San Joaquin River

Low Dissolved Oxygen ***Dissolved Oxygen*** **Provide assistance and incentives to develop and implement BMPs in the San Joaquin River near Stockton** (salmon, delta smelt)

Develop Best Management Practices with information gathered as a result of implementing the following field studies:

Field studies are needed to help support ongoing activities:

a) Quantify and identify the relative contribution of various sources of oxygen-depleting substances or oxygen-depleted water to the oxygen sag in the San Joaquin River.
b) determine the mechanisms that produce the oxygen depletion or oxygen-depleting substances at these sources.
c) evaluate the importance of the channel depression at the mouth of the Turning Basin to the oxygen depletion.
d) compare causes and characteristics of spring and fall oxygen sag.
e) determine 2 and 3 dimensional flow patterns.
f) develop accurate models to determine what substances introduced to the river will produce DO sags downstream and where.
g) identify and test new management strategies.
h) evaluate the effectiveness of current management strategies.

Conduct further detailed modeling studies using mass loading modeling tools.

Provide technical and financial assistance and regulatory incentives for implementing Best Management Practices (BMPs) to control oxygen depletion.

Low Dissolved Oxygen ***Dissolved Oxygen*** **Assist in new physical systems and operational strategies in Stockton** (salmon, delta smelt)

Work in conjunction with the Stockton Regional Wastewater Control Facility and Port of Stockton to develop and test new physical or operational management strategies. Possible management actions include physical mixing or other methods to decrease stratification and increase aeration in the Ship Channel and Turning Basin during periods of low dissolved oxygen, changing effluent discharge location, changing the channel configuration (i.e. filling the hole at the end of the Turning Basin or deepening the main channel), and constructing wetlands to increase treatment of effluent.

The goals of the proposed actions are to: 1) eliminate occurrences of dissolved oxygen concentrations below 5 mg/l throughout the water column; 2) reduce the impairment or blockage of fish migration past Stockton; 3) reduce occurrence of algal blooms; 4) reduce stress to fish due to low dissolved oxygen concentration near Stockton; and 5), eliminate fish kills near Stockton. Performance of all of these measures can be determined by appropriate monitoring programs.

OC Pesticides *OC Pesticides, agriculture runoff* Implement soil conservation efforts to retain OC pesticides on farms

Several conservation practices (either singly or in combination) have proven to be cost-effective methods of achieving significant water quality improvements through reduced tailwater runoff (sediments, pesticides, and nutrients) to water bodies and/or conveyance systems in the area. When combined in a "whole farm plan" as provided by NRCS, additional benefits include reduced electrical energy consumption, improved water conservation, improved water infiltration, and in some cases improved air quality, improved biodiversity and improved crop yields.

OC Pesticides *OC Pesticides, agriculture runoff* Agricultural runoff - water quality stressors

Continued research and technology transfer is needed to respond to increasing concerns related to surface water runoff from agricultural lands and their contribution to water quality stressors in the Sacramento-San Joaquin Delta.

Salinity *Salt* Establish Water Quality Objectives

(maintain lower trophic diversisty)

Water quality objectives are set by the California Regional Water Quality Control Board (CRWQB) to ensure protection of beneficial uses of a surface water. The CRWQCB could use its regulatory authority to establish water quality objectives on the mainstem San Joaquin River in the 130 mile segment that is listed on the CWA 303(d) list as impaired. Should corrective actions not result in achieving those water quality objectives, the CRWQCB could develop total maximum daily load (TMDL) allocations for affected water bodies, which would provide regulatory incentive for implementation of further actions to meet objectives. Use of financial incentives such as grants, low interest loans for drainage reuse, tiered water pricing, and establishment of demonstration projects should be considered. CALFED should support establishment of water quality objectives, development and implementation of BMPs, development of TMDLs (as necessary), and financial incentives for salt control.

Salinity *Salt* Agroforestry (local actions)

(maintain lower trophic diversisty)

Agroforestry has been practiced on several farms in the San Joaquin valley. The Westside Resource Conservation District manages experimental and demonstration projects. State and federal agencies and universities continue to develop and evaluate agroforestry systems. These activities include the management of drainage water, salt harvesting in a solar evaporator, salt processing, solar distillation of drainage water, the selection of trees and plant crops for highly saline conditions, and management of wildlife habitat. DWR, working with other agencies, districts, and growers, is developing agroforestry components. Management schemes are being developed to assess the long-term viability of agroforestry. Research and demonstration projects are focusing on:

- long-term maintenance of soil conditions that ensure growth of trees and halophytes using high salt/boron content drainage water for irrigation.
- identifying any adverse wildlife impacts associated with irrigating agroforestry with drainage water containing selenium and preventing those impacts.
- development of agronomic design and management of agroforestry to improve. evapotranspiration, growth, and sustainability.
- recovery or use and marketability of salts.

Selenium *Selenium* Discharge treatment (refineries) (Smelt, game fish)

Selenium occurs in several different waste streams within the refining process. Due to the different chemistries of each waste stream within a facility and between facilities different treatment processes are needed to obtain the maximum removal efficiency at reasonable costs. These treatments include ion-exchange treatments, Sorbplus treatment (a formulation of aluminum and magnesium), iron co-precipitation, activated alumina treatments, primary waste water treatment plant, and aerobic and anaerobic biochemical treatments.

Delta Waters

Mercury *Mercury* Bioavailable transformation studies - Demythlation studies

Develop and undertake a set of studies of bioavailability and methylation to understand specific geochemical/hydrological factors that contribute to the production of biologically available forms of mercury.

Develop and undertake a set of studies to understand the specific geochemical and hydrologic factors that contribute to demethylation or detoxification of mercury in the watershed.

Identify locations in the watershed with low and high bioavailability.

Develop general and/or specific models of mercury transformation and bioavailability in the watershed.

Mercury *Mercury* Evaluate mercury loading on fish tissue levels

Using new and existing data evaluate wildlife risks throughout the Sacramento-San Joaquin Delta-Estuary due mercury contamination. Identify local versus widespread risks. Consider whether risks require local or widespread remediation efforts. Include evaluation of acceptable levels of mercury in sediment and water.

Pesticides *Pesticides* Develop and implement "BMPs" for agriculture and residential use. (Lower trophic organisms)

Development of Agricultural MPs to keep orchard dormant spray insecticides on farm and out of surface water is just beginning. The work of the DPR, UC Integrated Pest Management, the Registrants, and others have been described below in "Existing Activities". The work of each group is too preliminary at present to ascertain whether any of these might be successfully implemented to reduce diazinon and chlorpyrifos concentrations in surface waters to non-toxic levels. No work has yet begun on evaluating possible irrigation return water pesticide control actions.

Finding diazinon and chlorpyrifos in urban runoff prompted the formation of an Urban Pesticide Committee (UPC). The UPC is an *ad hoc* committee formed to address the issue of toxicity in urban runoff and wastewater treatment plant effluent due to organophosphate insecticides, in particular diazinon and chlorpyrifos. The UPC is composed of staff from the US EPA, the San Francisco Bay and Central Valley Regional Water Quality Control Boards, the Department of Pesticide Regulation, Novartis and Dow Agro Sciences, municipal storm water programs, the Bay Area Stormwater Management Agencies Association, County Agricultural Commissioners, Wastewater treatment plants, the University of California, and Consultants. The members of the UPC are committed to working in partnership with the various stakeholders to develop effective measures to reduce the concentrations of organophosphate insecticides in urban runoff and wastewater treatment plant effluent. Management Practices could be distributed through education and outreach programs. We need to determine whether urban pesticide occurrence is attributable to legal use or illegal abuse of pesticides. Also, to date we have not found the source of chlorpyrifos in the Sacramento River watershed.

E—030771

Pesticides ***Diazinon/Chlorpyrifos*** **Develop Water Quality Objectives** (Lower trophic organisms)

The Regional Water Quality Control Board is in need of developing water quality objectives for Diazinon and Chlorpyrifos to better regulate discharges of these pesticides. Water quality objectives could facilitate treatment of certain waste streams and would serve as CALFED targets (an indicator of success). The water quality objective would be set such that it is protective of lower trophic organisms which are critical in the eco-system food chain.

Drinking Water ***TOC, Nutrients, Salt, Bromide*** **Manage eco restoration projects to minimize adverse impacts on drinking water**

There is the potential that CALFED ecosystem restoration and other habitat restoration projects may cause adverse impacts on drinking water quality, particularly with regard to additional production of TOC seen in natural and created wetlands. We recommend that CALFED locate habitat restoration projects to avoid TOC pollution at intakes. To the extent possible, consideration should be given to constructing restoration projects that yield reduced TOC loadings at intakes. Further research is warranted on this issue. Substantial uncertainty exists concerning TOC production and possible loadings from wetlands restoration, particularly with respect to production of more reactive TOC fractions. Proposals have been developed by USGS and DWR for CALFED funding consideration.

Trace metals ***Trace metals*** **study ecological impacts of trace metals** (lower trophic organisms - bio accumulation in resident fish)

CALFED should participate in studies to better define ecological impacts and spatial and temporal extent of heavy metal pollution. Ecological impact evaluations would be performed under the CALFED Ecosystem Restoration Program, in coordination with the Water Quality Program.

Unknown Toxicity ***Aquatic Toxicity*** **Toxicity Monitoring** (resident and migratory aquatic organisms)

Continue and expand toxicity monitoring to other tributaries and other species of aquatic life.

By definition the problem of unknown toxicity is the existence of data gaps. Where toxicity has been detected, there are several other things that need to be determined before control strategies can be implemented. The specific contaminates must be identified. Once identified, the duration, magnitude and frequency of pollution needs to be determined. Sources and the practices or actions which allow the toxicants to enter receiving waters must also be identified.

There is a lack of knowledge about the ecological impacts of the unknown toxicity that are identified with selected bioassay species. Limited bioassay testing has been done with native species. It has been argued that use of native species is the appropriate toxicity test. It is also realized that there are thousands of native species and that it in different test conditions one species cannot approximate the response of the masses.

Toxicity testing has not been conducted throughout the watershed. To date, the focus has been in the major tributaries and downstream of the major reservoirs.

Unknown Toxicity ***Aquatic Toxicity*** **TIE implementation for toxic samples** (resident and migratory aquatic organisms)

Ideally, when toxicity is detected, a TIE is performed and a causative agent is identified. Once a chemical is identified, it can be monitored in the field to identify its source and to characterize its spatial and temporal distribution. This information, along with concentration data, can be compared to values in the toxicological literature to provide a rough

estimate of ecological risk. This is the process that was used for several of the chemicals that are currently included in CALFED's list of constituents of concern (i.e., diazinon and chlorpyrifos).

CALFED has already approved funding to follow-up on the unknown toxicity observed with fathead minnows and *Selenastrum (algae)*. Activities to address these toxicity events follow the process outlined here.

Determining the chemical(s) responsible for toxicity requires using all the information available. Work would occur simultaneously in all of these areas:

Conduct a Toxicity Identification Evaluation (TIE):
Phase I: Determine the general class or characteristics of the toxicant (Is it a metal or an organic compound, is it volatile, filterable or sublatable)
Phase II : Determine the specific chemical(s)
Phase III : Confirm the chemical(s)
Determine spatial and temporal variability of toxicity
Determine the source of toxicity
Examine land use in the watershed to determine potential contaminants: For example, if agricultural land use: Look at cropping patterns and pesticide/fertilizer application patterns. Work with County agricultural commissioner, DPR, DPR pesticide use reports, farm advisors, pesticide applicators and growers
Consider species sensitivity: This involves looking at the toxicological literature to determine relative toxicity of potential contaminants (seeing if species which is exhibiting toxicity is sensitive to potential contaminants and if it is more sensitive to potential contaminants than species not exhibiting toxicity). This also involves consideration of additivity or synergism of multiple toxicants.
Work with analytical lab: Frequently samples contain compounds below recording limits or contain unknown peaks. Analytical labs can work to lower detection limits and identify unknown spikes. This must be closely coordinated with TIE work.
Consider factors besides contaminants: salts, minerals, physical factors (high TSS), biological factors (pathogens) and that apparent toxicity may be due to a deficiency of a physiologically required element (i.e. poor performance in a very soft water).

Work should begin immediately on determining the cause of toxicity exhibited by the following other species:

Ceriodaphnia toxicity occurs throughout the Central Valley and Delta. Chronic toxicity has been detected over large geographic areas and over several months. The toxicity is detected during critical spawning times and locations. Ceriodaphnia chronic toxicity is commonly detected in water supplies and effluents that originated as ground water. As we begin relying more on ground water supplies it is essential to determine why this water frequently causes chronic toxicity to *Ceriodaphnia*.

Striped Bass toxicity tests conducted during the late 80=s and early 90=s indicated significant toxicity in the Sacramento River. Striped Bass testing should resume during their spawning season at all locations where eggs and larvae occur.

Rainbow Trout embryo larval tests were recently initiated in the Sacramento River Watershed. Acute mortality was observed at locations dominated by urban storm run off. Testing should be resumed and should focus on critical habitats and critical periods for salmonid spawning.

Neomysis has been used as a test species intermittently in the Sacramento River Watershed, the Delta and other freshwater habitats characterized by high conductivity. *Neomysis* is an important food species for larval fish. Testing needs to be resumed.

Cache Creek - Cache Slough - North Delta

(The work is conducted in Cache Creek but has impacts on the delta and provides information for application in other areas)

Mercury ***Mercury*** **Map locations and potential for early remediation** (bio accumulation in resident organisms)

Map locations of mercury mines and mercury prospects.

Map locations of geological sources of mercury, such as springs.

Identify urban inputs of mercury.

Categorize sources based on size, mercury loading, and cleanup potential (both early remediation and full remediation).

Mercury ***Mercury*** **Preliminary remediation to remove total mercury** (bio accumulation in resident organisms)

Conduct remedial activities on those mine sites (or urban sites) that require minor improvements to eliminate large discharges of mercury.

Mercury ***Mercury*** **Bio-accumulation study (indicators)** (bio accumulation in resident organisms)

Develop and undertake a study of mercury bio accumulation. This will require sampling multiple species and trophic levels in aquatic food webs. Identify potential indicator species that show major steps in the entry or accumulation of methyl mercury in food webs. These species may serve as target indicators to follow the effects of remediation

Upper Watershed - Merced, Stanislaus, and Cosumnes

Turbidity and Sedimentation ***Sediment*** **Quantitative analysis of river sediment loads, budgets, sources**

Perform quantitative ecological assessments of the effects of sedimentation on the Merced and Stanislaus Rivers through the CALFED Ecosystem Restoration Program, in coordination with the Water Quality Program

The following scientific needs specific to sediment loading are recommended in the Cosumnes River watershed:
Quantitatively determine Cosumnes River sediment loads, budget, and sources. The USFS study may meet this need.

E—030774