

**4.5 PSP Cover Sheet (Attach to the front of each proposal)**

Proposal Title: Characterization of Quantity and Quality of Organic Carbon Loading and Transformation Associated with Nontidal Wetlands and Agricultural Drainage

Applicant Name: Municipal Water Quality Investigation Program, DWR

Mailing Address: 1020 Ninth Street, 3rd Floor, Sacramento, California 95814

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Email: dotis@water.ca.gov or pwendt@water.ca.gov

Amount of funding requested: \$ 722,495 for 3 years

Indicate the Topic for which you are applying (check only one box).

- Fish Passage/Fish Screens
- Habitat Restoration
- Local Watershed Stewardship
- Water Quality
- Introduced Species
- Fish Management/Hatchery
- Environmental Education

Does the proposal address a specified Focused Action?  yes  no

What county or counties is the project located in? Yolo/Sacramento

Indicate the geographic area of your proposal (check only one box):

- Sacramento River Mainstem
- Sacramento Trib: \_\_\_\_\_
- San Joaquin River Mainstem
- San Joaquin Trib: \_\_\_\_\_
- Delta: Results applicable to Delta
- East Side Trib: \_\_\_\_\_
- Suisun Marsh and Bay
- North Bay/South Bay: \_\_\_\_\_
- Landscape (entire Bay-Delta watershed)
- Other: Research project located in West Sacramento

Indicate the primary species which the proposal addresses (check all that apply):

- San Joaquin and East-side Delta tributaries fall-run chinook salmon
- Winter-run chinook salmon
- Late-fall run chinook salmon
- Delta smelt
- Splittail
- Green sturgeon
- Migratory birds
- Other: \_\_\_\_\_
- Spring-run chinook salmon
- Fall-run chinook salmon
- Longfin smelt
- Steelhead trout
- Striped bass
- All chinook species
- All anadromous salmonids

Specify the ERP strategic objective and target(s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

See attached page

Indicate the type of applicant (check only one box):

- State agency
- Public/Non-profit joint venture
- Local government/district
- University
- Federal agency
- Non-profit
- Private party
- Other: \_\_\_\_\_

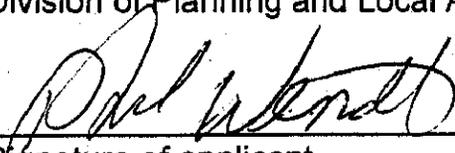
Indicate the type of project (check only one box):

- Planning
- Monitoring
- Research
- Implementation
- Education

By signing below, the applicant declares the following:

- 1.) The truthfulness of all representations in their proposal;
- 2.) The individual signing the form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or organization); and
- 3.) The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

\_\_\_\_\_  
Printed Name of Applicant  
Phil Wendt, Chief  
Water Quality Assessment Branch  
Division of Planning and Local Assistance

  
\_\_\_\_\_  
Signature of applicant

**ERP Goals and Strategic Objectives Addressed by Project:**

Strategic Plan for Ecosystem Restoration (Feb. 1999), Chapter 5. Goals and Objectives (p.27).

Goal # 6:

*Improve and maintain water and sediment quality to eliminate, to the extent possible, toxic impacts on organisms in the system, including humans.*

Objective:

*Reduce the concentrations and loadings of contaminants to levels that do not cause adverse effects in all aquatic environments in the Bay-Delta watershed (Table 5-1).*

Goal #4:

*Protect or restore functional habitat types throughout the watershed for public values such as recreation, scientific research and aesthetics (p.27).*

Objective:

*Increase the area of nontidal perennial aquatic habitat as an integral component of restoring large expanses of all major historical habitat types in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay (Table 5-1).*

April 16, 1999

**April 1999 ERPP Proposal Solicitation Process  
Water Quality Focused Action Proposal:**

**CHARACTERIZATION OF THE QUANTITY AND QUALITY OF  
CARBON LOADING AND TRANSFORMATION ASSOCIATED WITH  
NONTIDAL WETLANDS AND AGRICULTURAL DRAINAGE**

**Primary Contact:**

Dan Otis, Chief, Technical Services, Water Quality Assessment Branch, Division of  
Planning and Local Assistance, Department of Water Resources  
Address: 1020 9<sup>th</sup> Street, 3<sup>rd</sup> Floor, Sacramento, CA 95814  
Phone: (916) 327-1657 FAX (916) 327-1648  
E-mail: dotis@water.ca.gov

**Participants and Collaborators:**

Principle Investigator: Marvin Jung, Consultant to DWR  
Project Manager: Rich Breuer, DWR  
William Nickels, DWR  
David Gonzalez, DWR  
Christopher Huitt, DWR  
Michael Zanolli, DWR

**Organization:**

California Department of Water Resources

**EXECUTIVE SUMMARY:**

One of the basic principals of the CALFED process is that CALFED program actions and alternatives can not have significant third party impacts. CALFED is considering the restoration of about 100,000 acres of wetlands in the Delta (CALFED Draft Programmatic EIS/EIR), and while the ecological benefits of wetlands are already well established, it needs to make every effort to develop the necessary information to determine if this will have a significant impact on drinking water supplies from the Delta, and if so, how this impact can be mitigated through design, placement and operation of restored wetlands. This is reflected in CALFED's February 1999 Proposal Solicitation Package, which includes a Water Quality Focused Action to characterize the quantity and quality of total organic carbon (TOC) loading and transformation associated with tidal and nontidal wetlands, and assess impacts on the foodweb and drinking water quality. This proposal responds to that CALFED Focused Action.

The goal of this study is to provide a tool which can be used by CALFED for evaluating the potential water quality impacts of converting land from agricultural or other use to restored wetlands. In addition, this project will also provide added insight to wetland developers on design and operational characteristics that could minimize impact on drinking source water quality. This goal will be accomplished through characterizing the quantity and quality of organic carbon loading and transformation associated with non-tidal wetlands, and assess impacts on drinking water quality.

While great concern has been expressed by providers of drinking water from the Delta over the possible impacts from restored wetlands, the possibility exists that data gathered from this proposed research may indicate that restored wetlands represent a net benefit for Delta drinking water quality when compared to the agricultural operations they replace. The MWQI program will be using the results of this study and other ongoing monitoring and research it is conducting (including the SMARTS project) to evaluate this potential. The study results may provide information that would eliminate potential conflicts between the ERPP objective of restoring vast areas of wetlands and Water Quality Program objectives for water quality.

This study will be performed at DWR's Sacramento Maintenance Yard located in West Sacramento, which also houses the Bryte Chemical Laboratory, water quality assessment field unit, and SMARTS facility. The study team members were selected on the basis of their skills and experience in designing and conducting similar studies and knowledge of the Delta.

Predominant wetland plants will be cultivated from Delta samples in flow-through mesocosm-type tanks (to simulate a nontidal wetland) and monitored for total organic carbon and dissolved organic carbon (TOC/DOC) production and subsampled for laboratory biodegradation and transformation studies. Delta channel and drain water samples will also undergo monitoring of TOC/DOC degradation/transformation over time. The characterization of degrading TOC/DOC will include measurements of total trihalomethane formation potential (TTHMFP), ultraviolet spectrum wavelength (UV) absorbance, lignin and cellulose content, biological oxygen demand (BOD), and other appropriate indicator parameters. This experiment can be run to test various factors in TOC/DOC production, such as plant density, plant types, waterflow/flooding regimes, and seasonal changes. All of these factors are currently unknown, and the information gained would be useful in designing, locating and managing nontidal wetlands for the purpose of maximizing ecological benefits, while minimizing drinking water quality impacts. The study will extend for three year to cover three growing cycles.

## **PROJECT DESCRIPTION:**

### **Proposed Scope of Work:**

This study will assess the quantity and quality and transformation of organic carbon from newly constructed wetland habitats. In conjunction with other studies,

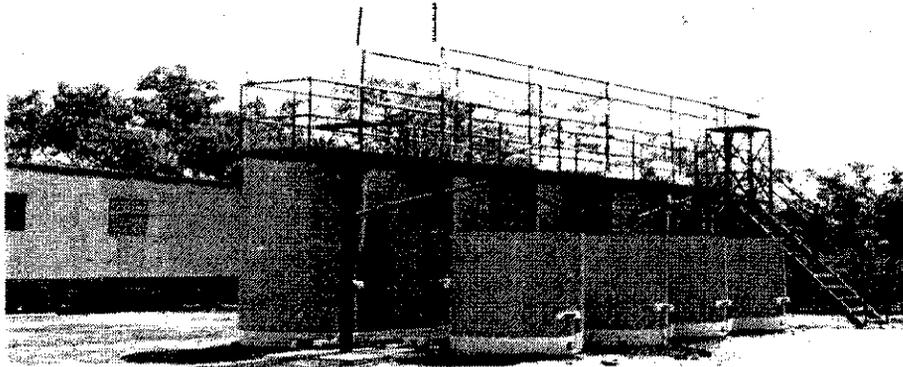
similar information will be obtained on the character and biodegradation of organic carbon in agricultural drain water, urban drainage, and Delta channels. The results will be used to refine DWR's Delta Simulation Model for predicting TOC/DOC distribution in the Delta. This model will be used to help design, operate, and locate wetlands. The goal will be to maximize wetland areas with minimal impact on drinking water quality. Currently, TOC/DOC is modeled as a conservative constituent in the model runs because of the short residence of water moving through the Delta. This assumption may be correct for aged organic matter in agricultural drain water that is discharged into the interior Delta. However, the replacement of organic carbon from drain water by fresh organic matter from wetlands may necessitate biodegradation equations in the model. Fresh organic matter degrades quickly and current model assumptions about TOC/DOC may overestimate their distribution. Information is needed to: (1) model and plan the location and proportion of wetlands to agricultural land use in the Delta, (2) determine if TOC or DOC from wetland and island drainage should be treated as conservative constituents in computer models of the Delta, and (3) compare the quantity and quality of disinfection byproduct precursors in organic carbon from different sources.

Our proposed approach is to answer these questions:

1. Can wetlands be designed, located and operated to minimize impacts on drinking water?
2. Is the quantity and quality (i.e., the reactivity to form disinfection byproducts) of organic carbon from wetlands similar to that of agricultural drainage?
3. Do restored wetlands represent a potential benefit to drinking water quality when compared to the agricultural drainage they replace?
4. What is the biodegradation rate and precursor potential of decaying wetland plant matter as compared to drainage from peat soil?
5. Can we alter the quantity and quality of organic carbon produced by wetlands by establishing different wetland plants or will the biodegraded compounds be the same regardless of origin?

Previous studies and monitoring by the DWR Municipal Water Quality Investigations Program (MWQI) have documented the concentrations of TOC/DOC and TTHMFP (trihalomethane formation potential) across the Delta channels and agricultural drainages. Recently, mesocosm experiments on the short-term effects of flooded peat soil environments on water quality, especially organic carbon levels, were completed at the new MWQI SMARTS (Special Multipurpose Applied Research Technology Station) facility.

Mesocosm tanks at DWR SMARTS research facility:



Water depth and water exchange rate were strong factors that affected TOC/DOC concentrations in impounded surface water overlying peat soil in the SMARTS studies. The results provided an estimate of organic carbon mass emissions from shallow flooded peat soil environments. However, the relative contribution of TOC/DOC from wetland plants was not studied. Depending on the operation and character of a wetland, organic carbon from wetland plants could be higher than from peat soil over time. This proposed project focuses on obtaining information to develop the management strategies to meet the goals of the CALFED ecosystem restoration plan and water quality objectives.

This study will be performed at the DWR Bryte Yard facility that houses the chemical laboratory, water quality assessment field unit, and SMARTS facility. The study team members were selected on the basis of their skills and experience in designing and conducting similar studies and knowledge of the Delta.

The study will include field sampling and mesocosm-type studies for comparison. Predominant wetland plants will be cultivated from Delta samples in tanks and monitored for TOC/DOC production and subsampled for laboratory biodegradation studies. Delta channel and drain water samples will also undergo monitoring of TOC/DOC degradation over time. A high sensitivity computerized respirometer will be used to measure gas consumption (e.g., oxygen, carbon dioxide) and production in the biodegradation and BOD experiments. The characterization of degrading TOC/DOC will include TTHMFP, UV absorbance, lignin and cellulose content, BOD, and other appropriate indicator parameters. The study will extend for three years.

The existing MWQI Advisory Committee (consisting of individuals with water quality expertise from various State Water Contractors, EPA, DHS, SWRCB, and other groups), as well as staff from other agencies, including scientists with expertise in wetland development and management, will provide external scientific review and

oversight for this study, and to critique and provide recommendations for improvements. Input will be obtained prior to commencement of any data collection, as well as during and at completion of the study.

A summary table of the phases and major tasks, duration, and milestones are shown below in the table.

**Table 1. Summary and Schedule of Tasks**

Phase and Tasks	Description	Duration (Approximate months)	Milestones
1.A. Wetland Plants - Field	Identify predominant wetland plants in Delta from USGS studies. Literature review on plant life cycle, requirements, and culturing.	1.5 months	Obtained ranking of predominant wetland plant species based on wetland type and age. Obtained information on plant requirements and tolerances.
1.B. Wetland Plants - Mesocosm	Obtain and culture wetland plants. Design and construct tank mesocosms. Conduct monthly monitoring of TOC, etc.	39 months (3 months prep; 36 months sampling) <u>concurrent</u> with Phase 2.A and 2. B.	Obtained monthly estimates of TOC and TTHMFP loads from predominant wetland plants based on species and planted density.
2.A. Biodegradation - Characterization (Field Samples)	Collect and run biodegradation experiments and characterization analyses on samples from the Delta	39 months (3 months equipment procurement; 36 months sampling) <u>concurrent</u> with Phase 1.B. and 2.A.	Obtained data to compare lab experimental results to field.

2.B. Biodegradation - Characterization (Lab Experiments)	Run biodegradation experiments and characterization analyses on cultured wetland plants	39 months (3 months equipment procurement; 36 months sampling) <u>concurrent</u> with Phase 1.A. and 2.A.	Obtained monthly biodegradation rates for computer simulation of wetland plant degradation and organic carbon of different origins.
3.A. Model Wetland Simulation Scenarios - Input Data	Develop hypothetical wetland designs, operations, and location scenarios. Discuss with peer review panel and ecologists on ecological needs of wetlands.	4 months (data analysis)	Report on candidate wetland designs and locations in the Delta for computer model simulations.
3.B. Model Delta Wetland Alternatives **	Run DWRSIM model with wetland scenarios and applicable TOC/DOC biodegradation equations.**	2 months**	Modeled results of wetland impacts on drinking water quality.**
Project Management	Oversight, coordination of resources, budget tracking	Duration of study	
External Scientific Review and Oversight	Critique study and provide recommendations for improvement	Duration of study	

\*\* (This task funded separately by MWQI Program)

**Location of Project:**

The study will be located at the DWR Bryte Yard in the West Sacramento area (Yolo County). The study facilities will be located totally on DWR property, adjacent to the MWQI Field Support office headquarters, DWR chemical laboratory and the SMARTS research facility.

## ECOLOGICAL/BIOLOGICAL BENEFITS:

### **Ecological/Biological Objectives:**

The ecological benefits of restored wetlands are unquestioned, and CALFED has plans to restore about 100,000 acres of wetlands in the Delta (CALFED Draft Programmatic EIS/EIR). While Delta agricultural drainage water quality has been well characterized, the amounts and types of organic carbon produced by wetlands in the Delta is relatively unknown. Because of this lack of knowledge, the drinking water quality impacts of replacing large acreages of ag land with wetlands are unknown, and need to be assessed. This need is reinforced by CALFED's basic principal that its program actions and alternatives can not have significant third party or redirected impacts. CALFED must make every effort to develop the necessary information to determine if large scale wetlands restoration will have a significant impact on drinking water supplies from the Delta, and if so, how this impact can be mitigated through design, operation and placement of restored wetlands.

This project will use a mesocosm and laboratory approach in attempting to answer critical water quality questions related to wetlands restoration. The mesocosm approach is being used instead of field studies in order to provide a controlled environment that can be manipulated to provide data needed to assess the water quality impacts of nontidal wetlands. The large number of variables and fluxes in the natural environment would make it very difficult to measure actual wetland-related changes in water quality in a field study of this type. However, this study will compliment studies being proposed by USGS to study similar wetland functions in a small constructed wetland in the Delta. The DWR study will provide a broader range of operational characteristics, and will also provide comparative results to better bracket DOC transformation characteristics in constructed wetlands.

While great concern has been expressed by providers of drinking water from the Delta over the possible impacts from restored wetlands, the possibility exists that data gathered from this proposed research may indicate that restored wetlands represent a net benefit for Delta drinking water quality when compared to the agricultural operations they replace. The MWQI program will be using the results of this study and other ongoing monitoring and research it is conducting (including the SMARTS project) to evaluate this potential.

The questions to be evaluated through this project are:

1. Can wetlands be designed, located and operated to minimize impacts on drinking water?
2. Is the quantity and quality (i.e., the reactivity to form disinfection byproducts) of organic carbon from wetlands similar to that of agricultural drainage?

3. Do restored wetlands represent a potential benefit to drinking water quality when compared to the agricultural drainage they replace?
4. What is the biodegradation rate and precursor potential of decaying wetland plant matter as compared to drainage from peat soil?
5. Can we alter the quantity and quality of organic carbon produced by wetlands by establishing different wetland plants or will the biodegraded compounds be the same regardless of origin?

#### **Linkages:**

DWR has been conducting mesocosm experiments at the new SMARTS facility on the effects of flooding peat soil on the quality of impounded water. The experiments examine organic carbon releases from peat soil only and how water depth and water exchange are factors. These studies show that significant concentrations of DOC are generated from flooded peat soil, and preliminary results from this study also track well with results from field investigations conducted jointly by DWR and USGS and others. This proposal would supplement the work by examining organic carbon from wetland plants.

DWR continues to monitor monthly water quality changes in the Delta channels and some agricultural drains. Samples from some of these locations will be tested to compare laboratory biodegradation experiment results to those of field samples.

This study also is tied to the study being proposed for CALFED funding by USGS in which they will be conducting field studies on land uses (including tidal and nontidal wetlands), similar to those proposed in this study (which is using controlled mesocosm experiments). These two approaches are complementary and data and results will be shared between the two projects where possible.

Work is also underway to model CALFED options such as reducing organic carbon loads in drainage by treatment. The SMARTS experiments in combination with this proposed study will provide guidance for designing, constructing, and operating wetlands in the Delta so as to not impair drinking water quality. The results of this proposal will lead to modeling simulated wetland management and location schemes in the Delta and their impact on TOC/DOC at the water supply intakes. This effort addresses ERP Stage 1 Actions listed under Water Quality and subitem 12 (page 99 Draft Implementation Plan, CALFED Phase II Report, 12/18/98).

#### **ERP Goals and Strategic Objectives Addressed by Project:**

(From Strategic Plan for Ecosystem Restoration (Feb. 1999), Chapter 5. Goals and Objectives (p. 27)):

**Goal # 6:**

*Improve and maintain water and sediment quality to eliminate, to the extent possible, toxic impacts on organisms in the system, including humans (p. 27).*

**Objective:**

*Reduce the concentrations and loadings of contaminants to levels that do not cause adverse effects in all aquatic environments in the Bay-Delta watershed (Table 5-1).*

**Goal #4:**

*Protect or restore functional habitat types throughout the watershed for public values such as recreation, scientific research and aesthetics (p. 27).*

**Objective:**

*Increase the area of nontidal perennial aquatic habitat as an integral component of restoring large expanses of all major historical habitat types in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay (Table 5-1).*

**Compatibility with Non-Ecosystem Objectives:**

This study will provide benefits to non-ecosystem objectives, specifically those of the Water Quality Program, by providing critical information on the potential for drinking water quality benefits associated with the ERPP objectives for wetlands restoration.

This proposed study will provide information needed for CALFED's adaptive management process as related to its wetlands restoration goals. The results of this study should provide a tool for CALFED to use in designing, locating and managing restored wetlands to maximize ecological benefits while minimizing impacts on drinking water quality. This study also directly responds to the Water Quality Focused Actions described in the ERPP 2/99 PSP.

**TECHNICAL FEASIBILITY AND TIMING:**

CEQA/NEPA and analysis of alternatives are not applicable to this study, since it does not involve implementation of construction projects. The study will be located at the DWR Bryte Yard, adjacent to the existing SMARTS research facility. There are no county zoning or planning ordinances that would constrain the study.

**MONITORING AND DATA COLLECTION METHODOLOGY:**

The hypotheses to be tested are:

- Total and dissolved organic carbon concentrations in the Delta can be treated as conservative constituents in computer models and water quality assessments because biodegradation is slow relative to the residence time of Delta water and

organic carbon in the Delta.

- The disinfection byproduct potentials of organic matter of different origins (ag vs. wetlands) are similar.
- There are no significant differences due to compositional transformations as to effect the TTHMFP concentration of organic matter.

Predominant plants growing in different wetlands in the Delta, that are being studied by the USGS (Simenstad, Cloern), will be identified, collected, and cultured in mesocosm tanks at the DWR SMARTS facility at Bryte. Water and decaying plant samples will be analyzed. Measurements of temporal changes of organic carbon include specific UV absorbance at multiple wavelengths, biodegradation rate, total trihalomethane formation potential, cellulose to lignin ratios, biochemical oxygen demand, and other appropriate analyses. Simulated conditions for conducting the experiments (e.g. biodegradation incubation) will be based on field water quality measurements (e.g., EC, water temperature, pH, dissolved oxygen) in the Delta. Water and plant samples from the Delta and in the mesocosm simulations will be tested each month to study different environmental and changing seasonal conditions and sources of organic carbon. For comparison, different sources of organic carbon collected under the DWR MWQI Program, such as agricultural and urban drainage and water upstream of the Delta, will also undergo the same measurements and testing. Ongoing experiments at the MWQI SMARTS facility will provide information on TOC/DOC from peat soil porewater and impounded surface water. An analysis of variance (ANOVA) statistical procedure will be used to test the hypotheses. A peer review panel of outside university and agency experts in biodegradation and wetland studies will be established for study plan design and data evaluation. The complete sample matrix will include TOC/DOC from: interior Delta channel waters, upstream river water (Hood), Delta wetland sources, different wetland and riparian plants, peat soil porewater (SMARTS), impounded surface water overlying peat soil (SMARTS), Delta agricultural drain water (MWQI), and urban drainage (MWQI - Natomas East Main Drainage Canal).

This is a three-year study with 3 – 6 months preparation time prior to beginning the monthly experiments. The monthly measurements will run for three years, followed by a six-month period for data analysis, peer review, and report writing.

**Table 2. Monitoring and Data Collection Information**

**Objective:** To refine assumptions in computer models on the behavior of TOC/DOC from different sources discharged into the Delta so as to improve predictions on the fate of organic matter from wetlands and other sources. This will provide guidance in the design of wetland management and placement strategies that will not impair drinking water quality.

Hypotheses/ Questions	Data Collection Approach	Data Evaluation Approach	Comments/ Data Priority
What is the load of TOC/DOC and TTHMFP from different wetland plants over time?	Identify, collect, and cultivate predominant Delta wetland plants in mesocosm tanks. Conduct mesocosm and laboratory biodegradation (respirometer) measurements.	ANOVA of measured parameters (TOC/DOC, UVA, BOD, etc.). Weekly samples. Peer review.	Delta wetland plants information will come from USGS wetland studies.
Are there significant differences in the character of TOC/DOC of different origins?	Collect and compare Delta water samples (channel, drainage, wetland) and from mesocosm tanks and run biodegradation experiments.	Measurements range from few hours to monthly. ANOVA of measured parameters. Peer review.	Non-wetland plant samples collected by DWR MWQI Delta monitoring.
What combinations of wetland plant species and plant density are best for not elevating TOC/DOC in Delta waters?	Tabulate the TOC/DOC and TTHMFP results from the plants in the mesocosm tanks.	Rank the data. Develop wetland plant scenarios for computer simulation.	Monthly biodegradation rates and predicted mass loads of carbon from wetlands will serve as input to DWRSIM runs.

**LOCAL INVOLVEMENT:**

This study will be situated entirely within the DWR Maintenance Yard located in the West Sacramento area. It will be on DWR property, adjacent to the existing SMARTS research facility. This is a mesocosm-scale research study, and not an "on

the ground" implementation project. Coordination with county or local groups is not applicable to this type of study. There are no affected landowners, and no potential third party impacts from this study.

As required by CALFED's proposal solicitation process, we have submitted letters to the Yolo County Board of Supervisors and the Yolo County Planning Commission (copies attached).

**COST:**

**Table 3. Total Budget (CALFED funds only)**

Task	Direct Salary & Benefits	Service Contracts	Materials	Misc. & Other Direct	Overhead & Indirect Costs <sup>1</sup>	Total Cost
<u>Project Mgmt.(DWR)</u>	37,908	<u>26,250</u>				64,158
<u>Literature Review</u>	2,636	8,750				11,386
<u>Select/Procure Test Plants/Tanks</u>	6,326	2,625	154,500			163,451
<u>Sampling &amp; Analyses</u>	109,005	26,250		255,000 (lab)		390,255
<u>Data Analysis/ Progress Rpts</u>	31,084	21,000				52,084
<u>Modeling</u>	24,081	6,563				30,644
<u>Final Report</u>	3,954	6,563				10,517
<b>Total</b>	<b>214,994</b>	<b><u>98,001</u></b>	<b>154,500</b>	<b>255,000</b>		<b>722,495</b>

<sup>1</sup> DWR-prescribed overhead included: 63.4% on salaries only

At this preliminary stage of the proposal, a quarterly budget would not be realistic to propose. A quarterly budget will be developed if funding for this study is approved.

**Schedule:**

See schedule in "Summary and Schedule of Tasks" in Project Description Section. Due to the relatively small scale of this study, there is minimal potential to incrementally fund or implement the proposed scope of work.

**COST-SHARING:**

This work will be supplemented by portions of DWR's MWQI Program elements

devoted to examining the drinking water impacts of CALFED Delta alternatives. These MWQI Program costs include consultant services (\$ 150,000), SMARTS experiments (\$250,000), Delta computer modeling support (\$75,000/yr), project and database management services (\$50,000/yr), and Delta water quality monitoring (\$320,000/yr).

### APPLICANT QUALIFICATIONS:

Project management for this study will be provided by Dan Otis of DWR. The Principal Investigator will be Marvin Jung, a consultant to the MWQI program. Mr. Jung has extensive, widely acknowledged experience and expertise with regards to water quality issues in the Delta. Management and primary staff will be as follows:

**Marvin Jung** will serve as principal investigator. He has a B.S. in Chemical Oceanography from the University of Washington (1972) and a M.S. degree in Oceanography from the University of Michigan (1973). He is a water quality specialist. Since 1983 he has written over 15 DWR publications on the drinking water quality of Delta water supplies. His work has been the foundation for studies on the impact of Delta island drainage discharges on municipal water supplies. He will direct the scientific and technical portions of the study. He designed DWR's SMARTS (Special Multipurpose Applied Research Technology Station) facility, which is being used to study the effects of flooded peat soil on water quality. He has experience in full-factorial designed experiments, computer modeling simulations, and chemical analyses. In 1991, he received a citation from the DWR Director Kennedy for his Delta island drainage investigation report.

### Pertinent Publications

1999. (DRAFT) A Study of Factors Determining Short-Term Water Quality Changes In Flooded Peat Soil Environments. Report to California Urban Water Agencies and DWR Municipal Water Quality Investigations Program. Draft. March 1999.

1999. Candidate Delta Regions for Treatment to Reduce Organic Carbon Loads. Consultant's Report to the Department of Water Resources Municipal Water Quality Investigations Program. MWQI-CR#2. January 1999.

1998. Delta Island Drainage Volume Estimates 1954-1955 versus 1995-1996. Consultant's Report to the Department of Water Resources Municipal Water Quality Investigations Program.

1994. Five-Year Report of the Municipal Water Quality Investigations Program. Summary and Findings During Five Dry years January 1987-December 1991. November 1994.

1990. Delta Island Drainage Investigation Report of the Interagency Delta Health Aspects Monitoring Program. A Summary of Observations During Consecutive Dry

Year Conditions Water Years 1987 and 1988. June 1990.

**Richard Breuer** - Chief, MWQI, will serve as project manager. (M.S., Plant Protection and Pest Management, UC Davis; B.S., Agronomy, CSU Chico). Program Manager for the MWQI Program with expertise in drinking water quality issues and terrestrial biology. Responsible for supervising and managing program resources and MWQI Unit staff coordination with the MWQI Committee and stakeholders. Expertise and Experience: Agronomy, Integrated Pest Management, Agricultural Chemical Fate in the Environment, GIS, GPS, CEQA/NEPA, FESA, CESA, Terrestrial Biology, Drinking Water Quality Issues and Research. Relevant project experience includes Reduction of Rice Herbicide in the Sacramento River Program (Department of Food and Agriculture/DPR), Land Management and Habitat Planning for Twitchell and Sherman Islands in the Western Sacramento-San Joaquin Delta (DWR), and Impact Evaluation and Mitigation Measures Development for the Interim South Delta Project (DWR).

**Michael Zanolli** (M.S., Environmental Management, University of San Francisco; B.S., Biological Science, California State Polytechnic University, San Luis Obispo). Expertise and Experience: Sampling program design, wastewater and stormwater discharge evaluation, trace metal contamination, data analysis and report writing. Relevant experience includes Mono Basin water quality studies, reconnaissance water quality investigation of Little Holland Tract, and developed a 5-year monitoring program for a constructed wetland project that included sampling water, sediment, and tissues of plants, invertebrates, and fish.

**David Gonzalez**, Chief, Technical Services Section Field Group (B.S., Biology, Eastern Michigan University; B.A., Environmental Studies and Planning, Sonoma State University). Responsible for managing the field unit staff, equipment, and logistics for field work to collect water quality and hydrological samples and data, and coordination with ESO field staff. Expertise and Experience: Management of environmental field monitoring programs, Delta water quality monitoring, analytical laboratory methods, and QA/QC procedures. Liaison between Field Unit and analytical laboratories on issues relating to sampling procedures and analytical methods. Received DWR "Trainer of the Year" Award in recognition of accomplishment for presentation of QA/QC courses.

**Chris Huitt** (candidate M.S. Biology, CSUS 1999; B.S. Conservation biology, CSUS). Plant ecologist with master's thesis work on restoration of native grassland habitat in the delta. Conducts water quality sampling and other related activities for MWQI, including participation in the ongoing SMARTS research project. Responsible for managing the Real-time Total Organic Carbon field monitoring project including the installation and operation of the total organic carbon analyzer, maintaining the water quality field investigations Field and Laboratory Information Management System (FLIMS) database. Expertise and Experience: Real-time Total Organic Carbon program sampling protocol design, conduct field water quality sampling activities for MWQI programs, and manage environmental field monitoring unit database. Relevant experience includes managing Salmonid fisheries monitoring programs (Hanson

Environmental, DFG), managed nesting and fledgling survey for threatened raptor species (UC Davis), and currently developing ecological restoration monitoring protocols for native perennial grassland communities (USFWS).

**William Nickels**, Chief of DWR's Bryte Chemical Laboratory (B.S. Analytical Chemistry, California State University, Sacramento). . Over twenty years of analytical experience on projects and programs involving analysis of surface and ground water. Expertise in water quality analyses of organic carbon, minerals, nutrients and trace metals using Flame AA, Graphite Furnace AA, ICP, ICP/MS, automated flow and organic carbon analyzers.

APR 14 1999

Yolo County of Clerk  
of the Board of Supervisors  
625 Court Street  
Woodland, California 95695-3448

Yolo County of Planning  
and Public Works Department  
625 Court Street  
Woodland, California 95695-3448

Pursuant to the CALFED grant application requirements for its Ecosystem Restoration Program, this letter is to notify you that the California Department of Water Resources plans to submit a request for CALFED grant funding for a research study to be located within the DWR Maintenance Yard located in Bryte. The study will involve a set of tanks with wetland vegetation grown in them to simulate a wetland typical of those found in the Delta region. This will be a small scale project using a few tanks (approximate size 5' by 10') with a low-flow circulating water supply. No hazardous or toxic materials will be used in this small scale study of native wetland plants.

Funding for this project is not assured. If CALFED elects to provide grant funds, you will receive additional notification from CALFED to that effect. In the interim, should you have any questions, please call me at (916) 327-1657.

Sincerely,

**Original Signed by**

Dan Otis, Chief  
Technical Services Section  
Division of Planning and Local Assistance

DOTis:Faye Portman  
c:\work\dotis\yololetter.wpd  
Spell check 4/14/99

# NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 19 (REV. 3-95) FMC

COMPANY NAME

California Department of Water Resources

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

## CERTIFICATION

*I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.*

OFFICIAL'S NAME

Philip Wendt

DATE EXECUTED

4/14/99

EXECUTED IN THE COUNTY OF

Sacramento

PROSPECTIVE CONTRACTOR'S SIGNATURE



PROSPECTIVE CONTRACTOR'S TITLE

Chief, Water Quality Assessment Branch

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

California Department of Water Resources

**STANDARD CLAUSES --  
SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER**

**NOTICE TO ALL BIDDERS:**

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 1896, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-5060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

\_\_\_\_\_ Yes\*                        X   No

\*Attach a copy of your certification approval letter.