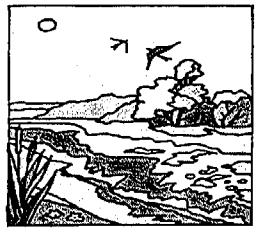
APPENDIX C

POTENTIAL TOOLS AND INDICATORS OF SUCCESS



Potential Tools and Indicators of Success

Tools for Correction	Indicators of Success
Drinking Water	
Drinking Water	
Evaluate causes of increased bromide in San Luis Reservoir	Identification of all major sources of bromide in San Luis Reservoir, as determined by loading calculations based on sampling data
Investigate combinations of new supplies, operational changes, and new technology to meet drinking water standards	Implementable strategy to prevent formation of disinfection by-products (DBPs) above drinking water standards
Convene expert panel to make recommendations regarding solutions to drinking water public health issues	Recommendations for drinking water solutions from an independent, nationally recognized panel of experts
Develop a plan to meet regulatory standards for brominated and chlorinated DBPs	Implementable strategy for meeting drinking water standards
Investigate alternative sources of high-quality water supply for urban users of Delta water	Thorough evaluation of feasibility of using alternative source water for export
Support studies about public health effects from brominated DBPs	Determination of safe drinking water concentrations of brominated DBPs
Investigate use of advanced treatment technologies (i.e., membranes) at water treatment plants	Feasibility of advanced treatment is determined, based on current source water and advanced treatment technology
Quantify importance of connate groundwater in Empire Tract and adjacent islands	Determination of connate water contribution to bromide levels in island discharges
Perform more thorough evaluation of bromide origin in San Joaquin River	Identification of all major sources of bromide in San Joaquin River system, as demonstrated by loading calculations based on sample data
Bromide, Total Organic Carbon, and Nutrients	
Optimize treatment plant operations to achieve lowest DBPs with current source water and common techniques	DBP formation above drinking water standards is prevented in a cost-effective manner, based on current source water and common treatment technology
Manage ecosystem restoration projects to minimize adverse impacts on drinking water	Ecosystem restoration activities result in no adverse impacts on drinking water intakes
MTBE	
Control recreational boating to reduce MTBE in applicable State Water Project (SWP) storage facilities	Reduce MTBE in drinking water supplies to non-detect levels

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Pathogens	
Provide secondary containment for sanitary facilities at SWP terminal reservoirs	Secondary containment at all sanitary facilities in terminal reservoirs
Control recreation to reduce human pathogens in SWP storage facilities	Minimized risk of pathogens to extent possible within legal and logistical constraints
Minimize pathogens from recreational boating in Bay-Delta area	Reduce risk of pathogens to drinking water supplies from boats in Delta and Delta rivers and from water-contact recreation, as established by sampling data
Pathogens and Nutrients	
Implement comment elements of watershed management programs in Clifton Court Forebay area	Implemented watershed BMPs to prevent input of nutrients, pathogens, and total organic carbon (TOC), enabling drinking water standards to be met reliably and cost effectively
Identify problems and source control activities for urban runoff in Delta Region	Properly characterized urban impacts on drinking water constituents and an implementable control strategy
Total Organic Carbon and Nutrients	
Conduct pilot study on agricultural drainage control actions in Bay-Delta area	Development of pilot-scale agricultural drain treatment system to remove TOC and nutrients in order to prevent DBP formation above drinking water standards
Conduct feasibility evaluations (literature and bench scale) for treating Delta island drainage to remove TOC and nutrients	Identification of most feasible options to remove TOC from discharges of Delta islands
Study algae and macrophyte growth potential in Delta and propose corrective strategy in distribution system	Implementable corrective strategy to prevent (or reduce) algal production in drinking water storage and conveyance facilities
Implement full-scale agricultural drainage control actions in Bay-Delta area	Treatment of key agricultural drains to reduce TOC levels such that DBP formation above drinking water standards is prevented
Total Organic Carbon, Pathogens, and Nutrients	
Implement common elements of watershed management program in Lake Del Valle area	Implemented watershed BMPs to prevent input of nutrients, pathogens, and TOC, enabling drinking water standards to be met reliably and cost effectively

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Participate in controlling wastewater discharges from Discovery Bay	Reduced impacts of wastewater discharges such that DBP formation above drinking water standards is prevented
Relocate Veale Tract agricultural drain	Reduced levels of TOC, pathogens, and nutrients in Contra Costa Water District's (CCWD's) Rock Slough intake in order to prevent DBP formation above drinking water standards
Study impacts of Discovery Bay outfall and mitigate as necessary	Properly characterized and mitigated impacts from Discovery Bay outfall on drinking water intakes in Clifton Court and Old River
Evaluate relocation of Tracy's intake from Delta-Mendota Canal (DMC) to SWP	Reduced risk of pathogen contamination from City of Tracy to that of other water purveyors in Delta
Establish watershed management program for San Joaquin River	Reduced nutrients, pathogens, salt, and TOC such that DBP formation above drinking water standards is prevented, and conservation and reuse are maximized
Develop drinking water protection strategy in addressing stormwater	Comprehensive implementable strategy that protects drinking water and wastewater discharge purveyors from all drinking water contaminants
Implement common elements of watershed management program for South Bay Aqueduct (SBA)	Implementable watershed BMPs to prevent input of nutrients, pathogens, and TOC, enabling drinking water standards to be reliably and cost-effectively met
Evaluate feasibility and cost effectiveness of providing an alternative point of intake for North Bay Aqueduct (NBA)	Availability of alternate source water that prevents DBP formation above drinking water standards
Implement Barker Slough watershed management program for NBA	Reduced levels of TOC, pathogens, and nutrients in NBA intake that prevent DBP formation above drinking water standards
Develop BMPs for livestock grazing that can be applied in several locations	Development of implementable BMPs that effectively reduce TOC, nutrients, and pathogens in surface waters, enabling drinking water standards to be met reliably and cost effectively
Total Organic Carbon, Pathogens, Nutrients, and Turbidity	
Develop watershed management program for SWP drainage and implement as appropriate	Minimized stormwater contribution of contaminants such that sedimentation and DBP formation above drinking water standards is prevented reliably and cost effectively

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Control stormwater discharges to SWP by physical modification of facilities	Minimized stormwater contribution of contaminants such that sedimentation and DBP formation above drinking water standards is prevented reliably and cost effectively
Develop watershed management programs for Castaic and Silverwood Reservoirs	Reduced input of nutrients and pathogens such that DBP formation above drinking water standards is prevented reliably and cost effectively
Total Organic Carbon, Taste and Odor, and Physical Plugging	
Evaluate structural controls of algae in Castaic Lake and Elderberry Forebay	Elimination of nuisance algal growths in Castaic Lake and Elderberry Forebay
Evaluate and change Castaic Lake and Elderberry Forebay structures to reduce algal growth	Elimination of nuisance concentrations of taste- and odor- (T&O-) producing algae in these reservoirs
Study algae control in Clifton Court Forebay and SBA	Reduced physical obstruction of water treatment and delivery facilities by algae and TOC levels such that DBP formation above drinking water standards is prevented, T&O problems are avoided, and treatment costs due to additional chemical usage and shortened filter runs are avoided
Control algal blooms and aquatic weeds in lower American River	Elimination of nuisance algal blooms in lower American River and reduce physical clogging of treatment plant facilities
Control algae in storage and conveyance facilities south of Delta	Minimized physical obstruction of facilities due to excessive algal growths and reduced TOC such that DBP formation above drinking water standards is prevented reliably and cost effectively
Low Dissolved Oxygen	
Dissolved Oxygen	
Develop management strategies with City of Stockton to maintain adequate oxygen levels in urban waterways	Development of effective stormwater program for City of Stockton that effectively eliminates most oxygen-depleting substances
Increase efforts to enforce waste discharge restrictions	No further potential enforcement actions in vicinity by Central Valley Regional Water Quality Control Board (CVRWQCB)
Assess current conditions for Stockton tributaries	Proper characterization of how Stockton tributaries affect DO in San Joaquin River

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Assist in new physical systems and operational strategies in Stockton Regional Wastewater Control Facility (RWCF) and Port of Stockton	No significant contributions from Port of Stockton or Stockton RWCF to low DO sags in San Joaquin River
Provide assistance and incentives to implement BMPs in San Joaquin River near Stockton	BMPs implemented in all applicable areas in Stockton vicinity
Continue lower permitted discharges of oxygen-depleting substances in San Joaquin River near Stockton	No allowance of effluent at higher concentrations of oxygen-depleting substances
Develop corrective strategies for potential sources (agriculture) in Stockton tributaries	Development of corrective measures that are feasible and cost effective
Manage lower Sacramento River stream bed enhancement program and develop river management plan	Improved inter-substrate permeability in river bed, which improves DO for salmon and steelhead
Develop and manage Merced, Tuolumne, and Stanislaus River management programs	Improved inter-substrate permeability in river bed, which improves DO for salmon and steelhead
Assess Suisun Marsh oxygen level and ecological importance	Proper characterization of Suisun Marsh inter-substrate DO concentrations
Develop BMPs to reduce oxygen-depleting substances in San Joaquin River near Stockton, based on research	Implementable BMPs to reduce or eliminate event or duration of DO sags below 5 mg/l in San Joaquin River
Assess extent and severity of DO problem in east side tributaries and develop strategies for correction	Proper characterization of DO levels and causes of DO depletions, with corrective actions
Mercury	
Mercury	
Map locations of mines and geological sources and potential for early remediation	Comprehensive listing of all mercury mines in western hills, complete with assessments of probable input and remediation potential
Develop remedial strategy for target watersheds and implement remedial activities as appropriate	Site remediation such that mercury leaving site does not cause exceedances of water quality targets
Monitor loads and forms of Hg in target watersheds	Complete database of historical loads and forms of mercury found to assist in remedial activities
Continue monitoring fish tissue for indicators of success	Mercury in fish tissue below levels considered a public heath concern or that cause harm to fish species
Complete human health risk assessment	Updated human health risk assessment for mercury in Delta, Cache Creek, and Sacramento River

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Develop Geographic Information System (GIS) and public information system	Detailed public information, complete with GIS, to assist others in research and remediation of watershed
Preliminary remediation to remove total mercury	Remediation that eliminates significant fractions of mercury inputs from more readily controllable mercury sources
Develop modeling strategy to include loading, bioavailability, and transformation	Reliable model that predicts impacts of upstream mercury input on Delta
Evaluate success of remediation	Site remediation such that mercury leaving site does not cause exceedances of water quality targets
Study mercury water and sediment levels to develop acceptable levels	Properly reviewed water quality targets for various types of mercury that will not cause public health advisories regarding fish tissue and will not adversely affect aquatic ecosystem
Fill data gaps regarding loads and forms of mercury	Properly characterized input data from mercury sources to Delta
Evaluate mercury loading on fish tissue levels	Established impacts of mercury loads in watershed on fish tissue in watershed and Delta
Determine demethylization processes and show where processes apply to conceptual model	Links of how demethylization of mercury affects mercury in ecosystem and fish tissue
Study relationship between bioavailability and transformation of forms of mercury	Established links between bioavailable forms of mercury and transformation of mercury
Study bioaccumulation mechanisms and determine indicator organisms	Selection of an organism that helps to predict whether actions have impacts on mercury levels in consumed fish tissue
Evaluate fish consumption patterns to better characterize public health hazard	Reliable demographic and consumption data to identify high-risk portions of population
Organochlorine Pesticides	
Organochlorine Pesticides and Agricultural Runoff	
Implement soil conservation efforts to retain organochlorine pesticides and soil on farms	Significant reductions in sedimentation and losses of soils on farms in western hills of San Joaquin Valley
Research into use of polyacrylamide (PAM) to retain soil and pesticides on agricultural lands	Evidence that uses of PAM reduces erosion of fine sediments, as established by monitoring data
Research and incentives for whole-farm approach to pest management and water use	Reductions in water and chemical use, while preserving soil and maintaining production

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Develop strategy to implement conservation measures and fund local conservation efforts	Long-term funding for local conservation efforts and implementation of conservation strategies; elimination of excessive sediment
Research irrigation conservation technology conservation	Reductions in water use and maintenance of production and soil
Reconstruct drainage channel	Reductions in erodible portions of channel following reconstruction
PCBs	
Monitor environmental and public health impacts, and strategize corrective actions if feasible	Evaluation of current PCB environmental threat and feasible solutions
Pesticides	
Pesticides	
Develop hazard assessment criteria, quantitative response limits, and water quality objectives	Development of water quality objectives (initially for diazinon and chlorpyrifos) that protect aquatic life and human health
Develop and implement BMPs for agriculture and residential use for diazinon and chlorpyrifos	Attainment of water quality targets in affected streams and channels
Evaluate effectiveness (adaptive management) and implement approach to solution for other toxic pesticides	Reductions in toxicity events attributed to pesticides of concern
Salinity	
Salinity	
Establish water quality objectives for salt in main stem San Joaquin River	Established water quality objective for salt in San Joaquin River that protects all beneficial uses
Investigation of reverse-osmosis membrane treatment systems for agricultural runoff (local actions)	Assessment of feasibility of using membrane technology to treat agricultural discharges
Investigate cogeneration disposal of higher saline water (local actions)	Identification and use of a cogeneration site for disposal of higher saline water
Integrated on-farm drainage management (local actions) to reduce salt concentrations in groundwater and surface water	Sustainable reductions in salt concentrations of groundwater through crop selection and management
Improve supply water quality through physical and operational changes (basinwide)	Reductions in salt concentrations in supply water that make water quality objectives attainable in San Joaquin River following discharge

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Real-time manage saline discharges to San Joaquin River (basinwide)	Maximized assimilative capacity of San Joaquin River without exceeding water quality objectives
Recirculate DMC water to dispose of salts during high assimilative capacity periods (basinwide)	Increased assimilative capacity in San Joaquin River due to DMC recirculation
Dispose of salt through reclamation, to conveyance out of valley (basinwide)	Ultimate salt disposal out of basin to permanently reduce amount of salt in basin
Control sources of salt from agricultural lands through drainage reduction (local actions)	Reductions of salt in discharges by irrigation changes, while maintaining productivity
Reuse higher saline water on salt-tolerant crops (local actions)	Crop replacement that keeps land in continuous production but reduces salt discharges to San Joaquin River
Selenium	
Selenium	
Use alternative crude oil sources (refineries)	Reduced selenium loads from refineries
Reuse sour water and treat recycled sour water (refineries)	Reduced selenium loads through industrial water conservation and recycling
Retire land and permanently discontinue irrigation to eliminate contributions of selenium (agriculture)	Retirement of land to prevent contributions to selenium loads
Remove selenium in plant product by phytoremediation (agriculture)	Permanent removal of some fraction of selenium from valley soils in plant material
Manage selenium-laden stormwater flows from upper watershed (agriculture)	Reduction in overall selenium concentrations from upper watershed
Actively manage land through crop selection, irrigation, and operation (agriculture)	Reduction of selenium discharged through operational practices
Market selenium for forage supplements or nutritional supplements (agriculture)	Harvesting and removal of some fraction of selenium to market as fodder or nutritional supplement
Develop tradable loads to give dischargers flexibility in discharge concentrations and volumes (agriculture)	Operational procedures to allow dischargers to trade assimilative capacity and prevent exceedance of water quality objectives
Treat refinery discharge (refineries)	Reduction of selenium discharges from refineries
Trace Metals	
Copper	
Work with local agencies to develop stormwater pollution control facilities	Reduction of trace metals in stormwater to meet all water quality objectives for each metal

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Participate in Brake Pad Consortium, to reduce or eliminate copper from road runoff	Reduction or elimination of copper use in brake pads, thus removing it from stormwater
Copper, Cadmium, and Zinc	
Implement remedial activities at mines in upper watershed	Reduction or elimination of trace metal impacts from mines in upper watershed on biota in Bay-Delta
Trace Metals	
Study ecological impacts of trace metals and spatial and temporal extent of heavy metal pollution	Proper characterization of trace metal effects on biota in Bay-Delta
Turbidity and Sedimentation	
Sediment	
Perform quantative ecological assessments of sediment loads in Merced and Stanislaus Rivers	Determine optimum range for sediment input to rivers
Evaluate use of a sedimentation pond near mouth of Gasburg Creek to prevent sediment in Tuolumne River	Reduced sediment from Gasburg Creek in Tuolumne River to a sustainable sediment budget level
Develop and implement BMPs along Tuolumne River tributaries	BMPs implemented to protect spawning beds in Tuolumne River and tributaries
Manage Tuolumne River floodplains to diminish negative impacts of fine sediment	Restored natural deposition of sediments in Tuolumne River floodplain
Determine Merced and Stanislaus River sediment loads	Established river sediment loads and budgeted as goals to reach in sediment input
Mechanically remove fine sediment from Tuolumne River banks	No effects on spawning beds in Tuolumne River from fine sediment in river bank
Evaluate use of head control structure on Dominici Creek	Reduction or elimination of excessive erosion caused by Dominici Creek
Develop Technical Watershed Group for Merced and Stanislaus Rivers	Initiated stakeholder process to protect watersheds from sediment impacts
Implement sediment BMPs for construction and agriculture in Napa River watershed	No impairment of sediment on spawning beds in Napa River
Unknown Toxicity	
Aquatic Toxicity	
Monitor toxicity	Expanded aquatic toxicity testing in all parts of Bay-Delta

Potential Tools and Indicators of Success (Continued)

Tools for Correction	Indicators of Success
Implement toxicity identification evaluation (TIE) for toxic samples	TIEs performed on all samples resulting in toxic effects; identification of toxicants
Investigate cause of toxicity	Identification of sources of toxicants from TIE
Identify cause and refer to appropriate portion of program	Prioritization of control of toxicant identified in TIE