

CALFED DRINKING WATER ACTIONS
Stage 1A
FY 2000-2001

(Summary)

The CALFED objective for drinking water quality is to continuously improve source water quality that allows for municipal water suppliers to deliver safe, reliable, and affordable drinking water that meets, and where feasible, is better than the applicable drinking water standards. The projects proposed for implementation in FY 2000-2001 would begin to implement the CALFED Drinking Water Quality Improvement Strategy, which seeks to reduce the loads and/or impacts of bromide, total organic carbon, pathogens, nutrients, salinity, and turbidity through a combination of measures including source control/reduction, treatment, using alternative sources of water, monitoring and assessment, storage and operations, and conveyance improvements.

Source Control / Reduction. The source control projects proposed for FY 2001 include a combination of studies and actions, which seek to control sources of drinking water pollutants in the Bay-Delta watershed and control sources that may impact water conveyance and storage facilities. Two of the projects are a continuation of projects started in FY 2000—Veale/Byron Tract drainage management and the salinity/selenium removal pilot project. Source control studies proposed to begin in FY 2001 would evaluate sources of organic carbon in the Bay-Delta watershed and recreation impacts on drinking water quality. Proposed source control actions would address source water protection requirements for conveyance facilities, industrial wastewater pretreatment, and watershed management activities in the Sacramento and San Joaquin River watersheds. Funding would be allocated to these projects through a combination of proposal solicitation process and directed actions.

Treatment. The treatment projects proposed for FY 2001 include a combination of bench, pilot and demonstration scale studies to evaluate drinking water treatment technologies. The proposed treatment studies include evaluation of UV disinfection, membranes, disinfection by-product precursor removal methods, bromate control measures and desalination, and evaluation of combinations of treatment strategies. Funding would be allocated to these projects through a proposal solicitation process.

Alternative Sources of Supply. This element of the Drinking Water Quality Improvement Strategy involves blending or water quality exchanges to improve the quality of water delivered to urban drinking water agencies that are dependent on the Delta. The actions proposed for FY 2001 include continuation of the Bay-Area Regional Blending Assessment project started in FY 2000, and initiating prefeasibility studies to evaluate the potential for water quality exchanges between San Joaquin Valley agricultural entities and southern California urban drinking water agencies. Funding would be allocated to these projects through directed actions.

Monitoring and Assessment. Monitoring and assessment activities proposed for FY 2001 seek to provide information and tools that are needed to better understand causes of drinking water quality degradation and to assess changes in drinking water quality as the CALFED Program is implemented. The proposed monitoring and assessment actions include continuation of the Assessment of Sources and Magnitudes of Loads of Drinking Water Constituents of Concern project started in FY 2000, and additional actions to improve analytical methods for detecting pathogens in Delta water and refine water quality modeling tools. Funding would be allocated to these projects through a combination of proposal solicitation process and directed actions.

Operations/Storage/Conveyance. A conveyance project proposed for FY 2001 is to conduct an analysis of the need for and feasibility of constructing an alternative intake for the North Bay Aqueduct. This project would be funded as a directed action. In addition, CALFED is considering changes in water project operations, and evaluating potential storage and conveyance improvements. These activities have the potential to impact or benefit drinking water quality for Delta water supplies. While the focus of these efforts is located outside the CALFED Drinking Water Program, there is a need for close integration between the Drinking Water Program and the water management and conveyance programs in CALFED to ensure that all potential drinking water benefits and/or impacts are fully evaluated and considered in future CALFED decision making.

CALFED DRINKING WATER ACTIONS

(one-pagers)

Stage 1A

FY 2000-2001

The CALFED objective for drinking water is to continuously improve source water quality that allows for municipal water suppliers to deliver safe, reliable, and affordable drinking water that meets, and where feasible, is better than the applicable drinking water standards. The projects identified for implementation in FY 2000-2001 would begin to implement the CALFED Drinking Water Quality Improvement Strategy, which seeks to reduce the loads and/or impacts of bromide, total organic carbon, pathogens, nutrients, salinity, and turbidity through a combination of measures including source control/reduction, treatment, using alternative sources of water, monitoring and research, storage and operations, and conveyance improvements.

SOURCE CONTROL/REDUCTION

Develop Minimum Requirements for the Protection of Drinking Water in Open Water Conveyance Facilities.

1. General Description

This project is a component of the CALFED Program to reduce pathogens and other constituents of concern in drinking water. A number of activities alongside open channels conveying drinking water could introduce pollutants such as salt, organic carbon, and microbials into these drinking water supplies through groundwater seepage and surface runoff from rain events. These activities include farming (in particular dairy operations) and application of recycled water and/or sludge, either for irrigation purpose or for evaporation. Even though the California Department of Health Services imposes a minimum buffer zone of these activities from domestic drinking water wells, the Department currently does not have any requirement or guideline as far as drinking water conveyance facilities are concerned. The purpose of this project is to establish the minimum requirement for the protection of drinking water in open water conveyance facilities. A pilot study to monitor groundwater transport and surface runoff into drinking water canals, for different setback distances and different soil conditions, will be carried out at an existing land discharge site for reclaimed water. The information from this project would be directly applicable to the protection of drinking water conveyed in unlined channels such as the Contra Costa Canal and the Delta-Mendota Canal (its water commingles with State Water Project water in San Luis Reservoir) through better land use management practices.

2. Cost Estimate

Project costs are \$650,000 for FY 2001.

3. Program Administration and Governance

The lead agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Coordination will occur through the DHS, DWR, USBR, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project will start in FY 2001 and will continue into FY 2002.

Evaluation of TOC/DOC Loads from Sources in the Bay-Delta Watershed

1. General Description

One of the drinking water quality parameters of concern is organic carbon, measured as total organic carbon (TOC) or dissolved organic carbon (DOC). The presence of TOC/DOC in drinking water source water is important to characterize because it can impact the ability to comply with drinking water regulations for disinfectants and disinfection by-products at the treatment facilities.

Sources of TOC/DOC in the Sacramento-San Joaquin Delta include agricultural discharges, animal enclosures, treated wastewater effluents, urban runoff, wetlands, and boating activities. However, data that characterize the relative contribution and loads from these sources are very limited. For example, data on drainage volume discharges to Delta channels are based on older studies and limited recent data. Additional measurements of Delta agricultural drainage volume and water quality characteristics are needed to comprehensively evaluate the contributions from agricultural drainage. This action consists of a comprehensive evaluation of the relative contribution (including volume) of TOC/DOC from agricultural discharges, animal enclosures, treated wastewater effluents, urban runoff, and boating activities. Through a comprehensive evaluation of contributions, CALFED will obtain information to help prioritize decisions regarding control and source reduction of TOC/DOC. This action also takes into consideration the development and use of improved Delta flow models to specifically assist with this evaluation.

2. Cost Estimate

The budget for this action is \$2.0 million for FY 2001 and \$2 million each year until FY 2006.

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. The CALFED Program will administer and govern this project.

4. Program Coordination

Coordination will occur with USEPA, USGS, DWR, DHS, DFA, DP&R, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project is to begin in FY 2001 and continue into FY 2006.

Veale/Byron Tract Drainage Management

1. General Description

The primary purpose of this project is to minimize elevated salinity and other constituents of concern to drinking water at urban intakes in the south Delta. Practical methods of reducing the impacts from the major sources will be developed and implemented where possible. Secondary project purposes include concurrent regional environmental water quality improvements, wetland creation, and flood control benefits if compatible with the primary project purpose. The proposed project advances the work funded in FY 2000 and consists of five components: a Regional Hydrology and Water Quality Study, a Water Quality Improvement Alternatives Study, an One-Site Treatment (wetlands) Feasibility Study, preparation of environmental and other regulatory compliance documentation, and construction and implementation of selected components. Establishing the Knightsen Community Services District is included as the first step in studying flood management options of the area.

2. Cost Estimate

Estimated costs are detailed below.

3. Program Administration and Governance

Lead agency is the Contra Costa Water District, with the Contra Costa County, US EPA, and US Army Corps of Engineers as potential co-lead agencies. The CALFED Program will administer and govern this project.

4. Program Coordination

Agencies actively involved include USEPA, USACE, USBR, DHS, DWR, Veale and Byron Tract Reclamation Districts, Contra Costa County, Delta Wetlands, South Delta Water Agency, Knightsen Flood Management District (to be formed), Discovery Bay Development and the CALFED Veale/Byron Tract Work Group consisting of agencies described above and landowners.

5. Schedule – Budget and schedule follows:

Budget

Task description	Schedule		Budget in \$1,000's Appropriated / Total
	Start	Completion	
<i>Component 1. Old River Watershed at the Los Vaqueros intake</i>			
1 <u>Confirm sources of WQ degradation</u>	07/2000	09/2000	30 / 30
a Identify additional information needed to confirm or modify findings in FSI report			
b Install recording device for RD 800 pump operations for comparison with measurements at LV intake			
c Analyze data to confirm RD 800 as cause of WQ degradation, or design new monitoring plan			
2 <u>Determine preferred actions</u>	10/2000	12/2000	20 / 20
- Review options considered in FSI report and its recommendations, determine preferred alternative			

Task description	Schedule		Budget in \$1,000's Appropriated / Total
	Start	Completion	
3 Plan implementation	01/2001	06/2001	150 / 150
a Identify permitting requirements and prepare environmental documentation			
b Design modifications and/or additions to existing discharge facility			
4 Construction	05/2001	09/2001	0 / 750
Subtotal for Component 1			200 / 950
Component 2. Rock Slough Watershed			
1 Quantify sources of degradation			
a Identify sources of degradation	06/2000	08/2000	30 / 30
i Review historical data and summarize current understanding			
ii Identify additional information needed to quantify the magnitude of water quality degradation due to different sources at CCWD's Contra Costa Canal intake off Rock Slough			
b Quantify discharges and seepage	09/2000	03/2001	170 / 170
i Design study plan, including impacts of flood water from the Knightsen area			
ii Collect additional data and/or conduct modeling study			
c Quantify degradation at intake	03/2001	06/2001	30 / 30
i Summarize historical and newly collected data			
ii Estimate water quality degradation at the Rock Slough intake due to different sources under the full range of hydrological conditions			
2 Address flooding and runoff from rain events in the Knightsen area			
a Form Community Services District	05/2000	06/2001	50 / 50
i Execute Work Program for the Town of Knightsen Flood Management. Work Plan attached.			
ii Summarize and update previous flood management plans (lead: Contra Costa County)			
b Analyze potential for wetland creation	05/2000	06/2001	50 / 50
i Review literature on water quality impacts/benefits, consult CALFED ERPP			
ii Identify potential sites and easements required for conveyance of runoffs to the site(s)			
3 Evaluate alternatives for water quality improvement actions at Rock Slough intake			
	07/2001	09/2002	0 / 300
4 Plan implementation	10/2002	09/2003	0 / 400
5 Implementation/Construction	10/2003	09/2005	0 / 8,000
Subtotal for Component 2			330 / 9,030
Component 3. Drainage reduction along Old River between Clifton Court and Franks Tract			
1 Quantify discharges	09/2000	12/2001	14 / 100
2 Evaluate alternatives	01/2004	12/2005	0 / 100
Subtotal for Component 3			14 / 200
Auditing requirement			
Annual auditing by an approved Accounting firm	04/2001	06/2005	6 / 30

Total appropriated: \$550,000.00 Project total: \$10,210,000.00

Demonstration Scale Treatment System to Remove Salt and Selenium from Agricultural Drainage Water

1. General Description

This project consists of developing demonstration scale treatment systems to remove salt and selenium from agricultural drainage water, and demonstration scale salt recovery, purification and utilization systems to address integrated on-farm drainage management and brine disposal issues. The purpose of this project is to improve San Joaquin River water quality, reduce the cost of treating agricultural drainage water high in salts and selenium, and determine the sustainability of integrated on-farm management for drainage water. The proposed project includes: 1) A local, on-site treatment plant will be build and operated to evaluate operations and maintenance issues and salt disposal options; and 2) A regional treatment plant will be designed (to be constructed and operated 2002 – 2007) to evaluate salt disposal and operations and maintenance.

2. Cost Estimate

Funding at \$700K has been provided in FY 2000 to investigate salt removal systems to improve San Joaquin River water quality. The study will involve determining the sustainability of integrated on-farm management. The estimated costs for advancing research and development projects is \$1.0 million for FY 2001 (design) and \$10 million for FY 2002 (operations and maintenance).

3. Program Administration and Governance

Lead agencies for FY 2001 funding and beyond have not been identified. This project will result in a project solicitation proposal. The CALFED Program will administer and govern this project.

4. Program Coordination

Agencies actively involved include the USBR, USEPA, DWR, CVRWQCB, and the CALFED Salinity/Selenium Work Group.

5. Schedule

This action was funded in FY 2000. This new action is scheduled for FY 2001 through FY 2002.

Feasibility Study to Control TDS Loads from Industrial Discharges

1. General Description

An industrial discharger contributes 8 to 15 per cent of the TDS load to a wastewater treatment plant that discharges into the Sacramento River. Although TDS is not a regulated component, the discharger is interested in participating in an evaluation of the feasibility of constructing treatment facilities to reduce this load. If treating this source of TDS proves feasible, the reduction of TDS discharges to the Sacramento River would provide measurable drinking water quality benefits to downstream water users. These benefits would include improved ability of drinking water agencies to recycle water, increased flexibility to blend Delta water with other water supplies thus reducing demand on the Delta, and reduced costs to drinking water consumers.

2. Cost Estimate

The total estimated project cost is in the range of \$2.5 to \$5.2 million.

3. Program Administration and Governance

Lead agency is unknown. This project will be a project solicitation proposal. The CALFED Program will administer and govern this project.

4. Program Coordination

Program coordination will occur with the USEPA, SWRCB, CVRWQCB, SRCSD (includes the County and City of Sacramento, City of Folsom, and City of Citrus Heights), appropriate dischargers and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project is scheduled to start in FY 2001 and continuing into FY 2002.

Watershed Management of Drinking Water Constituents

1. General Description

A focus group should be established to work on drinking water constituents and to initiate activities in the watershed that would improve drinking water quality. This includes a feasibility study to determine cost, benefits, major uncertainties and risks associated with implementation of watershed improvements to reduce constituents of concern in the Sacramento River. There is an existing watershed group for the Sacramento River and tributaries called the Sacramento River Watershed Program. The drinking water constituents focus group would be part of the existing SRWP. The constituents of concern would include TOC, pesticides, heavy metals (including arsenic and copper) of concern in drinking water, TDS, turbidity, and persistent pathogens (*Cryptosporidium*, *Giardia*). Potential projects to be evaluated include river restoration, mining drainage control, and agricultural practices (conversion from flood to drip irrigation).

In addition, there is a need to establish a watershed management program for the San Joaquin River composed of agencies and stakeholders. Such a program could address both drinking water and ecosystem concerns in the San Joaquin River watershed through a well-designed watershed management plan. The SJR Watershed Program should include monitoring of the San Joaquin River for key drinking water parameters and the development of best management practices which are technically feasible and cost effective for landowners to implement.

2. Cost Estimate

The FY 2001 cost estimate for supporting the SRWP focus group efforts to monitor drinking water constituents is \$500,000. The FY 2001 cost estimate for establishing a new San Joaquin Watershed Management Program is \$200,000. The FY 2002 – 2006 costs for monitoring are \$200,000 each year.

3. Program Administration and Governance

The lead agencies for the SRWP focus group are the SRCSD and the CVRWQCB. The lead agency for the new SJR Watershed Management Group is yet to be determined, and this funding may be handled through a proposal solicitation. Administration and governance of the funded programs will be through the CALFED Program.

4. Program Coordination

For the SRWP focus group project, coordination will occur with the existing SRWP Watershed Management Program (which includes numerous agencies and stakeholder groups). For the new SJR Watershed Management Program coordination will occur with DFA, DWR, USACOE, USBR, and appropriate CALFED workgroups.

5. Schedule

Both projects will begin in FY 2001 and continue throughout FY 2006.

Recreational Impacts on Drinking Water Quality in the Delta and Reservoirs

1. General Description

The Delta and reservoirs are designed for multiuse. Two cycle engines are considered major contributors of MTBE, and other fuel contaminants in source waters, particularly in storage reservoirs. Releases of wastewater from boats have also been identified as a problem in the Delta. In addition, body contact recreation may result in pathogen loads in storage reservoirs. CALFED supports the evaluation of methods to manage recreational activities in order to minimize contaminant loading from such activities without causing unacceptable restrictions to recreational uses. A comprehensive source evaluation of contaminants generated from recreational use of drinking water sources and a determination of methods to reduce the impacts of body-contact recreation and recreational boating are needed.

2. Cost Estimate

The cost estimate for FY2001 is \$200,000 continuing at \$200,000 each year thereafter.

3. Program Administration and Governance

Lead agency is unknown. This project will be a project solicitation proposal. The administration and governance of this project will be through the CALFED Program.

4. Program Coordination

Coordination will occur through the DWR, DHS, DPR, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project will begin in FY 2001 and continue through FY 2006.

TREATMENT

Advanced Wastewater Treatment

1. General Description

Filtration of wastewater that is discharged to the Sacramento River would improve the level of public health protection by removing constituents of concern such as organic carbon and pathogens. In addition, filtration is required for water reuse and would serve as a stepping stone to expanding reuse opportunities. Water reuse, in turn, would result in reduced Delta discharges of constituents of drinking water concern, including pesticides and endocrine disruptors. Two proposed studies would provide the information needed to determine the feasibility of projects that would lead to better quality drinking water supplies for downstream users.

A pilot study (predesign) would be conducted to evaluate the cost and water quality benefits of employing multimedia filters and chemical addition for treating wastewater in the Sacramento Valley region.

Industrial chemical contamination of ground water in the Folsom area has the potential to force abandonment of drinking water supply wells in favor of increased reliance on American River water supplies. Apart from causing ecosystem impacts and increasing conflict among Delta water uses, increased surface water diversions would cause adverse effects on the quality of downstream drinking water supplies as a result of reduced fresh water dilution. There is potential to locate a satellite wastewater treatment plant in the Folsom area that would create a new water source for this growing community. Proposed is a detailed analysis to determine the feasibility of locating a satellite plant in this area. The analysis includes groundwater modeling to determine fate and transport of the chemical contaminants of concern.

2. Cost Estimate

The estimated project cost is in the range of \$800,000 to \$1 million for the Pilot Study (predesign) to evaluate the cost and benefits of employing multimedia filters and chemical addition for treating wastewater in the Sacramento Valley region. The planning level project cost estimate for the satellite plant in the Folsom area is about \$52 million. The estimated cost of the proposed feasibility study for the satellite plant is \$600,000. Total cost is \$53, 600,000.

3. Program Administration and Governance

The lead agency is unknown. This will likely be a project solicitation proposal. The CALFED Program will administer and govern the project (s).

6. Program Coordination

Program coordination will occur with the USEPA, SWRCB, CVRWQCB, DHS and the CALFED Drinking Water Constituents Workgroup.

7. Schedule

This project is scheduled to begin in FY 2001 and continuing through to FY 2006.

Pilot Plant Treatment Demonstration Facility

1. General Description

A pilot and full scale treatability study is needed which examines the baseline of water treatment capability to meet existing as well as examine advanced technologies including ozone, UV, and membranes, various combinations, in addition to various process optimization steps. It is important to provide research which examines the entire treatment process and synergistic affects of treatment processes rather than to focus on technologies individually. This study will use ICR and utility data to establish various existing treatment capabilities for a wide variability of water quality conditions encountered in the Delta. Optimization of existing process capability will be examined to maximize existing treatment capability while looking at new technologies.

The study will perform pilot studies with a portable pilot plant at multiple sources for agencies who do not now have research capability however are most vulnerable to decisions in the examination of alternatives in the Delta. The proposed project is scheduled for completion in phases over a three year period. A proactive public and agency information program is also needed to promote confidence in the project and widely disseminate the results and accomplishments.

2. Cost Estimates

Cost estimates for FY 2001 are \$2 million.

3. Program Administration and Governance

Lead agency is unknown. The program would be administered and governed through the CALFED Program.

3. Program Coordination

The agencies that would be actively involved include the USEPA, DHS, drinking water agencies involved in the pilot scale treatment studies, and the CALFED Drinking Water Constituents Workgroup.

4. Schedule

The action will begin in FY 2001 and continue through FY 2003.

Bench, Pilot and Demonstration Scale Facilities to Evaluate Various NOM Removal Techniques

1. General Description

Past research on natural organic matter (NOM) characterization has shown a relationship to disinfection by-product (DBP) formation and control in drinking water. The drinking water industry is required to minimize DBP formation while ensuring adequate disinfection and therefore needs more information on this relationship and ways to remove various types of precursors. Additional work is necessary at the bench, pilot- and demonstration- scale to evaluate various NOM removal techniques for Sacramento/San Joaquin Delta water to minimize DBPs (e.g. trihalomethanes and haloacetic acids). TOC is removed at conventional treatment plants during the coagulation process using either alum or iron salts. Research has shown that coagulation tends to remove the humic and high-molecular-weight (MW) portion of the natural organic matter (NOM). Recent research that has evaluated both Sacramento-San Joaquin Delta and Colorado River Water (CRW) has shown that there are non-humic portions of the NOM that react with disinfectants to form significant amounts of DBPs. Thus, research is needed on innovative alternatives to traditional coagulants to remove the portions of NOM that are not removed by alum or iron salts. There is some information in the scientific literature that suggest that novel polymers that can bind the non-humic material may be able to enhance NOM removal at a conventional treatment plant, which may be much more cost effective than installing advanced precursor removal technologies. A project is needed to evaluate such alternative coagulants at a bench-, pilot-, and demonstration-scale.

2. Cost Estimates

Expected cost is \$500,000 for FY 2001.

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. The project will be administered and governed through the CALFED Program.

5. Program Coordination

Agencies actively involved include the USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

6. Schedule

Bench scale project begins in FY 2001, followed by pilot scale in FY 2003, and demonstration scale in FY 2005.

Pilot Scale Facility to Evaluate Removal of N-Nitrosodimethylamine

1. General Description

This is a multi-faceted project consisting of three parts – analytical methods development, development of treatment control techniques, and demonstration testing.

Detection of N-nitrosodimethylamine (NDMA) by the California Department of Health Services (CDHS) in systems receiving surface water in California has been reported recently. NDMA is an organic chemical that has been shown to cause cancer in laboratory-test animals and has been identified by the U.S. Environmental Protection Agency as a probable human carcinogen. NDMA occurrence has usually been associated with groundwater contamination associated with liquid rocket fuel. Because the formation mechanism in surface water is unknown, CDHS has temporarily increased the action level from 2 to 20 parts-per-trillion to provide time for occurrence, treatment chemical, and treatment process investigations. One cause is suspected to be nitrogen-containing organic precursors reacting with very low levels of nitrite during treatment. Work is needed at the pilot-scale to evaluate removal of these possible precursors from Sacramento/San Joaquin Delta water cost effectively. Agriculture drains in the Delta could be sources of NDMA precursors.

Additionally, methods development to improve the low-level analytical method for NDMA (nanogram per liter detection is required) and for detecting organic and inorganic nitrogen in drinking water is needed. The removal of organic nitrogen from drinking water is an area that is traditionally not studied. A wide range of control options need to be preliminarily explored at the bench- and/or pilot-scale. The most promising techniques need to be demo testing. State project water users would benefit by being able to provide water to the consumers that would meet a possibly more stringent standards.

2. Cost Estimate

The expected cost of this project is 750,000.

3. Program Administration and Governance

The lead agency is unknown. This will be a project solicitation proposal. The project would be administered and governed by the CALFED Program.

4. Program Coordination

Program coordination would occur with the following entities: USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

The project would begin in FY 2001 and end in FY 2004.

Bench , Pilot and Demonstration Scale Facilities to Test Innovative Resins for Removal of TOC

1. General Description

Granular activated carbon (GAC) is a costly means of removing TOC. Moreover, TOC breakthrough in either Delta water or Colorado River water occurs quickly. Research by Summers and colleagues has shown that certain resins placed upstream of GAC can significantly improve TOC removal in waters not that amenable to GAC treatment. Recent bench-scale studies have evaluated certain resins as stand-alone sorbents for the removal of TOC in Delta water and CRW. **Additional bench-scale work is needed to evaluate other promising resins. Pilot- and demo-scale testing of innovative resins for the removal of TOC are needed.** Issues such as regeneration frequency for the resins must be included.

2. Expected cost is \$500,000.

3. Program Administration and Governance

The lead agency is unknown. This will be a project solicitation proposal. The project will be administered and governed by the CALFED Program.

4. Program Coordination

Program coordination will occur with USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

The project is to start in FY 2001 and continue until FY 2003.

Bench, Pilot and Demonstration Scale Facilities to test Innovative Membranes for Removal of TOC, Arsenic and Microorganisms

1. General Description

TOC can be removed using nanofiltration (NF) or reverse osmosis (RO) membranes. However, these are the most costly types of membranes to use. Alternatively, research in France has evaluated the use of powdered activated carbon (PAC) upstream of ultrafiltration (UF) membranes to remove organic contaminants in water (primarily pesticides). Moreover, research by Amy and colleagues has shown that certain UF membranes can remove a certain portion of the NOM--as well as arsenic--even though the MW cutoffs of UF membranes are rather high. That is because these membranes are capable of removing both NOM and arsenic due to the charge of these contaminants (rather than based on size exclusion). Additional bench-scale work is needed to evaluate UF membranes for the removal of TOC in Delta water (with and without PAC addition upstream). Moreover, with the USEPA scheduled to propose an arsenic MCL at a low ug/L level in the very near future, the use of such membranes to also remove arsenic could be of value. Naturally, UF membranes also have the value of remove many microbial pathogens. Pilot- and demo-scale testing of innovative UF membranes (with and without PAC addition) for the removal of TOC (and arsenic) are needed.

2. Cost Estimates

Expected cost is \$500,000.

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. The project will be administered and governed through the CALFED Program.

4. Program Coordination

This project will be coordinated with the USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

6. Schedule

The project begins in FY 2001 and extends to FY 2004.

Alternative Bromate Control Measures during Treatment

1. General Description

Ozonation of Delta waters, which contain significant amounts of bromide, result in bromate formation. Although the reduction of the pH prior to ozonation can minimize bromate formation, the chemical costs for acid (and subsequent base addition) are higher than the cost of generating the ozone. Moreover, the chemicals added increase the TDS of the water significantly. Alternative bromate control measures are needed.

2. Cost Estimate

Estimated costs are \$250,000.

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. The project will be administered and governed by the CALFED Program.

5. Program Coordination

Program coordination will occur through USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

6. Schedule

The project begins in FY 2001 and continues through FY 2003.

Pilot and Demonstration Scale Facilities Using Ferrous Iron for Bromate Control

1. General Description

Ferrous iron has been shown at the bench-scale to be capable of reducing bromate to bromide (Siddiqui and Amy). Limited pilot testing of ferrous iron has shown it to be highly pH and temperature dependent (Krasner et al.) Moreover, a combination of ferrous and ferric iron was needed to control turbidity and particle removal. Additional pilot testing--as well as demo testing--of ferrous iron for the control of bromate is needed. Long-term process optimization needs to be evaluated in order that bromate is reduced to bromide while still meeting turbidity/particulate removal requirements.

2. Cost Estimates

Expected cost is \$500,000.

3. Program Administration and Governance

The lead agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Coordination will occur through the USEPA, DHS, AWWA Research Foundation, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project will begin in FY 2001 and continue through FY 2003.

Bench Scale Testing to Evaluate Bromate Control and Disinfection in Presence of Ammonia

1. General Description

Bench- and demo-testing of ammonia addition has been shown to sometimes control bromate formation and sometimes not in Delta water and in Colorado River water (Williams et al.). Moreover, the addition of ammonia sometimes negatively impacted the disinfection (CT) achieved. Additional bench-scale work needs to evaluate bromate control (and disinfection). Because ammonia addition may impact the downstream biological filtration process--as well as result in nitrification problems or problems with inactivation of heterotrophic plate count (HPC) bacteria in the effluent of the biological filters--long-term (continuous) demo testing of ammonia addition is required.

2. Cost Estimates

Expected cost of \$500,000.

3. Program Administration and Governance

The lead agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through the CALFED Program

4. Program Coordination

Program coordination will occur through USEPA, DHS, AWWA Research Foundation and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

The project begins in FY 2001 and continues through FY2003.

Pilot and Demonstration Scale Testing of Integrated Disinfection/Oxidation

1. General Description

UV has been suggested as an alternative disinfectant to ozone for the inactivation of Cryptosporidium. However, UV (at the doses required for Cryptosporidium inactivation) will not inactivate all microbial pathogens of concern (e.g., viruses) or oxidize organic micropollutants (e.g., those that cause taste-and-odor problems). Malley and other UV experts have suggested an "integrated" disinfection/oxidation scheme to control microbial pathogens, organic micropollutants, and DBPs: ozonation of the raw or settled water at doses used for Giardia and/or virus inactivation and/or taste-and-odor control, UV inactivation of the filter effluent for Cryptosporidium inactivation--as well as HPC bacteria control--and chloramine addition to the final treated water for a distribution-system residual. Pilot- and/or demo testing of this integrated disinfection/oxidation scheme is required.

2. Cost Estimate

Expected cost is \$500,000 for FY 2001. .

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Program coordination will occur through USEPA, DHS, AWWA Research Foundation, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project will begin in FY 2001 and will continue through FY 2003.

Design, Performance, and Evaluation of 100 MGD UV Treatment Plant

1. General Description

UV disinfection has shown promise as a disinfectant specifically for the inactivation of *Cryptosporidium*. At doses anticipated for disinfection, it is ineffective for oxidation of trace organic contaminants (e.g. taste and odor causing compounds). Its reliability for consistent *Cryptosporidium* inactivation, also, has not been demonstrated. If coupled with ozone, however, for the oxidation of taste and odor causing compounds and other microbial and organic contaminants UV could enable a more robust, cost-effective strategy for *Cryptosporidium* inactivation while enabling greater flexibility in handling adverse source water quality conditions. This proposed treatment scheme (i.e. ozone-filtration-UV) may be a most important option for water systems that treat source water with high levels of precursors to trihalomethane and ozonation by-products like bromate, such as the water delivered through the Sacramento-San Joaquin Delta serving millions of California residents. While many research projects are being conducted on UV, progress towards implementation of UV will only be accelerated by experience at a large, full-scale drinking water treatment plant. This project would promote implementation of UV through the actual design, construction, and performance evaluation at a large (100 MGD) treatment plant that would be installing ozone concurrently, such as Santa Clara Valley Water District.

2. Cost Estimate

Expected cost is \$9 million.

3. Program Administration and Governance

Lead implementing agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Program coordination will involve USEPA, DHS, AWWA Research Foundation, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project will begin in FY 2003 and continue throughout Stage I of the CALFED Program.

Develop New and Innovative Technologies on a Regional and Local Level to Reduce Costs of Desalination and Disposal of Brine

1. General Description

Dissolved mineral salts are a concern to drinking water and agriculture supplies. High salinity impacts local water management programs, such as water recycling and groundwater conjunctive use, and results in economic impacts on industrial and residential water users due to corrosion. High salinity levels in municipal water supplies are difficult to remove by conventional water treatment technologies. For agriculture, disposal of brackish drainage can have adverse ecological consequences. Existing salinity removal technologies are relatively energy-intensive and expensive. Moreover, salinity removal technologies usually involve a brine disposal problem. Innovative desalination technologies for non-traditional water sources such as brackish groundwater, wastewater, and agricultural drainage is needed. This CALFED action seeks to develop new and innovative technologies to substantially reduce the cost of desalinating water high in salts (including brackish sources) which will result in improved drinking water quality/supplies and reduced disposal problems. CALFED seeks to explore desalination opportunities on both a local and a regional basis. This could include large-scale reverse osmosis (RO) technologies for high salinity-surface water supplies as well as methods for control of scaling and/or biofouling with RO/membrane technologies. The success of this action may result in reduced salt loads from agricultural drainage, additional source-blending opportunities, enhanced recycling/reuse opportunities and would contribute to achieving CALFED's water quality improvement objectives.

2. Cost Estimate

Estimated costs are \$4 million for FY 2001 for treatment studies and design of demo scale treatment facilities; \$6 – 15 million for construction and operation of demo scale treatment facilities for FY 2002 - 2004; \$5 million for maintenance/cost-share in future years.

3. Program Administration and Governance

Lead agency is unknown. This will likely be a project solicitation proposal. The CALFED Program is responsible for administration and governance.

4. Program Coordination

Coordination will occur through USEPA, DHS, AWWA Research Foundation, and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

FY 2001 – treatment studies and design of demo scale treatment facilities; FY 2002-2004 construction and operation of demo scale treatment facilities; FY 2005 – 2006 – maintenance/cost share in future years.

ALTERNATIVE SOURCE WATERS

Southern California Alternative Sources of Supply

1. General Description

One element of the CALFED drinking water quality improvement strategy is alternative sources of supply, which involves blending or water quality exchanges to improve the quality of water delivered to urban drinking water agencies that are dependent on the Delta. There are potential opportunities for water quality exchanges between San Joaquin Valley agricultural entities and southern California urban drinking water agencies to improve the quality of water delivered to southern California. Before feasible water quality exchange projects can be identified, preliminary studies are needed to assess water quality needs, facilities required and costs. The purpose of this action is to conduct prefeasibility studies of the potential for water quality exchanges between San Joaquin Valley agricultural entities and southern California urban drinking water agencies. The scope of this action would include an assessment of water quality conditions and needs for agencies potentially involved in exchanges, facilities needed to implement exchanges, and the availability of exchange water.

2. Cost Estimate

The estimated costs for this project in FY 2001 is \$1 million.

3. Program Administration and Governance

This will be a directed action with Metropolitan Water District of Southern California as the lead agency. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Coordination will occur with USBR, DWR, appropriate CALFED workgroups and the project participants.

5. Schedule

This project will begin in FY 2001 and continue through FY 2006.

Bay Area Alternative Sources of Supply

1. General Description

The purpose of this study is to continue the investigation of the potential for blending of Sierra quality water or additional storage of higher quality Delta water to improve source water quality for Bay Area urban water suppliers. A prefeasibility study to quantitatively assess individual agency needs for higher quality source water and to assess the ability of existing facilities to convey the needed quantities assuming the water is available has been funded at \$100K for FY 2000. Depending on the findings of the prefeasibility study, the next phase could include data refinement and a modeling analysis.

2. Cost Estimate

FY 2000 funding was for a prefeasibility study at a cost of \$100,000. Estimated cost for FY 2001 is \$1 million.

3. Program Administration and Governance

Project lead for FY 2001 is unknown. This is likely to be a directed action. The administration and governance will be conducted by the CALFED Program.

4. Program Coordination

Coordination will occur with the existing Work Group consisting of the Bay Area urban water agencies.

5. Schedule

This project is a continuation of the work funded for FY 2000 and will continue into FY 2003.

MONITORING/RESEARCH/MODELING

Assessment of Sources and Magnitudes of Loads of Drinking Water Constituents of Concern

1. General Description

This is a continuation of the CALFED action "Assessment of Sources and Magnitudes of Loads of Drinking Water Constituents of Concern". The purpose of this project is to:

- a. Refine the baseline study
- b. Monitor key Delta channels where no baseline or hydrologic data exists to fill critical gaps,
- c. Monitor for changes in baseline water quality conditions,
- d. Develop forecasting ability and link Delta-wide models to site-specific changes,
- e. Quantify the loading and quality of drinking water constituents including precursors such as organic carbon,
- f. Prioritize management options,
- g. Refine the understanding of key sources, and,
- h. Design and implement cost-effective actions for source control.

2. Cost Estimate

In FY 2000 \$700,000 was allocated for the first phase of this project. The cost estimate to refine the study area baseline conditions and for monitoring/research/modeling is \$4.0 million for FY 2001.

3. Program Administration and Governance

The lead agency for FY 2001 is unknown. This will be a project solicitation proposal. Administration and governance will be through the CALFED Program.

4. Program Coordination

Coordination will occur through the existing CALFED Drinking Water Constituents Work Group, USEPA, DHS, DWR, and CVRWQCB.

5. Schedule

This is a continuation of the project initiated with FY 2000 funds. This project will be conducted every year throughout Stage 1.

Improvement of Measurement Methods for Pathogens in Delta Water

1. General Description

Molecular techniques are now available to discern between *Cryptosporidium* oocysts of human origin only or human and animal. These techniques are being developed and will help determine the relative contributions of oocysts from sewage vs runoff in the Bay-Delta watershed. Moreover, the current methods to detect pathogens are lacking in precision and accuracy in high turbidity water and need improvement. The purpose of this project is to improve methods to distinguish probable sources of pathogens and to refine method development to accurately detect pathogens in the Delta. The information from this project can be used to improve monitoring and analytical programs and help design watershed management practices for controlling pathogen discharges.

2. Cost Estimate

Project costs are \$1 million for FY 2001.

3. Program Administration and Governance

Lead agency is unknown. This will be a project solicitation proposal. Administration and governance will occur through CALFED.

4. Program Coordination

Coordination will occur through AWWA Research Foundation, DHS, USEPA, DWR and the CALFED Drinking Water Constituents Workgroup.

5. Schedule

This project is scheduled to start in FY 2001 and continue until FY 2003.

CALSIM Model Development

1. General Description

The CALFED Drinking Water Constituents Work Group has identified the need to develop and improve forecast abilities which links Delta-wide models to site-specific changes for drinking water constituents of concern.

2. Cost Estimate

The cost for FY 2001 is \$100,000.

3. Program Administration and Governance

The lead agency will be the DWR Modeling Group. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Coordination will occur with other modeling groups, in particular CCWD and MWD, and the CALFED Drinking Water Quality Operations and Drinking Water Constituents Workgroups.

5. Schedule

This project is slated to begin in FY 2001 and continue with additional funding through FY 2006 as more information on drinking water constituents of concern at key benchmark locations and under different hydrological conditions become available.

OPERATIONS / STORAGE / CONVEYANCE

North Bay Aqueduct Relocation Pre-Feasibility Study

1. General Description

The water quality in the NBA is considered some of the poorest in the Delta for drinking water (in terms of TOC but not in terms of bromide) resulting largely from water quality degradation in the watershed. Future changes in the northwest Delta may degrade the water quality at Lindsey Slough, which appears to provide an element of dilution to the degradation from the upper watershed. An alternative under consideration is construction of an alternate point of intake either on the Colusa-Tehama Canal or on Miner Slough. An in-depth analysis of the need for and the feasibility of constructing an alternate intake is needed. Potential water quality impacts of the ecosystem restoration activities, specifically at Lindsey Slough, need to be studied to determine whether the activities will increase concentrations of organic carbon or other drinking water contaminants at the NBA intake. Specifically, studies need to delineate the dry season organic carbon contributions and possible means to reduce loads, water quality data for alternative intake locations needs to be collected, and the water quality impacts of the CALFED ecosystem restoration activities on Barker Slough Pumping Plant diversions need to be made.

2. Cost Estimate

The cost of this project is estimated at \$200,000 for FY 2001. If relocation of a new intake is feasible, further CALFED funding may be available for future years.

3. Program Administration and Governance

No lead agency is identified. This will likely be a directed action. Administration and governance will occur through the CALFED Program.

4. Program Coordination

Coordination will occur with the NBA contractors, DWR, USBR, USACOE, Solano County and other stakeholders.

5. Schedule

This project is scheduled to begin in FY 2001 and depending on the results of the pre-feasibility study, may continue through FY 2006.

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