exotics in these restorations, (2) performance of in-situ bioassays to be used for monitoring and testing suitabilities of our restoration activities, again for use as models for full-scale restorations, (3) comparisons of water chemistry up- and downstream through the marshes, to be employed throughout restorations and bioassays to monitor improving water quality, and (4) field exploratory work and field/laboratory culture on native freshwater sponges and other filter feeders as natural biofilters for the essential work in improving Delta water quality.

c. **Approach/Tasks/Schedule** The project approach will include: (1) construction and monitoring of marsh mesocosms at selected stations throughout emergent marsh and riverine habitat; in this regard, mesocosms will be used to model success of replacement of exotic plants and animals with indigenous natives, (2) construction of in-situ field bioassays to assess the success of our marsh and riverine mesocosms, (3) use of water chemistry, especially heavy metal analysis, to monitor the success of our marsh mesocosms in the marsh and adjacent riverine habitat , and (4) use of native freshwater sponges and other taxa as natural biofilters to improve Delta water quality overall. These four approaches are integrated: all will require aquatic chemical analysis to monitor progress, and all aim towards implementing CALFED goals of improving critical Delta habitat, expanding habitat for fish and bird species recognized by CALFED as critically important, and maintenance/ improvement of Delta water quality. Our project tasks and schedule mirror the above approach. In this 3-year project, marsh mesocosms will be established and maintained in emergent freshwater marsh and adjacent riverine habitat during the first year, and monitored and expanded during years 2 and 3; *in-situ* bioassays will be emphasized in years 2 and 3 to improve success of our mesocosms; native freshwater sponge and other invertebrate culture in the laboratory (years 1-2) and field (years 2-3) will be undertaken to assess the water quality enhancing properties and persistence of these natural biofilters, and (4) water chemistry will be used throughout the 3-year period in all three tasks to assess task progress in improving water quality.

d. Justification for Project and Funding by CALFED. *This project directly* addresses CALFED's mission and specific RFP concerns: (a) provision of good water quality in the Bay/Delta system, improvement of aquatic habitats and ecological functions in the Bay/Delta, and reduction of risk to land use (through flood control), (b) addressing of priority habitats (tidal perennial freshwater habitat, instream aquatic habitat, shaded riverine aquatic habitat), and addressing of priority species or populations which will benefit from our project: salmon, delta smelt, splittail, and migratory birds.

e. Budget Costs and Third Party Impact. Total project budget request from CALFED is $1,315,640 over 3 years. Additional matching funds are provided by CSUH. Due to the natural biological processes merely accelerated in our proposed work, we anticipate no third party negative impacts.

f. Applicant qualifications. (1) *Christopher Kitting, Ph.D.*, is a Professor of Biological Sciences at CSUH with over 23 years of experience in aquatic ecology. His storm water marsh ecology program in Alameda county recently received a US EPA Excellence award. His education program on the Delta also received a local Environmental Achievement nomination. Additionally, Dr. Kitting has made related conference presentations internationally, and has published over 25 related works in major journals, plus other contributions. (2) *John T. Rees, Ph.D.*, is an Adjunct Professor of Biological Sciences at CSUH. He has 20 years experience in the environmental field, including 10 years field and research experience in California freshwater habitats. Dr. Rees has published over 30 peer-reviewed journal articles and other significant contributions on fresh, estuarine, and marine ecology, pollution control, and introduction of exotic aquatic species. (3) *Dr. Joy Andrews, Ph.D.* , is an Assistant Professor of Chemistry at CSUH. Dr. Andrews is an environmental chemist, and has co-authored a book on water quality analysis, "The Chemistry of Water," which will be available from University Science Books in the fall of 1997. She has published papers in leading chemistry journals and conference proceedings on the analysis of metals in plants. (4) *Sam McGinnis, Ph.D.*, is a Professor of Biological Sciences at CSUH, and has published over three dozen papers, book chapters, and books on ecology of California wildlife. Recently he has emphasized endangered and threatened plant and animal species, largely in work conducted for government agencies. He has conducted field studies and written biological impact reports for well over 100 projects since 1979, including over 25 in eastern Contra Costa County.

g. Monitoring and Data Evaluation. *Monitoring of our mesocosms and in-situ* bioassays will be an essential and integral part of our work. Enumeration of plant and animal species in both experimental and control marsh mesocosms and bioassays will take place on a continual basis. Water chemistry will be employed on an on-going basis to monitor and confirm trends in our mesocosm and bioassay results. Our program will be based on similar successful biological restoration work carried out elsewhere (e.g., Project Eden for native species on Western Australia shores). We plan to have two progress reports in the first year, and one each in the second and third years. Our work will be prepared and presented in appropriate venues, including local monitoring agencies such as the San Francisco Estuary Institute (SFEI). Oral presentations at scientific and agency meetings will provide immediate feedback from colleagues. We also plan to publish our work in academic and applied journals.

h. Local Support/Coordination with other Programs/Compatibility with CALFED objectives. The Delta Science Center, composed of numerous affiliated agencies, especially the Contra Costa Mosquito and Vector Control District, is in full support of this project. We plan to coordinate our program with several other local programs, including the ongoing monitoring of the San Francisco Estuary Institute, and with bioassay programs at the Lawrence Berkeley Laboratory and Lawrence Livermore Laboratory. Activities of all these programs are compatible with CALFED objectives.

Section II: Title Page

a. Title of Project: Completing Biological Restoration and Use of Biofiltration for Contaminant Reduction in Delta Tidal Freshwater Wetlands through Cultivation of Native Species in Restored Marshes

b. Names of applicants:

Christopher L. Kitting, Department of Biological Sciences (ckitting@csuhayward.edu)
John T. Rees, Department of Biological Sciences (johntrees@aol.com)
Joy C. Andrews, Department of Chemistry (andrews@csuhayward.edu)
Samuel M. McGinnis, Department of Biological Sciences (70730.1051@compuserve.com)
California State University Hayward
Hayward CA 94542
(510) 885-~~3471~~
FAX (510) 885-4747

Affiliation: CSUH

c. Type of organization: State agency/university (tax status: state agency)

d. Tax identification number: (CSUH Foundation's Federal Tax ID # is 94-1524922)

e. Technical and financial contact persons:

Technical: Dr. Chris Kitting: (510) 885-3001, FAX (510) 885-4747, Email: ckitting@csuhayward.edu

Financial: Ms. Cynthia Vinson, CSUH Foundation, (510) 885- 4039, FAX (510) 581-7995. E-mail: cvinson@csuhayward.edu

f. Participants/Collaborators in Implementation:

Delta Science Center, with its several affiliated agencies, is in full support of this project, particularly East Bay Regional Parks, and the Contra Costa Mosquito and Vector Control District. The latter agency, which is conducting extensive tidal restoration led by Karl Malamud-Roam, is kindly providing access to areas restored to tidal action, and will benefit from our biological restorations and monitoring. Ironhouse Sanitary District also is considering providing us with additional access to their agricultural lands scheduled for marsh habitat construction.

g. RFP project group type(s)

Because real estate and construction already are available and planned in preparation of this ecological restoration proposed for CALFED funding, the funding category is Group 3: Services (habitat restoration.)

Section III. Project Description

a. Project Description and Approach

We propose four integrated, major project tasks: (1) Provision and monitoring of *in-situ* tidal freshwater mesocosms, as pilot community restorations, to be used to enhance native plant and animal populations in adjacent full-scale restorations, with simultaneous removal of exotics, (2) performance of *in-situ* bioassays to be used for monitoring and testing suitabilities of our large-scale restoration activities, again for use as models in future restorations, (3) comparisons of water chemistry upstream and downstream through the marshes, to be employed throughout restorations and laboratory bioassays to monitor improving water quality, and (4) field exploratory work and field/laboratory culture on native freshwater sponges and other micro filter feeders as natural biofilters for essential work in improving water quality throughout the Delta.

This project proposes community restoration activities in several large Delta locations near the confluence of the Sacramento and San Joaquin Rivers, each location to become a tidal ("perennial aquatic") freshwater habitat between Antioch and Oakley. Two of the sites are adjacent to creeks with evidence of salmon spawning. The general region is planned for eventually extensive habitat restoration through the Delta Science Center (DSC). In the present project, we propose to enhance and expand the native marsh through repopulation with native plant and animal species, first in prototype marsh mesocosms, which are small field populations of native plants and animals representative of the marsh habitat. They would be replicated at multiple sites for security. The enhanced and increased amount of vegetation and micro filter feeders will (hypothetically) act to biologically filter heavy metals and other inorganic and organic materials from the water. We would plant willows and other native plants into the area, and native aquatic animals which would be recruited into the restored marsh and creek would include splittail, delta smelt and possibly chinook salmon. If necessary, we could obtain natives to transplant from levy construction sites or dredging areas, where animals and plants otherwise are virtually doomed.

Before, during and after habitat restoration, we will monitor the native plant and animal communities and the water quality on an ongoing basis, throughout restored and reference marshes. We will also note changes in abundances of plant and animal populations and water quality before, during and after the winter storm season. The monitoring of additional, enclosed, animal populations will serve as bioassays measuring the effectiveness of the restored marsh habitat to improve water and habitat quality. Water chemistry will be performed on an on-going basis throughout the project.

The proposed work would capitalize on our recent, successful experience with marsh restorations in Hayward and Fremont, which won an EPA National Excellence award, while our Delta Teacher Education program for the Delta Science Center received a local Environmental Achievement Award nomination. We hypothesize that our marsh community restoration will greatly improve the water quality, establish long-term stable habitats necessary for floral and faunal populations in severely depleted native plant and animal communities, and improve resistance of the area to flooding, as more plant-laden channels are available for accommodating runoff flows.

The restoration will be assisted with continued matching in-kind support from the Delta Science Center. A noteworthy collaborator with us and with the Delta Science Center is the Contra Costa Mosquito and Vector Control District, who have agreed to provide us access to new channels and other areas restored to tidal action, for these proposed biological restorations with native animal populations.

As a novel but potentially highly beneficial activity, we propose to culture native Delta freshwater sponge species and other micro filter-feeders for field experiments in water purification. Sponges may act as natural biofilters, removing even microscopic particles from the water, including bacteria (pathogenic and otherwise) and possibly chemical contaminants adhering to detritus. Recent work has shown that sponges can effectively filter enormous quantities of water under optimal conditions. We have located isolated populations of different resident sponges in the Delta, and propose to trial culture native Delta species initially in the laboratory, to determine which species will thrive best under specific laboratory conditions. After culture conditions are optimized, we will scale up culture to a pilot level to determine filtration rates and the effectiveness of our selected sponges in removing particles. The results of this work can be used in several ways in restoration efforts in the Delta, including the possible use of sponges in marsh treatment for a variety of wastewater flows found in the Delta system. We would conduct laboratory and field work in restored marsh areas to determine growth rates, filtration rates and viability of the sponges in different habitats. Enhanced populations of freshwater sponges may improve a marsh's natural biological filtration of medically important bacteria and other contaminants, and thus improve environmental health dramatically.

b. Location and/or geographic boundaries of project
The restored marsh areas would be located on the southern shores of the outer Sacramento River Delta, east and west of Antioch, California, including regions at the confluence of the Sacramento and San Joaquin Rivers.

c. Expected benefits
The primary stressors in the project area include insufficient marshplane, lack of riparian (or shaded) zones, the presence of chemical contaminant loads, increased nutrient input, and high water temperatures. The primary benefits of this project would include alleviation of the above stressors through the restoration of natural habitats and provision of greater area of appropriate habitats for native Delta species, particularly endangered fish species such as Delta smelt, splittail, and possibly chinook salmon. The increased marsh areas in these restored regions are expected to accommodate and disperse sudden increases in water level from runoff and Delta flow, minimizing risks of flooding the surrounding areas. Secondary benefits of this project would include decreased water temperature due to shading by planted vegetation, which would increase the dissolved oxygen content, making the environment more habitable for salmon and other native species. Expanded tidal marsh habitats and plant populations will also benefit migratory water birds. Secondary benefits would also include the supplanting of exotic with native species. Introduced species including the potentially dangerous mitten crab, would be removed from the site and used, with proper safeguards against further dispersal, as study animals in CSU Hayward laboratory classrooms. Exotic plants such as water hyacinth and Hydrilla ("water weed") will be removed from regions of our mesocosms. Such removal of these plants, which a hyperaccumulators of metals and other contaminants, may serve to remove a significant amount of pollutants from the area. (The plants may then be disposed of in general laboratory experiments for diverse chemistry and biology classes.) In addition, the project would lay the groundwork for future improvement of water quality potentially through the use of sponges as natural biological filters.

Third party benefits from this project include the accomplishment of the field mesocosm work which will be necessary prior to full restoration of the extensive marsh region at the Delta Science Center. The Contra Costa Mosquito and Vector Control District will

also benefit from our additional biological and chemical expertise in the collaboration, to supplement their restoration expertise in hydrology and provision of physical habitats.

Along with increased natural filtration provided by restored native plants, we expect to benefit CALFED ecosystem AND non-ecosytems objectives, especially improved water quality for all beneficial uses. With the results from this restoration program, we will be prepared in the future to restore, in conjunction with the Delta Science Center, larger areas near restricted channels of the San Joaquin River, where risks of upstream flooding of heavily populated areas can be reduced.

d. Background and Biological/Technical Justification

In habitats of the Sacramento Delta region, critical historic functions of wetlands for water purification, flood control, and natural populations have been largely lost, but may be restored through appropriate habitat and community reconstruction. One particularly important habitat for restoration has become tidal freshwater wetlands, largely destroyed in the Delta. These wetlands act as a natural sink for accumulated pollutants, buffers for rapidly rising water levels, and habitats for depleted native and endangered fish and wildlife populations. Properly restored, a tidal freshwater marsh can serve as a cost-effective biological filter, provide significant flood control, and restore habitat values and aesthetic values. At the same time, suitable Delta wetlands enhance open space and provide increased opportunities for education and recreation.

The biological restoration/repopulation efforts we propose would capitalize on our recent ecological findings at local wastewater marshes, urban stormwater treatment marshes, Delta habitats, and in habitat restoration for sensitive species (see papers by Kitting, Fry and Morgan, 1982, and other publications in the "qualifications" near the end of this proposal). In this marsh restoration project we would conduct a rare, efficient set of population enhancements of entire communities. Existing habitat restoration stops at physical habitat, or at vegetation, but primarily exotic plant and animal species are present and available to colonize newly restored habitats. We hypothesize that numerous native aquatic and amphibious animal species, including sensitive small crustacea, fishes and frogs will slowly colonize restored marsh habitats, but will increase more effectively if augmented with propagated transplants, and if exotics are removed.

Ideally, our initial comparisons of meso-scale restorations of whole communities would act as a guide to increase the efficiency and effectiveness of upcoming large-scale Delta restoration. The Delta Science Center marshes, including those being planned for construction, eventually would provide more large-scale implementation of our initial community restorations. In addition, scientific work proposed in this project will serve as a basis for public educational displays at the Delta Science Center. We propose that the entire marsh restoration project, both at the pilot mesocosm level and full-scale, can be part of the educational program in the DSC's future.

The water quality in the Sacramento Delta region is of vital importance, because it is an important source of drinking water to a large percentage of California's population. Monitoring by the San Francisco Estuary Institute (SFEI) and by our CSUH chemistry and biology departments have found levels of pollutants in our proposed project area, including heavy metals, that need be addressed to enhance all-over water quality on the Delta. We propose to monitor pH, alkalinity, dissolved oxygen levels, conductivity, temperature, and fecal vs. total coliform bacteria levels, on an ongoing basis throughout restored and control marshes, and to employ ion chromatography (IC) to determine

levels of chloride and sulfate, and nutrients such as nitrate and phosphate. In addition, with IC we can distinguish amounts of iron (+2) and iron (+3) that, with the above information, can be used to model the water's equilibrium chemistry and predict the speciation (oxidation state and binding) of heavy metals that are present, using computer programs such as MINEQL. The bioavailability and toxicity of metals is highly dependent on their speciation, thus this is vital information. With atomic absorption spectroscopy we will monitor total and dissolved levels of heavy metals, including mercury, a known Delta pollutant from mine tailings, as well as selenium, lead and cadmium, which have been found above recommended drinking water levels in our project area. Biological remediation to improve water quality using aerobic wetlands, especially for heavy metal contamination, has been successful in the past (an example being by Wildeman et al., in Emerging Technology for Bioremediation of Metals, Means & Hinchee, Eds., CRC Press, 1994.)

Marsh Creek in this region near the DSC apparently is contaminated with tailings from past mercury mining activities, as well as contaminants from a dump at its banks. The water chemistry of Marsh Creek is much altered, and gradients of pH, temperature, dissolved oxygen, suspended solids, redox conditions, and coliform bacteria may be discovered along the length of the creek. The creek is now acting as partial filter of contaminants, and with further restoration in future projects (it apparently is not yet available for restoration), its filtration qualities can be enhanced. Marsh Creek will be a good reference marsh for this present project, and is a good model for other streams entering the Delta. Our baseline comparative information collected concerning its chemistry and biology will be of significance in Delta creek restoration.

e. Proposed Scope of Work

Our proposed work scope involves four interrelated tasks: (1) pilot-scale marsh restoration, including planting of native trees to increase shade, and initial replacement of exotic plant with native plant species in a mesocosm setting; (2) use of field bioassays to assess present marsh habitat health, and assess marsh habitat health as pilot-scale restoration proceeds; (3) use of water chemistry throughout the field work to assess present water quality, and to monitor water quality improvement as restoration proceeds, and (4) experimental culture of native sponges and other micro-filter-feeders to assess their potential use in improving water quality overall in the Delta.

Refer to Section IVb (*Schedule Milestones*) for specific task schedules. Pilot-scale mesocosm marsh restoration will take place during year 1, and will be monitored and improved in years 2 and 3. *In-situ* bioassays will be conducted primarily in years 2 and 3, to test general marsh health and to monitor improvement in water quality as mesocosms and whole marsh communities are established. Water chemistry will be conducted throughout all phases of the project, specifically to monitor the progress of water quality as restoration occurs. The laboratory and pilot scale sponge field work is a project in which initial laboratory culture work and experimentation in years 1 and 2 and field experiments in year 3 will provide information on the effectiveness of the use of sponges in biological filters of water contaminants, for use in larger scale projects to follow. Marsh mesocosm restoration and its associated chemical and biological monitoring, will act as a pilot for our larger scale marsh restorations, including later projects at the DSC site and other appropriate Delta sites.

We plan to prepare periodic written updates on project progress for all tasks. Two progress reports will be prepared in the first year (at 6 months and 1 year) and one each at the end of the second and third years. Our CSUH Foundation prepares financial reports monthly, to be summarized at the end of each project year. This reporting process will aid in self-monitoring, to determine whether our goals are being

met satisfactorily and to make any necessary changes in procedures. In addition, auditing procedures are routine, if desired. We plan to make scientific and environmental management reports at local agency meetings. In addition, the work will be presented at a variety of larger scientific meetings, and in peer-reviewed journals and graduate student theses.

f. Monitoring and Data Evaluation

Monitoring and data analysis forms an integral part of each task as well as the overall project. Plant and animal populations will be identified and enumerated in our field sampling, on our standardized data tables suitable for GIS and other data storage and retrieval systems. These concise comparisons throughout restored and natural marshes will act as natural bioassays of environmental health throughout the marsh restoration process. Each step would be performed before, during and after the winter storm seasons, while the marsh expansion is beginning and as it matures. We predict that numerous native animal species, including sensitive small crustacea, fishes and frogs will have denser populations in downstream marsh sites that upstream, and that there will be fewer pathogens evident downstream. Data that we gather will be compared directly to analogous data from other marshes, both disturbed and more "pristine". These biological restoration methods are similar to those used in the successful "Project Eden" on Shark Bay, Western Australia.

Our non-destructive methods, including a portable fishfinder, are described by Kitting (1993, in below "qualifications"). The fishfinder can quantify broad distributions and abundances of fishes of several size classes across the spectrum, identified in traps. Our large and small nets and thrown cage samplers will quantify fishes and other animals throughout the food web, as documented by publications beginning with Huh and Kitting in 1985. For long-term comparisons of fish abundances, we will rely heavily on large Fyke nets (cylindrical fish traps, sampled overnight, but provided with an air space for air-breathing vertebrates), which provide direct information on fish populations utilizing different portions of the new marsh habitat. Upon sampling, augmented with photographic documentation, virtually all animals are released unharmed. Night-time sampling will supplement day-time sampling, to detect limiting factors in water conditions such as stratification and oxygen depletion, and limits on population distributions. Significant publications and other successful projects by each of the participants document the feasibility of these necessary comparative ecological analyses to improve restoration.

Water quality will also be monitored before, during and after marsh restoration, and before, during and after winter rainy season to give a quantitative chemical picture of the improvement of water quality by the marsh restoration projects. Results of monitoring analyses and computer modeling will be presented at scientific meetings and local agencies.

Virtually all of our community restorations and data will be referenced with a global positioning system, and on base maps, for efficient use with GIS. Oral presentations at scientific and agency meetings will provide immediate feedback from colleagues. Resulting Delta restorations, with the use of adaptive management as analyses become available, will also provide an important model for public and professional environmental education.

We plan to have two data reviews in the first year, and one each in the second and third years based on the reports prepared and presented in appropriate venues, including such local monitoring agencies as the San Francisco Estuary Institute (SFEI).

g. **Implementability**
Due to the natural processes to be merely accelerated in our work, we do not anticipate any regulatory or permit issues to arise, other than the need for our scientific collecting permits to be renewed, preferably with somewhat broader limits of methods and scales of collection and maintenance of populations.

Section IV. Costs and Schedule to Implement Proposed Project.

a. **Budget Costs**—See attached tables, consistent with CALFED's format suggested in the RFP.

Budget Justification:
Our proposed tasks are scientifically integrated but are separated for CALFED budgetary purposes. Progress in each task will benefit from sharing several separated costs, such as mobile laboratory costs. Any reductions in one task would still require the "operational" costs of that task, in partial support of other tasks.

Each budget item has been approved by CSUH as a valid expense for this extensive work. The university pays academic faculty salaries at ¾ time, based on teaching, which necessitates outside funding of summer/overload salary and for any other release time from class instruction. The latter (release time) will be matched by the university, as noted in the budget.
Delta Science Center and its affiliates are continuing their in kind contributions to our restoration and related education programs. No subcontracting is required.

b. Schedule milestones (see following page)

c. Third Party Impacts. Due to the natural biological processes merely accelerated in our proposed work, we do not anticipate any third party imparts from any portion of the project.

b. SCHEDULE MILESTONES

Year 1				Year 2				Year 3			
qrt 1	qrt 2	qrt 3	qrt 4	qrt 1	qrt 2	qrt 3	qrt 4	qrt 1	qrt 2	qrt 3	qrt 4

Task 1. Marsh restoration and Mesocosm set-up and Monitoring

Mesocosm establishment and monitoring; reporting

Large scale biological marsh restoration and monitoring; reporting

Task 2. *In-situ* Bioassay Preparation and Bioassay Monitoring

Bioassay establishment

Bioassay Monitoring and data analysis; reporting

Task 3. Water chemistry monitoring and improvements

Task 4. Invertebrate Biofilter Culture

Laboratory Establishment

Initial Sponge Polyculture

Scale-up of Polyculture

Field work with sponge availability and persistence

BUDGET - Year One
1/1/98 - 12/31/98

TASKS 1 & 2: Pilot and Major Marsh Community Restoration and in-situ Bioassays				
Salaries		**REQUEST**	**MATCH**	**TOTAL**
Chris Kitting	1/3 time x 1 Acad. Year qtr	$7,223		$7,223
($21,668/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$7,223	$7,223
	5/6 time x Summer quarter/overload	$18,056		$18,056
John Rees	1/3 time x 12 months	$28,748		$28,748
($86,244/yr)				
Sam McGinnis	1/3 time x 1 Acad. Year qtr	$7,223		$7,223
($21,668/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$7,223	$7,223
	2/3 time x 2 mo, Summer quarter	$9,630		$9,630
Student Asst.	5 x $10/hr x 13 hr/wk x 44 weeks	$28,600		$28,600
Technical Asst.	1 x $15/hr x 13 hr/wk x 44 weeks	$8,580		$8,580
Secretarial	1 x $15/hr x 13 hr/wk x 44 weeks	$8,580		$8,580
Fringe Benefits				
Chris Kitting	Academic year release rate = 37%	$2,672		$2,672
	Academic year release rate = 37%		$2,672	$2,672
	Summer/overload rate = 10%	$1,806		$1,806
John Rees	Adjunct faculty rate = 10%	$2,875		$2,875
Sam McGinnis	Academic year release rate = 37%	$2,672		$2,672
	Academic year release rate = 37%		$2,672	$2,672
	Summer/overload rate = 10%	$963		$963
Student Asst.	Student benefit rate = 10%	$2,860		$2,860
Technical Asst.	Part-time benefit rate = 10%	$858		$858
Secretarial	Part-time benefit rate = 10%	$858		$858
Subtotal, Salaries, Wages and Benefits:		***$132,204***	***$19,790***	***$151,994***
Other Direct Costs (Tasks 1&2)				
Equipment and supplies		$3,600		$3,600
* Repairs		$1,500		$1,500
Transportation Costs		$3,000		$3,000
* Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
Plant and animal acquisition		$10,000		$10,000

BUDGET - Year One
1/1/98 - 12/31/98

*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
	Subtotal, Other Direct Costs		***$24,130***	***$0***	***$24,130***
	Total Direct Costs, Tasks 1&2		$156,334	$19,790	$176,124
	Indirect Costs (25% of total direct costs)		$39,083	$32,354	$71,437
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
	Total, Tasks 1&2		**$195,417**	**$52,144**	**$247,561**
	TASK 3: Improvements in Water Chemistry and Monitoring				
	Salaries		**REQUEST**	**MATCH**	**TOTAL**
	Joy Andrews	1/3 time x 2 Acad. Year quarters	$9,264		$9,264
	($13,896/qtr)	Match: 1/3 time x 2 Acad. Year qtr		$9,264	$9,264
		Two Summer months	$9,264		$9,264
	John Rees	1/6 time x 12 months	$14,374		$14,374
	($86,244/yr)				
	Student Assist.	3 x $10/hr x 13 hr/wk x 44 weeks	$17,160		$17,160
	Technical Assist.	1 x $15/hr x 13 hr/wk x 44 weeks	$8,580		$8,580
	Lab Assist.	$8/hr x 10 hr/wk x 44 weeks	$3,520		$3,520
	Fringe Benefits				
	Joy Andrews	Academic year release rate = 37%	$3,428		$3,428
		Academic year release rate = 37%		$3,428	$3,428
		Summer/overload rate = 10%	$926		$926
	John Rees	Adjunct faculty rate = 10%	$1,437		$1,437
	Student Assist.	Student benefit rate = 10%	$1,716		$1,716
	Technical Assist.	Part-time benefit rate = 10%	$858		$858
	Lab Assist.	Student benefit rate = 10%	$352		$352
	Subtotal, Salaries, Wages and Benefits:		***$70,879***	***$12,692***	***$83,571***

BUDGET - Year One
1/1/98 - 12/31/98

Other Direct Costs (Task 3)					
	Equipment and supplies		$2,000		$2,000
	Transportation Costs		$3,000		$3,000
*	Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
Subtotal, Other Direct Costs			***$11,030***	***$0***	***$11,030***
Total Direct Costs, Task 3			$81,909	$12,692	$94,601
Indirect Costs (25% of total direct costs)			$20,477	$18,801	$39,278
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Task 3			**$102,387**	**$31,493**	**$133,880**
TASK 4: *Culture of Filter Feeders*					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Chris Kitting	1/10 time x 2 Acad. Year qtr	$4,334		$4,334
	($21,668/qtr.)	Match: 1/10 time x 2 Acad. Year qtr		$4,334	$4,334
	John Rees	1/3 time x 12 months	$28,748		$28,748
	($86,244/yr)				
	Student Asst.	2 x $10/hr x 13 hr/wk x 44 weeks	$11,440		$11,440
	Technical Assist.	1 x $15/hr x 13 hr/wk x 44 weeks	$8,580		$8,580
Fringe Benefits					
	Chris Kitting	Academic year release rate = 37%	$1,603		$1,603
		Academic year release rate = 37%		$1,603	$1,603
	John Rees	Adjunct faculty rate = 10%	$2,875		$2,875
	Student Asst.	Student benefit rate = 10%	$1,144		$1,144
	Technical Assist.	Part-time benefit rate = 10%	$858		$858
Subtotal, Salaries, Wages and Benefits:			***$59,582***	***$5,937***	***$65,519***
Other Direct Costs (Task 4)					
	Equipment and supplies		$2,000		$2,000
*	Repairs		$1,500		$1,500

BUDGET - Year One
1/1/98 - 12/31/98

	Transportation Costs	$3,000		$3,000
	Compound and low-power microscopes & camera access	$20,000		$20,000
	Culture facilities	$15,000		$15,000
*	Trailer use for lab space ($600/mo x 4 mo)	$2,400		$2,400
*	Office expenses (phone, fax, copies, etc.)	$3,300		$3,300
	Publication costs	$330		$330
Subtotal, Other Direct Costs		***$47,530***		***$47,530***
Total Direct Costs, Task 4		$107,112	$5,937	$113,049
Indirect Costs (25% of total direct costs)		$26,778	$4,016	$30,794
	CSUH Federal rate is 47% of salaries, wages & benefits.			
	The University will match with the unrecovered IDC.			
		REQUEST	**MATCH**	**TOTAL**
Total, Task 4		**$133,890**	**$9,953**	**$143,843**
		REQUEST	**MATCH**	**TOTAL**
GRAND TOTAL, YEAR ONE		**$431,694**	**$93,589**	**$525,283**
*	*Operations and Maintenance budget item.*			

BUDGET - Year Two
1/1/99 - 12/31/99

TASKS 1 & 2: Pilot and Major Marsh Community Restoration and in-situ Bioassays				
Salaries		**REQUEST**	**MATCH**	**TOTAL**
Chris Kitting	1/3 time x 1 Acad. Year qtr	$7,728		$7,728
($23,185/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$7,728	$7,728
	5/6 time x Summer quarter/overload	$19,320		$19,320
John Rees	1/3 time x 12 months	$30,760		$30,760
($92,281/yr)				
Sam McGinnis	1/3 time x 1 Acad. Year qtr	$7,728		$7,728
($23,185/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$7,728	$7,728
	2/3 time x 2 mo, Summer quarter	$10,304		$10,304
Student Asst.	5 x $10.70/hr x 13 hr/wk x 44 weeks	$30,602		$30,602
Technical Asst.	1 x $16.05/hr x 13 hr/wk x 44 weeks	$9,181		$9,181
Secretarial	1 x $16.05/hr x 13 hr/wk x 44 weeks	$9,181		$9,181
Fringe Benefits				
Chris Kitting	Academic year release rate = 37%	$2,859		$2,859
	Academic year release rate = 37%		$2,859	$2,859
	Summer/overload rate = 10%	$1,932		$1,932
John Rees	Adjunct faculty rate = 10%	$3,076		$3,076
Sam McGinnis	Academic year release rate = 37%	$2,859		$2,859
	Academic year release rate = 37%		$2,859	$2,859
	Summer/overload rate = 10%	$1,030		$1,030
Student Asst.	Student benefit rate = 10%	$3,060		$3,060
Technical Asst.	Part-time benefit rate = 10%	$918		$918
Secretarial	Part-time benefit rate = 10%	$918		$918
Subtotal, Salaries, Wages and Benefits:		***$141,458***	***$21,176***	***$162,634***
Other Direct Costs (Tasks 1&2)				
Equipment and supplies		$3,600		$3,600
* Repairs		$1,500		$1,500
Transportation Costs		$3,000		$3,000
* Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
Plant and animal acquisition		$10,000		$10,000

BUDGET - Year Two
1/1/99 - 12/31/99

*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
	Subtotal, Other Direct Costs		***$24,130***	***$0***	***$24,130***
	Total Direct Costs, Tasks 1&2		$165,588	$21,176	$186,764
	Indirect Costs (25% of total direct costs)		$41,397	$35,041	$76,438
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
	Total, Tasks 1&2		**$206,986**	**$56,217**	**$263,202**
	TASK 3: Improvements in Water Chemistry and Monitoring				
	Salaries		**REQUEST**	**MATCH**	**TOTAL**
	Joy Andrews	1/3 time x 2 Acad. Year quarters	$9,913		$9,913
	($14,869/qtr)	Match: 1/3 time x 2 Acad. Year qtr		$9,913	$9,913
		Two Summer months	$9,913		$9,913
	John Rees	1/6 time x 12 months	$15,380		$15,380
	($92,281/yr)				
	Student Assist.	3 x $10.70/hr x 13 hr/wk x 44 weeks	$18,361		$18,361
	Technical Assist.	1 x $16.05/hr x 13 hr/wk x 44 weeks	$9,181		$9,181
	Lab Assist.	$8.56/hr x 10 hr/wk x 44 weeks	$3,766		$3,766
	Fringe Benefits				
	Joy Andrews	Academic year release rate = 37%	$3,668		$3,668
		Academic year release rate = 37%		$3,668	$3,668
		Summer/overload rate = 10%	$991		$991
	John Rees	Adjunct faculty rate = 10%	$1,538		$1,538
	Student Assist.	Student benefit rate = 10%	$1,836		$1,836
	Technical Assist.	Part-time benefit rate = 10%	$918		$918
	Lab Assist.	Student benefit rate = 10%	$377		$377
	Subtotal, Salaries, Wages and Benefits:		***$75,841***	***$13,580***	***$89,422***

BUDGET - Year Two
1/1/99 - 12/31/99

Other Direct Costs (Task 3)					
	Equipment and supplies		$2,000		$2,000
	Transportation Costs		$3,000		$3,000
*	Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
Subtotal, Other Direct Costs			***$11,030***	***$0***	***$11,030***
Total Direct Costs, Task 3			$86,871	$13,580	$100,452
Indirect Costs (25% of total direct costs)			$21,718	$20,310	$42,028
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Task 3			**$108,589**	**$33,891**	**$142,480**
TASK 4: Culture of Filter Feeders					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Chris Kitting	1/10 time x 2 Acad. Year qtr	$4,637		$4,637
	($23,185/qtr.)	Match: 1/10 time x 2 Acad. Year qtr		$4,637	$4,637
	John Rees	1/3 time x 12 months	$30,760		$30,760
	($92,281/yr)				
	Student Asst.	2 x $10.70/hr x 13 hr/wk x 44 weeks	$12,241		$12,241
	Technical Assist.	1 x $16.05/hr x 13 hr/wk x 44 weeks	$9,181		$9,181
Fringe Benefits					
	Chris Kitting	Academic year release rate = 37%	$1,716		$1,716
		Academic year release rate = 37%		$1,716	$1,716
	John Rees	Adjunct faculty rate = 10%	$3,076		$3,076
	Student Asst.	Student benefit rate = 10%	$1,224		$1,224
	Technical Assist.	Part-time benefit rate = 10%	$918		$918
Subtotal, Salaries, Wages and Benefits:			***$63,753***	***$6,353***	***$70,105***
Other Direct Costs (Task 4)					
	Equipment and supplies		$2,000		$2,000
*	Repairs		$1,500		$1,500

BUDGET - Year Two
1/1/99 - 12/31/99

	Transportation Costs	$3,000		$3,000
	Culture facilities	$15,000		$15,000
*	Trailer use for lab space ($600/mo x 4 mo)	$2,400		$2,400
*	Office expenses (phone, fax, copies, etc.)	$3,300		$3,300
	Publication costs	$330		$330
Subtotal, Other Direct Costs		***$27,530***		***$27,530***
Total Direct Costs, Task 4		$91,283	$6,353	$97,635
Indirect Costs (25% of total direct costs)		$22,821	$10,129	$32,949
	CSUH Federal rate is 47% of salaries, wages & benefits.			
	The University will match with the unrecovered IDC.			
		REQUEST	**MATCH**	**TOTAL**
Total, Task 4		**$114,103**	**$16,482**	**$130,585**
		REQUEST	**MATCH**	**TOTAL**
GRAND TOTAL, YEAR TWO		**$429,678**	**$106,589**	**$536,267**
*	*Operations and Maintenance budget item.*			

BUDGET - Year Three
1/1/00 - 12/31/00

TASKS 1 & 2: Pilot and Major Marsh Community Restoration and in-situ Bioassays				
Salaries		REQUEST	MATCH	TOTAL
Chris Kitting	1/3 time x 1 Acad. Year qtr	$8,269		$8,269
($24,808/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$8,269	$8,269
	5/6 time x Summer quarter/overload	$20,673		$20,673
John Rees	1/3 time x 12 months	$32,914		$32,914
($98,741/yr)				
Sam McGinnis	1/3 time x 1 Acad. Year qtr	$8,269		$8,269
($24,808/qtr.)	Match: 1/3 time x 1 Acad. Year qtr		$8,269	$8,269
	2/3 time x 2 mo, Summer quarter	$11,026		$11,026
Student Asst.	5 x $11.45/hr x 13 hr/wk x 44 weeks	$32,747		$32,747
Technical Asst.	1 x $17.17/hr x 13 hr/wk x 44 weeks	$9,821		$9,821
Secretarial	1 x $17.17/hr x 13 hr/wk x 44 weeks	$9,821		$9,821
Fringe Benefits				
Chris Kitting	Academic year release rate = 37%	$3,060		$3,060
	Academic year release rate = 37%		$3,060	$3,060
	Summer/overload rate = 10%	$2,067		$2,067
John Rees	Adjunct faculty rate = 10%	$3,291		$3,291
Sam McGinnis	Academic year release rate = 37%	$3,060		$3,060
	Academic year release rate = 37%		$3,060	$3,060
	Summer/overload rate = 10%	$1,103		$1,103
Student Asst.	Student benefit rate = 10%	$3,275		$3,275
Technical Asst.	Part-time benefit rate = 10%	$982		$982
Secretarial	Part-time benefit rate = 10%	$982		$982
Subtotal, Salaries, Wages and Benefits:		***$151,360***	***$22,658***	***$174,018***
Other Direct Costs (Tasks 1&2)				
Equipment and supplies		$3,600		$3,600
* Repairs		$1,500		$1,500
Transportation Costs		$3,000		$3,000
* Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
Plant and animal acquisition		$10,000		$10,000

BUDGET - Year Three
1/1/00 - 12/31/00

*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
Subtotal, Other Direct Costs			***$24,130***	***$0***	***$24,130***
Total Direct Costs, Tasks 1&2			$175,490	$22,658	$198,148
Indirect Costs (25% of total direct costs)			$43,872	$37,916	$81,788
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Tasks 1&2			**$219,362**	**$60,574**	**$279,936**
TASK 3: Improvements in Water Chemistry and Monitoring					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Joy Andrews	1/3 time x 2 Acad. Year quarters	$10,607		$10,607
	($15,910/qtr)	Match: 1/3 time x 2 Acad. Year qtr		$10,607	$10,607
		Two Summer months	$10,607		$10,607
	John Rees	1/6 time x 12 months	$16,457		$16,457
	($98,741/yr)				
	Student Assist.	3 x $11.45/hr x 13 hr/wk x 44 weeks	$19,648		$19,648
	Technical Assist.	1 x $17.17/hr x 13 hr/wk x 44 weeks	$9,821		$9,821
	Lab Assist.	$9.16/hr x 10 hr/wk x 44 weeks	$4,030		$4,030
Fringe Benefits					
	Joy Andrews	Academic year release rate = 37%	$3,924		$3,924
		Academic year release rate = 37%		$3,924	$3,924
		Summer/overload rate = 10%	$1,061		$1,061
	John Rees	Adjunct faculty rate = 10%	$1,646		$1,646
	Student Assist.	Student benefit rate = 10%	$1,965		$1,965
	Technical Assist.	Part-time benefit rate = 10%	$982		$982
	Lab Assist.	Student benefit rate = 10%	$403		$403
Subtotal, Salaries, Wages and Benefits:			***$81,151***	***$14,531***	***$95,682***

BUDGET - Year Three
1/1/00 - 12/31/00

Other Direct Costs (Task 3)					
	Equipment and supplies		$2,000		$2,000
	Transportation Costs		$3,000		$3,000
*	Trailer use for lab space ($600/mo x 4 mo)		$2,400		$2,400
*	Office expenses (phone, fax, copies, etc.)		$3,300		$3,300
	Publication costs		$330		$330
Subtotal, Other Direct Costs			***$11,030***	***$0***	***$11,030***
Total Direct Costs, Task 3			$92,181	$14,531	$106,712
Indirect Costs (25% of total direct costs)			$23,045	$21,925	$44,971
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Task 3			**$115,226**	**$36,456**	**$151,682**
TASK 4: Culture of Filter Feeders					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Chris Kitting	1/10 time x 2 Acad. Year qtr	$4,962		$4,962
	($24,808/qtr.)	Match: 1/10 time x 2 Acad. Year qtr		$4,637	$4,637
	John Rees	1/3 time x 12 months	$32,914		$32,914
	($98,741/yr)				
	Student Asst.	2 x $11.45/hr x 13 hr/wk x 44 weeks	$13,099		$13,099
	Technical Assist.	1 x $17.17/hr x 13 hr/wk x 44 weeks	$9,821		$9,821
Fringe Benefits					
	Chris Kitting	Academic year release rate = 37%	$1,836		$1,836
		Academic year release rate = 37%		$1,716	$1,716
	John Rees	Adjunct faculty rate = 10%	$3,291		$3,291
	Student Asst.	Student benefit rate = 10%	$1,310		$1,310
	Technical Assist.	Part-time benefit rate = 10%	$982		$982
Subtotal, Salaries, Wages and Benefits:			***$68,214***	***$6,353***	***$74,567***
Other Direct Costs (Task 4)					
	Equipment and supplies		$2,000		$2,000
*	Repairs		$1,500		$1,500

BUDGET - Year Three
1/1/00 - 12/31/00

	Transportation Costs	$3,000		$3,000
	Culture facilities	$15,000		$15,000
*	Trailer use for lab space ($600/mo x 4 mo)	$2,400		$2,400
*	*Office expenses (phone, fax, copies, etc.)*	$3,300		$3,300
	Publication costs	$330		$330
Subtotal, Other Direct Costs		***$27,530***		***$27,530***
Total Direct Costs, Task 4		$95,744	$6,353	$102,097
Indirect Costs (25% of total direct costs)		$23,936	$11,110	$35,047
	CSUH Federal rate is 47% of salaries, wages & benefits.			
	The University will match with the unrecovered IDC.			
		REQUEST	**MATCH**	**TOTAL**
Total, Task 4		**$119,681**	**$17,463**	**$137,144**
		REQUEST	**MATCH**	**TOTAL**
GRAND TOTAL, YEAR THREE		**$454,269**	**$114,493**	**$568,762**
*	*Operations and Maintenance budget item.*			

SUMMARY BUDGET
1/1/98 - 12/31/00

TASKS 1 & 2: *Pilot and Major Marsh Community Restoration*					
		and in-situ Bioassays			
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Chris Kitting	Academic year request	$23,220		$23,220
		Academic year match		$23,220	$23,220
		Summer/overload request	$58,049		$58,049
	John Rees	Calendar year request	$92,422		$92,422
	Sam McGinnis	Academic year request	$23,220		$23,220
	($24,808/qtr.)	Academic year match		$23,220	$23,220
		Summer/overload request	$30,960		$30,960
	Student Asst.		$91,949		$91,949
	Technical Asst.		$27,582		$27,582
	Secretarial		$27,582		$27,582
Fringe Benefits					
	Chris Kitting	Academic year release rate = 37%	$8,592		$8,592
		Academic year release rate = 37%		$8,592	$8,592
		Summer/overload rate = 10%	$5,805		$5,805
	John Rees	Adjunct faculty rate = 10%	$9,242		$9,242
	Sam McGinnis	Academic year release rate = 37%	$8,592		$8,592
		Academic year release rate = 37%		$8,592	$8,592
		Summer/overload rate = 10%	$3,096		$3,096
	Student Asst.	Student benefit rate = 10%	$9,195		$9,195
	Technical Asst.	Part-time benefit rate = 10%	$2,758		$2,758
	Secretarial	Part-time benefit rate = 10%	$2,758		$2,758
Subtotal, Salaries, Wages and Benefits:			***$425,022***	***$63,624***	***$488,645***
Other Direct Costs (Tasks 1&2)					
	Equipment and supplies		$10,800		$10,800
*	Repairs		$4,500		$4,500
	Transportation Costs		$9,000		$9,000
*	Trailer use for lab space ($600/mo x 4 mo)		$7,200		$7,200
	Plant and animal acquisition		$30,000		$30,000

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SUMMARY BUDGET
1/1/98 - 12/31/00

*	Office expenses (phone, fax, copies, etc.)		$9,900		$9,900
	Publication costs		$990		$990
Subtotal, Other Direct Costs			***$72,390***	***$0***	***$72,390***
Total Direct Costs, Tasks 1&2			$497,412	$63,624	$561,035
Indirect Costs (25% of total direct costs)			$124,353	$105,310	$229,663
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Tasks 1&2			**$621,765**	**$168,934**	**$790,699**
TASK 3: Improvements in Water Chemistry and Monitoring					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Joy Andrews	Academic year request	$29,783		$29,783
	($15,910/qtr)	Academic year match		$29,783	$29,783
		Summer/overload request	$29,783		$29,783
	John Rees	Calendar year request	$46,211		$46,211
	($98,741/yr)				
	Student Assist.		$55,169		$55,169
	Technical Assist.		$27,582		$27,582
	Lab Assist.		$11,317		$11,317
Fringe Benefits					
	Joy Andrews	Academic year release rate = 37%	$11,020		$11,020
		Academic year release rate = 37%		$11,020	$11,020
		Summer/overload rate = 10%	$2,978		$2,978
	John Rees	Adjunct faculty rate = 10%	$4,621		$4,621
	Student Assist.	Student benefit rate = 10%	$5,517		$5,517
	Technical Assist.	Part-time benefit rate = 10%	$2,758		$2,758
	Lab Assist.	Student benefit rate = 10%	$1,132		$1,132
Subtotal, Salaries, Wages and Benefits:			***$227,872***	***$40,803***	***$268,675***

SUMMARY BUDGET
1/1/98 - 12/31/00

Other Direct Costs (Task 3)					
	Equipment and supplies		$6,000		$6,000
	Transportation Costs		$9,000		$9,000
*	Trailer use for lab space ($600/mo x 4 mo)		$7,200		$7,200
*	Office expenses (phone, fax, copies, etc.)		$9,900		$9,900
	Publication costs		$990		$990
Subtotal, Other Direct Costs			***$33,090***	***$0***	***$33,090***
Total Direct Costs, Task 3			$260,962	$40,803	$301,765
Indirect Costs (25% of total direct costs)			$65,240	$61,037	$126,277
	CSUH Federal rate is 47% of salaries, wages & benefits.				
	The University will match with the unrecovered IDC.				
			REQUEST	**MATCH**	**TOTAL**
Total, Task 3			**$326,202**	**$101,840**	**$428,042**
TASK 4: Culture of Filter Feeders					
Salaries			**REQUEST**	**MATCH**	**TOTAL**
	Chris Kitting	Academic year request	$13,932		$13,932
	($24,808/qtr.)	Academic year match		$13,608	$13,608
	John Rees	Calendar year request	$92,422		$92,422
	($98,741/yr)				
	Student Asst.		$36,780		$36,780
	Technical Assist.		$27,582		$27,582
Fringe Benefits					
	Chris Kitting	Academic yr release rate = 37%	$5,155		$5,155
		Academic yr release rate = 37%		$5,035	$5,035
	John Rees	Adjunct faculty rate = 10%	$9,242		$9,242
	Student Asst.	Student benefit rate = 10%	$3,678		$3,678
	Technical Assist.	Part-time benefit rate = 10%	$2,758		$2,758
Subtotal, Salaries, Wages and Benefits:			***$191,549***	***$18,642***	***$210,191***
Other Direct Costs (Task 4)					
	Equipment and supplies		$6,000		$6,000
*	Repairs		$4,500		$4,500

SUMMARY BUDGET
1/1/98 - 12/31/00

	Transportation Costs	$9,000		$9,000
	Compound and low-power microscopes & camera a	$20,000		$20,000
	Culture facilities	$45,000		$45,000
*	Trailer use for lab space ($600/mo x 4 mo)	$7,200		$7,200
*	Office expenses (phone, fax, copies, etc.)	$9,900		$9,900
	Publication costs	$990		$990
Subtotal, Other Direct Costs		***$102,590***		***$102,590***
Total Direct Costs, Task 4		$294,139	$18,642	$312,781
Indirect Costs (25% of total direct costs)		$73,535	$25,255	$98,790
	CSUH Federal rate is 47% of salaries, wages & benefits.			
	The University will match with the unrecovered IDC.			
		REQUEST	**MATCH**	**TOTAL**
Total, Task 4		**$367,674**	**$43,898**	**$411,571**
		REQUEST	**MATCH**	**TOTAL**
GRAND TOTAL, ENTIRE PROJECT		**$1,315,640**	**$314,672**	**$1,630,312**
*	*Operations and Maintenance budget item.*			

Section V. Applicant Qualifications

Christopher L. Kitting, Ph.D. Professor of Biological Sciences, CSUH

Professor Kitting earned his Biological Sciences Ph.D. in 1979 with a Stanford University Fellowship. His major role in the presently proposed project would be to lead the field sampling, marsh community expansion, and animal monitoring.

Kitting's CSUH program provides non-destructive comparisons of plants and resident animal populations in various bay area shorelines, and the natural importance of particular wetlands habitats. Kitting is an active member of 10 major ecological organizations, and currently serves on scientific panels for several organizations, for reviewing environmental effects on aquatic organisms. His program in Bay Communities previously focused on the Monterey Peninsula, and later, Gulf of Mexico shores. He presents principles of limiting resources with wide recognition in undergraduate and graduate classrooms and laboratories/field exercises, in graduate student supervision, in grant reports, at international research meetings, and in 25 major publications.

Kitting's numerous accomplishments include his appointment to the Board of Directors at the San Francisco Bay National Wildlife Refuge and Program Committee of the Delta Science Center. He also was an invited speaker at three Regional Bay Vegetation Research Workshops, and a 1991 Estuarine Research Federation Symposium on Advances in Ecological Methods. He also provided the key presentation for a Biology Conference for Educators at the California Academy of Sciences. During the past year, he has given invited presentations on marsh restoration at three international ecology conferences. During the past 5 years, his marsh research has been funded primarily through Cal State University, Union Sanitary District ($47,000), National Marine Fisheries Service ($25,000), National Science Foundation programs in Undergraduate Education ($15,000), E Bay Regional Pks Foundation/Delta Science Center ($35,000), and Alameda County Clean Water Program ($100,000). Earlier, he prepared a major habitat restoration at Carmel River Lagoon, with other agencies.

Relevant, recent examples of Kitting's publications: (His grad students recently have published four other major articles.) (1) Kitting, C.L., C.C. Ouverney, and F.Canabal. Small Fishes Concentrated During the First Five Years Outside an Experimental Wastewater Marsh in San Francisco Bay. Proc. Soc.Wetl.Sci.1994. DM Kent and JJ Zentner, Eds. pp. 90-103. (2) Kitting, C.L. 1994. Shallow populations of small fishes in local eelgrass meadow food webs. Alameda Naval Air Station's Natural Resources and Base Closure. Audubon Society, Berkeley, CA pp 65-83. (3) Kitting, C.L. 1996. Comparing naturally occurring population, as field bioassays of environmental health. in D.M. Kent and J. Zentner, Eds. Proc. Soc.Wetl.Sci. II. (80-83) (extended abstr). (4) Kitting, C.L. and D.E. Morse 1997. (in press) Feeding effects of postlarval red abalone, Haliotis rufescens (Mollusca: Gastropoda) on encrusting coralline algae. Molluscan Res. Volume on Abalone Biology. S. Shepherd, Ed. (5) Ouverney, C.C. and C.L. Kitting. (for Bull. Environ.Contam.Toxicol.) Field Bioassays on Common Epibenthic Organisms Near a Treated Wastewater Marsh in South San Francisco Bay. (6) Kitting, C.L. Field bioassays throughout marshes receiving suburban stormwater runoff. (invited for Env. Engineering).

John T. Rees, Adjunct Faculty, Department of Biological Sciences, CSUH

Dr. Rees received his Ph.D. in Zoology at the University of California at Berkeley in 1975, with a research emphasis in laboratory invertebrate culture. He is at present

holds an adjunct appointment at the University of California at Hayward in the Department of Biological Sciences. Dr. Rees has had 20 years experience in general environmental project management, and his career experience has been divided between the public and private sectors. He has had nine years post-doctoral and senior scientist experience in publicly-funded laboratory and field ecological research. Dr. Rees has had applied and basic research experience in general freshwater, estuarine, and marine ecology, ecological field sampling techniques and data analysis, and general water quality issues. He has established and monitored laboratory and experimental field work to ascertain the effects of artificially induced perturbations (such as a decrease in pH) in freshwater laboratory microcosms. He has managed projects for clients in water quality assessment, site assessment and contaminated site remediation technologies, application of NEPA/CEQA regulations, and natural resource and endangered species management. Dr. Rees has experience in interpreting technical environmental regulations and guidelines at the federal, state, and local levels, and in interaction with appropriate environmental regulatory agencies.

Dr. Rees' principal contributions to the project would will be in taking the lead in sponge and other native (and if appropriate, exotic) invertebrate and vertebrate culture for experimentation and transplantation into our constructed field microcosms. He would assist Drs. Kitting and Andrews in monitoring marsh fauna and flora, and in relating these results to the chemical monitoring data.

Selected relevant publications of Dr. Rees:

Rees, J. T. 1997. (1) The life cycle of the hydrozoan *Sarsia vesicularis* n. sp. (Coelenterata; Hydrozoa), and the significance of its colony in hydroid life cycle maintenance. (ms in review) (2) Lyandres, S., J. Meardon, and J. Rees. 1988. Evaluation of membrane processes for the reduction of trace organic contaminants. Env. Progress 8(4): 239-244. (3) Harte, J., D. Levy, and J. T. Rees. 1983. Pelagic diatom populations in lentic freshwater microcosms. Intern. Rev. Gesam. Hydrobiol. 68:255-267. (4) Rees, J.T. 1982. The hydrozoan *Cladonema* in California: a possible introduction from Japan. Pac. Sci. 36:439-444. (5) Rees, J.T. and J. Oldfather. 1980. Small scale mass culture of *Daphnia magna* Straus. Proc. World Maricul. Soc. 11:202-210. (6) Rees, J.T. 1979. Community development in freshwater microcosms. Hydrobiologia 63:(2)113-128

Joy C. Andrews, Assistant Professor, Department of Chemistry, CSUH

Dr. Andrews, an environmental chemist, received her Ph. D. in Biophysical Chemistry at the University of California, Berkeley in 1995, funded by a University Fellowship and a CSU Doctoral Incentive award. She was a Postdoctoral Associate at Lawrence Berkeley National Lab in 1995-1996. Her role in this project will be to monitor the water quality of the restored and control marshes on an ongoing basis.

This year, she received three grants to begin her research at CSUH; from the Research, Scholarship and Creative Activities committee, the Affirmative Action Development Program and the Faculty Development Office. She is also finishing up a National Science Foundation project begun at UC Berkeley. Dr. Andrews has taught water quality courses involving field studies, laboratory analyses and biological remediation at UC Berkeley and CSUH. She is currently supervising several graduate students in water quality analysis projects involving ion chromatography, atomic absorption spectroscopy and x-ray absorption spectroscopy, with studies in biological remediation of heavy metals, especially by plants.

While at LBNL, Dr. Andrews served on the Environmental Safety and Health Committee from 1992-1995, and won an Outstanding Graduate Instructor award in 1990. She has been a member of the American Chemical Society since 1988, with subdivision

memberships in environmental chemistry and biological chemistry. Before entering the academic field she was employed at Environmental Analytical Laboratories in Richmond, CA specializing in heavy metals analysis of water, soil and air samples.

She has co-authored a book on water quality analysis, "The Chemistry of Water" which will be available from University Science Books this fall, as well as 6 papers in leading edge chemistry journals and 2 conference proceedings on the analysis of manganese in plants. She recently chaired a session and presented a paper at the American Chemical Society meeting in April 1997, and has presented papers at 6 other conferences and posters at 6 conferences.

Dr. Samuel M. McGinnis, Professor of Biological Sciences, CSUH
Dr. McGinnis is an ecologist who specializes in the aquatic and terrestrial wildlife and plants of the greater San Francisco Bay Area. He earned his Ph. D. from University of California, Berkeley in 1965, and has conducted courses and supervised graduate research in ichthyology and vertebrate natural history since 1964. His major role in the present project will be in fish sampling and habitat improvements.

His major activities in recent years have centered around endangered and threatened plant and animal species. The majority of this work has been conducted for government agencies such as the U S Fish and Wildlife Service, the California Department of Fish and Game, the California Department of Transportation, the California Department of Parks and Recreation, and the planning departments of San Mateo, Alameda, and Contra Costa Counties. With respect to the latter, he researched and wrote the Plant and Animal Resources section of the Contra Costa County General Plan Conservation Element, 1988.

Dr. McGinnis has conducted field studies and written independent reports or the biological sections of environmental impact reports for over 95 projects since 1979, including over 20 in eastern Contra Costa County. Funded by diverse agencies and clients.

For example, samples of his recent reports in environmental projects from 1993: (1) A survey to determine the status of the California tiger salamander on a proposed land fill expansion site, Fairfield, CA. 1993. A study conducted for Wetlands Associates, San Rafael, CA (2) An evaluation of the lower reach of Tunitas Creek as a viable steelhead parr rearing site and habitat for other special status aquatic species 1993. Conducted for Caltrans, Oakland, CA.

During the past few years, Dr. McGinnis has emphasized the ecology of California red-legged frog and marsh snakes, with several agencies. He has published over three dozen papers, book chapters, and books on a variety of subjects dealing with the ecology of California wildlife. As a professional herpetologist, the majority of these are concerned with the ecology of California lizard and snake species. He also authored Freshwater Fishes of California 1984 - a 316 page book covering all freshwater fish species in California. It discusses the ecology of each species and emphasizes the reduction in native species due to the introduction of exotics, and habitat manipulations which have occurred in this state during the past century. Published by the University of California Press, Berkeley, Ca.

Section VI. Compliance with standard terms and conditions

As an agency, no further appendices apply at this time, as described in Appendix Table D-1 from CALFED.