

**KEY MANAGEMENT DECISIONS REQUIRING SCIENCE INPUT
AT OR BEFORE THE END OF STAGE 1**

KEY MANAGEMENT DECISION - IS ADDITIONAL SURFACE STORAGE NEEDED? Given that the CALFED Program will be implemented in stages over 30 years or more, the Water Management Strategy will develop guidelines for timing implementation of various tools so the strategy progresses in the most effective manner. Within the Water Management Strategy CALFED must develop two different strategies - one for Stage 1 of the CALFED Program, when not all tools are available to the same degree, and another strategy for the long term.

MANAGEMENT DECISION - CAN THE SWP/CVP EXPORT OPERATIONS BE MANAGED TO MEET RECOVERY GOALS OF LISTED SPECIES WHILE PROVIDING WATER SUPPLY RELIABILITY?

Science Question - What are population level impacts of Delta water project operations (including changes in hydrology, temporary and permanent barriers, predation and diversions) on listed and sensitive fish species?

Science Question - What are the relative effects of Delta water project operations compared to other abiotic (e.g. contaminants) and biotic (e.g. invasive species) factors in the Central Valley Estuary and Ocean to the populations of listed species?

MANAGEMENT DECISION - HAVE STAGE 1 ACTIONS INCLUDING INCREASED GROUNDWATER STORAGE, WATER USE EFFICIENCY, WATER TRANSFERS AND WATERSHED MANAGEMENT BEEN SUFFICIENT TO MEET WATER SUPPLY RELIABILITY NEEDS SUCH THAT ADDITIONAL SURFACE STORAGE IS NOT NEEDED?

Science Question - Can groundwater storage and conjunctive use provide additional yield or operational flexibility without significant redirected impacts and at a reasonable cost?

Science Question - Can urban, agricultural and environmental conservation and recycling significantly reduce demand, increase operational flexibility and improve water quality without significant redirected impacts and at a reasonable cost?

Science Question - Can a water transfer program be implemented so that water transfers can be a timely and reliable operational tool without causing significant redirected impacts and at a reasonable cost?

Science Question - Can watershed management actions result in increased yield or improved water quality without significant redirected impacts and at a reasonable cost?

KEY MANAGEMENT DECISION - IS THROUGH-DELTA CONVEYANCE ADEQUATE TO ACHIEVE THE CALFED GOALS

AND OBJECTIVES? CALFED has identified two factors, export water quality and diversion effects on fisheries, as especially important for evaluating the effectiveness of the CALFED conveyance alternative. These and other factors will be continually reevaluated during Stage 1 as part of the adaptive management. Based on the assumptions made for evaluations in the March 1998 *Phase II Interim Report*, the dual Delta conveyance with an isolated facility appeared to provide greater technical performance than the other alternatives. At the same time, however, there are still major assurances issues associated with this approach, and CALFED needs to obtain better scientific information plus information on an array of other water management options to assess the need for the dual Delta conveyance. In addition, while the dual Delta conveyance may have technical advantages over other Delta conveyance, it would likely take a decade or more to plan, design, permit, and construct.

MANAGEMENT DECISION - HAVE THE FEATURES OF THROUGH-DELTA CONVEYANCE MAINTAINED OR ENHANCED EXPORT WATER QUALITY?

Management Decision - Have actions taken to improve export water quality been sufficient to improve or maintain drinking water quality treatment costs?

Science Question - Can feasible and cost-effective treatment methods be developed to remove natural organic matter from Delta water supplies to minimize formation of disinfection by-products?

Science Question - Can feasible and cost-effective methods be developed to control the formation of bromate (a disinfection by-product) during the treatment of Delta waters with ozone?

Science Question - Can feasible and cost-effective treatment methods utilizing alternative disinfectants (such as UV disinfection, or an integrated disinfection/oxidation scheme utilizing ozone/UV disinfection/ chloramine) be developed to reliably disinfect Delta water supplies and reduce formation of harmful disinfection by-products?

Science Question - Can feasible and cost-effective treatment methods and brine disposal methods be developed to desalinate brackish water sources, in order to improve the quality of drinking water supplies and facilitate water management activities?

Management Decision - Has water quality in the source water areas and in the Delta been improved or maintained?

Science Question - Among river sources, island drainage, and autochthonous production, what are the major factors in the organic carbon budget of the delta at seasonal and shorter time scales?

Science Question - How is organic carbon partitioned among classes of compounds (precursors of disinfection byproducts, recalcitrant vs. labile, etc.); what are the origins of these compounds; and how are they transformed in delta channels and after export?

Science Question - How will the loads and quality of organic carbon be altered by proposed projects in the delta (on-island treatment, wetland restoration projects, etc.)?

Science Question - How does operation of the Delta Cross Channel gates affect salinity and bromide patterns in the delta for combinations of tides, river flows, and exports; and how would operation of screened diversion at Hood affect salinity patterns for these same conditions?

Management Decision - Have the water supply risks of levee failure caused by earthquake been reduced to an acceptable level?

Science Question - Are the water-supply risks of levee failures induced by earthquakes acceptable, or are other actions required?

Science Question - What is the probability of earthquakes of sufficient magnitude to produce strong ground motion in the delta?

Science Question - What is the probability that ground motions will cause failures of delta levees that exceed emergency response capabilities?

Science Question - What is the probability that the patterns of earthquake-induced levee failures will cause significant seawater intrusion into the delta?

Science Question - What is the probability that significant seawater intrusion into the delta will occur at a time when adequate sources of water are unavailable south of the delta?

Management Decision - Have the water supply risks of levee failure caused by Delta island subsidence been reduced to an acceptable level?

Science Question - What is the influence on levee integrity of island elevations in areas adjacent to the levees?

Science Question - Are island elevations subsiding in these areas at a fast enough rate to warrant subsidence mitigation? If so, what subsidence mitigation measures (rice straw, crop changes, etc.) are feasible?

Science Question - What are the effects of island subsidence and subsidence mitigation measures on organic carbon quality and loads in island drainage?

Science Question - Are levee subsidence and sea-level rise a significant concern for Delta levee stability?

MANAGEMENT DECISION - HAVE THE FEATURES OF THROUGH-DELTA CONVEYANCE BEEN SUFFICIENT TO IMPROVE THE STATUS OF LISTED FISH SPECIES AND REDUCE THE EFFECTS OF THE EXPORT DIVERSION INTAKES AND ASSOCIATED FISH FACILITIES?

Management Decision - Has the environmental water account been effective in reducing operational impacts to listed fish species?

Science Question - Is there operational flexibility (e.g. E/I ratio, b2, and other water management "tools") that can be used to reduce project impacts that result in movement to listed and sensitive fish species recovery?

Science Question - What has been the effect on delta smelt relative abundance and distribution of providing improved outflow and X2 conditions and other Delta hydrodynamics parameters using EWA?

Science Question - What is the latest information on the relationship of Delta flow and exports to the survival of juvenile salmon migrating downstream from the San Joaquin and Sacramento River basins and Delta east side tributaries?

Science Question - Can real time monitoring data be used to minimize losses of listed and sensitive fish species while increasing water supply reliability?

Management Decision - Has the restoration of non-flow related Delta and up-stream habitat been adequate to result in recovery of listed fish species?

Science Question - What are the population effects on listed and sensitive fish species of creating and restoring tidal shallow water habitat in the Sacramento-San Joaquin Delta and northern San Francisco Estuary?

Science Question - Can we create, modify or operate artificial floodways to enhance the recovery of listed and sensitive fish species?

Science Question - Have restoration of fluvial processes such as stream meander, hydrograph, gravel composition, interstitial flow and riparian habitat in Central Valley riverine habitat resulted in movement toward recovery of listed fish species?

Science Question - How important is the Delta as a habitat for listed salmon species rearing under varied hydrological conditions?

Management Decision - Have modifications to Delta export facilities and other Delta diversions been sufficient to move listed fish species towards recovery?

Science Question - Can fish protective facilities associated with the Hood Mokolunne Diversion be developed that will not limit the recovery of listed and sensitive fish species?

Science Question - Can new fish protective facilities at the Delta intakes to the State and federal water projects be developed that will enhance the recovery of listed fish species?

Science Question - What are the population level impact of the remaining unscreened agricultural diversion, both in the Delta and upstream, on listed and sensitive fish species?

Science Question - Can we screen Georgiana Slough and the Delta Cross Channel in order to protect downstream migrating fish while providing for upstream passage in a manner that will enhance the recovery of listed and sensitive fish species?

KEY MANAGEMENT DECISION - HAS THE PROGRAM BEEN SUFFICIENTLY SUCCESSFUL TO WARRANT CONTINUED INVESTMENTS?

Management Decision - Has the Program succeeded in restoring the Bay/Delta and Central Valley ecosystem?