CALFED End of Stage 1
Staff Report

November 2007

CALFED End of Stage 1 Report

Executive Summary

In August 2000, the CALFED Record of Decision (ROD) for the Programmatic Environmental Impact Statement and Report (PEIS/EIR) laid out a 30-year plan to meet program objectives for levee system integrity, ecosystem restoration, water supply reliability, and water quality. While CALFED agencies will continue to implement the ROD for many more years, some adjustments in planned activities may be warranted as anticipated in the ROD.

The Preferred Program Alternative chosen in the ROD employs a through-Delta approach to conveyance. CALFED agencies agreed in the ROD that this conveyance approach would be monitored and then assessed at the end of Stage 1 to determine whether it is meeting the Program's goals and objectives. In the event that the chosen conveyance approach is not working, the agencies agreed in the ROD to evaluate additional alternative conveyance actions and then make a decision to proceed accordingly.

As the first seven years (Stage 1) of the CALFED Program comes to an end, CALFED Program staff (hereafter Staff) has begun this assessment. In this report, Staff assessed the effectiveness of actions in meeting program objectives during Stage 1 and the likelihood that the actions will allow the Program to meet its objectives in the future. Staff has concluded that there is sufficient justification to consider alternatives to the existing through-Delta conveyance approach. CALFED agencies are currently participating in 3 processes to evaluate alternative conveyance approaches and alternative strategies to manage the risks to Delta levees. The Delta Vision and Bay Delta Conservation Plan (BDCP) processes and the Delta Risk Management Strategy (DRMS) each look at Delta conveyance from different perspectives. Recommendations from these initiatives may lead to some revision or refinement of Delta actions identified in the ROD or development of new Delta actions.

Conclusions

Based on assessments in this report, Staff concludes:

- The CALFED Program has experienced significant progress in areas outside the Delta. In-Delta progress has been more limited. CALFED was especially successful in providing a forum for state, federal and local agencies working collaboratively with stakeholders in an open, transparent and accountable way in an effort to secure California's water future while working towards a healthy ecosystem. A hallmark of the CALFED Program has been the development and integration of sound scientific information into all CALFED activities and decisions.

Conveyance role in the Preferred Program Alternative

The preferred program alternative is comprised of many interrelated parts with actions identified for implementation throughout much of California. While all these parts influence the success of the program, the method of Delta conveyance plays a disproportionately large role in the success of the program because of its influence on Delta water flow, water quality, habitat, and water supply.

- The continued Pelagic Organism Decline (POD), existing risks to Delta levees, and projected future conditions that will further jeopardize Delta levees are prime reasons to reevaluate the method of Delta conveyance. Re-evaluation of conveyance is currently underway as part of the Delta Vision and BDCP processes. Since the method of conveyance influences Delta water flow, water quality, ecosystem, and water supply, these elements also need to be reevaluated along with conveyance.
- CALFED agencies will continue to implement the ROD in an open, transparent and accountable way, focusing on actions with a direct link to the Delta. Further, the CALFED Science Program will continue to conduct focused research and the agencies will improve Program monitoring, tracking, and reporting.
- CALFED agencies will incorporate recommendations from the Delta Vision, BDCP, and DRMS processes as appropriate as the agencies shape CALFED activities over the next several years.

This report is not a decision document and does not trigger the need for new or revised environmental documentation. It is simply intended to describe progress made during the first seven years of the CALFED Program and assess the likelihood that the preferred program alternative will allow the Program to meet its objectives in the future. It also outlines the general direction for the continuation of the CALFED Program.

Contents

1. Introduction

Background

Since 1995, CALFED's state and federal agencies have worked with stakeholders to develop and begin implementing a long-term program for improving resource conditions in the San Francisco Bay/Sacramento-San Joaquin Delta. The purpose of the CALFED Bay-Delta Program was to achieve four interrelated objectives:

- **Levee System Integrity** - Reduce the risk to land use and associated economic activities, water supply, infrastructure and the ecosystem from catastrophic breaching of Delta levees.
- **Ecosystem Restoration** - Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.
- **Water Supply Reliability** - Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.
- **Water Quality** - Provide good water quality for all beneficial uses.

In August 2000, the CALFED ROD for the PEIS/EIR laid out a 30-year plan to meet program objectives. The single most important difference between CALFED and past efforts to solve problems of the Bay-Delta is the comprehensive nature of CALFED's interrelated resource management strategies. The CALFED agencies determined that the four problem areas of levee system integrity, ecosystem quality, water supply reliability, and water quality were interrelated, and that problems in any one program area could not be solved effectively without addressing problems in all four areas at once. Agencies also agreed that any solution must satisfy certain CALFED Solution Principles, which include being "implementable," and "reducing conflicts in the system."

The preferred program alternative chosen in the ROD employs a through-Delta approach to conveyance coupled with ecosystem restoration, water quality improvements, levee system improvements, increased water use efficiency, improved water transfer opportunities, watershed restoration, and additional surface and groundwater storage. The agencies agreed that this approach would be monitored and then assessed at the end of Stage 1 to determine whether it was meeting goals and objectives, consistent with the CALFED Solution Principles.

Purpose

As Stage 1 comes to an end, it is appropriate for Staff to conduct an assessment to document what has worked and what has not worked to allow adjustments, as appropriate, to the Program. The importance and urgency of CALFED's end of Stage 1 assessment has been heightened by the confluence of a series of unanticipated events in recent years:

- Populations of certain Delta fish species have declined precipitously. As a result, water operations have been adversely impacted and certain large water supply projects envisioned in the ROD are currently not implementable.
- The number of major Delta-related lawsuits has increased, including suits challenging the regulatory underpinnings of the joint state and federal water operations system.
- Research conducted since the 1989 Loma Prieta earthquake, the Upper Jones Tract levee failure, Hurricane Katrina and the initial results of the Delta Risk Management Strategy have sharpened the focus and concern over the aging levee system.
- New scientific studies suggest that global warming and other forces will alter the landscape and hydrology of the Delta in ways that were clearly not anticipated in 2000.

In light of these factors:

- The Governor in 2006 established a major effort called Delta Vision to write a strategic plan for a long-term sustainable Delta that includes a durable and reliable water conveyance approach.
- State and federal agencies and stakeholders embarked on a major planning effort for the Delta ecosystem and species conservation (BDCP) that is evaluating the options for a new conveyance system and other related restoration strategies. The plan is intended to lead to a major new course for water allocation and conveyance in the Delta that will secure the long-term regulatory approvals and predictability for water supplies that is now absent.
- The Legislature acknowledged concern over the Delta with passage of Assembly Bill 1200 in 2005. The bill required the Department of Water Resources (DWR) to evaluate the potential impacts on water supplies derived from the Sacramento-San Joaquin Delta resulting from subsidence, earthquakes, floods, changes in precipitation, temperature, and ocean levels, and a combination of those impacts. The Legislature is considering additional bills relating to the condition of the Delta.
- In November 2006, California voters entrusted DWR with about $9.5 billion in new bond funds (Propositions 1E and 84) for flood management and integrated regional water management, a portion of which will be available for the Delta.
- Congressman Miller and others in the California delegation called for oversight hearings on the ongoing crisis in the Sacramento-San Joaquin Delta. On July 2, 2007, various panels warned that the Delta teeters on the verge of crisis (Los Angeles Times, 2007).

Staff's End of Stage 1 assessment of the approach chosen in 2000 is necessary not only to help set the future course for the CALFED Program, but also to share information with the Delta Vision and the BDCP processes as well as DRMS. Similarly, the results from these three initiatives may lead to some revision or refinement of Delta actions identified in the ROD or development of new Delta actions.

Changing Conditions

There are several factors that will affect how CALFED's preferred program alternative (including the through-Delta conveyance system) can perform in the future. These factors can significantly alter how the Delta functions for levee system reliability, ecosystem, water supply reliability, and water quality.

Global Climate Change – Sea Level Rise

Over the last 100 years, the sea level at California's Golden Gate has been rising by an average rate of about 0.08 inches per year and now sits about 7 inches higher than it did in 1920 (California Climate Change Center, 2006). Recent evidence (Meier, et. al., 2007) predicts the trend to warmer global temperatures will accelerate melting of glaciers, which will release more water into the oceans. In addition, warmer ocean temperatures cause the water to expand, further raising the sea level. Current estimates by the Intergovernmental Panel on Climate Change indicate that sea level will rise by about 0.6 foot to 1.9 feet over the next 100 years, with a possible added 0.5 foot if the rate of Greenland ice melt increases (IPCC, 2007). Some scientists believe that the sea level rise could be significantly more (Meier, et. al., 2007). The CALFED Independent Science Board suggests that sea level is likely to rise at least 2.3 to 3.2 feet by 2100, and even greater (6.5 feet or more) if ice cap melting accelerates (Healey, 2007). The existing Delta levees were not designed to withstand the forces of rising sea level.

Regional Climate Change – Effects on Resources

By the end of the century, depending on future heat trapping emissions, statewide average temperatures are expected to rise between 3.0 and 10.5°F (California Climate Change Center, 2006). Projected increases in air temperature may lead to changes in the timing, amount and form of precipitation – rain or snow, changes in runoff timing and volume, effects of sea level rise on Delta water quality, and changes in the amount of irrigation water needed due to modified evapotranspiration rates (DWR, 2006). Storm runoff is likely to become more intense with higher snow lines and more winter precipitation to fall in the mountains as rain rather than snow. Average winter flows to the Delta are likely to become larger in the future which can cause more flooding (Knowles, et. al., 2004 and EPRI, 2003). The effects of climate change can alter reservoir inflows, delivery reliability and annual average carryover storage (DWR, 2006), thereby significantly impacting Delta exports.

Warmer temperatures and higher sea level also have important implications for species and ecosystems. Increases in water temperature and reductions in cold water in upstream reservoirs may hurt spawning and recruitment success of native fishes. Large parts of Suisun Marsh will be transformed from freshwater to saltwater marsh and marsh habitats will be squeezed against upland urban and industrial development. There will be less habitat available for migratory waterfowl unless new habitat is created. Salt water will intrude further into the Delta, reducing low salinity habitats preferred by some species to narrow zones within leveed channels. Higher water temperatures will make the Delta intolerable to some native species and also more attractive to some non-native invaders.

Seismic Activity

The Delta and Suisun Marsh lie in proximity to major faults that are capable of generating moderate to strong ground shaking, particularly in the western Delta (USGS, 2003). Liquifaction of foundation sands under some levees during a moderate to strong earthquake has the potential to fail many miles of Delta levees, none of which were designed or constructed to current seismic standards. There is high probability that an earthquake leading to multi-island flooding will occur during this century (URS, 2007).

Introduced Species

All aspects of the ecology of the Delta have been significantly and, in most cases, irrevocably altered by introduced (non-native) invasive species. Introduced species now dominate all habitats within the Delta. For example, 88 percent of the fish captured in 2003 during juvenile fish surveys, were introduced species (Light, et. al., 2005). In benthic sampling throughout the Delta, typically 95 percent or more of the biomass consists of introduced species (Light, et. al., 2005). The effects of most introduced species on the Delta ecosystem are unknown. Some introduced species are also invasive: they spread rapidly, take over habitats, and displace natives. Among the introduced species of the Delta, the most visible is the aquatic weed *Egeria densa*, which often chokes low-velocity channels in the central and southern Delta and reduces water turbidity (Resources Agency, 2007). Two clams from Asia dominate the benthos of the Delta: the Asian clam, *Corbicula fluminea* is most abundant in freshwater and the overbite clam *Corbula amurensis* is abundant in brackish to saline water. Corbula has substantial effects on the pelagic (open water) foodweb by filtering food from the water (Resources Agency, 2007). Striped bass and largemouth bass, both deliberate introductions, are not only among the most abundant fish of pelagic and nearshore habitats, they are also predatory and probably have a negative effects on natives (Nobriga, et. al., 2007).

Subsidence

Land subsidence, primarily through microbial oxidation of organic soils, has placed most of the Delta land below sea level, some as much as 15 feet or more. The dramatic reduction of land elevation on Delta islands has increased the differential between land and water surface elevations in the channels. Over the next 200 years, some areas, especially in the central Delta, could subside by another 18 feet from existing land levels if current land use practices continue (URS, 2007). The potential consequence of levee failures and related catastrophic island flooding has major implications for management of the Delta. The lower land surface makes levees more susceptible to failure and provides more room for inflowing salt water from Suisun Bay when a levee failure occurs. When flooding occurs, the flood waters leach organic material from the Delta peat soils back into Delta waters, negatively impacting quality for drinking water.

Population Growth and Urbanization

Population forecasts indicate that California's population may grow from the present 36 million to 90 million residents by 2100 (Landis, 2003). As noted in the California Water Plan Update 2005, this growth in population will change the nature and timing of demand

for water resources, directly and indirectly influencing the future of the Delta. Projections based on the 2000 Census suggest that the combined population of the six Delta and Suisun Marsh counties will grow from about 3,300,000 in 2000 to about 7,700,000 in 2050, an increase of over 130 percent (DWR, 2007). Population growth within the Delta, in the surrounding area, and in the state will place more demands on the Delta. More people will create more demand for recreation, transportation, utilities, and water supply, and more wastewater and urban runoff discharges into the Delta. Increasing population will also increase pressure for urban development resulting in more agricultural land being converted to urban land and further extension of the band of urban development encircling the Delta. Urbanization not only removes land from agriculture and other open space uses, but limits future management options in the Delta because the land is no longer available for other uses. For example, ongoing urban encroachment and levee improvements along the southern and eastern margins of the Delta limit the opportunity for future adjustments to Delta management strategies, such as use for a San Joaquin River flood bypass.

2. End of Stage 1 Assessment

CALFED is nearing the end of Stage 1 implementation. Stage 1 covers the first seven years of a 30-year program consisting of hundreds of actions. The Ecosystem Restoration Program alone identified over 600 programmatic actions. At the time of the ROD, the CALFED agencies recognized that the entire 30-year program was too long without some assessment and redirection along the way. The seven-year time period provided a reasonable period to implement some actions and start to show some benefits. For example, Stage 1 provided time to implement some ecosystem restoration actions upstream from the Delta, and enough time for several generations of salmon to benefit from those actions.

An assessment of past progress and likely future progress is appropriate at this time to assist with future program implementation.

Approach

Rather than individually considering each of the hundreds of programmatic actions identified in the ROD, this assessment focuses on the four CALFED objectives by providing answers to two questions:

- **Stage 1 Performance** – How well has Stage 1 implementation moved the program towards achieving the four program objectives?
- **Estimate of Likely Future Performance** – Is it likely that the four program objectives will be achieved if the preferred program alternative is fully implemented as envisioned by the ROD?

The preferred program alternative is comprised of many interrelated parts with actions identified for

Given the two questions:

Stage 1 Progress: The CALFED program has made progress towards meeting its objectives, particularly in areas outside the Delta. Progress within the Delta has been more limited. Unknowns about program performance and many problems that existed at the time of the ROD still exist and some new ones such as the POD have surfaced.

Likely Future Progress: The continued POD, existing risks to Delta levees, and projected future conditions that will further jeopardize Delta levees are prime reasons to reevaluate the preferred program alternative including through- Delta conveyance. Since the method of conveyance influences Delta water flow, water quality, ecosystem, and water supply, these elements also need to be reevaluated along with conveyance.

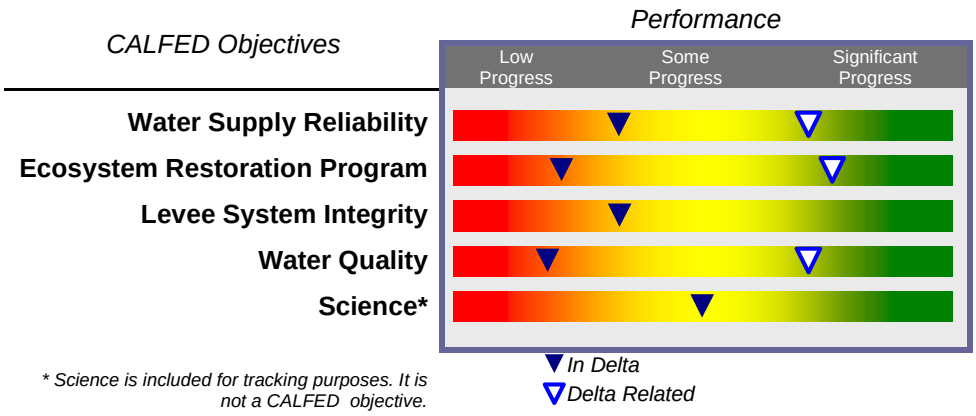
implementation throughout much of California. While all these parts influence the success of the program, the method of Delta conveyance plays a disproportionately large role in the success of the program because of its influence on water flow, water quality, habitat in Delta channels, and water supply.

The ROD recognized the role of Delta conveyance in the overall success of the program. The ROD also recognized the uncertainties surrounding Delta conveyance when it called for an evaluation of this means of conveying water across the Delta by the end of Stage 1.

Summary of Stage 1 Program Performance

CALFED agencies have worked together to invest approximately $2.5 billion and stakeholders have invested many billions more in a wide variety of actions within the Delta, in the upstream watersheds, and in the water service areas, primarily in the Bay Area and southern California. The program has made significant progress in some areas and has fallen short of expectations in other areas. CALFED was especially successful with state, federal and local agencies working collaboratively with stakeholders in an open, transparent and accountable way. A hallmark of the CALFED Program has been the development and integration of sound scientific information into all CALFED activities and decisions. In 2006, the *10-Year Action Plan* provided the foundation and restructuring to refocus the CALFED Program on the Delta (CALFED, 2006).

Appendix A (attached), *Program Performance Assessment, 2007,* prepared by the Bay-Delta Public Advisory Committee's Program Performance and Financing Subcommittee, contains an overview of Program progress during Stage 1. Their independent assessment of past performance is organized around the four CALFED objectives for water supply reliability, ecosystem restoration, levee system integrity, and water quality. In addition, their assessment includes information on coordination and science since both are needed for each of the CALFED objectives. The following figure shows qualitative performance rating scales for CALFED Stage 1 performance supported by the information in Appendix A.



CALFED Program Performance At-a-Glance. CALFED objectives have experienced significant progress in areas outside the Delta during Stage 1(indicated by the "Delta Related" symbols in the figure). In-Delta progress during Stage 1 has been more limited.

Levee System Integrity. CALFED Agencies have accomplished numerous goals including: increased protection for and maintenance of nearly 700 miles of Delta levees; improved stability of more than 45 levee miles; reused 1.36 million cubic yards of dredged material for levee stability and habitat improvement; and created approximately 50 acres of riparian and wetland habitat along with 3000 linear feet of shaded aquatic habitat.

Ecosystem Restoration Program. Numerous important projects, ranging from targeted research to full scale restoration, have been implemented under the Ecosystem Restoration Program (ERP). Full scale tributary restorations upstream from the Delta are showing some of the best results. Significant investments in fish screens, temperature control, fish passage improvements upstream of the Delta, and improvements in upstream habitats have resulted in an improved outlook for most salmon populations throughout the Central Valley. The recent settlement of long-standing legal disputes on the San Joaquin River has the potential to improve upper San Joaquin River salmon populations.

In the Delta, emphasis has been on targeted research and pilot projects to improve understanding of how to accomplish restoration. As a result of this research, many beliefs about Delta function have been replaced and a new paradigm for restoration has emerged that focuses on spatial and temporal variability. While understanding has increased, key species have, unfortunately, declined. Some, like the threatened delta smelt, are at all time low abundance. Funding and research has been refocused to find solutions to these unexpected species declines.

The ERP agencies have been successful at acquiring and protecting important lands in the Delta and along its tributary rivers and streams. To date, more than 130,000 acres of farmland and other habitat targeted for important species have been enhanced, protected, or restored. Most of the protection has occurred through easements working with local land owners and communities. Protection of agricultural lands is a high priority for CALFED because agricultural lands provide significant habitat values, including open space and resting and feeding habitat for migratory birds. For this reason, ERP issued a $9 million Proposal Solicitation Package entitled “Assisting Farmers Integration Ecosystem Restoration into Agricultural Management.” The ERP was also instrumental in developing the framework for adaptive management that has been adopted by the other components of CALFED.

CALFED Problem Area

In preparation of the CALFED PEIS/EIR, the geographic scope for analysis and actions focused on the Delta and Suisun Bay and Marsh as the problem area and included a broader area upstream and downstream of the Delta in the solution area (CALFED, 2000). Defining the Delta and Suisun Bay/Marsh as the problem area is as accurate today as it was at the time of the ROD.

Water Supply Reliability. Groundwater storage, conjunctive use and recycling projects outside of the Delta have improved water supply reliability in the state. In urban areas, major investment in water use efficiency (WUE), water reclamation, and local storage have helped stabilize demand for Delta water. Investments in WUE has also softened the impact of short term reductions in Delta exports.

Much has been learned about the Bay-Delta system relevant to water supply reliability. Delta hydrodynamics are much better understood as is the importance of tides in mixing

waters throughout the Delta. The potential impact of climate change on water supply from the Delta by shifting precipitation from snow to rain and by raising sea level have also been identified. Research has also revealed the catastrophic effect that massive failure of Delta levees caused by an earthquake would have on water exports. Studies have been conducted and, in some cases, environmental documentation developed for projects to improve Delta conveyance or increase surface storage. The South Delta Improvements Program EIS/R was finalized in December 2006; a State Feasibility Study Report (FSR) for In-Delta Storage was completed in 2006; and final FSRs and Environmental Documents for the other four surface storage projects (Shasta Lake Water Resources Investigation, North-of-the-Delta Offstream Storage, Los Vaqueros Expansion Investigation, and Upper San Joaquin River Basin Storage Investigations) will be released beginning in fall of 2008.

Water Quality. The ERP has awarded more than $48 million for ecosystem water quality projects and the Water Quality Program has awarded $76 million for drinking water quality grants. Projects funded by the ERP have focused on resolving the dissolved oxygen depletion in the Stockton Deepwater Ship Channel and developing and implementing a strategy to reduce the harmful effects of mercury. With the POD, toxicity of unknown origin has become an additional area of focus since 2005. State and federal agencies have made progress on the regulation and control of certain high priority pesticides throughout the Delta watershed and on salinity and boron in the lower San Joaquin River.

Projects funded by the Water Quality Program have focused on improving drinking water quality, with source improvement projects throughout the Delta watershed and in the local watersheds of the North Bay Aqueduct and Contra Costa County, as well as demonstrations of new treatment technologies. The Delta and its tributaries, however, continue to exceed regulatory objectives for many constituents. (Brown and Caldwell, 2005; CALFED, 2007a, 2007b, and 2007c). Local investments in new treatment technologies have allowed water districts using Delta water to stay in compliance with drinking water standards in spite of an increasingly challenging regulatory environment. The Old River and Rock Slough Water Quality Improvement Projects in the Delta are reducing salinity and other constituents of concern to drinking water at two urban intakes in the South Delta (CALFED, 2006).

It is now understood that shallow water habitats and intermittently flooded habitats in the Delta can be primary sites of mercury methylation so that restoration of these habitats can have adverse impacts on ecosystem water quality and mercury availability. Furthermore, these habitats can also be important sources of dissolved organic carbon, although most of the dissolved organic carbon in Delta water comes from upstream sources. The results of research on mercury and organic carbon have demonstrated that there are important trade-offs between habitat restoration and water quality in the Delta.

Science. The Science Program has provided independent scientific review of proposals, priority issues, and programs relevant to CALFED actions. In addition, the Science program engages science advisors who provide advice and technical support to implementing agencies in dealing with complex resource and ecosystem management problems. Independent science review has focused on priority issues including Operations Criteria and Plan (OCAP) Biological Opinion Review, Interagency Ecological

Program's (IEP) Pelagic Organism Decline (POD) work plan, CALSIM II water management simulation model, and the Environmental Water Account. The Science Program also provides support for the CALFED Independent Science Board (ISB).

In 2004 and 2006, the Science Program funded $16 million in research targeted to address cross program information needs and future change. Investments in research have led to significant improvements in understanding of the Bay-Delta system and its management. The multiple and interacting effects of Delta inflows, export pumping, toxic chemicals, invasive species and Delta hydrology on sensitive aquatic species is now much better understood, although solutions to restore native species remain elusive. The Science Program will continue to support ongoing science communication activities such as the electronic scientific journal dedicated to Bay-Delta and watershed issues and biennial CALFED Science Conferences. There will be an increased emphasis on coordination of science and synthesis of technical and scientific information to provide the scientific context for upcoming decisions on CALFED Program implementation.

Assessment of Likely Future Performance

The assessment of likely future performance of the preferred program alternative considers experience during Stage 1 (Appendix A), new information since 2000, and how future changing conditions (sea level rise, continued subsidence, introduced species, etc.) will influence program performance.

Levee System Integrity

The CALFED objective for levee system integrity is to reduce the risk to land use and associated economic activities, water supply, infrastructure and the ecosystem from catastrophic breaching of Delta levees. Delta conveyance and the levee system are closely linked. The levees define the channels that are part of through-Delta conveyance and affect Delta hydrodynamics.

> Based primarily on the condition of the existing levee system and the hazards that these levees face now and will face in the future, Staff believes that it is not possible to meet the levee system integrity objective with the actions outlined in the CALFED preferred program alternative. Through Delta conveyance cannot be reliable without a reliable levee system.

Recent passage of bond measures (Propositions 1E and 84) in November 2006 will provide about $5 billion for flood management in the Central Valley. Delta levees will receive a portion of these funds, but the amount has not been determined. It appears that the majority of presently available funding may be focused on urban areas (DWR, 2006). Preliminary estimates by DWR indicate that $3 to $5 billion may be required to improve the Delta levees, without addressing seismic stability (DWR, 2006).

Although CALFED recognized the potential for seismic failure of Delta levees, most of the proposed improvements in the ROD were intended to improve the levees to the Public Law 84-99 standard, one that does not consider seismic risk (CALFED, 2000). The CALFED Independent Science Board suggested that even a levee program that is adequately funded to achieve CALFED objectives might still leave the Delta vulnerable to catastrophic flooding as a result of earthquakes or global climate change (Resources Agency, 2005).

Since the ROD, the *Preliminary Seismic Risk Analysis Associated with Levee Failures in the Sacramento – San Joaquin Delta* (CBDA, 2004) and the Delta Risk Management

Strategy (DRMS) evaluated seismic risks for Delta levees (URS, 2007). Both reports highlight the potential for multiple levee failure during a moderate to severe earthquake. DRMS also considered risks from flood induced and "sunny day" failures of Delta levees. The Phase 1 DRMS analysis estimated that:

- An average of 2.1 Delta islands and tracts can be expected to flood per year from high storm flows.
- There is about a 35 percent chance that 20 or more islands will flood simultaneously from levee failures during a seismic event during the next 25 years.
- Unlike levee failures due to high storm runoff, an earthquake will cause thousands of feet, if not miles of levees to fail and may leave large areas of the Delta permanently flooded.
- The risk of seismic and flood failures to levees will increase over time.

Conveyance of water to the south Delta export facilities uses Delta channels that are bounded by levees. Without levees, the Delta would be an "inland sea" (DWR, 2006) and tidal mixing would make the Delta saltier, perhaps making the water for export unusable for drinking and agricultural uses (USGS, 2000). DWR's Special Flood Control Projects Program recognizes the importance of the eight western islands in controlling salinity in the Delta (DWR, 1996). Without a dependable levee system, the water used within the Delta and export water supplies would not be reliable.

The ROD did not fully anticipate the risk to Delta levees from earthquakes, sea level rise or increased winter flooding. If the Delta is to be maintained in its current physical configuration, these future conditions will necessitate more extensive and expensive levee modifications and make it increasingly unlikely that the actions described in the preferred program alternative alone can meet the levee system integrity objective.

Ecosystem Restoration

The CALFED objective for the ecosystem is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. Delta conveyance and the ecosystem in the Delta are closely linked. Delta conveyance and movement of water to the south Delta export pumps affect the movement of fish and their food (Resources Agency, 2007). Likewise, the rates of water export are affected by standards (State Water Resource Control Board, 1999) and requirements established to meet the State and federal Endangered Species acts and water right permits to protect the fish.

The current pelagic organism decline is a sign that it may not be possible to meet the in-Delta ecosystem objective with the preferred program alternative. A change in Delta conveyance may help resolve the pelagic organism decline, but conveyance appears to be only one contributor to this condition. How well the preferred program alternative meets the ecosystem objectives in the future is largely dependent upon future Delta conditions. Given that changes in current conditions are inevitable, staff believes the existing approach to ecosystem restoration in the Delta will need to be reassessed.

Most of the in-Delta ecosystem actions completed during Stage 1 have been studies for improved understanding of the Delta. In general, these studies have not yet been

translated into physical improvements that actually benefit the species. Conveyance projects designed to improve protection of fish have also focused on studies, as opposed to physical improvements. The through-Delta Facility feasibility study and the studies on the re-operation of the Delta Cross-Channel fall into this category. Further, the proposed fish screening facilities at the export facilities were deferred due to the high costs of these screens and scientific questions about their efficacy (South Delta Fish Facilities Forum, 2005).

Pelagic or open water fish have been declining in abundance for several decades. Four species (Delta smelt (listed as threatened), longfin smelt, threadfin shad, striped bass) have experienced precipitous decline beginning about 2002. The decline continued over the next several years and by 2004, was widely recognized as a serious issue and became known as the Pelagic Organism Decline (Bennett, 2005, Sommer, et. al. 2007 in press). The continued pelagic fish decline was even more unexpected since hydrologic conditions in the San Francisco estuary during this period were generally favorable for fish species (Resources Agency, 2005).

Intensive research was initiated to determine the causes of this decline and several factors have been identified. The amount of suitable habitat for the species has declined significantly, especially in the eastern and western areas of the Delta. An invasive species, the overbite clam, *Corbula amurensis*, has reached high abundance in the western Delta where it filters most of the food needed by the pelagic fish species out of the water. Toxic substances in the water may directly affect the health of the fish and their food. State, federal and local water project operations cause fish mortality when they draw water toward their intakes and suck fish out of the Delta.

During 2007, tow net surveys recorded low numbers of juvenile delta smelt (Delta Smelt Working Group, May 15, 2007). The low numbers of juveniles led first to a modification in operations that reduced the magnitude of reversed flows in Middle and Old Rivers (Delta Smelt Working Group, May 15, 2007). Subsequently, pumping of water was significantly curtailed at state and federal export facilities to avoid further taking of delta smelt (DWR News Release date May 31, 2007).

The decline of pelagic fishes, particularly Delta smelt, is having serious consequences on water withdrawal and export. However, solutions that will halt or reverse the decline remain elusive. How well the ecosystem objective can be met in the future depends on how future conditions/decisions influence the physical configuration of the Delta. If future conditions in the Delta result in extensive levee failures, it may be impractical to recover all flooded Delta islands and tracts thus changing conditions for the Delta ecosystem. Similarly, decisions about the quantities and locations for exporting water in response to permanently flooded Delta islands would also change conditions for the ecosystem. In addition, future sea level rise, continued introductions of non-native species, and urbanization could lead to a change in the ecosystem. On the whole, the future conditions will likely result in a different Delta ecosystem than is in place today. Some changes may be beneficial to the ecosystem and native species and some may be detrimental. As a result of changed conditions, the current approach to ecosystem restoration in the Delta will need to be reassessed.

Water Supply Reliability

Based primarily on the risks of increased Delta salinity due to levee failures, climate change and sea level rise and the continued conflicts between the in-Delta ecosystem and water exports, Staff believe that water supply reliability objectives cannot be met with the preferred program alternative.

The CALFED objective for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system. Delta conveyance provides the flow of fresh water for in-Delta water users and for the south Delta export pumps. Because of exports, the Delta is managed as a fresh water system (State Water Resources Control Board, 1999).

During Stage 1, exports reached levels slightly higher than the highest export levels of the 1980s (Resources Agency, 2005). However, what looked to some as a more reliable export water supply appears to have been a temporary period of opportune conditions. The state's water supply may be less reliable in the future due to increased water allocation for pelagic species conservation, climate change, and other factors. The following, noted in chronological order, offer a sense of why export water supplies may not be as reliable in the future as they have been in the recent past.

- Scientific research supported by CALFED is providing increasing evidence that the export pumps are one of several factors having an adverse effect on pelagic fish species, including the threatened delta smelt (Resources Agency, 2005). As a result, increases in Delta exports, as permitted in the ROD, have not been implemented, and there is growing doubt whether existing exports can be maintained.
- The Biological Opinion for Salmon (NMFS, 2004) concluded that the Long-Term Central Valley Project and State Water Project OCAP for existing and future Delta export operations would not jeopardize salmon. The CALFED Science Program reviewed the biological opinion (BO) and concluded that the scientific information used in the BO was not the best available (CALFED, 2005). This BO has been challenged (Pacific Coast Federation of Fishermen's Association v. Gutierrez). Judicial hearings began in August 2007.
- The February 2005 BO for delta smelt (USFWS, 2005) concluded that the 2004 OCAP would not jeopardize delta smelt or alter its critical habitat. This BO was challenged (NRDC v. Kempthorne). On May 25, 2007, United States District Judge Oliver W. Wagner found that the BO was unlawful and inadequate and must be rewritten (United States District Court, Eastern District of California, 2007).
- *The Pelagic Fish Action Plan* (Resources Agency, 2007) recommended a series of four water project operations actions for consideration in 2006-2007 to address the POD and stabilize the Delta ecosystem. Implementation of this series of seasonal actions is dependent on specific environmental and biological conditions occurring in the Delta and the continuing availability of resources to implement each subsequent action. The water costs of these actions may be highly variable depending on hydrologic conditions and export demand, and individually range

from 35 TAF to 580 TAF, but could total up to about 1.6 MAF. These actions were the basis of the interim remedy proposal for the lawsuit discussed below.

- On April 18, 2007, the State Water Project (SWP) was placed under court order to cease water diversions within 60 days unless a California Endangered Species Act permit was obtained. DWR appealed the order, but has also agreed with the Department of Fish and Game (DFG) to help complete the federal BOs by April 2008, to keep all variable assets used to protect at-risk native fish consistent to those used in the past several years, to purchase water assets of 210 TAF to 250 TAF if needed to help meet targets, and other actions (CDWR & CDFG, 2007).
- In mid-May 2007, export pumping from the Delta was reduced in an attempt to achieve non-negative flows in Old and Middle rivers. Observed entrainment of juvenile smelt between May 25 and May 31 at the Harvey O. Banks pumping plant facility resulted in DWR stopping pumping at SWP facilities in the Delta on May 31, 2007, to provide maximum protection for Delta smelt (DWR, 2007). The Bureau of Reclamation (BR) also cut back pumping at the C.W. "Bill" Jones Pumping Plant and purchased water to try to achieve non-negative flows in Old and Middle rivers.
- On August 31, 2007, United States District Judge Oliver W. Wagner ordered less water to be exported from the Delta to help protect delta smelt (Fresno Bee, September 2007). Under the ruling, export limits would be put in place from the end of December 2007, the beginning of the spawning season, until June 2008, when young fish can move into better habitat with more food. Judge Wanger gave both sides 50 days to put his oral statement into a written order. Estimates by DWR indicate that this could amount to a 35 percent reduction in water export during 2008. The measures will be in place until federal agencies develop a revised biological opinion for delta smelt with its own provisions to ensure the various water projects comply with Endangered Species Act requirements.

Emerging science suggests that water supplies will not be as reliable in the future without changes in water management strategy. Changing climate including changing snow melt patterns will alter patterns of water delivery from the watershed and reduce the winter storage as snow. Rising sea level will make it more difficult to prevent sea water intrusion into the water supply. These factors will adversely affect project operations, the delivery of water to replenish south-of-Delta storage, and the transport of water from sellers upstream of the Delta to buyers downstream under the current through Delta conveyance system. Maintenance of a reliable water supply will require strategies to deal with these emerging risks.

Increased winter flooding potential and the probability of earthquakes failing levees will further threaten water supply. In the event of a catastrophic levee failure in the Delta, salt water intrusion into the Delta could limit or shut down both in-Delta diversions and exports (URS, 2007). Even if the state were to fully upgrade Delta levees, sea level rise could negatively impact water supply reliability by increased sea water intrusion that will accompany sea level rise. The increased use of upstream reservoir water to repel the salinity would leave less water to release for urban, agricultural and environmental uses. Additional reductions in exports may be required to reduce or reverse the POD in the near-term and long-term (Resources Agency, 2007). Therefore, the current POD, seismic

risk, and potential future climate conditions make it increasingly unlikely that the preferred program alternative can meet the water supply reliability objective.

Water Quality

The CALFED objective for water quality is to provide good water quality for all beneficial uses including domestic, industrial, agricultural, recreation and ecosystem. The Delta is currently managed as a freshwater system (State Water Resources Control Board, 1999) to keep water suitable for in-Delta consumptive uses and for export water supply. Delta conveyance moves water from upstream sources such as the Sacramento River and several of its tributaries such as the Mokelumne River to the south Delta and directly influences the Delta's water quality for all uses.

It is unlikely that ROD bromide and organic carbon targets for Delta water can be met with the preferred program alternative, so the Program has focused on working towards an equivalent level of public health protection. Based on the gradual increase in salinity due to sea level rise or the sudden increase in salinity due to catastrophic levee failures, Staff believes that the Delta will eventually become too salty for use as an agricultural and drinking water source. Therefore, it is unlikely that the drinking water objectives can be met in the future with the preferred program alternative. For the ecosystem, elevated salinity levels are less problematic because many estuarine species can move or adapt to changing salinity. Elevated salinity may benefit some species and be a disadvantage to other species.

The ROD (CALFED, 2000) set a target to "achieve either: (a) average concentrations at Clifton Court Forebay and other southern and central Delta drinking water intakes of 50 μg/L bromide and 3.0 mg/L total organic carbon, or (b) an equivalent level of public health protection using a cost-effective combination of alternative source waters, source control, and treatment technologies."

Salts, including bromide, at current levels, have a negative impact on: drinking water quality; blending Delta water with other sources; water recycling; and agricultural water use. Short-term modeling studies indicate that the combination of conveyance improvements with the through-Delta facility, Delta Cross Channel Gate operations and the Franks Tract project could incrementally lower bromide at times, but not to the level targeted by the ROD (DWR, 2007).

Although organic carbon at Delta drinking water intakes typically averages just over 3 mg/L, it can easily spike beyond 10 mg/L (Brown and Caldwell, 2005). While there are projects underway investigating organic carbon source improvement methods, it is too early to tell if any of these efforts will lead to significantly reduced concentrations at the drinking water intakes. However, given the watershed-wide contributions of organic material, it will be difficult to measurably reduce either averages or spikes of organic carbon at the drinking water intakes (AWWA, 2007; CALFED, 2007c and 2007d).

Recent studies show that advanced water treatment technologies are nearing the physical, and cost effective, limits for reducing the concentrations of harmful disinfection byproducts from drinking water. Future regulations are difficult to predict, but new categories and species of disinfection byproducts are continually being discovered. Export of water from Delta channels leaves drinking water supplies at risk from future regulatory tightening and water quality degradation. Further tightening of standards or significant increases in pollutant concentrations could make treating drinking water from the Delta very expensive.

Initial progress has been made on the dissolved oxygen, mercury, selenium, and pesticide toxicity problems through research, pilot projects, and regulatory programs. These ecosystem water quality problems are complex and will be difficult to fully correct. With continued diligence, including continued research and adaptive testing of management practices, further progress can be expected. Urbanization of the watershed continues to be a threat because of increased wastewater and stormwater discharges. Increased water temperatures could severely impact some desirable species. There are also trade-offs between water quality for drinking and agriculture and ecosystem restoration in the Delta. Current scientific ideas about improving ecological function in the Delta are focused on increasing short and medium term variability in floodplain inundation, water residence time and Delta salinity but these actions would all lead to reductions in water quality for drinking or agriculture over large parts of the Delta.

If current in-Delta water quality standards are maintained in response to the higher salinities, it would be increasingly difficult to flush the Delta of salts, even with re-operation of upstream reservoirs or construction of new reservoirs. This would likely result in lower reservoir levels which would decrease the ability to meet water supply and salinity requirements, particularly during dry periods. This could also result in a smaller cold water pool in upstream reservoirs for use in maintaining cold temperatures for fish in downstream rivers.

Another risk to the Delta as an agricultural and drinking water source may be a catastrophic event, such as an earthquake, that fails and floods multiple Delta islands (URS, 2007). The Phase 1 DRMS Risk Analysis Report (URS, 2007) estimated that a flooding of 30 islands during an earthquake could shut down the export facilities from 16 to 23 months due to elevated salinity levels. If levees breach during non-flood flow periods, salt water from the Suisun Bay can flow upstream to flood islands with breached levees and lead to higher salinities at the export facilities. Depending on the actual levee failures, it may be impractical to recover all the flooded islands and the Delta could remain salty for extended periods of time. Water left standing within the Delta islands with high peat soils would leach high levels of organic carbon into Delta waters. In this case, elevated salinity and organic carbon levels at the export facilities could persist for extended periods of time, with potentially profound, long-lasting negative impacts on drinking water quality. For the ecosystem, salinity is less of a threat because of the ability of estuarine species to move and adapt to a wide range of conditions. Increased salinity may benefit some species and may be a disadvantage for other species.

In the long run, due to sea level rise or catastrophic failure of the levees, the Delta is likely to become too salty for use as an agricultural and drinking water source. In these cases, the potential for water quality problems will cause a loss in water supply reliability. Therefore, it is unlikely, in the long-term, that the Program objectives can be met in the future with the preferred program alternative. For the ecosystem, elevated salinity levels in the future may benefit some species and be a disadvantage to other species.

3. What's Next?

As the CALFED Program completes Stage 1, a direction needs to be established for continuation of the Program. As envisioned by the ROD, CALFED agencies are currently evaluating alternative approaches for Delta conveyance, primarily by participating in the Delta Vision and BDCP processes that include consideration of alternative conveyance approaches for the Delta. Similarly, the agencies are participating in DRMS to assesses the major risks to the Delta resources from floods, seepage, subsidence, and earthquakes and develop recommendations to manage the risk. As such, it is premature to set a specific future direction at this time. However, it is expected that many of CALFED's Stage 1 actions will continue in the future. Further, recommendations from the initiatives may lead to some revision or refinement of Delta actions identified in the ROD or development of new Delta actions.

Coordination with Ongoing Initiatives

As CALFED agencies consider future steps for the CALFED Program, they are participating in other initiatives to ensure a solution that satisfies the multiple needs of the state. Three initiatives that are expected to play a sizable role in CALFED's future direction are Delta Vision, BDCP and DRMS.

Delta Vision

The role of the Delta Vision initiative (Governor Schwarzenegger's Executive Order S-17-06) is to identify a strategy for managing the Sacramento-San Joaquin Delta as a sustainable system for all environmental and economic services that the Delta provides. The scope of Delta Vision is broader than that for CALFED since it also includes issues like land use, transportation, utilities, recreation, and local and state economics. However, the CALFED agencies are largely responsible for staffing the Delta Vision efforts and providing information on water supply, water quality, levees and ecosystem restoration to this effort.

A key component of Delta Vision is a Governor-appointed independent Blue Ribbon Task Force that is responsible for recommending future actions to achieve a sustainable Suisun Marsh and Delta. The process includes a diverse Stakeholder Coordination Group and broad public outreach to evaluate different Delta visions and management scenarios. The Delta Vision Blue Ribbon Task Force will present its findings and recommendations by January 1, 2008 and its Strategic Plan by October 31, 2008. A Cabinet-level Delta Vision Committee will submit the Delta Strategic Plan to the Governor and Legislature by December 31, 2008.

Bay Delta Conservation Plan

BDCP is a Natural Community Conservation Planning effort to address water operations and facilities in the legal Delta. BDCP is focusing primarily on aquatic ecosystems and natural communities. Among other things, the plan will:

- Provide for conservation and management of species impacted by the covered activities
- Preserve, restore, and enhance aquatic, riparian and associated terrestrial habitats

- Provide clear expectations and regulatory assurances for Delta water operations and facilities (CVP, SWP, and Mirant Corporation)

The BDCP will work on a conservation strategy from early 2007 through late 2008. The Final Bay Delta Conservation Plan is expected to be completed in October 2009. The CALFED agencies are also largely responsible for staffing the BDCP effort.

Delta Risk Management Strategy

The preferred program alternative included a Delta Risk Management Strategy (DRMS) to assess major risks (Phase 1) to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS is also developing alternative strategies to manage the risk (Phase 2). Phase 1 is scheduled for completion in October 2007 and Phase 2 will be completed in December 2007.

Other Initiatives

There are a number of other initiatives that may influence CALFED's future direction. Examples include:

- Interagency Ecological Program (IEP)
- Delta Regional Ecosystem Restoration Implementation Plan (DRERIP)
- Habitat Management, Preservation, and Restoration Plan for Suisun Marsh (Suisun Marsh Plan)
- Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (OCAP)
- Corps of Engineers Long-Term Management Strategy for Dredged Material in the Delta (LTMS)
- Water Resources Control Board workshops on emerging issues (Southern Delta Salinity, Pelagic Organism Decline, San Joaquin River Flows, and Climate Change) identified by the 2006 Water Quality Control Plan for the Delta
- Updated biological opinions

Actions

- CALFED agencies will continue implementation of many Stage 1 actions while participating in the Delta Vision and BDCP on alternative conveyance approaches and DRMS on alternative strategies for managing risk. CALFED agencies will assess recommendations from these initiatives and will incorporate those recommendations as appropriate as the agencies shape CALFED activities over the next several years. Many of the in-Delta actions identified in the ROD may need to be modified or refined to better reflect new understanding about the Delta and

Interim Actions

Certain actions can continue while CALFED, Delta Vision, and BDCP are collectively evaluating and making decisions on needed physical and/or operational changes for the system. Some have referred to these as "no-regrets" actions that do not pre-judge or bias the outcome of Delta Vision, BDCP, or CALFED decisions. The majority of these actions are already covered by the CALFED Programmatic EIS/EIR. Some may need additional environmental documentation.

to better support any changes in conveyance that result from the Delta Vision, BDCP, and DRMS processes.

Continuing Actions

- **Continue to Focus on Actions with a Direct Link to the Delta** – Responding to the Governor's directive to "refocus" the CALFED Program, the CALFED agencies identified (10-Year Action Plan, April 2006) a subset of actions to be managed more intensively. These actions generally include those that are most critical to resolving Delta conflicts.
- **Continue to Provide a Working Forum –** CALFED will continue to provide a forum for state, federal, and local agencies working collaboratively with stakeholder in an open, transparent, and accountable way to secure California's water future while working towards a healthy ecosystem.
- **Identify Alternative Delta Conveyance and Conservation Actions** – CALFED agencies will continue to participate in the Delta Vision and BDCP processes to identify alternative conveyance approaches and conservation options for the Delta.
- **Identify Alternative Management Strategies for Managing Risks** – CALFED agencies will continue to participate in the DRMS process to identify alternative strategies for managing risks to Delta resources.
- **Implement In-Delta Action**s – Some of the previously defined CALFED actions within the Delta will continue or be initiated because they will not pre-judge or bias the outcome of Delta Vision, BDCP, DRMS or CALFED conclusions. Examples of actions include: continued levee maintenance and improvement, preparation of emergency response measures, new tidal marsh habitat, and a Franks Tract project designed for flexible operations.
- **Implement Actions Outside of the Delta** – Some of the previously defined CALFED actions located outside of the Delta will continue or be initiated, because they will not pre-judge or bias the outcome of Delta Vision, BDCP, DRMS or CALFED decisions. Examples of actions include: feasible surface water storage, integrated regional water management, water quality best management practices, water use efficiency, and recycling.
- **Conduct Focused Research** – CALFED Science Program will continue research on prioritized Delta issues to narrow uncertainty so the best information is available in making future decisions regarding the Delta.
- **Improve Program Monitoring, Tracking, and Reporting** – The CALFED Program will continue to improve on a system to provide accurate and complete accounting of investments and develop and implement performance measures to document what was achieved with those investments. These performance outcomes will serve as a basis to adaptively mange the program and ensure quantifiable data exists to make decisions and to plan for the future.

Future Actions

- **Program's Future Direction** – It is expected that the Program's direction will be largely influenced by current CALFED Stage 1 actions, the CALFED ROD, the CALFED 10-Year Action Plan, and Delta Vision, BDCP, and DRMS processes.
- **Governance and Financing** – In order to be successful, the CALFED Program will require a clearly defined governance structure and funding commitments from state, federal, and local agencies.
- **Prepare Environmental Documentation** – CALFED agencies will prepare appropriate environmental documentation prior to implementing any actions including alternative conveyance approaches or conservation options that may result from the Delta Vision or BDCP processes.

4. Conclusions

Based on assessments in this report, Staff concludes:

1. The CALFED Program has experienced significant progress in areas outside the Delta. In-Delta progress has been more limited. CALFED was especially successful in providing a forum for state, federal and local agencies working collaboratively with stakeholders in an open, transparent and accountable way in an effort to secure California's water future while working towards a healthy ecosystem. A hallmark of the CALFED Program has been the development and integration of sound scientific information into all CALFED activities and decisions.
2. The continued Pelagic Organism Decline (POD), existing risks to Delta levees, and projected future conditions that will further jeopardize Delta levees are prime reasons to reevaluate the method of Delta conveyance. Re-evaluation of conveyance is currently underway as part of the Delta Vision and BDCP processes. Since the method of conveyance influences Delta water flow, water quality, ecosystem, and water supply, these elements also need to be reevaluated along with conveyance.
3. CALFED agencies will continue to implement the ROD in an open, transparent and accountable way, focusing on actions with a direct link to the Delta. Further, the CALFED Science Program will continue to conduct focused research and the agencies will improve Program monitoring, tracking, and reporting.
4. CALFED agencies will incorporate recommendations from the Delta Vision, BDCP, and DRMS processes as appropriate as the agencies shape CALFED activities over the next several years.

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